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Massive radiation in *Ammopelmatus* Jerusalem crickets (Orthoptera: Stenopelmatoidea: Stenopelmatinae): Phylogenomics, revision, and biology of 105 new species from the United States and Mexico

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On the whole, the genus [*Ammopelmatus*] presents possibly the greatest number of difficulties to be found in any of the North American genera of Orthoptera. Morgan Hebard, 1916.

Abstract

We review and discuss all named United States and Mexico species of *Ammopelmatus* Tinkham Jerusalem crickets, even if synonymized in earlier literature. We recognize as valid 12 previously named taxa: *A. cahuilaensis* (Tinkham), *A. comanchus* (Saussure & Pictet), *A. davewerneri* (Tinkham), *A. fuscus* (Haldeman), *A. intermedius* (David & Smith), *A. kelsoensis* Tinkham, *A. longispinus* (Brunner von Wattenwyl), *A. mescaleroensis* (Tinkham), *A. muwu* Rentz & Weissman, *A. navajo* (Rentz), *A. nigrocapitatus* (Tinkham & Rentz), and *A. pictus* (Scudder).

We confirm *A. californicus* (Brunner von Wattenwyl) as a junior synonym of *A. longispinus.* We synonymize *A. monahansensis* (Stidham & Stidham) under *A. mescaleroensis.* We designate neotypes for *A. fuscus* and *A. mescaleroensis.*

We declare the following 6 names to be nomen dubium: *A. cephalotes* (Walker), *A. fasciatus* (Thomas), *A. hydrocephalus* (Brunner von Wattenwyl), *A. irregularis* (Brunner von Wattenwyl), *A. oculatus* (Scudder), and *A. terrenus* (Rehn).

We recognize 11 major clades, and 26 Groups within those 11 clades, delimited by DNA, morphology, karyotype, ecology, and calling drum pattern. In their phylogenetic tree order, we recognize (1) the Winchester Group, with 11 (possibly 12) species; (2) the Big Sur Group, with 1 species; (3) the Longispinus Group, with 12 species; (4) the Portal Group, with 2 species; (5) the Argus Group, with 5 species; (6) the Mojave Desert Group, with 8 species, 1 which is tentative; (7) the Springville Group, with 1 species; (8) the Lightfooti Group, with 10 species; (9) the Smithi Group, with 3 species; (10) the Grayi Group, with 1 species; (11) the Southern California Group #1, with 4 species; (12) the Southern California Group #2, with 4 species; (13) the Southern California/Baja California Group #3, with 9 species; (14) the Lincoln County Group, with 1 species; (15) the Utah Group, with 3 species; (16) the Fuscus Group, with 5 species, 2 of which are tentative; (17) the Mono Lake Group, with 7 species; (18) the Muwu Group, with 1 species; (19) the Pratti Group, with 1 species; (20) the Fast Drumming Group, with 13 species; (21) the Vandenberg Air Force Base Group, with 2 species; (22) the San Gabriel/ Pelona Mts Group, with 2 species; (23) the Islander Group, with 2 species; (24) the Southern California Group #4, with 3 species; (25) the Southern California Group #5, with 2 species; and (26) the Monica Mts Group, with 2 species;

We describe the following 105 taxa as new: *A. abelai* Weissman, *A. acton* Weissman, *A. angelusoaks* Weissman, *A. anzaborrego* Weissman, *A. argus* Weissman, *A. ashleighi* Weissman, *A. bajasur* Weissman, *A. bakersfield* Weissman, *A. ballmeri* Weissman, *A. ballonadark* Weissman, *A. bartonflats* Weissman, *A. bigsur* Weissman, *A. brachysocius* Weissman, *A. briani* Weissman, *A. brockovichi* Weissman, *A. bruneaudunes* Weissman, *A. calimesa* Weissman, *A. carsoncity* Weissman, *A. castaneus* Weissman, *A. catalinae* Weissman, *A. cathedralgorge* Weissman, *A. cedarview* Weissman, *A. chimineas* Weissman, *A. chinalake* Weissman, *A. christmasvalleydunes* Weissman, *A. clarki* Weissman, *A. coralpink* Weissman, *A. coyflat* Weissman, *A. crypticus* Weissman, *A. danieli* Weissman, *A. descansodunes* Weissman, *A. dogtown* Weissman, *A. eatoncanyon* Weissman, *A. ensenada* Weissman, *A. etiwanda* Weissman, *A. evansi* Weissman, *A. finnon* Weissman, *A. fisheri* Weissman, *A. fremontpeak* Weissman, *A. glacierlodge* Weissman, *A. glennville* Weissman, *A. gomezfarias* Weissman, *A. grahami* Weissman, *A. grapevine* Weissman, *A. grayi* Weissman, *A. hovorei* Weissman, *A. icenoglei* Weissman, *A. idaho* Weissman, *A. intermedioides* Weissman, *A. islander* Weissman, *A. joshuatree* Weissman, *A. juniperdunes* Weissman, *A. kennedymeadows* Weissman, *A. kennedymeadowsdos* Weissman, *A. kirai* Weissman, *A. knighti* Weissman, *A. kokoweef* Weissman, *A. lagunahanson* Weissman, *A. lakecachuma* Weissman, *A. lakesherwood* Weissman, *A. larumorosa* Weissman, *A. leei* Weissman, *A. lightfooti* Weissman, *A. lincolncounty* Weissman, *A. longispinoides* Weissman, *A. mahogani* Weissman, *A. monolake* Weissman, *A. mtpinos* Weissman, *A. mtshasta* Weissman, *A. oneillpark* Weissman, *A. owensvalley* Weissman, *A. pinnacles* Weissman, *A. pinyonpines* Weissman, *A. piute* Weissman, *A. portal* Weissman, *A. pratti* Weissman, *A. reno* Weissman, *A. rentzi* Weissman, *A. rusti* Weissman, *A. sakai* Weissman, *A. sandiego* Weissman, *A. sanfrancisco* Weissman, *A. sangabriel* Weissman, *A. sanjacinto* Weissman, *A. sanmartinensis* Weissman, *A. sanpedromartir* Weissman, *A. santarosaplateau* Weissman, *A. sierrapelona* Weissman, *A. skinner* Weissman, *A. smithi* Weissman, *A. sonoraensis* Weissman, *A. springville* Weissman, *A. stringfellow* Weissman, *A. tarcanyon* Weissman, *A. tehachapi* Weissman, *A. temblor* Weissman, *A. tomsplace* Weissman, *A. vandenberg* Weissman, *A. warnermts* Weissman, *A. westgardpass* Weissman, *A. whitewater* Weissman, *A. winnemucca* Weissman, *A. wrightwoodi* Weissman, *A. yubalake* Weissman, and *A. zayante* Weissman.

Ammopelmatus has its highest species' diversity in Southern and Central California, with most taxa having limited distributions; and with most species nearest genetic relative usually being geographically close. Six newly described taxa rank as the six heaviest insect species in California, with some adults exceeding 12 grams.

Where two *Ammopelmatus* species are sympatric, we present data that indirectly suggest that calling song drums may act as a premating barrier; and that diploid chromosome number may act as a post mating barrier.

Key words: *Stenopelmatus,* color polymorphism, adult reproductive dormancy, Baja California, California floristic province, cryptic species, drumming, incomplete linkage sorting, integrative taxonomy, karyotypes, male-complicit postcoital sexual cannibalism, parasitoid, OR-TE analysis

Introduction

Jerusalem crickets (JCs) are iconic, widespread inhabitants of the western United States (Powell & Hogue 1979, Hogue 1993, Weissman 2005), responsible for more inquiries of museum entomologists than any other insect. At least 6 new taxa (*A. brachysocius, A. chimineas, A. danieli, A. mahogani, A. tarcanyon*, and *A. temblor*) described in this paper are the heaviest insects in California, with some adult females weighing over 12 g and exceeding 50 mm in length. In certain desert habitats JCs are the most numerous orthopterans, and are a major food source for various vertebrate predators.

The United States' JCs were last revised in 1916 by Morgan Hebard, who tallied three valid taxa and seven previous synonyms. In the ensuing 109 years, one new US genus, one new Mexican genus, and eight new species were added to this list, always as a single taxon per publication, and always based on strictly morphological characters. Recently, Weissman *et al.* (2021) separated the Mexican, Central, and South American species (genus *Stenopelmatus*) from those in the United States and Baja California (genus *Ammopelmatus*), a decision supported by subsequent data in Gutiérrez-Rodríguez *et al.* (2022). The number of New World JC genera was reduced from four to two, based upon a combination of morphology, DNA, and behavior. Gutiérrez-Rodríguez *et al.* (2022), Suastes-Jiménez *et al.* (2023), and Ruiz-Mendoza *et al.* (2023) presented data confirming the underappreciated documented biodiversity in *Stenopelmatus*, as predicted by Weissman *et al.* (2021). Weissman *et al.* (2024) documented that the family Stenopelmatidae, as currently conceived (Cigliano *et al.* 2025), is paraphyletic.

The present contribution is the result of 45+ years of field work in the western United States and Baja California, including the rearing of thousands of nymphs to adult. Under the proper collecting conditions (see p. 11), juveniles of many species can be fairly common although adults, especially males, are frequently rare. These field efforts are now combined with the analysis of more than 4700 laboratory recordings of calling drums of adults of both sexes, phylogenomics, morphological analysis, and karyotype determination to support the occurrence of at least 105 new species of *Ammopelmatus*.

Materials, Methods, and Terminology

How to use this paper. We studied *Ammopelmatus* JCs from British Columbia, 17 western US states, the Baja California Peninsula (Mexican states of Baja California and Baja California Sur), and 4 Mexican mainland states. Although we are describing 105 new taxa of *Ammopelmatus*, 83 of them are restricted to California, with the majority in Southern California. Given that fact, coupled with Jerusalem crickets having one basic morphological "plan" (see p. 20, under **How we drew the lines between species**) with many species looking alike, and the fact that few species are sympatric with another JC taxon, it is a necessity to make collection locality one of the most important "characters" for species' identification.

Furthermore, we divide Southern California into three types of regions: (1) by county, (2) by geological feature (e.g., Central Valley, Colorado/ Mojave Desert, Sierra Nevada, etc.), and (3) by mountain range. By using adults, especially males, the reader should consult the Table of Contents for the appropriate regional Table from where their specimen was collected. Then go to that Table and compare names, and their tabulated characters, with the physical characters of their unidentified JC. In some cases, knowing the calling song drum characters (rate and pattern) and, rarely, karyotype number will be needed. In rare cases, DNA is required. Because there are so few helpful morphological characters for identifying species, we generally discuss, in the 'Recognition Characters' section of each taxon, how to separate (1) most closely related taxa, as documented in the species' trees as inferred using multicoalescense analysis (ASTRAL), and (2) in those situations where two species are sympatric or nearly so. In those individuals where no Table name seems correct, then Tables from adjacent geographical areas should be consulted. We estimate (see p. 756 for further discussion) that we have described some 90% of the *Ammopelmatus* taxa present in the western United States, Baja California Peninsula, and northwestern mainland Mexico.

Institutions—abbreviations for repositories:

ANSP Academy of Natural Sciences, Drexel University, Philadelphia, Pennsylvania
CAS California Academy of Sciences, San Francisco, California
NHMUK (formerly BMNH) Natural History Museum of United Kingdom, London
NHMW Vienna (Wien), Austria
SDNHM San Diego Natural History Museum, San Diego, California
UMMZ University of Michigan Museum Zoology, Ann Arbor, Michigan
USNM Smithsonian National Museum of Natural History, Washington, D.C.

Field collecting techniques. Long, continuous, late spring and summertime oatmeal trails (Fig. 1) have proven invaluable for collecting those JCs that live in sandy habitats (and elsewhere), but they rarely lure in early instars which are over 1 year from their molt to adult. For instance, in 2004 and 2014, DBW and DC Lightfoot laid 114 kg and 95 kg of Quaker Oats, respectively, on numerous sand dunes in eastern Washington, eastern Oregon, and southern Idaho, over 8 and 7 nights, and collected 54 and 119 JCs. Trails were placed at least 1 hour before local sunset, and the dunes walked while waiting for dark. At no time did we see any JCs wandering the dunes, yet the oatmeal trails would have them during this same time period. Apparently, JCs stay under the cover of dune vegetation until they leave such cover to approach the oatmeal trail. The major disadvantage of using oatmeal in a sandy habitat is the presence of kangaroo rats (*Dipodomys* spp.), that will harvest a trail hard and repeatedly. Many times, we would get in only one good walk, starting around 45 minutes after local sunset, before this occurred. Placing the oats on the trail thicker helps to slow down the kangaroo rats; and using fast cooking oats, theoretically, should also slow them down since the smaller particles would require more time to gather. Both forms of oats seem to be equally odoriferous.



FIGURE 1. Oatmeal trail, using uncooked oats, laid before dusk, and where various animals can easily be seen eating once dark. Unless there are kangaroo rats around, trail does not have to be this thick.

Antifreeze pitfall traps, placed under vegetation, can effectively collect JCs, and we wonder if the smell of the antifreeze can act as an attractant? Interestingly, such pitfalls almost never catch adults. Additionally, pitfall traps using the more environmentally friendly propylene glycol, as opposed to ethylene glycol, can effectively preserve DNA (Nakahama *et al.* 2019) for later analysis.

Winter and early spring collecting in areas of California, Nevada, and Baja California, where there are infrequent or no freezing periods, and when the ground is wet and maximum daytime temperatures are below 16°C, can also be rewarding and result in adult females and many early to mid-instars (Weissman & Lightfoot 2007). For instance, DBW and VF Lee collected Great Basin eastern California and western Nevada from 17-19-iv-1998, when it was too cold to effectively use an oatmeal trail, and in 3 days of daytime rock rolling and turning trash wherever we could find it, especially in sparsely inhabited towns, we collected 66 JC nymphs. Collecting in campgrounds with natural vegetation, where trails are bordered by human placed rocks, can also be productive: we collected good series of nymphs in such settings at Eaton Canyon Nature Center, Placerita Canyon Nature Center, O'Neill Park, Caspers Park, Santa Rosa Plateau, etc., all in Southern California.

Over the years, many specimens were sent to DBW alive, frequently as juveniles, and the original collector is noted in each species' section. Such specimens were usually given a DBW field stop number and entered into DBW field notebooks, which will be deposited at CAS.

Raising of specimens. Museum collections are largely composed of immatures collected during the winter and spring, or adult females collected in late fall and winter. Nymphs cannot be used for identification since they don't have adult morphological characters. Also, adult females don't have the diagnostic species' characters that adult males may have and rarely drum in captivity since they are usually mated when captured. Additionally, unless properly curated (see below), specimens will be discolored if placed directly into alcohol; and discolored and shriveled if dry-pinned. Thus, our winter collection efforts, in areas without a prolonged freeze, were directed toward obtaining large numbers of nymphs that we then raised for 3–15 months until they molted to adult. In areas with a prolonged winter freeze, our collection efforts were focused on mid-late spring and early summer collecting and obtaining series of late instars that we then raised to adult. Pertinent to this long rearing period is the possibility that during one of 10–12 (Weissman 2001a) molts, damage occurs to a (usually rear) leg such that what is seen morphologically in these adults, may be abnormal and a reflection of the ability of JCs to regenerate entire limbs, which we documented earlier (Weissman 2001a).

We have somewhat modified our previously published rearing techniques (Weissman 2001a, Weissman & Lightfoot 2007). Individuals are now isolated in 350 ml, clear polypropylene plastic Fabri-Kal Corporation containers with a minimal amount of sterilized sand, which is slightly moistened in one corner; and fed a revised diet of organic romaine lettuce, uncooked oatmeal flakes, dry rabbit food, cat or dog pellets, and fish flakes. No holes are placed in the lids and the sand and food are replaced every 6 to 10 days, depending on the ambient temperature. The tubs are exposed to natural day length and day light. These containers are a marked improvement over the previously used margarine tubs in which the JCs could eat a hole and escape.

Specimens of most species collected as mid to late instars, and less than 7 months to molting to adult, were generally successfully raised to adult in 70–80% of cases; with the notable exception of *A. grahami* (see p. 484). Smaller nymphs that still had to be raised over a second winter, had a success rate of reaching adult of around 30–40%.

How to determine adults. Adult males have two fully developed, black, sclerotized, incurved hooks located medial to each cercus (Fig. 2A). These hooks develop gradually with each successive molt, starting from tiny ridges barely visible in early instars. In comparison with adult male *Stenopelmatus* (see Fig. 11, in Weissman *et al.* 2021), *Ammopelmatus* hooks are readily visible because they are separated from the lighter colored body and not hidden behind the cerci. The hooks are crucial to a successful mating (Weissman 2001b).

Adult females are distinguished by a darkened (at least at the tips and on the ventral surfaces), sclerotized ovipositor (Fig. 2B), the six components (Fig. 3) of which develop progressively with each molt. According to Matushkina & Stetsun (2025), and N. Matushkina (pers. comm. to DBW, February, 2025): "one of two sets of terms, gonocoxa-gonapophysis or valvifer-valvula/valve, can be used to refer to the six main components of the ovipositor, namely paired gonapophysis 8 (= first valvula; ventral valve), paired gonapophysis 9 (= second valvula; dorsal, or inner valve), and paired gonoplac (= third valvula; lateral valve)."

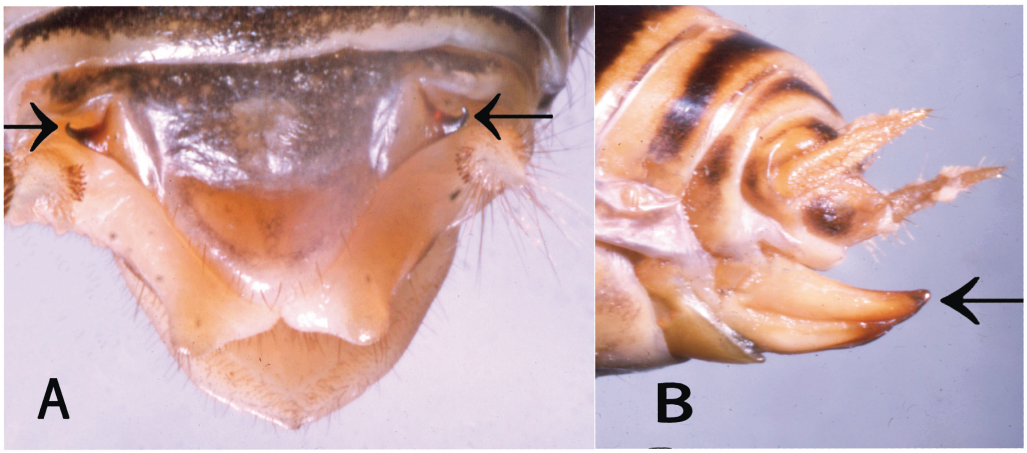


FIGURE 2. How to determine when JCs are adult. A. By the presence of fully formed, black sclerotized hooks (arrows) in males. B. By the presence of darkened edges and tip of ovipositor (arrow) in females.

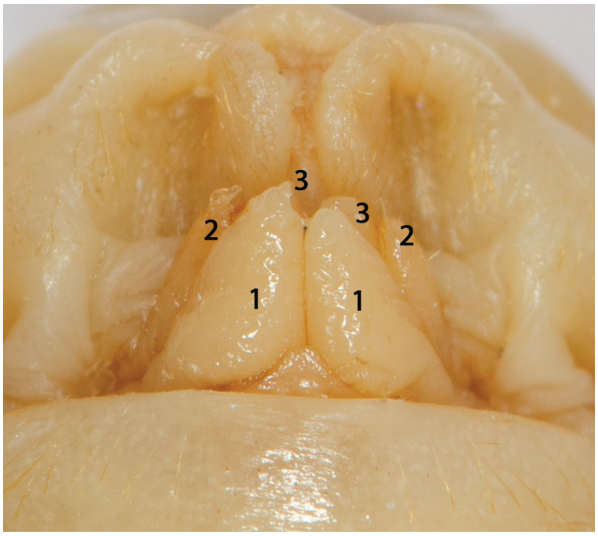


FIGURE 3. Development of ovipositor in a mid-instar JC. Six components are visible and numbered (as viewed from underneath).

Size categories. We use arbitrary adult-size class assignments: Small <25 mm in body length; Medium 25–35 mm; Large 35–45 mm; Very large >45 mm. Body length measurements in females exclude the ovipositor. The largest individual JC is an adult female (see Fig. 3.2 in Weissman 2001a), probably *A. tarcanyon* from Kings County, CA, but the collection data are uncertain. An *A. mahogani* adult female from Arroyo Seco, San Gabriel Mts (S04-34) weighed 12.96 g. Three adult females of *A. longispinoides* (all from S05-43, Colusa Co.) weighed more than 12 g, with the heaviest at 12.84 g. An adult *A. brachysocius* female from San Benito Co. (S05-5, R05-157) weighed 10.73 g. The smallest individual JCs may be adult males of *A. intermedius* from San Francisco (S89-90, 440 mg); and an adult male from Oakland Hills (S98-113, R99-5, 532 mg). Other taxa with small adult males include *A. bigsur* and *A. kelsoensis*, but those were not weighed.

Leg armament terminology: These terms apply to the tibiae of all six legs of all *Ammopelmatus* (and *Stenopelmatus*) species, since there are no armaments on any femur or tarsi: ***Spines*** are unmovable teeth, thorn like processes, or projections of the cuticle not separated from it by a joint, and, most importantly in JCs, may form different numbers and arrangements on the inner and outer sides of the rear leg tibia. ***Calcars*** are moveable processes, connected by a joint (see Fig. 4 for numbering sequence). Calcar #1 is the most medial and almost always the longest. ***Spurs,*** which are just short calcars, are ventral, moveable cuticular appendages adjacent to the calcars on all six legs.

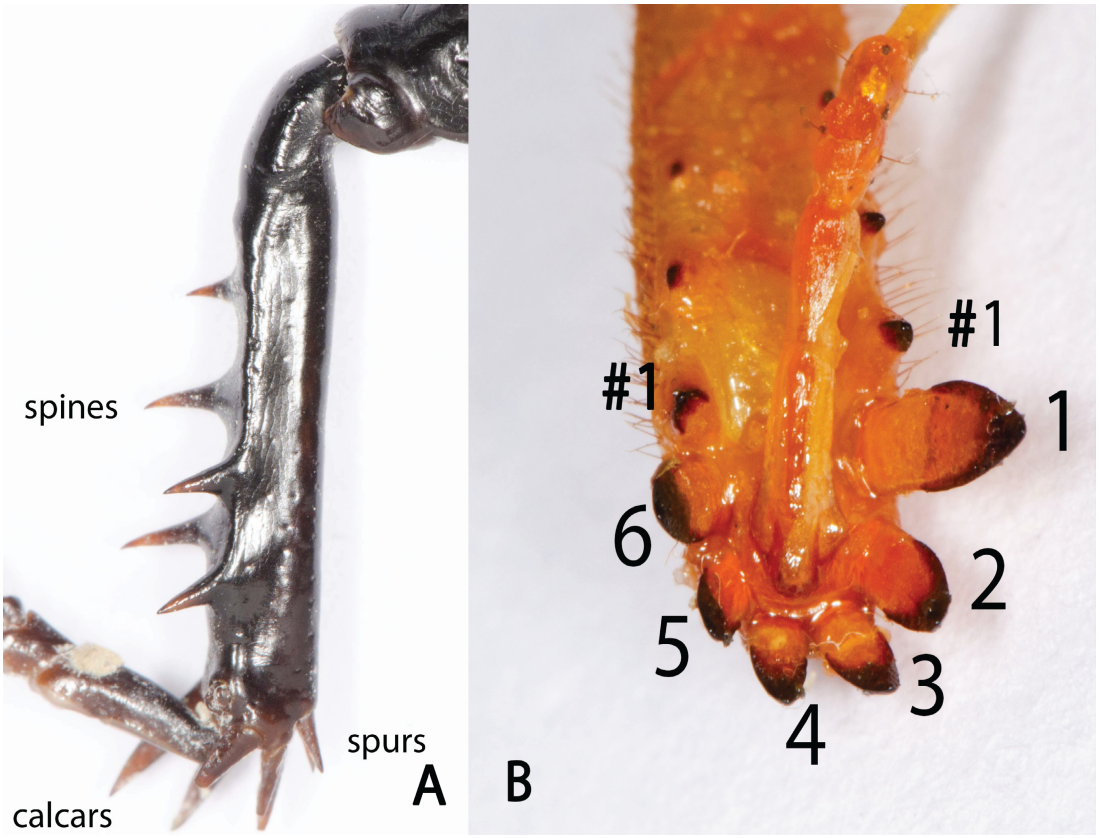


FIGURE 4. Rear leg tibial terminology in Jerusalem crickets. A. Right hind leg tibia: here with 3 inner and 2 outer spines, which are not articulated and, therefore, not moveable; spurs (usually two); and ringlet of 6 calcars that are all articulated and moveable. B. Left hind leg: calcars are numbered 1 to 6, with 1 usually the longest. Calcar 1 is adjacent to inner spine #1; while calcar 6 is adjacent to outer spine #1.

In most species of JCs, both spine and calcar shapes are best described as ***acuminate*** and ***attenuate***, that is they gradually taper apically, to a point, usually from a wide base. Species living in sand dunes, or sandy habitats, can have a number of modifications of their rear leg tibial calcars and spines: (1) Rear leg tibial **calcars** can be ***spatulate*** in shape, which means rounded and broad at tip, narrower at the base, somewhat resembling a spoon. (2) Rear leg, inner and outer tibial **spine** #1, can also have a posteriorly-directed, flat face; or even be spoon-shaped, with a concave face (see Fig. 905, p. 502), apparently further adaptations for "swimming" through sand. Stidham & Stidham (2001) have accurately described such spines as horseshoe shaped. In the sand dune taxa *A. joshuatree*, *A. kelsoensis*, *A. mescaleroensis*, and *A. muwu*, amongst others, all six rear leg calcars are generally spatulate in shape with outer and inner spines #1 posteriorly flattened and concave, the latter especially evident in larger specimens. (3) Another sand dune adaptation is seen where species have reduced, in both number and size, inner and outer rear leg tibial spines. Lastly, the most extensive sand dune adaptations are seen in *A. davewerneri*, where modifications (1) and (3) are combined with a unique (4) adaptation of a flattened and rotated rear leg tarsus (see Fig. 47, p. 75). These above terms will be particularly important when discussing the widely divergent members of the Winchester Group (see p. 58).

The **front** legs (Fig. 5A) always have a ringlet of 5 tibial calcars, usually with 2 or 3 ventral tibial spurs, depending on the species. The **middle** legs (Fig. 5B) generally have 7 or 8 tibial calcars, with the middle ones arranged in a ringlet and the remaining ones spaced out along both sides of the tibia. There are invariably 2 ventral spurs. The **hind** legs (Fig. 4B) always have 6 calcars in the ringlet at the distal end of the tibia. Invariably, calcar #1 is the longest of the six. There are usually a variable number of inner and outer tibial spines, which can be useful for species identification.

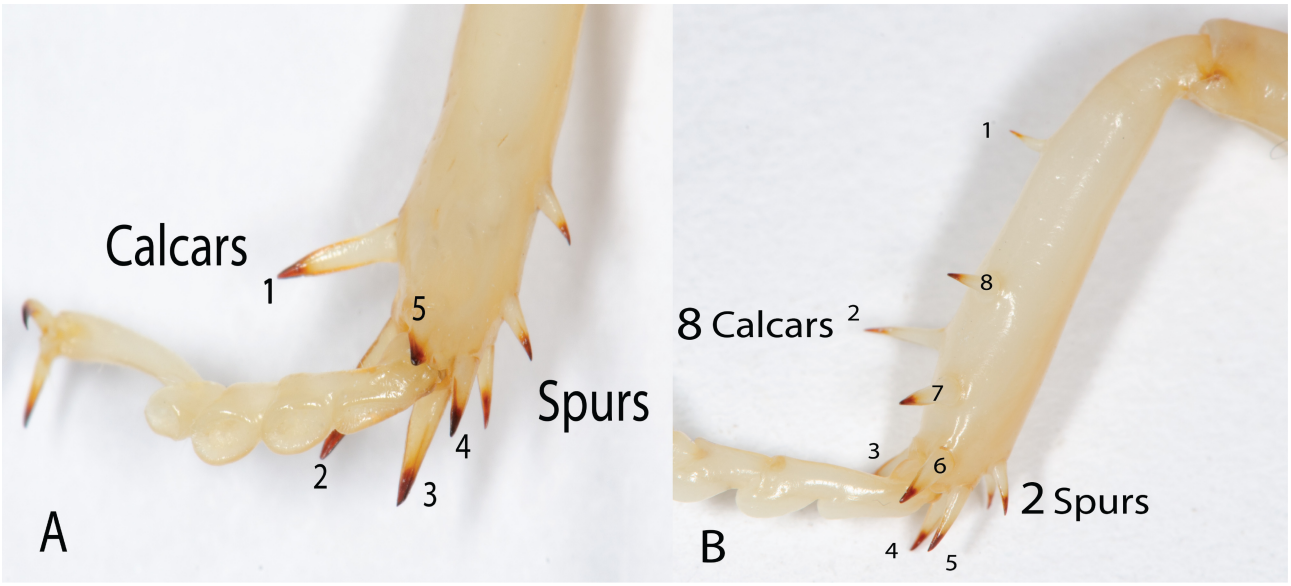


FIGURE 5. Typical tibia in *Ammopelmatus* JCs. A. Left front leg showing 5 numbered calcars and 3 unnumbered spurs. B. Right middle leg showing 8 numbered calcars and 2 unnumbered spurs.

When tabulating these tibial armaments, where one leg had a different number of spines, calcars, or spurs than the other leg, the higher number was recorded. In many individuals, only one middle leg is present since the other was removed for DNA studies.

Within a species, we found no difference in spine and calcar number between adult males and females and have combined all such data. In contrast, there are significant, and diagnostic, differences in the shape of the rear leg calcars, between males and females, especially in Lightfooti and Longispinus Group adult males. In all species, we have tabulated the **variation** present in the types and paratype series in spine, calcar, and spur numbers, and include such information in each species' section, and in the Tables presented for the various Groups. In the Tables, if a morphological character occurs less than 30% of the time, it is indicated by brackets around it. Thus, if the rear leg inner tibia can have either 4 or 5 spines, it is written as "(4) 5". This indicates that fewer than 30% of individuals have 4 spines, and greater than 70% have 5 spines. If written as '4 or 5', this indicates that more than 30% of individuals have either 4 or 5 spines. The number of individuals tabulated may not equal the number of paratypes because some individuals had damaged or missing legs. We have not systematically studied the spacing of spines along the inner and outer margins of the hind tibia but we suspect that valuable taxonomic information may be there.

Male genitalia. Gorochov (2020) noted that male genitalia in the Stenopelmatinae are "short, entirely membranous and non-retractable", "with dorsal and ventral folds usually divided into 3 and 2 lobes respectively." We examined (Weissman *et al.* 2024) male internal genitalia (phallic lobes as used by Weissman 2001b, Weissman *et al.* 2008, Weissman *et al.* 2021) using the techniques of Rocha-Sánchez *et al.* (2018) and Suastes-Jiménez *et al.* (2023), and found that their microstructure is difficult to determine in preserved specimens because the folds are stiff and can't be easily manipulated, and the whole structure is compressed. But, during copulation the lobes are unfolded (contra Gorochov 2020) making their substructure more amenable to examination (see Fig. 4 in Weissman *et al.* 2024). We thus believe that while the "species differences" claimed to be documented by Suastes-Jiménez *et al.* (2023), in preserved specimens, are provocative, further comparisons are necessary using genitalia extruded in live males. Interestingly, many adult males in the Lightfooti Group spontaneously unfold their phallic lobes (Fig. 6) after they have been injected with Williams' fixative (see next section). But even in these situations, additional efforts with further injections of fluid (such as 70% ethanol) must occur to maintain the extruded lobes tumescent while they become fixed in place.

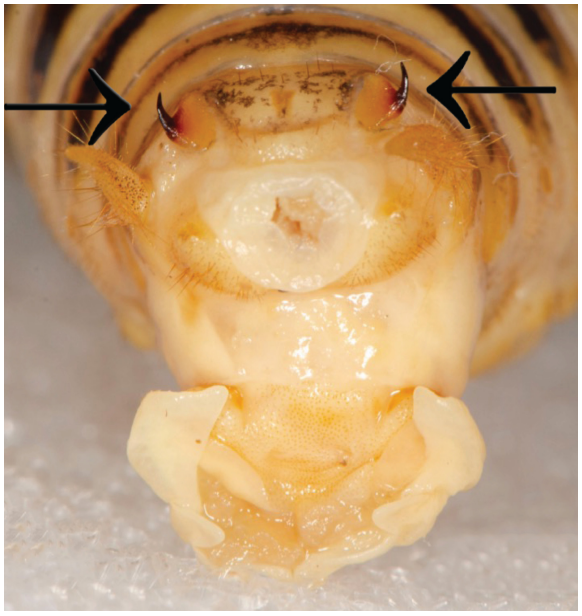


FIGURE 6. Rear end of Lightfooti Group adult male showing how internal genitalia frequently spontaneously extrude upon injecting with preservative. Note bilateral sclerotized hooks (arrows) confirming adult status.

Killing, preservation, and labeling. Adults were killed by hypodermic needle injection of "Williams' fixative" (Williams 1968), into the thorax and abdomen, through the dorsal membrane between the head and pronotum. Because JCs have meaty, bulbous abdomens, pinning them without removing the abdominal contents will likely result in discolored, blackened, rotted abdomens and shriveled, distorted genital features. Gutting and stuffing with both powder preservative and cotton (e.g., Rentz 2010) give better results but requires a lot of time. Freeze drying (for example, Fig. 7) does give better color preservation than gutting and stuffing but takes space, especially when done in a home frost-free freezer; and special equipment when done more quickly in the laboratory. Placing specimens directly into 70 or 75% ethanol gives unpredictable results: some specimen's colors are preserved well but many, especially those with larger abdomens, still have discolored rear legs and body parts. We have not tried 90% ethanol for preservation. JCs can also be immersed in boiling water for 60s before being placed in 75% ethanol, but this is time intensive.

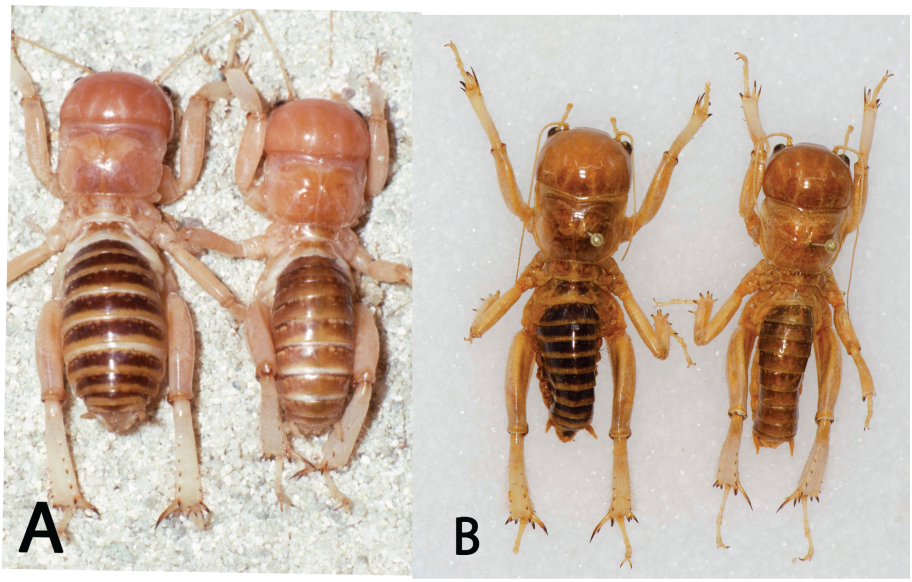


FIGURE 7. Attempt at freeze drying, with only partial success. Both photos of same 2 adult males of *A. navajo* from Holbrook, AZ (S93-32). Specimens in A. immediately after killing (R93-6 on left side and R93-16 on right side). Same specimens in B., in same relative position, after 8 months in home, frost-free freezer, without gutting of abdomens.

Instead, we used the following preservation treatment after drumming is recorded, photos taken, and a middle leg removed for DNA analysis. Once the executed JC stops twitching, a slit is made in the abdominal sternites and additional William's fixative is injected into the abdominal cavity before placing the entire JC into William's fixative for 4-10 hours, depending on body size. Individuals are then transferred to 75% ethanol for permanent storage. Since this process results in reasonable, but not perfect color preservation, as documented herein, we present photos of most new species' types, taken as live adults, compared with the same individual after the above William's fixative preservation. The good news is that few body structures become darkened, because of decomposition due to inadequate preservation. And, fortunately, the structures and limbs remain flexible for easy examination.

Collection information in the holotype, allotype, and paratype sections of this paper, may not be quoted verbatim from the labeled specimens because (1) some localities have been reinterpreted after speaking with the original collector; (2) in most instances, GPS coordinates have been determined from Google Earth and; in other cases, (3) initial inaccurate information is corrected. In the section on "Paratypes", absence of a listed collector signifies that they were collected by DBW, frequently with the assistance of a colleague (see under Acknowledgments). Only adults are tabulated as paratypes, although late instar males whose testes were taken for karyotyping, may also be noted. Nymphs not successfully raised to adult were generally discarded.

Handwritten labels associated with alcoholic preserved JCs include several abbreviations: "S" is for stop number associated with DBW's notebooks, which will be archived at CAS. "R" is for DBW recording number. "F" is for the corresponding leg removed from that individual for genetic analysis. "T" denotes the testes number taken for karyotyping. "A" is for when that individual molted to adult. "C" denotes that those colors of recently killed adults were recorded after being matched against color cards in the Munsell Soil Color Charts (1992 revised edition), a practice discontinued, in 2008, once digital cameras became convenient. "P" denotes that either a photograph was taken by DBW, with Kodachrome slide film, using a Minolta SRT101 camera; or by Daniel Weissman, using a Nikon D7000 digital camera. "D" denotes that either that individual drummed on that date or died on that date, depending on context.

We mapped all holotype, allotype, and paratype collection locations using arcGIS pro.

Aspects of drumming

Recording of drums. Recording techniques were described in Weissman (2001b), but songs are now analyzed in Audacity 2.3.3 and oscillograms made using Raven Lite 2.0.1. Most adults, and some juveniles (see p. 19; and Appendix 1, p.768) of *Ammopelmatus*, are loud and frequent drummers. Their containers were moved, after hearing them drum, to under the microphone where they, frequently, soon drummed again. Additionally, many *Ammopelmatus* adults can be stimulated to drum (to "duet") when one uses a finger, tapping on the same surface on which their tub rests, that mimics the drum cadence and pattern of the opposite sex. Since 1982, we have recorded the drums of over 4700 individuals.

Drumming terminology. Drumming occurs when an individual JC strikes the substrate with its abdomen. For discussion purposes, a **burst** is a series of single drums, generally produced at one drumming speed. In certain taxa and individuals, bursts can begin fast and then slow down, or vice versa. The interval between bursts is usually longer than the length of the burst, but not always. **Trills** are closely grouped drums, with intervals between groups easy to hear. Such trills are usually short in duration (less than 8 drums) and the interval between trills can be shorter or longer than the duration of the trills.

Types of drumming. Weissman (2001b) recognized 4 types of drumming in JCs: (1) calling drums, (2) sex clarification drums (SCD), (3) courtship drums, and (4) nymphal drums. Drumming JCs can be seen in a KQED produced video during the filming of Deep Look's "Jerusalem crickets only date drummers", available on YouTube: https://www.youtube.com/watch?v=mHbwC-AIyTE&t=147s&ab_channel=DeepLook

(1) *Calling drums* can be diverse depending on drumming rate (from 0.5 to 35 drums/second in different *Ammopelmatus* taxa [Weissman 2001b]), length of drum, grouping of drums, intervals between bursts, lag time between receipt of burst and response, etc. It is notable that JCs have no external tympanums and that drumming produces vibrations that are probably sensed by a combination of substrate and airborne sound transmission (Weissman 2001b, Strauß & Lakes-Harlan 2008, Strauß 2017, Strauß *et al.* 2021). It is well accepted, and documented since the late 1950's, that different species of *Gryllus* field crickets can be separated on the basis of calling songs, especially

when and where microsympatric with other congenerics (Weissman & Gray 2019). Subsequently, adults, especially male *Gryllus*, have been shown to have morphological characters that are congruent with these song differences. Such methodology was only recently applied (Weissman 2001b) to Jerusalem crickets. Given the general lack of morphological characters by which to separate species of JCs, calling song drum becomes that much more important. Calling drum characteristics are given significant weight in species separation for several reasons: (1) The calling drum of an adult is stereotypic and generally unchanged during the lifetime of that individual (including, in juveniles, in those taxa that also drum as nymphs [see Appendix 1, p.768] as well as adults). (2) The variation of the calling drum between individuals within a population is also minimal, although in some Groups of *Ammopelmatu*s, the sexes do drum differently (Weissman 2001b, and below, p. 25). (3) While microsympatric populations (see Appendix 2, p.771) of 2 Jerusalem cricket species are rare, where they do occur, the taxa generally have different drums. (4) From many thousands of individuals recorded, only one presumptive field hybrid, based on drumming, was discovered (Weissman 2001b, p. 359). We discuss this female elsewhere in this paper (see p. 271), which we now recognize, based on genetic data, as a sympatric third species, *A. crypticus*, at Tehachapi Mt State Park. (5) Adults of both sexes generally only duet with other individuals that drum similarly, even if that individual is another, normally allopatric species.

We have not systematically analyzed other calling song parameters which may be significant in certain species. For instance, when duetting, is the male or female "polite"? That is, does the answerer wait until the first drummer is done before starting their drum? We have seen both patterns occur in different taxa. Is the interval between the end of the first drum and the beginning of the answering drum important? Such a time period could give an indication of distance separation between the drummers, and possibly, an indication of size. Is the interval between bursts important? In some taxa, successive bursts may only be separated by a few seconds. In other species, a laboratory individual may only drum once every hour. How are these responses affected by mating status, time since last mating, and nutritional status? While we have not done these analyses, they would be of interest and such factors may differ between different taxa. In almost all species, we have recorded multiple adult male and female calling drums, as close to 20°C as possible. Once digitized, we plan to make these recordings available at the CAS web site and/or on the Orthopterists' Society web site, the latter having assumed supervision of Tom Walker's web site (https://orthsoc.org/sina/) on the Singing Insects of North America (SINA). Such information will then be available for further analysis re individual variation within a population/species to help determine what factors vary between individuals and what might be important when adults are trying to select which conspecific individual to mate with.

While we tried to record all drumming close to 20°C, to make across species drum comparisons easier, this was not always possible for those species that molted to adult in late fall and early winter because the recording laboratory was poorly heated and sometimes much cooler than 20°C. On the other hand, recordings done at these lower temperatures were used elsewhere (Weissman 2001b, Walker & Weissman 2001) to document the generally linear relationship of drum rate vs temperature. We also tried to match the illustrated drumming temperature for both the holotype and allotype of each taxon to facilitate comparison between the sexes.

Earlier (Weissman 2001b), we calculated drums/second, from an oscilloscope screen, starting around the 15th drum, because initial drums were frequently more rapid than once the cadence 'settled down.' Subsequently, we have counted most drums, even initial slower or faster ones, and divided by the total number of seconds, because this method is more convenient. When calculating drums/second, we measured the time between the start of one drum and the end of the next drum or drums.

To help us decide if one or two taxa are sympatric, we used the situation at Christmas Valley Dunes, Oregon (S01-58 & S01-59), where 2 sympatric taxa occur, as a guide. The common species, *A. christmasvalleydunes,* drums at ~3.5 drums/s; while the rare *A. monolake* drums at ~1.5 drums/s. For this paper, we arbitrarily set a species' drum-cutoff-rate at double the rate of the slower, to distinguish the 2 species; and to hopefully eliminate confusion resulting from variation within a species. Nevertheless, there are sympatric species pairs where this rule doesn't work (see Appendix 2, p.771). For example, at Pt Conception, California, *A. abelai* (2n♂=25) occurs microsympatric with *A. muwu* (2n♂=23). Adults of both sexes of both species drum around 3 drums/s. We collected good samples of both taxa there without any morphological or cytological evidence of hybridization. Besides their karyotype differences, the two taxa are recovered in different clades.

Virgin adult females appear easier to finger trigger the older they are and the longer they have been unmated; and are probably also more receptive to answering drums that differ significantly from their normal calling drum.

(2) *Sex clarification drums* (SCD) are made by adult males in response to sensing their calling drums (Weissman 2001b). SCD are a burst of fast (usually 8–12 drums/second), loud, non-species-specific substrate drums only made in those species where males and females have the same calling drum rate. We postulated (Weissman 2001b) that SCDs are probably a means for one individual to discern the sex of the other drumming individual. That is, a male hearing a calling drum, from an individual of unknown sex, can response with a SCD to let the original drummer know that he is a male. If the original drummer is a male, he replies back with a SCD, and the individuals could then terminate their duetting. Should the original drummer be a female, she can repeat her calling drum, which then allows the male to begin to locate her though back and forth duetting. SCD are biologically unnecessary, and unknown, in species where males and females drum differently, such as the Winchester Group.

Gwynne & Kelly (2001) cited lack of data, or literature support, for our 2001 statement (Weissman 2001b) that "…[SCD] besides telling females there is a male nearby *may* (our emphasis) also give an indication of his size." In fact, we did cite De Luca & Morris (1998) as an example of such size documentation in the meadow katydid *Conocephalus nigropleurum* (Bruner), without ever claiming that we had documented such a situation in JCs.

(3) Courtship drums are frequently made when two adults of either sex are within 6 cm of each other. They are short series of barely audible, non-species-specific abdominal strikes or tremulations at a rate of two to four per second.

(4) Nymphal drums have an unknown function (Weissman 2001b). Nymphal drum rates are identical to the adult calling drum rate, although the burst length is usually shorter (see *A. pinyonpines*, p. 407, for an exception). They are unknown in the 11 Winchester Group species, the only group where males and females have different calling drums. Nymphal drums are sporadic and made by different instars in different species, and usually only made during one instar of any individual's juvenile life. Some juveniles will duet with other JCs, or a finger prompting drum. This behavior is not as easy as adult calling drums to document because juveniles, in their individual tubs, were not isolated but typically kept on cardboard sheets stacked several high: a drumming individual could thus be difficult to locate.

We wonder if there might be convergent evolution in calling drum pattern in unrelated JC taxa that live in certain habitat types where the physical properties of the substrate (see discussion in Hager & Kirchner 2019) might make, for example, slow drumming in sand dunes, more effective than faster drumming? By drumming slowly, the JC may have more time to raise the abdomen higher and have a louder, farther substrate-transmitted sound. In any case, using the ground as a drumming surface is documented (Brandt *et al.* 2023) as a means of increasing acoustic efficiency.

Chromosomes and cytology. Prior to 2018, removed testes were incubated in a 0.05% colchicine solution at room temperature for one hour and then fixed in 3 parts 100% ethanol:1-part glacial acetic acid and stained with aceto-carmine before analyzing with squash preparations. Idiograms were constructed by arranging homologous chromosomes by size and in order of centromere position. Starting in 2018, when EW-S replaced the retired NU, testes were incubated at room temperature, in 0.9% sodium citrate, for 30-45 minutes after removal, fixed in 3:1 for 50 minutes, then either transferred to 70% ethanol or left in the original 3:1 for permanent freezer storage. The fixed material was squashed in 45% acetic acid. Cover slips were removed by the dry ice procedure and the preparations air-dried. Spermatogonial metaphases and meiotic stages were analyzed and photographed with a Nikon Eclipse 400 microscope fitted with a CCD DS-U1 camera and equipped with sets of standard filters. The software Lucia Image 5.0 was used and images mounted in Adobe Photoshop. Karyotypes were reconstructed by arranging homologous chromosomes in order of decreasing size. The later fixed material is deposited in the Institute of Systematics and Evolution of Animals, PAS (Kraków, Poland).

As noted by Weissman (2001a), meiosis is rare in adults of those Orthoptera (e.g., JCs, silk-spinning crickets *Cnemotettix* Caudell, hump-winged grigs *Cyphoderris* Uhler [Mesa & Ferreira 1984], field crickets *Gryllus* Linnaeus [Randell and Kevan 1962], and desert long-antennae grasshoppers *Tanaocerus* Bruner [Weissman unpublished]) that overwinter as juveniles; such that testes should be removed in those species once they molt to last instar. For most taxa, especially those in the Lightfooti and Longispinus Groups, last instar males are easy to distinguish because the ridges that will become the adult sclerotized hooks, are nicely elevated and sometimes curved at the tip. In contrast, species in the Fast Drumming Group never develop much of a ridge and testes are best taken from these males 4–6 weeks before they are predicted to molt to adult, when they are late penultimate or early last instars.

In describing centromere position, we use the terminology of John & Hewitt (1968) and Hewitt & John (1971). A metacentric chromosome has the centromere located near the center; while submetacentric is when the

centromere is not in the middle but is still closer to the middle than to either end. Telocentric refers to a centromere located at the end of a chromosome. These are also known as rod-shaped chromosomes, and we distinguished them from an acrocentric (short armed) chromosome where the centromere is close to, but not quite terminal (see Fig. 8). The above categories are, of course, a continuum, and will be affected by how well the cells are spread and flattened during preparation, and by fixation. For many species we present multiple meiotic idiograms (and where available, higher information mitotic idiograms—see, for example, *A. rentzi*, Fig. 322, p. 217, T92-11) because such preparations are from different individuals in the same population, or from individuals from different populations. In all cases, such photos should confirm each other's accuracy, which are especially important in cases where we use the number of chromosomes to distinguish between taxa. Because this work is the first modern pass at the systematics of *Ammopelmatus,* we have not focused on the differences in centromere position between related taxa, although it is clear from our results that future efforts could uncover important phylogenetic differences. Since 2018, in addition to the Giemsa-Schiff method, we have focused on the analysis of constitutive heterochromatin revealed by the C-banding methed, as described by Sumner (1972). Such more extensive detailed investigations can now accurately proceed in light of our taxonomic efforts.

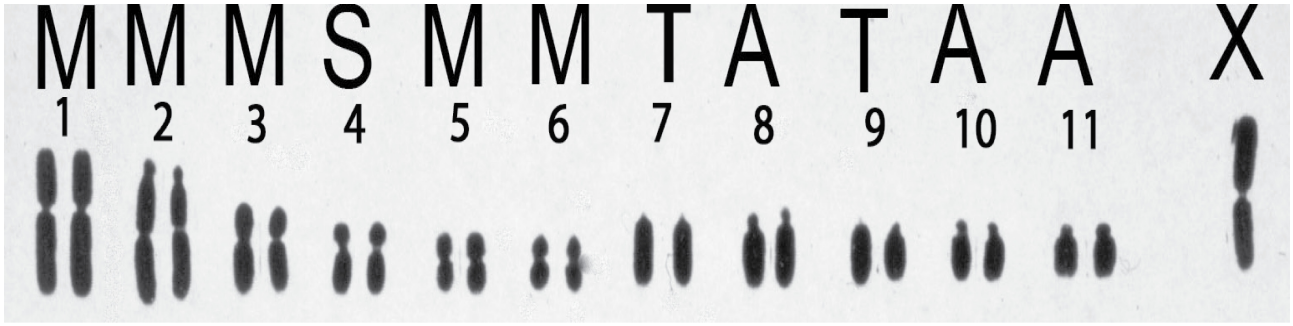


FIGURE 8. Chromosome morphology during meiosis in type locality *Ammopelmatus ballmeri* (T93-17, S92-141) with 2n♂=23. Autosomal pairs 1, 2, 3, 5 and 6 are all metacentric (M). Pair 4 is submetacentric (S). Pairs 7 and 9 are both telocentric (T) while pairs 8, 10, and 11 are acrocentric (A). The single X sex chromosome is metacentric.

How we drew the lines between species

We use the following hierarchy for what characters to emphasize in "where to draw the line" between populations and when to call them different species. In our general order of importance:

1. Populations with at least one consistent, unique morphological difference, excluding color polymorphisms (see p. 24), are considered different species. We have not done comparative analysis on inflated internal male genitalia, which require using live adults, but such efforts might be useful in the future (see Weissman *et al.* 2024, for further discussion).

2. For populations with different chromosome numbers, we take the operational shortcut that they are different species. While this may not be the actual situation in nature, the only currently documented way to see if there are hybridization barriers between such populations resulting from these karyotypic differences, assuming that F_1 offspring are even viable, is to examine chromosome pairing during meiosis in these hybrids (e.g., John & Weissman 1977, John 1983, John *et al.*1983, Shaw *et al.* 1998); and see if such hybrids can mature to sexually reproductive adults with chromosomally balanced spermatids. To obtain such hybrids, one must successfully mate and then get females to oviposit, and raise hatched juveniles for 2 years, before examining testes of late instar males for meiotic alignments. Since we have been unable to get any female JCs to oviposit, after years of trying, testing this biological species concept is basically a non-starter. There is a large biological literature about the relationship between chromosome number, and other karyotype changes, and the possible effects of such on speciation, for example, in lizards (Hall 2009), mice (Baird & Macholán 2012, Garagna *et al*. 2014), shrews (Polyakov *et al.* 2011), and in general (King 1993, Lucek *et al.* 2023). Certainly, simple mating trials could be conducted in JCs, but we are unsure what information that might yield. The import of this study would possibly be most relevant to those taxa in the Lightfooti Group, where males of different species have 19, 21, 23, or 25 chromosomes—this is the only *Ammopelmatus* Group with this range of chromosome counts.

In contrast to allopatric populations, we do not feel it is necessary for us to attempt crossing experiments

between microsympatric taxa, because the JCs have, operationally, already done the "work". As an example, in the Santa Monica Mts, *A. leei* (2n♂=23) and *A. lakesherwood* (2n♂=25) are morphologically inseparable, with similar drums and DNA. Their distributions are near sympatric in places. Yet, based on karyotypic analysis of 24 last instar males, where any hybrids would probably be 2n♂=24, we found no such counts.

While different populations of the same species always have the same chromosome number, we occasionally find differences in number of metacentric/submetacentric and acrocentric/telocentric chromosomes. These differences could result from several factors: (1) Differential chromosome spreading and condensing during slide preparation, with arbitrary assignment of submetacentric vs acrocentric chromosomes; (2) Whether mitotic or meiotic cells were examined, with mitotic cells generally better for centromere localization (for example, see under *A. rentzi,* Fig. 322, p. 217); (3) The presence of duplications or deletions in different individuals (John 1983); and (4) The presence of supernumerary chromosome segments. In any case, such potential differences are a good reason to check at least 2 males from the same population. We can say that in comparing testes incubated, before fixation, in 0.05% colchicine vs 0.9% sodium citrate, no appreciative differences were noted by EW-S, but it was thought that the latter treatment was better for obtaining less condensed chromosomes in many situations. In any case, we are unsure of the importance of metacentric vs submetacentric, or acrocentric vs true telocentric chromosomes, as far as reproductive isolation is concerned, but we do note where such differences were found. One constant is that the X chromosome, in all species of JCs, is metacentric and usually the largest chromosome in the complement. This metacentric X chromosome condition was previously documented in all examined species of the Stenopelmatoidea (Vandergast *et al.* 2017, p. 27).

3. Molecular data provided additional evidence for species delimitation. Because *Ammopelmatus* species are externally similar across closely related species, and because certain species seem to have a wide distribution, we took the approach of including multiple representatives of any given putative species in the phylogenetic analysis to test individual species concept. The working hypothesis was that a valid species should be recovered as monophyletic. This approach generally worked well, and in some cases, helped us recognize misidentifications. It also helped identify clades of closely related species, many of which were not evident based on morphology alone, which eventually led to the designation of 26 species groups.

Because of the duration of these studies, we used an evolving genomics approach to resolve the phylogenetic relationships within *Ammopelmatus.* In the early years (pre-2017), we used Sanger sequencing of mitochondrial and ribosomal gene regions (Vandergast *et al.* 2007, 2009, 2017). While 12S ribosomal sequences were useful, COI was uninformative and yielded conflicting results, similar to what we found elsewhere with *Gryllus* field crickets (Weissman & Gray (2019). Starting in 2017, we used a rather unconventional approach: instead of using a small number of fast-evolving loci (such as mitochondrial genes) or single nucleotide polymorphism (SNP) data, we used Orthoptera-specific Target Enrichment (OR-TE) probes that we previously designed (Shin *et al.* 2024) for higher-level orthopteran phylogenomics. The benefit of using these probes, which were generated from single-copy protein-coding genes inferred from 80 orthopteran transcriptomes, is that it could capture up to 1,800 loci that are specifically designed to broadly survey across the phylogeny of Orthoptera. Although these probe sets were designed for higher-level relationships, our earlier application to species-level phylogeny was promising, prompting us to apply broadly to resolving the phylogeny of *Ammopelmatus*. In general, the use of these phylogenomic data allowed us to resolve relationships robustly and testing the monophyly of individual species. However, the analysis also revealed that several lineages were results of recent radiations, leading to incomplete lineage sorting. As a result, certain species were not recovered as monophyletic or only recovered with low nodal support values. Nevertheless, the use of phylogenomic data provided unprecedented clarity to understanding the diversity and evolution of *Ammopelmatus*.

We also present (in Appendix 3, p.775) the available mtDNA data for comparison; and also, to release these sequence data that may be useful for guiding future identification through DNA barcoding (e.g., Timm *et al.* [2022], but see Song *et al.* [2008] for a review of the problem of nuclear mitochondrial DNA segments in Orthoptera).

Interestingly, DNA has been 100% accurate in confirming our previously noted morphological characters and placing together the many taxa within the Fast Drumming, Lightfooti, Longispinus, Portal and Winchester Groups.

4. Virgin adult JCs can frequently be stimulated to drum if one taps a finger on the surface, where the JC's tub is resting, at the same rate as its calling drum. This technique works because the calling drum in a species, while linearly related to temperature (Weissman 2001b, Walker & Weissman 2001), is constant during a JC's adult lifetime, and fairly constant between individuals. We have, thus, somewhat arbitrarily decided, based on many

anecdotal laboratory stimulation attempts, that a drumming rate that is twice as fast as, or half as fast as, that of another population, is sufficiently different to represent distinct species. As an example, a JC that has a calling drum of 2 drums/s at a certain temperature, would be considered different than one that drums at 1 drum/s or one that drums at 4 drums/s at the same temperature. In general, adult males of any species drum slightly faster than conspecific adult females (except in the Winchester Group and the 3 [out of 5] species documented in the Argus Group). That latter finding is partially explained in that males have shorter drum bursts, with the first few drums being more rapid than later drums.

5. In any case, we always asked ourselves if the DNA-recovered phylogenetic pattern makes geographical, ecological, and biogeographical sense? For instance, the Baja California Peninsula JCs *A. davewerneri* and *A. clarki* are so morphologically adapted, and modified, for living in sandy habitats that, based on their rear leg spine formulas, we could not have predicted what group they are members of. But their recovery in the Winchester Group makes biogeographic sense, since that is the major group (see Table 37, p.49) in the state of Baja California. In fact, in the majority of situations, the nearest DNA relative of most JC taxa is also a geographically close one.

6. Our last criterion for species' separation is a little more intuitive and subjective, and comes in the documented context of speciation patterns in the genus: speciation seems sensitive to minor differences in substrate, rainfall, temperature, vegetation, and isolation; with such ecological differences seeming to result in rapid speciation. So, if we found nearby populations without differences in morphology (except for color), karyotype, drumming, and DNA, and in the absence of vicariant features, then we considered these populations to be the same species. This philosophy is most apparent in our decisions involving the 13 species in the Fast Drumming Group.

These initial species' lines will give us more manageable units to discuss while we further refine these divisions. We acknowledge that some of our decisions might create "new species" where there are none. But we prefer this outcome to the reverse, where cryptic taxa are overlooked, since the former situation seems easier to recognize, and correct, than the latter. A similar sentiment was expressed by Sharkey *et al.* (2021): "Information is not lost in the long run if species are split. However, if species are lumped, the literature becomes confounded with false data, [with] host and distributional data being attributed to one species when there are actually two or more species."

7. Should *Ammopelmatus* be divided into several genera? We believe that retaining all USA, Mexico, and Baja California species in *Ammopelmatus* is the best practice because it allows relationships between the various clades and groups to be most easily discussed and appreciated. Also, all species of *Ammopelmatus* are recovered as monophyletic in our ASTRAL tree.

Amplification and analysis of mtDNA genes. Tissue samples were stored in 95% ethanol at -80°C after collection. We used the DNEASY Tissue Kit or the Gentra Puregene Tissue Kit (Qiagen, Valencia, CA) to isolate genomic DNA from the femur of each specimen. We amplified segments of the mitochondrial Cytochrome Oxidase I Gene (COI) and 12S mitochondrial ribosomal RNA gene using previously published primers: COI-C1-J-2183 and C1-N-2872 (Simon *et al.* 1994); 12S F and 12S R (Kambhampati 1995). All amplification and sequencing methods can be found in Weissman *et al.* (2021).

We used Sequencher v. 5.4.6 (Gene Codes Corporation, MI) to align contigs and verified the protein translation using the invertebrate mitochondrial genetic code in MEGA5 (Tamura *et al.* 2011) for the COI gene. Ribosomal 12S sequences were aligned using the E-INS-I strategy in MAFFT v. 7.221 (Katoh & Standley 2013). We used Gblocks 0.91 (Castresana 2000) to eliminate poorly aligned and divergent regions of the alignments using the default parameters and allowing gaps within the final blocks. Final aligned and trimmed gene regions were concatenated. We implemented a partitioned concatenated Maximum Likelihood (ML) analysis using IQ-TREE v.3.0.1 (Thomas *et al.* 2025) implementing ModelFinder (Kalyaanamoorthy *et al.* 2017) and the BIC criterion to select the best nucleotide substitution model and estimating with nodal support with 1000 pseudoreplicates via the ultrafast bootstrap (UFboot) approximation algorithm (Hoang *et al.* 2018).

Phylogenetic OR-TE taxon sampling. For outgroups, we included 17 specimens belonging to key lineages of basal Ensifera (Schizodactylidae, Gryllacrididae, Anostostomatidae, and the Old World Stenopelmatidae) as well as 24 specimens belonging to the genus *Stenopelmatus* from Mexico and Central America. For the ingroup, we included 639 specimens broadly collected from the entire range of *Ammopelmatus*. Samples added to three subsequent runs were based on results from the previous tree.

To ascertain the collection information for any *Ammopelmatus* individual listed in the phylogenetics trees, one goes to the species' account for that tree entry, and then using the Stop Number, also listed in the tree, finds the corresponding stop entry in either (for new species) the Holotype, Allotype, or Paratype section; or (for already

described species) in the Specimens studied section of that species. Collection data for *Stenopelmatus* and outgroup individuals are found in Weissman *et al.* (2024).

Phylogenomic data generation and analyses. We used the Orthoptera-specific Target Enrichment (OR-TE) probes (Shin *et al*. 2024) to capture 1,828 loci from genomic DNA. See Weissman *et al*. (2021) and Shin *et al*. (2024) for DNA extraction, library preparation, hybrid capture, and data processing. DNA extraction was performed at Texas A&M University (College Station, TX) and library preparation, target enrichment, and sequencing were conducted at Daicel Arbor Biosciences (Ann Arbor, MI). We followed the bioinformatics pipeline described in Shin *et al*. (2024) for data filtering, assembly, orthology search, and alignment, implemented in the Texas A&M High Performance Research Computing GRACE cluster. We inferred the phylogeny using a coalescent-based species tree analysis in the program ASTRAL 5.7.3 (Zhang *et al*. 2018) to account for incomplete lineage sorting. Specifically, initial data processing resulted in 1,003 gene alignments that included at least four taxa. We filtered these alignments to minimize gaps caused by missing data using the following constraints using a custom R script (in R Core Team 2020): 25% of gaps allowed per site, 25% of gaps allowed per taxon across all alignments, at least 100 sites to be retained in a given alignment, and at least 5% of total taxa to be retained in a given alignment. This filtering step significantly reduced the number of alignments to 468 with the number of taxa per alignment ranging between 34 to 644, but increased nucleotide saturation per alignment. These 468 alignments were used to generate 468 gene trees in RAxML 8 (Stamatakis 2014) using 100 rapid bootstrap pseudoreplicates and the GTRCAT model. After collapsing any node with bootstrap support value lower than 10, we proceeded with the ASTRAL analysis, using *Comicus* as a root. The resulting trees were visualized using FigTree v1.4.4. (http://tree.bio.ed.ac.uk/software/figtree/). The alignments, individual trees used for the ASTRAL analysis, as well as the final tree file were deposited in figshare (doi:10.6084/m9.figshare.30341401).

Results

Number of *Ammopelmatus* species by state: California has 83 valid species (71% of total taxa) of *Ammopelmatus*, with the remaining United States, Canadian, and Mexican states as shown in Fig. 9. The Baja California Peninsula (Mexican states of Baja California and Baja California Sur) contains 11 species, 9 of which are endemic (*A. fisheri* and *A. larumorosa* are also found in adjacent Southern California). This diversity of Orthoptera in California, when compared with other USA states, continues the pattern explored by Harrison (2013), and confirms the California Floristic Province as a JC hotspot.



FIGURE 9. Number of *Ammopelmatus* species in each state or province in the United States, Mexico, and Canada.

Basic Jerusalem cricket morphology. All *Ammopelmatus* Jerusalem crickets have a similar, basic body plan: the **front** legs (Fig. 5A, p. 15) all have a ringlet of 5 calcars on the distal tibia plus 2 or 3 ventral tibial spurs. The **middle** legs (Fig. 5B, p. 15) have 7 or 8 spaced tibial calcars plus 2 ventral tibial spurs. The **hind** legs (Fig. 4A, p. 14) have a ringlet of 6 tibial calcars, and a variable number of inner and outer tibial spines, depending on the species. Almost all taxa have 2 rear leg ventral tibial spurs, except for around 65% of *A. nigrocapitatus*, which have 1. In addition, 1 rear leg tibial spur is also seen in 4 (*A. clarki*, *A. davewerneri*, *A. kelsoensis*, and *A. muwu*) sand dune obligate species, but not in the sand obligate *A. joshuatree.* One hind leg tibial spur is clearly convergent since these four taxa are recovered in three different Groups.

JC abdomens have alternating, circular light and dark bands along with differences in color patterns and the shape of the rear leg calcars and inner and outer spine numbers. Useful terminal genital characters are lacking in both sexes, including on the supra-anal and subgenital plates, as first noted by Hebard (1916), which caused him to proclaim that "… the genus presents possibly the greatest number of difficulties to be found in any of the North American genera of Orthoptera."

***Ammopelmatus* species that have two or more color morphs:** Included taxa are: *A. abelai* (p. 652); *A. castaneus* (p. 588); *A. mahogani* (p. 107); *A mescaleroensis* (p. 500) and its junior synonym *A. monahansensis* (p. 739); *A. navajo* (p. 513); and *A. yubalake* (p. 554), the latter only at Dugway Proving Grounds. The causes and effects of color polymorphism in JCs are further discussed on p. 500, under *A. mescaleroensis.* Our data are consistent with the conclusions of Winter *et al.* (2021), who discussed the inheritance of color and pattern body polymorphism in grasshoppers in Germany, and concluded that "the most likely driver of morph-specific [color] selection is crypsis". On the other hand, since all JCs are usually strictly nocturnal, it is unclear how body color differences are appreciated by predators when sunlight is minimal. Anecdotally, we do know that JC surface activity is much decreased when moonlight is considerable.

***Ammopelmatus* species that are megacephalic variable:** Hebard (1916) commented about the occurrence of megacephalism, especially in male individuals of *Stenopelmatus* (now *Ammopelmatus*) *fuscus.* We confirm the unpredictable occurrence of megacephalism in certain species, but note its most extreme manifestation in those members of *A. mescaleroensis* from Monahans State Park, Texas (p. 500); *A. danieli* from Monterey County, near King City (S23-105), California (p. 603); and *A. tarcanyon* from Kings Co, California (p. 638).

Basics of *Ammopelmatus* drumming: In general, female calling drums were longer than male calling drums in the same species. The longest slow-rate calling drums were made by (a) a female *A. etiwanda* (R98-167, S97-140) who drummed 962 times over 1030 seconds; and (b) a female *A. monolake* (R05-27, S04-28) who drummed 1078 times over 756 seconds. The longest rapid-rate drums were made by (a) a female *A. danieli* (R97-22, S96-110) who drummed 1760 times over 233 seconds; and (b) a female *A. pinnacles* (R23-4, S23-31) who drummed 2064 times over 219 seconds. Virgin adult females, anecdotally, appear easier to prompt to drum the older they are and the longer they have been unmated; and are probably also more receptive to answering drums that differ significantly from their normal calling drum rate.

Sex clarification drums (SCD) are known for species in many diverse Groups and would thus appear to be an old character with little phylogenetic use. We documented their occurrence in 58% of species (Summarized in Appendix 1, p.768), but note that such behavior can be difficult to elicit. In some species (e.g., *A. tomsplace*), almost all adult males produce a SCD in the presence of the proper stimulus. In other taxa (e.g., *A. castaneus* and *A. nigrocapitatus*), only 1 adult male out of many produced a SCD. We can only say with some certainty that SCDs are unknown in 41 taxa; since the residual 18 taxa (out of 117 total) are known from too few (0 to 2) live adult males to be determinative.

Trying to prompt adult males to produce SCDs, in the laboratory, is facilitated by simultaneously having several adults, especially females, of the same species actively drumming nearby. In three cases (*A. islander* [S83-169, R84-11], *A. juniperdunes* [S86-26, R86-6], and *A. owensvalley* [S96-16]), SCDs were heard in a single late instar male of each species.

SCDs are more common in *Ammopelmatus* then in *Stenopelmatus* (where only known in *S. perote* [Weissman *et al.* 2021]), and are widespread and characteristic of several *Ammopelmatus* Groups, such as the Portal and Lightfooti Groups. SCD have even been documented in one species in the trilling Longispinus Group: *A. nigrocapitatus* (S14-4, R14-127).

Nymphal drums, documented across several major JC Groups, are made by at least 23 taxa, and are tabulated in Appendix 1, p.768.

***Ammopelmatus* species where males and females have different calling drums:** See Table 19.3 in Weissman (2001b). Includes most species in Winchester Group (but not *A. davewerneri*; and calling drum in male *A. clarki* unknown). (2) Many species in the Longispinus Group, such as sister taxa *A. briani* and *A. rentzi*; in addition to *A. finnon, A. longispinoides,* and *A. mtshasta*, where males of the latter three species have actual trills and many females have only single drums; (3) And *A. portal* where both sexes typically have a fast, introductory part although the drum rate is 2 to 3 times faster in males than females.

Basics of *Ammopelmatus* cytology. There are two separate testes in each male JC, one in each lateral gutter located near the midpoint of the abdomen. They first become visible during the penultimate and last instars. Each testis is an ivory-white color and embedded within the off-white fat body, making them a little difficult to identify after a dorsal, midline longitudinal incision of the abdomen.

All New World JCs have sex determining XO♂, XX♀ mechanism, with an odd number of chromosomes in the male ranging from 19 (*A. christmasvalleydunes* and *A. idaho*) to 27 (*Stenopelmatus piceiventris* Walker [Weissman *et al.* 2021]). At least several autosomal pairs are fixed as metacentrics along with the always metacentric X sex chromosome, consistent with the latter's generally conservative nature, as discussed in John & Rentz (1987) and Vandergast *et al.* (2017). For the 105 *Ammopelmatus* species herein described, plus 12 previously named species, we present karyotypes for 92, or ~79% (Summarized in Appendix 1, p.768). The most common diploid number is 2n♂=25 (57 species, 62% of total); with 2n♂=23 found in 30 species, or 33% of taxa. Only in the Lightfooti Group (Table 39, p.51) is the chromosome number further reduced, with 3 species having 2n♂=21, and 2 species having 2n♂=19. In every documented species, the X chromosome is always metacentric and frequently the largest chromosome in the karyotype. We report supernumerary, or B, chromosomes for the first time in *Ammopelmatus*, finding them rare, but present, in *A. carsoncity, A. lakesherwood, A. leei,* and *A. nigrocapitatus.*

In light of our exhaustive survey results, it is now clear that the earlier report by Stevens (1905; corrected in 1909) of 2n♂=47 in a California *Stenopelmatus* (=*Ammopelmatus*) is an error in count (John & Rentz 1987).

Can we determine what is the "ancestral or primitive (White 1973) karyotype" in New World Stenopelmatinae? Vandergast *et al.* (2017), Weissman *et al.* (2021), and this report (Fig. 10, p. 28) (but not Weissman *et al.* (2024) all recovered *Stenopelmatus piceiventris* Walker, with 2n♂=27, at the base of New World Stenopelmatinae. The 3 other species of *Stenopelmatus* karyotyped in Weissman *et al.* (2021) were 2n♂=25, which represents a small, but consistent, sample of the total diversity, most of it unnamed, in that genus (Gutiérrez-Rodríguez *et al.* 2022, Suastes-Jiménez *et al.* 2023, and Ruiz-Mendoza *et al.* 2023. In contrast, our extensive survey of *Ammopelmatus* shows that 2n♂=25 is the highest and most common number of chromosomes in this genus, and would logically be the ancestral karyotype number. White (1973, p. 452) discusses the difficulty of documenting which direction chromosome numbers have evolved within a group; a situation which has apparently not significantly improved in the last 50 years (Sylvester *et al.* 2020, Lucek *et al.* 2023, Palacios-Gimenez *et al.* 2025). We thus think it reasonable to assume that in *Ammopelmatus,* 2n♂=25 is the ancestral karyotype. Under that assumption, we believe that there have been at least 9 independent chromosomal reductions from 2n♂=25 to 2n♂=23, since 9 (Groups 3, 5, 8, 11, 12, 13, 20, 25, & 26) of our 26 DNA Groups have species with both 23 and 25 karyotypes.

Mating in *Ammopelmatus* Jerusalem crickets. Interested readers are referred to previous publications: Weissman (2001b); Weissman *et al.* (2008, 2021, 2024); and a high resolution video produced by Deep Look entitled "Jerusalem crickets only date drummers": https://www.youtube.com/watch?v=mHbwC-AIyTE&t=147s&ab_channel=DeepLook, where a pair of laboratory raised, known virgins of *A. lakecachuma,* were filmed mating. To these previous reports, we here add a unique observation (see Fig. 1378, p. 731) made during an attempted mating between a male *A. leei* and a female *A. lakesherwood* where the male (S86-173, R87-48) extruded his internal phallic lobes and raised his abdomen, as if releasing a pheromone. Actual attempted coupling was absent as the female showed no interest. We have not seen such behavior in over 100 successful matings between known conspecifics (Weissman, unpublished).

Elsewhere (Weissman 2001b), we discuss the occurrence of male-complicit, postcoital sexual cannibalism (MCPSC), specifically where the male permits the female to eat him after successful copulation, while making no effort to escape. (We distinguish this phenomenon from sexual cannibalism, as reviewed in Wilder *et al.* 2009). While field evidence of MCPSC is found only fortuitously, we have continued, over the years, to accumulate documentation of field matings. Since Weissman (2001b), we have found another two field matings. So, in a total of five field matings, one resulted in MCPSC. We give several theoretical reasons to support the potential benefits of such a reproductive strategy: (1) It may be a rare day for a male to find a sexually receptive female. (2) To increase

their odds of finding a mate, males do a lot of wandering (as documented by oatmeal trails and road cruising), and apparent drumming on the surface, while adult females may be more sedentary below the surface. (3) This behavior pattern places males more at risk, from predation, while they are on the surface. (4) In the face of such risks, and perhaps infrequent mating opportunities, it may make sense for a male to let the female eat him after mating, with his body acting as the ultimate nuptial gift. (5) Adult males, at least in the laboratory, have shorter lifespans than adult females. (6) MCPSC in nature may be more common than indicated by the ~9% (6 of 68 matings) of laboratory matings (Weissman 2001b) that resulted in MCPSC; and might partially help explain the preponderance of adult females, vs adult males, both in museum collections and in the field, as the season progresses. We wonder if the incidence of MCPSC might increase after a male's second or third mating? Hopefully, continued field work can address the skepticism of Gould (1985), who stated (p. 55) that "…I am even more persuaded that sexual cannibalism [in any species] is a phenomenon without proven examples."

Many orthopteran species have sclerotized genital parts which probably act in a lock and key fashion (e.g., Rentz 1972, Cole *et al.* 2021) to help assure species' integrity. Since JCs have no such taxonomic aids, and given the fact that spermatophore transfer takes less than 10 seconds, with no insertion of any structures, this paucity is not surprising. On the other hand, before spermatophore transfer, individuals usually require several minutes maneuvering into proper alignment. We wonder if this behavior, which is necessary to get the male's hooks properly aligned with the female's ventral abdominal plates, might be a modified form of lock and key? Afterall, we have shown (Weissman *et al.* 2008) that small body length male Longispinus Group *A. brachysocius* have a mating advantage over large males because the former can mate with almost any sized adult female—even where a male is as much as 24 mm shorter than the female. In contrast, males as little as 2 mm longer than a potential, and receptive, female may physically be unable to copulate. This situation probably also applies to several other taxa (*A. finnon, A. longispinoides, A. mtshasta*) in the Longispinus Group, since in the latter 3 species, males, as in *A. brachysocius*, appear likewise sexually dimorphic for hind femur length.

And to extend the importance of the necessary "Kama Sutra" gymnastics (Weissman *et al.* 2008) that mating JCs must engage in before copulation can occur, we note that significant body length differences (see Fig. 220, p. 163), as seen between the sympatric *A. intermedius* and *A. longispinoides* (at Pacifica, San Mateo Co.); and between the sympatric *A. intermedioides* and *A. brachysocius* (at Fremont Peak, San Benito Co.), would undoubtedly act as a premating barrier in both situations when the male was of the larger species.

Adult reproductive dormancy in *Ammopelmatus* Jerusalem crickets. An adult reproductive dormancy (ARD) is a period, which can be several months in duration, where adult individuals are characterized by the absence of some, or all, reproductive activity and behavior, in one or both sexes. Missing activities can include absence of gonad maturation, absence of sexual signaling, and absence of mating and oviposition. An ARD can be invisible to the casual observer because some adult activities, such as flying and feeding, can be present at near normal levels. As an example, Weissman & French (1980) documented an ARD in a small California grasshopper, *Trimerotropis occidentalis* (Bruner) (males average 150 mg and nongravid females average 275 mg), where reproductive activities were delayed for months after the molt to adult; and adult survivorship lasting 100 days was not unusual. Such a life history strategy appears to be a response to a Mediterranean type climate, with its long summer drought and typically late fall and winter precipitation. A similar life history pattern, in response to drought, is also common in central African grasshoppers, with Phipps (1968) and Chapman (1962) claiming its presence in up to 70–80% of taxa.

Our latest analyses indicate, contra Weissman 2001a, p. 63, that ARD may also occur in several species of Southern California JCs that live in lower elevation, coastal areas that don't have a winter freeze, with adults (especially females) living for months and frequently surviving the winter. This potential was noted because, although the nymphs of almost all of the low elevation/coastal species found in Southern California molt to adult by mid-summer, and start drumming one to three weeks later, there were several taxa where both sexes (but not all individuals) delayed drumming until early to mid-December. During this 2 to 3.5-month delay period, we were also unable to stimulate those adults to drum by the frequently reliable method of finger tapping on the table top near their containers. We initially noted this pattern in *A. mahogani*, but with recent, good sample sizes for several other species in Southern California, we can now extend this observation to include two (*A. skinner* and *A. oneillpark*) of the three species in Group 24, Southern California #4. Additionally, the third taxon in that group, *A. stringfellow,* generally molts to adult in October, and requires 3 to 5 weeks before drumming commences. This seemingly delayed behavior in *A. stringfellow* may be partially explained by the cooler laboratory temperatures,

and slower cuticle hardening, during that time period. In contrast, other Southern California JCs like *A. fisheri*, *A. santarosaplateau*, and *A. sierrapelona*, start drumming soon after molting to adult. A third reproductive variant appears to occur in *A. icenoglei,* where nymphs just molt to adult in mid to late fall, as opposed to mid-summer, and start to drum soon after.

We encourage further investigations to examine how widespread this strategy is: (1) Will adults mate even before they start drumming? (2) Adult females are easily dissected to assess egg development; (3) Laboratory raising of field-collected juveniles should indicate when drumming begins; and (4) Most definitively, the spermatheca can be removed from field-collected adult females to assess mating status (Weissman 1979). Species with ARD also appear to drum at lower temperatures when compared to those taxa without an ARD; which makes sense since temperatures in November and December are typically lower than those seen 2 months earlier. In fact, we wonder if rainfall and/or cooler temperatures might be needed to break their ARD period?

Phylogeny of *Ammopelmatus*. The ASTRAL analysis (Fig. 10) resulted in a well-resolved topology. We recovered the New World Stenopelmatidae as a monophyletic group, consisting of two monophyletic genera *Stenopelmatus* and *Ammopelmatus*. The Old World Stenopelmatidae did not group with the New World Stenopelmatidae, consistent with previous findings (Weissman *et al*. 2024), which strongly suggests the current taxonomic concept of Stenopelmatidae may require a revision. Within *Ammopelmatus*, we recovered a large number of well-differentiated clades. In light of the morphology, drumming patterns, and geographic distributions, we identified a total of 26 species groups, most of which corresponded to the recovered clades. The only non-monophyletic species group was the Fast Drumming Group, because of the placement of the Pratti Group. In most cases, species were recovered as monophyletic, but some of species belonging to the Argus Group, Mojave Desert Group, Lightfooti Group, Fuscus Group, and Mono Lake Group, and a large number of species belonging to a larger clade consisting of species groups #18–26, were not recovered as monophyletic. Branch lengths leading to these species were often very short with the nodal support values associated with these groupings were often low. There could be a few reasons why these patterns emerged. The first is biological in that most of these species are incipient species currently undergoing speciation, and as a result, lineage sorting has not been completed. Given how morphologically similar these species are, this is a reasonable assessment. The second reason is related to the type of phylogenomic markers used for this analysis. Target enrichment techniques in general have inherent stochasticity built in. Depending on the preservation of DNA and how DNA is sheared during library preparation, the efficiency of bait hybridization can vary. Even during sequencing, the number of reads sequenced for different libraries can differ considerably due to the stochasticity of the sequencing chemistry. As a result, the number of loci captured from two individuals of the same species may not be identical. The third reason may be due to the design of the OR-TE probes used in this study. Among different individuals of the same species, there might not be a large number of sequence variation across different single-copy protein-coding genes. This means that the actual number of phylogenetically informative sites generated using this method might not be sufficient to fully resolve the relationships among populations or geographic races that still maintain gene flows. Nevertheless, the overall performance of the OR-TE probes was excellent in resolving the majority of species-level relationships, providing a robust basis for this work.

Maximum likelihood consensus tree using mtDNA. The resulting mtDNA concatenated dataset (see Appendix 3, p.775) contained 240 individuals and 954 aligned sites, 354 of which were parsimony informative. The analysis was rooted on outgroups within Stenopelmatidae and Gryllacrididae. The Tamura Nei two parameter model with intermediate substitution rates (TIM3+F+I+G4) was selected by BIC. Most major groups supported by the OR-TE analysis were also recovered in the mtDNA consensus tree with ultrafast bootstrap support ranging from 55% to 100%. At the species level, most described species were recovered as monophyletic. Exceptions included *A. mescaleroensis* with individuals recovered in both the Fuscus Group and the Utah Group; *A. danieli* and *A. zayante* with individuals interspersed across subclades within the Fast Drumming Group; and *A. monolake* across multiple subclades within the Monolake Group. Despite these discrepancies, overall, these results suggest that DNA barcoding with these mtDNA gene regions could be used to initially assign unknown individuals to their major groups and closest described species, until other data can be collected to verify. Sequence data were deposited in GenBank (accession numbers for 12S: PX901467–PX901706; COI: PX905358–PX905436).

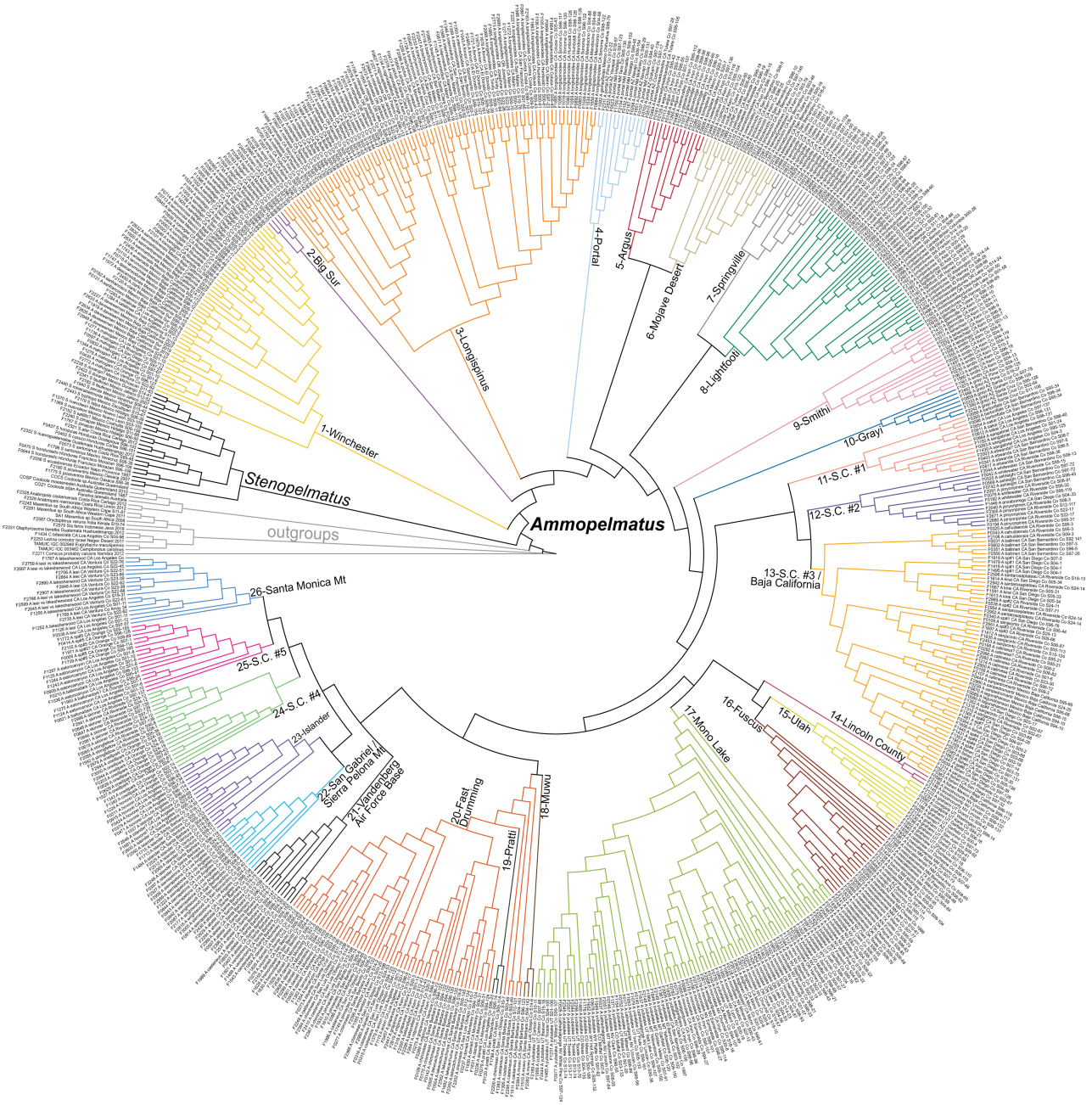


FIGURE 10. OR-TE tree showing relationships between the 26 Groups (as numbered in the tree and text), and the 639 individual *Ammopelmatus* specimens sequenced for this study. Included in the tree are those results for 24 individuals of the related JC genus *Stenopelmatus* (from Weissman *et al.* 2021). Outgroups (17 specimens) are as used previously (Vandergast *et al.* 2017, Weissman *et al.* 2024), but with the inclusion of two gryllacridids which were not included in the latter study.

Tables/Keys to southern and central California species, by County:

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Kern County, Table 2 . . . . . p. 30
Los Angeles County, Table 3 . . . . . p. 31
Monterey County, Table 4. . . . . p. 32
Orange County, Table 5 . . . . . p. 33
Riverside County, Table 6. . . . . p. 33
San Benito County, Table 4. . . . . p. 32
San Bernardino County, Table 6 . . . . . p. 33
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Tables/Keys to California species, by Geographical Region:

Central coastal CA, including Channel Islands, Table 11. . . . . p. 36
Central CA, between coast and Central Valley, Table 12 . . . . . p. 37
Western side CA Central Valley, Table 13 . . . . . p. 38
Eastern side CA Central Valley, western side Sierras, Table 14 . . . . . p. 38
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Tables/Keys to California species, by Mountain Range:

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Tables/Keys to rest of United States species, by State:

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Tables/Keys to Canada and Mexico species:

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Tables/Keys to species in the 4 major Groups:

Fast Drumming Group, Table 38 . . . . . p. 50
Lightfooti Group, Table 39 . . . . . p. 51
Longispinus Group, Table 40 . . . . . p. 51
Winchester Group, Table 41 . . . . . p. 52

TABLE 1. Fresno Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. nigrocapitatus	Jacalitos Canyon	small	2n♂=25	0.5–0.8 trills/s	no	2 (3)
A. pictus	San Francisco	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A. rentzi	Central Valley	small-medium	2n♂=25	long to short trills	no	3
A. springville	E Springville	medium-large	2n♂=25	3.4–3.7	yes	3 (4)
A. tarcanyon	Tar Canyon	medium-very large	2n♂=23	7.1 to 13.6	yes	2

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. nigrocapitatus	7 (8)	2	2 or 3i/2o	2 or 3	2 (3)	1 or 2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A. rentzi	(7) 8	2	5i/4o	(4) 5 (6)	4	2
A. springville	(7) 8	2	5i/3o	5 (6)	(2) 3 (4)	2
A. tarcanyon	8	2 (3)	5i/3o	5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 2. Kern Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. bakersfield	Bakersfield	large	unknown	9 to 10	no	2
A. brockovichi	near Hinkley	small-medium	2n♂=25	1.1–2.2	yes	(0, 1) 2
A. chinalake	China Lake dunes	medium	unknown	2.1	unknown	(1) 2
A. crypticus	Tehachapi Mt Park	medium-large	unknown	3.1–4.0	yes	3
A. glennville	near Glennville	small-medium	2n♂=25	2.6–3.9	yes	2
A. grapevine	Grapevine	large	2n♂=25	8.7–12	no	(1) 2 (3)
A. mtpinos	Mt Pinos	large	2n♂=23	7.2–9.6	no	2 or 3
A. nigrocapitatus	Jacalitos Canyon	small	2n♂=25	0.5–0.8 trills/s	no	2 (3)
A. piute	Piute Mts	large	unknown	5.2–5.9	unknown	2
A. smithi	Sand Ridge	small-medium	2n♂=25	4.5–5.5	yes	(2) 3
A. tehachapi	7 m SSE Arvin	small-large	2n♂=25	1.4–1.5	yes	3
A. temblor	Temblor Range	large	2n♂=23	male: 10; female: 8	no	2 (3)

.....continued on the next page

TABLE 2. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. bakersfield	7 (8, 9)	2	5i/3o	5	3	2
A. brockovichi	(6) 7	(1) 2	1 or 2i/2o	1 or 2	(1) 2 (3)	(1) 2
A. chinalake	7	(1) 2	2i/2 or 3o	2 (3)	2 or 3	2
A. crypticus	8	2	5–6i/3o	5 or 6	3	2
A. glennville	(7) 8	2 (3)	5i/3o	5 (6)	3 (4)	2
A. grapevine	(7) 8	(1) 2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. mtpinos	8	2	5i/3o	5	3	2
A. nigrocapitatus	7 (8)	2	2 or 3i/2o	2 or 3	2 (3)	1 or 2
A. piute	8	2	5i/3o	5	3	2
A. smithi	(7) 8 (9)	2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. tehachapi	(7) 8 (9)	2	5i/3o	(4) 5 (6)	3 (4)	2
A. temblor	(7) 8	(1) 2 (3)	3i/3o	3 (4)	3	(1) 2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 3. Los Angeles Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. acton	Acton Wash	medium-very large	2n♂=23	7.9–9.7	yes	2
A. ballonadark	Ballona Wetlands	medium-large	2n♂=23	5.5–5.9	yes	3
A. bigpines	Big Pines	small	unknown	8.6	unknown	3
A. catalinae	Santa Catalina Island	small-large	2n♂=25	male: 3 parts female: fast to slow drums	no	3
A. eatoncanyon	Eaton Canyon	medium-large	2n♂=25	4.9–7.7	yes	3
A. hovorei	Placerita Canyon	medium-large	2n♂=25	4.6–6 .0	yes	(2) 3
A. lakesherwood	Lake Sherwood	large	2n♂=25	4.3–5.5	yes	3
A. leei	Pt Dume	medium-large	2n♂=23	5.5–6.7	yes	3
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. pratti	El Mirage Dry Lake	medium	2n♂=25	4.5–5.4	no	(1) 2
A. sakai	Ballona Wetlands	small to medium-large	2n♂=23	0.52–0.56	no	3
A. sangabriel	Chilao Campground	small-medium	2n♂=23	0.6–1.1	no	3
A. sierrapelona	Sierra Pelona Mts	medium-large	2n♂=25	5.1–6.4	yes	3
A. wrightwoodi	Cajon Pass	medium	unknown	4.5	no	(2) 3

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TABLE 3. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. acton	8	2	5i/3o	5	3 (4)	
A. ballonadark	(7) 8	2	5i/3o	5 (6)	3 (4)	
A. bigpines	8	2	5 or 6i/3o	5 or 6	3	2
A. catalinae	(7) 8	2	4 or 5i/ 4o	4 or 5	(3) 4	2
A. eatoncanyon	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. hovorei	(6-7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. lakesherwood	(6) 7 (8)	2	5i/3o	(4) 5	3	2 (4)
A. leei	7 or 8	2	5i/3o	5 (6)	3	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. pratti	(7) 8 (9)	(1) 2	3 or 4i/3o	(2) 3 or 4	3 (4)	(1) 2
A. sakai	(7) 8	2	5i/3o	(3, 4) 5 (6)	(2) 3 (4)	2
A. sangabriel	(7) 8	2	5i/3o	(4) 5	3	2
A. sierrapelona	7 or 8	2 (3)	5i/3o	(4) 5	3 (4)	2
A. wrightwoodi	7	2	5i/3o	5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 4. Monterey & San Benito Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/ s)	Sex clarification drum?	Fore leg tibial spurs*
A. bigsur	Pfeiffer Big Sur State Park	small	2n♂=25	short to long trills	no	3
A. brachysocius	Jasper Ridge	small-large	2n♂=25	trills to drums	no	3
A. danieli	Arroyo Seco	medium-large	2n♂=23	6.3–11.3	no	2
A. fremontpeak	Fremont Peak	large-very large	2n♂=23	male: 8–9 female: 6–6.8	yes	2
A. intermedioides	Fremont Park	small	unknown	long to short trills	no	3
A. pictus	San Francisco	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A pinnacles	Pinnacles NP	large	2n♂=23	5–6.5	no	2 (3)

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. bigsur	8	2	4 or 5i/4o	(3) 4 or 5 (6)	(2,3) 4	2
A. brachysocius	8	2	4i/2o	(3) 4	(1) 2 (3)	2
A. danieli	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. fremontpeak	8	2	5i/3 or 4o	5	3 or 4	2
A. intermedioides	(7) 8	2	4i/2o	4	2 (3)	2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A pinnacles	8	2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 5. Orange Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. oneillpark	O'Neill Park	small-large	2n♂=25	5.9–7.7	yes	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. oneillpark	(7) 8	2	5i/3o	(4) 5	3 (4)	2 (3)

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 6. San Bernardino and Riverside Co., California, excluding San Bernardino and San Jacinto Mts.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. ballmeri	Colton Dunes	small-large	2n♂=23	4..1–4.9	no	2 or 3
A. brockovichi	near Hinkley	small-medium	2n♂=25	1.1–2.2	yes	(0, 1) 2
A. cahuilaensis	Palm Springs	medium-large	2n♂=25	4.8–4.9	yes	(1) 2 (3)
A. calimesa	Calimesa	medium-large	2n♂=23	7.3	yes	(2) 3
A. etiwanda	Etiwanda	small-large	2n♂=23	0.8–1.2	no	(2) 3
A. icenoglei	Winchester	small to large	2n♂=25	Male: ~17 Female: 9.5	no	3
A. joshuatree	Pleasant Valley, JTNP	small	2n♂=25	0.7–0.8	yes	1 (2)
A. kelsoensis	Kelso Dunes	small-medium	unknown	0.7–1.0	yes	(1) 2
A. kirai	Warner Springs	medium	2n♂=23	6.2–7.9	yes	(2) 3
A. kokoweef	Kokoweef Peak	large	unknown	unknown	unknown	3
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. pratti	El Mirage Dry Lake	medium	2n♂=25	4.5–5.4	no	(1) 2
A. santarosaplateau	Santa Ana Mts	medium	2n♂=23	8.1–10	yes	(2) 3
A. skinner	Borel Rd	large	2n♂=25	4.7–5.4	yes	3
A. stringfellow	Jurupa Valley	medium-large	2n♂=25	6.4–7	yes	(2) 3 (4)
A. whitewater	Whitewater Canyon	large	2n♂=25	1–1.1	yes	3
A. wrightwoodi	Cajon Pass	medium	unknown	4.5	no	(2) 3

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TABLE 6. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. ballmeri	(6, 7) 8	2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. brockovichi	(6) 7	(1) 2	1 or 2i/2o	1 or 2	(1) 2 (3)	(1) 2
A. cahuilaensis	7 or 8	2	3i/3o	3 (4, 5)	(2) 3	2
A. calimesa	(7) 8	2	5i/3o	5 (6)	3 (4)	2
A. etiwanda	(7) 8	2	5i/3o	5 (6)	3	2
A. icenoglei	7	(1) 2 (3)	5i/4o	(3, 4) 5	(3) 4	2
A. joshuatree	(6) 7	2	2 or 3i/2o	2 or 3	2	(1) 2
A. kelsoensis	7	2	1i/2o	1	2	1 or 2
A. kirai	7 or 8	2	5i/3o	(4) 5	3	2
A. kokoweef	8	2	5i/2 or 3o	5	2 or 3	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. pratti	(7) 8 (9)	(1) 2	3 or 4i/3o	(2) 3 or 4	3 (4)	(1) 2
A. santarosaplateau	(7) 8	2	5i/3o	5	3 (4)	2
A. skinner	(6,7) 8	2	5i/3o	5 (6)	3 (4)	2
A. stringfellow	7 or 8	2	5i/3o	5	3 (4)	2
A. whitewater	(7) 8	(1) 2	5i/3o	(4) 5	3	2
A. wrightwoodi	7	2	5i/3o	5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 7. San Diego Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. anzaborrego	Anza-Borrego State Park	large	unknown	1	no	3
A. fisheri	Tijuana Estauary	small-medium	2n♂=23	4–7.6	yes	(2) 3 (4)
A. kirai	Warner Springs	medium	2n♂=23	6.2–7.9	yes	(2) 3
A. larumorosa	La Rumorosa	small to medium-large	2n♂=25	male: 4.9–9.1 female: 2.2–3.8	no	2
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. sandiego	Lake Hodges	medium-large	2n♂=25	Male: 10–11.2 Female: 7.3	no	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. anzaborrego	8	2	5 or 6i/3o	5 or 6	3	2
A. fisheri	(7) 8 (9)	2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. kirai	7 or 8	2	5i/3o	(4) 5	3	2
A. larumorosa	7 (8)	2	4i/3o	(2,3) 4 (5)	3 (4)	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. sandiego	7	2	5i/3 or 4o	(4) 5	3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 8. Santa Barbara Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. abelai	Vandenberg	small-large	2n♂=25	2.6–3.4	yes	3
A. castaneus	Vandenberg	medium-large	2n♂=23	6 to 11	no	2
A. chimineas	Chimineas Ranch	lagre-very large	2n♂=23	7.7–9.4	no	2
A. islander	Santa Cruz Island	large	2n♂=25	5.3–6.6	yes	(2) 3
A. lakecachuma	Lake Cachuma	large	2n♂=23	8.8–10.5	no	2 (3)
A. muwu	Pt Conception	small-large	2n♂=23	2.8–3.3	yes	1 (2)
A. vandenberg	Vandenberg	(small)-large	2n♂=25	1.1–1.7	yes	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. abelai	(7) 8	(1) 2	5i/3o	5 (6)	3 (4)	2
A. castaneus	(7) 8	2	5i/3o	(4) 5	3 (4)	1 or 2
A. chimineas	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. islander	(7) 8	(1) 2	6i/3o	5	(2) 3 (4)	2
A. lakecachuma	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. muwu	(6) 7 (8)	1 or 2	1i/3o	1 (2)	(1 or 2) 3	1
A. vandenberg	(7) 8	2	5i/3o	5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 9. Tulare Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. coyflat	Coy Flat	large	2n♂=25	7.5–9.9	yes	3
A. glennville	near Glennville	small-medium	2n♂=25	2.6–3.9	yes	2
A. kennedymeadows	Kennedy Meadows	small	2n♂=25	4.2–7.7	no	(1) 2
A kennedymeadowsdos	13 m SE Kennedy Meadows	large	unknown	5	unknown	3
A. springville	E Springville	medium-large	2n♂=25	3.4–3.7	yes	3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. coyflat	8	2	6i/4o	(5) 6 (7)	4	(1) 2
A. glennville	(7) 8	2 (3)	5i/3o	5 (6)	3 (4)	2
A. kennedymeadows	(6) 7 (8)	2	3i/2o	(1 or 2) 3	2 (3 or 4)	2
A kennedymeadowsdos	8	2	5i/3o	5	3	2
A. springville	(7) 8	2	5i/3o	5 (6)	(2) 3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 10. Ventura Co., California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. islander	Santa Cruz Island	large	2n♂=25	5.3–6.6	yes	(2) 3
A. lakesherwood	Lake Sherwood	large	2n♂=25	4.3–5.5	yes	3
A. leei	Pt Dume	medium-large	2n♂=23	5.5–6.7	yes	3
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. mtpinos	Mt Pinos	large	2n♂=23	7.2–9.6	no	2 or 3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. islander	(7) 8	(1) 2	6i/3o	5	(2) 3 (4)	2
A. lakesherwood	(6) 7 (8)	2	5i/3o	(4) 5	3	2 (4)
A. leei	7 or 8	2	5i/3o	5 (6)	3	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. mtpinos	8	2	5i/3o	5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 11. Central ooastal California, including Channel Islands.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. abelai	Vandenberg	small-large	2n♂=25	2.6–3.4	yes	3
A. bigsur	Pfeiffer Big Sur State Park	small	2n♂=25	short to long trills	no	3
A. brachysocius	Jasper Ridge	small-large	2n♂=25	trills to drums	no	3
A. castaneus	Vandenberg	medium-large	2n♂=23	6 to 11	no	2
A. catalinae	Santa Catalina Island	small-large	2n♂=25	male: 3 parts female: fast to slow drums	no	3
A. chimineas	Chimineas Ranch	lagre-very large	2n♂=23	7.7–9.4	no	2
A. danieli	Arroyo Seco	medium-large	2n♂=23	6.3–11.3	no	2
A. islander	Santa Cruz Island	large	2n♂=25	4.1–6.6	yes	(2) 3
A. lakecachuma	Lake Cachuma	large	2n♂=23	8.8–10.5	no	2 (3)
A. lakesherwood	Lake Sherwood	large	2n♂=25	4.3–5.5	yes	3
A. leei	Pt Dume	medium-large	2n♂=23	5.5–6.7	yes	3
A. muwu	Pt Conception	small-large	2n♂=23	2.8–3.3	yes	1 (2)
A. vandenberg	Vandenberg	(small) large	2n♂=25	1.1–1.7	yes	3

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TABLE 11. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. abelai	(7) 8	(1) 2	5i/3o	5 (6)	3 (4)	2
A. bigsur	8	2	4 or 5i/4o	(3) 4 or 5 (6)	(2,3) 4	2
A. brachysocius	8	2	4i/2o	(3) 4	(1) 2 (3)	2
A. castaneus	(7) 8	2	5i/3o	(4) 5	3 (4)	1 or 2
A. catalinae	(7) 8	2	4 or 5i/ 4o	4 or 5	(3) 4	2
A. chimineas	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. danieli	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. islander	(7) 8	(1) 2	6i/3o	5 (6)	(2) 3 (4)	2
A. lakecachuma	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. lakesherwood	(6) 7 (8)	2	5i/3o	(4) 5	3	2 (4)
A. leei	7 or 8	2	5i/3o	5 (6)	3	2
A. muwu	(6) 7 (8)	1 or 2	1i/3o	1 (2)	(1 or 2) 3	1
A. vandenberg	(7) 8	2	5i/3o	5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 12. Central California: between coast and Central Valley.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. brachysocius	Jasper Ridge	small-large	2n♂=25	trills to drums	no	3
A. chimineas	Chimineas Ranch	lagre-very large	2n♂=23	7.7–9.4	no	2
A. danieli	Arroyo Seco	medium-large	2n♂=23	6.3–11.3	no	2
A. fremontpeak	Fremont Peak	large-very large	2n♂=23	male: 8–9 female: 6–6.8	yes	2
A. intermedioides	Fremont Park	small	unknown	long to short trills	no	3
A. intermedius	Oakland	small-medium	2n♂=23	long to short trills	no	3
A. lakecachuma	Lake Cachuma	large	2n♂=23	8.8–10.5	no	2 (3)
A. longispinoides	Pepperwood	medium-large	2n♂=25	2.2–2.4 trills/s	no	3
A. nigrocapitatus	Jacalitos Canyon	small	2n♂=25	0.5–0.8 trills/s	no	2 (3)
A. pictus	San Francisco	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A pinnacles	Pinnacles NP	large	2n♂=23	5–6.5	no	2 (3)
A. tarcanyon	Tar Canyon	medium-very large	2n♂=23	7.1 to 13.6	yes	2
A. zayante	Felton	small-medium (large)	2n♂=23	7 to 10	yes	2

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TABLE 12. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. brachysocius	8	2	4i/2o	(3) 4	(1) 2 (3)	2
A. chimineas	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. danieli	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. fremontpeak	8	2	5i/3 or 4o	5	3 or 4	2
A. intermedioides	(7) 8	2	4i/2o	4	2 (3)	2
A. intermedius	8	2	4i/2o	(3) 4 (5)	2 (3)	2
A. lakecachuma	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. longispinoides	8	2	5i/2o	(4) 5	(1) 2 (3)	2
A. nigrocapitatus	7 (8)	2	2 or 3i/2o	2 or 3	2 (3)	1 or 2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A pinnacles	8	2	5i/3o	(4) 5	3	2
A. tarcanyon	8	2 (3)	5i/3o	5 (6)	3 (4)	2
A. zayante	(7) 8	2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 13. Western side Central Valley, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. nigrocapitatus	Jacalitos Canyon	small	2n♂=25	0.5–0.8 trills/s	no	2 (3)
A. pictus	San Francisco	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A. tarcanyon	Tar Canyon	medium-very large	2n♂=23	7.1 to 13.6	yes	2

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. nigrocapitatus	7 (8)	2	2 or 3i/2o	2 or 3	2 (3)	1 or 2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A. tarcanyon	8	2 (3)	5i/3o	5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 14. Eastern side Central Valley, California; western side Sierra Nevadas.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. bakersfield	Bakersfield	large	unknown	9 to 10	no	2
A. briani	Lake Tahoe	small-large	2n♂=25	male: 0.4 female: short trills	no	3
A. coyflat	Coy Flat	large	2n♂=25	7.5–9.9	yes	3
A. glennville	near Glennville	small-medium	2n♂=25	2.6–3.9	yes	2
A. pictus	San Francisco, CA	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A. rentzi	Central Valley	small-medium	2n♂=25	long to short trills	no	3
A. smithi	Sand Ridge	small-medium	2n♂=25	4.5–5.5	yes	(2) 3
A. springville	E Springville	medium-large	2n♂=25	3.4–3.7	yes	3 (4)
A. tehachapi	7 m SSE Arvin	small-large	2n♂=25	1.4–1.5	yes	3

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TABLE 14. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. bakersfield	7 (8, 9)	2	5i/3o	5	3	2
A. briani	(7) 8	2 (3)	5i/4o	5	4	2
A. coyflat	8	2	6i/4o	(5) 6 (7)	4	(1) 2
A. glennville	(7) 8	2 (3)	5i/3o	5 (6)	3 (4)	2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A. rentzi	(7) 8	2	5i/4o	(4) 5 (6)	4	2
A. smithi	(7) 8 (9)	2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. springville	(7) 8	2	5i/3o	5 (6)	(2) 3 (4)	2
A. tehachapi	(7) 8 (9)	2	5i/3o	(4) 5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 15. Eastern side Sierras, California; or just east of Sierras.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. argus	Argus Mts	medium-large	unknown	2.5–3.4	yes	3
A. briani	Lake Tahoe	small-large	2n♂=25	male: 0.4 female: short trills	no	3
A. dogtown	near Conway Summit	medium	unknown	1.3–1.9	no	3
A. glacierlodge	Glacier Lodge	large	2n♂=25	Male: 2.5–3.0 Female: 2.6–3.2	no	3
A. kennedymeadows	Kennedy Meadows	small	2n♂=25	4.2–7.7	no	(1) 2
A kennedymeadowsdos	13 m SE Kennedy Meadows	large	unknown	5	unknown	3
A. monolake	Mono Lake	medium-large	2n♂=25	1.5–1.8	no	(2) 3 (4)
A. mtshasta	Mt. Shasta	medium-large	2n♂=25	1.3–2.8 trills/s	no	(2) 3
A. owensvalley	Big Pine	large	2n♂=23	Male: 1.8–3.1 Female: 2.8–3.4	yes	(2) 3
A. tomsplace	Toms Place	small-medium	2n♂=23	2.0–2.7	yes	3 (4)
A. warnermts	Warner Mountains	medium	unknown	2.8 trills/s	unknown	3
A. westgardpass	Westgard Pass	medium-large	unknown	1.2–1.5	no	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. argus	8	2	5i/3o	5 (6)	3 (4)	2 (3)
A. briani	(7) 8	2 (3)	5i/4o	5	4	2
A. dogtown	8	(1) 2	5i/3 or 4o	(4) 5	3 or 4	2
A. glacierlodge	(7) 8	(1) 2	5i/3o	(4) 5	(2) 3	2
A. kennedymeadows	(6) 7 (8)	2	3i/2o	(1 or 2) 3	2 (3 or 4)	2
A kennedymeadowsdos	8	2	5i/3o	5	3	2

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TABLE 15. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. monolake	(7) 8	2 (3)	5i/ 3 or 4o	(3, 4) 5 (6)	3 or 4	2
A. mtshasta	8	2 (3)	5i/4o	5 (6)	4	2
A. owensvalley	(6, 7) 8	(1) 2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. tomsplace	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. warnermts	8	2	5i/4o	5	4	2
A. westgardpass	8	2	5i/3o	(4) 5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 16. Colorado and Mojave Desert, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. acton	Acton Wash	medium-very large	2n♂= 23	7.9–9.7	yes	2
A. brockovichi	near Hinkley	small-medium	2n♂=25	1.1–2.2	yes	(0, 1) 2
A. cahuilaensis	Palm Springs	medium-large	2n♂=25	4.8–4.9	yes	(1) 2 (3)
A. chinalake	China Lake dunes	medium	unknown	2.1	unknown	(1) 2
A. joshuatree	Pleasant Valley, JTNP	small	2n♂=25	0.7–0.8	yes	1 (2)
A. kelsoensis	Kelso Dunes	small-medium	unknown	0.7–1.0	yes	(1) 2
A. kokoweef	Kokoweef Peak	large	unknown	unknown	unknown	3
A. pratti	El Mirage Dry Lake	medium	2n♂=25	4.5–5.4	no	(1) 2
A. whitewater	Whitewater Canyon	large	2n♂=25	1–1.1	yes	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. acton	8	2	5i/3o	5	3 (4)	2
A. brockovichi	(6) 7	(1) 2	1 or 2i/2o	1 or 2	(1) 2 (3)	(1) 2
A. cahuilaensis	7 or 8	2	3i/3o	3 (4, 5)	(2) 3	**2**
A. chinalake	7	(1) 2	2i/2 or 3o	2 (3)	2 or 3	2
A. joshuatree	(6) 7	2	2 or 3i/2o	2 or 3	2	(1) 2
A. kelsoensis	7	2	1i/2o	1	2	1 or 2
A. kokoweef	8	2	5i/2 or 3o	5	2 or 3	2
A. pratti	(7) 8 (9)	(1) 2	3 or 4i/3o	(2) 3 or 4	3 (4)	(1) 2
A. whitewater	(7) 8	(1) 2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 17. Vandenberg Air Force Base, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. abelai	Vandenberg	small-large	2n♂=25	2.6–3.4	yes	3
A. castaneus	Vandenberg	medium-large	2n♂=23	6 to 11	no	2
A. muwu	Pt Conception	small-large	2n♂=23	2.8–3.3	yes	1 (2)
A. vandenberg	Vandenberg	(small) large	2n♂=25	1.1–1.7	yes	3

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TABLE 17. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. abelai	(7) 8	(1) 2	5i/3o	5 (6)	3 (4)	2
A. castaneus	(7) 8	2	5i/3o	(4) 5	3 (4)	1 or 2
A. muwu	(6) 7 (8)	1 or 2	1i/3o	1 (2)	(1 or 2) 3	1
A. vandenberg	(7) 8	2	5i/3o	5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 18. San Bernardino Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. angelusoaks	Angelus Oaks	medium	unknown	3.2	unknown	3
A. ashleighi	Bruin Woods	medium to large	2n♂=25	0.7–1.1	no	3 (4)
A. bartonflats	Barton Flats	small-medium (large)	2n♂=25	1.4–1.7	yes	(2) 3 (4)
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. angelusoaks	8	2	5i/3o	(4) 5	3	2
A. ashleighi	8	2	5i/3o	5 (6)	3	2
A. bartonflats	(7) 8	(1) 2	5i/ 3 or 4o	5 (6)	3 (4)	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 19. San Gabriel Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. acton	Acton Wash	medium-very large	2n♂= 23	7.9–9.7	yes	2
A. bigpines	Big Pines	small	unknown	8.6	no	3
A. eatoncanyon	Eaton Canyon	medium-large	2n♂=25	4.9–7.7	yes	3
A. hovorei	Placerita Canyon	medium-large	2n♂=25	4.6–6 .0	yes	(2) 3
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. sangabriel	Chilao Campground	small-medium	2n♂=23	0.6–1.1	no	3
A. sierrapelona	Sierra Pelona Mts	medium-large	2n♂=25	5.1–6.4	yes	3
A. wrightwoodi	Cajon Pass	medium	unknown	4.6–5.0	no	3

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TABLE 19. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. acton	8	2	5i/3o	5	3 (4)	2
A. bigpines	8	2		5, 6	3	2
A. eatoncanyon	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. hovorei	(6-7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. sangabriel	(7) 8	2	5i/3o	(4) 5	3	2
A. sierrapelona	7 or 8	2 (3)	5i/3o	(4) 5	3 (4)	2
A. wrightwoodi	6 or 7	2	4 or 5i/3o	4 or 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 20. San Jacintos-Santa Rosa Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. pinyonpines	Pinyon Pines	medium-large	2n♂=25	1.0–1.3	yes	3
A. sanjacinto	James Reserve	medium-large	2n♂=23	3.9–6.7	yes	(2) 3

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. pinyonpines	8	2	5i/30	5 (6)	3 (4)	2
A. sanjacinto	(7) 8	2	5i/3o	5	(2) 3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 21. Santa Ana Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. oneillpark	O'Neill Park	small-large	2n♂=25	5.9–7.7	yes	(2) 3 (4)
A. santarosaplateau	Santa Ana Mts	medium	2n♂=23	8.1–10	yes	(2) 3

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	2	2
A. oneillpark	(7) 8	2	5i/3o	(4) 5	3 (4)	2 (3)
A. santarosaplateau	(7) 8	2	5i/3o	5	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 22. Santa Cruz Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs
A. brachysocius	Jasper Ridge	small-large	2n♂=25	trills to drums	no	3
A. zayante	Felton	small-medium (large)	2n♂=23	7 to 10	yes	2

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. brachysocius	8	2	4i/2o	(3) 4	(1) 2 (3)	2
A. zayante	(7) 8	2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 23. Santa Monica Mts, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. lakesherwood	Lake Sherwood	large	2n♂=25	4.3–5.5	yes	3
A. leei	Pt Dume	medium-large	2n♂=23	5.5–6.7	yes	3
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. lakesherwood	(6) 7 (8)	2	5i/3o	(4) 5	3	2 (4)
A. leei	7 or 8	2	5i/3o	5 (6)	3	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 24. Transverse Ranges, Tehachapi/Grapevine, California.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. bakersfield	Bakersfield	large	unknown	9 to 10	no	2
A. chimineas	Chimineas Ranch	lagre-very large	2n♂=23	7.7–9.4	no	2
A. crypticus	Tehachapi Mt Park	medium-large	unknown	3.1–4.0	yes	3
A. grapevine	Grapevine	large	2n♂=25	8.7–12	no	(1) 2 (3)
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. mtpinos	Mt Pinos	large	2n♂=23	7.2–9.6	no	2 or 3
A. tehachapi	7 m SSE Arvin	small-large	2n♂=25	1.4–1.5	yes	3
A. temblor	Temblor Range	large	2n♂=23	male 10; female 8	no	2 (3)

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TABLE 24. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. bakersfield	7 (8, 9)	2	5i/3o	5	3	2
A. chimineas	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. crypticus	8	2	5–6i/3o	5 or 6	3	2
A. grapevine	(7) 8	(1) 2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. mtpinos	8	2	5i/3o	5	3	2
A. tehachapi	(7) 8 (9)	2	5i/3o	(4) 5 (6)	3 (4)	2
A. temblor	(7) 8	(1) 2 (3)	3i/3o	3 (4)	3	(1) 2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 25. Arizona.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. grayi	Madera Canyon	medium	2n♂=25	4.2–4.7	yes	3
A. navajo	Moenkopi Dunes	medium (large)	2n♂=25	1.8–1.9	no	3
A. portal	Portal, AZ	small-medium	2n♂=23	multiple patterns	yes	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. grayi	(6) 7	2 or 3	4i/3o	4	3 (4)	2
A. navajo	8	(1) 2	5i/3o	(4) 5	3 (4)	2
A. portal	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 26. Colorado.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. portal	Portal, AZ	small-medium	2n♂=23	multiple patterns	yes	3
A. yubalake	Yuba Lake	small-large	2n♂=25	1.2–1.7	no	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. portal	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. yubalake	(7) 8	(1) 2	5i/3 or 4o	(4) 5 (6)	3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 27. Idaho.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. bruneaudunes	Bruneau Dunes	small -medium	2n♂=21	3.7–3.9	yes	3
A. idaho	St. Anthony Dunes	small-medium	2n♂=19	3.6–3.9	yes	3
A. juniperdunes	Juniper Dunes, WA	medium	2n♂=21	3.6–4.4	yes	(2) 3
A. yubalake	Yuba Lake	small-large	2n♂=25	1.2–1.7	no	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. bruneaudunes	8	2	5 or 6i/ 4 or 5o	5 or 6	4 or 5	2
A. idaho	8 (9)	2 (3)	6i/4–5o	(5) 6	4 or 5	2
A. juniperdunes	(6) 8	2	5 or 6i/4o	(4) 5 or 6	(3) 4 (5)	2
A. yubalake	(7) 8	(1) 2	5i/3 or 4o	(4) 5 (6)	3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 28. Kansas & Oklahoma.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. mescaleroensis	Mescalero Sands	medium-very large	2n♂=25	0.9–1.1	no	(2) 3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. mescaleroensis	8	2	5i/3 or 4o	(3, 4) 5 (6)	(2) 3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 29. Montana, Nebraska, North Dakota, South Dakota, & Wyoming.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. yubalake	Yuba Lake	small-large	2n♂=25	1.2–1.7	no	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. yubalake	(7) 8	(1) 2	5i/3 or 4o	(4) 5 (6)	3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 30. Nevada.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. cathedralgorge	Cathedral Gorge	medium-large	2n♂=25	1.2	yes, but rare	3
A. lincolncounty	along NV-UT border	medium-large	unknown	0.9–1	yes	3
A. monolake	Mono Lake	medium-large	2n♂=25	1.5–1.8	no	(2) 3 (4)
A. reno	Reno	medium-large	2n♂=25	1.1–1.7	no	(2) 3
A. yubalake	Yuba Lake	small-large	2n♂=25	1.2–1.7	no	(2) 3 (4)
LIGHTFOOTI GROUP						
A. carsoncity	Carson City	medium	2n♂=23	4–4.9	yes	2 or 3
A. evansi	Crescent Dunes	small	unknown	6.4–6.5	unknown	3
A. knighti	Fallon	medium-large	2n♂=25	4.5–5.3	yes	(2) 3
A. rusti	Blow Sand Mt	large	2n♂=23	6	yes	2 or 3
A. winnemucca	Winnemucca Dunes	small-medium	2n♂=21	36	3.1 –3.9	yes

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. cathedralgorge	8	2	5i/3 or 4o	5	3 or 4	2
A. lincolncounty	8	2	5i/ 3 or 4o	5	3 or 4	2
A. monolake	(7) 8	2 (3)	5i/ 3 or 4o	(3, 4) 5 (6)	3 or 4	2
A. reno	8	2	5i/ 3 or 4o	(4) 5	3 or 4 (5)	2
A. yubalake	(7) 8	(1) 2	5i/3 or 4o	(4) 5 (6)	3 or 4	2
LIGHTFOOTI GROUP						
A. carsoncity	8	2	5i/ 3 or 4o	(4) 5 (6)	(2) 3 or 4	2
A. evansi	8	2	5i/3o	5	3	2
A. knighti	8	2	5i/3o	5 (6)	3 (4)	2
A. rusti	8 (9)	2	5i/3o	5 (6)	3 (4)	2
A. winnemucca	3	8	2	5i/4o	5 (6)	(3) 4 (5)

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 31. New Mexico.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. fuscus	Santa Fe, NM	small-medium	unknown	1.3–1.7	no	3
A. mescaleroensis	Mescalero Sands	(small) medium-very large	2n♂=25	0.9–1.1	no	(2) 3
A. portal	Portal, AZ	small-medium	2n♂=23	multiple patterns	yes	3

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TABLE 31. (Continued)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. fuscus	8	(1) 2	5i/3o	5	3 (4)	2
A. mescaleroensis	8	2	5i/3 or 4o	(3, 4) 5 (6)	(2) 3 or 4	2
A. portal	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 32. Oregon.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. christmasvalleydunes	Christmas Valley Dunes, OR	small-medium	2n♂=19	3.4–3.6	yes	3 (4)
A. juniperdunes	Juniper Dunes, WA	medium	2n♂=21	4.0–4.1	yes	(2) 3
A. lightfooti	Alvord Lake Dunes, OR	medium	2n♂=23	3–3.2	yes	2 or 3
A. longispinoides	Pepperwood	medium-large	2n♂=25	2.2–2.4 trills/s	no	3
A. monolake	Mono Lake	medium-large	2n♂=25	1.5–1.8	no	(2) 3 (4)
A. mtshasta	Mt. Shasta	medium-large	2n♂=25	1.3–2.8 trills/s	no	(2) 3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. christmasvalleydunes	8	2	5 or 6i/4 or 5o	(4) 5 or 6	(3) 4 or 5	2
A. juniperdunes	(6) 8	2	5 or 6i/4o	(4) 5 or 6	(3) 4 (5)	2
A. lightfooti	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. longispinoides	8	2	5i/2o	(4) 5	(1) 2 (3)	2
A. monolake	(7) 8	2 (3)	5i/ 3 or 4o	(3, 4) 5 (6)	3 or 4	2
A. mtshasta	8	2 (3)	5i/4o	5 (6)	4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 33. Utah.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. cedarview	Cedarview	small-medium	2n♂=25	1.3–1.4	no	3
A. coralpink	Coral Pink	medium-large	2n♂=25	1.7–1.9	no	3
A. grahami	Gilson Butte	medium-large	2n♂=25	1.4–1.6	no	3
A. yubalake	Yuba Lake	small-large	2n♂=25	1.2–1.7	no	(2) 3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. cedarview	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. coralpink	8	(1) 2	5i/3 or 4o	5 (6)	3 or 4	2
A. grahami	(7) 8	(1) 2	5i/3 or 4o	(3) 5	3 or 4	2
A. yubalake	(7) 8	(1) 2	5i/3 or 4o	(4) 5 (6)	3 or 4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 34. Texas.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. mescaleroensis	Mescalero Sands	medium-very large	2n♂=25	0.9–1.1	no	(2) 3
A. portal	Portal, AZ	small-medium	2n♂=23	multiple patterns	yes	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. mescaleroensis	8	2	5i/3 or 4o	(3, 4) 5 (6)	(2) 3 or 4	2
A. portal	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 35. Washington & Canada.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. juniperdunes	Juniper Dunes, WA	medium	2n♂=21	3.6–4.4	yes	(2) 3
A. longispinus	Vancouver Island	medium	unknown	unknown	unknown	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. juniperdunes	(6) 8	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. longispinus	8	2	5i/4o	5	4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 36. Mainland Mexico.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. comanchus	Villa Lerdo	large	unknown	unknown	unknown	3
A. gomezfarias	Gomez Farias	small-medium	unknown	slow to fast, trill at end	unknown	3
A. mescaleroensis	Mescalero Sands	medium-very large	2n♂=25	0.9–1.1	no	(2) 3
A. sonoraensis	S of Obregon	medium	unknown	unknown	unknown	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. comanchus	8	2	5i/3o	5	3	2
A. gomezfarias	7 or 8	2	5i/3o	5	(2) 3 (4)	2
A. mescaleroensis	8	2	5i/3 or 4o	(3, 4) 5 (6)	(2) 3 or 4	2
A. sonoraensis	unknown	unknown	4i/2o	4	2	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 37. Baja California Peninsula.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
Baja California						
A. clarki	El Berrendo	medium-large	2n♂=25	3.9–4.1	unknown	0 (1)
A. davewerneri	Viscaino Desert	small-large	2n♂=25	2.2–2.9	unknown	1 or 2
A. descansodunes	Descanso Dunes	small-medium	2n♂=25	male: 5.9–6.5 female: 2.1–2.3	no	2
A. ensenada	34 km S Ensenada	small-medium	2n♂=25	male: 8.1–10 female: 5.4–6.8	no	2
A. fisheri	Tijuana Estuary, CA	small-medium	2n♂=23	4 to 5	yes	3
A. lagunahanson	Sierra de Juarez	medium	2n♂=23	male: 4.1– 5.3 female: 3.8–5.0	yes	3
A. larumorosa	La Rumorosa	small to medium-large	2n♂=25	male: 4.9–9.1 female: 2.2–3.8	no	2
A. sanmartinensis	Baja California	small-medium	unknown	Male: 5.4–7.9 Female: 3.8	no	2
A. sanpedromartir	Sierra San Pedro Martir	(small) medium	2n♂=25	3.0–3.7	yes	3
Baja California Sur						
A. sanfrancisco	Sierra San Francisco	large	unknown	male: 11.2 female: 4.4–5.0	no	3
A. davewerneri	Viscaino Desert	small-large	2n♂=25	2.2–2.9	unknown	1 or 2
A. bajasur	San Miguel de Comundu	medium	unknown	unknown	unknown	3 (4)

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
Baja California						
A. clarki	(6) 7	0 or 1 (2)	too variable	0–3	(2) 3	(0) 1
A. davewerneri	8	2	0i/3o	0	3 (4)	1
A. descansodunes	7	2	4 or 5i/3o	4 and 5	3	2
A. ensenada	7 (8)	2	3, 4, or 5i/3o	3, 4, or 5 (6)	3 (4)	2
A. fisheri	8	2	5i/3o	5	3	2
A. lagunahanson	7 or 8	2	5i/3o	(4) 5	3	2
A. larumorosa	7 (8)	2	4i/3o	(2,3) 4 (5)	3 (4)	2
A. sanmartinensis	8 (9)	2	5 or 6i/5o	5 & 6	(4) 5	2
A. sanpedromartir	8	2	5i/3o	(3) 5	(2) 3 (4)	2
Baja California Sur						
A. sanfrancisco	8	2	5i/3 or 4o	5 (6)	3 or 4 (5)	2
A. davewerneri	8	2	0i/3o	0	3 (4)	1
A. bajasur	(7) 8	2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time. Winchester Group species highlighted in yellow.

TABLE 38. Fast Drumming Group.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. acton	Acton Wash	medium-very large	2n♂=23	7.9–9.7	yes	2
A. bakersfield	Bakersfield	large	unknown	9 to 10	no	2
A. castaneus	Vandenberg	medium-large	2n♂=23	6 to 11	no	2
A. chimineas	Chimineas Ranch	lagre-very large	2n♂=23	7.7–9.4	no	2
A. danieli	Arroyo Seco	medium-large	2n♂=23	6.3–11.3	no	2
A. fremontpeak	Fremont Peak	large-very large	2n♂=23	male: 8–9 female: 6–6.8	yes	2
A. grapevine	Grapevine	large	2n♂=25	8.7–12	no	(1) 2 (3)
A. lakecachuma	Lake Cachuma	large	2n♂=23	8.8–10.5	no	2 (3)
A. mtpinos	Mt Pinos	large	2n♂=23	7.2–9.6	no	2 or 3
A. pinnacles	Pinnacles NP	large	2n♂=23	5–6.5	no	2 (3)
A. tarcanyon	Tar Canyon	medium-very large	2n♂=23	7.1 to 13.6	yes	2
A. temblor	Temblor Range	large	2n♂=23	male: 10; female: 8	no	2 (3)
A. zayante	Felton	small-medium (large)	2n♂=23	7 to 10	yes	2

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. acton	8	2	5i/3o	5	3 (4)	2
A. bakersfield	7 (8, 9)	2	5i/3o	5	3	2
A. castaneus	(7) 8	2	5i/3o	(4) 5	3 (4)	1 or 2
A. chimineas	(7) 8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. danieli	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. fremontpeak	8	2	5i/3 or 4o	5	3 or 4	2
A. grapevine	(7) 8	(1) 2	5i/3o	(4) 5 (6)	(2) 3 (4)	2
A. lakecachuma	(7) 8	2	5i/3o	(4) 5	3 (4)	2
A. mtpinos	8	2	5i/3o	5	3	2
A. pinnacles	8	2	5i/3o	(4) 5	3	2
A. tarcanyon	8	2 (3)	5i/3o	5 (6)	3 (4)	2
A. temblor	(7) 8	(1) 2 (3)	3i/3o	3 (4)	3	(1) 2
A. zayante	(7) 8	2	5i/3o	(4) 5	3	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 39. Lightfooti Group.

Species	Type locality	Adult body size	Chromosome number	Number of arms: NF in males	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. bruneaudunes	Bruneau Dunes, ID	small-medium	2n♂=21	36	3.7–3.9	yes	3
A. carsoncity	Carson City, NV	medium	2n♂=23	36	4–4.9	yes	2 or 3
A. christmasvalleydunes	Christmas Valley Dunes, OR	small-medium	2n♂=19	38	3.4–3.6	yes	3 (4)
A. evansi	Crescent Dunes, NV	small	unknown	unknown	6.4	unknown	3
A. idaho	St. Anthony Dunes, ID	small-medium	2n♂=19	38	3.6–3.9	yes	3
A. juniperdunes	Juniper Dunes, WA	medium	2n♂=21	42	3.6–4.4	yes	(2) 3
A. knighti	Fallon	medium-large	2n♂=25	44	4.5–5.3	yes	(2) 3
A. lightfooti	Alvord Lake Dunes, OR	medium	2n♂=23	40	3–3.2	yes	2 or 3
A. rusti	Blow Sand Mt, NV	large	2n♂=23	44	6	yes	2 or 3
A. winnemucca	Winnemucca Dunes, NV	small-medium	2n♂=21	36	3.1 –3.9	yes	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. bruneaudunes	8	2	5 or 6i/4 or 5o	5 or 6	4 or 5	2
A. carsoncity	8	2	5i/3 or 4o	(4) 5 (6)	(2) 3 or 4	2
A. christmasvalleydunes	8	2	5 or 6i/4 or 5o	(4) 5 or 6	(3) 4 or 5	2
A. evansi	8	2	5i/3o	5	3	2
A. idaho	8 (9)	2 (3)	5 or 6i/4 or 5o	5 or 6	4 or 5	2
A. juniperdunes	(6) 8	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. knighti	8	2	5i/3o	5 (6)	3 (4)	2
A. lightfooti	8	2	5i/3o	(4) 5 (6)	3 (4)	2
A. rusti	8 (9)	2	5i/3o	5 (6)	3 (4)	2
A. winnemucca	8	2	5i/4o	5 (6)	(3) 4 (5)	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 40. Longispinus Group.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. brachysocius	Jasper Ridge	small-large	2n♂=25	trills to drums	no	3
A. briani	Lake Tahoe	small-large	2n♂=25	male: 0.4 female: short trills	no	3
A. finnon	Finnon Reservoir	medium-large	2n♂=25	2 trills/s	no	3
A. intermedioides	Fremont Park	small	unknown	long to short trills	no	3

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TABLE 40. (Continued)

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. intermedius	Oakland	small-medium	2n♂=23	long to short trills	no	3
A. longispinoides	Pepperwood	medium-large	2n♂=25	2.2–2.4 trills/s	no	3
A. longispinus	Vancouver Island	large	unknown	unknown	unknown	3
A. mtshasta	Mt. Shasta	medium-large	2n♂=25	1.3–2.8 trills/s	no	(2) 3
A. nigrocapitatus	Jacalitos Canyon	small	2n♂=25	0.5–0.8 trills/s	no	2 (3)
A. pictus	San Francisco	small-medium	2n♂=25	1.2–1.7 trills/s	no	(2) 3
A. rentzi	Central Valley	small-medium	2n♂=25	long to short trills	no	3
A. warnermts	Warner Mountains	medium	unknown	2.8 trills/s	unknown	3

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs
				inner	outer	
A. brachysocius	8	2	4i/2o	(3) 4	(1) 2 (3)	2
A. briani	(7) 8	2 (3)	5i/4o	5	4	2
A. finnon	(7) 8	2	4i/3o	4 (5)	3 (4)	2
A. intermedioides	(7) 8	2	4i/2o	4	2 (3)	2
A. intermedius	8	2	4i/2o	(3) 4 (5)	2 (3)	2
A. longispinoides	8	2	5i/2o	(4) 5	(1) 2 (3)	2
A. longispinus	8	2	5i/4o	5	4	2
A. mtshasta	8	2 (3)	5i/4o	5 (6)	4	2
A. nigrocapitatus	7 (8)	2	2 or 3i/2o	2 or 3	2 (3)	1 or 2
A. pictus	8	2	3 or 4i/2 or 3o	3 or 4	2 or 3	2
A. rentzi	(7) 8	2	5i/4o	(4) 5 (6)	4	2
A. warnermts	8	2	5i/4o	5	4	2

* Numbers in ( ) indicate condition found less than 30% of time.

TABLE 41. Winchester Group.

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. catalinae	Santa Catalina Island	small-large	2n♂=25	male: 3 parts female: fast to slow drums	no	3
A. clarki	El Berrendo	medium-large	2n♂=25	3.9–4.1	unknown	0 (1)
A. davewerneri	Viscaino Desert	small-large	2n♂=25	2.2–2.9	unknown	1 or 2
A. descansodunes	Descanso Dunes	small-medium	2n♂=25	male: 5.9–6.5 female: 2.1–2.3	no	2
A. ensenada	34 km S Ensenada	small-medium	2n♂=25	male: 8.1–10 female: 5.4–6.8	no	2
A. icenoglei	Winchester	small-large	2n♂=25	Male: ~17 Female: 9.5	no	3

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TABLE 41. (Continued)

Species	Type locality	Adult body size	Chromosome number	Drum rate @ 20°C (drums/s)	Sex clarification drum?	Fore leg tibial spurs*
A. larumorosa	La Rumorosa	small to medium-large	2n♂=25	male: 4.9–9.1 female: 2.2–3.8	no	2
A. mahogani	Eaton Canyon	medium-very large	2n♂=25	Male: 0.7 Female: 0.5 trills/s	no	3 (4)
A. sandiego	Lake Hodges	medium-large	2n♂=25	Male: 10–11.2 Female: 7.3	no	(2) 3 (4)
A. sanfrancisco	Sierra San Francisco	large	unknown	male: 11.2 female: 4.4–5.0	no	3
A. sanmartinensis	Baja California	small-medium	unknown	Male: 5.4–7.9 Female: 3.8	no	2

Species	Middle leg tibial calcars*	Middle leg tibial spurs*	Simplified hind tibial formula	Hind leg tibial spines*		Hind leg tibial spurs*
				inner	outer	
A. catalinae	(7) 8	2	4 or 5i/ 4o	4 or 5	(3) 4	2
A. clarki	(6) 7	0 or 1 (2)	variable	0–3	(2) 3	(0) 1
A. davewerneri	8	2	0i/3o	0	3 (4)	1
A. descansodunes	7	2	4 or 5i/3o	4 and 5	3	2
A. ensenada	7 (8)	2	3, 4, or 5i/3o	3, 4, or 5 (6)	3 (4)	2
A. icenoglei	7	(1) 2 (3)	5i/4o	(3, 4) 5	(3) 4	2
A. larumorosa	7 (8)	2	4i/3o	(2,3) 4 (5)	3 (4)	2
A. mahogani	8 (9)	2	5i/4o	(4) 5 (6)	(3) 4 (5)	2
A. sandiego	7	2	5i/3 or 4o	(4) 5	3 or 4	2
A. sanfrancisco	8	2	5i/3 or 4o	5 (6)	3 or 4 (5)	2
A. sanmartinensis	8 (9)	2	5 or 6i/5o	5 & 6	(4) 5	2

* Numbers in ( ) indicate condition found less than 30% of time.

List of *Ammopelmatus* species that are sympatric with each other

At only 42 collection sites (Appendix 2, p. 771), out of thousands sampled, did we find 2 *Ammopelmatus* species sympatric. At 32 of those sites (76%), the calling drums between the two species were different enough—as defined by us on p. 217—that this difference probably acts as a premating barrier. In those 10 cases where calling drums were similar, chromosome counts (2n♂=23 vs 2n♂=25) were different in 9, with the count unknown in 1 species in the tenth pair.

At 17 of the 42 collection sites, the two species had the same chromosome count; with 21 localities having different chromosome counts and information incomplete for the remaining 4 sites.

We consequently believe that both of these differences would be acting as complementary premating (drumming) and post mating (karyotype) isolating mechanisms, which could explain why we have yet to find a clearly documented hybrid between any two JC species.

List of *Ammopelmatus* species where calling drum, karyotype, and/or DNA revealed cryptic taxa

1. Santa Monica Mts: Santa Monica Mt Group members *A. leei* (2n♂=23) vs *A. lakesherwood* (2n♂=25).
2. Central California: Longispinus Group members *A. brachysocius* (trills to single drums) vs *A. longispinoides* (trills only).

3. Central Valley: Smithi Group members *A. smithi* (4.5–6 drums/s) vs *A. tehachapi* (1.5 drums/s).
4. San Jacinto Mts: *A. sanjacinto* (2n♂=23, 4–6.5 drums/s) vs *A. pinyonpines* (2n♂=25, 0.9–1.2 drums/s).
5. Mojave Desert: *A. brockovichi* (1.1–1.4 drums/s) vs *A. pratti* (4.5–5.4 drums/s).
6. Lightfooti Group: 10 species with 4 different chromosome numbers.
7. Tehachapi Mt Park: *A. crypticus* (3–4 drums/s) vs *A. grapevine* (10.7–11.9 drums/s) vs *A. tehachapi* (1.4–1.5 drums/s).
8. Eleven members of Winchester Group where DNA confirmed different rear leg tibial spine patterns for the different species.
9. The "triangle area" of Orange, Riverside, and San Diego Counties where DNA and karyotype helped resolve the complex distributions of several medium-fast drumming species (i.e. *A. calimesa* (2n♂=23), *A. kirai* (2n♂=23), *A. oneillpark* (2n♂=25), *A. santarosaplateau* (2n♂=23), *A.* skinner (2n♂=25), and *A. stringfellow* (2n♂=25).
10. *A. intermedioides* at Fremont Peak State Park where microsympatric with *A. brachysocius*; and different than *A. intermedius.*
11. Vandenberg Air Force Base, where the color-variable *A. abelai* was distinguished from *A. vandenberg* by drum rate.
12. High elevation eastern Nevada where *A. lincolncounty* and *A. cathedralgorge* are separated only by DNA.
13. There are a number of localities, for which we have multiple specimens in the tree, that don't correspond to any of the 117 valid *Ammopelmatus* names recognized in this paper. These specimens are indicated by the names: "*A.* sp. #1" through "*A.* sp. #7". We plan on addressing these specimens in a future paper, after additional field work.

Predation, parasitism, and parasitoids in *Ammopelmatus* JCs: Over the years, our colleagues have been kind enough to send us photographs that add to the predation documentations cited by Weissman (2001a), Bogiatto *et al.* (2003), and Woods *et al.* (2009, specifically from birds). These new records include an *Otospermophilus beecheyi* ground squirrel (Fig. 11); a *Sceloporus* blue belly lizard (Fig. 12); a Henry Coe State Park tarantula (Fig. 13); a Half Moon Bay burrowing owl (Fig. 14); a Sausalito Galinas Ponds American Kestrel (Fig. 15); and the parasitic wasp *Isodontia* probably *philadelphica* (Fig. 16), from Glade Park, Colorado (S11-113), identified by W. Pulawski of the CAS. An additional record of a scorpion feeding on *A. kelsoensis*, is found in Fig. 460, p. 286.



FIGURE 11. Ground squirrel eating a JC in underpass, Valley Center Rd, Escondido, CA. (Photo USGS).



FIGURE 12. Blue belly lizard eating a JC at Laguna Coast Wilderness, CA. (Photo Steve Bennett).



FIGURE 13. Tarantula preying on JC at Henry Coe State Park, Santa Clara County, CA. (Photo Paul Zimmerman).



FIGURE 14. Burrowing owl eating JC, Half Moon Bay, San Mateo Co., CA. (Photo Ken Hickman).



FIGURE 15. American Kestrel eating a JC, Sausalito Galinas Ponds, Marin Co., CA (Photo Richard Pavek).



FIGURE 16. Sphecid wasp *Isodontia* probably *philadelphica,* from Glade Park, CO, transporting a paralyzed *A. yubalake* JC. (Photo Linda Branscon).

We have previously published (Poinar & Weissman 2004) on infections in Jerusalem crickets resulting from hairworms and nematodes. We now add our few records of infections resulting from parasitoid flies. Given that we have raised many thousands of JCs, such occurrences do appear rare.

1. S91-57 (type locality of *A. ashleighi*, Lake Arrowhead, San Bernardino Co.) 14-vii-1991, 4 larvae from 1 JC nymph: Blondeliini(?), possibly *Meigenielloide*s, according to Monty Wood.
2. S98-7 (CA, Tuolumne Co., Hwy 120, 15.2 miles E Oakdale) mid instar female nymph collected 12-ii-1998 with 2 adult flies emerging 9-v-1998 from the dying JC, which could be either *A. pictus* or *A. rentzi*, as both occur at this site. The tachinid fly *Chetogena* sp., near *parvipalpis*, according to Monty Wood. Unfortunately, the dead, rotten JC specimen was not retained so species ID not possible.
3. NV, Churchill Co., Fallon, 23-ix-2003, type locality of *A. knighti*, with 2 Sarcophagidae flies emerging.
4. S22-57, *A.* sp., probably either *A. leei* or *A. lakesherwood*, from Santa Monica Mts, mid instar male collected 8-xi-2022 with fly larvae emerging 21-ii-2023.

Systematics and bionomics

Major taxonomic groupings of *Ammopelmatus* species. We recovered 11 major clades of *Ammopelmatus*, which we further divided into 26 Groups. Even before obtaining confirmatory data provided by DNA, we had recognized, from morphology and drumming alone, 4 major Groups, each containing 10 or more taxa, and representing 46 of the 117 valid species (39%) of JCs: Fast Drumming Group, Lightfooti Group, Longispinus Group, and Winchester

Group. We note that our use of taxonomic "Groups" is an informal designation (as per Connors 2024) to facilitate discussion and arrangement of this large and diverse genus.

Interestingly, the various mountains of Southern California contain at least seven medium elevation (over 1000m) taxa that drum around once per second. Included are *A. anzaborrego* (near Pinyon Ridge, San Diego County, 2n♂ unknown); *A. ashleighi* (San Bernardino Mts, 2n♂=25); *A. joshuatree* and *A. whitewater* (both Little San Bernardino Mts, and both with 2n♂=25); *A. pinyonpines* (San Jacinto Mts, 2n♂=25); *A. sangabriel* (San Gabriel Mts, 2n♂=23); and *A. tehachapi* (Tehachapi Mts, 2n♂=25). While *A. anzaborrego*, *A. ashleighi*, *A. pinyonpines*, and *A. whitewater* are recovered in the same group (Southern California Group #2), the three other taxa are each recovered in different groups. There are no known slow drumming taxa from the Santa Ana Mts, Santa Monica Mts, Sierra Pelona Mts, or Verdugo Mts, although JCs are known from the first three areas and undoubtedly occur, although not collected, in the fourth area.

In sequence, below, we present the ASTRAL tree for each of the 26 Groups, in the order they appear in the ASTRAL tree (Fig. 10, p. 28), give the characteristics of that Group, and then present, in alphabetical order, the species in that Group.

(CLADE 1) Group 1, Winchester Group (Fig. 17)

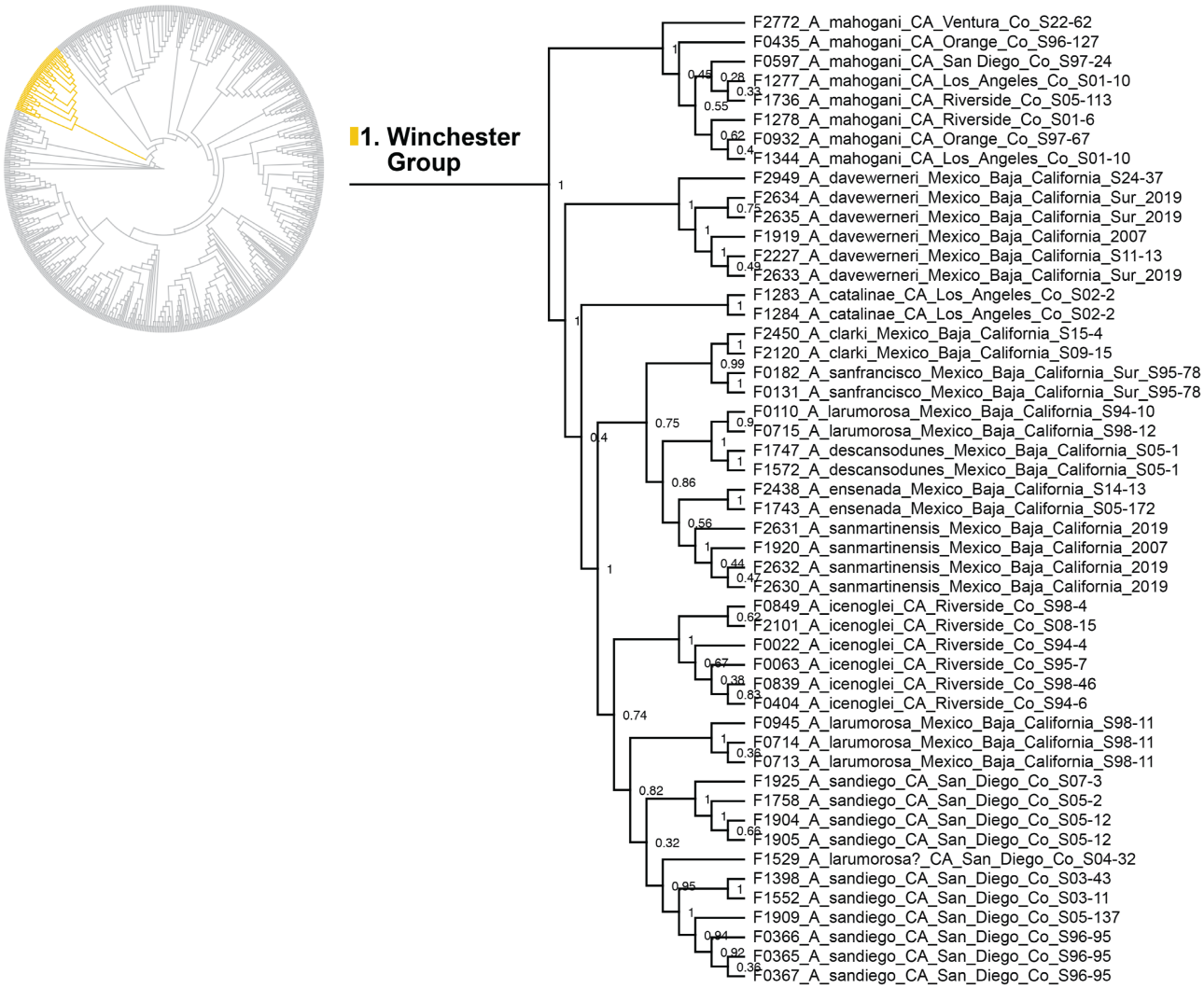


FIGURE 17. ASTRAL tree for Winchester Group.

This Group of 11 (possibly 12) species is restricted to Southern California and the Baja California Peninsula. Characterized by (1) rear leg inner tibial spine #3 longest of all spines; (2) calling drum rate in male ~twice as fast as in female; (3) ovipositor extends beyond abdomen and visible from above; and (4) in the 9 of the 11 taxa in this Group examined, all with 2n♂=25.

In at least four situations, various Winchester Group taxa occur microsympatric with another JC species: (1) Between La Rumorosa and Laguna Hanson, Baja California, *A. larumorosa* occurs with *A. lagunahanson*; (2) In San Diego Co., *A. sandiego* and *A. fisheri* occur together; (3) *A. icenoglei* occurs microsympatric at Jurupa Valley with *A. stringfellow*; and (4) The widespread Southern California *A. mahogani* occurs microsympatric (see p. 115) with several other *Ammopelmatus* taxa. In these 4 situations, having males and females drum differently not only helps to distinguish the sexes but also to distinguish the species.

In at least five situations, other Winchester Group species occur as the sole JC species known from their locality: (1) *A. descansodunes* as the Descanso Dunes, Baja California, endemic; (2) *A. catalinae* as the Santa Catalina Island endemic; (3) *A. sanfrancisco* as the San Francisco Mountains, Baja California Sur, endemic; (4) *A. sanmartinensis* from central coastal Baja California; and (5) *A. clarki* on the eastern side of the Sierra San Pedro Mártir, Baja California.

SPECIES WRITE UPS: *A. bajasur* (tentative placement, p. 59); *A. catalinae* (p. 61); *A. clarki* (p. 69); *A. davewerneri* (p. 73); *A. descansodunes* (p. 80); *A. ensenada* (p. 85); *A. icenoglei* (p. 93); *A. larumorosa* (p. 99); *A. mahogani* (p. 107); *A. sandiego* (p. 116); *A. sanfrancisco* (p. 121); and *A. sanmartinensis* (p. 125).

***Ammopelmatus bajasur* Weissman, sp. nov.**

Baja California Sur Jerusalem Cricket
Figs 18–20, Table 37

Distribution. (Fig. 18). Only known from two localities in Baja California Sur, Mexico; with those sites separated by some 255 km.

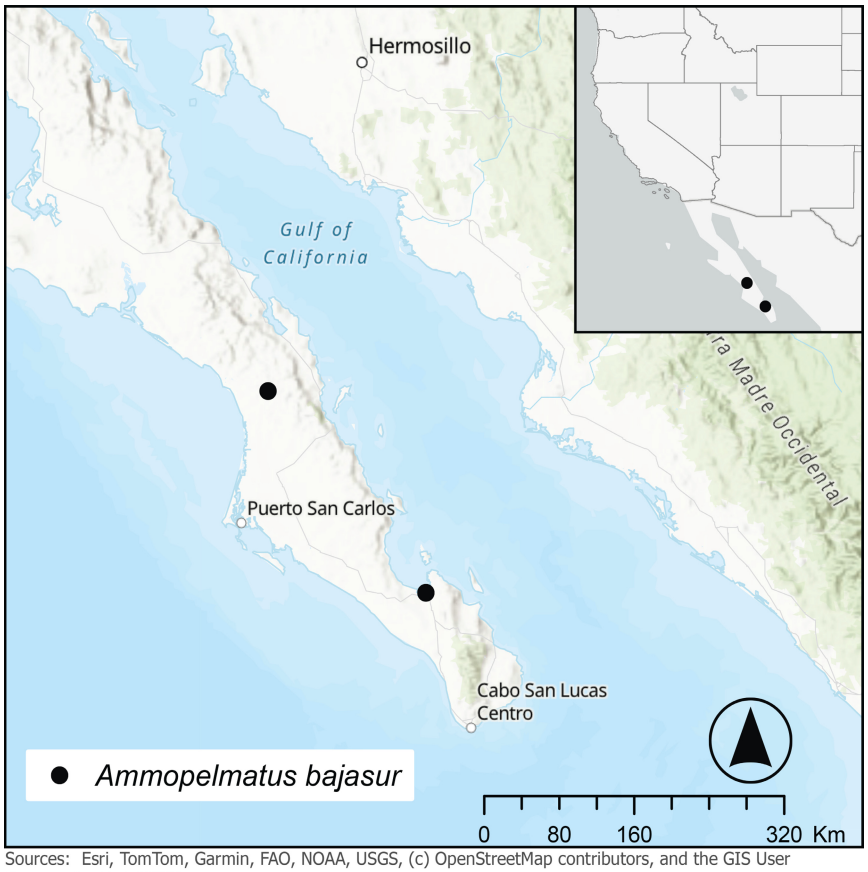


FIGURE 18. Known distribution of *A. bajasur.*

Recognition characters. Phylogenetic placement unknown. Tentatively placed in the Winchester Group, as are the only 2 other Baja California Sur species, *A. sanfrancisco* (see p. 121) and *A. davewerneri* (see p. 73), but difficult to assess if inner spine #3 will be longest once individual is adult. From Fig. 20, inner spines #1–3 appear of similar lengths. A medium sized, light-colored JC known from Baja California Sur. Rear leg femur with 4 or 5 inner and 3 outer spines. Separated by some 250 km and the Gulf of California from *A. sonoraensis.* Calling drum unknown.

Holotype. Probable last instar male (pinned, Fig. 19) as gauged by prominent hook ridge. **Mexico, *Baja California Sur,*** 3m SW San Miguel de Comondú, [26.017066° -111.858847°], 1500' [actually 180m], 21-iv-1969, #181, SC Williams & HL Heringhi. Deposited CAS, Entomology type #20235. Measurements in mm: Body length 26.13, hind femur length 9.3, hind femur width 3.6. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 20) with 4 or 5 inner and 3 outer spines, 2 ventral spurs; rear leg tibial calcars clearly somewhat spatulate.

Paratypes. ♂1 ♀2 (all subadult). **MEXICO, *Baja California Sur,*** same data as holotype, late instar female and mid instar male. La Paz, ~24.140° -110.345° [perhaps at El Sombrero Trailer Park, according to William's field notebooks, but unable to locate site in old Baja California Guidebooks], 7m, 23-iv-1969, #183, SC Williams, 1 late (last?), megacephalic instar female.

Derivation of name. Named in reference to being restricted to the state of Baja California Sur.

Habitat. DBW visited the type locality on 31-i-2011 (S11-11), at 180m (not 1500' [=457m] as on the original label), and found a lovely, rocky canyon with running water, sandy banks, and lots of native vegetation. A long oatmeal trail along the dirt road brought in several orthopterans but no JCs. We suspect that the La Paz habitat is also sandy, given the light color and somewhat spatulate shape of the rear leg calcars of the type series.

Life cycle and seasonal occurrence. Probably 2-year typical life cycle.

Variation. From the 4 immatures in the type series, 3 had 3 and 1 had 4 ventral **fore** leg tibial spurs; 1 had 7 and 3 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 3 had 5 inner **rear** leg tibial spines, while all 4 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Unknown.

Karyotype. Unknown.



FIGURE 19. Pinned holotype late instar male *A. bajasur.*

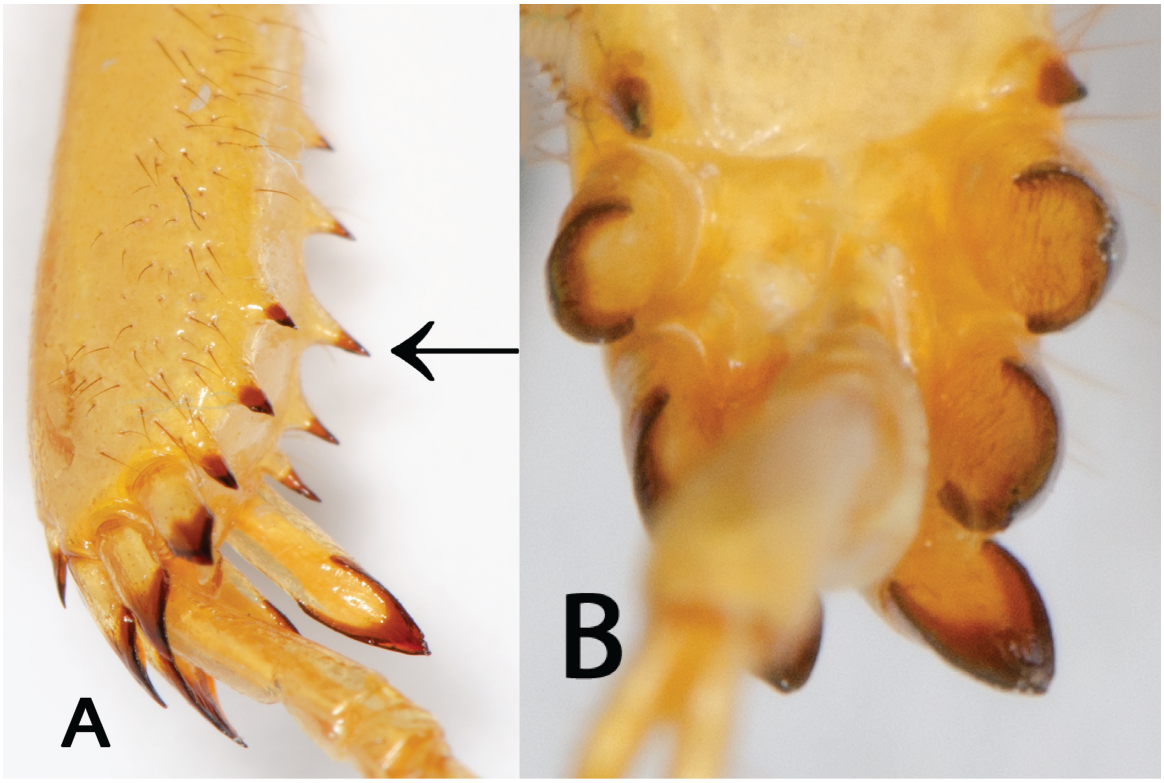


FIGURE 20. Left rear leg tibia holotype late instar male *A. bajasur.* A. Showing 3 outer and 5 inner spines. Note that inner spine #3 (arrow) might be longest once adult. B. Showing shape of calcars.

Discussion. We discussed whether or not to name this species or just note its existence, since we lack adults, calling drums, karyotype information, and DNA results. Surprisingly, during our numerous collecting trips in Baja California Sur, we never encountered any specimens, although our use of oatmeal trails was limited during the period 1977-1995. Additionally, we never visited the type locality nor made directed efforts to collect Baja California Sur during wet, cool winter or spring periods when JCs might be found under rocks and junk during the daytime. By naming this species, we aim to faciliate future research and specimen collection. The holotype and 3 paratypes were all collected by Stan Williams during his research on Baja Peninsula scorpions. Unfortunately, he had no recall of their collection particulars when asked some 20 years ago by DBW, so we don't know if they were found under objects during the daytime or while using an ultraviolet light at night. Elsewhere, we have seen that light-colored, desert inhabiting JCs will glow under black light, although not as prominently as scorpions do.

Vincent F. Lee helped correct the locality data for the holotype, as verified in Stan Williams' field notebooks, which are archived at CAS. However, VF Lee notes that there was no discussion about JCs in his notebook: "Coll. insects with Coleman light ..." and "Collected aquatic insects & spiders & other arthropods in small stream near camp."

Ammopelmatus catalinae Weissman, sp. nov.

Santa Catalina Island Jerusalem Cricket
Figs 21–34, Tables 3, 11, 41

Species #10, Weissman 2001b.

Distribution. (Fig. 21). Only known from Santa Catalina Island, California.

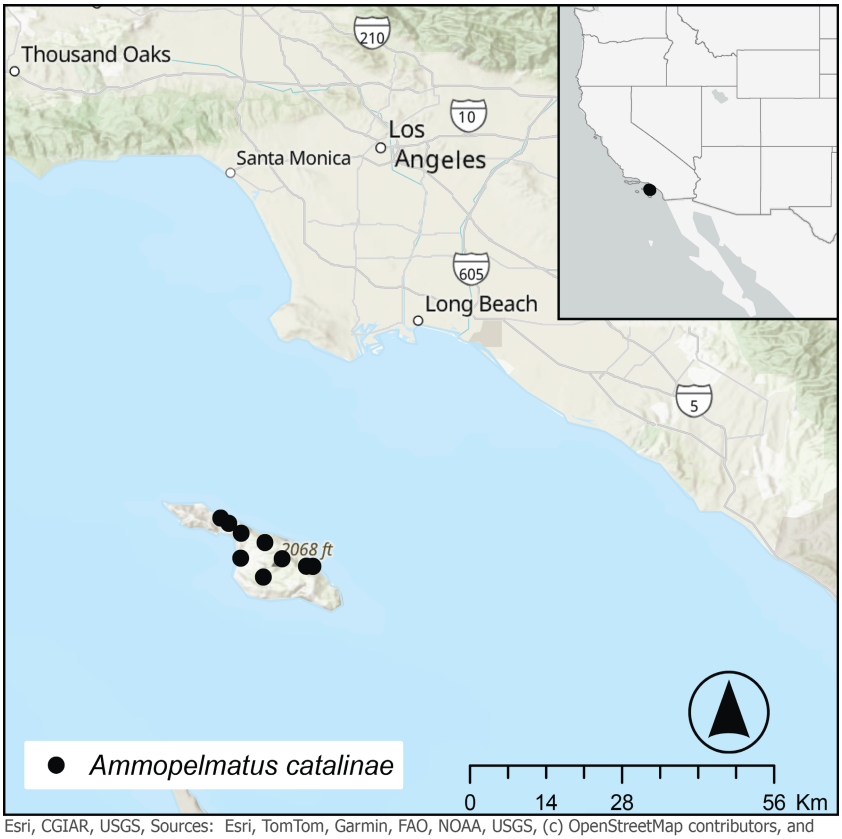


FIGURE 21. Known distribution of *A. catalinae.*

Recognition characters. Member of Winchester Group, and the only species of JC on Santa Catalina Island. Mis-identified by Rentz & Weissman (1981, p. 117) when they said "possibly *A. fuscus".* A small to large JC with a distinctive dark brown-black color pattern (Figs 22 & 24) seen on the pronotum and dorsum of the abdomen of many individuals, often combined with hints of purple; and narrow, circular purple bands on the abdomen. Male calling drum unique for California JCs: composed of three different speeds and patterns.

Holotype. Male (in alcohol, Fig. 22): **California, *Los Angeles Co*.**, Santa Catalina Island, Blackjack Campground, 33.385797° -118.406288°, 459m, 25-v-2008 (S08-49) AG Vandergast. R08-49, F2088. Molt to adult 28-ix-2008. Deposited CAS, Entomology type #20075. Measurements in mm: Body length 30.02, hind femur length 9.55, hind femur width 3.38. Fore tibia with 3 ventral spurs, middle tibia with 8 calcars and 2 ventral spurs, hind tibia (Fig. 23) with 5 inner and 4 outer spines, 2 ventral spurs.

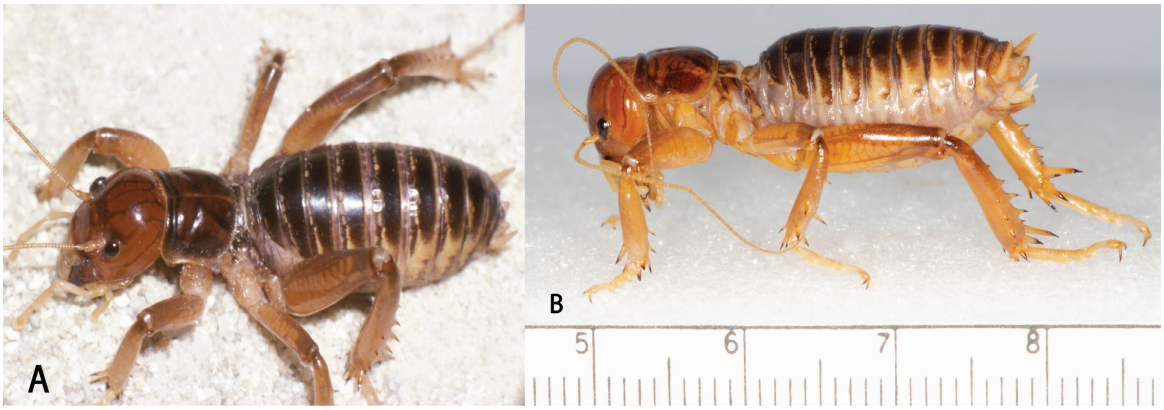


FIGURE 22. Holotype adult male *A. catalinae.* A. When alive. B. When preserved.



FIGURE 23. Rear leg tibia holotype adult male *A. catalinae.* A. Left leg with 4 outer and 5 inner spines. B. Right leg showing shape of calcars.

Allotype. Female (in alcohol, Fig. 24): same data as holotype except R08-54, F2114. Molt to adult 19-x-2008. Deposited CAS Entomology #8413798. Measurements in mm: Body length 40.37, hind femur length 10.52, hind femur width 4.03. Fore tibia with 3 ventral spurs, middle tibia with 8 calcars and 2 ventral spurs, hind tibia (Fig. 25) with 5 or 4 inner and 3 outer spines and 2 ventral spurs. Right rear leg detached, but in vial, for cutaneous cuticular hydrocarbon studies. Ovipositor Fig. 26.

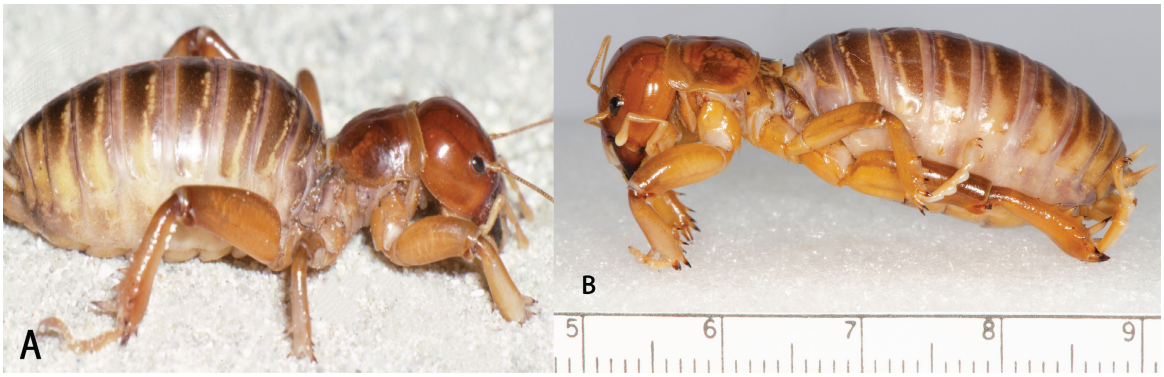


FIGURE 24. Allotype adult female *A. catalinae*. A. When alive. B. When preserved.



FIGURE 25. Left rear leg tibia allotype adult female *A. catalinae*. A. Showing 3 outer and 5 inner spines. Note how inner spine #3 is longest of any spine. B. Showing shape of calcars.



FIGURE 26. Ovipositor allotype *A. catalinae*.

Paratypes. ♂30 ♀26. **CALIFORNIA, *Los Angeles Co.,*** Santa Catalina Island, Blackjack Mt., 26-i-1985 (S85-11) S. Bennett ♀1; Big Geiger's Cove, 18-iii-1985 (S85-37) S. Bennett ♀1; Isthmus Cove, 33.44312° -118.494419°, 5m, 14-xi-1987 (S87-117) S. Bennett ♀1; Toyon Bay, 33.373650° -118.366097°, 20m, 15-xi-1982 (S82-127) S. Bennett ♂3; 25-xi-1982 (S82-130) S. Bennett ♂2; 14-i-1984 (S84-1) S. Bennett ♀1; 16-ii-1985 (S85-14) S. Bennett ♀2; 7-xii-1985 (S85-141) S. Bennett ♂1; 13-ii-1988 S. Bennett ♀1; 14-v-1988 (S88-20) S. Bennett ♀1; 2-vii-1988 (S88-56) S. Bennett ♂1; 20-iv-1999 (S99-20) K. Gordon ♀2. Toyon Bay, Marine Science Institute, 26-iv-2001 (S01-23) A. Weissman ♂1; Toyon Canyon, 33.373448° -118.355340°, 16m, 1-i-1982 (S82-155) S. Bennett ♀1; 20-vii-1984 (S84-44) S. Bennett ♂1; 23-ii-1985 (S85-19) S. Bennett ♀2; 16-ii-1987 (S87-4) S. Bennett ♀2; 26-iv-1987 (S87-20) S. Bennett ♀1; 29-i-1988 (S88-3) S. Bennett ♂1; 24-xii-1989 (S89-95) S. Bennett ♂1; 13-iv-1991 (S91-17) S. Bennett ♂1; Middle Ranch, 33.356066° -118.437326°, 224m, 9-xi-1991 (S91-122) S. Bennett ♂1; Middle Ranch, 7-iv-1999 (S99-7) G. Saldana ♀1; East End, 33.41206° -118.43466°, 358m, and 33.42712° -118.47398°, 245m, 20-22-iii-2002 (S02-2) A. Backlin ♂5 ♀3; Upper and Lower Cherry Valley, 33.451777° -118.507874°, 48m, 21-23-iv-2008 (S08-16) AGV & D. Hedgecock ♂3 ♀2; between Mt. Orizaba and Blackjack Mt, 21-iv-2008 (Array 7), AGV & D. Hedgecock ♂1; Cottonwood Canyon, 21-iv-2008 (Array 15) AVG & D. Hedgecock ♂3 ♀1; Little Springs Canyon, 33.386695° -118.474801°, 5m, 21-iv-2008 (Array 20) AVG & D. Hedgecock ♂6; Cherry Valley, 25-iii-2010 (S10-8) L. Wollerman ♂2 ♀1; Cherry Valley, 15-22-iii-2011 (S11-18) L. Nelson ♂1 ♀1; Middle Ranch, 19-23-iii-2011 (S11-19) L. Nelson ♂2 ♀1.

Drum. The sexes drum differently (Weissman 2001b). For males, the basic pattern is slow single drums, followed by pairs, followed by single drums faster than in the opening salvo of slow drums. In contrast, females have a series of fast drums transitioning to slower drums. **Male:** Paratype R11-18 (Fig. 27), S11-19, at 16°C: 7 slow over 9.7s (0.7 drums/s), then 18 singles and pairs over 21.5s, then 23 faster singles over 21.4s (1.1 drums/s). Paratype R10-42 (Fig. 28), S10-8, 18.5°C: 4 slow drums over 5.5s (0.7 drums/s), then 4 pairs over 5.1s, then 19 single drums over 14.5s (1.3 drums/s). **Female:** R08-53a (Fig. 29A), S08-16, at 18°C: 16 rapid, irregular drums over 4.1s, then 4 evenly spaced slower drums, then 1 pair, then 71 slow drums over 60.3s (1.2 drums/s). Same female R08-53b (Fig. 29B), S08-16), at 18°C: 6 rapid drums in 2.2s, then gradual slowing of 10 drums over 4.9s, then slow portion of 21 drums over 17.2s (1.2 drums/s).

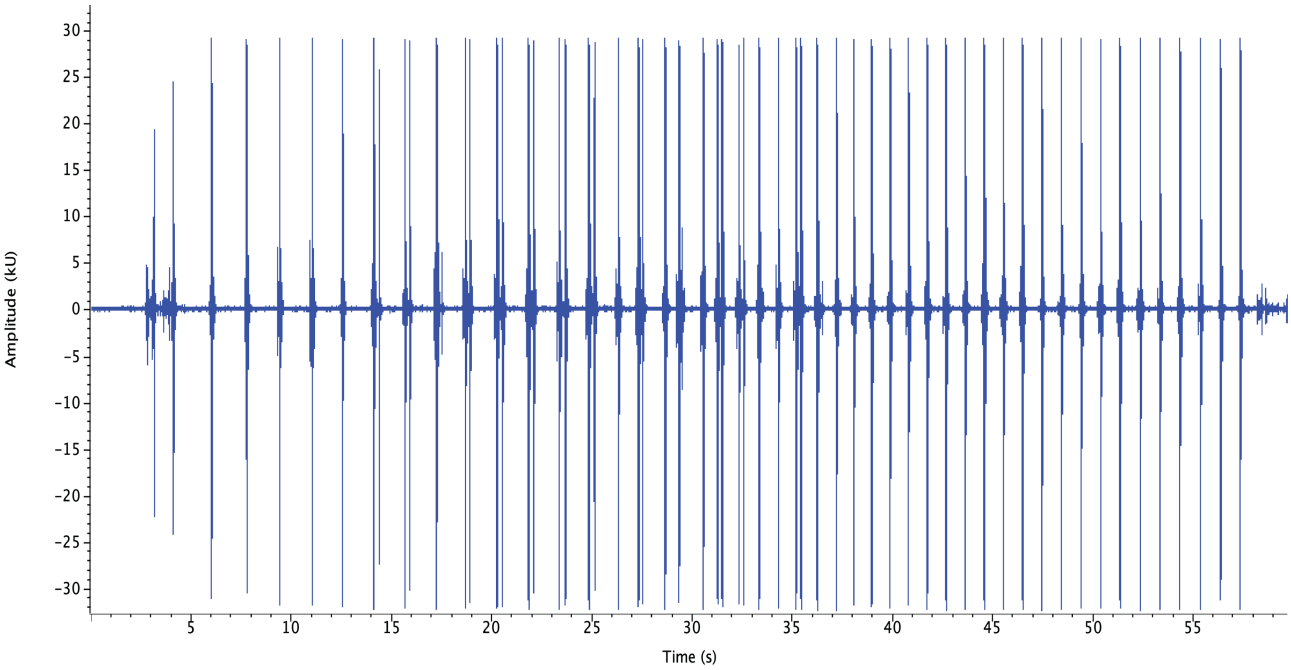


FIGURE 27. Calling drum (R11-18) paratype *A. catalinae.*

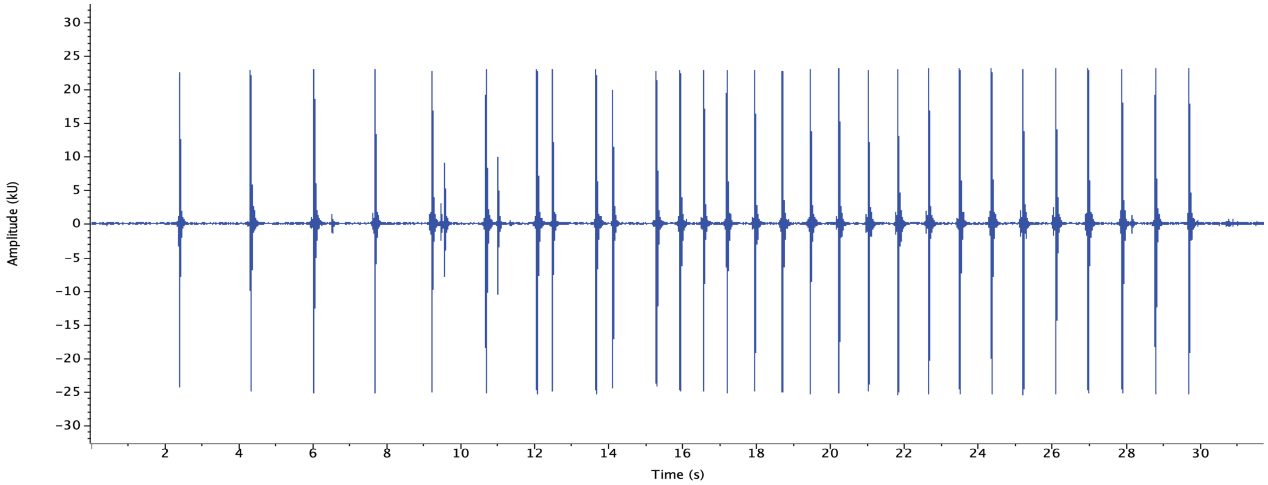


FIGURE 28. Calling drum (R10-42) paratype *A. catalinae.*

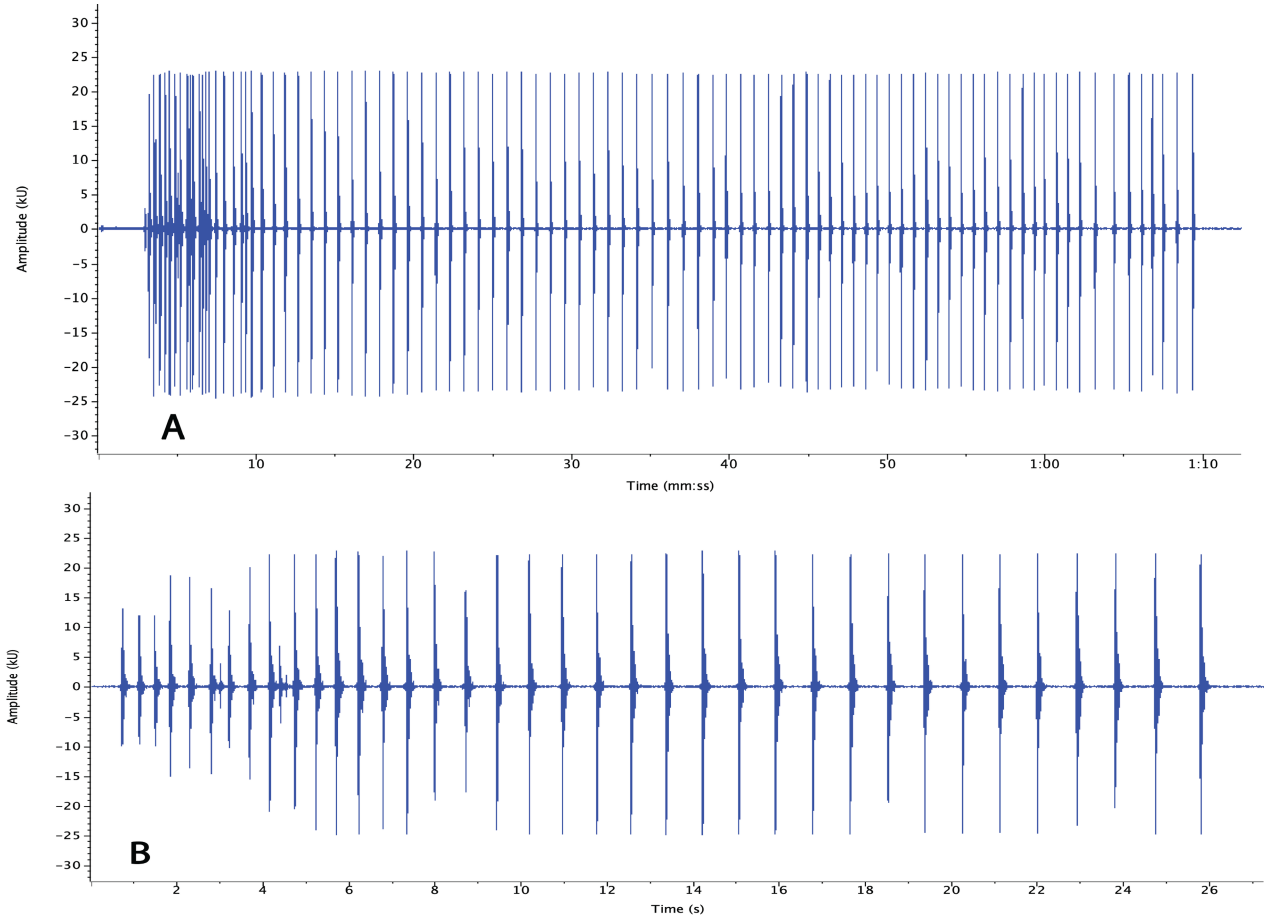


FIGURE 29. Calling drum (R08-53) adult female *A. catalinae*. Two bursts (A. and B.) from the same female, at the same temperature, recorded minutes apart showing variation in calls. Note different time scales.

Derivation of name. Named for Santa Catalina Island, its only known locality.

Habitat. Chaparral to scrub oak woodland (S02-2) to oak woodland to pine forests (S08-49), pretty much across the Island.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For between 20 and 39 individuals tabulated, all 20 had 3 ventral **fore** leg tibial spurs; 1 had 7 and 19 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 15 had 4 and 24 had 5 inner **rear** leg tibial spines, and 9 had 3 and 30 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F1283 & F1284 (both type locality, S02-2) recovered in their own subclade within Group #1 Winchester.

Karyotype. 2n♂=25. Five males examined, with some slight variations: T08-2 (Fig. 30, S08-16) with 8 metacentric or submetacentric autosomal pairs; 4 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T03-2 (Fig. 31, S02-2); T08-1 (Fig. 32, S08-16); and T08-3 (Fig. 33, S08-16) with 9 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T08-4 (Fig. 34, S08-16) with 10 metacentric or submetacentric autosomal pairs; 2 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. We are unsure of the significance of these differences because these classification decisions are somewhat subjective and also dependent on how well the chromosomes were flatten and spread.

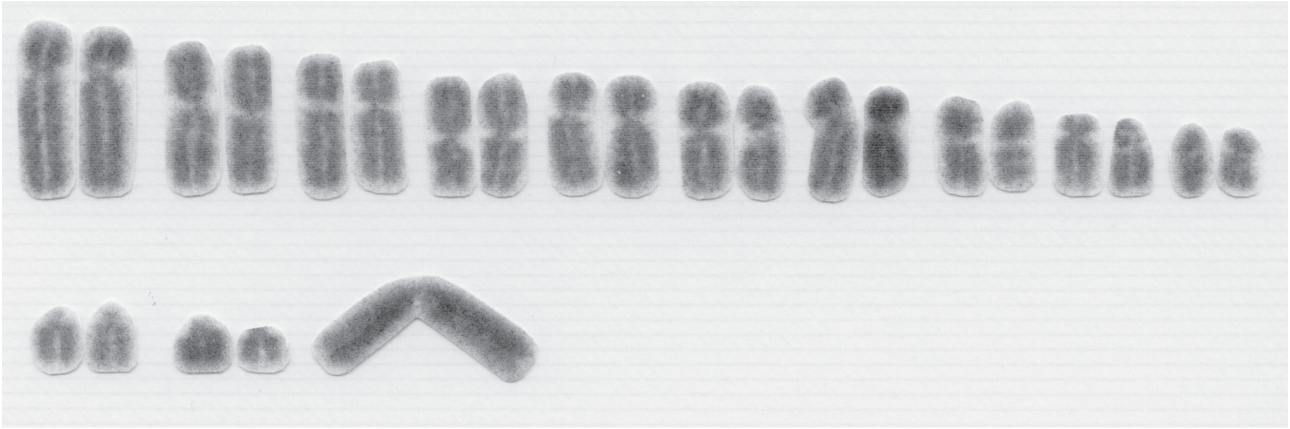


FIGURE 30. Idiogram T08-2 *A. catalinae* (S08-16).

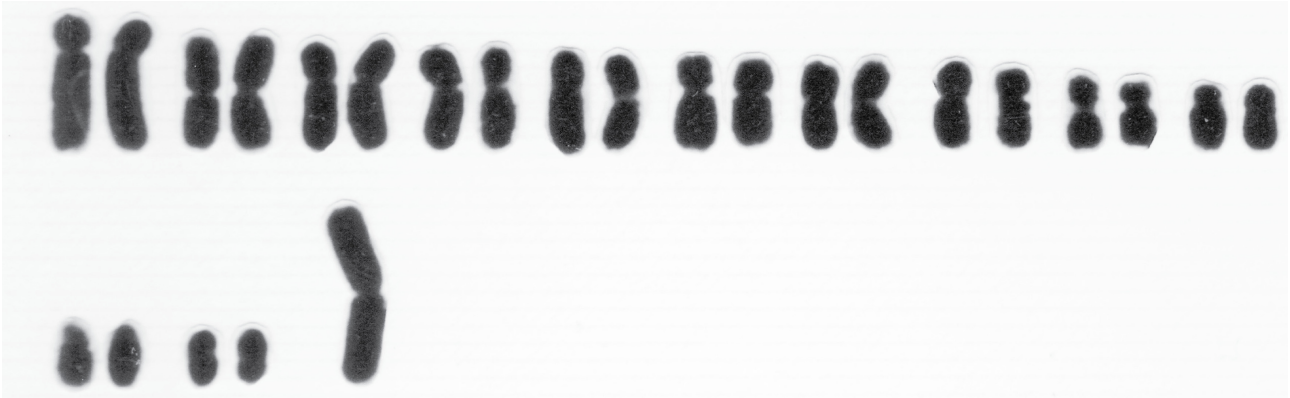


FIGURE 31. Idiogram T03-2 *A. catalinae* (S02-2).

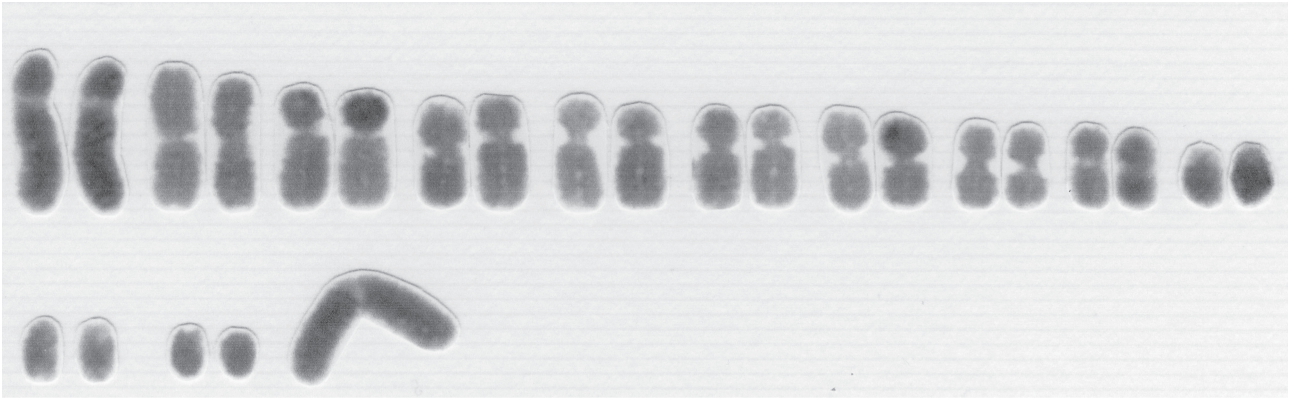


FIGURE 32. Idiogram T08-1 *A. catalinae* (S08-16).

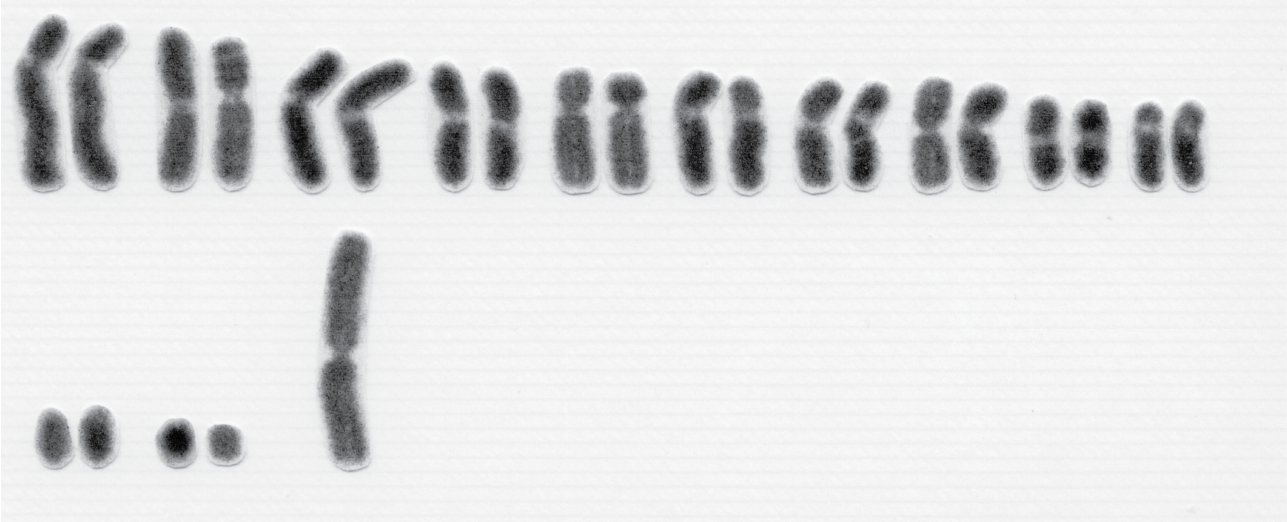


FIGURE 33. Idiogram T08-3 *A. catalinae* (S08-16).

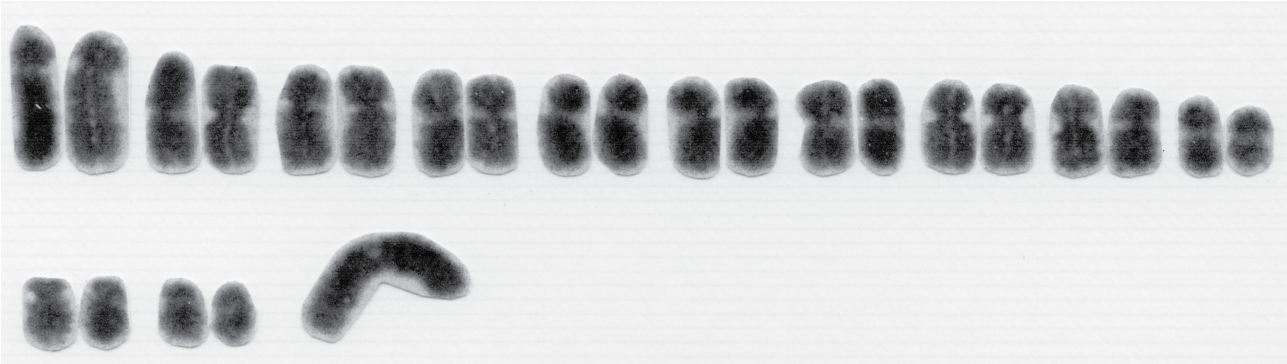


FIGURE 34. Idiogram T08-4 *A. catalinae* (S08-16).

Discussion. Vandergast & Weissman (2008) and Dennis Hedgecock (pers. comm., 2008), Department of Biological Sciences, University of Southern California, independently discovered that 2 COI clades exist in *A. catalinae.* These clades are intermixed within populations (e.g., S02-2) and in distribution across the Island. We thus combined laboratory efforts, in 2008, to see if we could find any drumming, karyotypic, or cuticular hydrocarbon (CHC) differences associated with these clades. While our sample sizes were small (n = 5–10), our unpublished results found no differences in calling drums or karyotypes between the two clades. These results, once again, confirm the unreliability of using COI barcoding in Orthoptera (discussed in Weissman *et al* 2024). Unfortunately, efforts looking for CHC differences weren't successful but such an investigative avenue has been productive elsewhere (Neems & Butlin 1995).

Given the fact that Catalina Island may have recently been divided into 2 islands when the Isthmus area was flooded, we wondered if the 2 clades might have evolved in isolation only to be reunited once sea levels subsequently lowered. We had discussions in 2009 with Daniel R. Muhs, Donald L. Johnson, and Thomas Oberbauer regarding possible dates for when Catalina may have been 2 islands divided at the Isthmus. While all agreed that Catalina has experienced a number of periods of uplift and decline, apparently accurate dates are unavailable (Rowland 1984, Muhs *et al.* 2002, 2003).

Interestingly, Cockerell (1939) specifically noted the absence of JCs on Catalina Island. Laughrin (1977), with the 'assistance' of the endemic Channel Island fox subspecies, documented their occurrence; and Steve Bennett was instrumental in the early collection of live individuals.

***Ammopelmatus clarki* Weissman, sp. nov.**
El Berrendo Jerusalem Cricket
Figs 35–42, Tables 37, 41

Distribution. (Fig. 35). Known from only one isolated area of Baja California, Mexico, southwest of San Felipe.



FIGURE 35. Known distribution of *A. clarki.*

Recognition characters. Morphologically aberrant member of Winchester Group. Medium to very large JCs with spatulate, rear leg calcars, and known from a single site in the Colorado Desert, in Baja California, on the eastern side of the Sierra de San Pedro Mártir.

Holotype. Female (in alcohol, Fig. 36). **Mexico, *Baja California***, El Berrendo (= the pronghorn), ~60 air km SE San Felipe, 30.551887° -115.134565°, 684m, 27-iii-2012 (S12-9) WH Clark. R13-41, F2346. Molt to adult late August, 2013. Deposited CAS, Entomology type #20074. Measurements in mm: Body length 46.56, hind femur length 12.63, hind femur width 4.84. Fore leg tibia with 0 ventral spurs; middle leg tibia with 7 calcars, 0 and 1 ventral spurs; rear leg tibia (Fig. 37) with 1 or 2 small outer spines and 3 small inner spines, 1 ventral spur. Ovipositor Fig. 38.

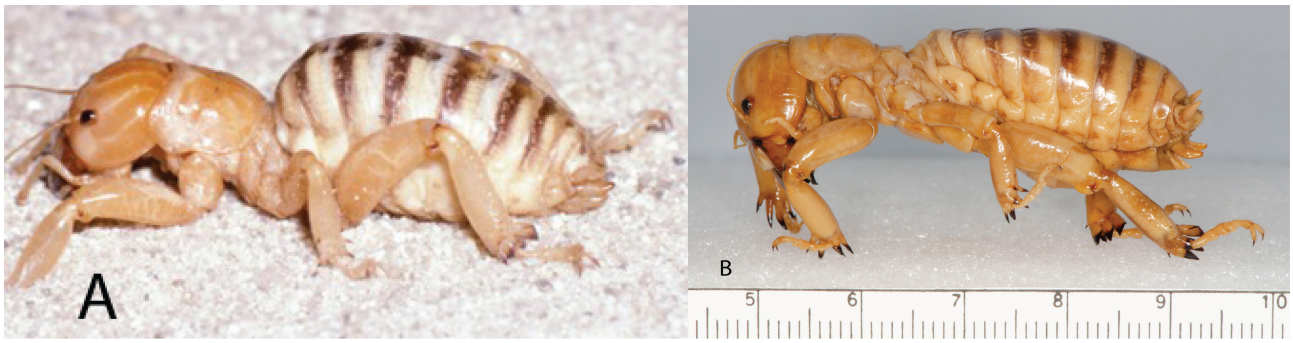


FIGURE 36. Holotype adult female *A. clarki.* A. When alive. B. When preserved.

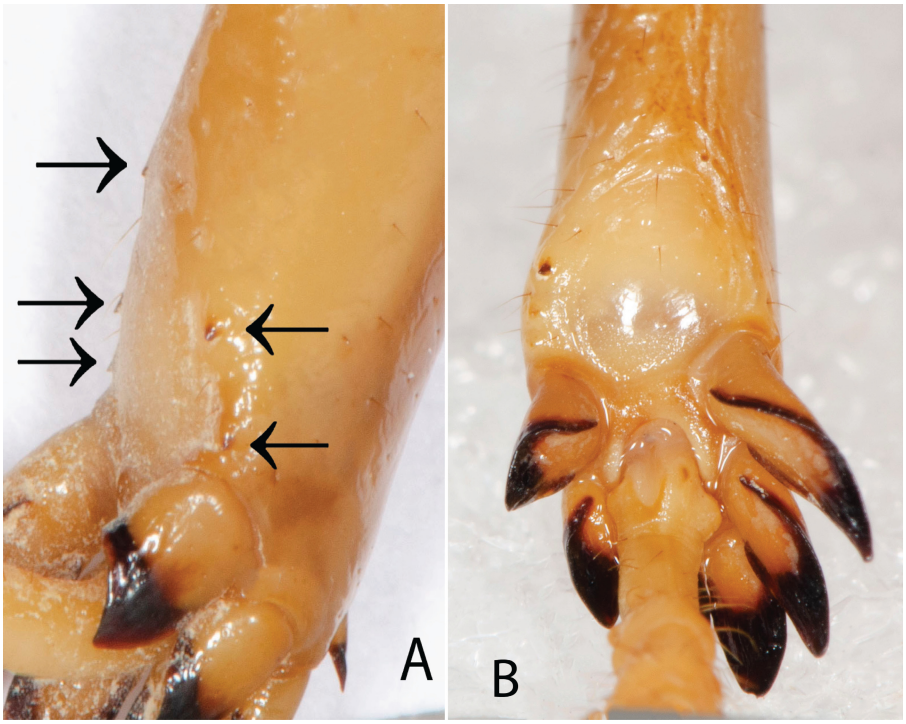


FIGURE 37. Right rear leg tibia holotype *A. clarki.* A. Showing 3 inner and 2 outer spines, all spines small (arrows). B. Showing shape of calcars.



FIGURE 38. Ovipositor allotype *A. clarki.*

Adult male unknown. We have one topotypic, late instar male, from whom testes were taken, that appears similar to both late instar and adult females.

Paratypes. ♀5. **MEXICO, *Baja California***, type locality, 31-iii-2005 (S05-45) WH Clark ♀1; 16-v-2009 (S09-15) DBW, 1 late instar male, for testes; 27-iii-2012 (S12-09) WH Clark ♀2; 21-iv-2015 (S15-4) WH Clark ♀1; 17-iii-2017 (S17-1) WH Clark ♀1.

Drum. Females: Holotype, R13-41 (Fig. 39, S12-9), 93 drums over 23.7s (3.9 drums/s). R13-54 (Fig. 40, S12-9), 3rd burst, with 15 rapid introductory drums over 1.6s (9.4 drums/s), then transitioned to 89 slower drums over 22.3 s (4.0 drums/s). Next burst in same female without rapid drums but 37 drums over 9.1s (4.1 drums/s). Adult females easy to stimulate with finger tapping.

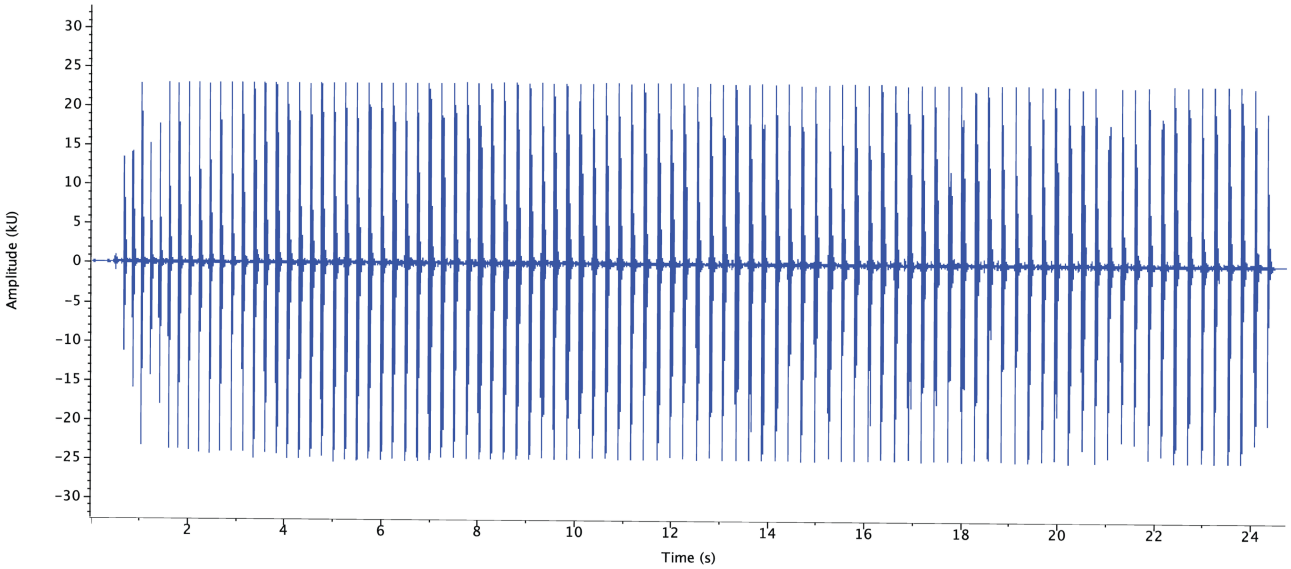


FIGURE 39. Calling drum (R13-41) adult female (S12-9).

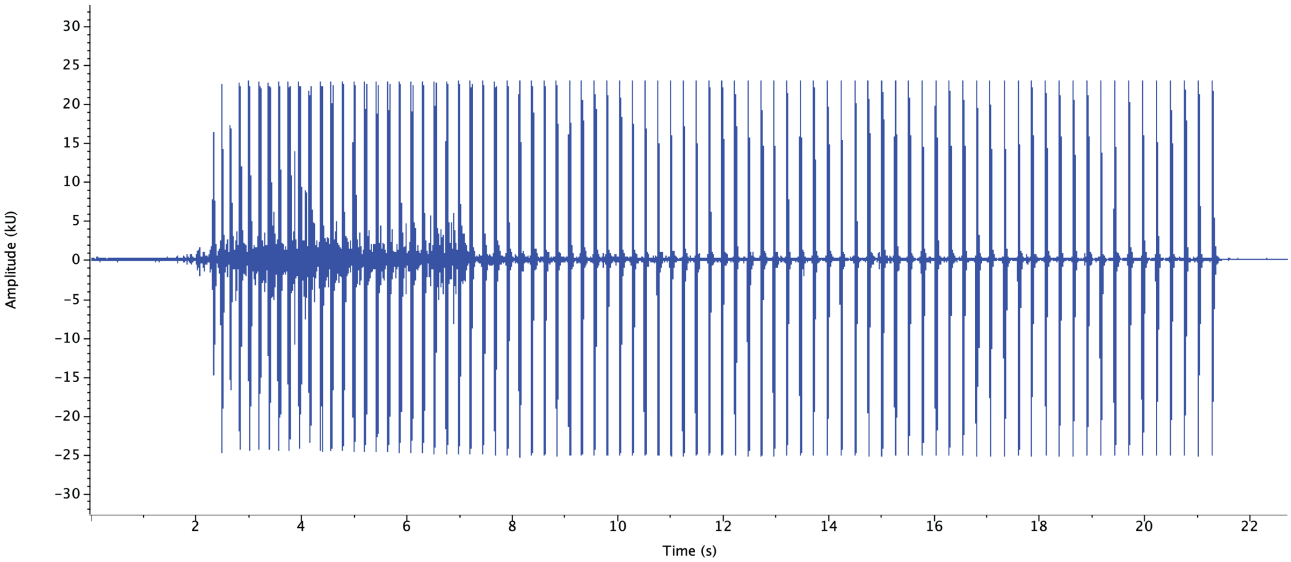


FIGURE 40. Calling drum (R13-54) adult female (S12-9). Note presence of rapid drums at start, not seen in Fig. 39.

Derivation of name. Named for Mary and William Clark, who collected the first (adult) specimen, when she ambulated through their campfire area on a cold March night.

Habitat. Kavanaugh & Clark (2012) discuss the type locality (Fig. 41) at the southern end of the Sierra de San Pedro Mártir in northern Baja California, an area that includes an oasis of native blue palms. The site is a large, remote arroyo with granite boulders and granitic sand substrate. It lies within the Lower Colorado Phytogeographic Province and mesquite is the dominant tree in the area. On visit 16-v-2009 (S09-15), *Acacia greggii,* desert willow, and *Opuntia* all in bloom. Dry river bed banks, where all of the JCs have been collected, are sandier than the granitic river bed bottom.



FIGURE 41. Type locality of *A. clarki.*

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation (including holotype). **Fore** leg tibial ventral spurs: 4 adults had 0 and 1 adult had 2 spurs. **Middle** tibia calcars: 1 adult had 6 and 4 had 7 calcars. **Middle** tibia spurs: 2 adults had 0, 2 adults had 1, and 1 adult had 2 ventral spurs. **Rear** leg tibia spines (all small): 3 adults had 0, 1 adult had 2, and 1 adult had 3 inner spines; 1 adult had 2 and 4 adults had 3 outer spines; 1 adult had 0 ventral spurs while 4 adults had 1 ventral spur.

DNA. Fig. 17, p. 58. F2120 (S09-15) and F2450 (S15-4), both type locality, recovered in Group 1 Winchester, and closest to Baja California Sur *A. sanfrancisco.*

Karyotype. 2n♂=25. One type locality male examined: T09-2 (Fig. 42, S09-15): with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

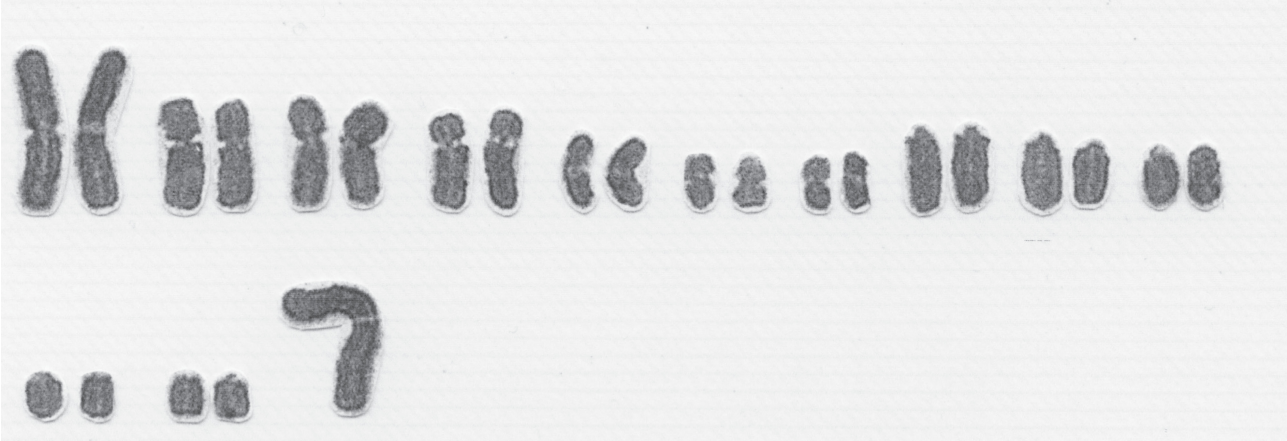


FIGURE 42. Idiogram T09-2 from topotypic *A. clarki* (S09-15).

Discussion. Without DNA, we would have little idea that this species is in the Winchester Group; since like the similarly adapted and modified Baja California sand obligate *A. davewerneri,* the spines on the rear leg tibia are so modified that there is no Group diagnostic, long inner 3rd spine.

This is an uncommon JC. Except for the first collected individual, all others have been attracted to extensive oatmeal trails, using between 5–15 kg of dry oats on each occasion, laid throughout the area. At least 5 other visits to the type locality have yielded no JCs. Fortunately, the absence of kangaroo rats in the area meant that an oatmeal trail would last more than one night.

Ammopelmatus davewerneri (Tinkham)

Vizcaíno Desert Jerusalem cricket

Figs 43–56, Tables 37, 41

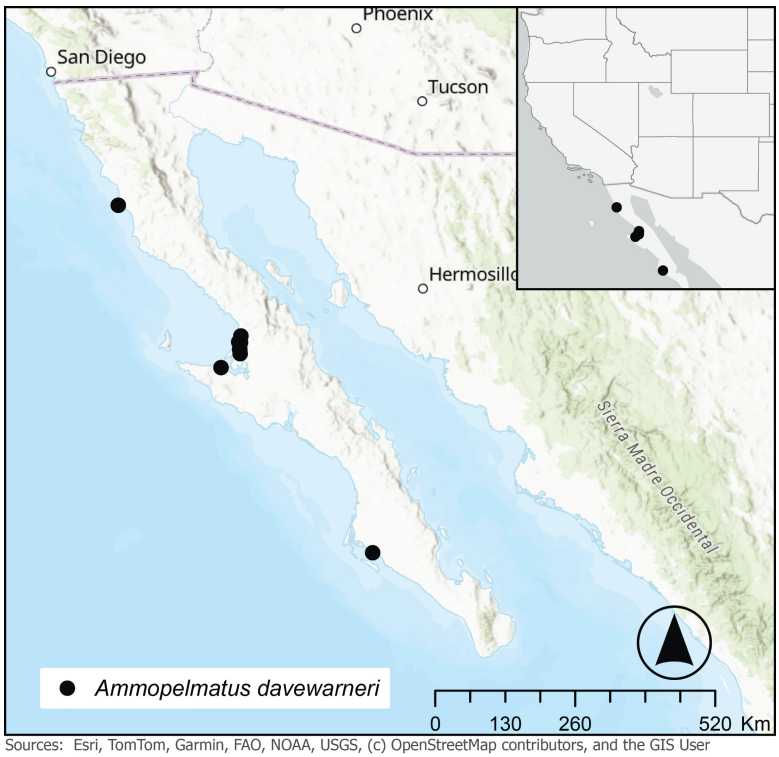


FIGURE 43. Known distribution of *A. davewerneri.*

1970. *Viscainopelmatus davewerneri.* Great Basin Naturalist, 30, 173–179. Sex and instar of holotype unknown, as abdomen missing from specimen when collected. Deposited CAS, Entomology type #16099. Specimen examined. This species is the one taxon, in *Ammopelmatus*, that might deserve generic status, based upon its several morphological adaptations to living in sand dunes. But, following our reasoning as applied to *A. kelsoensis* (see p. 281), we nevertheless **synonymized** (Weissman *et al.* 2021) *Viscainopelmatus* under *Ammopelmatus* because to do otherwise, would obscure the clear relationship between the two genera. In addition, they are both recovered together in the large clade that includes the rest of the *Ammopelmatus* species. *A. davewerneri* also maps in the Winchester Group, along with its geographically nearest neighboring taxa. Tinkham *et al.* (1974) discussed a second, early instar male of *A. davewerneri* collected from the Vizcaíno Desert.

Distribution. (Fig. 43). Known mainly from the Vizcaíno Desert, on the Baja California Peninsula, and south of the type locality for some 425 km to the dunes at Bahia Magdalena; and north of the type locality for some 320 km to the peninsular coastal sand dunes across from Isla San Martín. This north-south range of some 750km indicates that coastal sand dune localities in between should be checked for populations.



FIGURE 44. Two views live topotypic (S91-18, R91-85 & R91-96) adult male *A. davewerneri.*



FIGURE 45. Preserved adult male *A. davewerneri* (same male as Fig. 44).

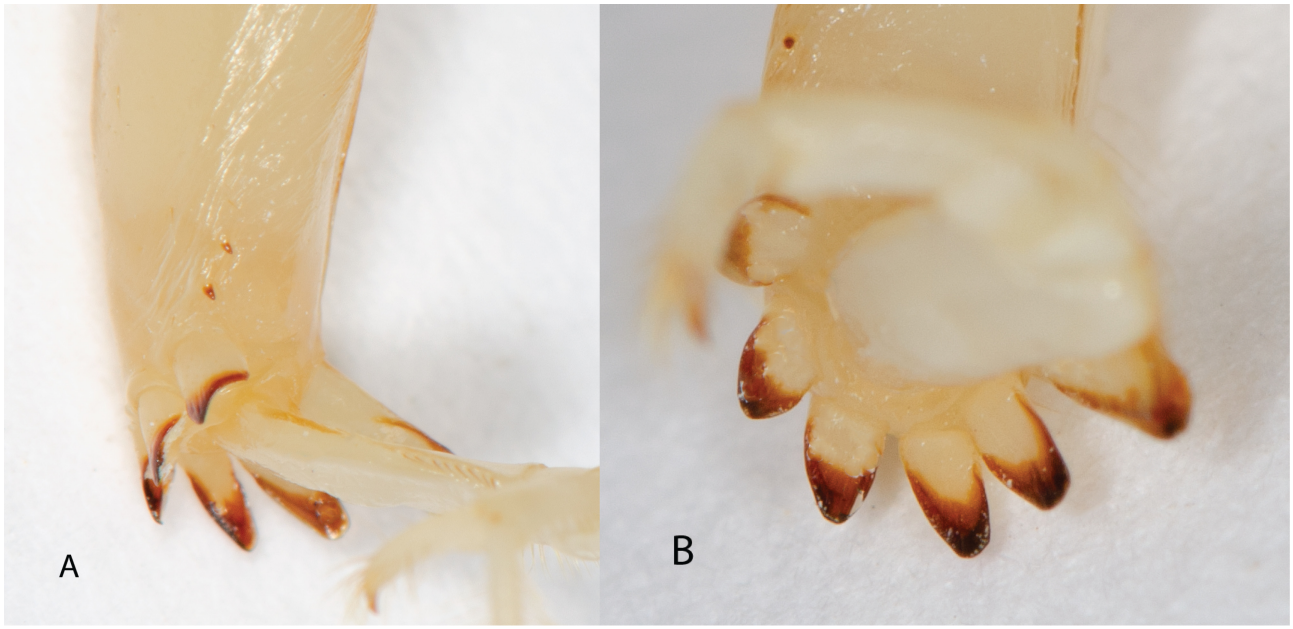


FIGURE 46. Left rear leg tibia topotypic adult male (S91-18, R91-85 & R91-96). A. Showing 2 outer and 0 distal inner spines. B. Showing shape of calcars.

Recognition characters. Morphologically aberrant member of Winchester Group. Widespread in the type locality coastal sand dunes of the Vizcaíno Desert south to the Bahia Magdalena Dunes and north to the dunes across from Isla San Martín. Rear leg tarsi in both sexes unique, amongst all JCs, in being semi circularly twisted (Fig. 47) and flattened, in all instars, along with rear leg tibial adaptations in spine number and calcar shape. **Front** tibia with 1 or 2 well developed ventral spurs (Tinkham [1970] noted 2 spurs in his holotype); **middle** tibia with 8 calcars, 2 ventral spurs; **hind** tibia (Fig. 46) with 3, rarely 4, small outer spines, and zero, distal inner spines, and 1 ventral tibial spur. These same individuals do have the unique condition of 1 or 2 proximal inner tibial spines (Fig. 46). Adult females generally much larger than adult males. The male and female drums of *A. davewerneri* are similar, which is atypical for the Winchester Group where males normally drum 2 or 3 times faster than conspecific females.

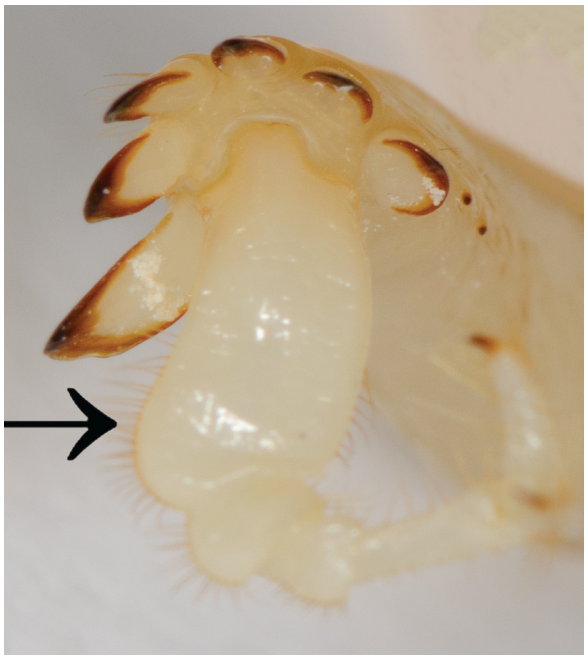


FIGURE 47. Left rear leg tibia adult male *A. davewerneri* (S91-18, R91-85 & R91-96) showing flattened and rotated tarsi (arrow) and spatulate shaped calcars.

Adult male topotype. See Figs 44 & 45.
Adult female topotype. See Figs 48 & 49. Rear leg tibia Fig. 50. Ovipositor Fig. 51.



FIGURE 48. Two views live adult female topotypic *A. davewerneri* (S92-34, R93-2).



FIGURE 49. Topotypic adult female from Fig. 48. A. When preserved. B. View from rear, showing rotated and flattened tarsi (arrow), sand barrier formed by 6 calcars, and 3 outer distal spines and 1 proximal inner spine.



FIGURE 50. Left rear leg tibia same adult female as Figs 48 & 49. A. Showing 3 distal outer spines and 2 proximal inner spines. B. Showing shape of calcars. Note flattened tarsi.



FIGURE 51. Ovipositor adult *A. davewerneri.*

Drum. Calling drum similar in adults of both sexes, and in a male instar (as per Weissman 2001b): Adult **male** S91-18, R91-85 (Fig. 52): 3 calling drums, all short, only ones heard in 5 hours and separated by ~10 minutes; with 4, 5, and 6 drums over 1.4, 1.7, and 2.1 seconds (all at 2.9 drums/sec), all at 18.5°C. Male nymph R90-2 (Fig. 53) with 5 short, spontaneous series of 7 or 8 drums, each series over 2.6–2.9 s (2.7 drums/s), all at 18°C. Intervals between series from 23–36s. Adult **female** (Fig. 54, R93-2) with 2 single series each of 12 drums over 5.5s (2.2 drums/s), at 14°C. This is the only species, out of 11 in the Winchester Group, where males and females drum at the same rate.

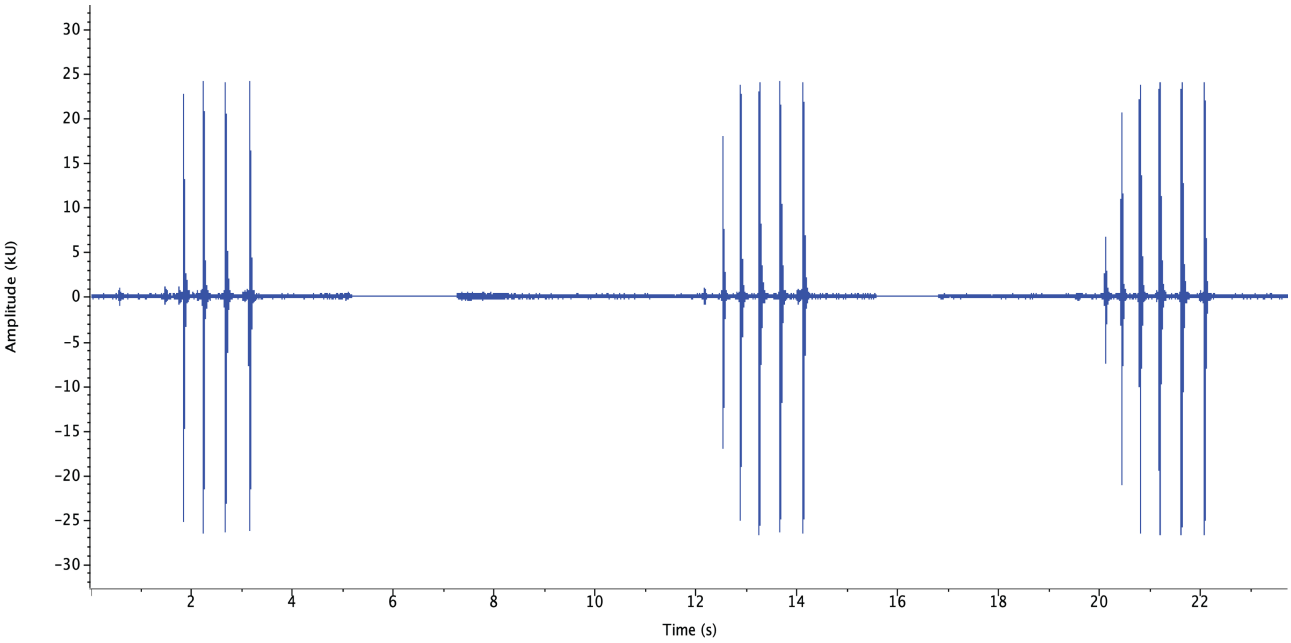


FIGURE 52. Adult male *A. davewerneri* (R91-85) with 3 calling drums at 18.5°C, spliced together to conserve space.

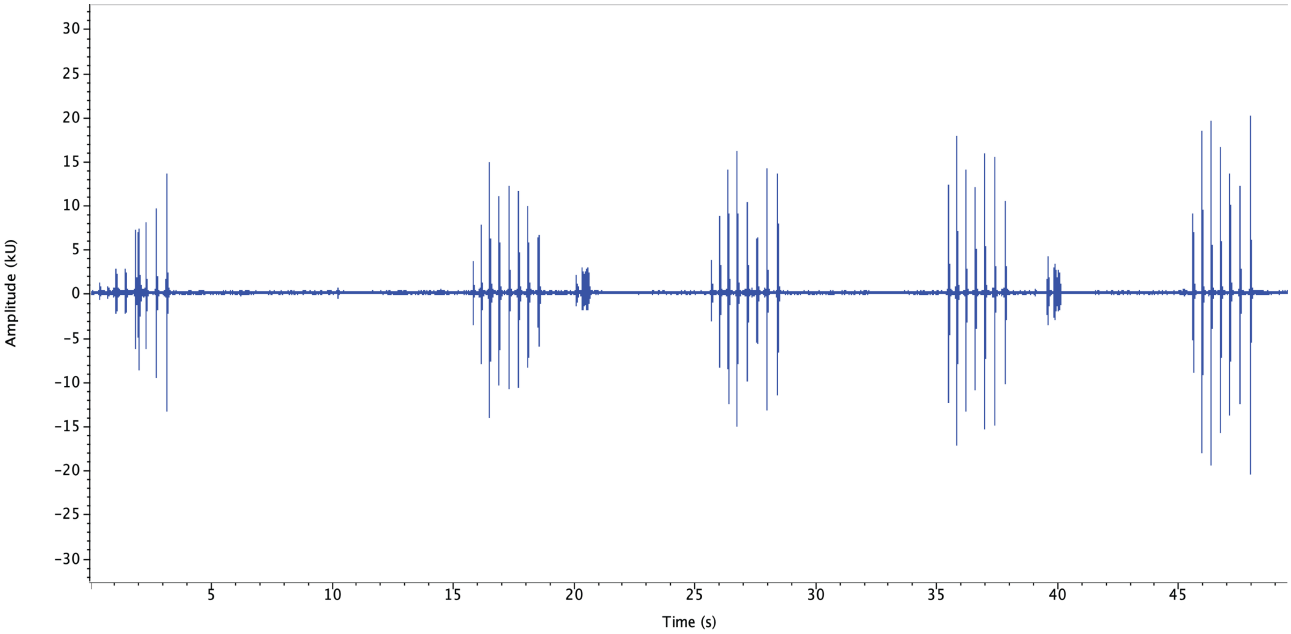


FIGURE 53. Five calling drums (R90-2) male nymph *A. davewerneri* (S90-11) at 18°C. Series are spliced together to conserve space.

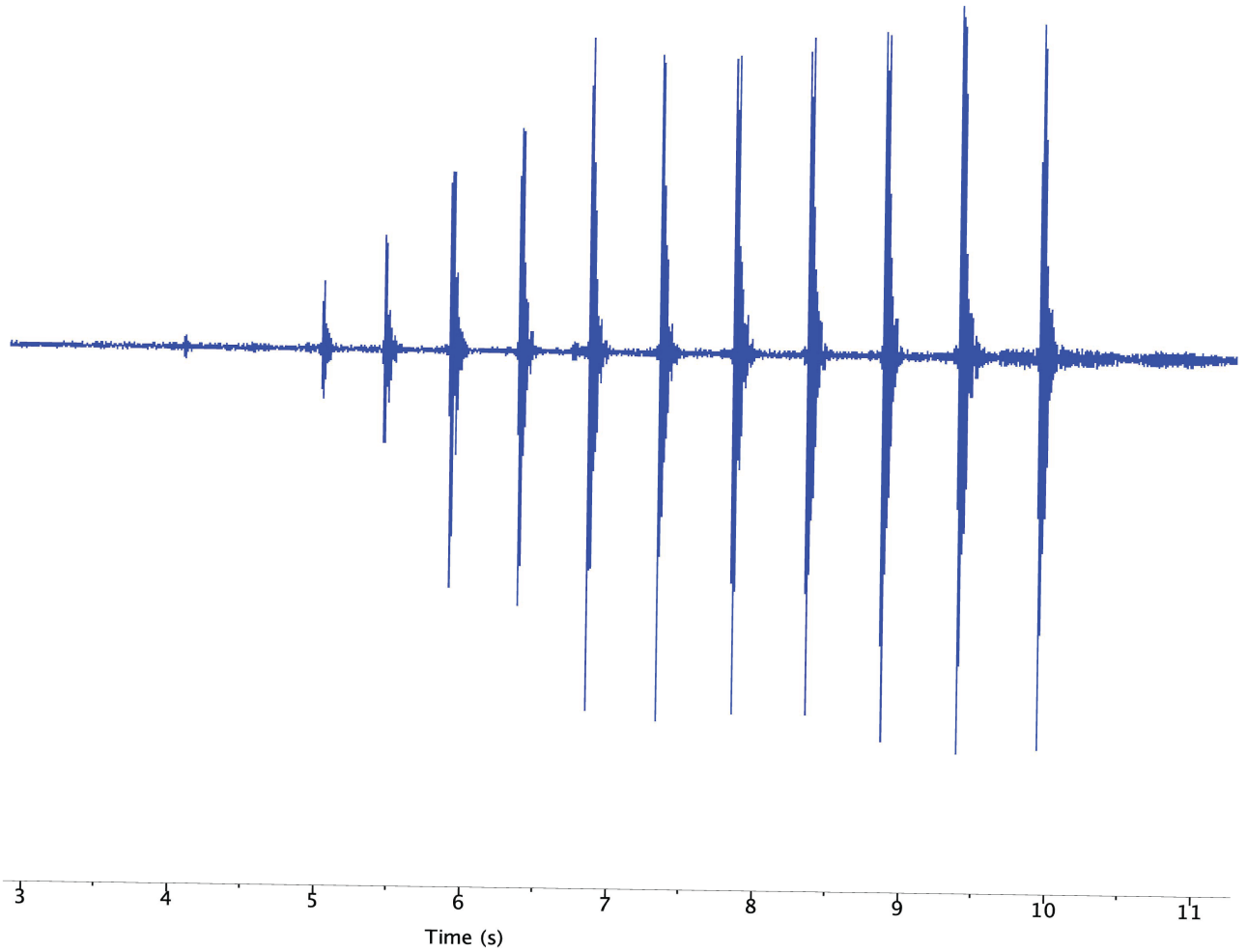


FIGURE 54. Calling drum (R93-2) adult female *A. davewerneri* from S92-34, at 14°C.

Derivation of name. Genus name (*Viscainopelmatus*) derived from its original only known locality, the Vizcaíno Desert. Species named for Dave Werner, who collected the holotype.

Habitat. Low lying coastal sand dunes with various well-spaced shrubs. The specimen across from Isla San Martín (S24-37) was dug up about 0.5 m deep. The sand, on a SW facing slope and under a *Hazardia* shrub, was moist at this depth. According to the collector, Ivan Parr, he also found legless lizards in the general area.

Behavior. Very mellow when collected. No luck with extensive oatmeal trail, 21-viii-1995 (S95-69), in same locality (S90-11) where got some 40 individuals when sifting in 1990.

Life cycle and seasonal occurrence. Appears to have 2-year life cycle typical for *Ammopelmatus.*

Variation. Of 10 adults and late instars, 5 individuals had 1 and 5 had 2 ventral **fore leg** tibial spurs; all 10 had **middle leg** tibia with 8 calcars and 2 ventral spurs; and 10 had **hind leg** tibia with 0 inner spines, while 8 had 3 and 2 had 4 small, outer spines, and all 10 had 1 ventral spur. Some 30% of specimens had 1 or 2 small, rear leg inner tibial spines but since these located in the proximal half of the tibia, while none located in the more typical distal half, they were not tabulated as inner spines. **Color:** A mid instar male, from the most northern known population (S24-37), with distinctive pink coloration (Fig. 55). Unfortunately, he died before molting to adult, but his DNA (F2949) was recovered with other *A. davewerneri* individuals.



FIGURE 55. Mid-late instar male *A. davewerneri* from S24-37. (Photo Ivan Parr)

Specimens examined. **MEXICO, *Baja California,*** 15 m N Guerrero Negro, 28.172919° -114.006917°, 25m, 23-24-iii-1987, J. Doyen. 11.3 km N Guerrero Negro, iv/1976-i/1977, pit fall trap, RL Aalbu. 6 km N border with Baja California Sur, at Km sign post 121.8, and 1.3 km W Hwy 1, 28.060483° -114.019831°, 9m, 13-ii-1990 (S90-11); 14-iv-1991 (S91-18) GE Ballmer, ♂1; early March, 1992 (S92-34), R. Johnson, 1 adult female, 2 medium-large males and 3 medium-large females, 2 small instars; 19-v-1992, W. Clark, ♀1 on dunes at night; 2-ii-2011 (S11-13), 1 mid instar male. 28.059083° -114.022417°, 16m, 31-iii-2007, F1919, M. Van Dam, ♀1; 31-vii-2007, M. Van Dam. 9 km N Guerrero Negro, iv/1976-i/1977, pit fall trap, RL Aalbu. Laguna Manuela dunes W Villa Jesus Maria, 28.18124° -114.03711°, 4m, 6-13-v-2019, San Diego Museum Natural History dunes team, 1 mid male. Coastal Peninsular dunes across from Isla San Martín, 30.477013° -116.046242°, 20m, 17-vi-2024 (S24-37) I. Parr 1 late instar male. ***Baja California Sur,*** 1 m N Guerrero Negro, 27.983061° -114.012946°, 4m, 28-29-i-1976, ME Thompson & DE Morqua. 1.15 m W Guerrero Negro on road to Estero de San Jose, 29-xii-1978, S79-7. Southwest

side Laguna Scammon, 27.750° -114.333°, 18m, 30-xii-1971, in rodent burrow, BH Banta (see Tinkham *et al.* 1974, for details). Bahia Magdalena dunes, N Puerto Argudin, 24.64065° -111.80308°, 12m, 10-17-i-2019, San Diego Museum Natural History dunes team, 1 mid male, 1 late instar female.

From iNaturalist: ***Baja California***, Ejido Villa Jesus Maria, 28.28227° -114.00109°, 35m, 31-i-2021, "jadh".

DNA. Fig. 17, p. 58. F1919 (type locality, S11-13); F2227 (near type locality, SS11-13); F2633 (Laguna Manuela); F2634 & F2635 (Bahia Magdalena); F2949 (S24-37, across from Isla San Martín) all recovered in their own subclade in Group 1 Winchester. Although this taxon can't have the typical long 3rd inner tibial spine, because individuals have no distal inner tibial spines, the geographically closest JC species (*A. sanfrancisco*) to the south of the type locality; and the geographically closest species (*A. ensenada*) to the north of the type locality, at El Campito, are all recovered as members of the Winchester Group.

Karyotype (Fig. 56). 2n♂=25. One male determined: (T92-16, S90-11) shows 9 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 56. Idiogram T92-16 *A. davewerneri* (S90-11).

Discussion. For such a typically rare JC, we had perfect timing on 13-ii-1990 (S90-11). The area had good winter rains as there were carpets of annual flowers in flat, sandy areas adjacent to sand dunes, but few annuals on the dunes themselves. Sand on south facing slopes was dry to a depth of several cm, but where sand was covered by vegetation or surface debris, then damp right below surface. Major plant is bush *Encelia ventorum* (determined by Bruce Bartholomew, CAS Botany Department), along with a few *Yucca* on the open dunes. In 7 man-hours of sifting, mostly under *E. ventorum,* we collected some 40 JCs. With small ones "thrown back", we kept 9 large, 3 medium, and 2 small males along with 6 large, 7 medium, and 2 small females.

This is the only member of the Winchester Group of 11 species where both sexes have similar calling drum rates (the calling drum is unknown in male *A. clarki*). While this is the only JC species that occurs in the Vizcaíno Dunes, it might still be advantageous for males and females to be able to distinguish between each other, at a distance, as discussed by Weissman (2001b).

Ammopelmatus descansodunes Weissman, sp. nov.

Descanso Dunes Jerusalem Cricket
Figs 57–65, Tables 37, 41

Species #8 Weissman (2001b).

Distribution. (Fig. 57). Only known from El Descanso Dunes in Baja California. We have sifted on dunes just south of Ensenada (31.778558° -116.617900°) on several occasions without finding any JCs; and Robert Fisher's group, at USGS in San Diego, has done years of pitfall trapping in suitable coastal habitat in southern San Diego Co., without finding *A. descansodunes.*

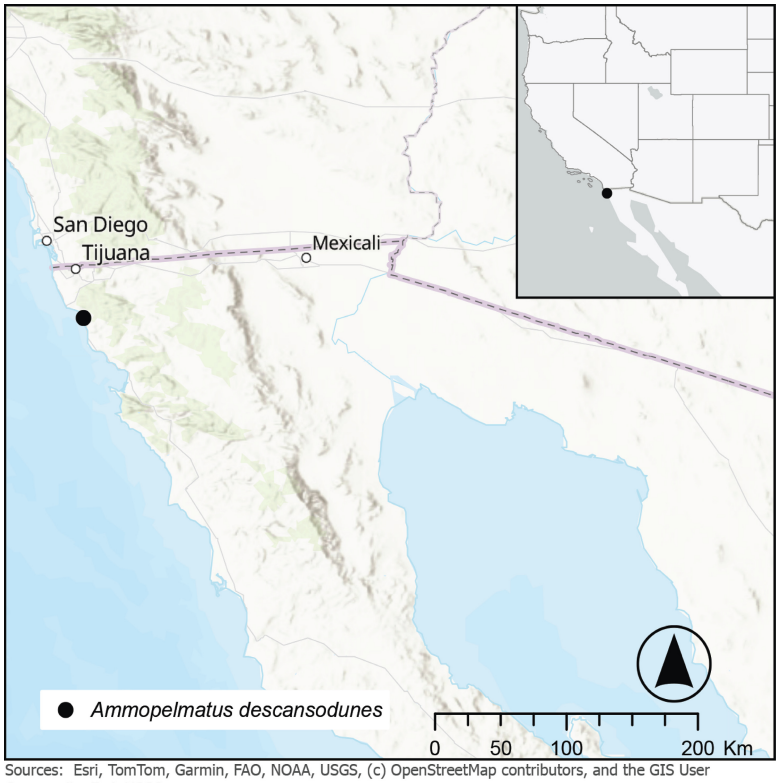


FIGURE 57. Distribution of *A. descansodunes.*

Recognition characters. Member of Winchester Group. Small to medium sized sand obligate JC with spatulate rear leg tibial calcars, especially calcar #1 which is curved around in both sexes; and rear leg inner tibial spines where spine #3, and sometimes spine #2, is the longest of all inner spines. Male drumming rate around 3X that of females. Differs from closest DNA relatives *A. larumorosa* by 7 middle leg tibial calcars vs 8 in *A. larumorosa*, and habitat; and from *A. sanmartinensis* by number of middle leg tibial calcars and number of hind leg outer tibial spines (Table 41).

Holotype. Male (in alcohol, Fig. 58): **Mexico, *Baja California***, Descanso Dunes at km 49.5 on Mexico 1 libre, ~190m from ocean high tide line, 32.203500° -116.911917°, 9m, 14-ii-1990 (S90-13) DBW, VF Lee. R90-58 & R90-63. Molt to adult 16-x-1990. Deposited CAS, Entomology type #20079. Measurements in mm: Body length 30.60, hind femur length 8.09, hind femur width 2.72. Fore tibia with 2 ventral spurs, middle tibia with 7 calcars and 2 ventral spurs, rear leg tibia (Fig. 59) with 4 inner and 3 outer spines, 2 ventral spurs.

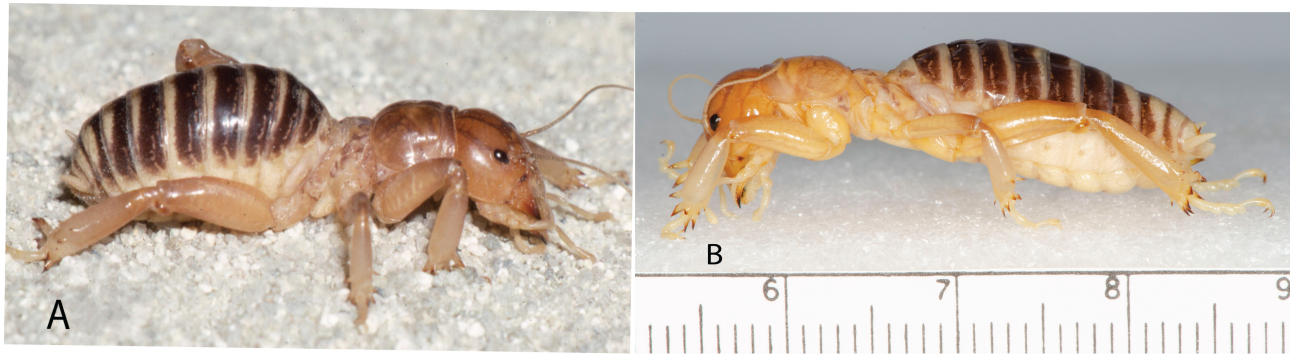


FIGURE 58. Adult male holotype *A. descansodunes.* A. When alive. B. When preserved.



FIGURE 59. Rear leg tibia holotype adult male *A. descansodunes.* A. Left leg showing 3 outer and 4 inner spines. B. Right leg showing shape of calcars.

Allotype. Female (in alcohol, Fig. 60): same data as holotype except R90-67. Molt to adult 29-x-1990. Deposited CAS, Entomology #9083332. Measurements in mm: Body length 30.70, hind femur length 8.28, hind femur width 2.73. Fore tibia with 2 ventral spurs, middle tibia with 7 calcars and 2 ventral spurs, rear leg tibia (Fig. 61) with 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 62.



FIGURE 60. Adult female allotype *A. descansodunes.* A. When alive. B. When preserved.

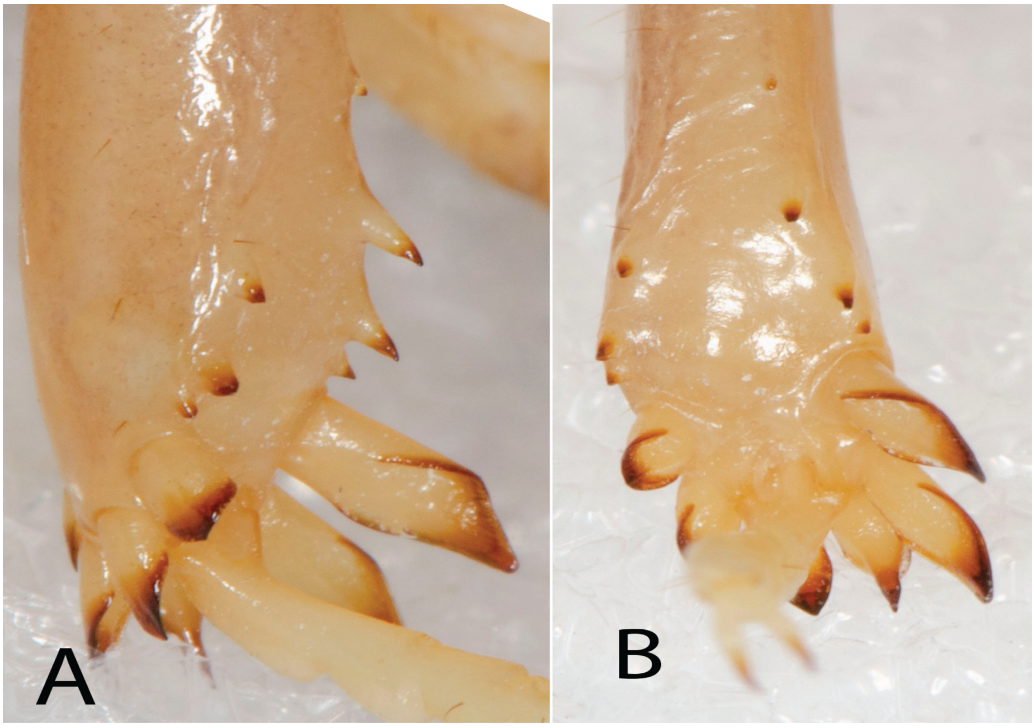


FIGURE 61. Left rear leg tibia allotype *A. descansodunes.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

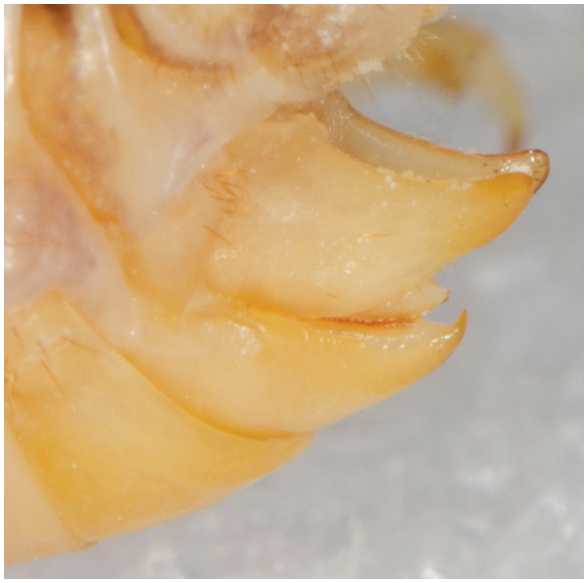


FIGURE 62. Ovipositor allotype *A. descansodunes*.

Paratypes. ♂5 ♀18. **MEXICO, *Baja California,*** same locality as holotype: 20-xii-1987 (S87-128) ♂1; 10-ii-1990 (S90-4) ♀5; 14-ii-1990 (S90-13) ♀4; 3-iii-1992 (S92-15) ♂3 ♀6; 1-i-2005 (S05-1) ♂1 ♀3.

Drum. Males drum around 3X as fast as females drum at the same temperature. **Male**: R90-63 (Fig. 63, holotype, S90-13), 19°C: 26 single drums in 4.0s (6.5 drums/s). Other bursts in R90-63 include: 20 drums in 3.3s (6.1 drums/s), 23 drums in 3.6s (6.4 drums/s), 23 drums in 3.7s (6.2 drums/s). Other recording holotype R90-58, 20C°: 17 drums over 2.6s (6.5 drums/s). Topotype male R06-6 (S05-1), 17°C: (a) 29 drums over 4.9s (5.9 drums/s); (b) 23 drums over 4.0 s (5.8 drums/s). **Female**: R90-67 (Fig. 64, S90-13) 20.5°C: 108 drums in 46.6s (2.3 drums/s). Topotype female: R06-137, S05-1, 18.5°C: 102 drums over 49.2s (2.1 drums/s).

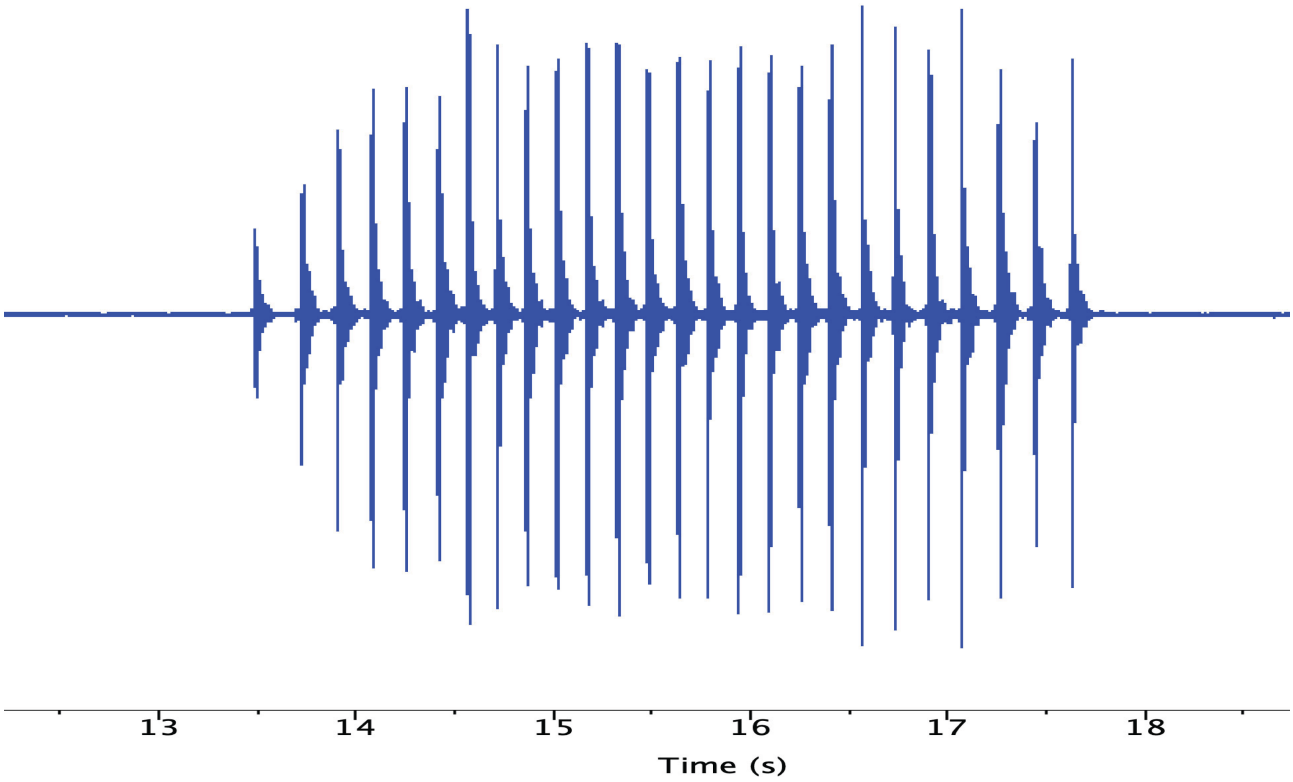


FIGURE 63. Calling drum (R90-63) holotype adult male.

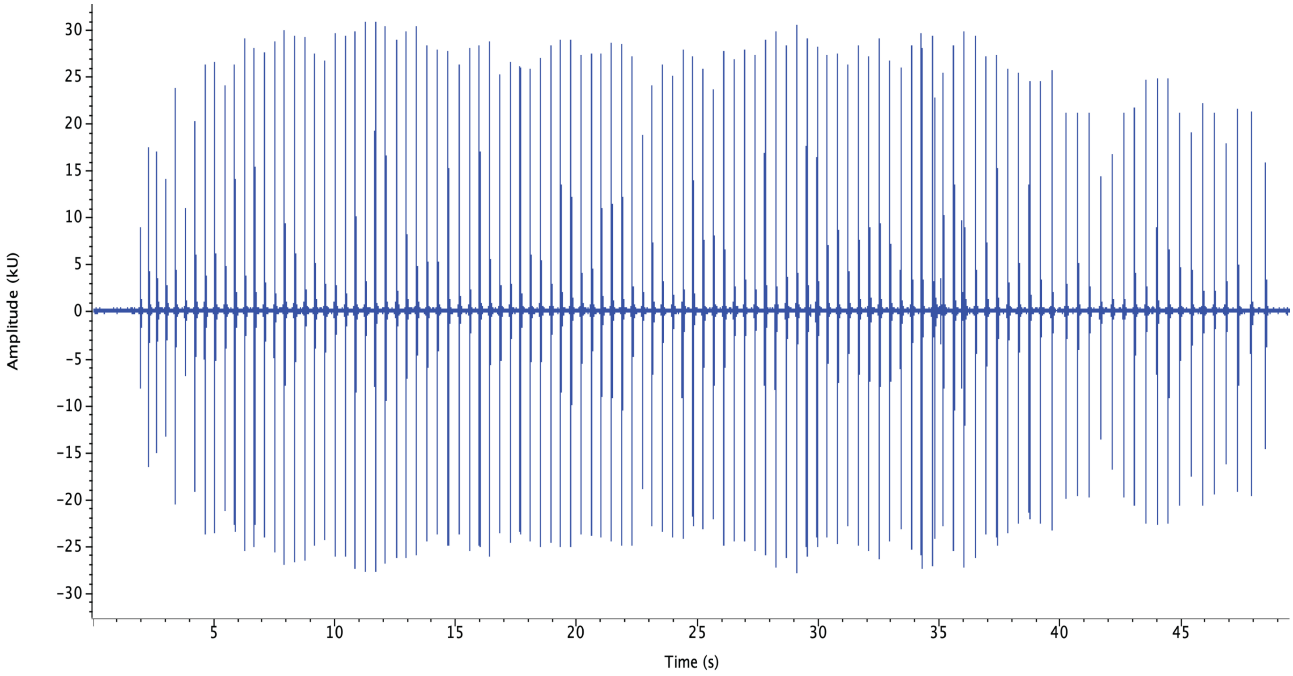


FIGURE 64. Calling drum (R90-67) allotype adult female

Derivation of name. Named after the dunes, near the town of El Descanso in Baja California, which is its only known locality.

Habitat. The Descanso Dunes are vegetated coastal sand dunes ~1.6 km long. We found JCs while sifting under *Ambrosia* (best) and *Haplopappus* (variable), and under boards and other junk. Between 1990 and our last trip to the dunes in 2005, the amount of *Ambrosia* on the dunes was severely reduced, apparently from ATV damage.

Life cycle and seasonal occurrence. Typical 2-year life cycle with most field collected nymphs molting to adult in early fall.

Variation. For 24 individuals, all had 2 ventral **fore** leg tibial spurs; all had 7 **middle** leg tibial calcars, all with 2 ventral spurs; 16 had 4 and 9 had 5 inner **rear** leg tibial spines, although some inner spines very small, and all 24 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. In some individuals, the number of rear leg inner tibial spines varied from 3 to 5 between the left and right sides.

DNA. Fig. 17, p. 58. F1572 and F1747 (both type locality, S05-1) recovered in Group 1 Winchester, and closest to *A. larumorosa*.

Karyotype. 2n♂=25. T92-58 (Fig. 65, S92-15) shows 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

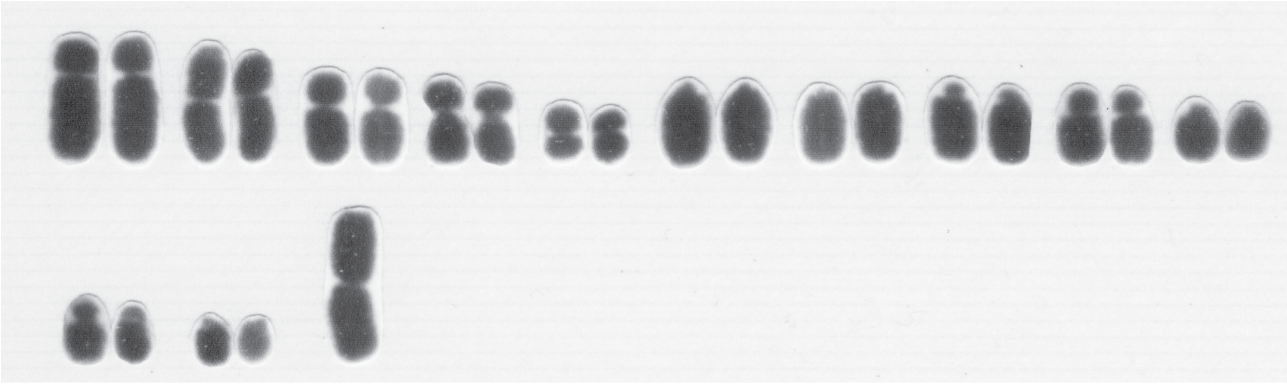


FIGURE 65. Idiogram T92-58 *A. descansodunes* (S92-15).

Discussion. The Descanso Dunes are subject to sand removal and ATV activity, which may impact the local habitat (ATVs were available to rent at the type locality in 2005). The uniqueness of these dunes is further explained by Robert N. Fisher, USGS (pers. comm to DBW, July, 2020):

"The Descanso Dunes are part of a late cretaceous sandstone feature that is localized around Primo Tapia [adjacent to the Descanso Dunes] and north a bit. These sand dunes are derived from that feature. They are unlike the dunes around Ensenada or Tijuana Estuary [San Diego Co., California]. The dunes that used to be at La Jolla Shores [32.8578° -117.2566°] might have been more similar to these but they are entirely or almost entirely gone now. There are a few creeks that have this feature as eroded sand along the wash to the north of Puerto Nuevo [32.2453° -116.9395°] so that might be another place to look; it's a pretty unique feature in northern Baja California. South of Ensenada by Punto Santo Tomas [31.5359° -116.6586°], there is some more of this feature. Camp Pendleton has some inland sandstone formations that could be the same feature and are about the same age 66–110 MY, and these are almost entirely restricted to the San Onofre watershed [33.3815° -117.5691°]. The San Joaquin Hills [33.6103° -117.8205°] are entirely sandstone also but they only age to about 11 MY so they are much younger. The dunes around Laguna Beach [33.5417° -117.7847°] might be a place to look, but there is not much left."

We have collected several of Fisher's suggested areas and found either no JCs there (Ensenada Dunes); or other species of *Ammopelmatus* present (e.g., at Tijuana Estuary, Puerto Nuevo, Camp Pendleton, and Laguna Beach). It thus appears that *A. descansodunes* may, indeed, be restricted to this one dune system.

***Ammopelmatus ensenada* Weissman, sp. nov.**

Baja California Coastal Jerusalem Cricket
Figs 66–79, Tables 37, 41

Species #1, Weissman 2001a.

Distribution. (Fig. 66). Mexico, northwestern Baja California from midway between Tijuana and Ensenada (S82-146) to 50 km S San Quintín (at El Campito, S90-10), and as far as 45 km inland near Ojos Negros (S90-6).

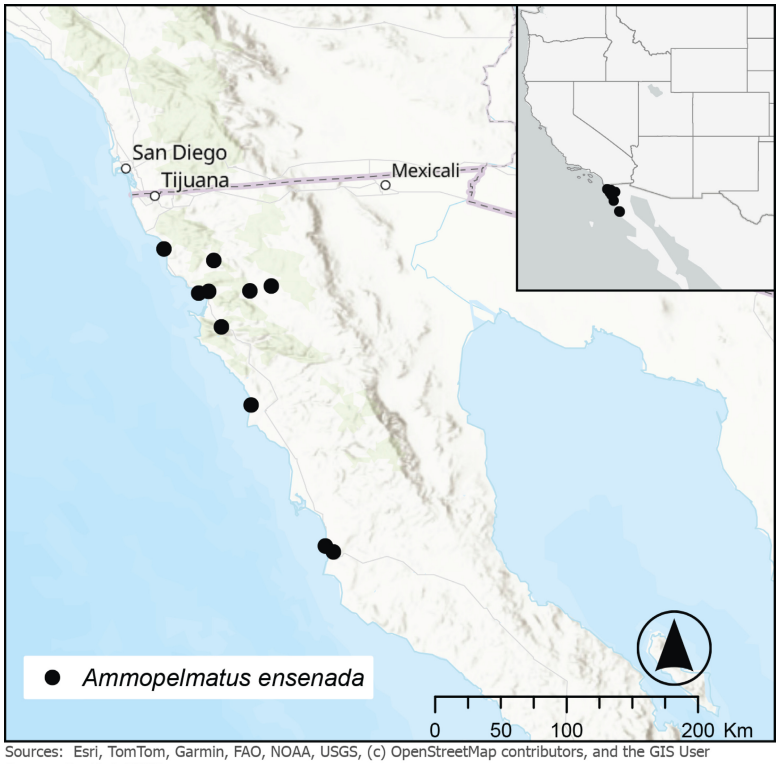


FIGURE 66. Distribution of *A. ensenada.*

Recognition characters. Member of Winchester Group. A small to medium sized JC that differs from geographically more northern sister species *A. sandiego* by having 2 front tibial spurs vs (usually) 3 for *A. sandiego*, and different DNA (Fig. 17, p. 58). Differs from sister species *A. sanmartinensis* where *A. ensenada* has 7 vs 8 calcars on the middle tibia, and fewer outer rear leg tibial spines (3 spines vs 5). *A. ensenada* also borders *A. sanmartinensis* to the north (at S90-8, San Antonio del Mar) and to the south (at S91-19, El Campito). Differs from USA *A. icenoglei* in being generally smaller, coastal vs inland, having a less prominent 3rd inner tibial spine, having only 2 fore tibial ventral spurs vs 3 in latter taxon, different DNA, and where the female drum is ~1/2 as fast (also see Discussion below) as the female drum in *A. icenoglei.* Differs from inland, higher elevation Baja California *A. larumorosa* in that overall head, pronotum, abdomen, and legs are darker in *A. ensenada.* The latter 2 taxa are separated by at least 70 km. Differs from sympatric *A. fisheri* where *A. ensenada* lacks development of male rear leg calcar #1, inner rear leg tibial spine #3 longest spine, 2n♂=25 vs 2n♂=23 in *A. fisheri,* absence of SCD drum, where males and females drum at different rates, and DNA.

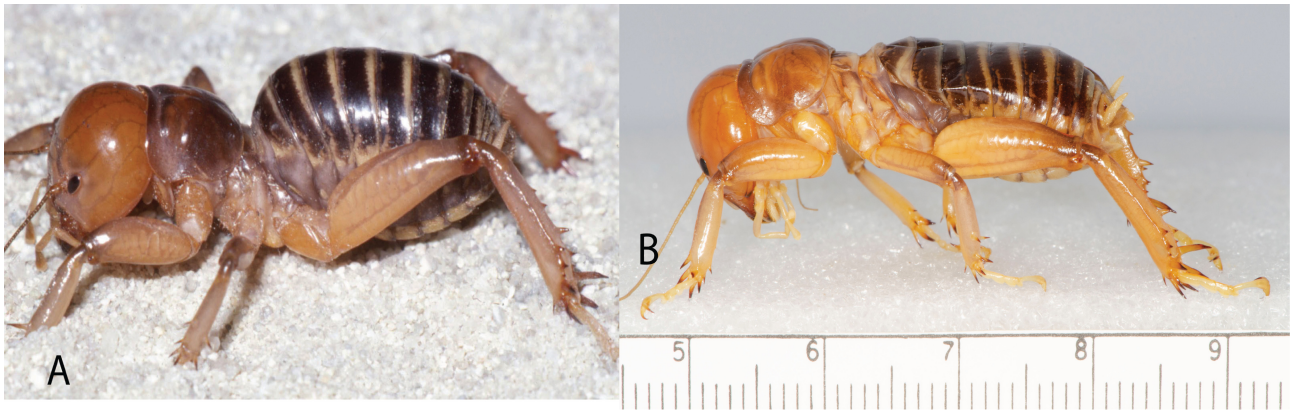


FIGURE 67. Holotype adult male *A. ensenada.* A. When alive. B. When preserved.

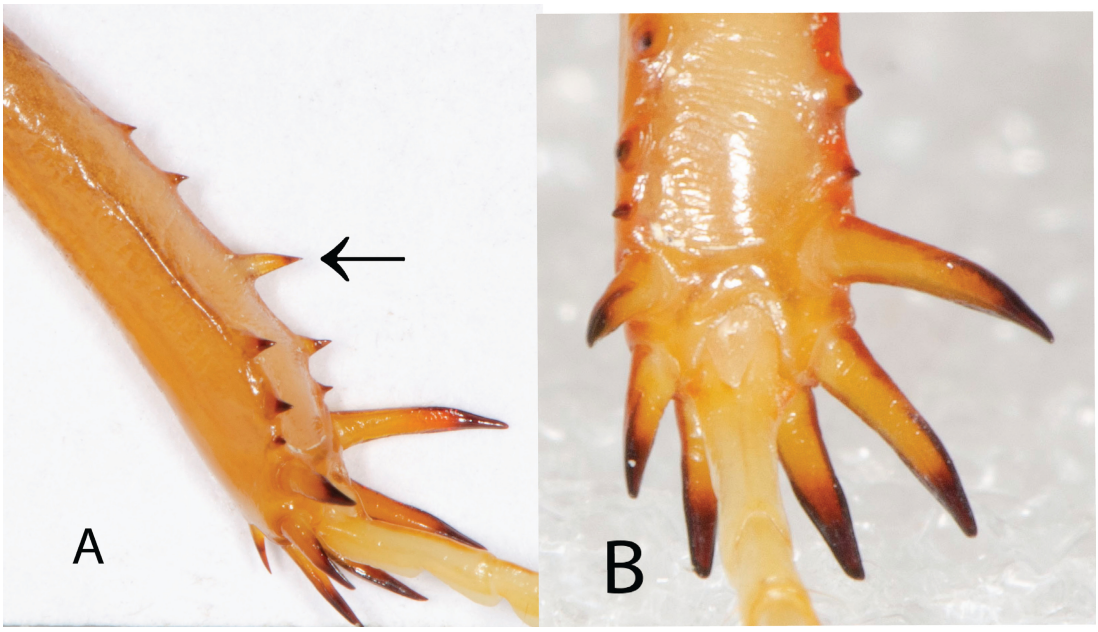


FIGURE 68. Left hind leg tibia holotype male *A. ensenada.* A. Showing 3 outer and 5 inner spines. Note largest inner spines #3 (arrow). B. Showing shape of calcars.

Holotype. Male (in alcohol, Fig. 67): **Mexico, *Baja California,*** Mexico Highway 1 at km post 34.3 S Ensenada or 9.9 m N Santo Tomás, 31.639279° -116.510982°, 145m, 20-xii-1987 (S87-127) DBW & BI Weissman. R88-118 & R88-122. Molt to adult 24-ix-1988. Deposited CAS, Entomology type #20081. Measurements in mm: Body length 33.5, hind femur length 10.9, hind femur width 4.36. Foretibia with 2 ventral spurs; middle tibia with 7 calcars, 2 ventral spurs; rear leg tibia (Fig. 68) with 5 inner and 3 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 69): same data as holotype except R88-119 & R88-145. Molt to adult 24-ix-1988. Deposited CAS, Entomology #9085094. Measurements in mm: Body length 35.8, hind femur length 11.9, hind femur width 4.24. Foretibia with 2 ventral spurs; middle tibia with 7 calcars, 2 ventral spurs; rear leg tibia (Fig. 70) with 4 and 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 71.

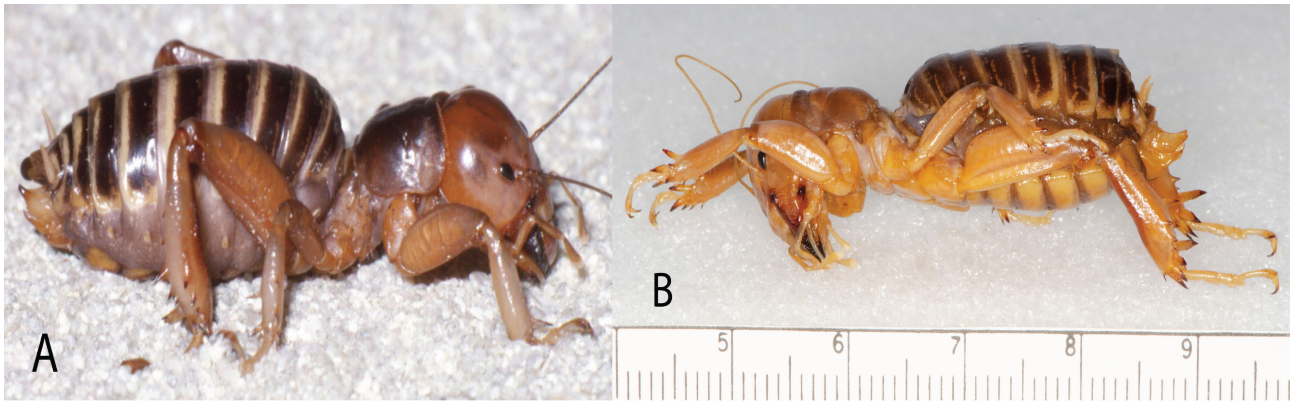


FIGURE 69. Allotype adult female *A. ensenada.* A. When alive. B. When preserved.



FIGURE 70. Left rear leg tibia adult allotype *A. ensenada.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 71. Ovipositor allotype *A. ensenada*.

Paratypes. **MEXICO, *Baja California***: ♂22 ♀35. Same as type locality, 27-xii-1978 (S79-1) ♂1 ♀6; 8-i-1979 (S79-39) ♀1; 19-iii-1980 (S80-4) ♂1 ♀5; 19-xii-1982 (S82-145) ♂2 ♀1; 4-x-1983 (S83-133) ♂1; 20-xii-1987 (S87-127) ♂4 ♀4; 10-ii-1990 (S90-7) ♂2 ♀4. Mexico Hwy 1 53.5 km S Tijuana, 32.169217° -116.903742°, 39m, 19-xii-1982 (S82-146) ♂2. El Campito, 30.149116° -115.800714°, 12m, 14-iv-1991 (S91-19) G. Ballmer, ♂2 ♀2. Ensenada, CICESE, 31.868928° -116.666338°, 59m, 1-xii-2005 (S05-172) WH Clark ♀1. Ensenada, 31.88050° -

116.59778°, 95m, 7-v-2014 (S14-13) WH Clark, ♂1. 2 m S Ensenada, Hotel Dorado, 20-ii-1978 (S78-3) ♀1. Hwy 3 at km sign 34.7, 5.1 m W intersection with turnoff to Ojos Negros, ~31.884244° -116.316504°, 772m, 10-ii-1990 (S90-5) ♂3 ♀2. Hwy 3, km post 78 at 78 km S Tecate, 32.090970° -116.563166°, 336m, 3-iii-1992 (S92-17) ♂1. 6.1 m E Ojos Negros on road to Laguna Hanson, 31.917° -116.170°, 821m, 10-ii-1990 (S90-6) ♂1. San Antonio del Mar 7 m W Hwy 1, 31.107872° -116.308025°, 5m, 11-ii-1990 (S90-8) ♂1 ♀7. Hwy 1 at km sign post 50.5 S San Quintín, 30.108809° -115.745780°, 197m, 12-ii-1990 (S90-10) ♀1.

Drum. Calling drum slower in females than males (and see Discussion below). Holotype **male:** R88-118 (Fig. 72), showing 27 drums in 2.7s (10 drums/s) at 18.5°C. Topotype **male:** R88-146 (Fig. 73), showing 47 drums in 5.8 s (8.1 drums/s) at 10°C. Allotype **female:** R88-119 (Fig. 74) showing 56 drums in 10.3s (5.4 drums/s) at 18.5°C. Topotype **female**: R88-120 (Fig. 75), showing 53 drums in 7.8s (6.8 drums/s) at 19°C.

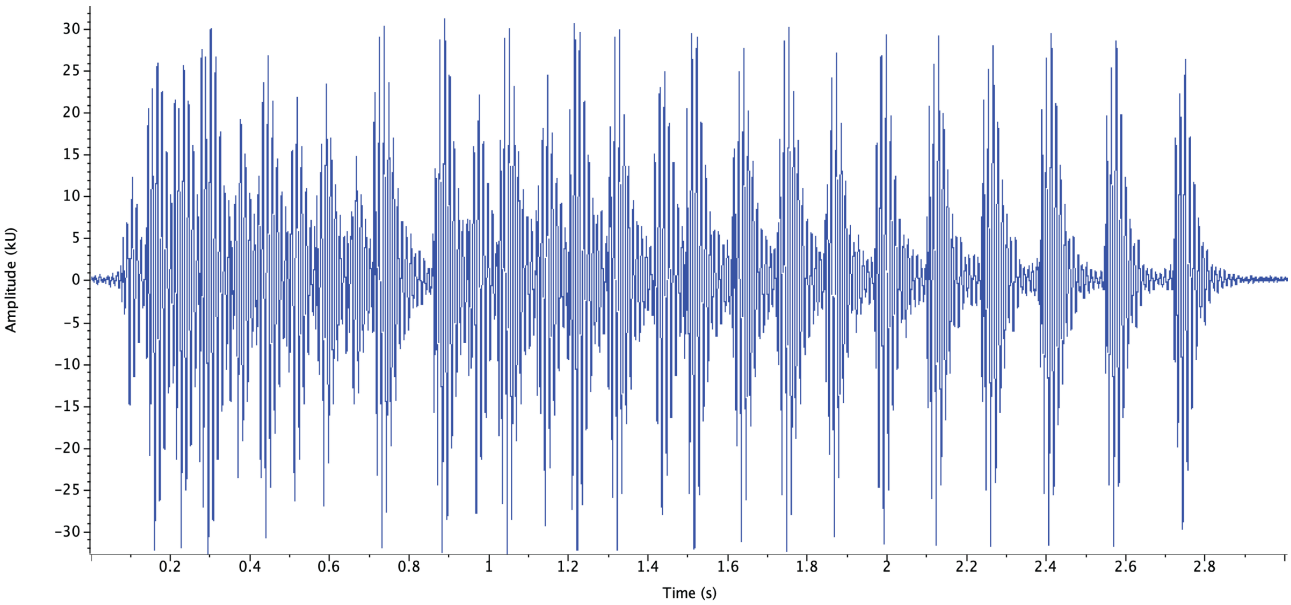


FIGURE 72. Calling drum (R88-118) holotype adult male *A. ensenada.*

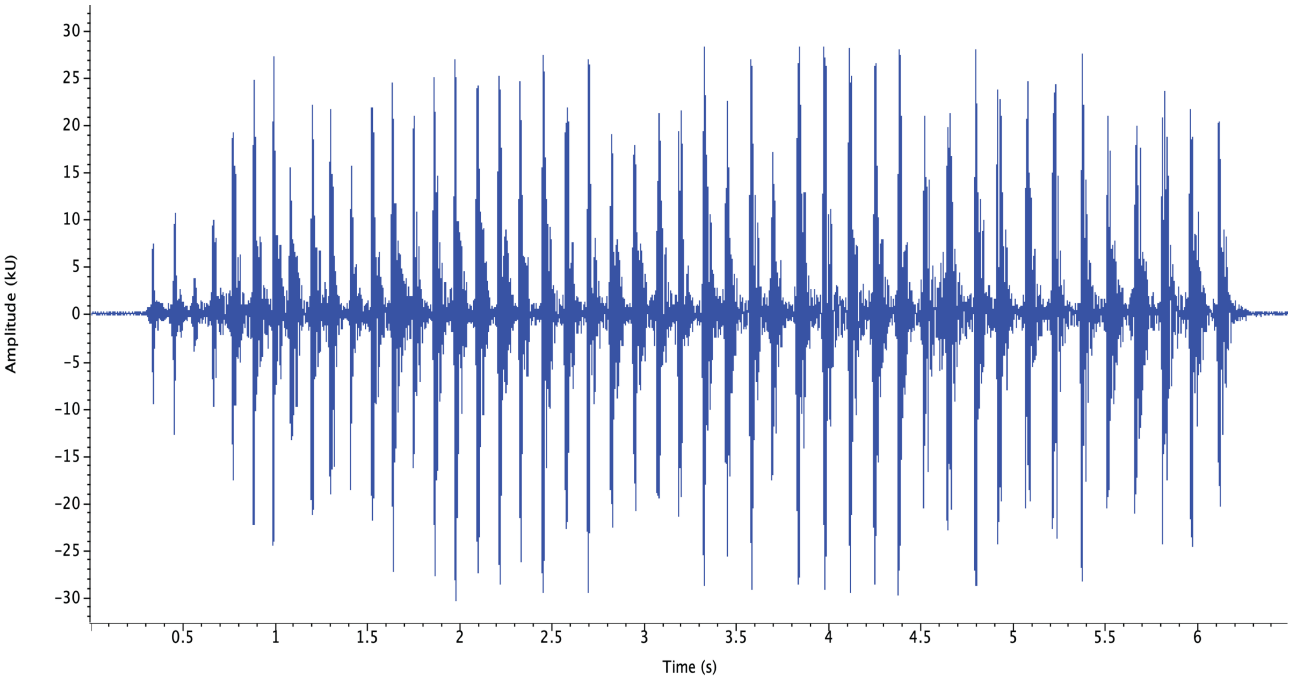


FIGURE 73. Calling drum (R88-146) topotypic adult male *A. ensenada*.

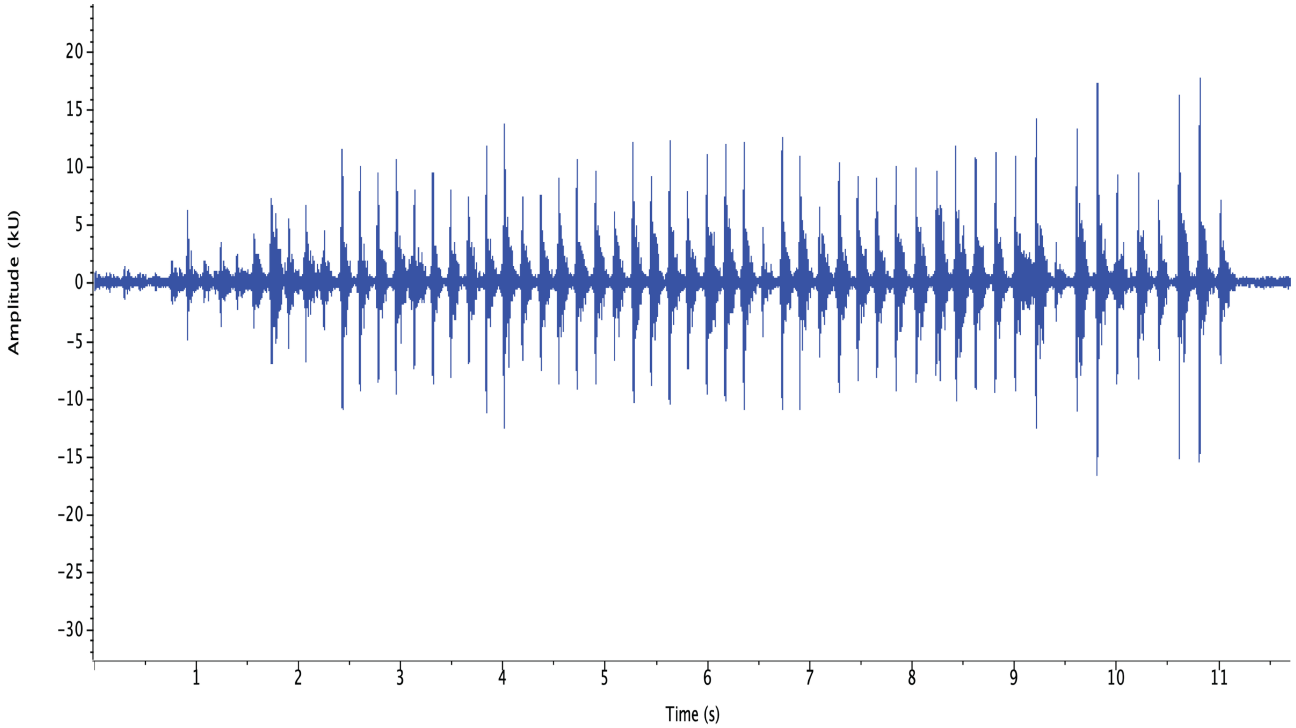


FIGURE 74. Calling drum (R88-119) allotype adult female *A. ensenada.*

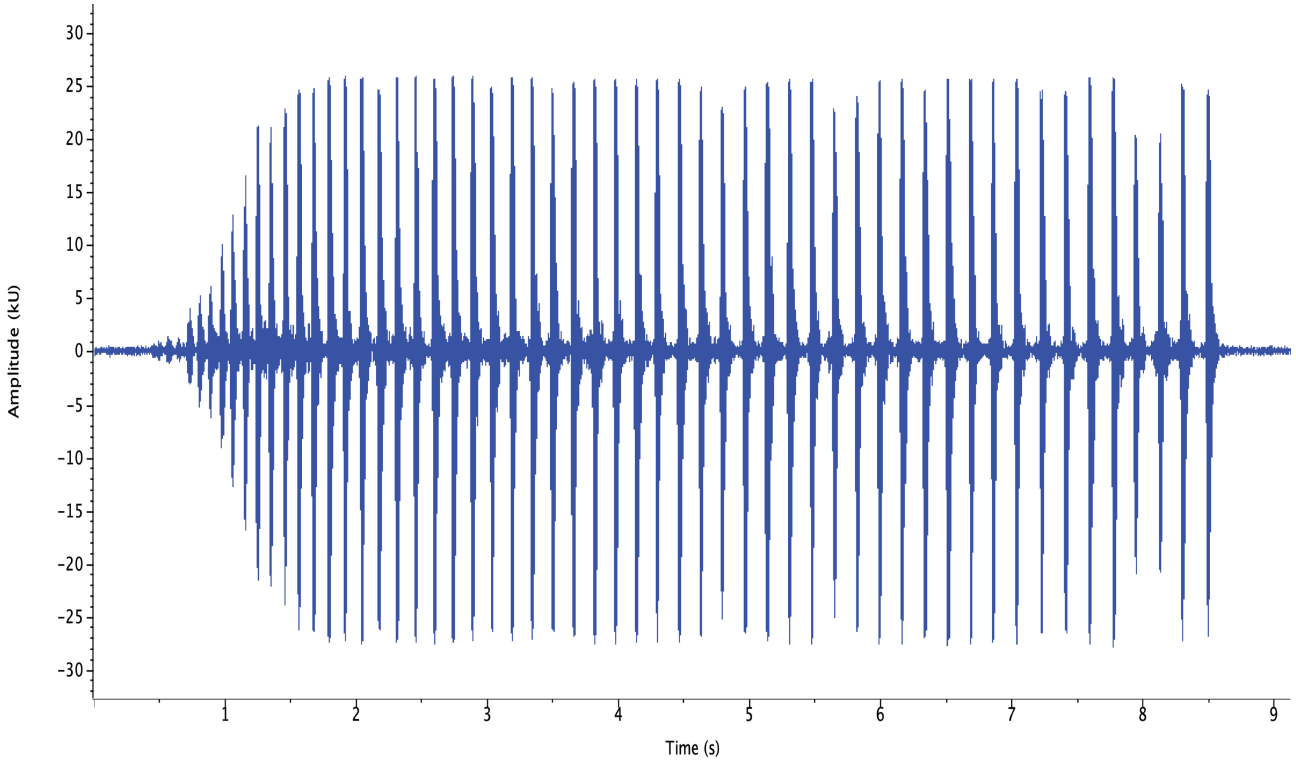


FIGURE 75. Calling drum (R88-120) topotype adult female *A. ensenada.*

Derivation of name. Named in reference to the large Baja California city near where most specimens were collected.

Habitat. Coastal sandy areas, coastal scrub and coastal bluff vegetation.

Life cycle and seasonal occurrence. Apparent 2-year life cycle. One small male nymph collected 8-i-1979 (S79-

39) molted 9 times, on the following dates, before becoming adult: 22-ii-1979, 5-iv-1979, 15-v-1979, 4-vii-1979, 30-viii-1979, 9-x-1979, 14-ii-1980, 27-iv-1980, 14-ix-1980. He died 25-iv-1981.

Variation. Of 61 adults, all had 2 ventral **fore** leg tibial spurs; 51 had 7 and 8 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 19 had 3, 19 had 4, 20 had 5, and 1 had 6 inner **rear** leg tibial spines, while 57 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F1743 (S05-172, Ensenada); F2438 (S14-13, Ensenada) recovered in their own subclade within Group 1 Winchester.

Karyotype. 2n♂=25. Two type locality individuals (S87-127) checked: T88-16 (Fig. 76) and T88-23 (Fig. 77), both show 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 76. Idiogram T88-16 *A. ensenada* (S87-127).



FIGURE 77. Idiogram T88-23 *A. ensenada* (S87-127).

Discussion. We can separate coastal northern Baja California *A. ensenada*, where all 61 adults had 2 ventral fore leg tibial spurs, from inland USA Riverside County sister taxon *A. icenoglei*, where all 45 adults had 3 ventral fore leg tibial spurs.

For geographically in between *A. sandiego*, in San Diego County, the situation is, morphologically, not as well defined: of 25 adults of *A. sandiego*, 4 had 2 fore leg tibial spurs, 20 had 3, and 1 individual had 4. Specifically for the latter, 2 of 3 Tijuana Estuary (S97-38, S03-11, coastal sage scrub) adults had 2 spurs; 1 adult from type locality Lake Hodges (S05-2, coastal sage scrub) had 2 spurs, and 2 adults had 3 spurs; and 1 of 5 adults from Rancho Jamul (S05-61, coastal sage scrub and grassland) had 2 spurs. For more southern *A. sanmartinensis*, individuals are distinct by usually having 5 outer rear leg tibial spines. And, importantly, all four species were recovered in their own subclades, and separate from each other.

The calling drum rates in *A. ensenada* adults are closer to *A. sandiego* than to *A. icenoglei*. A regression of temperature vs drumming rate (Figs 78 & 79) in these three taxa shows high correlation in male *A. icenoglei* (R^2 = 0.97) when compared to males of either *A. ensenada* (R^2 =0.07) or *A. sandiego* (R^2 = 0.52). Similarly for female *A.*

icenoglei, regression correlations are higher ($R^2 = 0.98$) then in either *A. ensenada* ($R^2 = 0.47$) or *A. sandiego* ($R^2 = 0.43$). We wonder if these low correlation values in both the latter two species might represent the effects of past interbreeding; possibly also involving *A. sanmartinensis* (see p. 125), which has the slowest calling drum rate in both sexes of these four species?

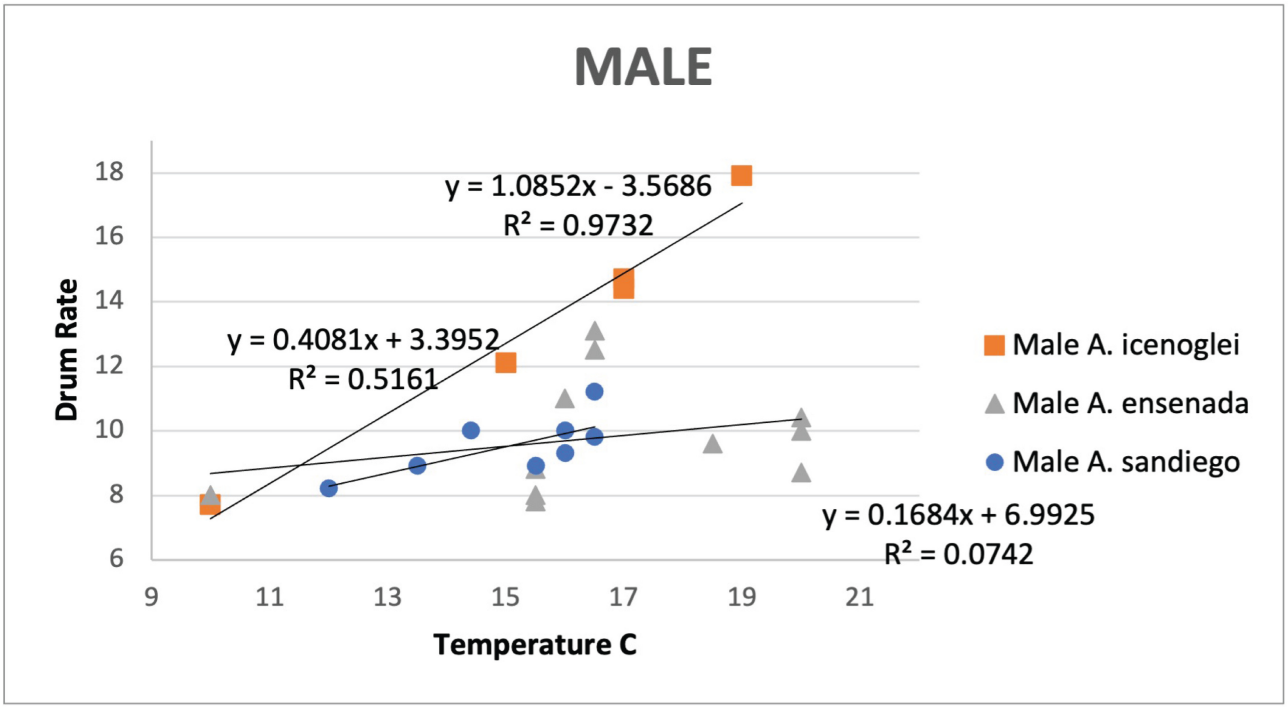


FIGURE 78. Drumming rate as a function of temperature in males of Winchester Group sister species. For *A. icenoglei, A. ensenada,* and *A. sandiego*, each symbol represents one recording of one male, or the same male recorded at different temperatures.

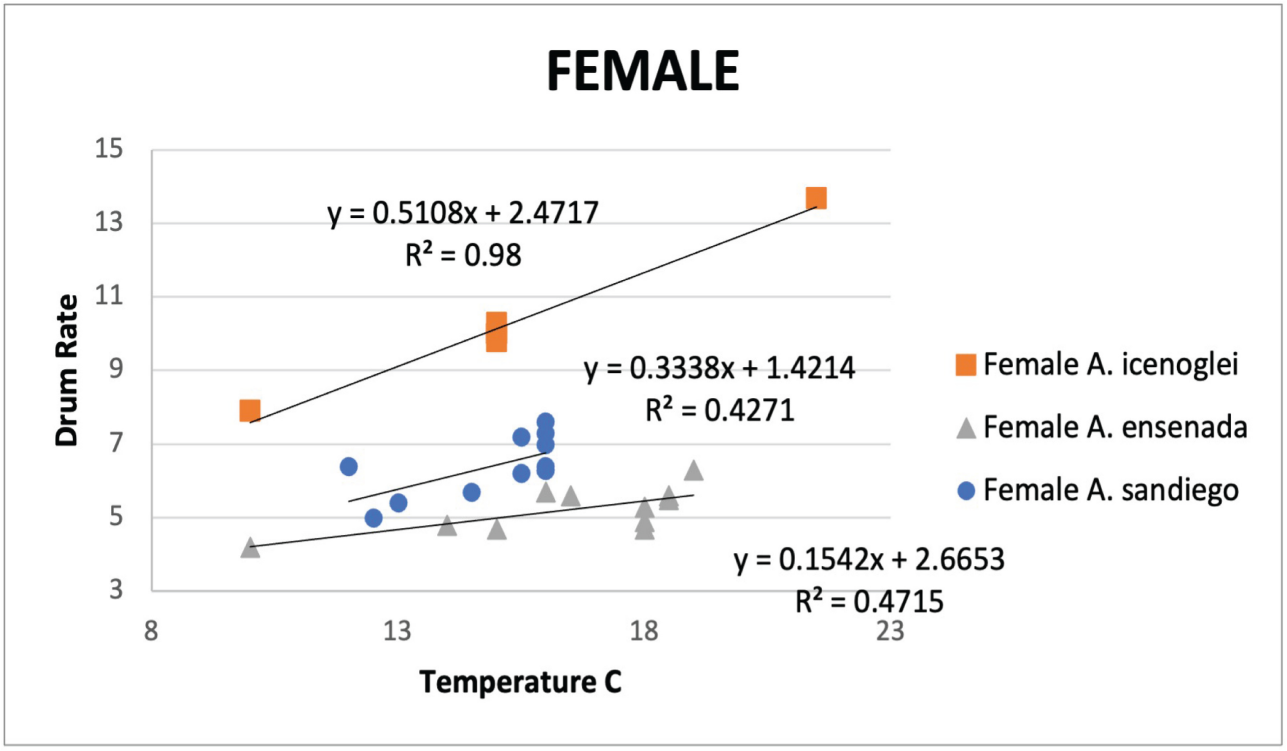


FIGURE 79. Drumming rate as a function of temperature in female Winchester Group sister species. For *A. icenoglei, A. ensenada,* and *A. sandiego*, each symbol represents one recording of one female, or the same female recorded at different temperatures.

***Ammopelmatus icenoglei* Weissman, sp. nov.**
Winchester Jerusalem Cricket
Figs 80–91, Tables 6, 41

Species #6 Weissman (2001b), & Walker & Weissman (2001).

Distribution. (Fig. 80). Only known from inland Riverside and San Bernardino Counties, California.

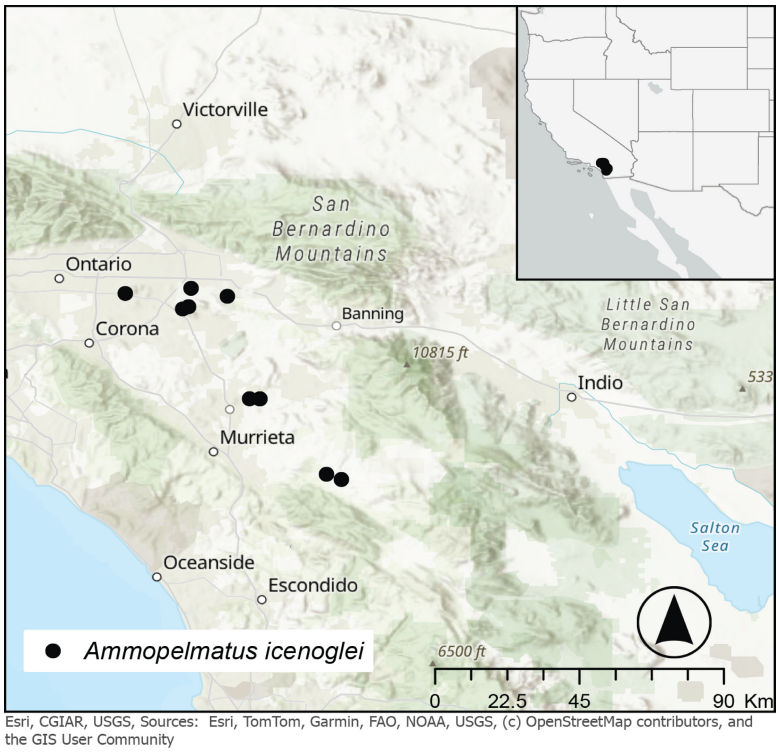


FIGURE 80. Distribution of *A. icenoglei.*

Recognition characters. One of four allopatric, Southern California-Baja California Winchester Group taxa of similar coloring: *A. icenoglei, A. ensenada, A. sandiego,* and *A. sanmartinensis. A. icenoglei* is a small to large, fast drumming JC, that can, morphologically, be reliably separated from smaller sister taxon *A. ensenada* as follows: in *A. icenoglei*, 100% of 45 individuals have 3 fore tibial ventral spurs vs. 100% of 57 *A. ensenada* individuals with 2 spurs. Additionally, 78% (36 out of 46) adult *A. icenoglei* with 4 outer rear leg tibial spines; while 98% (63 out of 64) adult *A. ensenada* with 3 outer spines. Drumming rate slower (see Figs 90 & 91 below) in female *A. ensenada* and habitat preferences (inland for *A. icenoglei* and coastal for *A. ensenada*) also separate the two taxa. Hind leg inner tibial spine #3 longer in *A. icenoglei* then in *A. ensenada* but, in general, adults of the former also larger than the latter. They also differ in DNA.

From also closely related, geographically closest, coastal, sister taxon *A. sandiego,* in San Diego County, the situation is not as well morphologically defined: of 25 adults of *A. sandiego*, 4 had 2 fore leg tibial spurs, 1 individual had 2 and 3 spurs, and 20 had 3 fore leg tibial spurs. Nevertheless, the two taxa are recovered in separate subclades; and we do not believe that "*A. sandiego*" simply represents hybrids between *A. icenoglei* and *A. ensenada* since we find no mixed genetic populations. See "Discussion" section below for further information on drumming analysis comparing these three taxa.

The fourth morphologically similar member, *A. sanmartinensis,* is known from a limited coastal area of Baja California, and nearby Isla San Martín, and is bounded by populations of *A. ensenada* to the north and south. See discussion on p. 125.

Holotype. Male (in alcohol, Fig. 81A, live topotype adult male S88-15, R88-13; preserved holotype male Fig. 81B). **California, *Riverside Co.,*** 1 m NW Winchester, 33.713767° -117.090900°, 458m, 25-xii-2007 (S08-15) W. Icenogle. R08-62. Molt to adult 9-x-2008. Deposited CAS, Entomology type #20080. Measurements in mm: Body

length 32.86, hind femur length 12.22, hind femur width 4.35. Fore tibia with 3 ventral spurs, middle tibia with 7 calcars and 2 ventral spurs, rear leg tibia with 5 inner and 4 outer spines with inner spine #3 much longer (Fig. 82) than any other, 2 ventral spurs.



FIGURE 81. Adult male *A. icenoglei.* A. Live topotype (S88-15, R88-13). B. Preserved holotype adult male (S08-15, R08-62). Note prominent rear leg inner tibial spine #3 in both males.



FIGURE 82. Left rear leg tibia holotype adult male *A. icenoglei.* A. Showing 4 outer and 5 inner spines, with inner spine #3 (arrow) longest. B. Right rear leg tibia showing shape of calcars, with missing tips secondary to wear.

Allotype. Female (in alcohol, Fig. 83A, live topotype adult female S86-170, R88-140, R88-143, R88-148; Fig. 83B, preserved allotype adult female), same data as holotype except R08-65, F2101. Molt to adult 9-x-2008. Deposited CAS, Entomology #8413778. Measurements in mm: Body length (not including ovipositor) 39.19, hind femur length 9.58, hind femur width 3.90. Fore tibia with 3 ventral spurs; middle tibia with 7 calcars and 2 ventral spurs; rear leg tibia with 5 inner and 4 outer spines with inner spine #3 much longer (Fig. 84) than any other, 2 ventral spurs. Ovipositor Fig. 85.

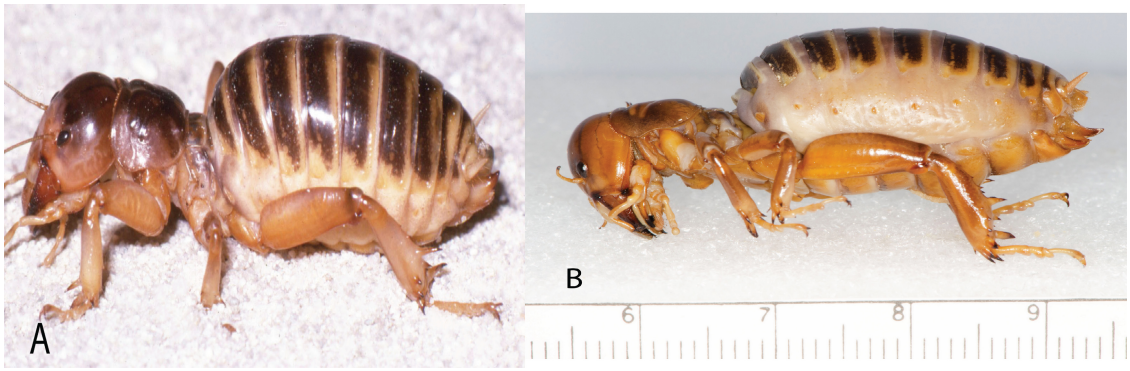


FIGURE 83. Adult female *A. icenoglei.* A. Live topotypic (S86-170, R88-140). B. Preserved allotype.

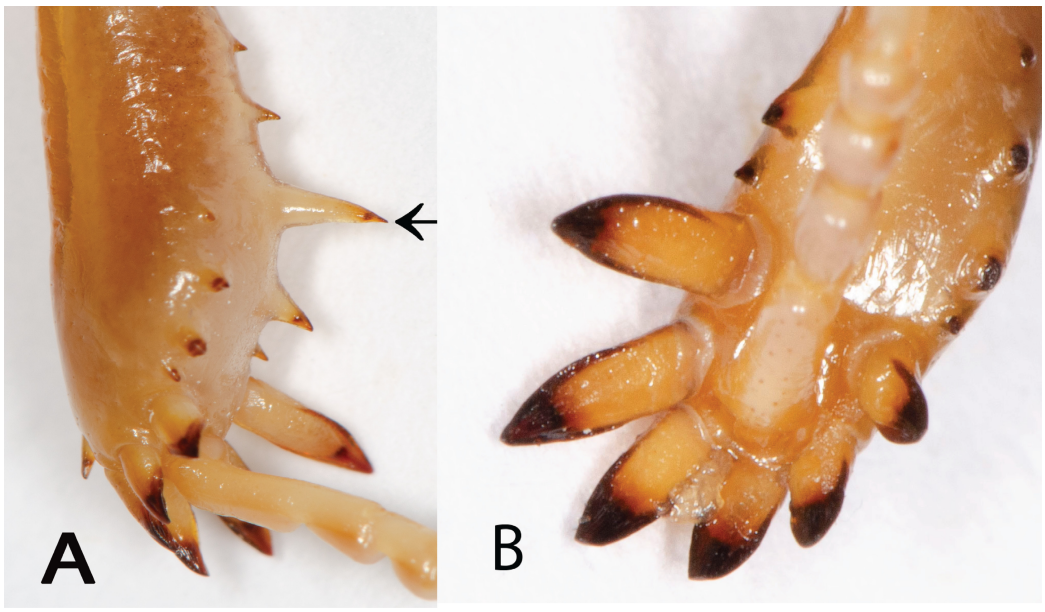


FIGURE 84. Allotype female *A. icenoglei.* A. Showing left rear leg tibia with 4 outer and 5 inner spines. Note inner spine #3 (arrow) as longest. B. Right rear leg tibia showing shape of calcars.



FIGURE 85. Ovipositor allotype *A. icenoglei*.

Paratypes. ♂34 ♀38. **CALIFORNIA, *Riverside Co.,*** type locality, all collected by W. Icenogle, 33.713767° -117.090900°, 458m, 27-xii-1985 (S85-149) ♀1; 14-18-i-1986 (S86-7) ♂2 ♀3; 26-i to 22-ii-1986 (S86-12) ♂1 ♀2; 19-23-xi-1986 (S86-156) ♂1 ♀6; 20-xii-1986 (S86-170) ♂1 ♀4; 10-21-xii-1986 (S86-170) ♂4 ♀1; 15-25-iv-1987 (S87-18) ♀2; 29-iv-1988 (S88-15) ♂4 ♀3; 22-i-1995 (S95-2) ♀3; early January to mid-March, 2005 (S05-35) ♂1 ♀1; 25-xii-2007 (S08-15) ♂5 ♀4. Billy Goat Mt, Aquanga, 33.479470° -116.862668°, 883m, 24-i-1998 (S98-4) GF Pratt ♂1. Double Butte, 455m, 17-iii-24-x-1983, W. Icenogle ♀3. Glen Avon area, Pyrite Rd, 8-v-1988 (S88-63) W. Icenogle ♂1; base of Jurupa Mts, 34.020025° -117.467558°, 317m, 6-i-1989 (S89-1) W. Icenogle ♂1 ♀1; early i-mid iii, 2005 (S05-36) W. Icenogle ♀2. SW Hemet, ~33.278023° -116.985376°, 477m, 26-xi-1996 (S96-94) R. Fisher, ♂2. 2 m NW Winchester, Grand Ave near junction Leon Rd., 33.713996° -117.119723°, 452m, 15-xii-2008 (S09-1) W. Icenogle, ♂1. Moreno Valley, base of Box Springs Mts, 33.981496° -117.290487°, 704m, 7-i-1995 (S95-7) RK Velten ♂1. Box Springs Mts, Granite Hills, 335m, 28-i-1993 (S93-3) J. Gannon ♀1. El Toro Rd N Hwy 74, 33.373° -117.334° 545m, 27-i-1993 (S93-4) J. Gannon ♂1. Near Perris Reservoir, 33.86714° -117.1957, 525m, 5-6-ii-1997 (S97-16) R. Fisher ♂2. Rawson, 33.6313° -117.008°, 647m, 26-xi-1996 (S96-93) R. Fisher ♂1. Riverside, 10-iii-1983 (S83-10) J. Johnson ♂1; 12-v-1998 (S98-46) J. Morris ♂1. Riverside, Riverside Fire Station #9, 33.930374° -117.345968°, 422m, 30-xi-1983 (S83-155) E. Soltera ♂1. Sage Rd ~2.5 m N Hwy 79, 33.494609° -116.904384°, 558m, 19-i-1998 (S98-2) GR Ballmer & GF Pratt ♀1. Near UC Riverside, 33.975° -117.307°, 421m, 7-i-1993 (S93-1) G. Ballmer ♂1. San Timoteo Canyon, 426m, mid-February (S94-4) J. Gannon, ♀1. ***San Bernardino Co.,*** Colton, 11876 Reche Canyon Rd, 34.034974° -117.283540°, 356m, 17-iii-1994 (S94-6) C. Lovell ♀1. San Timoteo Canyon Rd and Allesandro Rd, 34.011832° -117.181875°, 447m, 20-ii-1992 (S92-4) J. Gannon ♀1.

Drum. Males drum around 2X faster than females at the same temperature (Weissman 2001b, and below). **Male**: Topotype R08-59 (Fig. 86), S08-15, 17°C: 70 drums in 4.3s (16.3 drums/s). **Female**: R08-64 (Fig. 87), S08-15 (type locality), 17°C, 18 drums in 1.9s (9.5 drums/s). Since maturing late in the year, we were able to record the same individual, and different individuals, over a range of temperatures: See Figs 19.6 and 19.7 in Weissman 2001b, and Figs 90 & 91 below.

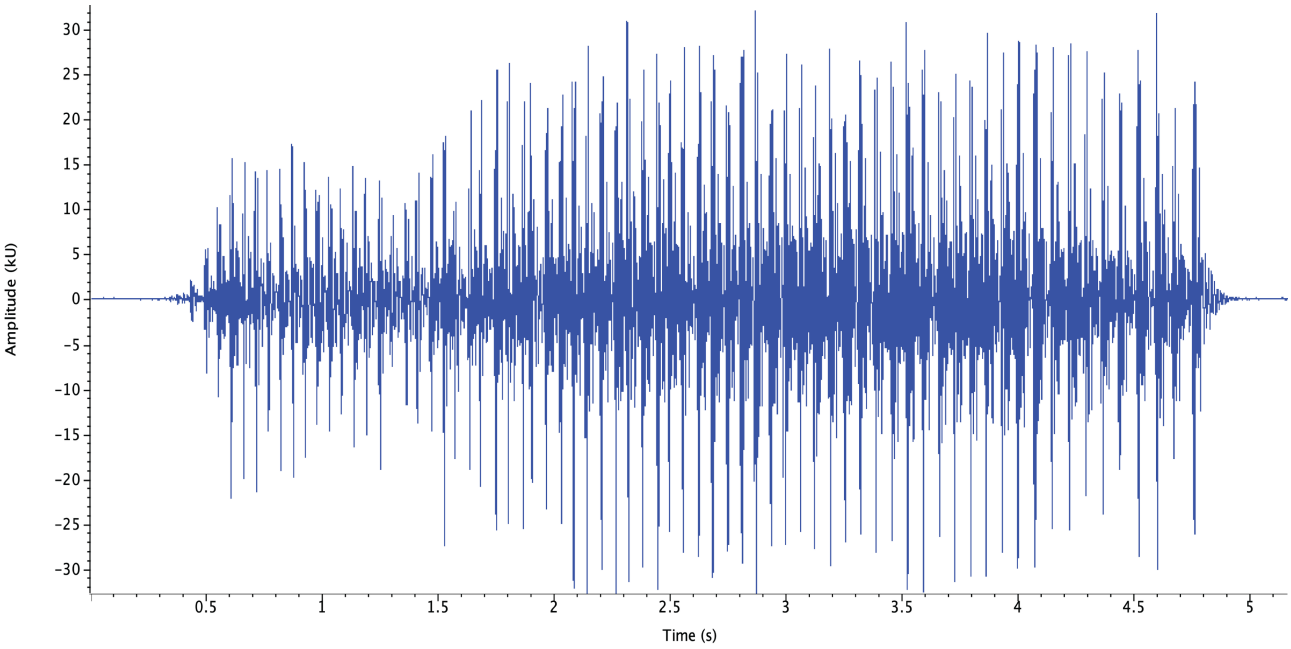


FIGURE 86. Calling drum R08-59) adult male topotype *A. icenoglei*.

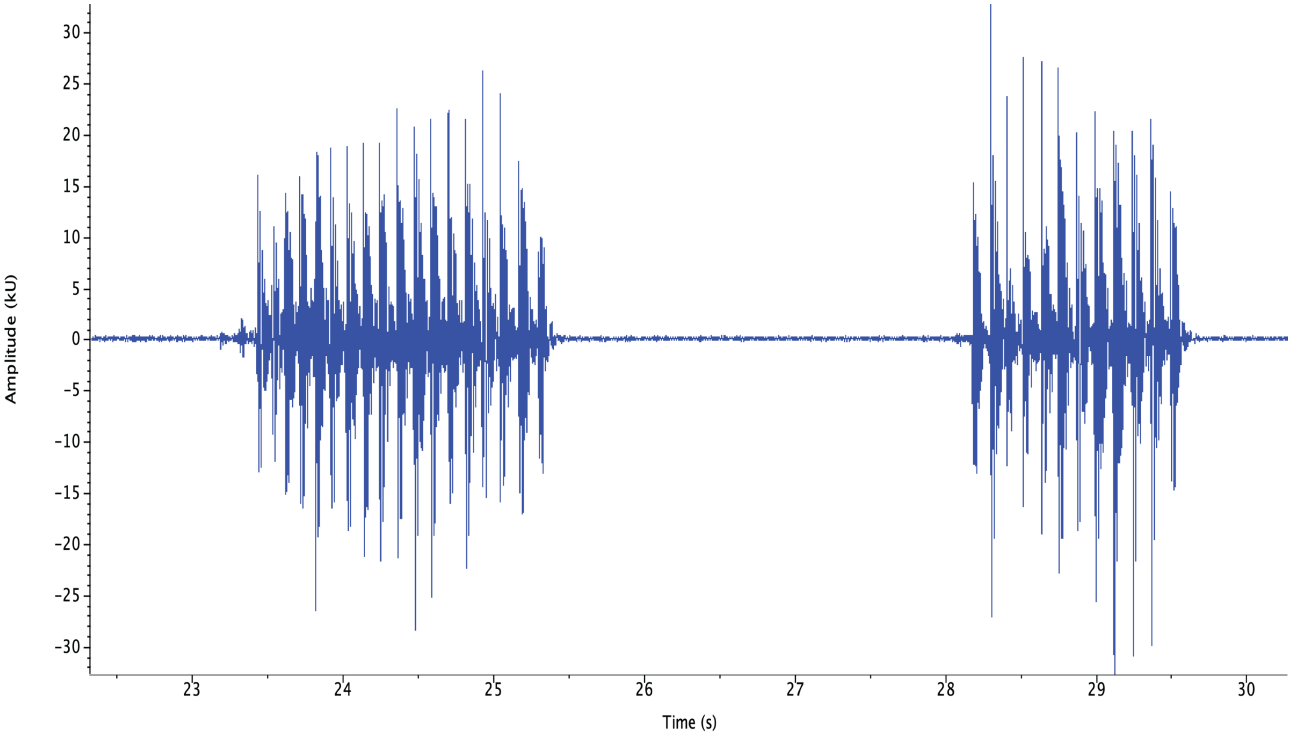


FIGURE 87. Calling drum (R08-64) topotype adult female *A. icenoglei*.

Derivation of name. Named for Wendell Icenogle, who has collected many JCs for DBW over the years, and first collected this species on his property.

Habitat. Type locality is sage scrub with *Artemisia, Eriogonum*, etc. Also, in grassland (S94-6), and chaparral (S94-4).

Life cycle and seasonal occurrence. Typical 2-year life cycle. Individuals matured in the laboratory in mid to late fall and some individuals drummed well at 9°C.

Variation. Of 45 adults, all with 3 ventral **fore leg** tibial spurs; all had 7 **middle leg** tibia calcars, while 1 had 1, 43 had 2, and 1 had 3 ventral spurs; and on the **rear leg**, 1 had 3 inner, 5 had 4 inner, and 40 had 5 inner spines; while 10 had 3 outer and 36 had 4 outer spines, all with 2 ventral spurs. In some individuals, inner rear leg tibial spine #1 was absent while the longest #3 spine was always present. The size of **inner spine** #3 can vary in size, but it is always the longest inner spine. **Color**: One male (Fig. 88A, S09-1) collected as adult, lighter in color, and with albino-like eyes (Fig. 88B).

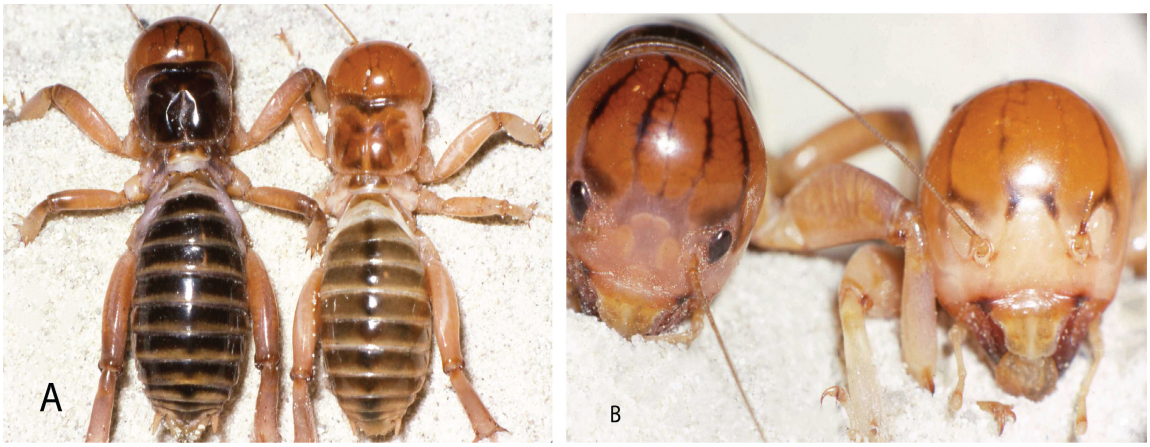


FIGURE 88. Unique color variant/mutation in type locality (S09-1) adult male *A. icenoglei* (on right side in A and B photos), compared with normal colored topotypic adult male on left side in A and B. No other similar colored individuals of *A. icenoglei* seen.

DNA. Fig. 17, p. 58. F0022 (S94-4, Timoteo Canyon); F0063 (S95-7, Moreno Valley); F0404 (S94-6, Colton); F0839 (S98-46, Riverside); F0849 (S98-4, Aguanga); and F2101 (type locality S08-15) all recovered together in Group 1 Winchester, and closest to *A. larumorosa* and *A. sandiego.*

Karyotype. 2n♂=25. 3 type locality individuals checked: T88-17 (S88-15), T89-28 (S88-15) and T05-12 (Fig. 89, S05-35), and all similar with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

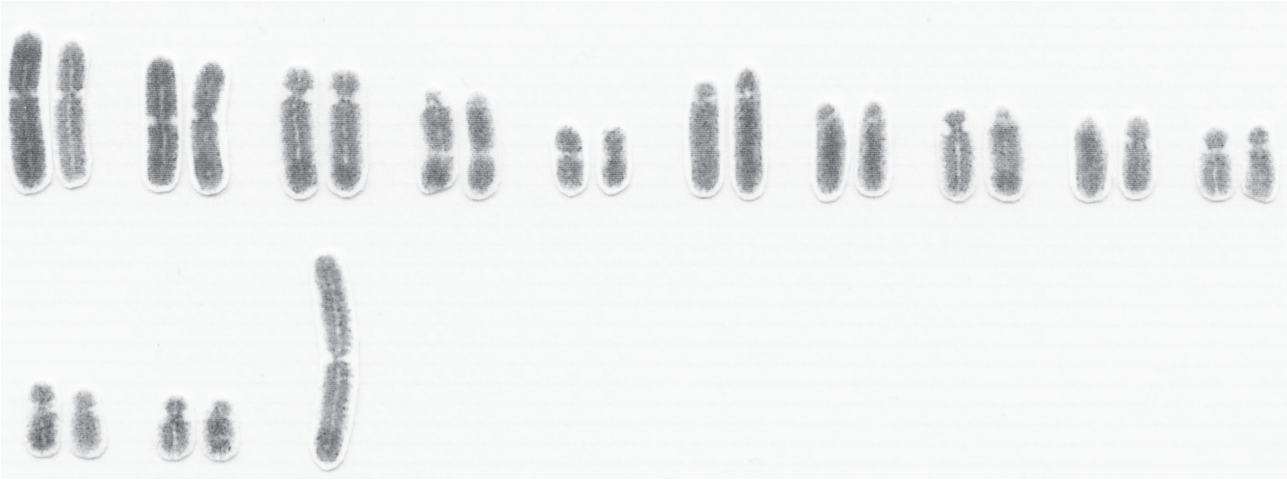


FIGURE 89. Idiogram T05-12, type locality *A. icenoglei* (S05-35).

Discussion. In addition to the mixed situation seen in fore leg tibial spurs, discussed above, when comparing *A. icenoglei* with *A. ensenada* and *A. sandiego,* the calling drums in *A. sandiego* adults also appear mixed. Specifically, a regression of temperature vs drumming rate in *A. icenoglei* is highly correlated in both males (Fig. 90, $R^2 = 0.97$) and females (Fig. 91, $R^2 = 0.98$); than in either sex in *A. sandiego*, where male drumming (Fig. 90) is correlated with an $R^2 = 0.52$ and female drumming (Fig. 91) is correlated with an $R^2 = 0.43$. Whether this situation might represent a past zone of introgression or an active suture zone is unknown.

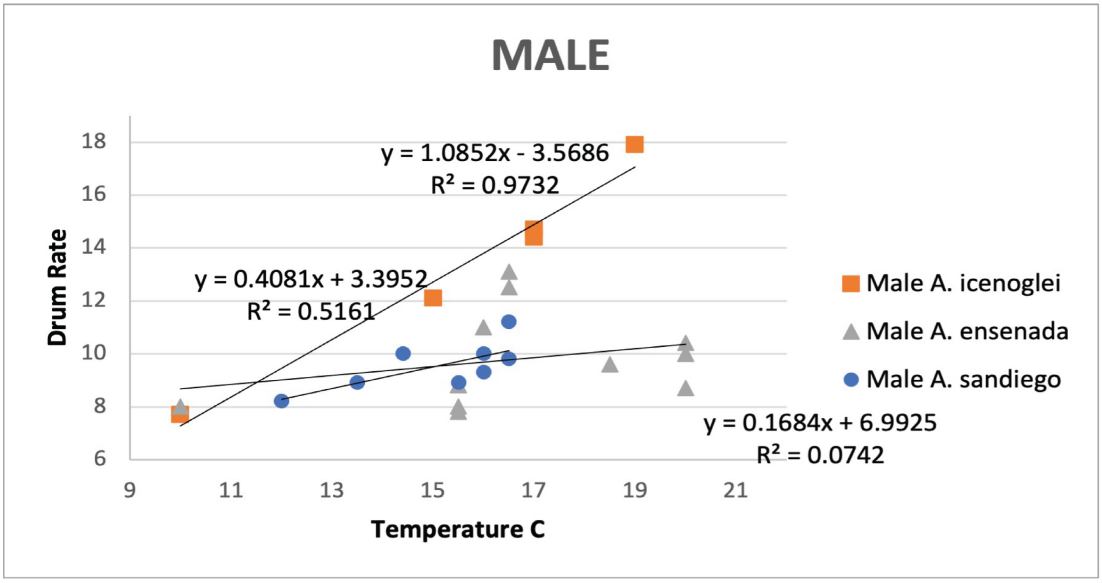


FIGURE 90. Drumming rates as a function of temperature in male Winchester Group sister species. For *A. icenoglei, A. ensenada,* and *A. sandiego*, each symbol represents one recording of one male, or the same male recorded at different temperatures.

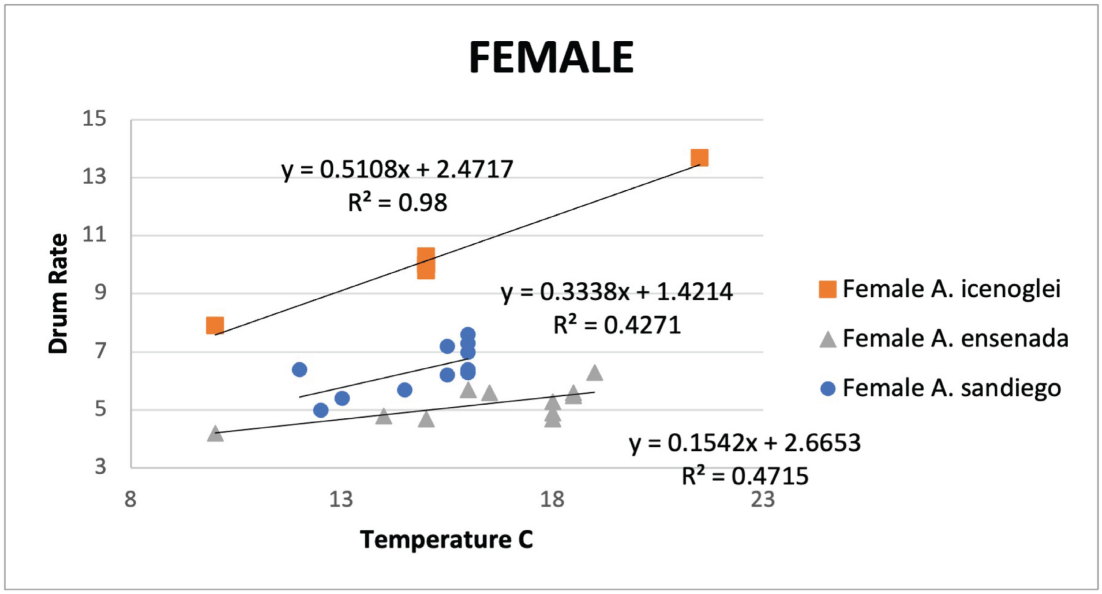


FIGURE 91. Drumming rates as a function of temperature in female Winchester Group sister species. For *A. icenoglei, A. ensenada,* and *A. sandiego*, each symbol represents one recording of one female, or the same female recorded at different temperatures.

Sympatric with 7 drums/s *A. stringfellow* at Timoteo Canyon (S94-4, Riverside Co.), and Colton (S94-6, San Bernardino Co.).

***Ammopelmatus larumorosa* Weissman, sp. nov.**
La Rumorosa Jerusalem Cricket
Figs 92–108, Tables 37, 41

Species #3, Weissman 2001b.

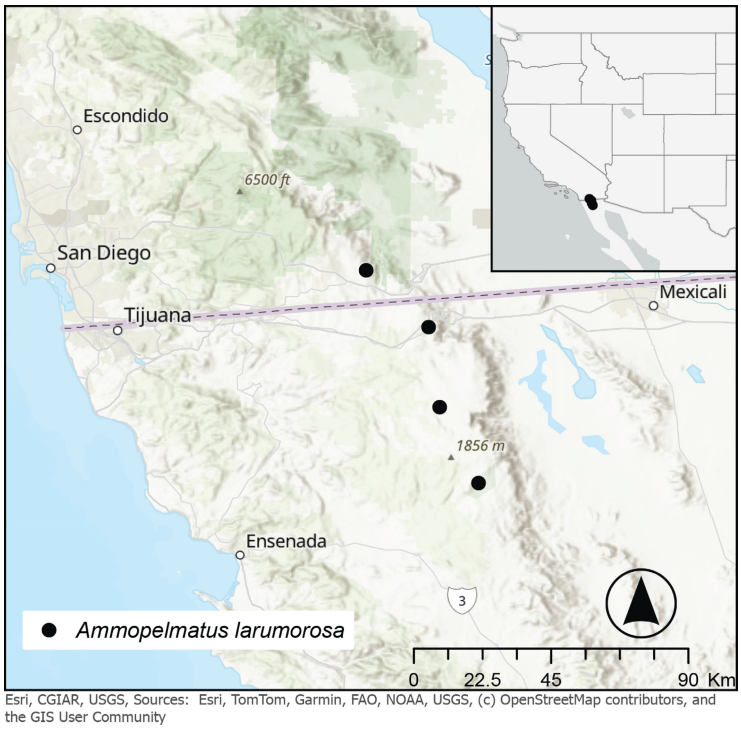


FIGURE 92. Distribution of *A. larumorosa.*

Distribution. (Fig. 92). Northern Baja California, Mexico, around La Rumorosa and southward toward Laguna Hanson. Probably gets across the border into San Diego Co., California.

Recognition characters. Member of Winchester Group. Small to medium-large, light-colored JCs with rear leg inner tibial spine #3 longest (sometimes rear leg tibial spine #2 of similar length), 2n♂=25, only 2 fore leg ventral tibial spurs, calling drum in males 2–3 times as rapid as in females. Separated from *A. lagunahanson*, with which it can be sympatric in areas between La Rumorosa and Laguna Hanson, by latter being darker (Fig. 93), rear leg inner tibial spine #1 longest, 2n♂=23, and 3 fore leg ventral tibial spurs. Drumming rate in adult females is not a good character for separating these 2 taxa because there is a lot of overlap in rate (see Table 41). In contrast, males of *A. larumorosa* do drum faster than males of *A. lagunahanson*.



FIGURE 93. Sympatric adult males of *Ammopelmatus* species, both from S94-10. Left, *A. lagunahanson* (R95-25); Right, *A. larumorosa* (R95-36).

Holotype male (in alcohol, Fig. 94): **Mexico, *Baja California,*** Mexico Hwy 2 libre in vicinity of La Rumorosa, between km posts 65 and 71 (km post 69 is at 32.538603° -116.051242°, 1255m, with the kilometer numbers decreasing going east toward Mexicali. Intersection of Hwy 2 libre and road to Laguna Hanson [= Constitution de 1857] is at 32.519981° -116.067617°, 1284m), 13-iii-1998 (S98-11) DBW & VF Lee. R99-33, F0945. Molt to adult 22-viii-1999. Deposited CAS, Entomology type #20083. Measurements in mm: Body length 31.95, hind femur length 9.39, hind femur width 3.64. Fore tibia with 2 ventral spurs, middle tibia with 8 calcars, hind tibia (Fig. 95) with 3 and 4 inner and 3 outer spines, 2 ventral spurs.

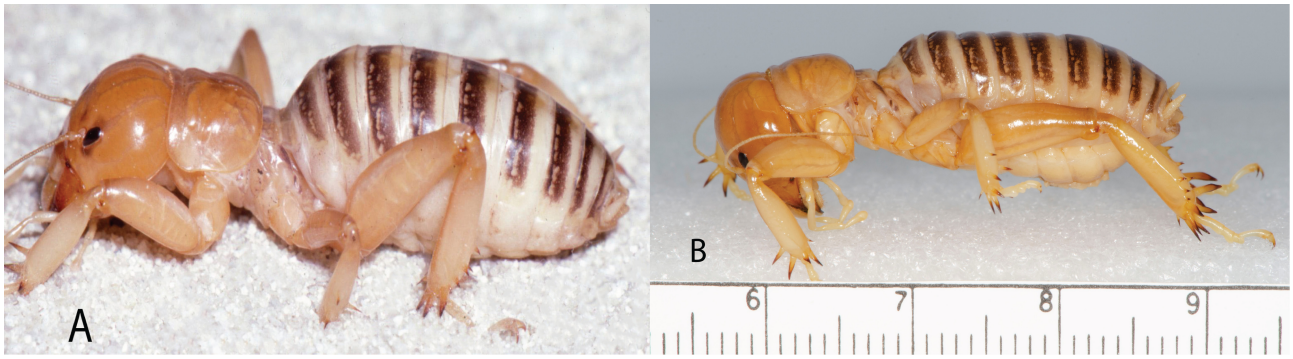


FIGURE 94. Holotype adult male *A. larumorosa.* A. When alive. B. When preserved.

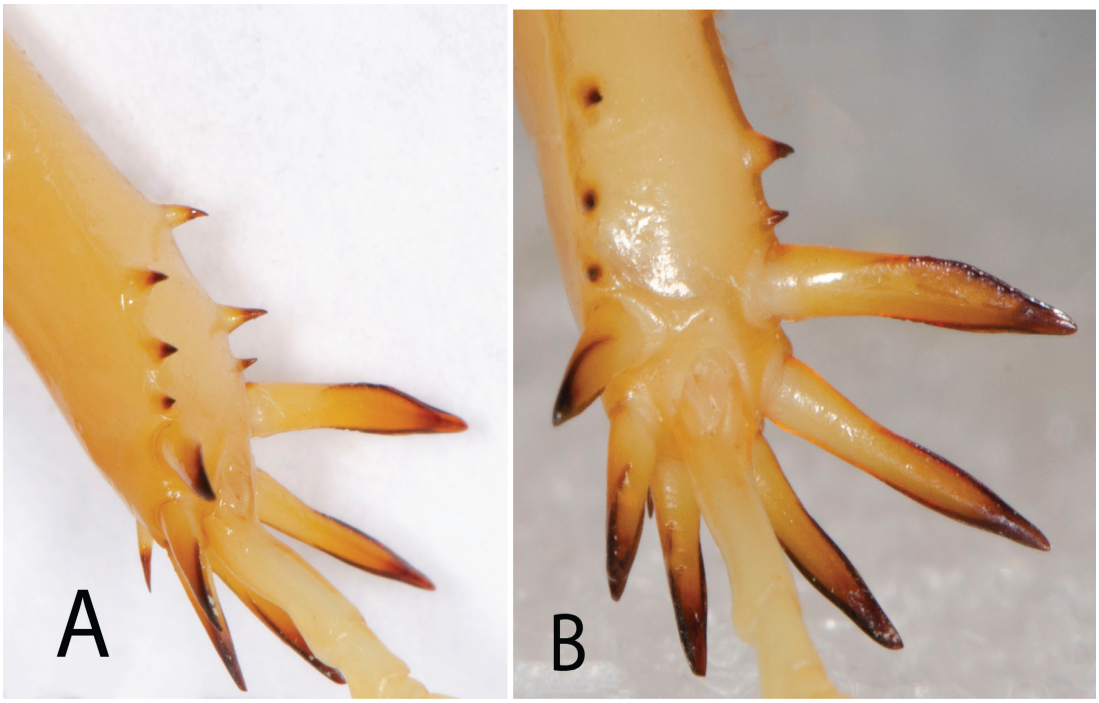


FIGURE 95. Left rear leg tibia holotype adult male *A. larumorosa.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

Allotype female (in alcohol, Fig. 96A live paratopotype; Fig. 96B allotype). Same data as holotype except R98-59, F0713. Molt to adult 6-ix-1998. Deposited CAS, Entomology #9080085. Measurements in mm: Body length 32.11, hind femur length 9.54, hind femur width 3.43. Fore tibia with 2 ventral spurs, middle tibia with 7 calcars, hind tibia (Fig. 97) with 3 and 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 98.

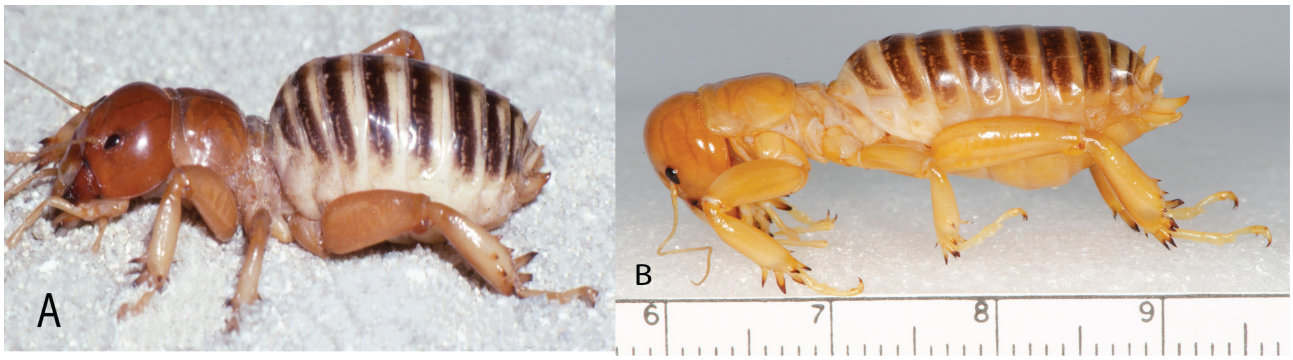


FIGURE 96. Adult female *A. larumorosa.* A. Live paratopotype (S92-50, R93-72). B. Preserved allotype.



FIGURE 97. Left rear leg tibia adult female allotype *A. larumorosa*. A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

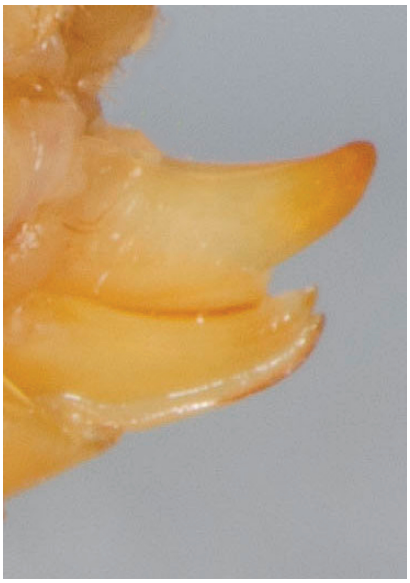


FIGURE 98. Ovipositor allotype *A. larumorosa.*

Paratypes. ♂18 ♀24. **MEXICO, *Baja California,*** type locality, 19-ii-1978 (S78-108) ♂2; 18-xii-1982 (S82-140) ♂4 ♀7; 20-xii-1987 (S87-125) ♂4 ♀6; 3-iii-1992 (S92-20) ♂5 ♀4; 13-iii-1998 (S98-11) ♂1 ♀5. 18.2 m (=29.3 km) S La Rumorosa on road to Laguna Hanson, 32.298692° -116.018638°, 1512m, 13-iii-1998 (S98-12) ♂1. 0–3 m N Laguna Hanson, 32.0711° -115.9042°, early April, 1994 (S94-10) J. Gannon ♂1 ♀2.

Probable placement. **CALIFORNIA, *San Diego Co*.**, McCain Valley, 32.708834° -116.235115°, 1212m, 13-v-2004 (S04-32) N. Crawford ♂1. R04-116, F1529. This high elevation, inland male specimen (Fig. 99A) drummed at 7.8 drums/s at 17°C. He is light colored like typical *A. larumorosa* but his rear leg calcars are more spatulate (Fig. 99B) than seen in typical adult male specimens. In Astral tree, he (F1529) is recovered in a clade with 10 coastal *A. sandiego* individuals. This is the only USA collected specimen of *A. larumorosa*, and more material is needed to confirm this placement and identification. This locality is some 19 km NW of the Baja California type locality of *A. larumorosa*.

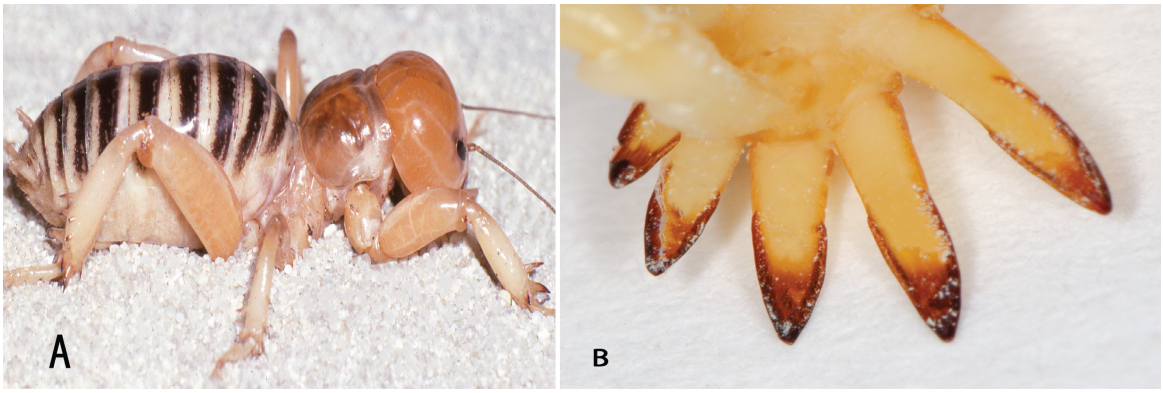


FIGURE 99. Adult male, probably *A. larumorosa*, from McCain Valley. A. When alive. B. Showing calcars more spatulate than topotypic male *A. larumorosa* (see Fig. 95 above).

Drum. Males drum faster than females, as is typical for Winchester Group species. But even so, we find (Fig. 100) a much larger range between individual males (at just the type locality) then normally seen in drumming rates, especially when regressed to account for different recording temperatures. **Male:** Holotype R99-33 (Fig. 101), S98-11, 29 drums in 5.9s (4.9 drums/s) at 18.5°C. Topotypic male R93-27 (Fig. 102), S92-20, 32 drums in 3.5s (9.1 drums/s); 28 drums in 3.1s (9 drums/s); and 26 drums in 3.0s (8.7 drums/s), all at 20°C. We have a single male (Fig. 103) from south of the type locality (S98-12) with an anomalous calling drum (R98-28, Fig. 104). He consistently drummed, over a period of one month, at 1/3 the rate of typical *A. larumorosa* males (2.9, 3.2, & 3.5 drums/s in the 3 series (of 10, 11, and 11 drums) shown in Fig. 104). Morphologically, he is light colored with the distinctive rear leg tibial third inner spine and 1 or 2 front leg tibial spurs, all characters consistent with *A. larumorosa.* His DNA (F0715) is recovered with 3 other *A. larumorosa* paratypes. The nearest population of slower drumming *A. lagunahanson* (2n♂=23) is from a site (S98-13) just 0.8 km S of where this male was collected. We wonder if there has been some past hybridization between these two taxa, despite their different chromosome numbers? **Female:** Allotype R98-59 (Fig. 105), S98-11, 164 drums over 56s (2.9 drums/s) at 19.5°C. These variable male drumming rates could, partially, but not completely, be explained by the fact the initial drums in a burst are faster than subsequent drums; and that the number of these fast, initial drums vary between individuals. Since males have shorter bursts than females, the drum rate in males will be more influenced by how many initial, fast drums there are. This factor can be seen when comparing male holotype drum R99-33, Fig. 101, at 18.5°C, with a drum rate of 4.9 drums/s, with topotypic male drum R93-27, Fig. 102, at 20°C.

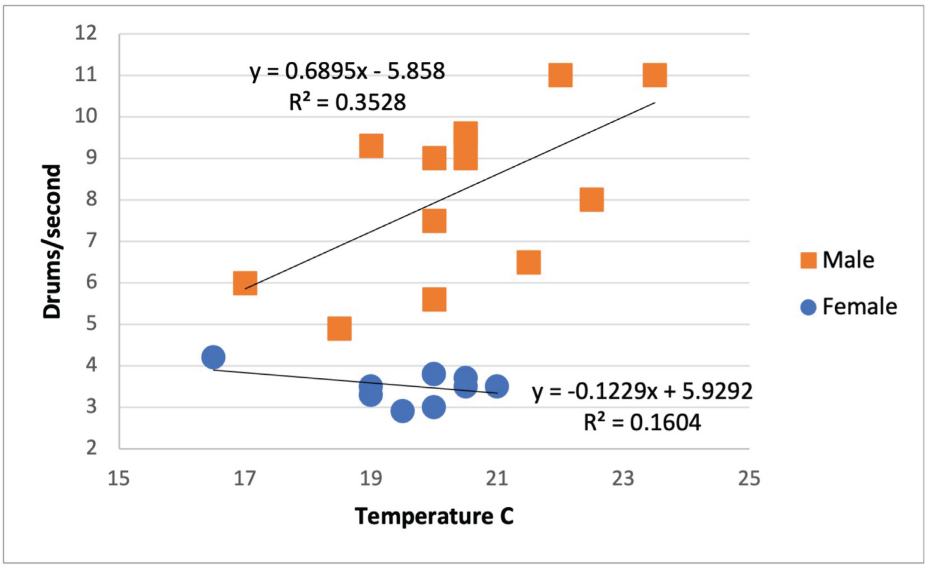


FIGURE 100. Drumming rate variability in type locality male and female *A. larumorosa.* Regression does not include anomalous male (R98-28) from S98-12, discussed above.

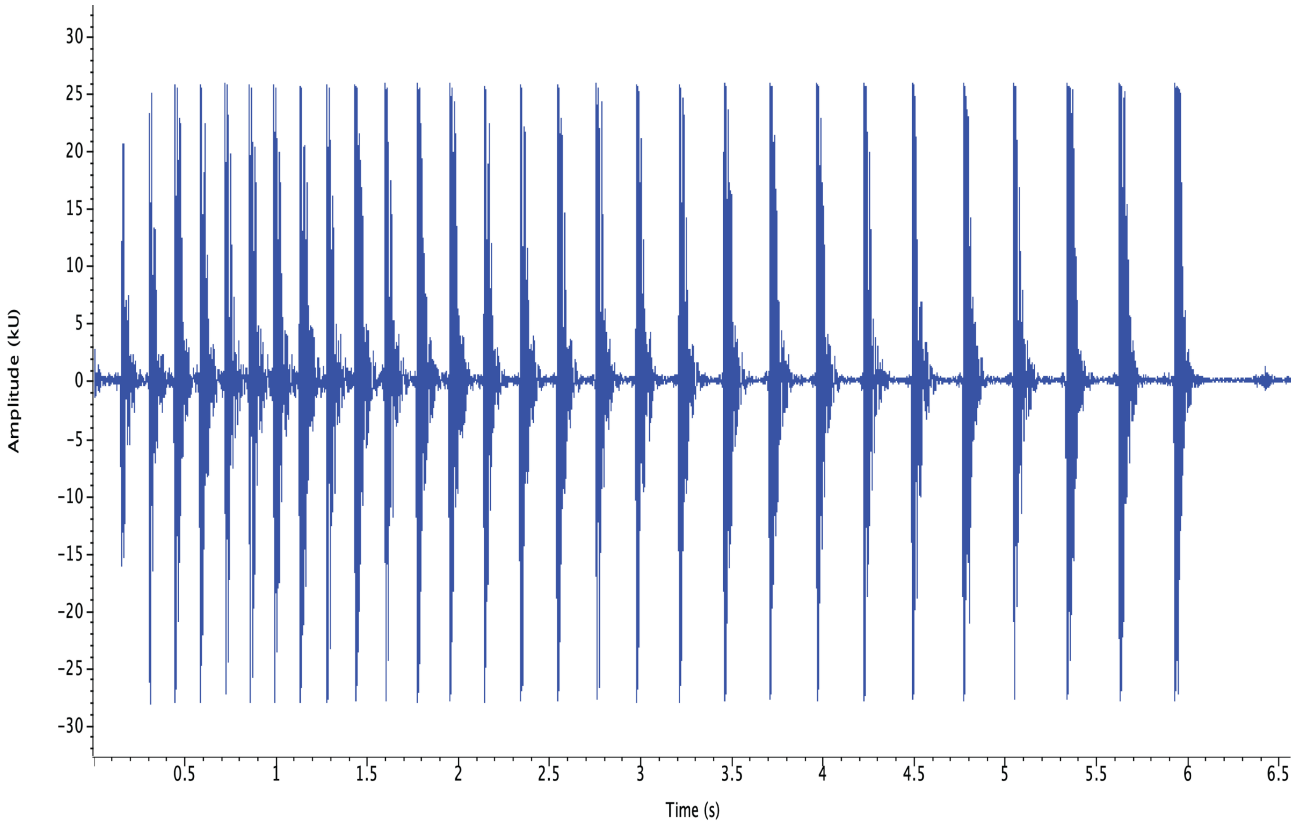


FIGURE 101. Calling drum (R99-33) in adult male holotype *A. larumorosa.*

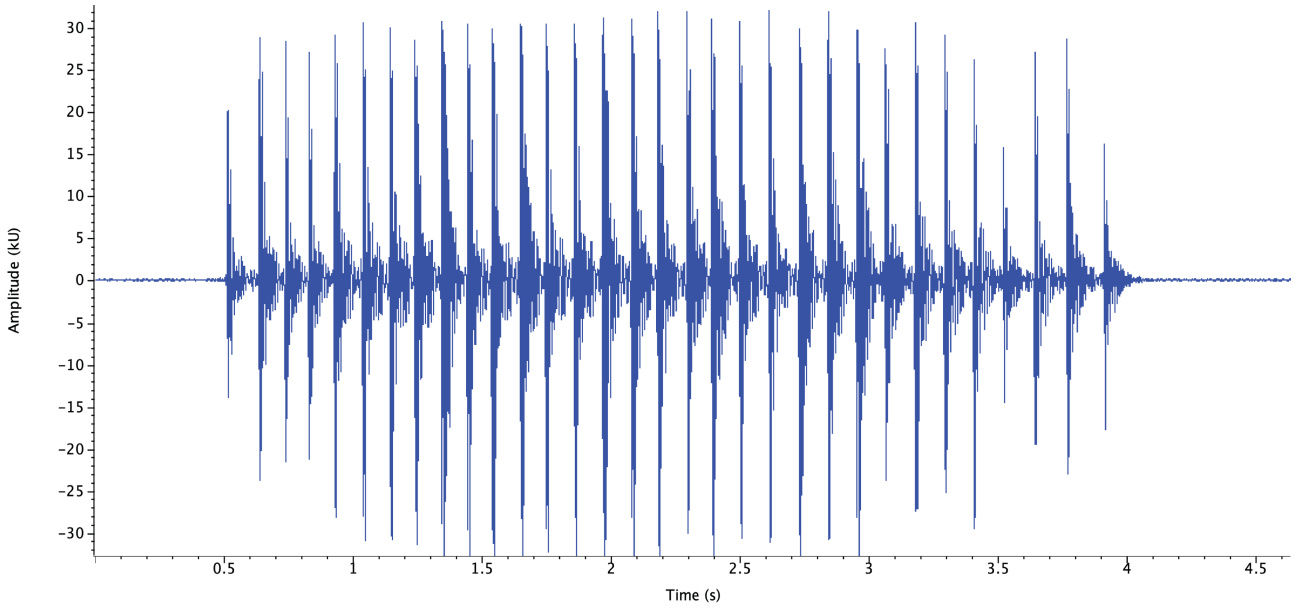


FIGURE 102. Calling drum (R93-27) in adult male topotype. Note scale difference vs above Fig. 101.



FIGURE 103. Adult male *A. larumorosa* from S98-12 with anomalous drum (R98-28) as shown in Fig. 104.

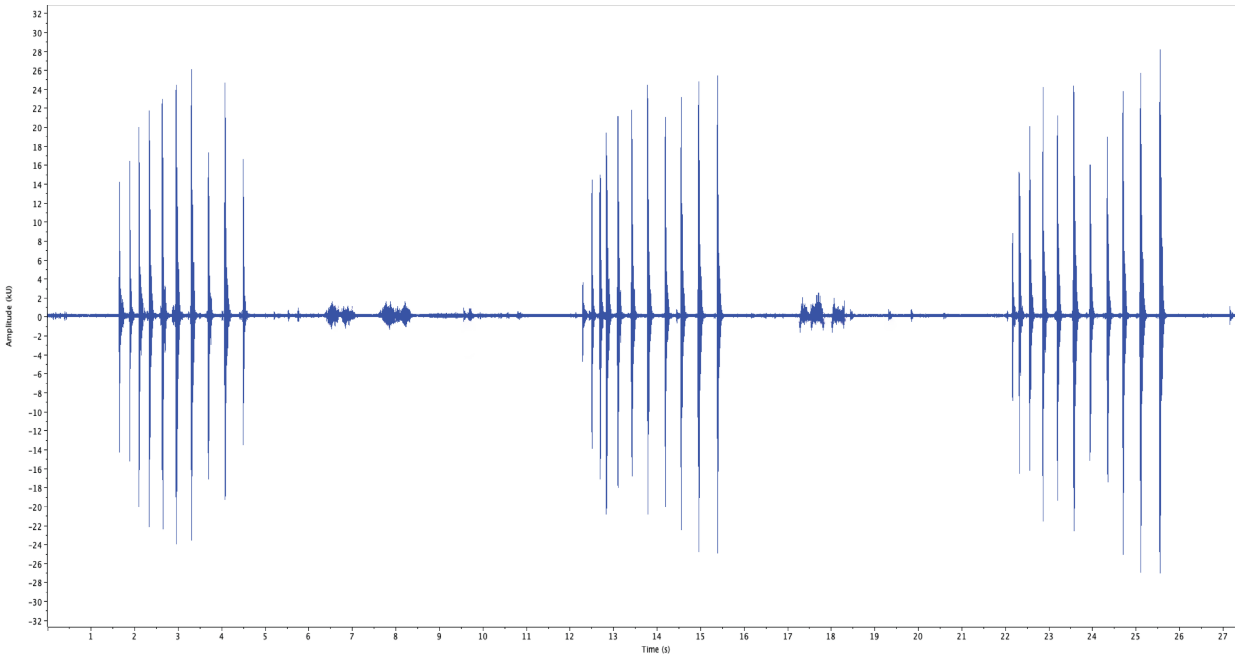


FIGURE 104. Three calling drums (R98-28), spliced together, from adult male *A. larumorosa* (S98-12) discussed in text.

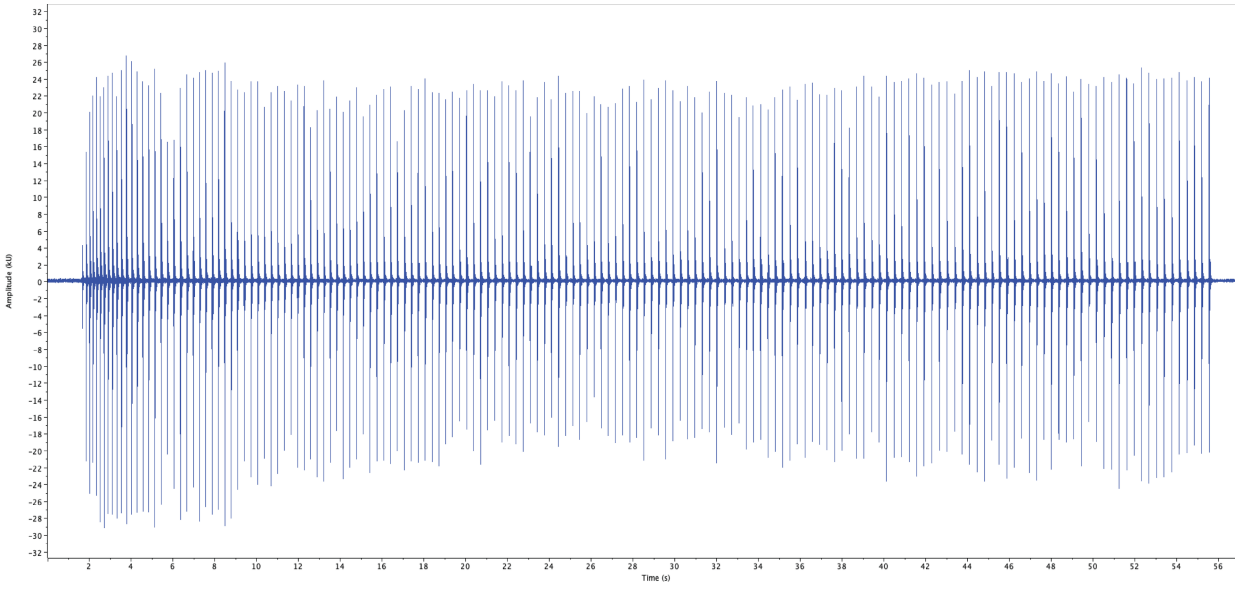


FIGURE 105. Calling drum (R98-59) adult female allotype *A. larumorosa.*

Derivation of name. Named after the type locality

Habitat. Open juniper oak-woodland with scrub oaks, *Yucca*, *Eriogonum,* cactus.

Life cycle and seasonal occurrence. In winters with good rainfall and green grass, can be found under rocks along Hwy 2 libre. Typical 2-year life cycle.

For 32 to 42 examined adults, all with 2 **fore leg** ventral tibial spurs; 30 had 7 and 2 had 8 **middle leg** calcars, all with 2 ventral spurs; and 1 had 2, 13 had 3, 26 had 4 and 2 had 5 **rear leg** inner spines; while 39 had 3 and 3 had 4 outer spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F0110 (S94-10, Laguna Hanson); F0713 & F0714 (both type locality S98-11); F0715 (S98-12, S of type locality); F0945 (type locality S98-11); F1529 (S04-32, McCain Valley) all recovered in a mixed Group 1 Winchester, with several other Winchester Group species.

Karyotype. 2n♂=25. Three males examined: two individuals from type locality (S92-20) examined: T92-6 and T92-15 (2 cells, Figs 106 & 107), both with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T94-03 (Fig. 108) from S94-18 (near Laguna Hanson), also with 2n♂=25, but here autosomal pair L_2 is clearly larger than that seen in the 2 cells from T92-15, and there are only 5 metacentric or submetacentric autosomal pairs. The significance of these chromosomal differences is unknown, but given their DNA disparities, we encourage further efforts here.

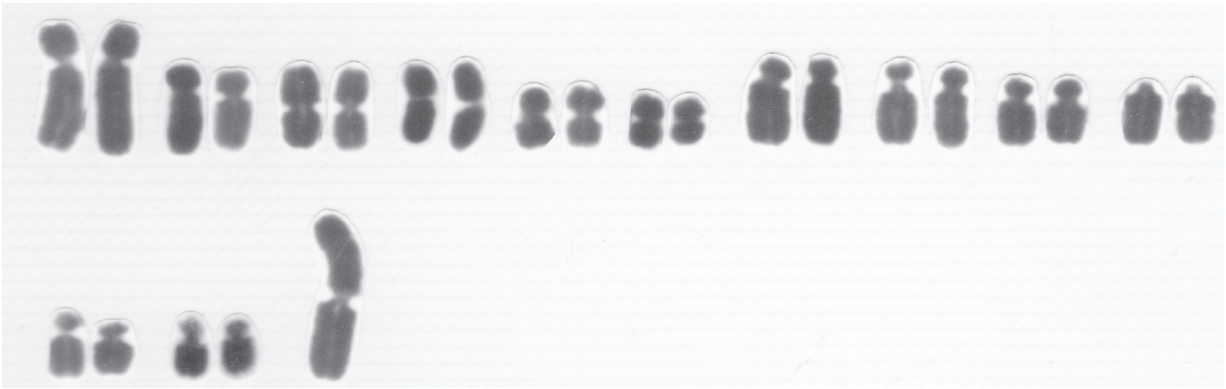


FIGURE 106. Idiogram T92-15, cell 1, *A. larumorosa* (S92-20).



FIGURE 107. Idiogram T92-15, cell 2, *A. larumorosa* (S92-20).



FIGURE 108. Idiogram T04-3 *A. larumorosa* (S94-18).

Discussion. This is the only species of JC found at La Rumorosa. As one drives south toward Laguna Hanson, starting at 18.7 m S La Rumorosa (S98-12), the darker and then more common *A. lagunahanson* is encountered microsympatric with *A. larumorosa*. The two taxa can be separated as discussed above under Recognition characters.

Ammopelmatus mahogani **Weissman, sp. nov.**

Mahogany Jerusalem Cricket
Figs 109–123, Tables 3, 5, 6, 7, 10, 18, 19, 21, 23, 24, 41

Species # 4, Weissman 2001a.
Species #2, Weissman 2001b.
Stenopelmatus 'mahogani' Vandergast *et al.* 2007
Ammopelmatus 'mahogani', transferred by Weissman *et al*. 2021.

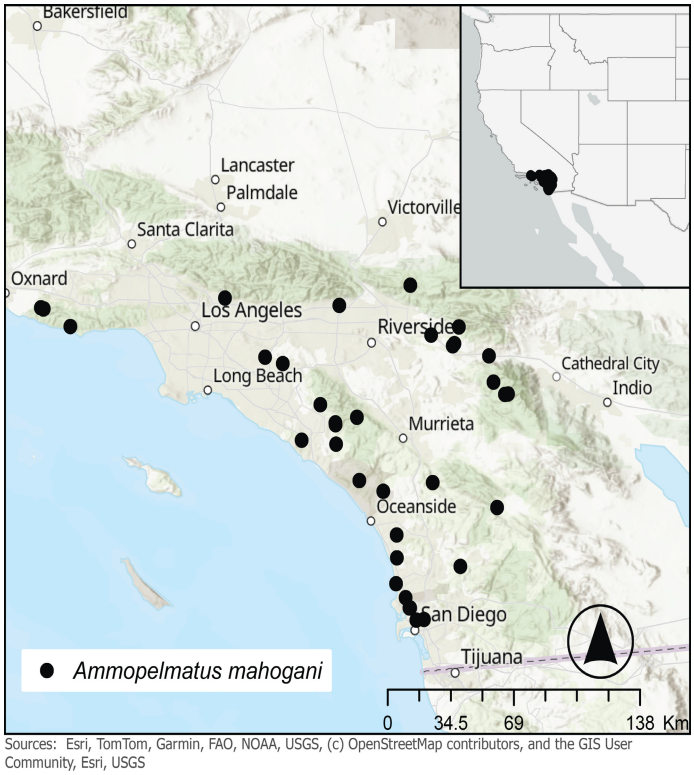


FIGURE 109. Distribution of *A. mahogani.*

Distribution. (Fig. 109). Southern California.

Recognition characters. Aberrant member of Winchester Group because male and female calling drums are distinctly different in pattern whereas they are usually just different in drumming rate in the other taxa in this Group. A color variable (Fig. 110), widespread Southern California species typically lacking abdominal stripes, and found from near sea level (Encinitas, S05-173) to mountain elevations of 1740m (near Skyforest, S92-76). There is local genetic diversity based upon physical isolation of many populations (Vandergast *et al*. 2007). Well-preserved alcoholic adults of this species are readily recognizable in collections because of their large size, long rear legs (especially in males), general lack of abdominal stripes and dark colored abdominal tergites and sternites, and pale reddish color of all 6 legs including, occasionally, the ventral abdomen. Ovipositor is broad and extends beyond end of abdomen. In earlier instars, antennae longer than body length. Only specimens of *A. reno* from Reno, Golden Valley (S00-46, see Fig. 980, p. 546 for photo) look similar in size and general color pattern.

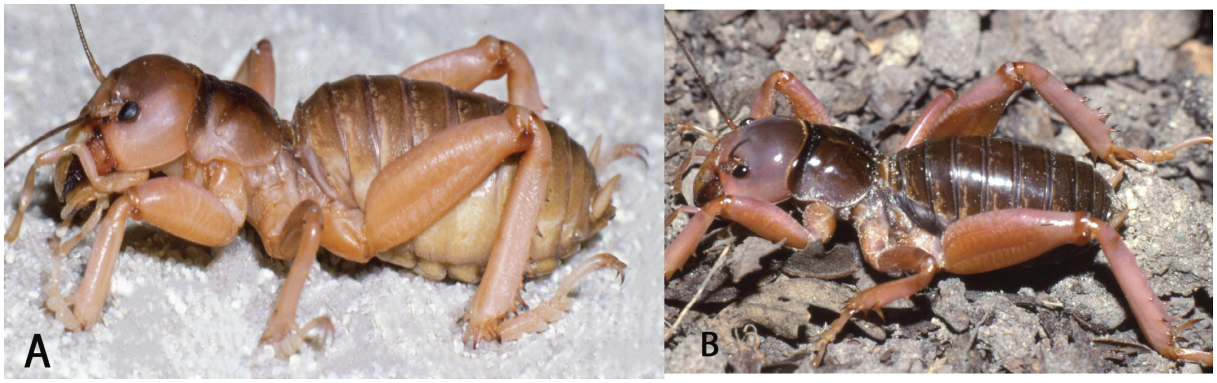


FIGURE 110. Color variation seen in adult male *A. mahogani.* A. Paratopotype Eaton Canyon (S84-87, R85-67). B. Paratype Santa Monica Mts (Malibu, Loop Trail, Array 27).

Holotype. Male (in alcohol, Fig. 111): **California, *Los Angeles Co.*** Pasadena, Eaton Canyon Nature Center, 34.176528° -118.097237°, 291m, 25-ii-2001 (S01-10) DBW, VF Lee. R01-144, F1277. Molt to adult 18-ix-2001. Deposited CAS, Entomology type #20076. Measurements in mm: Body length 46.26, hind femur length 18.01, hind femur width 7.13. Fore tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 112) with 4 outer and 5 inner spines, 2 ventral spurs.



FIGURE 111. Preserved adult male holotype *A. mahogani.*

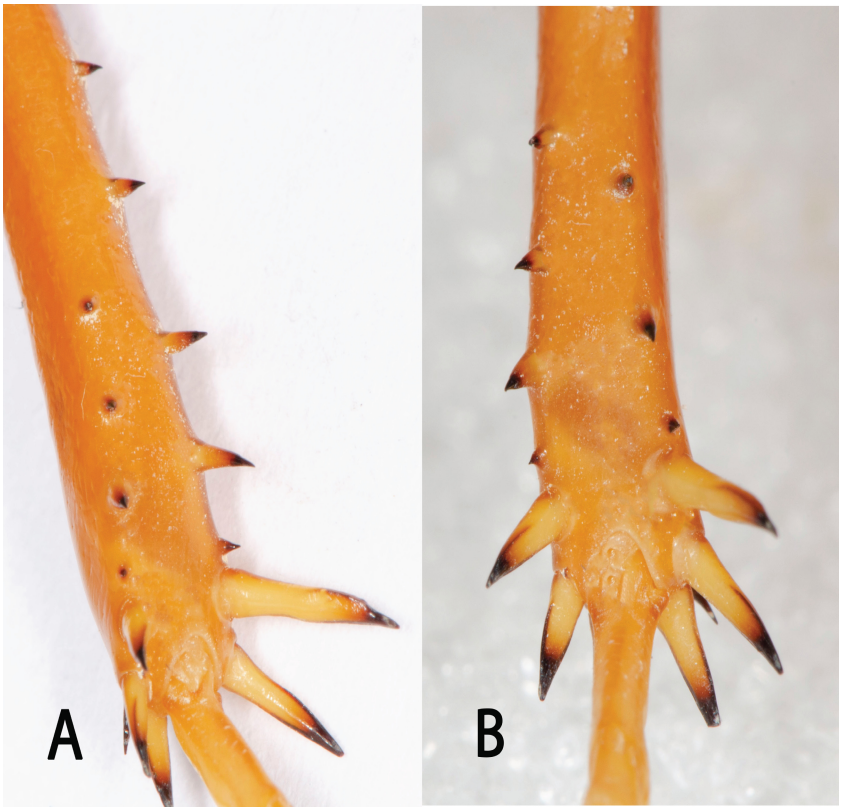


FIGURE 112. Left rear leg tibia adult male holotype *A. mahogani.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 113): same data as holotype except 28-xii-1984 (S84-87) DBW. Molt to adult 17-ix-1986. Deposited CAS, Entomology type #9085847. Measurements in mm: Body length 52.46, hind femur length 16.49, hind femur width 6.83. Fore tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 114) with 4 outer and 5 inner spines, 2 ventral spurs. Ovipositor Fig. 115.

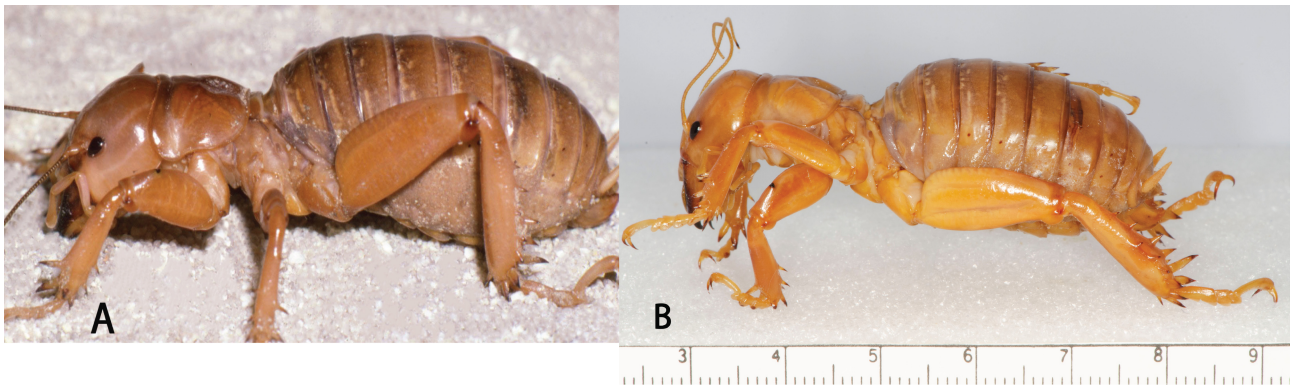


FIGURE 113. Adult female allotype *A. mahogani*. A. When alive. B. When preserved.

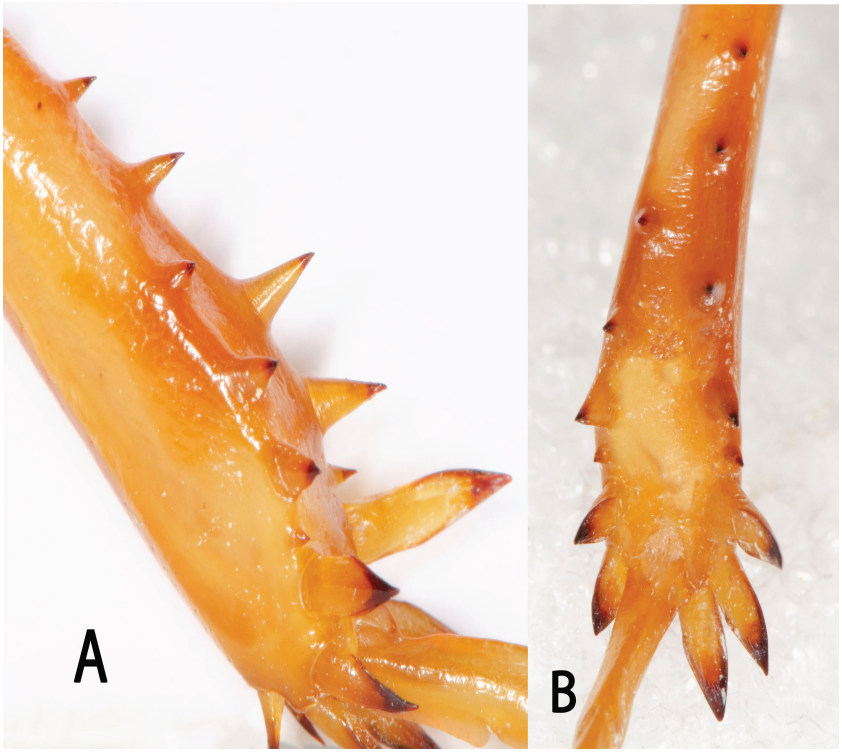


FIGURE 114. Left rear leg tibia adult female allotype *A. mahogani.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars



FIGURE 115. Ovipositor allotype *A. mahogani*.

Paratypes. ♂82 ♀54. **CALIFORNIA, *Los Angeles Co.,*** Arcadia Wilderness Park, 34.175920° -118.019118°, 259m, 22-xi-1985 (S85-144) MT Kouba ♀2; 25-ii-2001 (S01-8) ♂1. Calabasas, Mulholland Hwy, Array 55, 34.09829° -118.69833°, 223m, 2006 ♀1. Malibu, Loop Trail, Array 27, 34.10688° -119.03284°, 250m, 2006 ♂1. Malibu, near Topanga Canyon, 16-iii-1986 (S86-14) W. Sakai ♀1. Mt. Wilson, near Chantry Flat, 34.196228° -118.023271°, 665m, 31-x-1987 (S87-113) W. Sakai ♂1. Winter Creek near Chantry Flat, 34.209215° -118.037183°, 846m, 4-vi-1988 (S88-24) ♀1. Mt. Wilson, Upper Winter Creek, W. Sakai, 13-iii-1987 (S87-7) ♀2; 15-x-1988

(S88-112) ♂1 ♀2, 14-x-1989 (S89-88) ♂3 ♀2; 1-iii-1998 (S98-8) ♂2. Pasadena, Arroyo Seco, 15-iv-2004 (S04-34) M. Wilcox & N. Moorhatch ♀1. Type locality, Eaton Canyon Nature Center, 305m, 26-xii-1982 (S82-152) ♂3 ♀1; 23-xii-1983 (S83-164) ♂3 ♀1; 28-xii-1984 (S84-87) ♂2 ♀3; 14-iii-1985 (S85-31) ♂2 ♀2; 18-x-1986 (S86-140) ♂1 ♀2; 25-ii-2001 (S01-10) ♂2. Placerita Canyon Nature Center, 34.377961° -118.467527°, 472m, 23-xii-1991 (S91-131) ♂1. San Gabriel Mts, Monte Cristo Campground 34.3450° -118.1100°, 1110m, 29-iv-2001 (S01-25) ♂1. Pomona Valley area, N Claremont, Chicken and Every Canyons, 23-ii-1989 (S89-6) CL Hogue ♀1. Santa Anita Canyon, 34.170839° -118.022567°, 850m, 16-iii-1985 (S85-38) W. Sakai ♀1. Santa Monica Mts, Charmlee County Park, 34.058782° -118.879495°, 407m, 31-i-1987 (S87-3) F. Hernandez ♂1; 19-iii-1995 (S95-25) ♂1. Pacific Palisades, 34.036347° -118.522878°, 80m, 31-x-1987 (S87-115) W. Sakai ♂1. Santa Ynez Canyon, 34.085215° -118.575192°, 265m, W. Sakai, 18-iv-1985 (S85-44) ♀1; 6-iii-1986 (S86-17) ♀1. Topanga, 240m mid-February, 1993 (S93-5) G. Handler ♀1. Topanga State Park, 34.093402°-118.599962°, 257m, 1-vii-2019 (S19-31) ♂2. Westlake Village, Big Sycamore Canyon Rd, 34.12923° -118.98775°, 101m, (Array 40) 2006 ♂1 ♀1; 34.12871° -118.99056°, 99m, 2006 (Array 41) ♂1. Junction Hwy 1 and Hwy 23, 34.051387° -118.857210°, 300m, 23-xi-1996 (S96-98) ♂1. ***Orange Co.,*** Aliso Woods Canyon, 33.551321° -117.720442°, 59m, 3-i-2003 (S03-1) A. Vandergast ♂1. Brea, 33.916476° -117.900262°, 106m, 18-xii-1996 (S96-127) S. Bennett ♂1. Brea Carbon Canyon, 220m 28-xii-2008 (S08-90) C. DeMarco ♂1. Santa Ana Mts, Bell Canyon, Starr Ranch Reserve, 33.619558° -117.553928°, 376m, 11-vi-1997 (S97-67) R. Fisher ♀1; 33.627836° -117.554629° 130m, 8-v-2007 (S07-16) S. Bennett ♂1. Casper's Wilderness Park, 33.534111° -117.551222, 117m, 13-x-1987, L. & K. LaPierre ♀1. Harding Canyon, 33.707797° -117.628661°, 404m, 23-iii-2002 (S02-5) C. Dickson, S. Crow ♀1. Hwy 74, Hot Springs Canyon turnoff, 370m, late v-2001 (S01-54) W. Icenogle ♀1. Hot Springs Canyon, 20-xii-1989 (S89-97) S. Bennett ♀1. Hot Springs Canyon, 1m N Hwy 74, 400m, 5-i-1991 (S91-1) W. Icenogle ♀2. Near Blue Jay Campground, 33.6523° -117.4490°, 1036m, 5-i-2005 (S05-13) MS Caterino ♂2. Yorba Linda, 33.888489° -117.813234°, 120m, 22-xii-2004 (S04-162) ♂1. ***Riverside Co.,*** Bautista Canyon, 1070-1220m, 27-xi-1997 (S97-144) NC Hinkle ♂3. Near Live Oak Canyon Rd offramp, I10, Exit 85 East, 34.013592° -117.084286°, 650m, 24-ii-2001 (S01-6) ♀1. Cherry Valley, 33.976105° -116.969591°, 886m, J. Gannon, mid-March, 1990 (S90-26) ♂1; late iii-1990 (S90-28) ♂3 ♀1; 5-ii-1994 S94-2) ♀1; early April, 1994 (S94-11) last instar male for testes. San Jacinto Mts, UC James San Jacinto Reserve, 33.806909° -116.777797°, 1643m, 9-v-1987 (S87-27) W. Sakai ♀1. Idyllwild, Hwy 243 0.6 m NW town center, Deer Springs Trail, 33.752942° -116.721590°, 1718m, 31-viii-2005 (S05-113) ♂1. Westridge, SE Idyllwild, 1460m, early-May-1995 (S95-30) J. Gannon ♂1. 3.7 m S Idyllwild, 1396m, 9-x-1983 (S83-141) TJ Cohn ♂1 ♀1. Idyllwild, 55101 Pine Crest Ave., 33.754977° -116.706432°, 1733m, 4-ix-2005 (S05-128) K. Miglin ♂1. Garner Valley 20 m SE Idyllwild, early iv-1990 (S90-29) J. Gannon ♂1. 5 m E Banning along I10, 33.922192° -116.799847°, 601m, 24-ii-1990 (S90-22) J. Gannon ♀1. 11 m SE Valle Vista, 16-x-1994 (S94-113) T. Prentice ♂2. Near Baker Mt., Lake Fulmor 1520m late April, 1990 (S90-37) J. Gannon ♀1. Santa Ana River, Tequesquite landfill M. Wilcox, 22-i-1998 (S98-6) ♀1; 2-ii-1998 (S98-5) ♂2 ♀2. Santa Rosa Plateau Ecological Preserve, Granite Loop Trail, 33.54360° -117.27015°, 544m, 25-26-ii-2024 (S24-14, S24-15) ♂2 ♀1. ***San Bernardino Co.,*** Oak Glen, 34.049457° -116.947804°, 1460m, late April-1990 (S90-38) J. Gannon ♂1 ♀1. Rancho Cucamonga near Day Creek, 34.144182° -117.535447°, 600m, 2-iv-1994 G. Ballmer ♀1. 2.9 m W Cherry Valley, off Beaumont Ave., 33.966381° -116.978011°, 837m, 4-iv-1991 (S91-12) ♂1. San Bernardino Mts, Switzer Park Picnic Grounds 0.4 m W Skyforest, 34.232971° -117.186429°, 1735m, 20-vii-1992 (S92-76) ♂1. Near Glen Martin Creek and Hwy 38, 1600m, 29-iii-1995 (S95-28) T. Prentice ♀1. ***San Diego Co.,*** Camp Pendleton, 33.3742° -117.437°, 247m, 23-xii-1996 (S97-11) R. Fisher ♀1; Camp Pendleton, 33.326956° -117.319439°, 91m, 4-iii-1997 (S97-24) T. Prentice ♂2. Carlsbad, 33.134798° -117.253549°, 104m, 23-ii-1996 (S96-20) C. Nagano ♀1. Clairemont, near Tecolote Canyon, 32.814206° -117.187205°, 105m, 12-ii-1990 (S90-18) F. Ashcraft ♂1. Encinitas, 1644 Mapleleaf Court, 33.034249° -117.252432°, 80m, 18-xii-2005 (S05-173) J. Kazmarek ♂1. Hinshaw Scenic Vista Observation Site, Hwy S7, E Grade Rd, 33.255512° -116.759978°, 977m, 24-ii-2024 (S24-10) ♂1. Pala, 33.365216° -117.076474°, 125m, 14-iv-1992 (S92-41) J. Gannon ♂1 ♀1. San Diego, Normal Heights, 32.763352° -117.119495°, 30m, mid-January, 1985 (S85-31) D. Porter ♂1. San Diego, University Heights, 4567 New Hampshire St., 32.760345° -117.156780°, 100m, 27-i-1985 (S85-6) D. Porter ♀1. San Diego, 7042 Dennison St., 32.859241° -117.209621°, 106m, 10-ix-2005 (S05-134) B. Claborn ♂1 ♀1. San Diego, 4651 Mt. Alifan Dr., 32.814035° -117.190968°, 90m, 5-ii-2005 (S05-15) T. Jensen ♂1. San Diego, 0.5 m S Dos Ricos County Park, 32.996589° -116.94049234.133789° -119.002108°, 478m, 28-x-1986 (S86-144) DK Faulkner ♂1. Mt. Palomar, E of Pauma Valley, 730-910m, 9-xi-1990 (S90-106) TJ Cohn ♂1. Torrey Pines, 32.92055° -117.25661°, 66m, R. Fisher, 6-12-i-1997 (S97-10) ♂5; mid-May-1997 (S97-39) ♂1

♀1; 19-iii-1999 (S99-23) ♂3. 6m SW Ramona, 21-iii-1993 (S93-17) M. Fuller ♂1. ***Ventura Co.,*** Santa Monica Mts, Pt. Mugu State Park, 34.133789° -119.002108°, 185m, 8-11-xi-2022 (S22-62) ♂1; 21-ii-2023 (S23-10) ♂1.

Drum. Males and females drum differently (Weissman 2001b): **Male** paratype (R95-118, S95-30, San Jacinto Mts near Idyllwild) with 38 single drums (Fig. 116) in 53.1s (0.72 drum/s) at 18.5°C. **Female** paratype (R88-153, S87-27, San Jacinto Mts James Reserve) with 43 trills (Fig. 117) in 79.3s (0.54 trills/s), at 18°C, with drum rate of ~7 drums/s. She started with 3 drums/trill (Fig. 118), then to 4 drums/trill (1 trill with 5 drums). Despite populations being found over a wide geographical area, adult male and female calling drums were consistent throughout its range.

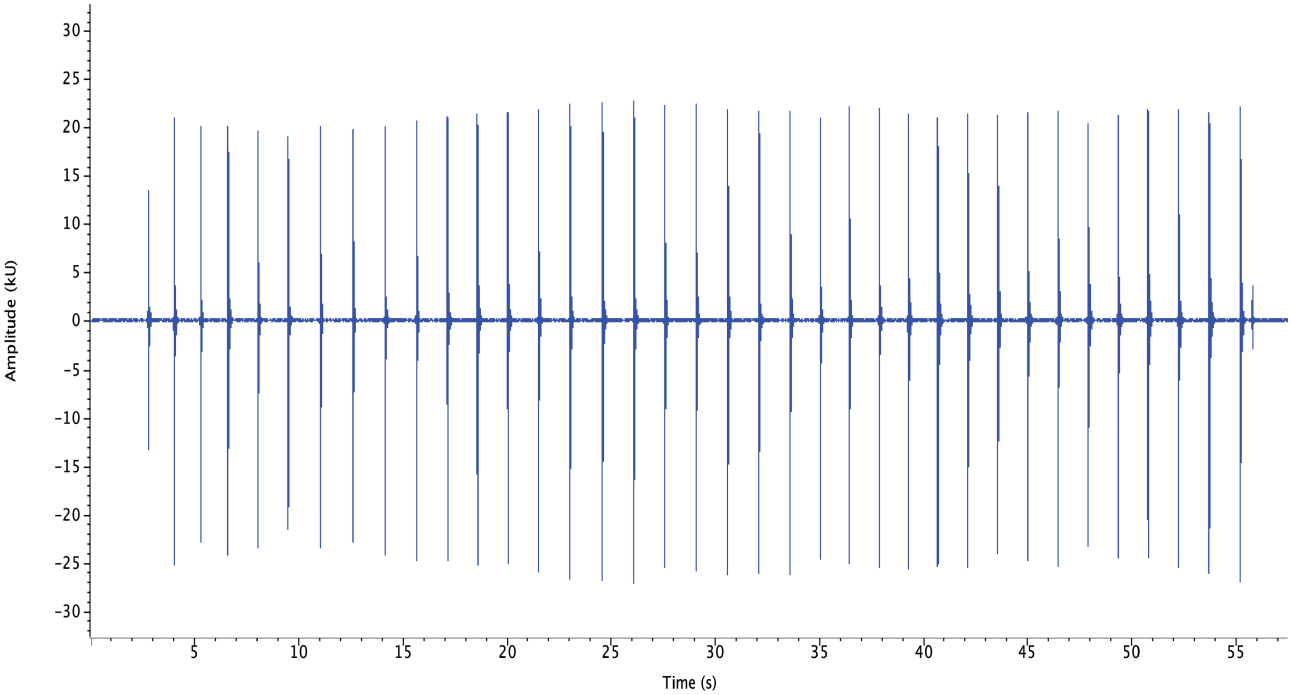


FIGURE 116. Calling drum (R95-118) adult male paratype *A. mahogani*.

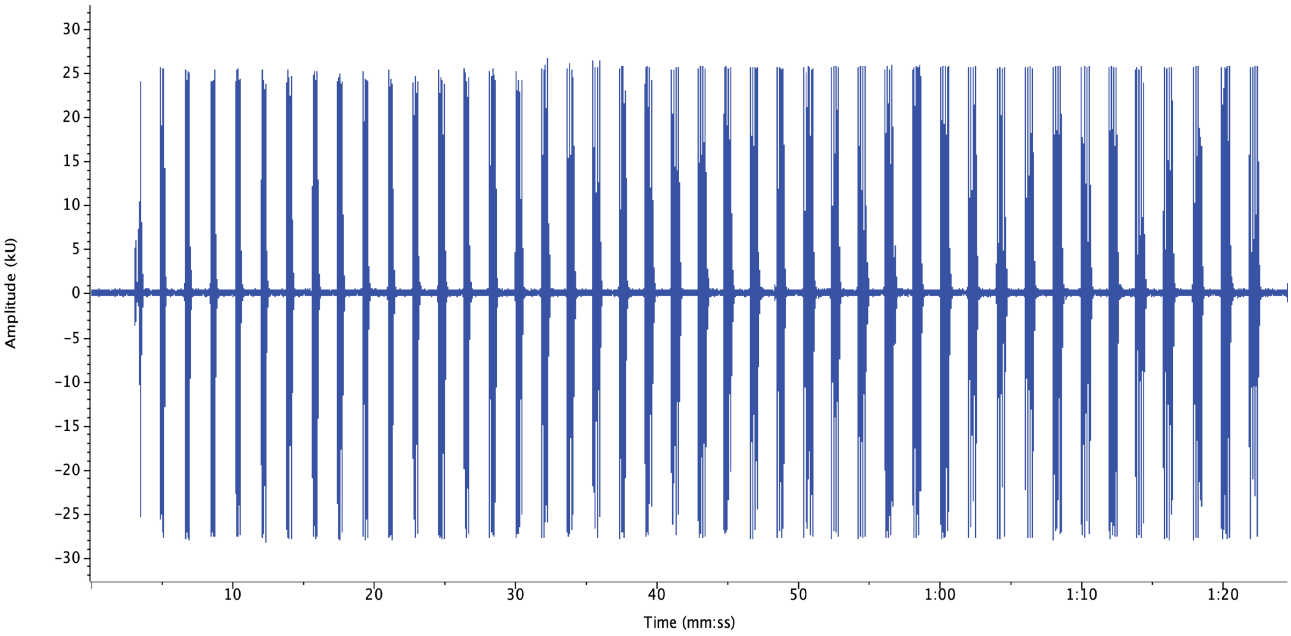


FIGURE 117. Calling drum (R88-153) adult female paratype *A. mahogani*.

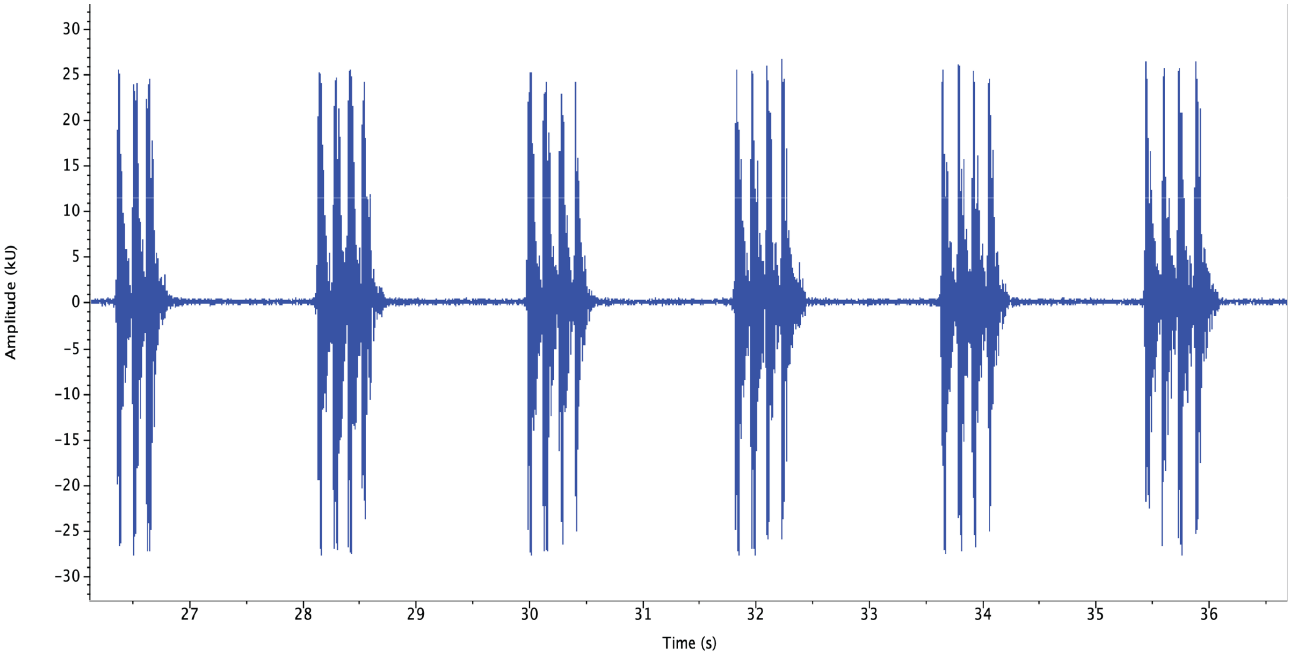


FIGURE 118. Expanded calling drum from Fig. 117, showing initial trills.

Derivation of name. Named in reference to the distinctive mahogany color seen in many individuals.

Habitat. In the Santa Monica Mts, found in a variety of habitats from coastal sage (Array 27), riparian (Topanga Canyon State Park) oak-woodland (Array 40), riparian-grassland (Array 41)

Life cycle and seasonal occurrence. Appears to have typical 2-year life cycle with adults appearing in late summer and fall. In the laboratory, unmated adult females can live a year. Adults of both sexes may have a reproductive dormancy period—see discussion on p. 26.

Variation. From some 50 randomly selected adults across the species' range, 49 individuals with 3 and 1 with 4 **fore** leg tibia spurs; 48 with 8 and 2 with 9 **middle** leg tibial calcars, all with 2 ventral spurs; 3 with 4, 40 had 5, and 3 with 6 inner **rear** leg tibial spines; while 5 had 3, 40 had 4, and 1 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F0435 (S96-127, Orange Co.); F0597 (S97-24, San Diego Co.); F0932 (S97-67, Orange Co.); F1277 (type locality S01-10); F1278 (S01-6, Riverside Co.); F1344 (type locality S01-10, Los Angeles Co.); F1736 (S05-113, Riverside Co.); F2772 (S22-62, Ventura Co.) all recovered together in Group 1 Winchester in their own subclade.

Karyotype. 2n♂=25. 7 males from 5 localities examined: T84-41 (Fig. 119, type locality Eaton Canyon S83-164; T88-1 (Fig. 120, type locality Eaton Canyon, S86-140); T90-4 (S89-88, Mt Wilson; T92-4 (Fig. 121, S90-29, San Jacinto Mts; T92-55 (Fig. 122, S91-131, Placerita Canyon); T94-1 (Fig. 123, S94-11, Cherry Valley); T94-2 (S94-2, Cherry Valley) with slightly differing results: 5 or 6 (T92-4) metacentric or submetacentric autosomal pairs; 6 (T92-4) or 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X.

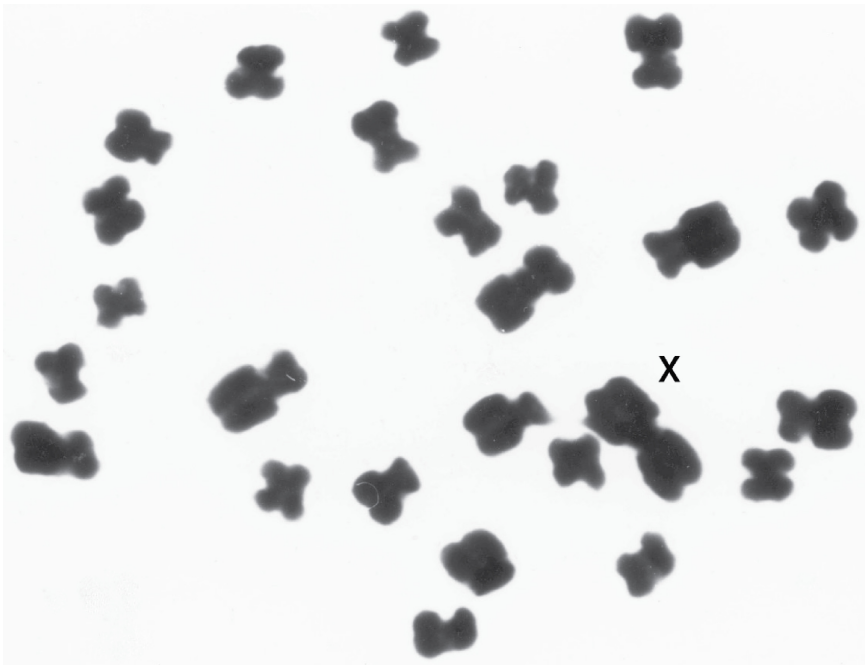


FIGURE 119. Mitotic metaphase in T84-41 (S83-164) showing apparent metacentric or submetacentric nature of all chromosomes, including the marked X chromosome.



FIGURE 120. Idiogram T88-1 *A. mahogani* (S86-140).



FIGURE 121. Idiogram T92-4 *A. mahogani* (S90-29).

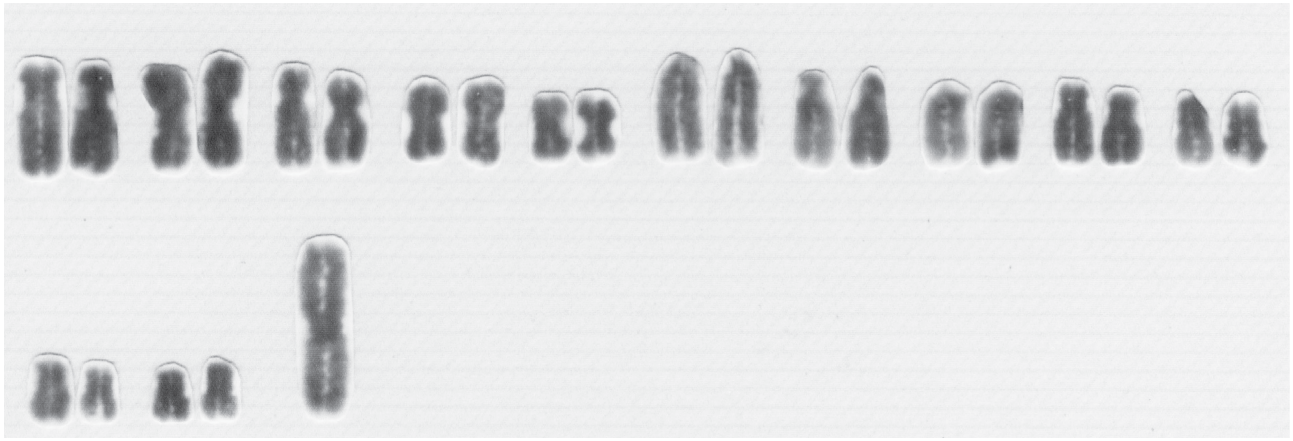


FIGURE 122. Idiogram T92-55 *A. mahogani* (S91-131).



FIGURE 123. Idiogram T94-1 *A. mahogani* (S94-11).

Discussion. This is one of the 6 heaviest *Ammopelmatus* species (see p. 13), with some adult females weighing over 12 gm. We thus found it surprising that such a large and morphologically distinctive species has remained undescribed, especially considering its frequent occurrence in urban situations.

Because of its widespread distribution, *A. mahogani* occurs microsympatric (or close to) with several other species of JCs: (1) In Santa Monica Mts, at Charmlee State Park, with *A. leei*. (2) In San Bernardino Mts, with *A. ashleighi* (S92-76, near Skyforest). In San Jacinto Mts, with (3) *A. sanjacinto* at several localities; and (4) *A. pinyonpines* in Garner Valley. In Riverside Co., with (5) *A. calimesa* (near Calimesa); and with (6) *A. calimesa*, and possibly *A. ashleighi* in Cherry Valley. In San Gabriel Mts, with (7) *A. eatoncanyon* at Eaton Canyon and Wilderness Park; with (8) *A. hovorei* at Placerita Canyon Nature Center; and with (9) *A. sangabriel* at Winter Creek. In Santa Ana Mts, with (10) *A. oneillpark* at Caspers; and with (11) *A. santarosaplateau* at Santa Rosa Plateau. (12) At Torrey Pines and Pala, San Diego Co, with *A. fisheri.* At these 12 localities, *A. mahogani* is always the less common of the two JC species there.

The type locality Eaton Canyon Nature Center area was ravaged by the catastrophic Eaton Fire of January, 2025: https://www.latimes.com/travel/newsletter/2025-01-16/the-wild-eaton-canyon-nature-recovery-the-wild

Occasionally, disturbed individuals (e.g., Eaton Canyon, Los Angeles Co.) emit a smelly anal discharge, making this one of only 2 or 3 *Ammopelmatus* taxa that display this defensive behavior. Rare individuals also employ femoral-abdominal stridulation when disturbed. All instars and adults were very mellow when handled, and the senior author has never been bitten by any individual of *A. mahogani.*

***Ammopelmatus sandiego* Weissman, sp. nov.**
San Diego County Jerusalem Cricket
Figs 124–134, Tables 7, 41

Distribution. (Fig. 124). Restricted to coastal San Diego County, California, and east into the Peninsular Ranges, between the Volcan and Cuyamaca Mts.

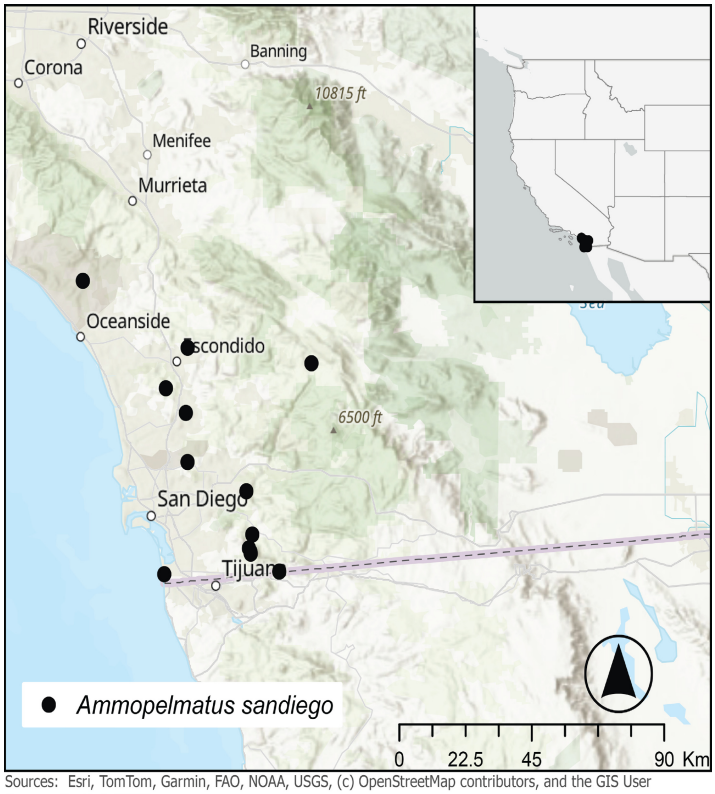


FIGURE 124. Distribution of *A. sandiego.*

Recognition characters. Member of Winchester Group. Differs from geographically more southern sister species *A. ensenada* by DNA and (generally) 3 fore leg tibial spurs vs 2 spurs in *A. ensenada.* Differs from California inland sister species *A. icenoglei* by DNA, and faster drum rate in both sexes of the latter taxon (see Discussion below). In many locations, including the type locality, occurs sympatric with *A. fisheri*, from which it can be separated by DNA, 3rd inner rear leg tibial spine the longest in *A. sandiego* (because it is a member of the Winchester Group), absence of a well-developed rear leg calcar #1 as seen in *A. fisheri* males, and chromosome count (2n♂=23 in *A. fisheri* vs 2n♂=25 in *A. sandiego*).

Holotype. Male (in alcohol, Fig. 125). **California, *San Diego Co*.**, Lake Hodges, 33.057954° -117.119048°, 105m, 2-i-2005 (S05-2) DB Weissman. R06-165, F1903. Molt to adult 4-ix-2006. Deposited CAS, Entomology type #20109. Measurements in mm: Body length 35.08, hind femur length 10.64, hind femur width 4.22. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 126) with 5 inner and 4 outer spines, 2 ventral spurs.

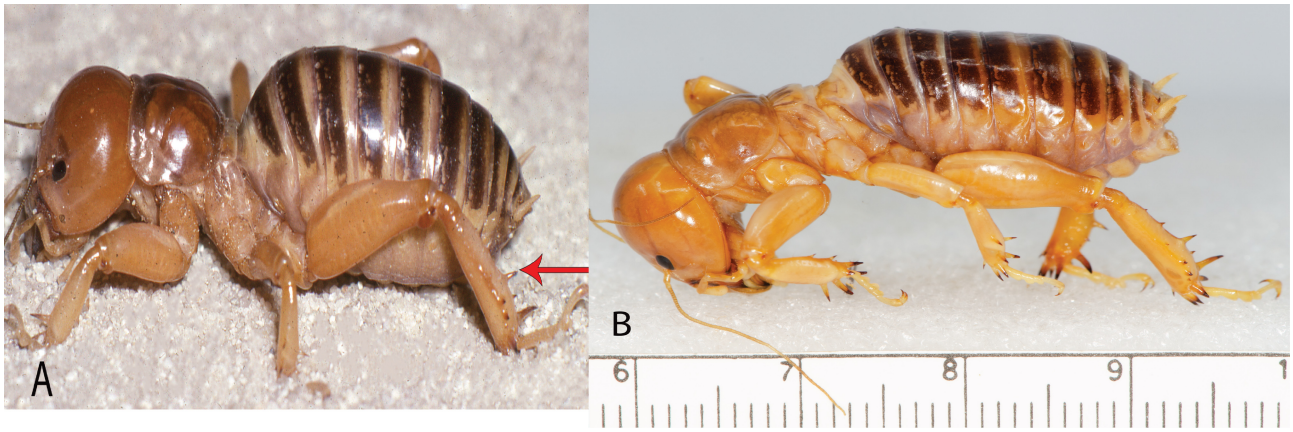


FIGURE 125. Adult male holotype *A. sandiego.* A. When alive. Arrow points to longest inner rear leg tibia spine #3, characteristic of Winchester Group species. B. When preserved.



FIGURE 126. Left rear leg tibia in adult male holotype. A. Showing 4 outer and 5 inner spines. Note long inner spine #3 (arrow). B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 127). Same data as holotype except R06-9, F1758. Molt to adult 4-x-2006. Deposited CAS, CASENT # 8414376. Measurements in mm: Body length 33.66, hind femur length 9.15, hind femur width 3.56. Fore leg tibia with 2 and 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 128) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 129.

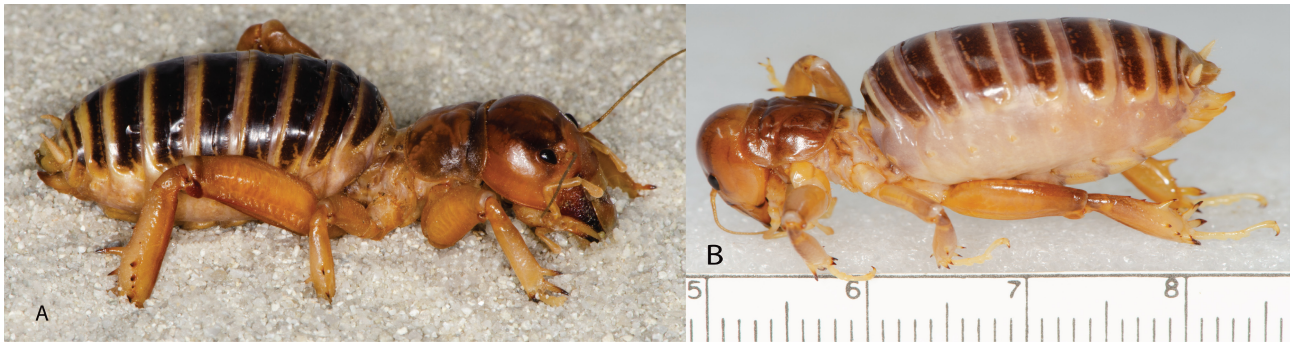


FIGURE 127. Adult female *A. sandiego.* A. Topotypic (S23-28) when alive. B. Allotype adult female when preserved.



FIGURE 128. Left rear leg tibia adult female allotype *A. sandiego.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

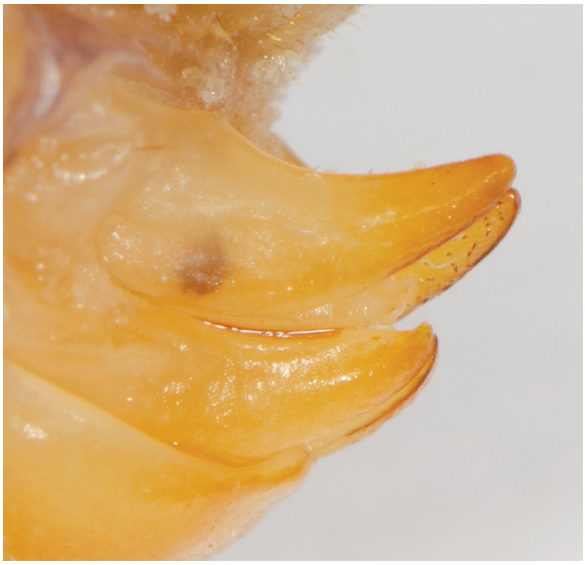


FIGURE 129. Ovipositor allotype *A. sandiego.*

Paratypes. ♂12 ♀17. **CALIFORNIA, *San Diego Co.***: Type locality, Lake Hodges, 2-i-2005 (S05-2) ♀1; 20-iii-2023 (S23-28) ♀1; 23-ii-2024 (S24-7) ♂1 for testes. Lakeside, 12134 Saddle Rock Rd, 32.842604° -116.929912°, 194m, 7-vii-2005 (S05-67) S. Fabares ♀1. Camp Pendleton, 33.34561° -117.37262°, 134m, 15-ii-2007 (S07-3) A. Vandergast, ♂2. Daley Ranch, 33.166365° -117.052714°, 354m, 23-ii-2024 (S24-8) ♀1. El Cajon, 3294 Dehesa Meadow Rd, 32.782041° -116.873359°, 152m, 29-iv-2003 (S03-43) A. Vandergast ♂1. Lemon Grove, 32.7436° _117.0268°, 135m, 13-iii-1988 (S88-7) R. Watts ♀1. Little Cedar, 32.615° -116.860°, 404m, 25-xi-1996 (S96-96) R. Fisher, ♀1. Little Cedar, 32.62052° -116.86099°, 365m, 3-vi-2005 (S05-59) ♀1. Little Cedar, 32.62914° -116.86559°, 338m, 18-viii-2005 (S05-137) J. Macias ♂1. Marron Valley, 32.567° -116.773°, 168m, 26-xi-1996 (S96-95) R. Fisher, ♀3. Marron Valley, Cottonwood Creek, 32.573° -116.757°, 174m, 9-iii-2002 E. Ervin ♀1. Mission Trails State Park, 32.8603° -117.053°, 171m, 22-iii-2003 (S03-16) M. Helin) ♂1. Rancho Bernardo, Pomerado Rd, 32.991853° -117.058070°, 185m, 16-i-2005 (S05-12) ♂2 ♀4. Rancho Jamul, 32.66606° -116.85534°, 297m, 14-vi-2005 (S05-61) D. Wood, ♂1 ♀1. San Diego, 4295 Hawk St, 32.755635° -117.172065°, 77m, 7-ii-1985 (S85-12) A. Grennan ♂1. San Diego, 8605 Innsdale Lane, 32.705752° -117.020941°, 124m, 21-xi-1987 (S87-118) C. Cox ♂1. Santa Ysabel, 33.12490° -116.67471°, 926m, 10-vi-2005 (S05-60) D. Wood, ♂1. Tijuana Estuary 13, 32.55989° -117.124°, 2m, 28-v-1997 (S97-38) R. Fisher, ♂1; 19-iii-2003 (S03-11) ♀2.

Drum. Drumming rate in male faster than in females; but not the usual 2X as fast as seen in most Winchester Group taxa. Holotype **male**: R06-165 (Fig. 130), 16°C, 41 drums over 4.1s (10 drums/s). Allotype **female**: R06-9 (Fig. 131), 15.5°C, 165 drums over 22.7s (7.3 drums/s).

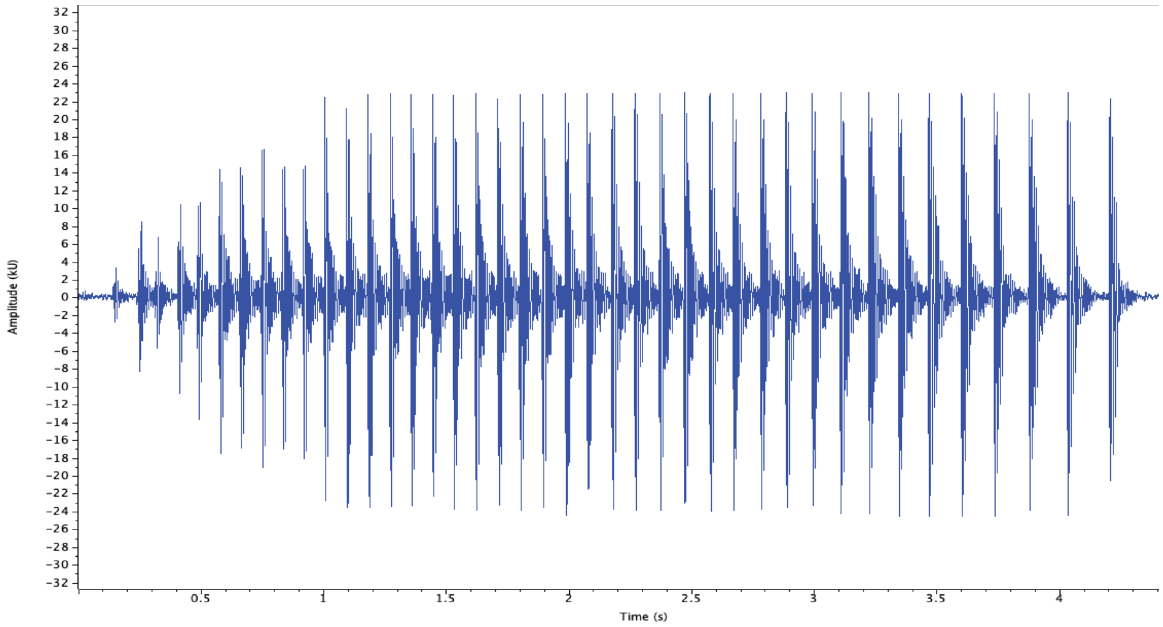


FIGURE 130. Calling drum (R06-165) adult male holotype *A. sandiego.*

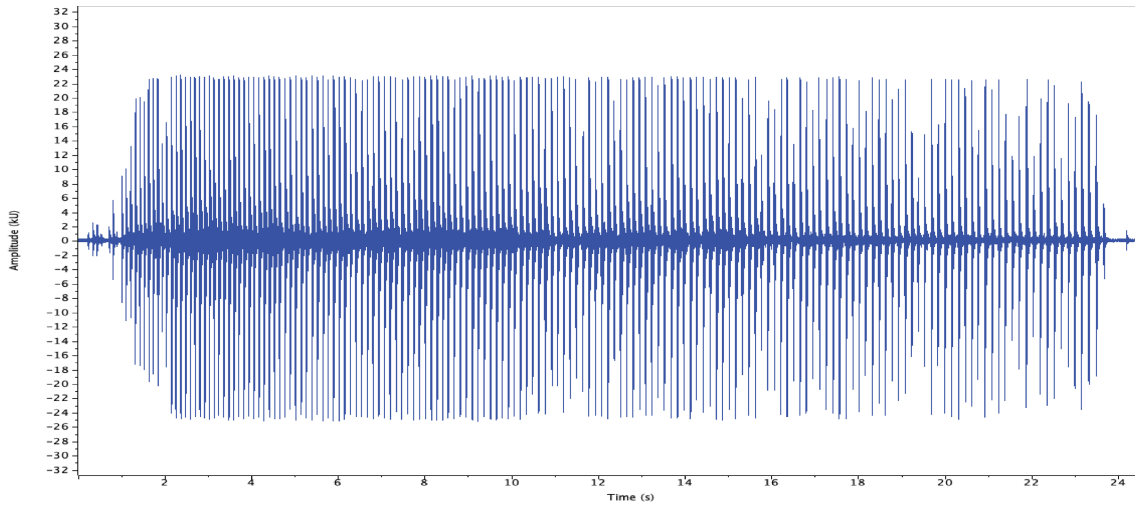


FIGURE 131. Calling drum (R06-9) adult female allotype *A. sandiego.*

Derivation of name. Name after the only California County where it is known to occur.

Habitat. Coastal bluff and coastal sage vegetation areas.

Life cycle and seasonal occurrence. Apparent 2-year typical life cycle.

Variation. Of 25 individuals, 4 had 2, 20 had 3, and 1 had 4 ventral **fore** leg tibial spurs; all 25 had 7 **middle** leg tibial calcars all with 2 ventral spurs; 2 had 4 and 23 had 5 inner **rear** leg tibial spines, and 16 had 3 and 9 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. More specifically broken down, 2 of 3 **Tijuana Estuary** (S97-38, S03-11, coastal sage scrub) adults had 2 spurs; 1 adult from **Lake Hodges** (S05-2, coastal sage scrub) had 2 spurs, 1 adult had 3 spurs, and 1 adult had 2 and 3 spurs on different sides; and 1 of 5 adults from **Rancho Jamul** (S05-61, coastal sage scrub and grassland) had 2 spurs.

DNA. Fig 17, p. 58. F0365, F0366, F0367 (S96-95, Marron Valley, 33 km inland); F1398 (S03-43, El Cajon); F1552 (S03-11, Tijuana Estuary); F1758 (type locality S05-2, Lake Hodges); F1904, F1905 (S05-12, Rancho Bernardo); F1909 (S05-137, Little Cedar); F1925 (S07-3, Camp Pendleton) all recovered in Group 1 Winchester with one individual (F1529) of *A. larumorosa.*

Karyotype. 2n♂=25. One type locality (S24-7) male (T24-13) checked (Fig. 132). An appropriate cell was not available to construct an idiogram, but a good diplotene-diakinesis cell was located to confirm the count.



FIGURE 132. Diplotene-diakinesis meiotic cell (T24-13), using C-banding, from topotypic (S24-7) male instar *A. sandiego*.

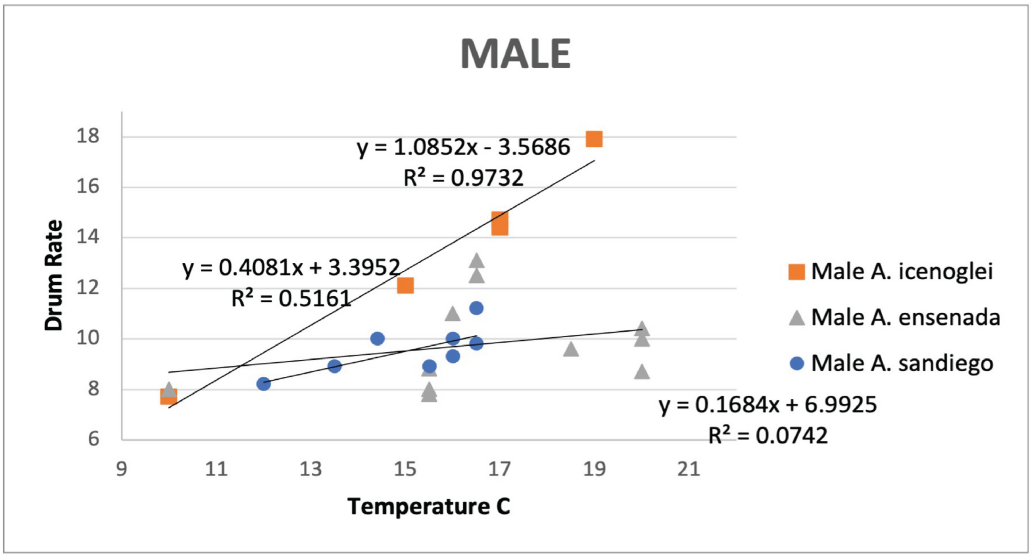


FIGURE 133. Drumming rates as a function of temperature in males of Winchester Group sister species. For *A. ensenada, A. icenoglei,* and *A. sandiego*, each symbol represents one recording of one male, or the same male recorded at different temperatures.

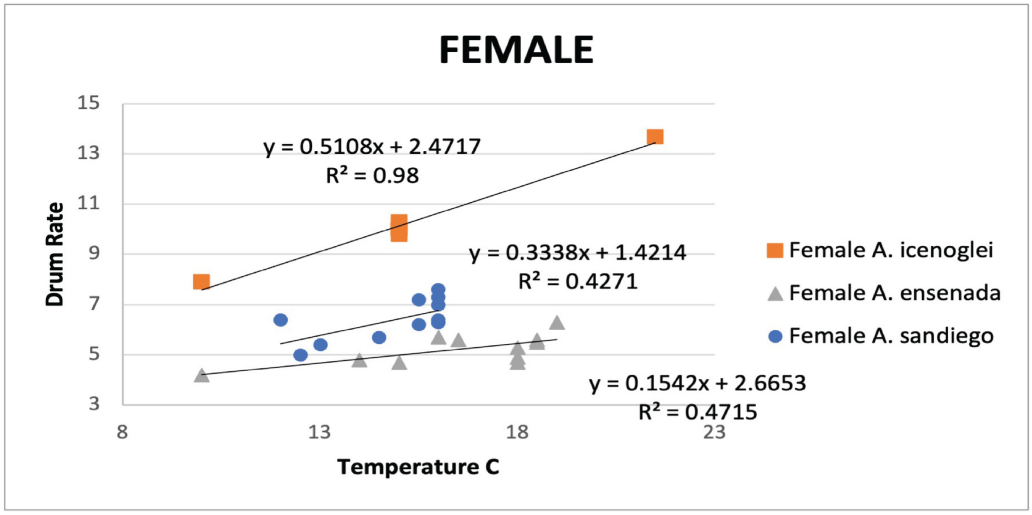


FIGURE 134. Drumming rates as a function of temperature in female Winchester Group sister species. For *A. ensenada, A. icenoglei,* and *A. sandiego*, each symbol represents one recording of one female, or the same female recorded at different temperatures.

Discussion. Found sympatric at Daley Ranch (S24-8) with the more common *A. fisheri.* The three Southern California-Northern Baja California similar looking taxa of *A. ensenada*, *A. icenoglei*, and *A. sandiego* do show differences in adult male and female drumming rates (Figs 133 & 134), with both *A. icenoglei* males and females drumming faster than the other two taxa. These differences are most pronounced in females and should be helpful in separating field collected specimens.

Ammopelmatus sanfrancisco Weissman, sp. nov.

San Francisco Jerusalem Cricket
Figs 135–143, Tables 37, 41

Species #7, Weissman 2001b.



FIGURE 135. Distribution of *A. sanfrancisco.*

Distribution. (Fig. 135). Only known from Sierra Agua Verde Mountain Range, San Francisco Peak area, Baja California Sur, Mexico.

Recognition characters. Member of Winchester Group. A large JC with reddish colored head, pronotum, and legs, characterized by inner rear leg tibial spine #3 being longer than all other spines, and different calling drums between males and females.

Holotype. Male (in alcohol, Fig. 136): **Mexico, *Baja California Sur,*** ~31.2 road km NE Mexico Hwy 1 on road to San Francisco de la Sierra, 27.587778° -113.051111°, 1125m, 23 and 30-viii-1995 (S95-78) DBW & DC Lightfoot. R95-129, R95-131, R95-139. Molt to adult 6-x-1995. Deposited CAS, Entomology type #20078. Measurements in mm: Body length 34.3, hind femur length 11.7, hind femur width 4.2. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; rear leg tibia (Fig. 137) with 3 outer and 5 inner spines, 2 ventral spurs.

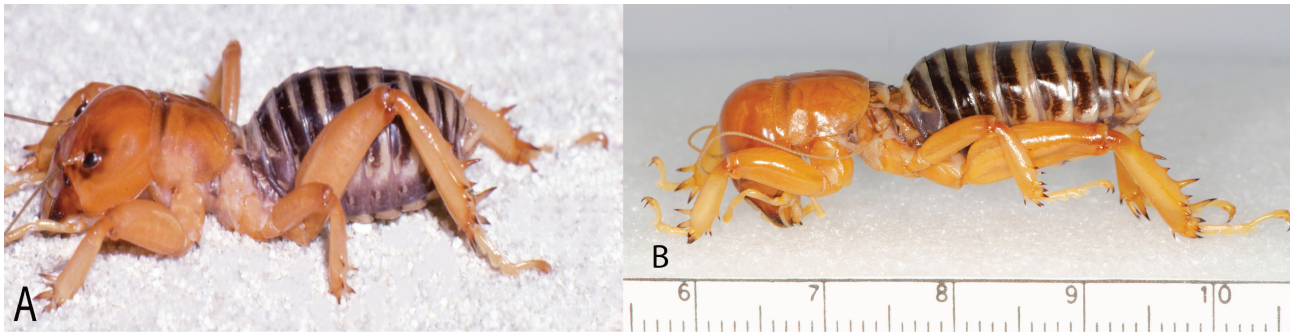


FIGURE 136. Holotype adult male *A. sanfrancisco.* A. When alive. B. When preserved.

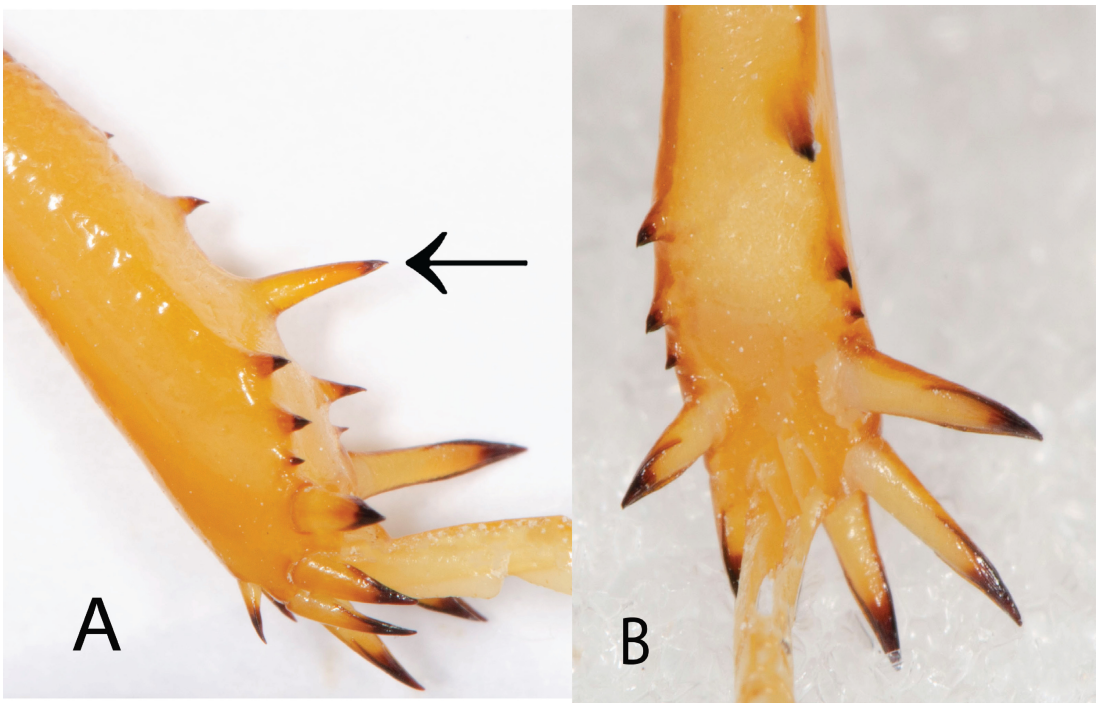


FIGURE 137. Left rear leg tibia adult male holotype *A. sanfrancisco.* A. Showing 3 outer and 5 inner spines, with arrow pointing at diagnostic 3rd inner spine. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 138): Same data as holotype except R95-116, F0182. Molt to adult 14-x-1995. Deposited CAS, Entomology # 9081940. Measurements in mm: Body length 37.84, hind femur length 11.36, hind femur width 4.38. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; rear leg tibia (Fig. 139) with 4 outer and 5 or 6 inner spines (with inner spine #3 much elongated compared with all others), 2 ventral spurs. Ovipositor (Fig. 140) extends beyond end of body.

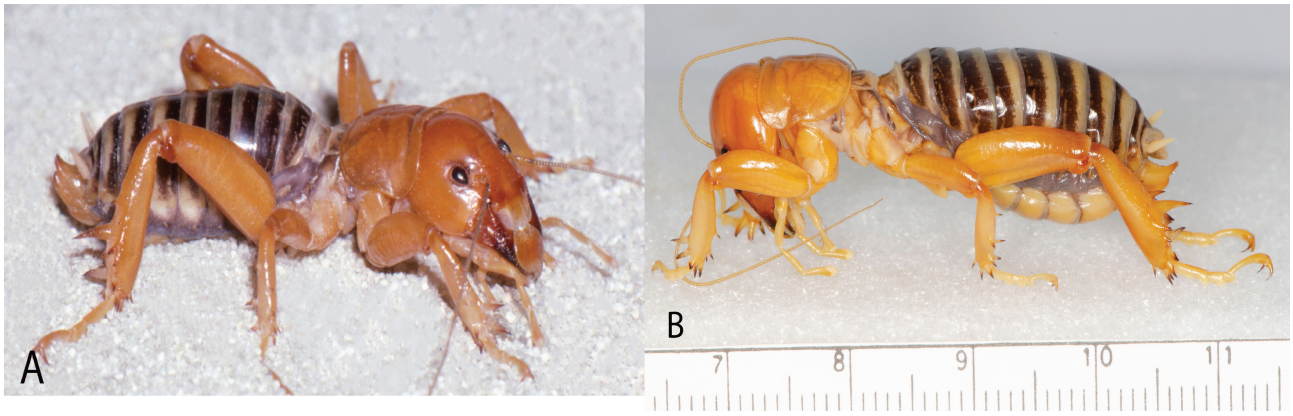


FIGURE 138. Adult female allotype *A. sanfrancisco.* A. When alive. B. When preserved.

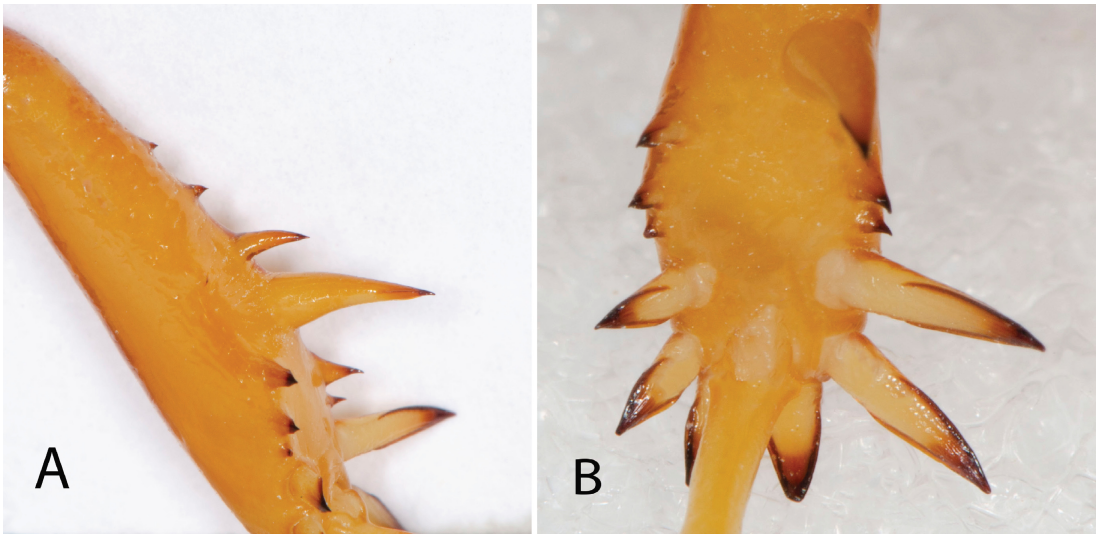


FIGURE 139. Left rear leg tibia adult female allotype *A. sanfrancisco.* A. Showing 3 outer and 6 inner spines. B. Showing shape of calcars.



FIGURE 140. Ovipositor allotype *A. sanfrancisco.*

Paratypes. ♀3. **MEXICO, *Baja California Sur,*** same data as holotype and allotype.

Drum. As is typical for this Group, males drum around twice as fast as females. **Male**: Holotype R95-139 (Fig. 141), 18.5°C: 77 drums over 6.9s (11.2 drums/s). It was easy to stimulate him to drum by finger tapping at a rate similar to the female's drum rate. **Female**: Allotype R95-116, 20.5°C: (a) 81 drums in 16.2s (5.0 drums/s); (b) Fig. 142, 67 drums over 13.7s (4.9 drums/s). Another type locality adult female R95-123, 17.5°C: (a) 68 drums over 14.2s (4.8 drums/s), (b) (Fig. 143) 84 drums over 17.6s (4.8 drums/s), (c) 125 drums over 28.6s (4.4 drums/s).

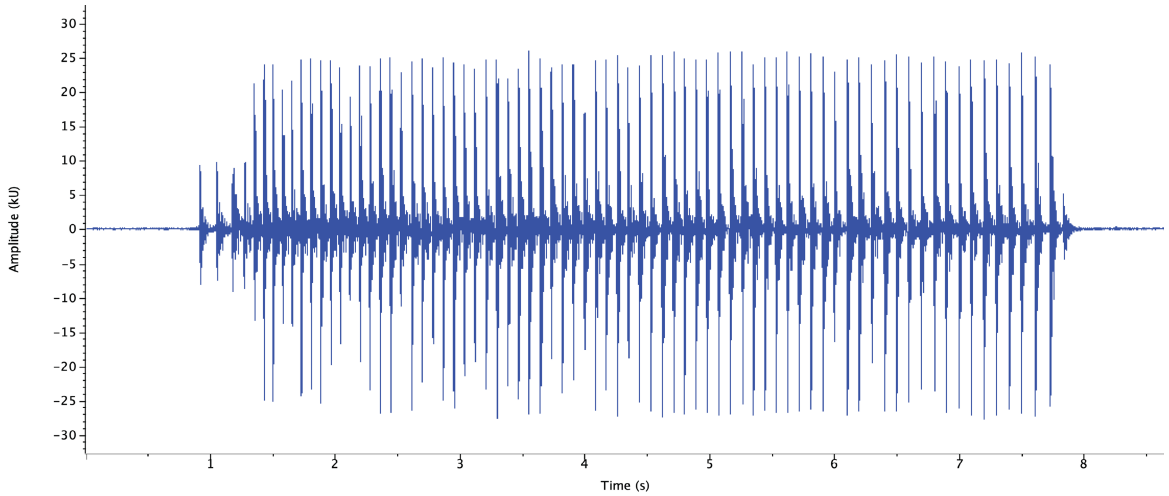


FIGURE 141. Calling drum (R95-139) holotype male *A. sanfrancisco*.

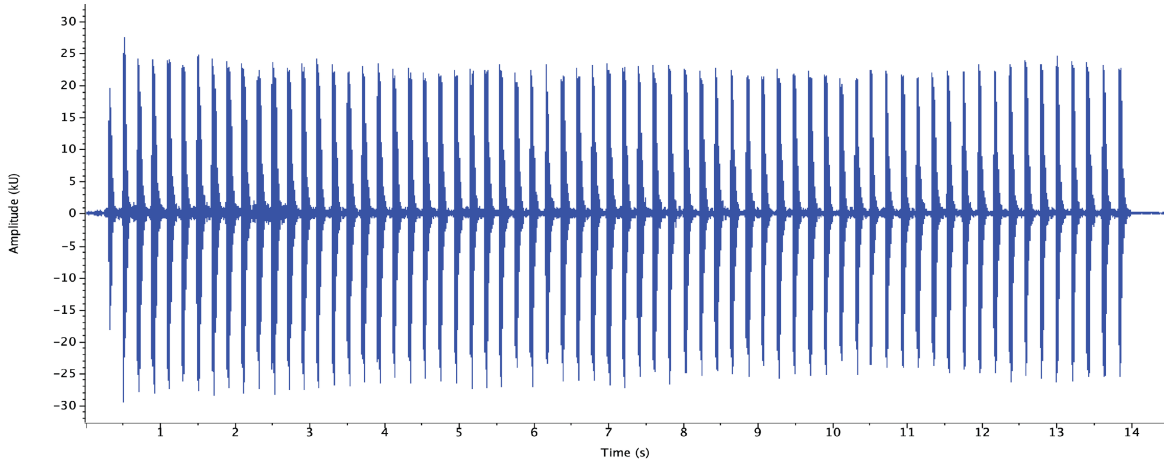


FIGURE 142. Calling drum (R95-116) allotype female *A. sanfrancisco*.

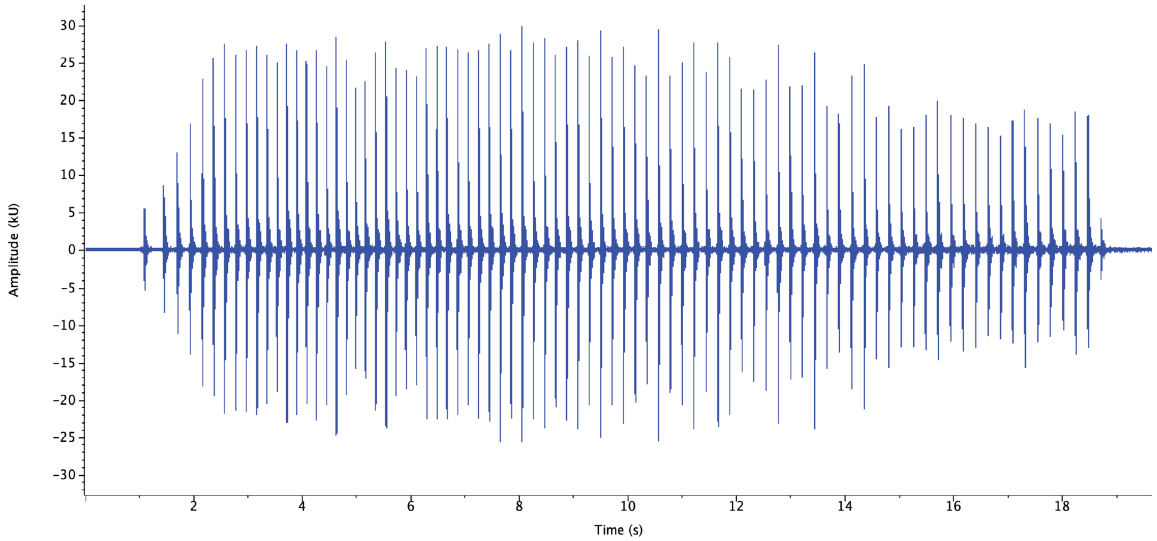


FIGURE 143. Calling drum (R95-123) adult female paratopotype *A. sanfrancisco.*

Derivation of name. Named after the Sierra San Francisco, Baja California Sur, the only known locality of this species.

Habitat. On a north facing, rocky slope with water seeps, adjacent to the road. Area overgrazed by sheep and burros. Plants included cactus, mesquite, *Acacia*, boojums, *Nicotiana* and lots of mosses and lichens.

Life cycle and seasonal occurrence. At time of collection, one female was adult while rest of series were last instars.

Variation. For 5 individuals, all had 3 ventral **fore** leg tibial spurs; all 5 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 4 had 5 and 1 had 6 inner **rear** leg tibial spines, and 2 had 3, 2 had 4, and 1 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F0131 and F0182 (both type locality) were recovered in Group 1 Winchester, and, surprisingly, as most closely related to *A. clarki,* which is some 380 km to the NW in Baja California.

Karyotype. Unknown

Discussion. We placed long oatmeal trails in several locations near the type locality, but collected JCs at only the type locality. On 23-viii, we got 1 juvenile female on the 23:30 and 05:00 walks, but none on the 02:00 walk. We returned on 30-viii and placed more extensive trails (~10 kg oatmeal), with the following results: 0 JCs on the 21:30 walk (moon still visible), 1 juvenile male and 1 juvenile female on the 23:00 walk, 1 adult female on 02:00 walk, and 1 juvenile female on 04:30 walk.

Access to the type locality required a 4-wheel drive vehicle in 1995 but by 2011, a paved road was in place from Hwy 1. In 1995, the type locality was heavily impacted by grazing from sheep and burros. With easy access now in place because of the paved road, we suspect that this endemic JC, and the endemic cricket *Rubrogryllus coloratus* Vickery (1997), will both face possible extinction. Interestingly, while these two sky island endemics are both reddish in color, neither was found on, or near, red substrate.

***Ammopelmatus sanmartinensis* Weissman, sp. nov.**

Isla San Martín Jerusalem Cricket

Figs 144–153, Tables 37, 41

Distribution. (Fig. 144). Baja California, Mexico. On Isla San Martín, 5.5 km W of the Baja California Peninsula; and, on the Peninsula, from the dunes at Punto Mazo, ~15 km SW of San Quintín, to the El Socorro dunes ~24 km SE of San Quintín.

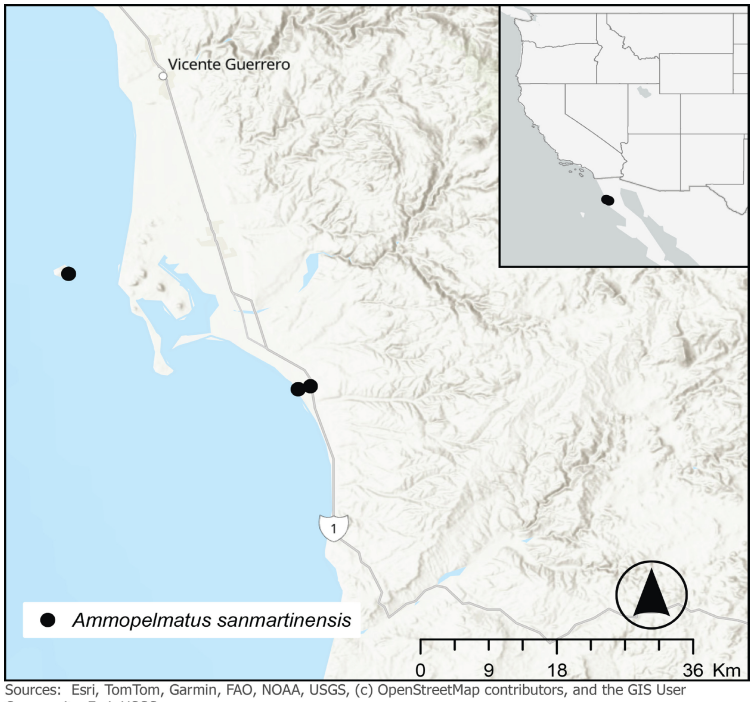


FIGURE 144. Distribution of *A. sanmartinensis.*

Recognition characters. Member of Winchester Group. Bordered to the north (S90-8, San Antonio del Mar) and south (S91-19, El Campito) by *A. ensenada.* Similar to latter species based upon coastal habitat. But different based upon all 8 adults having 8 calcars on the middle leg tibia, vs 7 in *A. ensenada* (including those 12 individuals of *A. ensenada* from San Antonio del Mar and El Campito, as discussed below). Also, the hind tibiae in *A. sanmartinensis* have 5 (rarely 4) outer spines vs 3 (rarely 4) in *A. ensenada.* While no genetic material is available from the 1983 collected type locality, several individuals collected in 2019 from the adjacent Baja California Peninsula, by the San Diego Museum of Natural History dunes team (https://issuu.com/terrapeninsular/docs/mediterranews-15-issue/s/105460), provided confirmatory DNA data as to the separation of the two taxa (Fig. 17, p. 58). Calling drum rate in both sexes of *A. sanmartinensis* is slower than in *A. ensenada*, although sample size is small in former.

Holotype. Male (in alcohol, Fig. 145): **Mexico, *Baja California,*** Isla San Martín, Hassler's Cove, 30.485572° -116.106115°, 16m, 30-vi-1983 (S83-82) DBW, DC Lightfoot, VF Lee. R84-41. Molt to adult 7-ix-1984. Deposited CAS, Entomology type #20082. Measurements in mm: Body length 30.35, hind femur length 9.36, hind femur width 2.99. Fore tibia with 2 ventral spurs. Middle tibia with 8 calcars. Rear leg tibia (Fig. 146) with 6 inner and 5 outer spines, 2 ventral spurs.

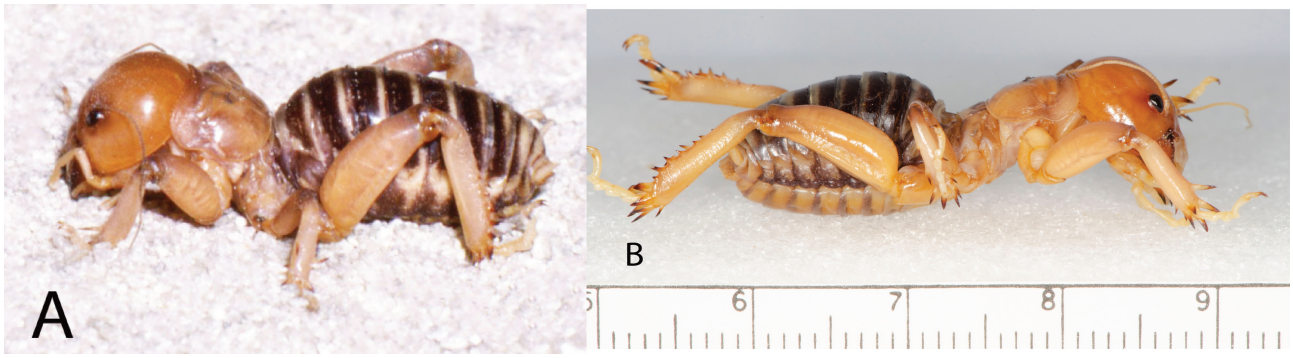


FIGURE 145. Holotype adult male *A. sanmartinensis.* A. When alive. B. When preserved.



FIGURE 146. Right rear leg tibia adult male holotype *A. sanmartinensis.* A. Showing 6 inner and 5 outer spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 147): Same data as holotype except R83-510. Molt to adult 31-x-1983. Deposited CAS, Entomology #9084322. Measurements in mm: Body length 32.82, hind femur length 10.18, hind femur width 3.91. Fore tibia with 2 ventral spurs; middle tibia with 6 and 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 148) with 4 and 5 inner and 3 and 5 outer spines, 2 ventral spurs. Ovipositor Fig. 149.



FIGURE 147. Preserved adult female allotype of *A. sanmartinensis.*



FIGURE 148. Left rear leg tibia adult female allotype *A. sanmartinensis.* A. Showing 3 outer and 4 inner spines.



FIGURE 149. Ovipositor allotype *A. sanmartinensis*.

Paratypes. ♂3 ♀3. **MEXICO, *Baja California,*** same data as types, ♂1 ♀1. El Socorro sand dunes adjacent to Hwy 1, km sign post 22, 30.345767° -115.819129°, 25m, 12-ii-1990 (S90-9) ♂2 ♀1; El Socorro sand dunes, 30.342042° -115.833817°, 20m, 29-iii-2007, 1 early instar male, M. Van Dam. El Socorro Dunes, 30.34215° -115.833458° 25-ii-3-iii-2019, San Diego Museum Natural History dunes team, late female instars #2. Punto Mazo dunes, Reserva Natural Punta Mazo, 30.436289° -116.029932°, 8m, 25-ii-2-iii-2019, San Diego Museum Natural History dunes team, ♀1.

Drum. Males drum around twice as fast as females. Holotype **male** (Fig. 150, R84-41, S83-82) with 31 drums in 3.9s (7.9 drums/s) at 19°C. El Socorro Dunes **male** (Fig. 151, R91-75, S90-9) with 33 drums in 5.1s (6.5 drums/s) at 17°C. Analysis of the latter's 9 recorded bursts, all which start fast and slow down, show bursts of 25–36 drums over 4.6–5.1s, at a rate of 5.4–7.7 drums/s. This range in rate is mostly attributable to how many slower drums there are toward the end of each burst. Allotype **female** (Fig. 152, R83-510, S83-82) shows 268 drums (not counting first 3 drums) in 71.2s (3.8 drums/s) at 18°C.

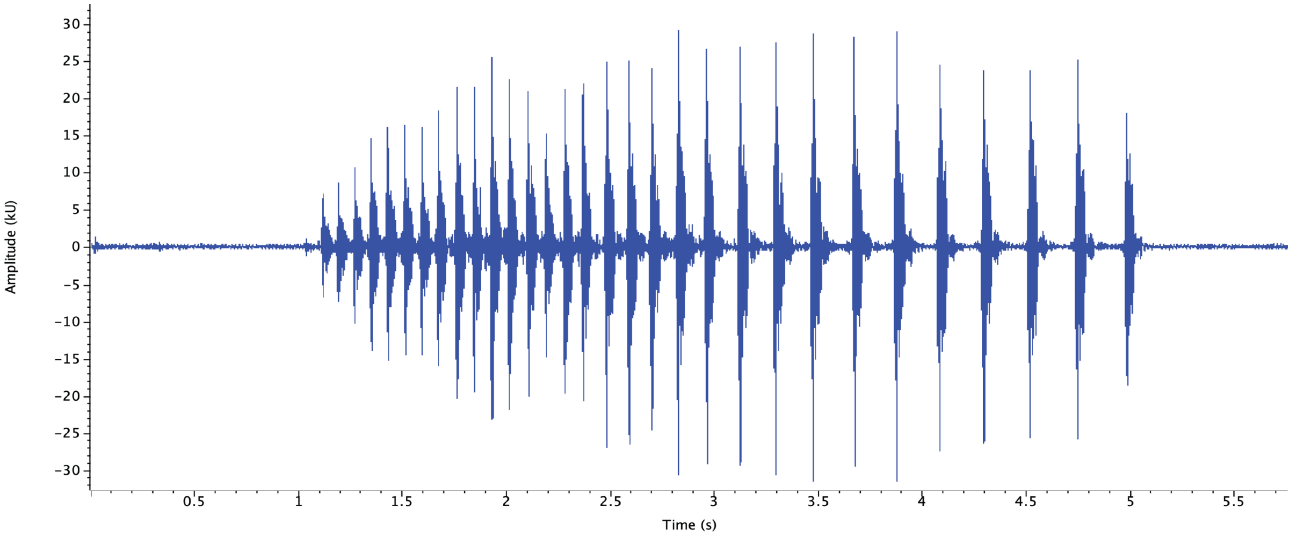


FIGURE 150. Calling drum (R84-41) adult male holotype *A. sanmartinensis*.

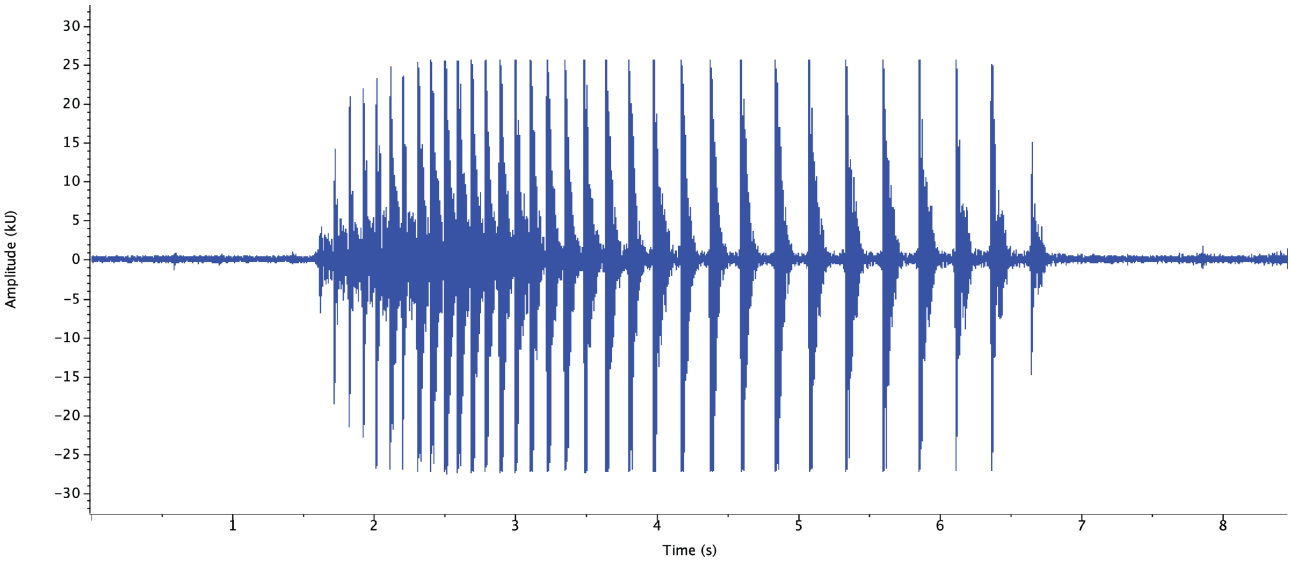


FIGURE 151. Calling drum (R91-75) adult male paratype *A. sanmartinensis*.

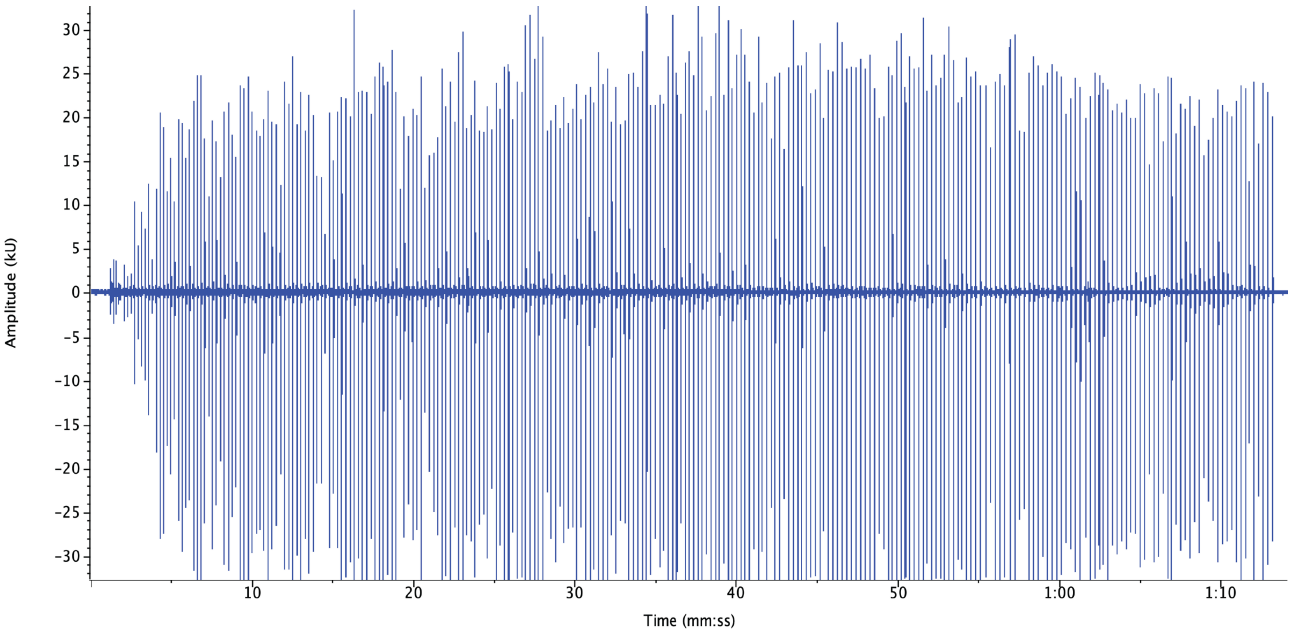


FIGURE 152. Calling drum (R83-510) adult female allotype *A. sanmartinensis.*

Derivation of name. Named after the holotype locality.

Habitat. Type locality is a dormant volcanic cinder cone island of cactus scrub with sandy substrate (see Vanderplank & Mata 2010). The El Socorro Dunes (S90-9) site is rolling dunes about 2 km from the ocean. These dunes with good plant cover of *Ephedra*, composites, cactus, etc., but we only had sifting success under *Ephedra.* The 2007 early instar male was collected under ice plant, near the beach, where the El Socorro Dunes reach the coast.

Life cycle and seasonal occurrence. Apparent 2-year life cycle. Many small nymphs collected on 30-vi-1983 on San Martín Island.

Variation. Of 7 adults, all had 2 **fore** leg tibial spurs; 6 had 8 **middle** leg tibial calcars and 1 had 9, all with 2 ventral spurs; and 4 had 5 and 3 had 6 inner **rear** leg tibial spines while 1 had 4 and 6 had 5 outer rear leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 17, p. 58. F1920, F2630, & F2632 (all 3 from El Socorro Dunes, 2019); F2631 (from the Punta Mazo Dunes, 2019), all recovered in Group 1 Winchester, with *A. ensenada* as closest relative.

Karyotype. Unknown.

Discussion. The 2.3 square kilometer volcanic Isla San Martín used to harbor an endemic wood rat, driven to extinction by feral cats in the 1950s, with the latter subsequently removed from the Island in 1999: (https://www.islapedia.com/index.php?title=ISLA_SAN_MARTIN_FAUNA).

The only known Baja Peninsula sites of *A. sanmartinensis* are the dunes at El Socorro (Fig. 153) and Punta Mazo. There are coastal sand dune sites of *A. ensenada*, some 23 km to the south of El Socorro Dunes, at El Campito (S91-19); and some 80 km to the north of Punta Mazo at San Antonio del Mar (S90-8). Of the 4 adults at El Campito, and 8 adults at San Antonio del Mar, all 12 had 3 rear leg outer tibial spines, conditions invariably seen in topotypic *A. ensenada*; vs the 5 rear leg outer tibial spines usual for *A. sanmartinensis.* The recovered DNAs from all four of these sites are concordant with this physical separation.



FIGURE 153. Adult male *A. sanmartinensis* (S90-9, R91-75) from El Socorro Dunes.

(CLADE 2) Group 2, Big Sur Group (Fig. 154)

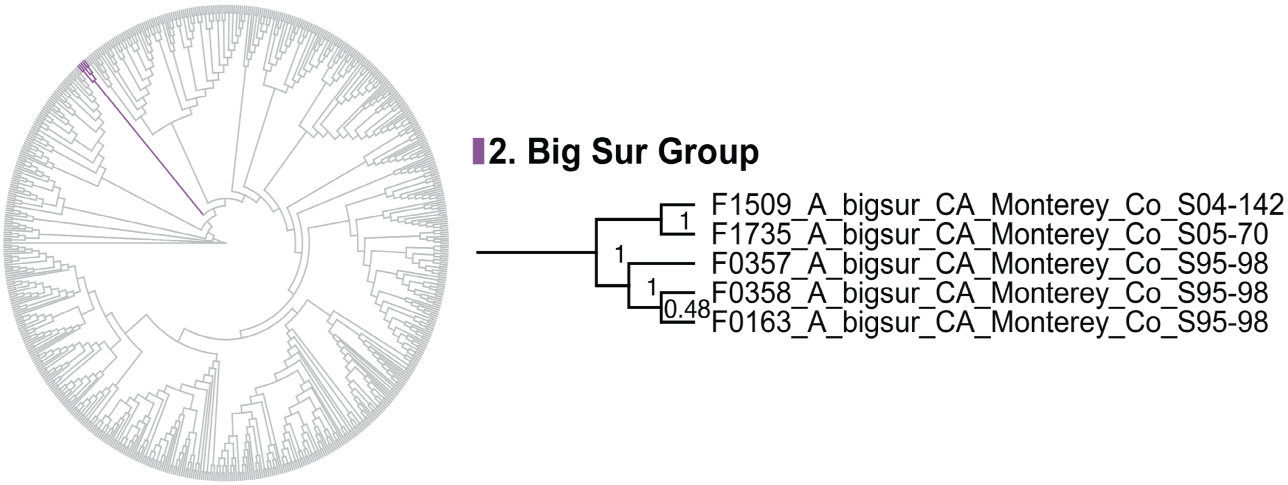


FIGURE 154. ASTRAL tree for Big Sur Group.

This Group contains a single, small species (*A. bigsur*) known only from coastal Monterey County, California. The calling drum is a rapid trill, reflecting its relatedness to the trilling Longispinus Group. We treat it separately from that Group because of its long branch.

SPECIES WRITE UP: *A. bigsur* (p. 130).

***Ammopelmatus bigsur* Weissman, sp. nov.**
Big Sur Jerusalem Cricket
Figs 155–166. Tables 4, 11

Species #11, Weissman 2001b.

Distribution. (Fig. 155). Coastal sandy habitats in Monterey County, California.

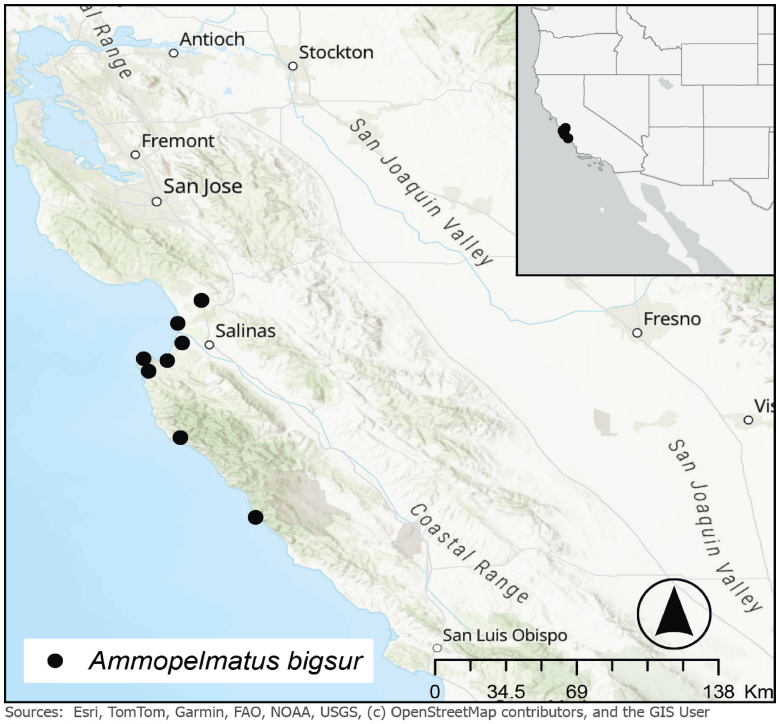


FIGURE 155. Known distribution of *A. bigsur.*

Recognition characters. Small, coastal species with a dark, pigmented pattern on adult pronotum (pattern also present in late instars but not as dark). Hind tibia with 4 inner and 3 outer spines, 2 ventral spurs. Fore tibia with 3 ventral spurs. Drum unique, usually with short trills at start converting to long trills. 2n♂=25. Separated from similarly small *A. intermedioides* from Fremont Peak State Park, Monterey County, by DNA, drumming pattern, and outer rear leg tibial spine number. Distinguished from similarly small, more northern *A. intermedius* which has a calling drum of long trills transitioning to short trills, 2n♂= 23, and DNA.

Holotype. Male (in alcohol; topotype live male Fig. 156A); holotype preserved male Fig. 156B): **California, *Monterey Co.,*** Pfeiffer Big Sur State Park, oatmeal trail along River Path Trailhead, 36.250272° -121.783698, 64m, 23-ix-1995 (S95-98) DBW. R95-126. Collected as adult. Deposited CAS, Entomology type #20066. Measurements in mm: body length 21.17, hind femur length 8.45, hind femur width 2.79. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 157) with 4 inner and 3 outer spines, 2 ventral spurs.

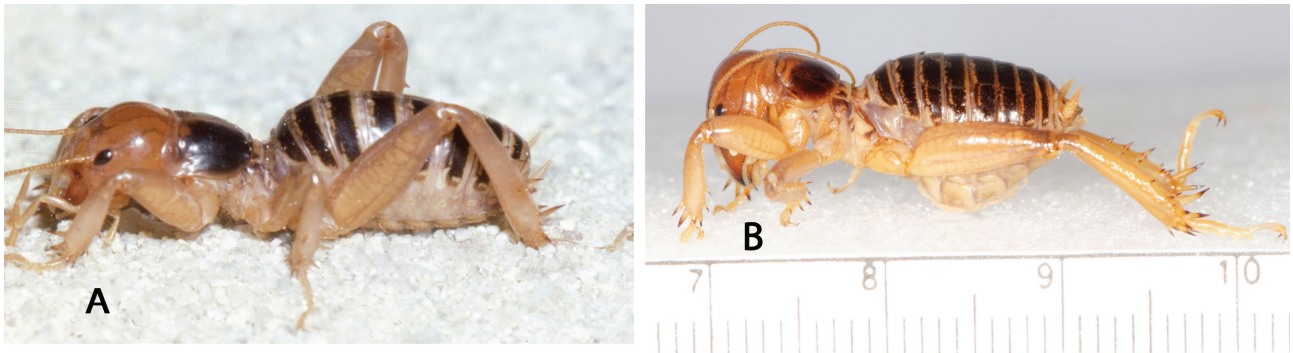


FIGURE 156. Adult male *A. bigsur.* A. Live topotype (S85-113, R85-39). B. Preserved holotype.

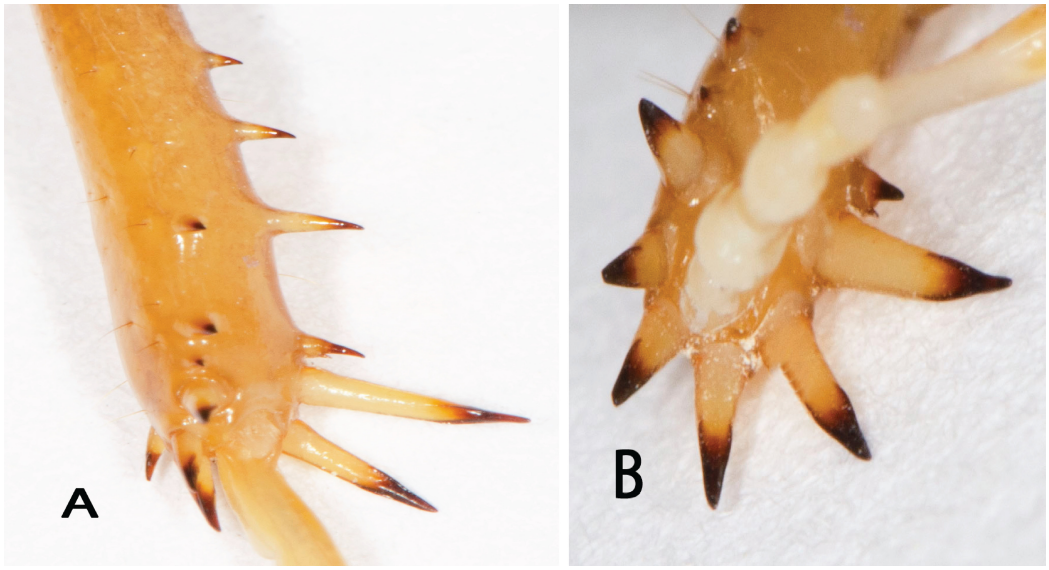


FIGURE 157. Left rear leg tibia adult male holotype *A. bigsur*. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 158): same data as holotype except R96-151, F0352. Molt to adult 19-x-1996. Deposited CAS, CALENT #9081964. Measurements in mm: Body length 28.17, hind femur length 8.37, hind femur width 3.04. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind femur (Fig. 159) with 4 inner and 3 outer spines on left side but 2 inner and 2 outer spines on right side, 2 ventral spurs. Ovipositor Fig. 160.

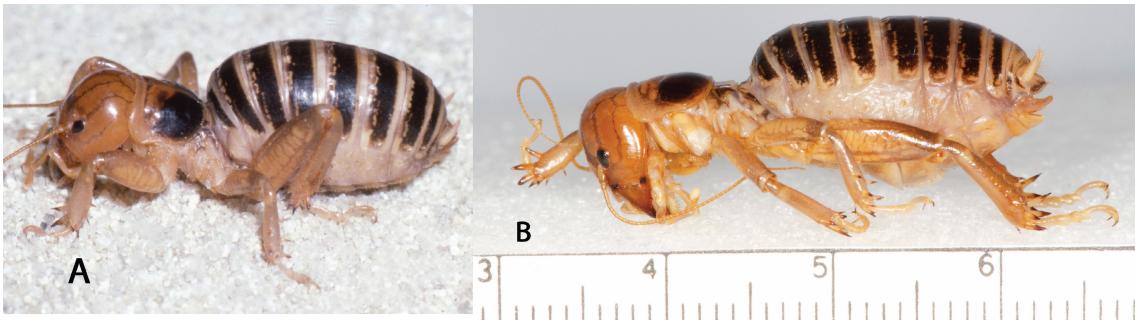


FIGURE 158. Adult female allotype *A. bigsur*. A. When alive. B. When preserved.

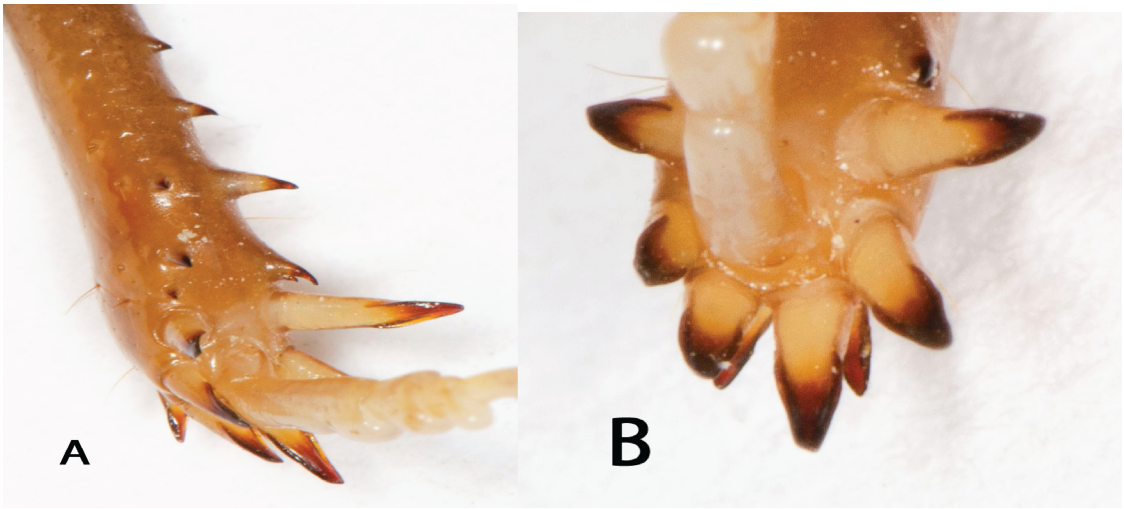


FIGURE 159. Left rear leg tibia of adult female allotype *A. bigsur*. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 160. Ovipositor allotype *A. bigsur*.

Paratypes. ♂26 ♀12. **CALIFORNIA, *Monterey County,*** Type locality, 27-ix-1985 (S85-113) ♂5; 29-ix-1985 (S85-115) ♂3 ♀3; 28-xii-1988 (S88-131) ♂1 ♀1; 23-ix-1995 (S95-98) ♂6 ♀3. Carmel-By-The-Sea, 36.554770° -121.922681°, 66m, 8-x-2004 (S04-142) ♂1; 10-xi-2011 (S11-123) ♂1. Fort Ord, UC Santa Cruz Natural Reserve, 36.6854° -121.7756°, 41m, 23-vii-2023 (S23-65) C. Grinter, D. Montelonga, D. Phan, J. Betz ♂2 nymphs. Monterey, around and in Eucalyptus grove at corner of Del Monte and Sloat, 36.880745° -121.691587°, 66m, 27-ix-1985 (S85-112) ♂1 ♀1; 23-ix-1995 (S95-97) ♂1 ♀2. Moss Landing, Salinas River Sate Beach, 36.775464° -121.795176°, 5m, 24-ix-1995 (S95-99) ♂1 ♀1. Pebble Beach Inn, 36.612822° -121.944439°, 11m, 14-v-1989 (S89-16) ♀1. Royal Oaks, 2487 Tuckahoe Terrace, 36.880745° -121.691587°, 66m, 25-xi-2005-23-i-2006 (S05-166), L. Black ♂2. Seaside, 1180 Wanda Ave., 36.603807° -121.841042°, 33m, 23-vii-12-ix-2005 (05-70) M. St. Mary (S05-70) ♂1. Treebones Resort, 35.883459° -121.454915°, 117m, 6-vii-2024 (S24-39) DW Weissman & C. Binder ♂1.

Drum. Calling drums similar in both sexes, although the 2 females recorded (n=8 for recorded males) appear to have fewer short introductory trills, than seen in males, before transitioning to longer trills with longer intervals between trills. **Male**: holotype, R95-126 (Fig. 161, A, B), 7 short trills over 2.8s, from 2–5 drums/trill, drum rate ~20 drums/s, then 2.1s gap until 7 long trills over 17.5s (0.4 trills/s) with 10–12 drums/trill with drum rate ~20 drums/s, all at 19.5°C. **Female**: allotype, R96-151 (Fig. 162, A, B): 15 long trills in 52.4s (0.29 trills/s), from 6 (first) to 22 drums/trill, drum rate ~16 drums/s at 19°C. A second topotypic female (R96-160) (Fig. 163, A, B): 4 short trills, of 4–6 drums/trill, over 2.7s, then 28 long trills, with longer intervals between trills, over 51.5s (0.54 trills/s), with drum rate of ~15 drums/s at 17°C.

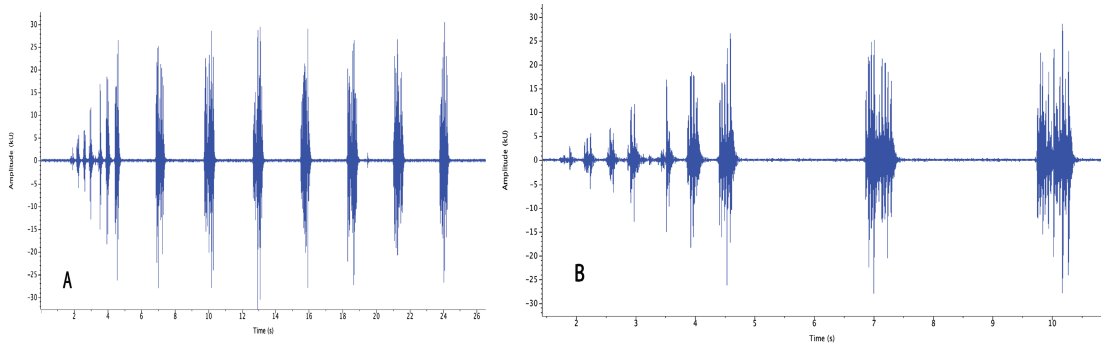


FIGURE 161. Calling drum (R95-126) holotype male showing: A. Both short and long trills, with B. An enlarged section from oscillogram A.

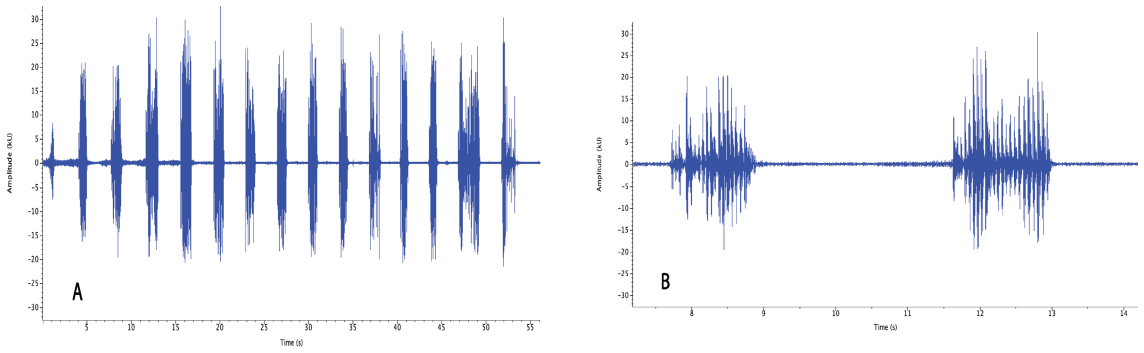


FIGURE 162. Calling drum (R96-151) allotype female showing A. Both short and long trills, with B. an enlarged section of long trills from Fig. A.

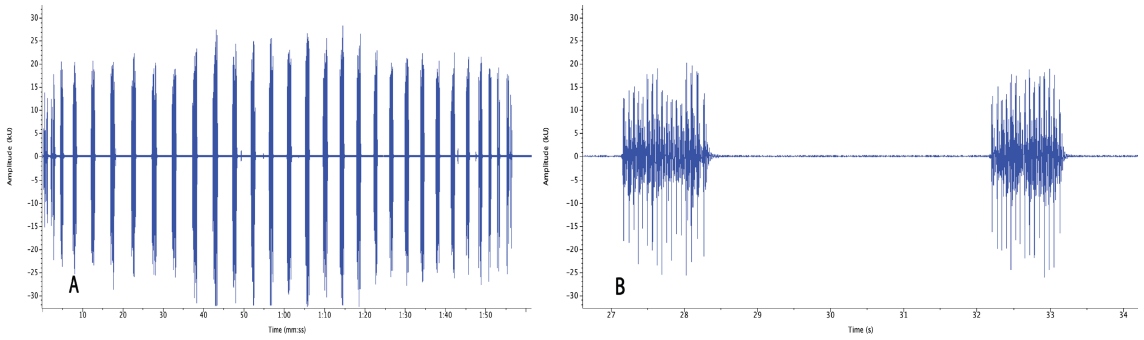


FIGURE 163. Calling drum (R96-160) topotypic female showing A. Both short and long trills, with B. An enlarged section of long trills from FIGURE A.

Derivation of name. Named for the location of the type locality.

Habitat. Type locality is sandy riparian habitat adjacent to Big Sur River. Habitats in Monterey and Moss Beach also sandy.

Life cycle and seasonal occurrence. Apparently 2-year typical life cycle.

Variation. From some 37 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 3 had 3, 13 had 4, 20 had 5, and 1 had 6 inner **rear** leg tibial spines; and 2 had 2, 3 had 3, and 32 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. 1 adult female (S88-131) with body length of 31.12 mm, longest known adult. The adult male shown in Fig. 164 is the darkest one seen. Both Fort Ord males also dark (S23-65) but neither successfully raised to adult.



FIGURE 164. Darkest adult male *A. bigsur* seen (S88-131, R89-103).

DNA. Fig. 154, p. 130. F0163, F0357, F0358 (S95-98, all type locality); F1509 (S04-142, Carmel); and F1735 (S05-70, Seaside) all recovered together in their own clade and group (Group 2 Big Sur). *Ammopelmatus bigsur* is most closely related to the large clade of Longispinus Group trillers, which is not surprising given the fact that these are the only JC species to have a trilling calling drum.

Karyotype. 2n♂=25. Two topotypic (S95-98) males examined: T96-5 (Fig. 165, meiosis) and T96-17 (Fig. 166, mitosis), both similar: with 7 or 8 metacentric or submetacentric autosomal pairs; 4 or 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X.

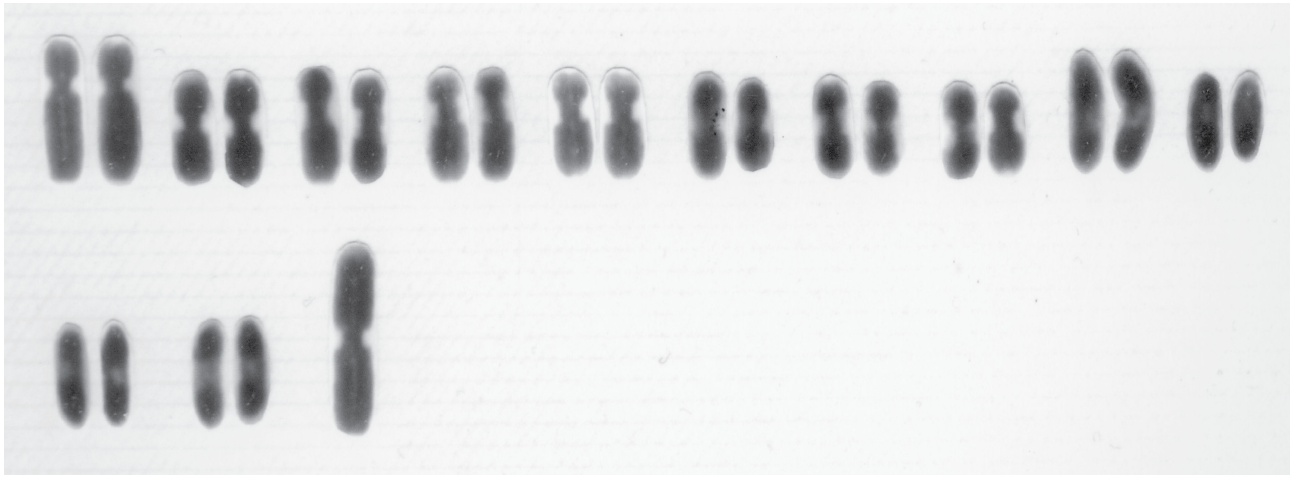


FIGURE 165. Idiogram T96-5 *A. bigsur* (S95-98).

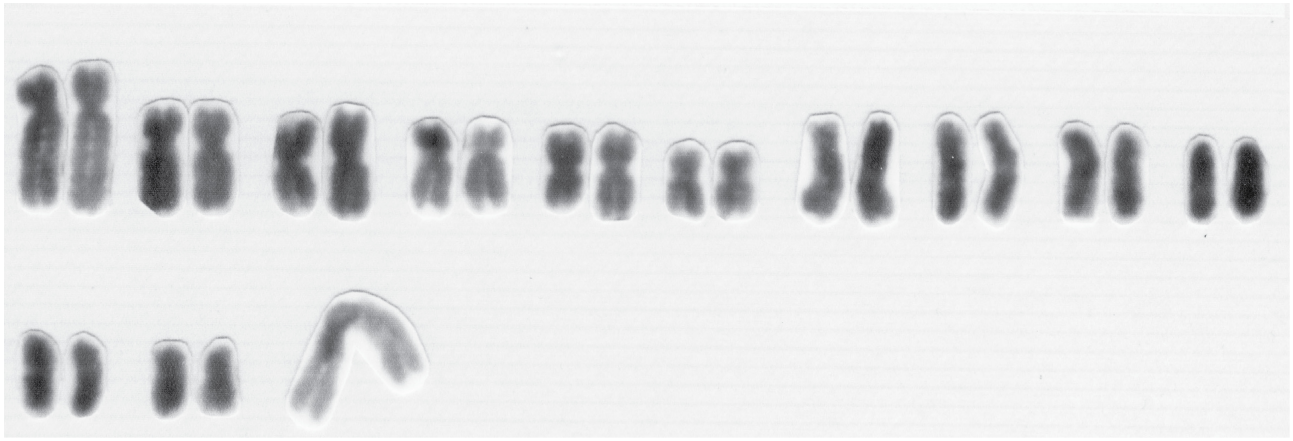


FIGURE 166. Idiogram T96-17 *A. bigsur* (S95-98).

Discussion. Readily attracted to oatmeal trials along the sandy banks of the dry river bed at the type locality. Sympatric with *A. danieli* at Seaside (S05-70).

(CLADE 3) Group 3, Longispinus Group (Fig. 167)

This Group of 12 valid species, and 13 total names with *A. californicus* confirmed as a junior synonym, is named after the nominate species, described in 1888. Like all taxa in this Group, the rear leg tibial ringlet calcars are sexually dimorphic, with those of the male, especially calcar #1, being disproportionately long. In fact, adult male calcar #1 can be so different from that seen in the female, that the name *A. longispinus* was given to the adult male while *A. californicus* was given to the adult female, even though both were from Vancouver Island, Canada, and with the same collection information.

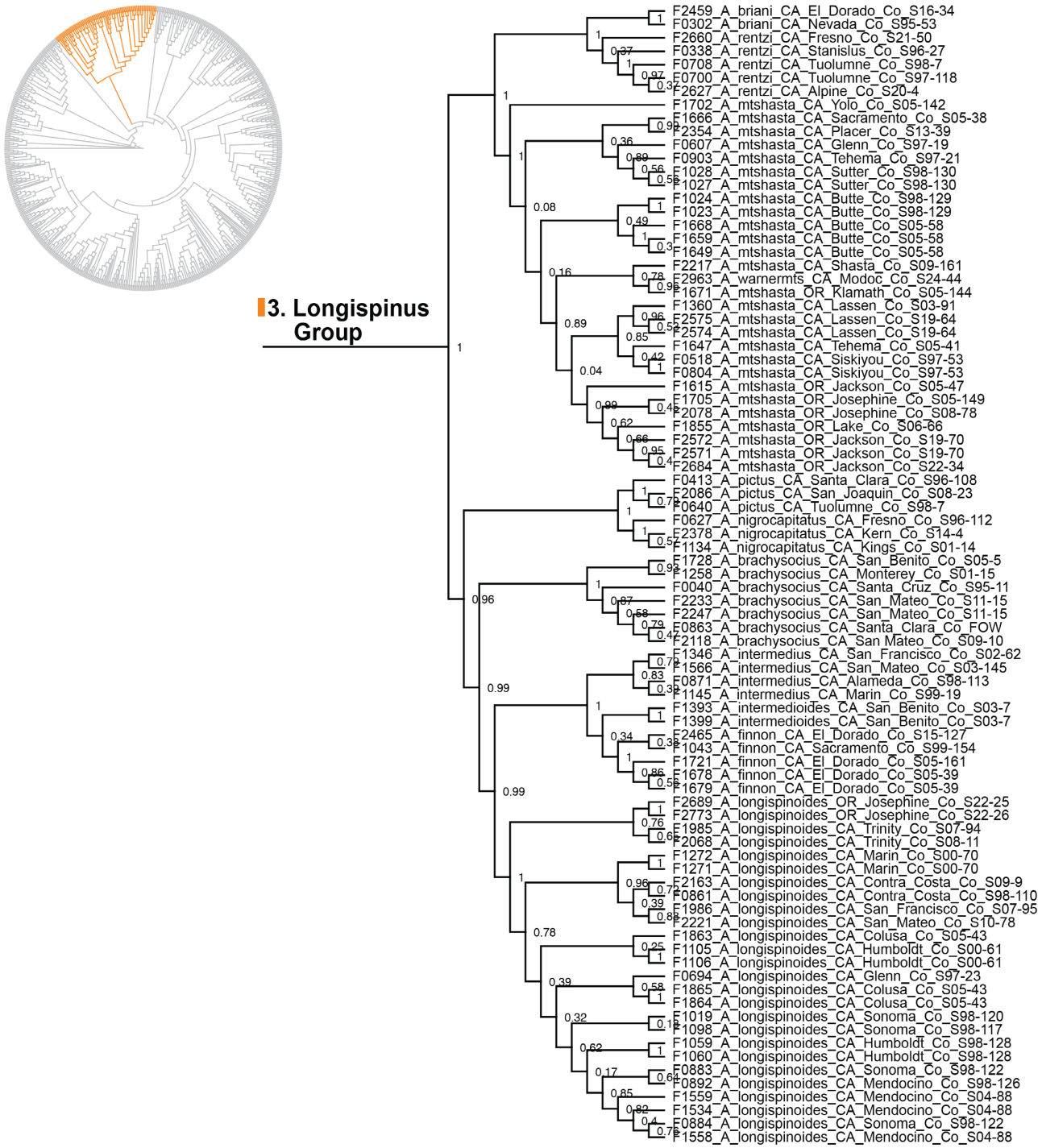


FIGURE 167. ASTRAL tree for Longispinus Group.

The Group has the following characteristics: (1) Restricted to California, Oregon, and Washington, and always in or to the west of the Cascades and Sierras (except for *A. warnermts*). (2) Rear leg calcar #1 always the longest calcar. (3) There are at least 10 distinct genetic subclades, each subclade with its own predominate rear leg tibial spine arrangement (see Summary Table 40, p. 51). (4) All calling drums similar in both sexes of each species, and composed of clustered drums, giving a broken trilling pattern. Number of drums in female trill frequently less than in male trill. (5) Almost always dark colored, even when living in coastal sand dunes (e.g., MacKerricher State Park). Exceptions to this dark color are seen in *A. warnermts*, and the reddish ecomorph of *A. intermedius* from Marin Co. (6) In the 4 species with the largest individuals (*A. brachysocius*, *A. finnon*, *A. longispinoides*,

and *A. mtshasta*), the sexes are dimorphic for hind femur length, which are longer in males than in similar sized females (see Weissman *et al*. 2008). (7) 2n♂=25 typical karyotype, except for *A. intermedius* where 2n♂=23. (8) Megacephalism rare or unknown. (9) Some taxa with thick antennae. (10) Last instar males have a prominent ridge hook, many with an obvious overhang. (11) Hooks in adult males larger than in other groups. (12) Contains the few species that stridulate, although rarely heard even in this group.

DNA was critical for helping to figure out the relationships, and distinguishing characters, amongst the three similarly-drumming, largest taxa of *A. finnon, A. longispinoides*, and *A. mtshasta.* Specifically, the rear leg tibial spine pattern is 4 inner and 3 outer in *A. finnon*; 5 inner and 2 outer in *A. longispinoides;* and 5 inner and 4 outer in *A. mtshasta*. The fourth large species in the Longispinus Group, *A. brachysocius*, with 4 inner and 2 outer spines, but it has a unique calling drum for the Group (see Fig. 174 below).

SPECIES WRITE UPS: *A. brachysocius* (p. 137); *A. briani* (p. 145); *A. finnon* (p. 150); *A. intermedioides* (p. 155); *A. intermedius* (p. 160); *A. longispinoides* (p. 170); *A. longispinus* (p. 182); *A. mtshasta* (p. 184); *A. nigrocapitatus* (p. 193); *A. pictus* (p. 202); *A. rentzi* (p. 211); and *A. warnermts* (p. 218).

Ammopelmatus brachysocius **Weissman, sp. nov.**

Jasper Ridge Jerusalem Cricket
Figs 168–182, Tables 4, 11, 12, 22, 40

Species #18, Weissman 2001b.
Weissman *et al.* 2008.
Strauß & Lakes-Harlan (2008), and Strauß (2017).

Distribution. (Fig. 168). Restricted to 7 counties around and near the southern portion of San Francisco Bay, California.

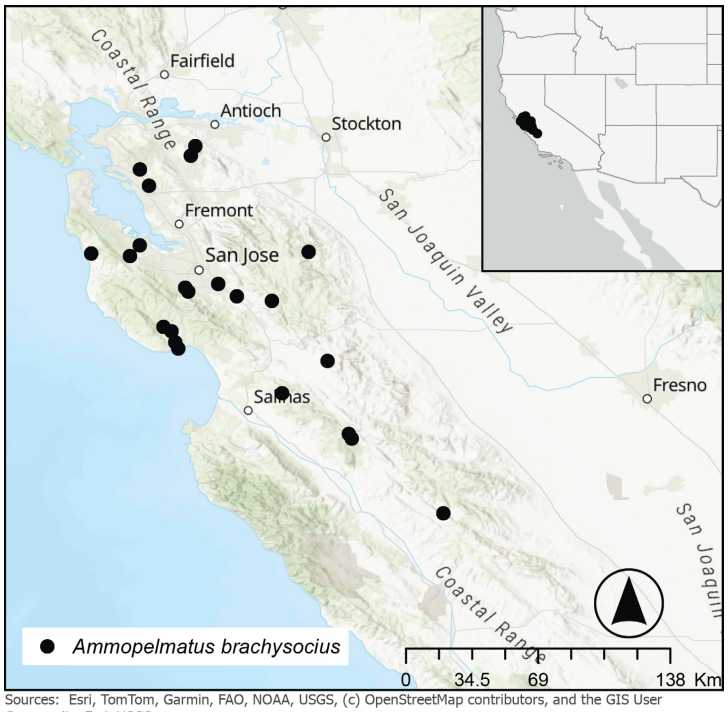


FIGURE 168. Known distribution of *A. brachysocius.*

Recognition characters. Only species in the Longispinus Group, where taxa normally just trill, whose calling drum starts with trills and then transitions to single drums. A small to large species, 2n♂=25, male calcars longer and more developed than those of female (compare Fig. 170 with Fig. 172 below).

While the distributions of morphologically similar *A. brachysocius* and *A. longispinoides* broadly overlap in

the Mt. View-Palo Alto part of the San Francisco Bay Area, they are not known to be microsympatric anywhere, although their different calling drums (only trills in *A. longispinoides*) could act as a premating barrier. The 2 taxa can be separated by number of inner rear leg tibial spines: there are 3 or 4 in *A. brachysocius* vs 5 in *A. longispinoides* due to the consistent addition of 1 spine closest to calcar #1 that does not occur in *A. brachysocius*. The 2 taxa also differ in DNA.

Holotype. Male (in alcohol, Fig. 169): **California, *San Mateo Co.,*** Woodside, Stanford University's Jasper Ridge Biological Preserve, 37.400489° -122.211569°, 161m, 1-xii-1984 (S84-78) DBW. R85-76. Molt to adult 17-x-1985. Deposited CAS, Entomology type #20067. Measurements in mm: Body length 35.12, hind femur length 12.2, hind femur width 4.62. Fore tibia with 3 ventral spurs, middle leg tibia with 8 calcars, hind tibia (Fig. 170) with 4 inner, 3 outer, and 2 ventral spurs.

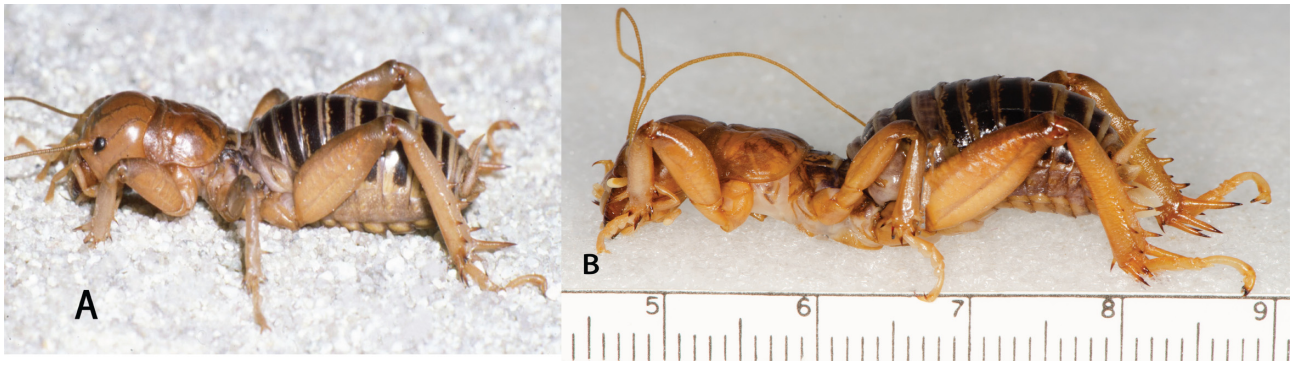


FIGURE 169. Holotype adult male *A. brachysocius.* A. When alive. B. When preserved.



FIGURE 170. Left rear leg tibia holotype male *A. brachysocius*. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 171): same data as holotype except collected as adult. Deposited CAS, Entomology type # 9085831. Measurements in mm: Body length 33.06, hind femur length 10.21, hind femur width 4.24. Fore tibia with 3 ventral spurs; middle leg tibia with 8 calcars; hind tibia (Fig. 172) with 4 inner spines, 2 or 3 outer spines, and 2 ventral spurs. Ovipositor Fig. 173.

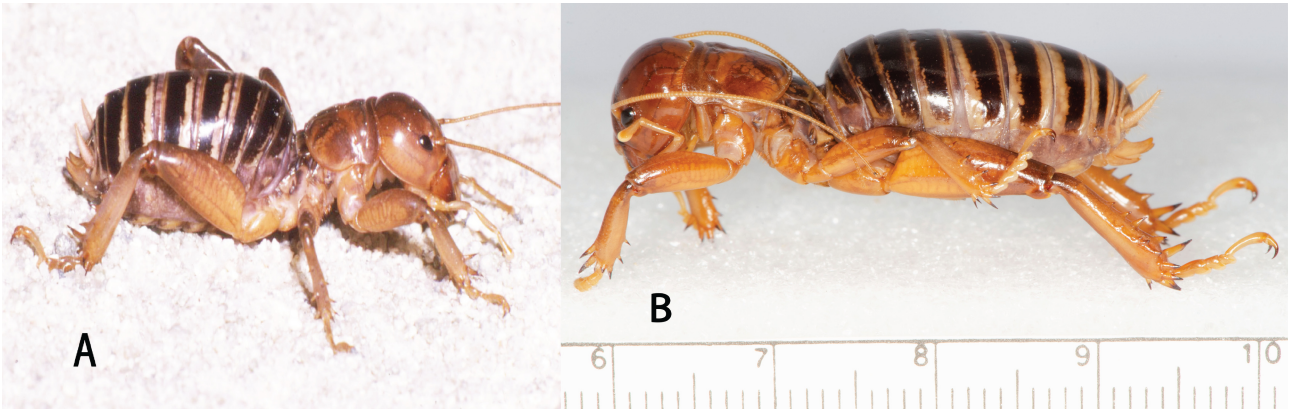


FIGURE 171. Allotype adult female *A. brachysocius.* A. When alive. B. When preserved.

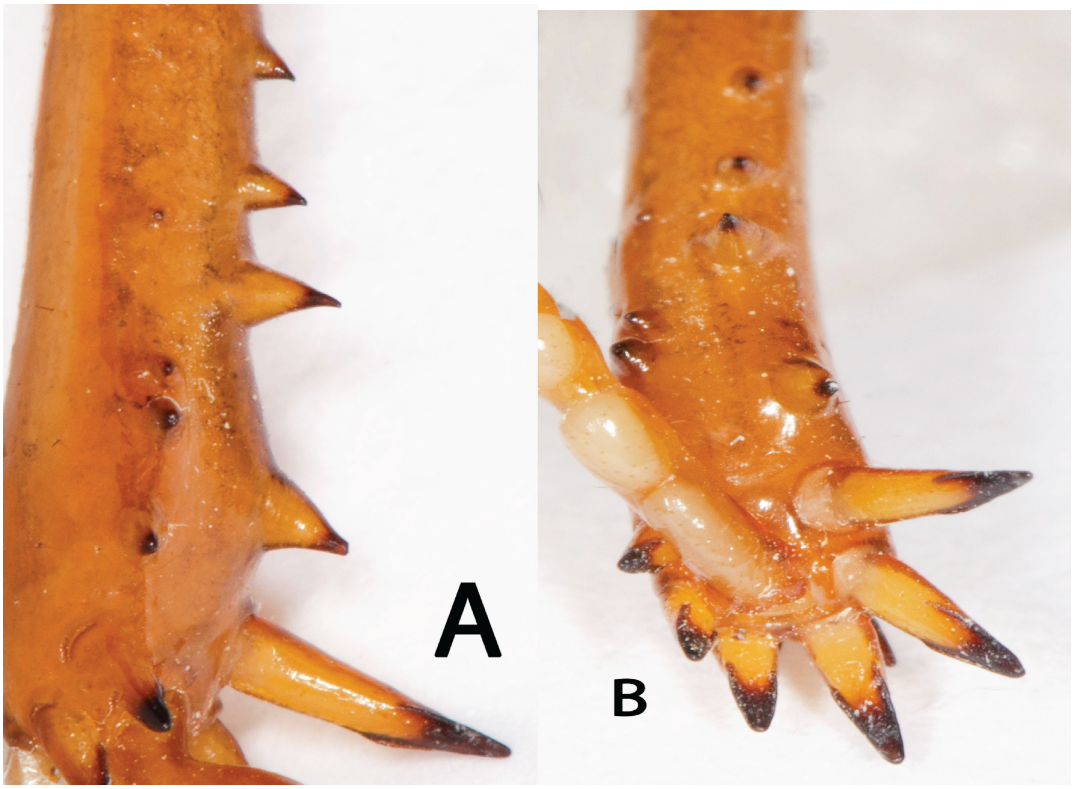


FIGURE 172. Left rear leg tibia adult female allotype *A. brachysocius*. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 173. Ovipositor allotype *A. brachysocius.*

Paratypes. ♂229 ♀155. **CALIFORNIA**, ***Alameda Co.,*** Lake Chabot Dam, 37.7298° -122.1225° 72m, 15-xi-1993 (S93-84) E. Miller ♂1. Piedmont Stables, 6525 Redwood Rd, 37.806301° -122.165011° 246m, 25-x-1993 (S93-96) E. Miller ♀1. ***Contra Costa Co***., Clayton, Russelmann Park Rd., 37.915899° -121.904922°, 255m, 12-iv-2019 (S19-3) ♂1. Mt. Diablo State Park, 2500-3849', 13-vii-1982 (S82-37) ♂1; 30-vi-1990 (S90-61) ♀1; 11-viii-1990 (S90-87) ♂1; 37.870680° -121.926192°, 819m, 13-viii-1991 (S91-99) ♂1 ♀4; 19-ix-1992 (S92-126) 1 male for testes. ***Monterey Co.,*** Hwy 198, 20.2 m E San Lucas, 36.195191° -120.741551°, 710m, 26-ii-2001 (S01-15) ♂1. ***San Benito Co.,*** Fremont Peak State Park, 36.757644° -121.497997°, 817m, 28-xii-1991 (S91-135) ♂1 ♀1; 1-iii-1992 (S92-7) ♂1. Lone Tree Rd. 6.4 m W Fairview, 36.908998° -121.284811°, 479m, 27-xii-1984, TS Briggs, VF Lee, D Ubick (S85-2) ♂1 ♀1. Lone Tree Rd 6.5 m SE Fairview Rd, 36.54542° -121.17115°, 21-iii-2003 (S03-8) ♂1; 6-i-2005 (S05-5) ♂4 ♀2. Panoche Rd. 12.7 m SE Paicines, 36.566881° -121.185059°, 460m, 1-xii-1984 (S84-80) TS Briggs, VF Lee, D. Ubick ♂2 ♀3. ***San Mateo Co.,*** type locality, 21-iii-1982 (S82-4) ♂1 ♀1; 17-iv-1982 (S82-12) ♀1; 6-x-1982 (S82-118) ♂4 ♀1; 11-x-1982, S82-119) ♂3 ♀3; 5-ii-1984 (S84-4) ♂1 ♀2; 3-iii-1984 (S84-11) ♂1; 1-xii-1984 (S84-78) ♂2 ♀2; 2-v-1992 (S92-44) ♂1; 11-iv-2009 (S09-10) ♀1; 27-iii-2011 (S11-15) ♀2. Elkus Youth Ranch, 37.412376° -122.393333°, 115m, 10-vi-1995 (S95-52) KJ Ribardo ♂1. ***Santa Clara Co.***, Coyote Ridge, 37.211931° -121.710283°, 256m, 3-iv-2010 (S10-9) ♂1. Los Gatos, 15431 Francis Oaks Way, 37.234295° -121.938280°, 193m, multiple dates 1986 to 2021, ♂156 ♀61; Wanda Lane near Los Gatos Blvd., 37.252457° -121.952809°, 89m, 31-x-1984 (S84-73) ♂11 ♀10. Los Gatos, Los Gatos Summit Rd, 548m, 1-xi-1992, W. Rush ♂1. Henry W. Coe State Park, 37.190611° -121.545915°, 896m, 6-iv-2013 (S13-2) ♂1. Mt. Hamilton, Mt. Hamilton Rd. from 2.6 to 12.3 m SE Alum Rock Rd. on way to Mt. Hamilton peak, 381-731m, 10-iv-1982 (S82-9, S82-11); 12-vi-1982 (S82-21); 12-xii-1982 (S82-131, S82-132, S82-133) ♂9 ♀9; Mt Umunhum. 37.152823° -121.898778°, 1016m, 7/5/2018 (S18-20), ♀1. Palo Alto, Waverley St. near San Francisquito Creek, 37.450511° -122.165913°, 27m, 15-ix-1985 (S85-106) ♂2 ♀2, BI Weissman; 19-iv-1986 (S86-18) ♀3, BI Weissman; 10-iii-1987 (S87-8) ♂1 ♀1, BI Weissman. San Jose, near intersection Coyote Rd. and 101, 37.269799° -121.797759°, 59m, 1-xii-1983 (S83-154) ♀1. ***Santa Cruz Co.,*** Capitola, Escalona St, 10-i-1991 W. Sakai ♀3. Felton, near Zayante Fire Station, 7710 E. Zayante Rd., 37.068655° -122.054416°, 128m, 17-i-1995 (S95-1) ♀1; 7-ii-1995 (S95-11) ♀7; 1-iii-1995 (S95-18) ♂4 ♀2; 31-iii-1995 (S95-26) ♂1 ♀6; 20-iv-1996 (S96-24) ♂1; 25-iv-1998 (S98-33) ♂1 ♀6; 23-iv-2003 (S03-23) ♀2. Santa Cruz, 25-xi-1981, ♀3; 10-vii-1982 (S82-41) ♀1; 5-vii-1982 (S82-43) ♂1; 36.967333° -121.985115°, 23m, 11-xii-1983 (S83-158) ♂3 ♀6; 18-xi-1984 (S84-76) ♂1; 1-iii-1995 (S95-18) ♂3 ♀2. DeLaveaga Park, Disc Golf course, 36.996368° -121.999363°, 130m, 26-xi-2012 (S12-122) ♂1 ♀1. Scotts Valley, 37.048344° -122.016828°, 172m, 1-viii-1983 (S83-108) ♂1.

Probable placement. **CALIFORNIA, *Stanislaus Co.,*** Frank Raines County Park, Del Puerto Canyon,

37.420253° -121.373677°, 345m, 10-iii-1985 (S85-24, R85-37), ♀1. This large female molted to adult on 8-ix-1985. Her calling drum was trills transitioning to single drums at a rate of 3.8 drums/s at 18.5°C. She has 4 inner and 3 outer rear leg tibial spines, all consistent with *A. brachysocius*, even if somewhat disjunct in distribution. Unfortunately, no DNA was available for analysis.

Drum. Calling drum similar in both sexes although longer in females. A species' unique combination of from 2–11 introduction trills that transition to single drums. In many cases, the trills do not contain distinctive substrate drums. Adults also drum well at 12°C, or cooler, since natural adult activity is most pronounced in fall and winter with the advent of cold rains. **Male**: Mt Diablo, S90-87, R90-49 (Figs 174 & 175), 19°C. 5 long, spaced trills over 5.9s of 4–6 drums followed by 65 single drums in 12.0s (5.4 drums/s) at 19°C. **Female**: Los Gatos, Francis Oaks Way, R98-232 (Figs 176 & 177), 3 long, spaced trills at start over 2.5s, with 5–6 drums/trill, then 174 drums over 50.1s (3.5 drums/s) at 18°C.

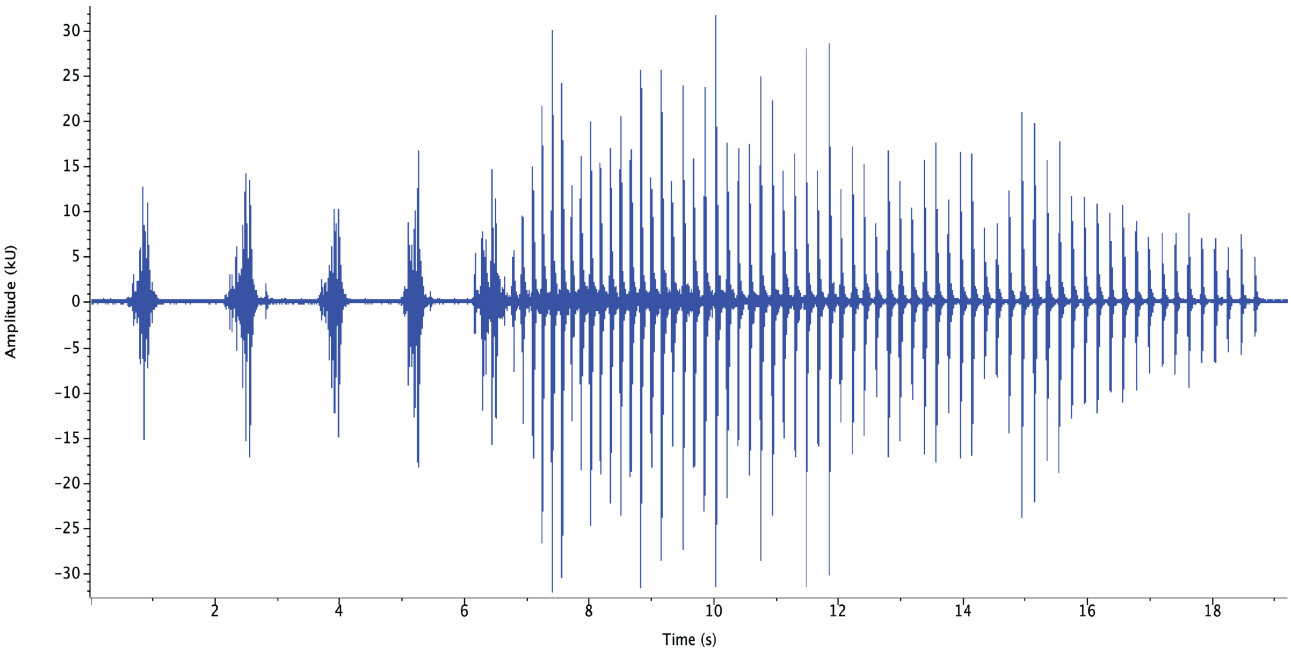


FIGURE 174. Calling drum (R90-49) adult male Mt Diablo showing 5 introductory trills followed by 65 single drums.

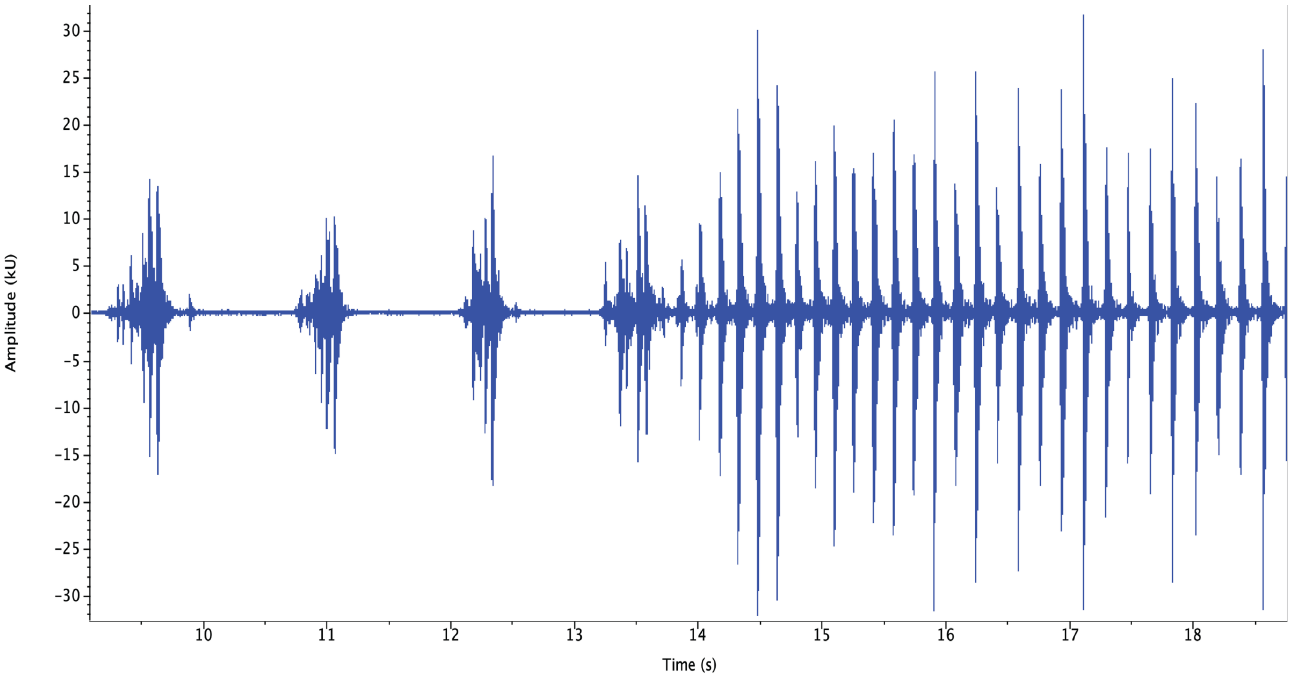


FIGURE 175. Enlarged portion of Fig. 174 showing introductory trills comprised of 5–6 single drums.

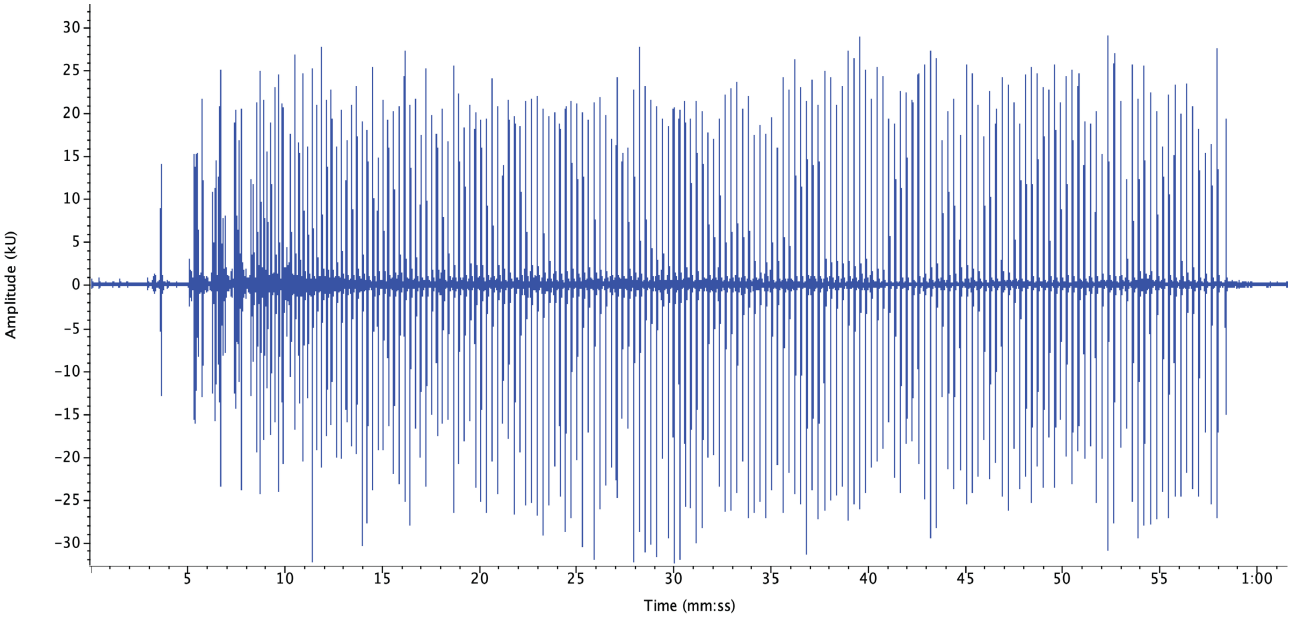


FIGURE 176. Calling drum (R98-232) adult female Francis Oaks Way.

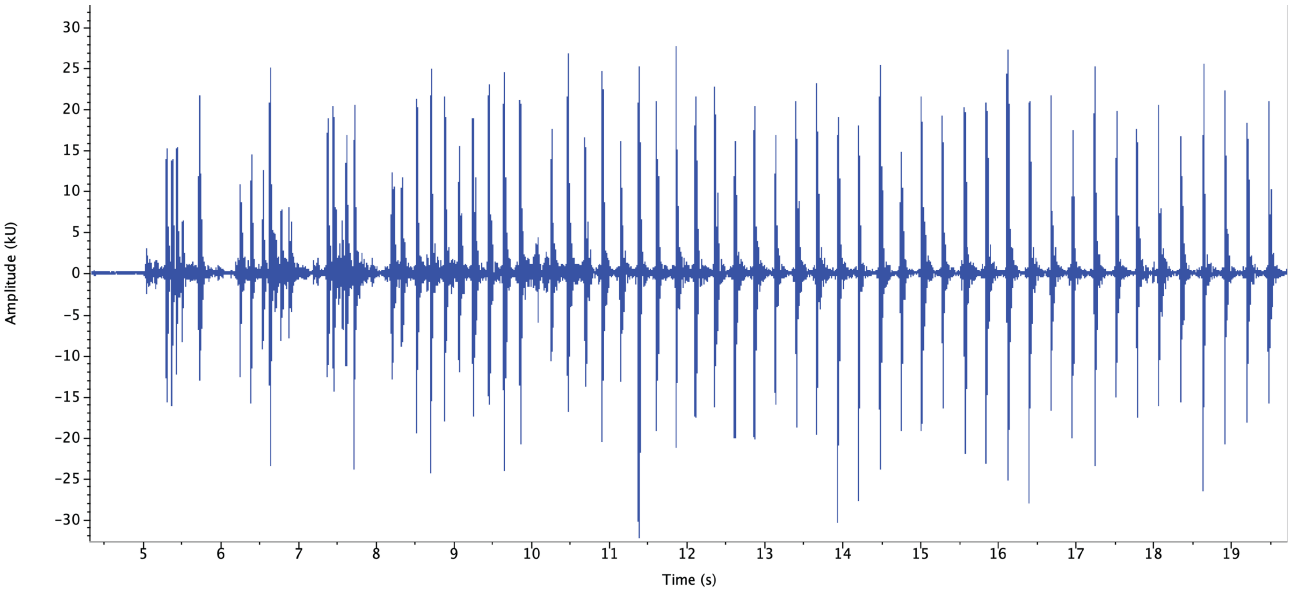


FIGURE 177. Enlarged portion Fig. 176 showing introductory trills of 4–6 single drums.

Derivation of name. "brachy" is Greek for short, and "socius" is Latin for companion, in reference to the fact that small (short) males of this species can mate with more females than can large (longer) males (see Weissman *et al.* 2008).

Habitat. Type locality is semi-open oak woodland-grassland, under rocks on sandstone substrate, where JCs were more common than on adjacent serpentine substrate. Elsewhere in open grassy fields and oak woodland areas. The large number collected at Francis Oaks Way, Los Gatos, Santa Clara Co., reflects wandering adults drowning after falling into a cold swimming pool, during winter, and being nicely preserved until removed. Elsewhere, a Marin Co., California, swimming pool, adjacent to an open space area, was an effective collecting device for multitudes of parasitic Hymenoptera (Zuparko & Schweikert 2020).

Life cycle and seasonal occurrence. Typical 2-year period seen in other species.

Variation. Size differences notable (Fig. 178). Some individuals with redder bodies but such appears unrelated to substrate color. From some 25–30 individuals, all had 3 ventral **fore** leg tibial spurs; all 25 had 8 **middle** leg tibial

calcars, and 2 ventral spurs; of 30 adults, 3 had 3 and 27 had 4 inner **rear** leg tibial spines; 1 had 1, 26 had 2, and 3 had 3 outer **rear** leg tibial spines, all with 2 ventral tibial spurs.

The smallest known individuals are a set of adult field-collected females from the sandhills in Felton, Santa Cruz Co., and their reduced size may reflect the poor nutritional content of the sands there (Fahey 2012).



FIGURE 178. Size variation in adult male *A. brachysocius*, all from Los Gatos, Francis Oaks Way. See Weissman *et al.* (2008) for mating implications for these different sized males.

DNA. Fig. 167, p. 136. F0040 (S95-11, Santa Cruz Co.); F0863 (Francis Oaks Way, Santa Clara Co.); F1258 (S01-15, Monterey Co.); F1728 (S05-5, San Benito Co.); F2118 (S09-10), F2233 & F2247 (S11-15), latter 3 all from type locality Jasper Ridge, San Mateo Co., all recovered in their own subclade within Group 3 Longispinus.

Karyotype. 2n♂=25. Four testes yielded somewhat variable results T92-1 (Fig. 179, type locality S92-44), and T93-14 (Fig. 180, S92-126 Mt Diablo) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X. Two males from the Santa Cruz Mts (S95-18,) T95-8 (Fig. 181) and T95-18 (Fig. 182), also had 2n♂=25, but with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X. We are unsure if these differences represent actual population differences or simply preparation artifacts.

Discussion. Small male mating advantage in *A. brachysocius* was discussed in Weissman *et al.* (2008). This described phenomenon probably occurs in the 4 largest species in the Longispinus Group (see Table 40, p. 51), where the sexes are dimorphic for hind leg length.

There are 3 species of JCs essentially microsympatric at Fremont Peak State Park: Besides *A. brachysocius,* there is also *A. intermedioides* in similar oak woodland habitat under tree cover; and the larger, lighter colored *A. fremontpeak* in adjacent, more open, sometimes grazed grassland. Individuals of *A. brachysocius* from here should have their DNA sequenced, since *A. intermedioides*, and possibly *A. fremontpeak,* is a Fremont Peak endemic.

At S84-73 (Santa Clara Co.), in Los Gatos, sympatric with *A. pictus.* In Felton (S95-26, Santa Cruz Co.), microsympatric with *A. zayante.*

Individuals of this species were used in neurophysiology studies by Strauß & Lakes-Harlan (2008) and Strauß (2017).

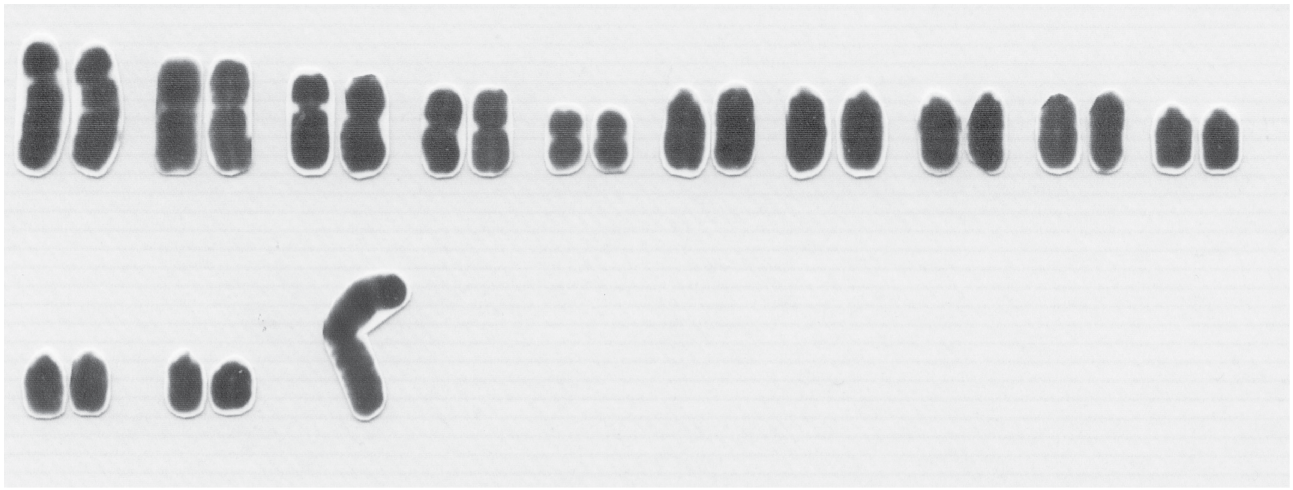


FIGURE 179. Idiogram T92-1 *A. brachysocius* (S92-44).



FIGURE 180. Idiogram T93-14 *A. brachysocius* (S92-126).

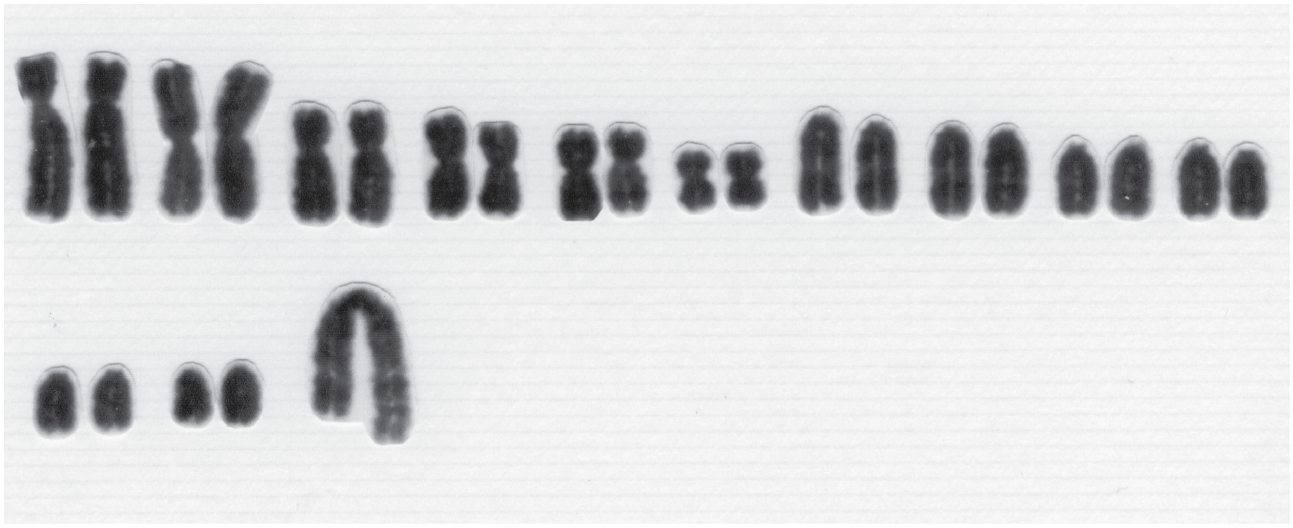


FIGURE 181. Idiogram T95-8 *A. brachysocius* (S95-18).

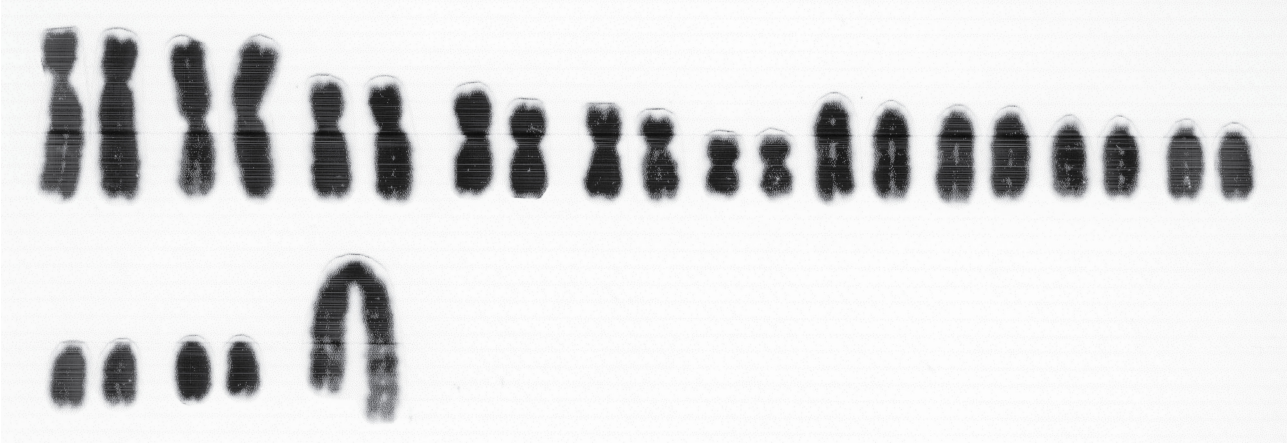


FIGURE 182. Idiogram T95-18 *A. brachysocius* (S95-18).

***Ammopelmatus briani* Weissman, sp. nov.**
Lake Tahoe Jerusalem Cricket
Figs 183–192, Tables 14, 40

Species #5, Weissman 2001b.
Strauß (2017) in studies of the scolopidial accessory organ in JCs.

Distribution. (Fig. 183). Only known from pine forests around Lake Tahoe, in California and Nevada.

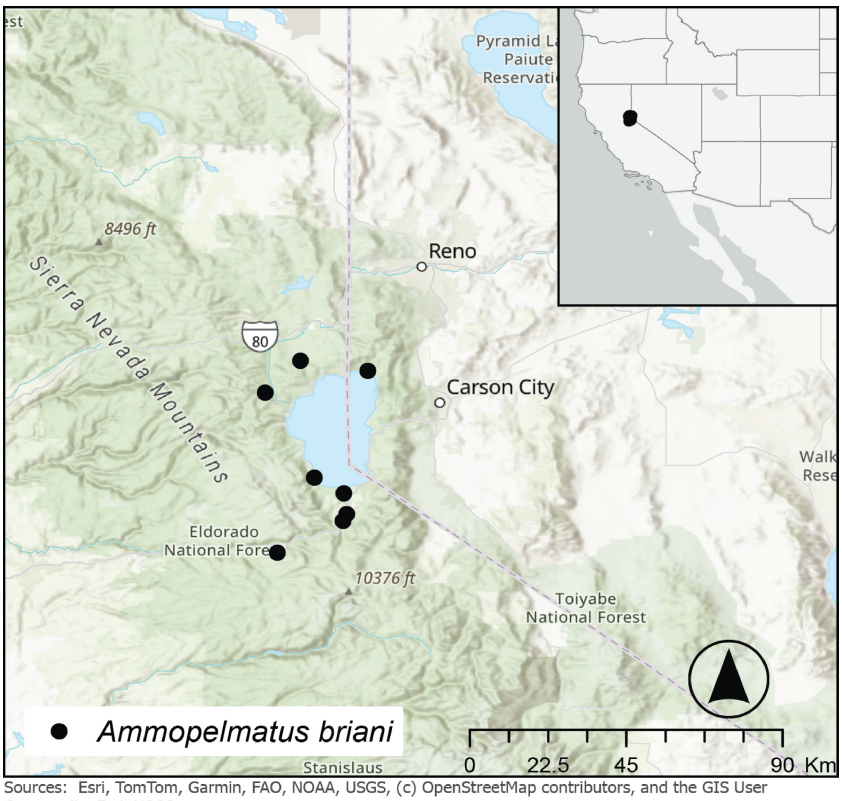


FIGURE 183. Known distribution of *A. briani.*

Recognition characters. Member of Longispinus Group. Small to large sized JCs where males and females have similar calling drum rates of ~0.4 drums/s, around 20°C, but males produce single drums while females combine 2–4 drums into trills. Ovipositor extends beyond abdomen, something also seen in more southern sister species *A. rentzi*, from which it is separated by DNA and drum.

Holotype. Male (in alcohol, Fig. 184): **California, *El Dorado Co.,*** Meyers, near intersection Hwy 50 and Hwy 89, 38.849734° -120.016699°, 1944m, 28-viii-1986 (S86-97) DBW, BI Weissman, DCF Rentz. R86-29. Collected as adult. Deposited CAS, Entomology type #20070. Measurements in mm: Body length 27.92, hind femur length 11.35, hind femur width 4.51. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 185) with 5 inner and 4 outer spines, 2 ventral spurs.

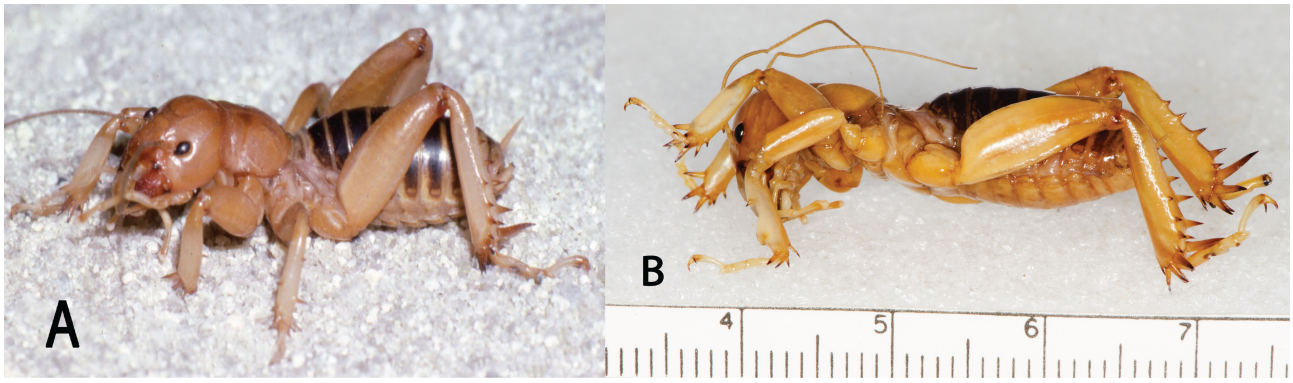


FIGURE 184. Holotype adult male *A. briani.* A. When alive. B. When preserved.

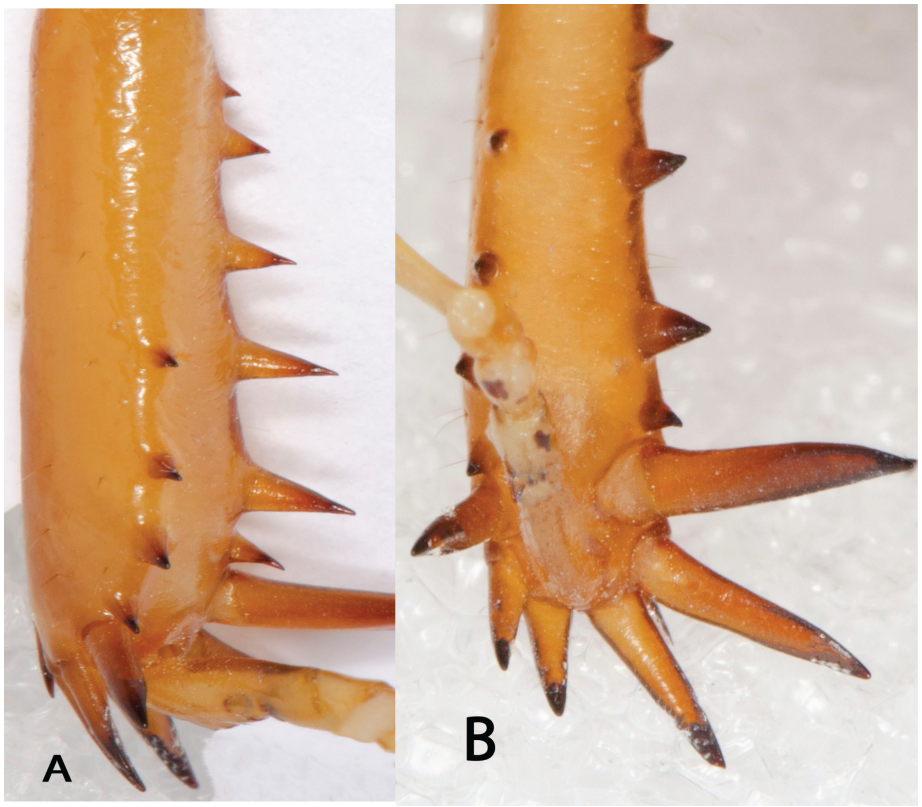


FIGURE 185. Left rear leg tibia in *A. briani.* A. Showing 4 outer and 6 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 186): same data as holotype except R86-31. Collected as adult. Deposited CAS, Entomology type #9085742. Measurements in mm: Body length 37.02, hind femur length 10.87, hind femur width 4.32. Fore tibia with 2 and 3 ventral spurs; middle tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 187) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 188.

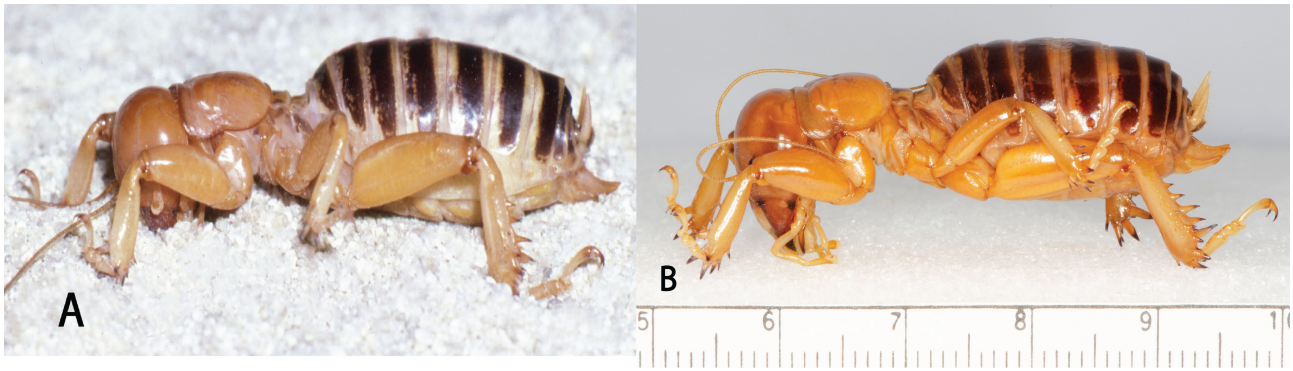


FIGURE 186. Allotype adult female *A. briani.* A. When alive. B. When preserved.

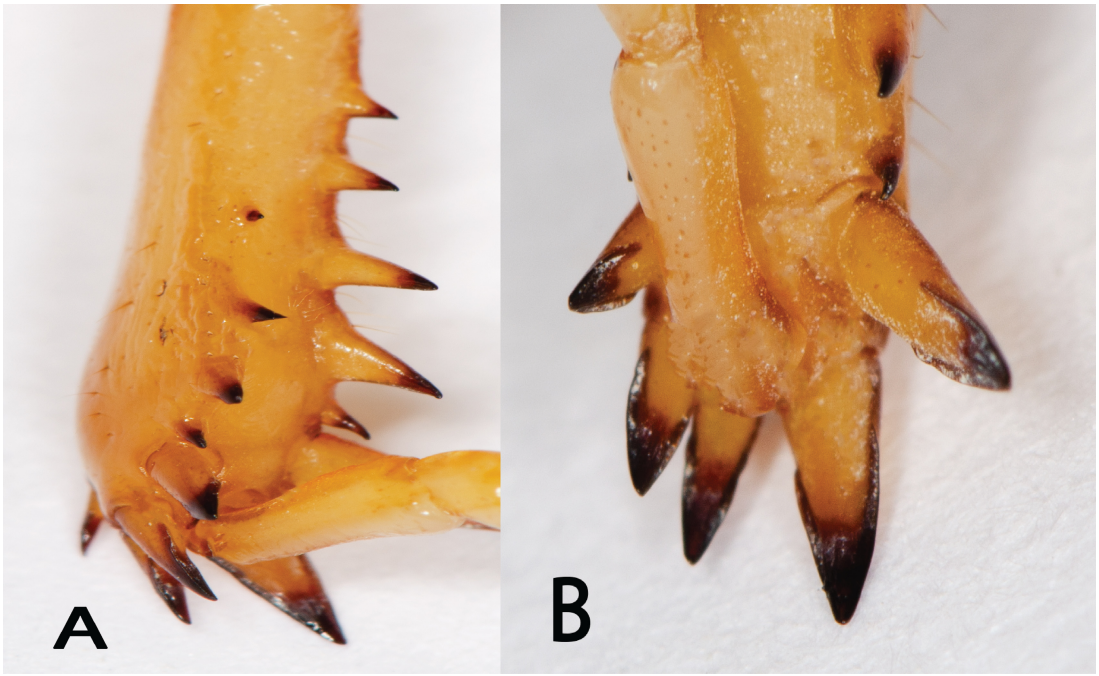


FIGURE 187. Left rear leg allotype *A. briani.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 188. Ovipositor allotype *A. briani.*

Paratypes. ♂30 ♀21. **CALIFORNIA, *El Dorado Co.,*** Type locality, 1-ix-1983 (S83-127) N. Smith, ♂3; 28-viii-1997 (S86-97) ♂1 ♀2; 9-vii-1988 (S88-59) ♀3; 3-viii-1992 (S92-118) ♂2 ♀4; 26-viii-2006 (S06-106) L. Hubbell ♂1. Emerald Bay State Park, Rubicon Trail, 38.964888° -120.090884°, 1904m, 8-vii-2016 (S16-22) DW Weissman ♂1. Hwy 50/89 1.6 m N Meyers, 38.867883° -120.007350°, 1919m, 26-viii-2005 (S05-88) DBW & DC Lightfoot ♂2. South Lake Tahoe, Tahoe Keys, 38.923091° -120.014676°, 1907m, 28-viii-2016 (S16-34) DW Weissman ♂9. SW Kyburz, 38.764854° -120.186576°, 2192m, 4-v-2018 (S18-12) A. Abela ♀2. ***Nevada Co.,*** Glenshire/Truckee, 39.276527° -120.126817°, 1987m, 22-vi-1995 (S95-53) M. Leffler ♀2. ***Placer Co.,*** Squaw Valley, 39.191443° -120.217922°, 2103m, 1-viii-1988 (S88-95) VF Lee ♂1. **NEVADA, *Washoe Co.,*** Incline Village, 39.249683° -119.952685°, 1960m, 10-12-vii-1991 (S91-56) BI Weissman ♂10 ♀8.

Drum. One of only 10 known species (Weissman 2001b, and see p. 25) where females and males have different calling drums, other than the typical difference of female's series being longer than males. This is the only member of the Longispinus Group; while 8 of the 9 other species, with different sex drums, are in the Winchester Group. The 10th species is *A. portal* in the Portal Group. **Male:** R16-5 (Fig. 189, near type locality, S16-34), 21°C: 5 single drums in 11.2s (0.45 drums/s). Near type locality male R16-6, S16-34, 21–21.3°C: 2 series of 4 drums in 9.8s (0.41 drums/s) and 5 drums in 11.5s (0.43 drums/s). In 8 total recordings of 7 males, no male had more that 5 drums in a series and three had only 3. **Female:** R96-94 (Fig. 190, Truckee S95-53), 18.5°C. 8 trills over 20.3s (0.4 trills/s). Trills of 3-4 single drums. Drum rate in trills of 13-16 drums/s at 18.5°C. Others include R91-54, S91-56, 13 trills in 38.0s (0.3 trills/s). Trills of 2-4 drums. Drum rate ~13 at 17.5°C. R91-56, S91-56. 8 trills over 20.5s (0.4 trills/s), trills of 2-4 drums. Drum rate ~15 at 19.5°C. In 7 total recordings of 6 females, no female ever had more than 19 trills in a burst, with a range of 5–19 trills.

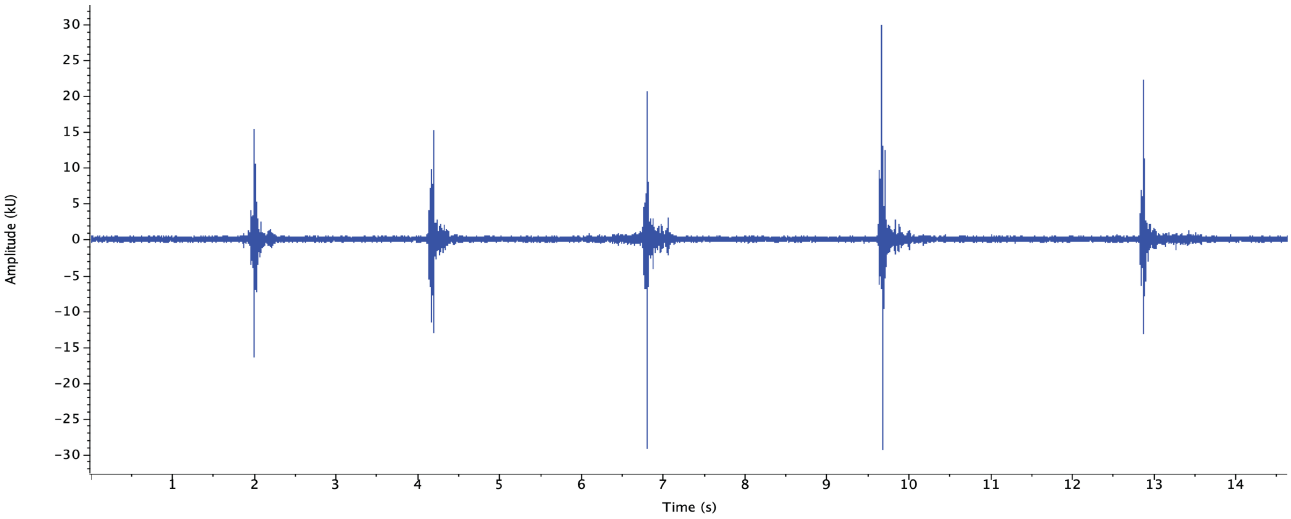


FIGURE 189. Calling drum (R16-5) in paratype male *A. briani.*

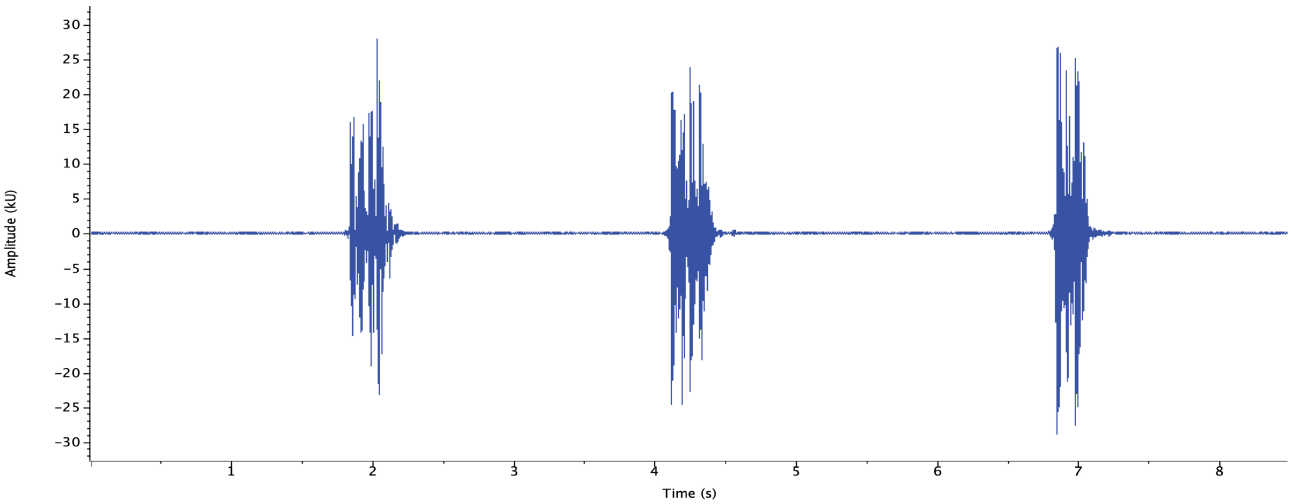


FIGURE 190. Partial calling drum (R96-94) in Truckee female *A. briani.*

Derivation of name. Named in honor of the senior author's son, Brian Weissman, who not only collected the largest series of this species, but who was also a great companion on many field trips, even if such trips haunted by the specter of killer cows and maraudering armadillos.

Habitat. Open pine oak woodland. Readily attracted to oatmeal trails but individuals also under rocks, logs and boards during the daytime in tree covered, shaded areas.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle with field adults starting in July.

Variation. From some 37-43 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 37 had 8 **middle** leg tibial calcars, 36 had 2 and one had 3 ventral spurs; 43 had 5 inner **rear** leg tibial spines, and 43 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Size:** Smallest individuals seen were from Incline Village (S91-56) while the largest females seen were from south of Lake Tahoe (S18-12).

DNA. Fig. 167, p. 136. F0302 (S95-53, Nevada Co.) and type locality F2459 (S16-34, El Dorado Co.) recovered together in their own subclade, along with sister taxon *A. rentzi*, both in larger Group 3 Longispinus.

Karyotype. 2n♂=25. Three testes checked and all similar: T91-8 (Fig. 191, S91-56, Incline Village); T92-57 & T93-20 (Fig. 192), both type locality S92-118, with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

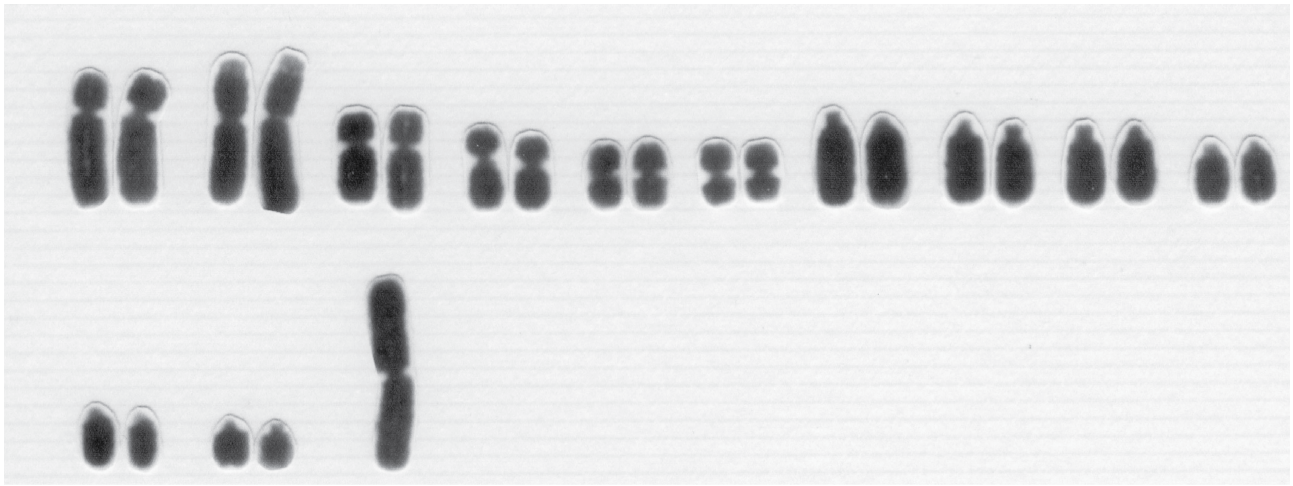


FIGURE 191. Idiogram T91-8 *A. briani* from Incline Village (S91-56).

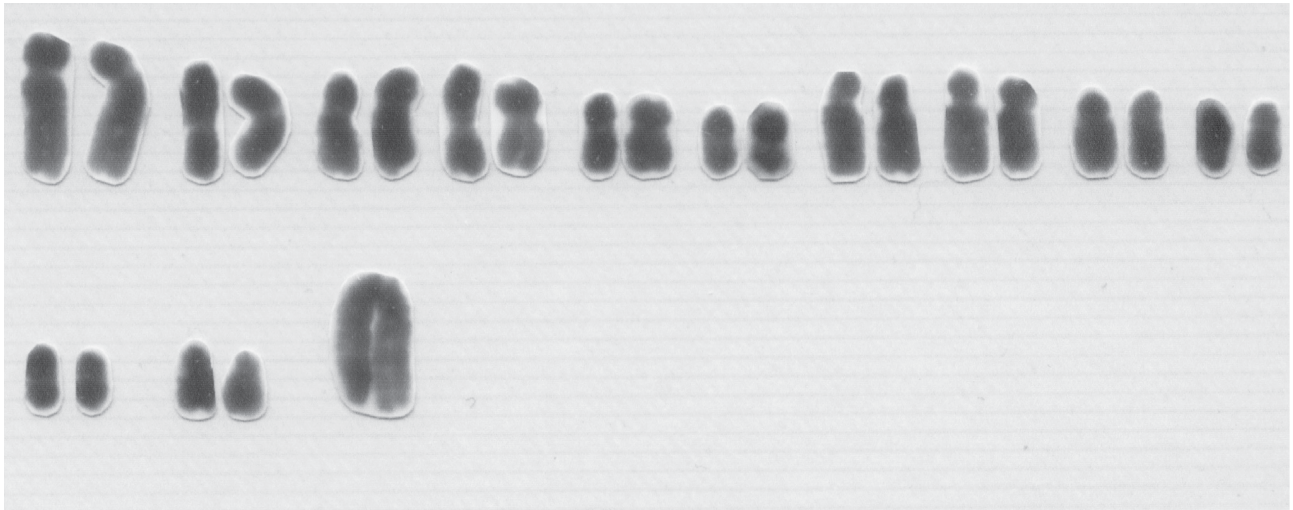


FIGURE 192. Idiogram T93-20 *A. briani* from type locality (S92-118).

Discussion. Separated from more southern sister taxon *A. rentzi* by some 40 km (Meyers to Lake Alpine). This species does not drum well in the laboratory.

***Ammopelmatus finnon* Weissman, sp. nov.**
Finnon Reservoir Jerusalem Cricket
Figs 193–202, Table 40

Distribution. (Fig. 193). El Dorado and Sacramento Counties, California, around Placerville.

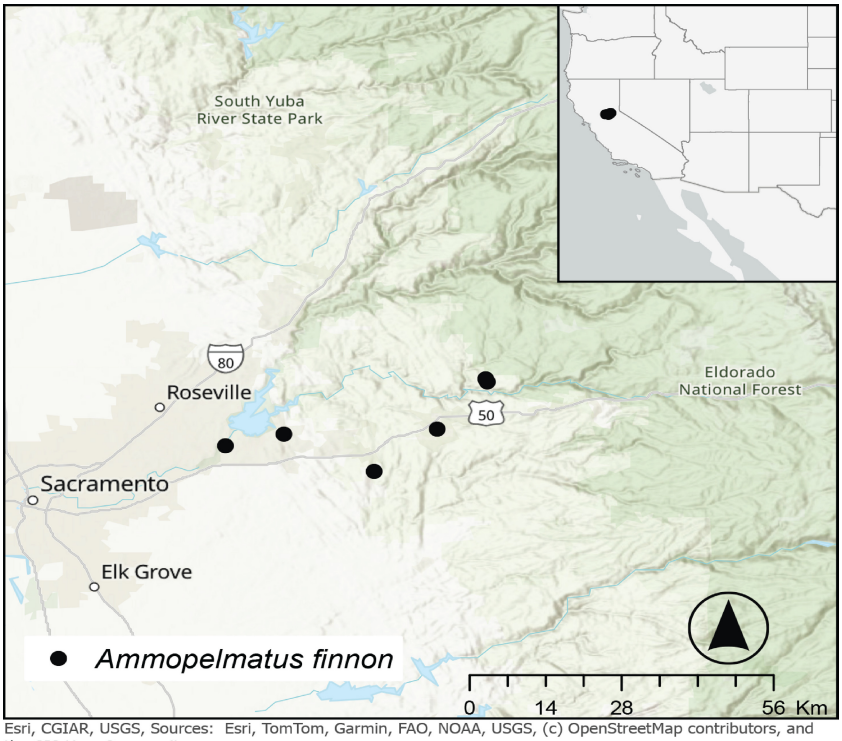


FIGURE 193. Distribution of *A. finnon.*

Recognition characters. Member of Longispinus Group. Maps in same subclade as *A. intermedius* but can be separated from latter by its larger size; inland vs coastal location; DNA; rear leg tibial spine pattern of, generally, 4 inner and 3 outer in *A. finnon* vs 4 inner and 2 outer in *A. intermedius*; and karyotype of 2n♂=23 in *A. intermedius* vs 2n♂=25 in *A. finnon*. Less closely related to similarly sized *A. longispinoides* and *A. mtshasta* but can be separated by its usual 4 inner and 3 outer rear leg tibial spines while *A. longispinoides* has 5 inner and 2 outer spines and *A. mtshasta* has 5 inner and 4 outer spines. Additionally, in the one male of *A. finnon*, from Folsom (S99-154), with 5 inner spines, the most distal spine (spine #1) is not short, as is seen in *A. longispinoides* (see Fig. 237, p. 171), while the 2 adult females (F1043 and F1044) from there have the normal complement of 4 inner spines. *A. finnon* (S99-154) is only 5 km from the closest locality of *A. mtshasta* (S05-38, F1666).

Holotype. Male (in alcohol, Fig. 194). **California**, ***El Dorado Co.,*** Mosquito Road Cutoff 0.7 km SE Finnon Reservoir entrance, 38.79499° -120.74320°, 734m, 29-iii-2005 (S05-39) DBW. R05-100, F1678. Molt to adult 23-ix-2005. Deposited CAS, Entomology type #20106. Measurements in mm: Body length 39.57, hind femur length 14.74, hind femur width 5.48. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 195) with 4 inner and 3 outer spines, 2 ventral spurs.

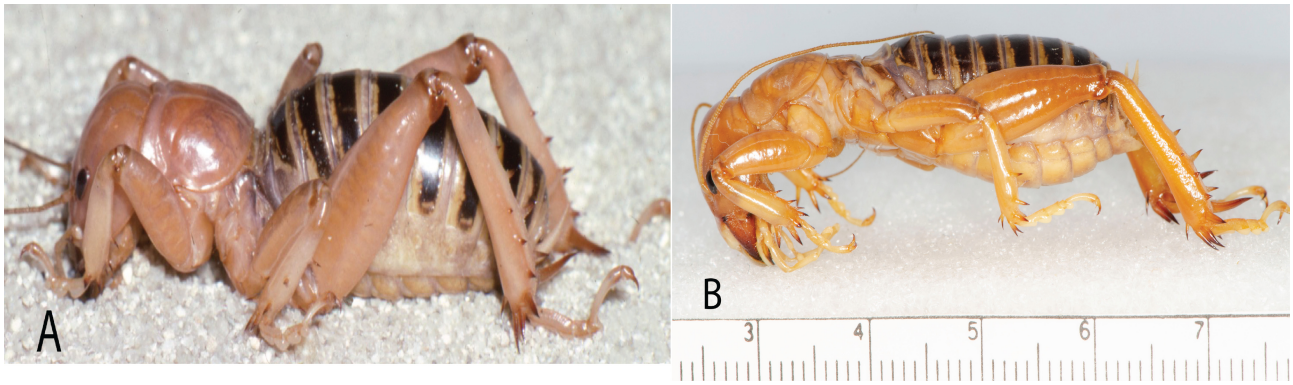


FIGURE 194. Holotype adult male *A. finnon.* A. When alive. B. When preserved.



FIGURE 195. Left rear leg tibia male holotype *A. finnon.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 196). Same data as holotype except R05-155, F1732. Molt to adult 3-x-2005. Deposited CAS, CASENT #8414448. Measurements in mm: Body length 42.2, hind femur length 12.33, hind femur width 4.82. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 197) with 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 198.

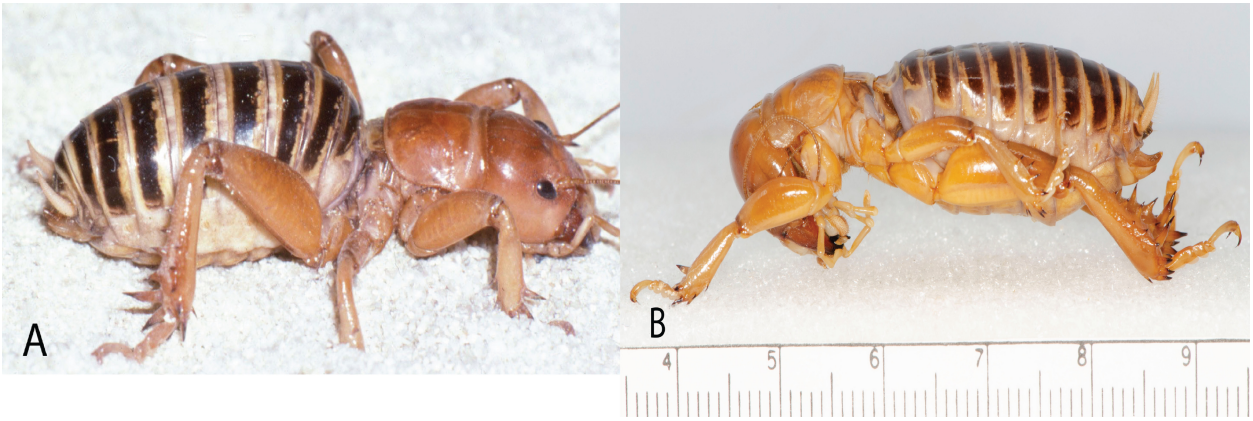


FIGURE 196. Allotype adult female *A. finnon.* A. When alive. B. When preserved.



FIGURE 197. Left rear leg tibia allotype adult female *A. finnon.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 198. Ovipositor allotype *A. finnon*.

Paratypes. ♂11 ♀13 **CALIFORNIA, *El Dorado Co.,*** Type locality, same data as holotype, ♂2 ♀5; 23-iii-2023 (S23-32), 1 male for testes. El Dorado Hills, 2581 Pendleton Dr., 38.698868° -121.079833°, 224m, 31-x-2005 (S05-161) E. Baxter ♂1. Finnon Lake Recreation Area, 10 m NE Placerville, 38.800611° -120.745917°, 747m, 5-6-viii-1995 (S95-62) ♀2. Placerville, 3771 Ellies Alley, 38.708129° -120.826160°, 563m, 3-x-2005 (S05-146) W.

McGann ♂1; 2-18-xi-2006 (S06-126) ♂2; 2-v-2010 (S10-15) ♂1 ♀1; 14-vi-2011 (S11-38) ♂2 ♀1. Shingle Springs, 5130 Holly Dr, 38.630226° -120.930541°, 351m, 26-xii-2015 (S15-127) K. & R. Warner ♂1 ♀2. ***Sacramento Co.,*** Folsom, Old Town Inn, 38.677473° -121.176567°, 72m, 24-x-1999 (S99-154) ♂1 ♀2.

Drum. Calling drum pattern similar in both sexes although initial trills longer in males and drum rate faster in males. **Male:** Holotype, R05-100 (Figs 199 & 200): 5 long trills of 10-21 drums/trill over 5s, then transition to 36 trills, of 2–4 drums/trill, over 18.2s (2 trills/s) with a drum rate of ~28 at 20°C. Topotype male R05-77: 7 long trills over 8.0s of 7–20 drums, then 23 short trills over 10.s (2.3 trills/s), of 3–4 drums/trill. Drum rate ~26 at 21.5°C. **Female:** Allotype, R05-155 (Fig. 201): 2 long trills of 5 & 6 drums over 1.9s, then 66 quick trills of (2) 3 drums/trill over 40.4s (1.6 trills/s), drum rate ~18 at 16°C. Topotype female R06-152: 2 long trills of 4–8 drums/trill over 1.0s, then transition of 5 trills over 2.3s with 3–5 drums/trill, the 98 trills of 3 drums/trill over 57.9s (1.7 trills/s). Drum rate ~16.3 at 20°C.

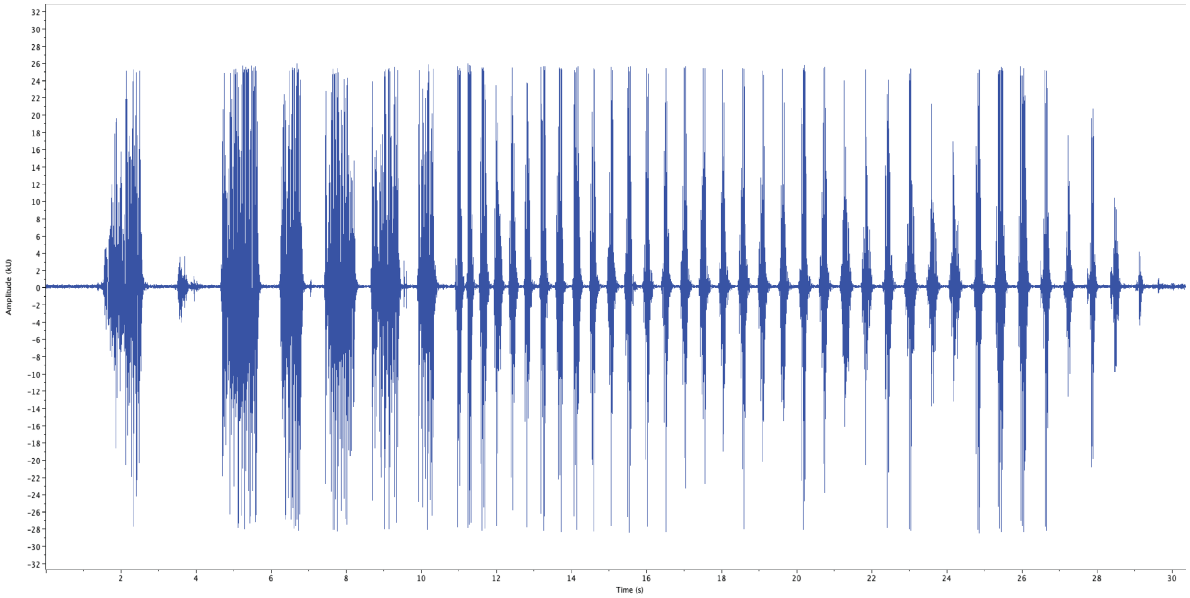


FIGURE 199. Calling drum (R05-100) adult male holotype *A. finnon*.

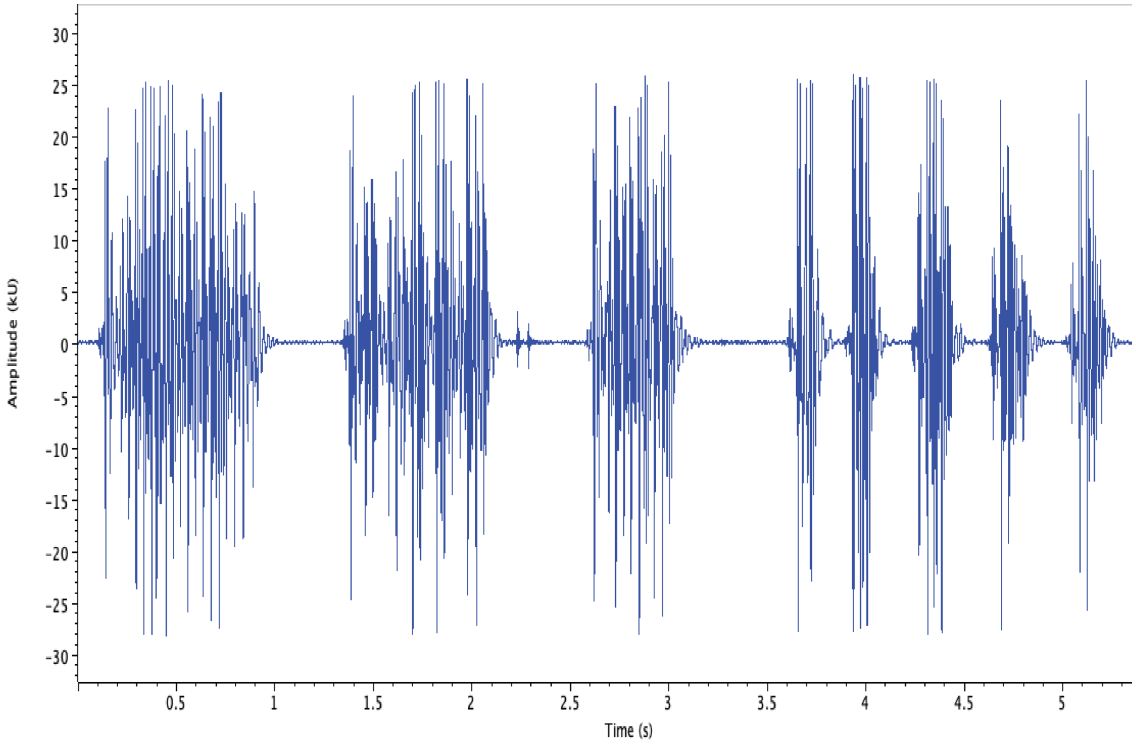


FIGURE 200. Enlarged portion of Fig. 199 showing structure of last 3 long trills and first 5 short trills, from R05-100, holotype adult male of *A. finnon.*

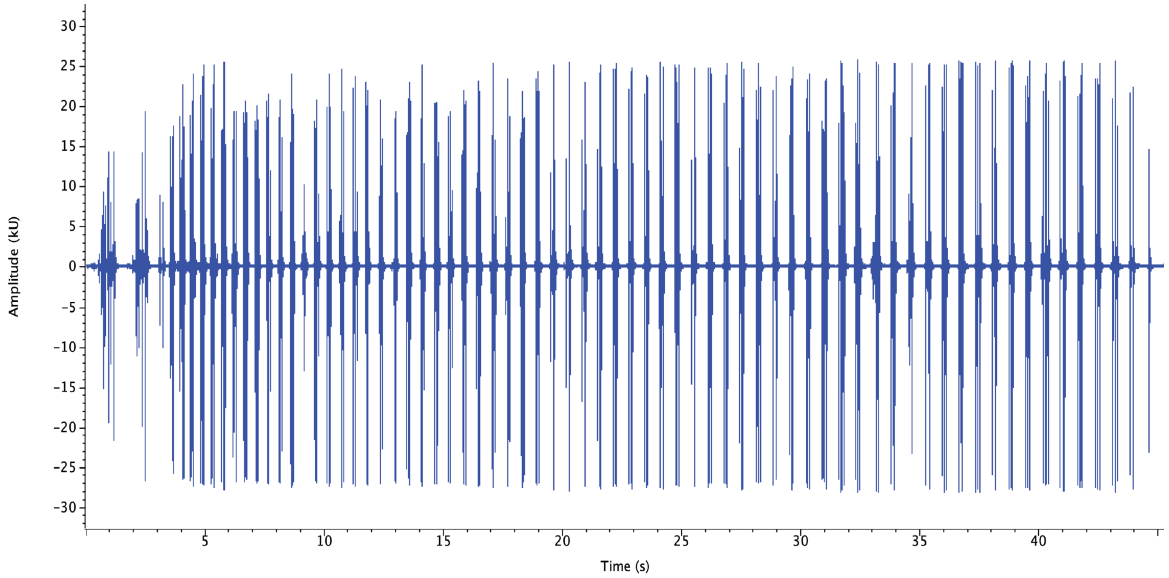


FIGURE 201. Calling drum (R05-155) allotype female *A. finnon.*

Other **male** recordings that document variation in calling drums include: (1) El Dorado Hills (between Folsom Lake and Finnon Reservoir), S05-161, R05-149, with 8 long trills over 10.8s, with 7–10 drums/trills, then 2 or 3 fast transition trills, then 28 short trills over 13.7s (2.0 trills/s) with 3–4 drums/trill. Drum rate ~20 at 17.5°C. (2) Folsom (S99-154, R99-91), with 2 series. First: 6 long, slow trills over 6.6s, then a 3s pause, then 4 transition trills over 2.0s, longest with 7 drums, then 33 short trills over 15.2s (2.2 trills/s) with 3–5 drums/trills, drum rate ~26 at 20.5°C. Second: 4 long trills over 1.9s, then 4 transition over 1.0s, then 29 short trills over 14.1s (2.1 trills/s) of 2–5 drums/trill at 20.5°C. Drum rate ~26/s.

Derivation of name. Named after nearby Finnon Reservoir, where first specimens were collected.

Habitat. Mixture oaks, manzanita, pines, grassland.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle. No specimens, at Finnon Reservoir, on 8-viii-2014 (S14-76) to long oatmeal trail, although shorter oatmeal trail successful on 5-6-viii-1995 (S95-62) in same location.

Variation. Of 25 adults examined, all had 3 **fore leg** tibial spurs; 1 had 7 and 24 had 8 **middle leg** tibial calcars, all with 2 ventral spurs; and 22 had 4 and 1 had 5 **rear leg** inner tibial spines, while 23 had 3 and 2 had 4 outer rear leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 167, p. 136. F1043 (S99-154, Folsom); F1678 (holotype) & F1679 (paratopotype, both S05-39, Finnon Reservoir); F1721 (S05-161, El Dorado Hills); and F2465 (S15-127, Shingle Springs) all recovered in Group 3 Longispinus, and nearest to *A. intermedioides*.

Karyotype. 2n♂=25. T23-1 (Fig. 202) from type locality (S23-32) shows12 metacentric or submetacentric autosomal pairs; 2 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 202. Idiogram T23-1 *A. finnon* (S23-32), stained for C-bands. Note the original cell (on right) from which the idiogram was constructed.

Discussion. Nearby Finnon Lake Recreation Area—Reservoir is the type locality for the decticine katydid *Neduba radocantans* Cole, Weissman & Lightfoot. Finnon Lake Recreation Area is private property that is owned and managed by the Mosquito Volunteer Fire Association (www.gomvfa.org). The conservation prospects of this area are unknown.

Interestingly, the narrow distribution area of *A. finnon* is very similar to the narrow distribution area seen in the field cricket *Gryllus saxatilis* "mormoni" Weissman & Gray (2019). We wonder if there is some historic, vicariant explanation for this coincidence?

***Ammopelmatus intermedioides* Weissman, sp. nov.**

Fremont Peak Trilling Jerusalem Cricket
Figs 203–212, Tables 4, 12, 40

Distribution. (Fig. 203). Known only from Fremont Peak State Park, Gabilan Range, San Benito County, California.

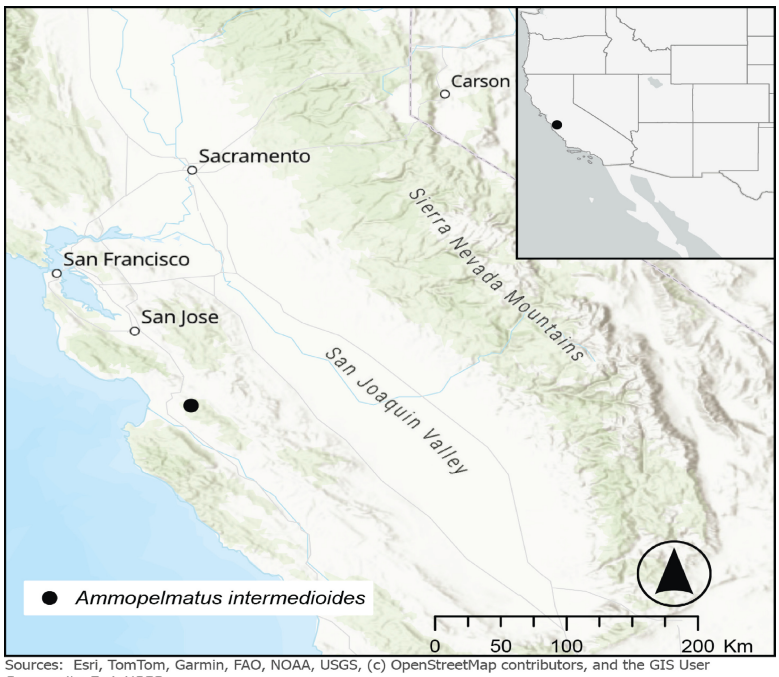


FIGURE 203. Distribution of *A. intermedioides.*

Recognition characters. Member of Longispinus Group. Small, rapid trilling JC that is morphologically indistinguishable from more northern *A. intermedius,* but with distinct DNA and habitat. Known only from Fremont Peak State Park with the nearest population of *A. intermedius* some 100 km NW in San Mateo County, at Edgewood County Park. Occurs essentially microsympatric at type locality with both larger *A. brachysocius* and *A. fremontpeak*, from which *A. intermedioides* differs from both by size, drum, and DNA.

Holotype. Male (in alcohol, Fig. 204): **California, *San Benito Co.,*** Fremont Peak State Park, 36.760167° -121.503000°, 854m, 21-iii-2003 (S03-7) DBW. R03-56, F1393. Molt to adult 1-ix-2003. Deposited CAS, Entomology type #20108. Measurements in mm: Body length 27.22, hind femur length 10.51, hind femur width 3.85. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 205) with 4 inner and 2 outer spines, 2 ventral spurs.



FIGURE 204. Adult male holotype *A. intermedioides.* A. When alive. B. When preserved.



FIGURE 205. Left hind tibia adult male holotype *A. intermedioides.* A. Showing 2 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 206): Same data as holotype except R03-66, F1399. Molt to adult 8-x-2003. Deposited CAS, CASENT #9079392. Measurements in mm: Body length 32.95, hind femur length 9.55, hind femur width 3.75. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 207) with 4 inner and 2 outer spines, 2 ventral spurs. Ovipositor Fig. 208.



FIGURE 206. Preserved allotype adult female *A. intermedioides.*



FIGURE 207. Left rear leg tibia adult female allotype *A. intermedioides.* A. Showing 2 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 208. Ovipositor allotype *A. intermedioides.*

Paratypes. ♂1 ♀5. **CALIFORNIA, *San Benito Co.,*** Same as type locality, 28-xii-1991 (S91-135) ♀1; 1-iii-1992 (S92-7) ♂1 ♀4.

Drum. Individuals have a complex and somewhat variable drum, even in the same specimen. **Male holotype**: R03-56 (Fig. 209), S03-7, 20°C: 13 long trills, 4-7 drums/trill, delivered slowly over 15.4s; followed by 31 short trills, 2-4 drums/trill, delivered rapidly over 13.6s; drum rate ~29/s. **Paratopotypic male** (S92-7) was recorded on two separate occasions: On 29-ix-1992, R92-83, 20.5°C; 17 long trills over 22.1s; followed by 37 shorter trills over 14.8s, although drums/trill not clear. On 6-x-1992, three series were recorded (R92-94 at 22°C); (#1) 8 long trills over 10.1s, with 24 drums in first trill but usually 7–10 drums/trill, rate of 23 drums/s; followed by 24 shorter trills over 9.1s, with 3–5 drums/trill, drum rate of 29.4 drums/s. (#2) 10 long trills over 23.3s, usually 5–8 drums/trill but trill #2 with 14 drums; followed by 27 short trills over 20.1s, with 3–5 drums/trill. (#3) (Fig. 210) 5 long trills over 5.4s, 4–29 drums/trill, longest 29 trills over 1.3s at a rate of 22.3 drums/s; followed by 26 short trills over 9.5s, at a rate of 32 drums/s. **Female allotype**: R03-66 (Figs 211 & 212), S03-07, 13.5°C, 15 long trills, 8–10 drums/trill, delivered slowly over 64s; followed by 112 shorter trills, 3–4 drums/trill, delivered rapidly over 71s, drum rate ~11/s. Allotype recorded 16-xi-2003 when ambient laboratory temperature was considerably cooler than when holotype recorded on 18-x-2003.

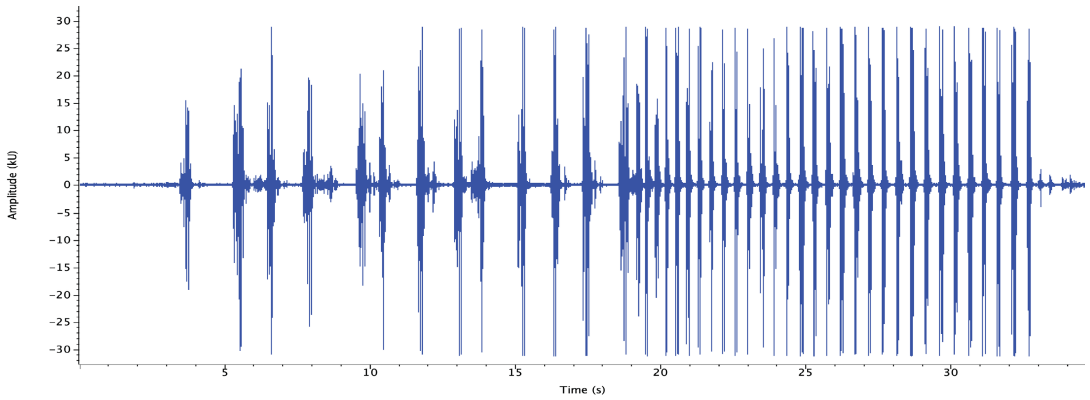


FIGURE 209. Calling drum (R03-56) adult male holotype *A. intermedioides*.

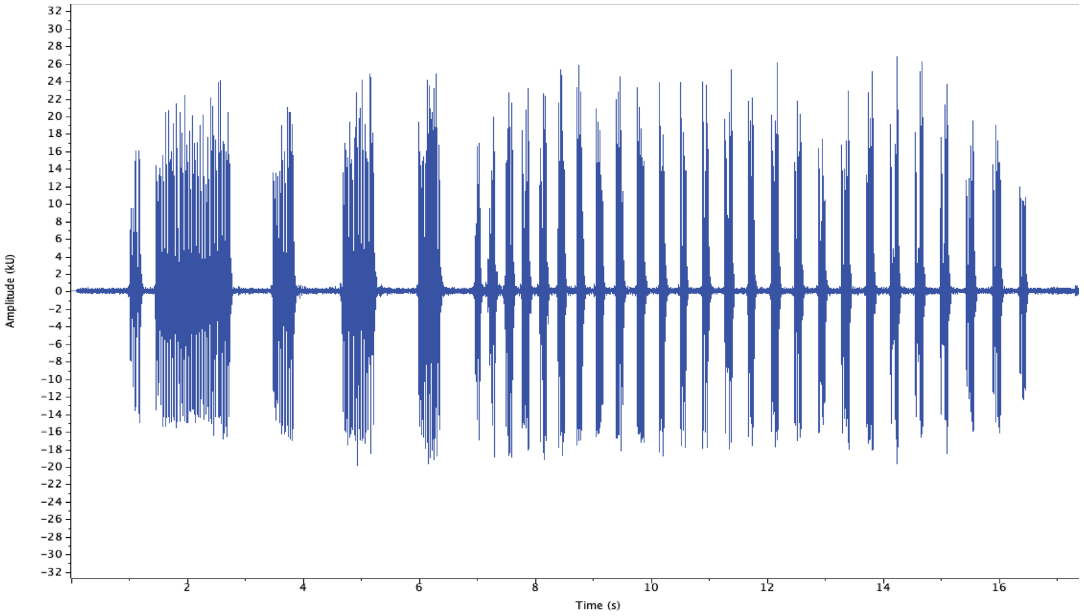


FIGURE 210. Calling drum (R92-94) adult male paratopotype *A. intermedioides*.

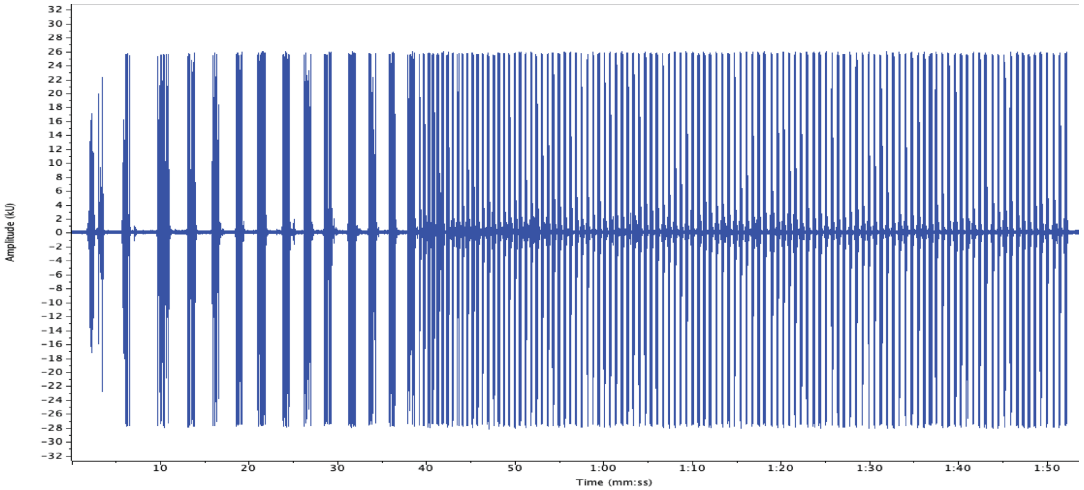


FIGURE 211. Calling drum (R03-66) adult female allotype *A. intermedioides*.

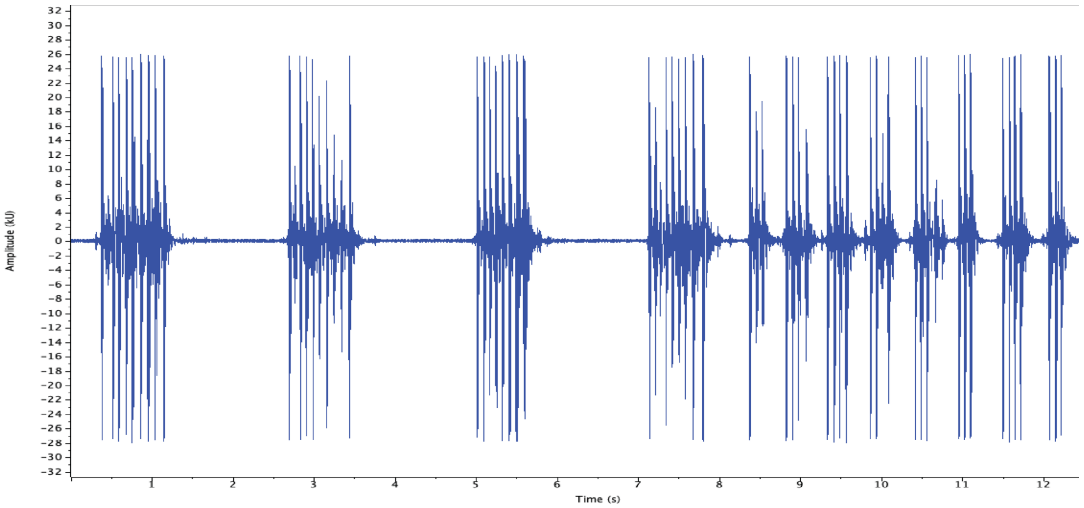


FIGURE 212. Expanded beginning of Fig. 211, R03-66, showing complexity of allotype female calling drum *A. intermedioides*.

Derivation of name. "oides" Greek, for like, in reference to its overall similarity to *A. intermedius*, from which it is distinguished by habitat (mid-elevation oak-woodland vs low elevation, coastal habitat) and DNA.

Habitat. Under rocks in mid-elevation open oak woodland.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For 7 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 6 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 4 inner **rear** leg tibial spines, and 6 had 2 and 1 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 167, p. 136. Topotypic F1393 and F1399 recovered together in Group 3 Longispinus; and closest to *A. finnon.*

Karyotype. Unknown, but of interest since nearest relative *A. finnon* has 2n♂=25; while near relative *A. intermedius* is the only taxon in the Longispinus Group, of 12 species, that has 2n♂=23, while all the other known taxa have 2n♂=25.

Discussion. There are 3 species of JCs essentially microsympatric at Fremont Peak State Park: Besides *A. intermedioides,* there is also the larger *A. brachysocius* in the same oak woodland area under tree cover; and the larger, lighter colored *A. danieli* in adjacent, more open grassland situations. We do not know how to separate the nymphs of *A. intermedioides* and *A. brachysocius*, except by DNA and perhaps by size, since both are of similar dark color with similar leg spination.

***Ammopelmatus intermedius* (Davis & Smith)**

Intermediate Jerusalem Cricket

Figs 213–234, Tables 12, 40

Species #12 Weissman (2001b).

1926. *Stenopelmatus intermedius.* The Pan-Pacific Entomologist, 2, 174–181. Holotype female (Fig. 213A), Oakland, California. Deposited CAS, Entomology type #1875. Davis & Smith (1926) clearly designated the female as holotype, apparently convinced (p. 178) that the ovipositor possessed some diagnostic features (which we have failed to confirm). In any case, Tinkham's subsequent action (1966) of "correcting" the holotype to the male is unjustified and based upon his misconception that the female is always the allotype (similar to what Tinkham [1965] did with *A. kelsoensis*, where his type series included only females and he designated the proper holotype female as the 'allotype').

Allotype male (Fig. 213B) with hooks confirming adult status. Deposited CAS, Entomology type # 1876. We also note that the measurements given by Davis & Smith (1926, p. 179), for body lengths of the types of *A. intermedius*, are too large, and are apparently typos since they are the same lengths given on p. 177, of that same paper, for their *Stenopelmatus fuscus.*

2021. *Ammopelmatus intermedius.* Weissman *et al.* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on rear leg tibial spines, distribution, and DNA.



FIGURE 213. Types of *A. intermedius.* A. Adult female holotype. B. Adult male allotype.

Distribution. (Fig. 214). In 5 counties all adjacent to San Francisco Bay, California. It is not found on any California Channel Island, contra Rentz & Weissman (1981, p. 118).

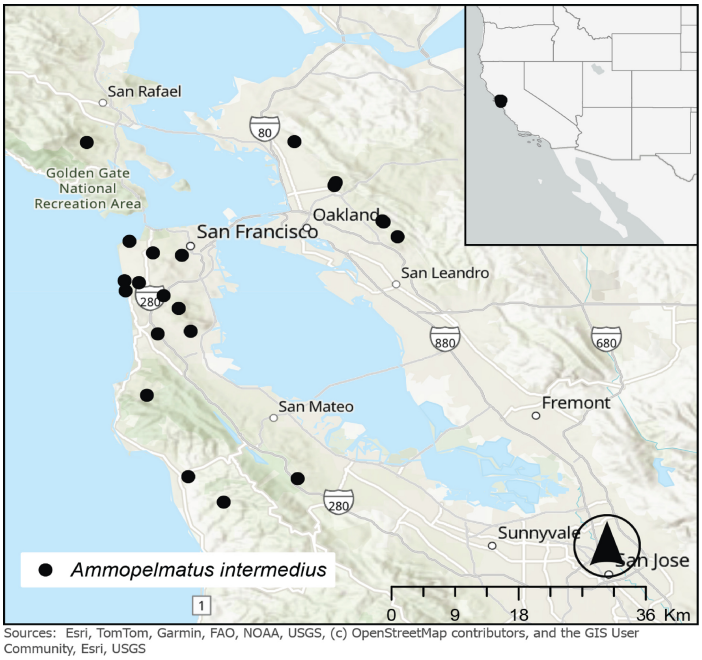


FIGURE 214. Distribution of *A. intermedius.*

Recognition characters. Only member of the Longispinus Group with 2n♂=23. Small to medium sized adults. Calling drum composed of long trills that transition to short trills, with the drum rate the same in each section. Generally dark color (Fig. 215A), although specimens from Marin Co. distinctly reddish (Fig. 215B). Both sexes small (Fig. 216). Adult topotypic female rear leg tibia (Fig. 217) with 2 outer and 4 inner spines. Ovipositor (Fig. 218) not distinctive (contra Davis & Smith 1926).

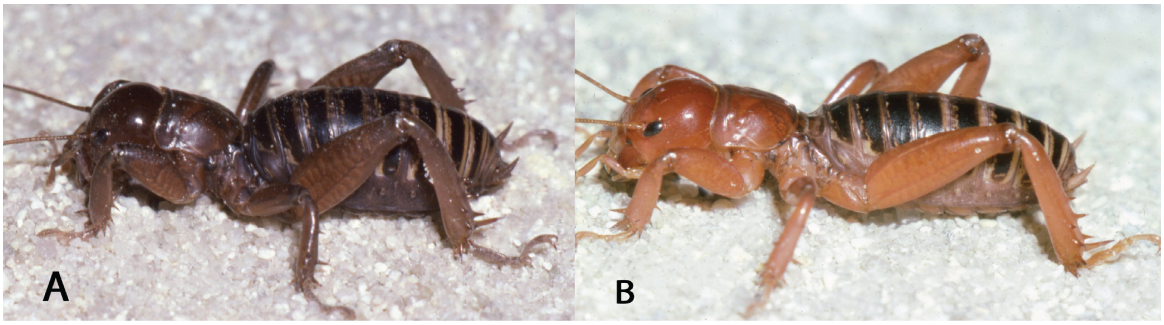


FIGURE 215. Live adult males of *A. intermedius*, showing color variation. A. From El Cerrito, Contra Costa Co. (S85-129, R85-96, R85-99, R85-102). B. From Mill Valley, Marin Co. (S85-110, R85-88).

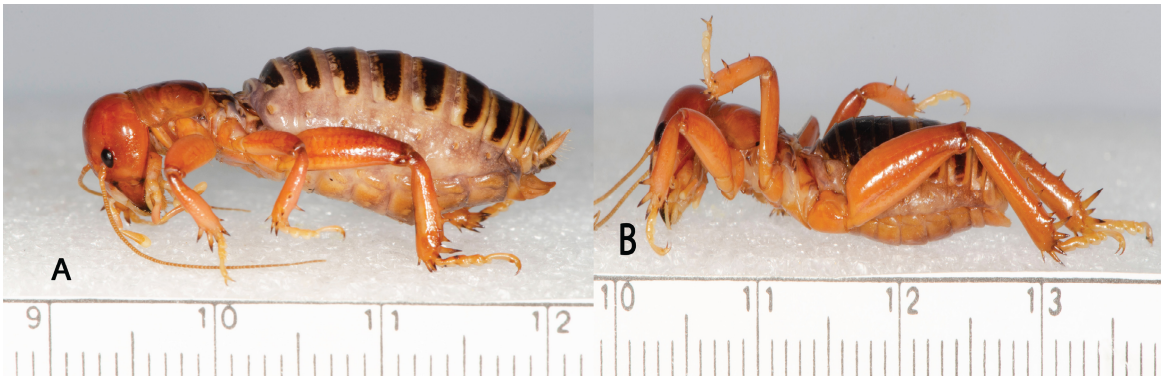


FIGURE 216. Preserved adult *A. intermedius.* A. Female, Mill Valley, Marin Co. (S98-116, F0875). B. Male, Mill Valley, Marin Co. (S85-110, R85-88).

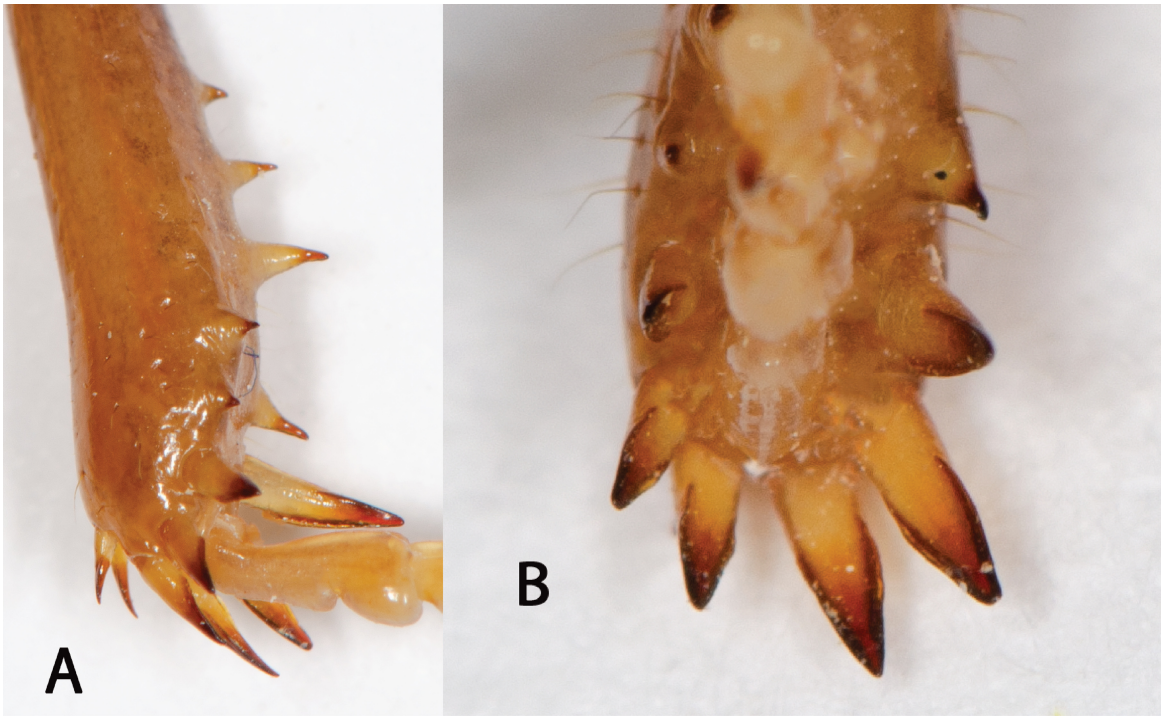


FIGURE 217. Left hind leg tibia topotypic female *A. intermedius* (S98-113, F0872). A. Showing 2 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 218. Ovipositor topotypic female *A. intermedius* (S98-113, F0872).

Male similar to female, including rear leg tibia (Fig. 219) in same Contra Costa Co male as in Fig. 215A.

Most closely related to morphologically and similar-drumming *A. intermedioides*, but separated by DNA and a 100 km distribution gap. Also closely related to *A. finnon*, a larger inland taxon with similar rear leg spines and

a similar drum, but different DNA and karyotype (2n♂=25). Distinguished from occasionally sympatric, more northern, larger (Fig. 220) *A. longispinoides*, by DNA, karyotype (2n♂=25), and rear leg tibial spines of 5 inner and 2 outer configuration. Distinguished from similar sized, more southern *A. bigsur*, by DNA, karyotype (2n♂=25), and drum: Drum in *A. intermedius* goes from long to short trills, with a variable transition section between. In *A. bigsur,* drumming goes from short to long trills.

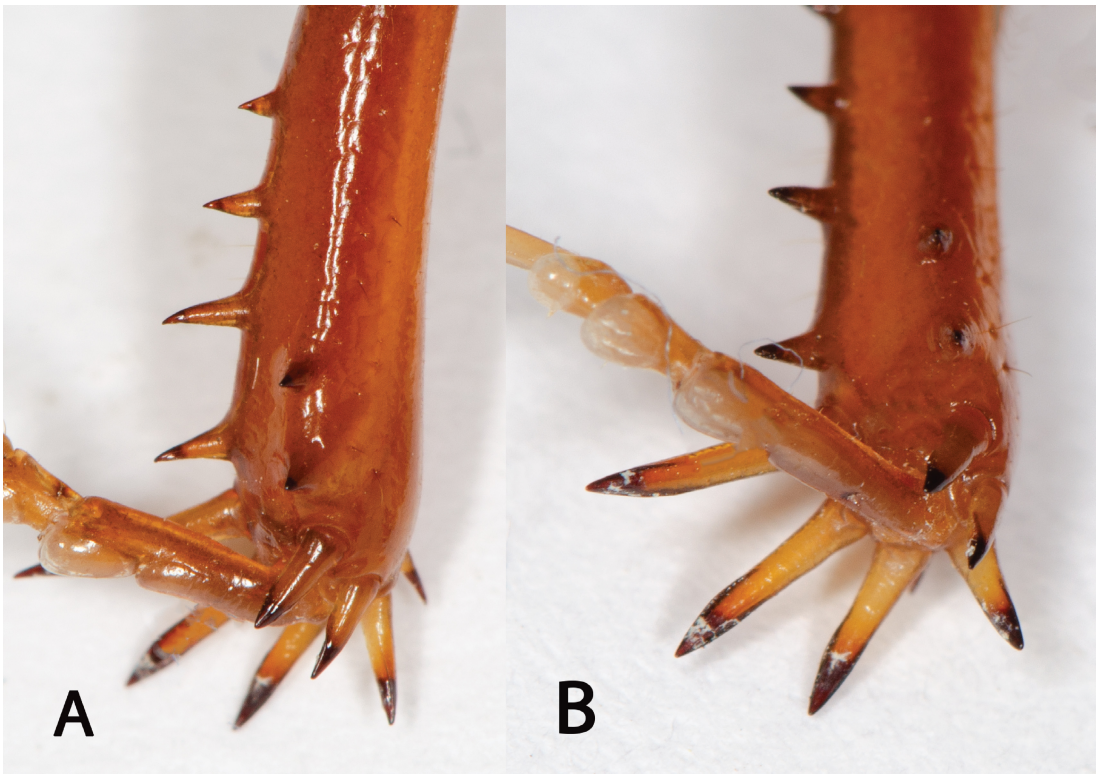


FIGURE 219. Right rear leg tibia same adult male *A. intermedius* as in Fig. 215A (S85-129, R85-96, R85-99, R85-102). A. Showing 4 inner and 2 outer spines. B. Showing shape of calcars.



FIGURE 220. Color and size comparison of sympatric adult males from Pacifica (S12-120): On left, A. longispinoides (R12-40, R12-42, R12-43). On right, A. intermedius (R12-41). A discussion/comparison of their drums is found below.

Drum. Calling drum similar in both sexes and generally composed of 2 or 3 parts. Since the calling drum is somewhat variable, we present recordings from several localities. Type locality **Oakland Hills**, *Male*: R99-10 (Fig. 221 & expanded in Fig. 222), S98-115, 17°C. 5 long, rapid trills (same drum rate as in short trills); then 26 short trills over 15.4s. Short trills of (4) 5 (6) drums, drum rate ~21. **Mill Valley**, *Male*: R85-88 (Fig. 223 & expanded in Fig. 224), S85-110, 20°C. 6 long, rapid trills over 6.7s with around 13 drums/trill; then 7 shorter trills over 2.4s, with (4) 5 drums/trill; then 34 short trills over 17.7s with 4 drums/trill. Drum rate ~27.8–31. **Pacifica**, *Male*: R12-41 (no Fig.), S12-120, 15.5°C: 11 long trills over 11.75s, with 3–11 drums/trill, drum rate ~20; then faster trills over 3.1s; then 61 fast trills over 37.4s of (3) 4 drums/trill with drum rate ~20/s. **Quarry Park**, San Mateo Co, *Female*: R04-132 (Fig. 225 and expanded in Fig. 226), S03-145, 13.5°C. 5 long trills over 2.8s with 3–5 drums/trill; then ~5 faster trills over 1.8s with (2) 3 (4) drums/trill; then ~218 short trills over 124s (1.8 trills/s) with 2 drums/trill. Same *Female* as R04-132: now R05-2 (Fig. 227 & expanded Fig. 228), but warmer at 17°C. 5 long trills over 3.9s with 3–9 drums/trill; then ~9 transition trills of 2–4 drums/trill; then ~255 trills of (1) 2 (3) drums over 115s (2.2 trills/s).

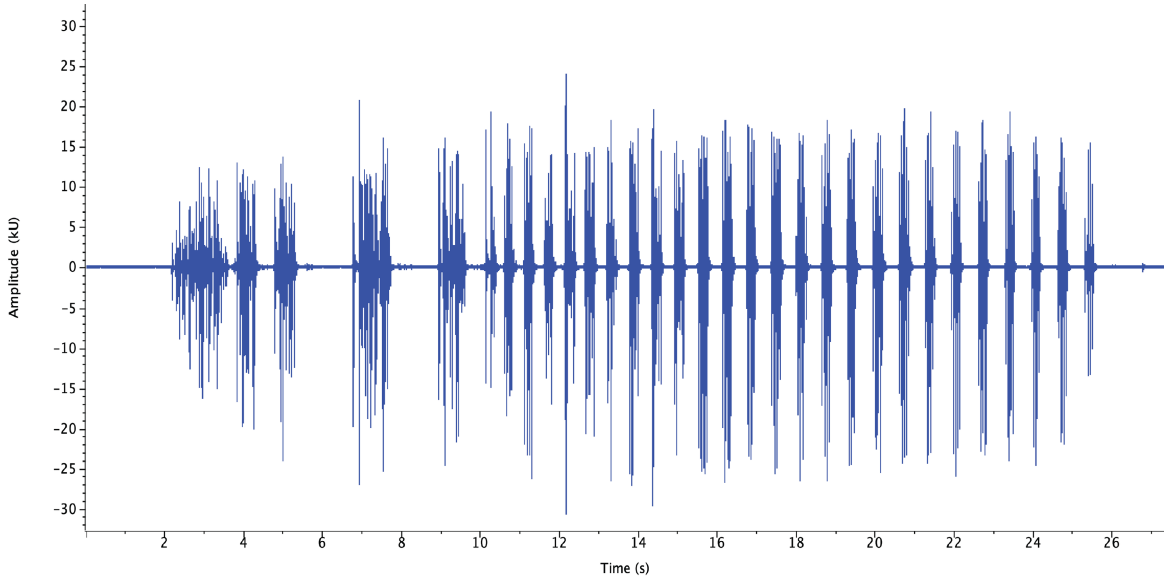


FIGURE 221. Calling drum (R99-10) topotypic adult male *A. intermedius* (S98-115) at 17°C.

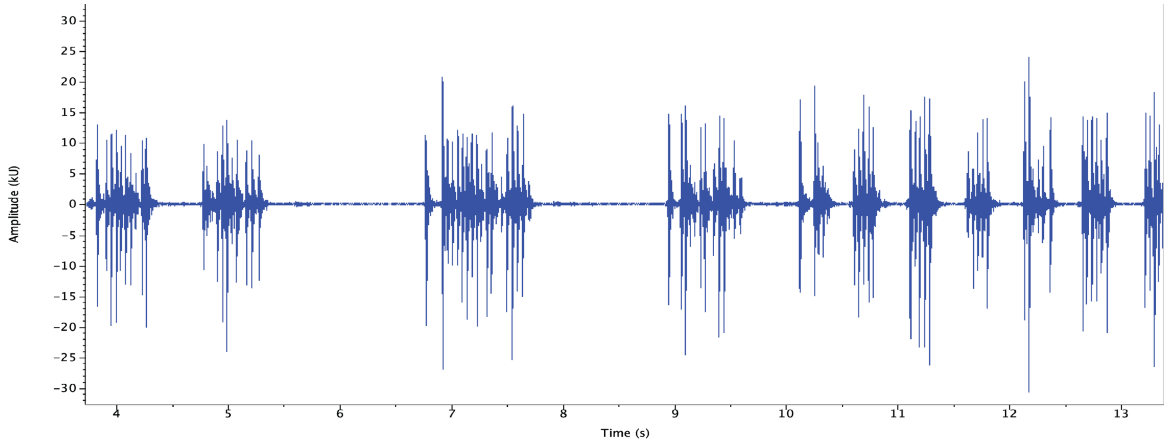


FIGURE 222. Expanded view of Fig. 221, calling drum (R99-10) topotypic adult male *A. intermedius.*

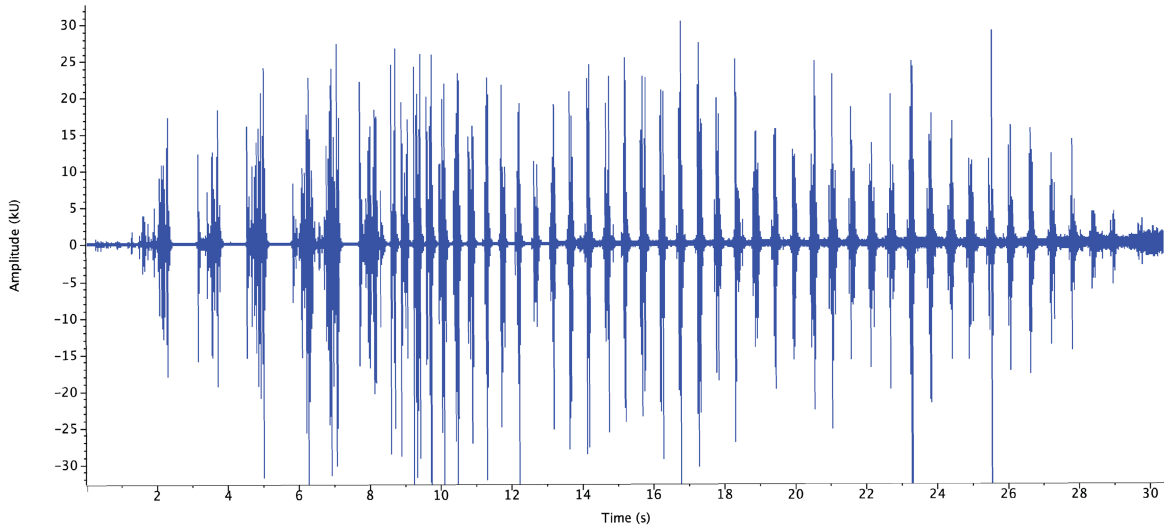


FIGURE 223. Calling drum (R85-88) Mill Valley adult male *A. intermedius* (S85-110), at 20°C.

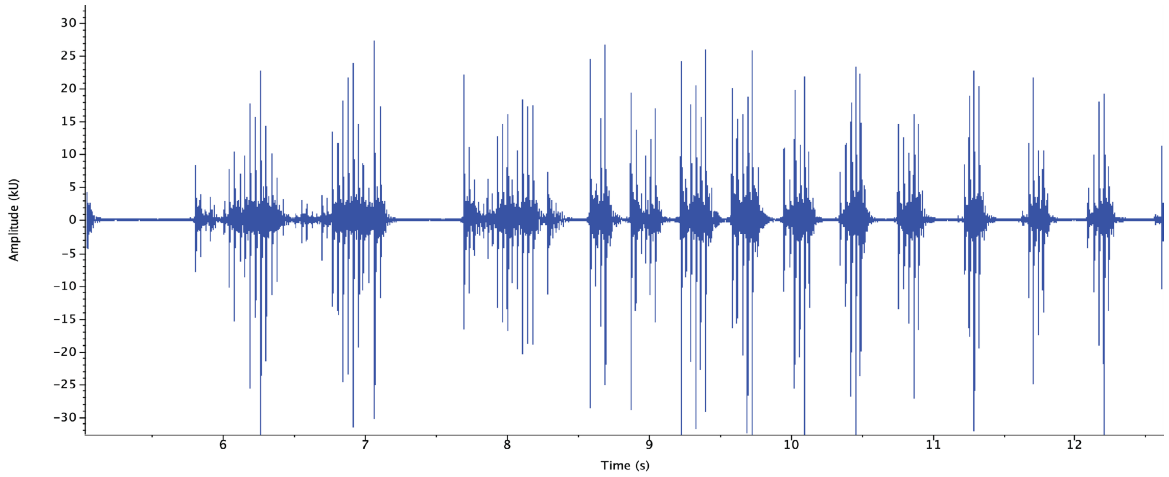


FIGURE 224. Expanded view of Fig. 223, calling drum (R85-88) Mill Valley adult male *A. intermedius*.

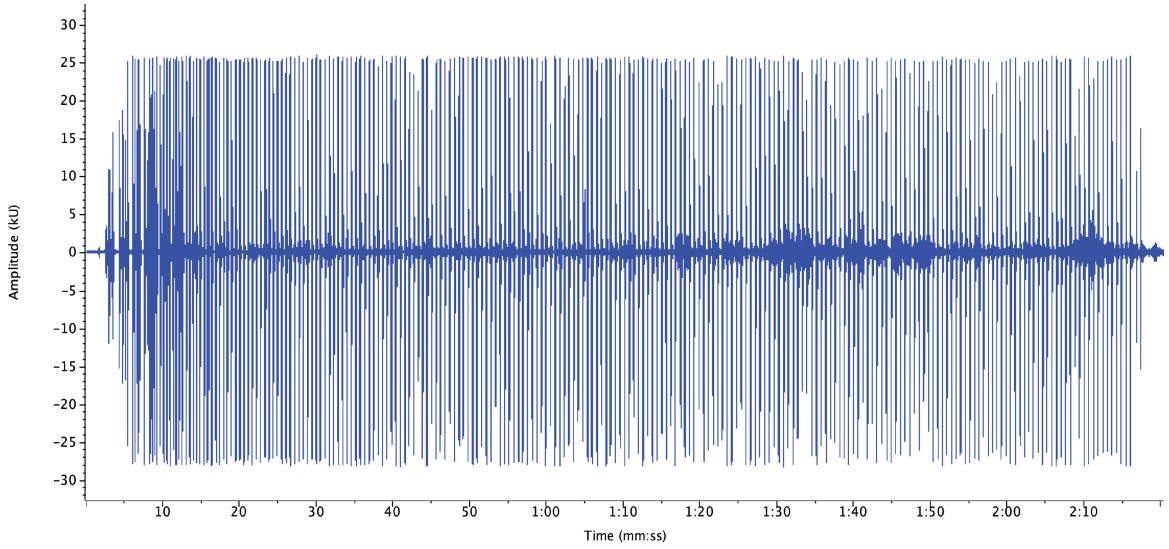


FIGURE 225. Calling drum (R04-132) adult female *A. intermedius* from Quarry Park (S03-145) at 13.5°C.

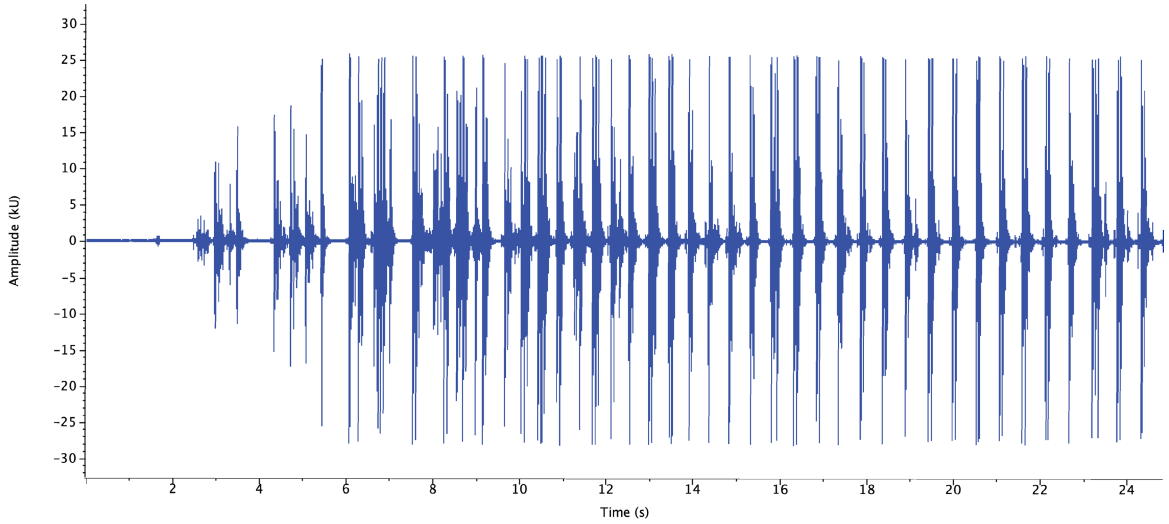


FIGURE 226. Expanded view of Fig. 225, calling drum (R04-132) adult female *A. intermedius* from Quarry Park (S03-145) at 13.5°C.

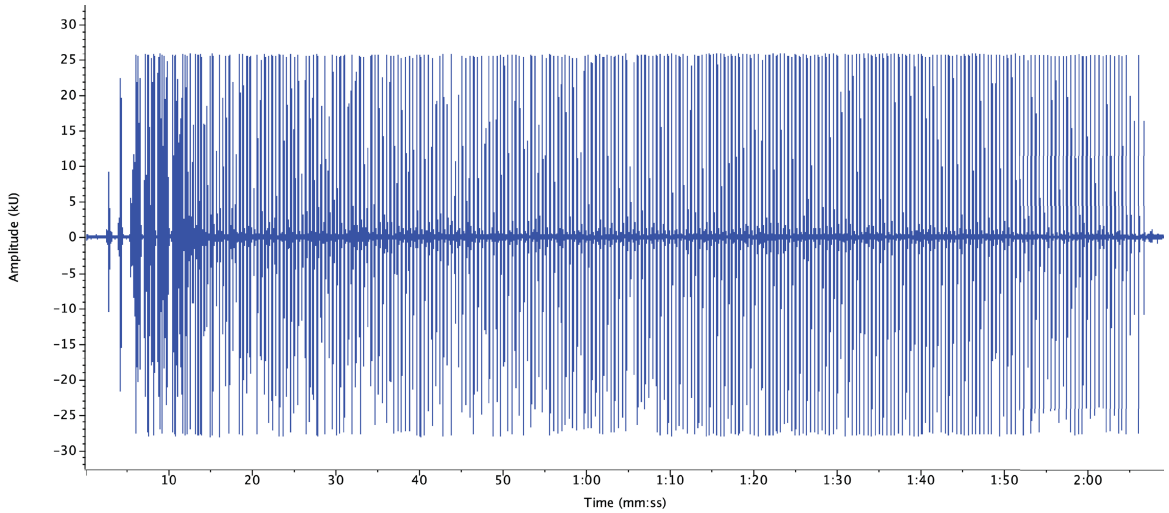


FIGURE 227. Calling drum (R05-2) same adult female *A. intermedius*, as in Fig. 225, from Quarry Park (S03-145), at 17°C.

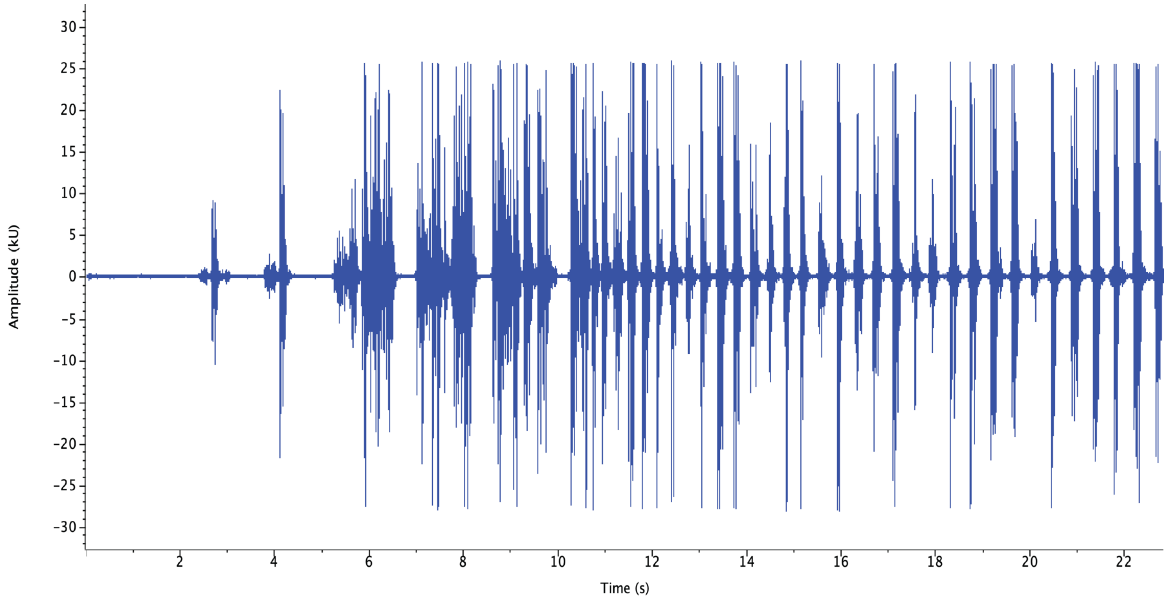


FIGURE 228. Expanded view of Fig. 227, adult female *A. intermedius* from Quarry Park (R05-2, S03-145) at 17°C.

Comparing the calling drums, at similar temperatures, of Pacifica (both S12-120) adult males *A. intermedius* (R12-41, Fig. 229) with that of microsympatric *A. longispinoides* (R12-43, Fig. 230), shows they have a similar trills/sec rate of around 1.6; similar drums/trill (3) 4 for *A. intermedius* versus 2–3 for *A. longispinoides*; and similar drum rates of 20 drums/s for *A. intermedius* versus 15 drums/s for *A. longispinoides.* Where the 2 taxa significantly differ is that *A. intermedius* has both an introductory section of long trills and a transition section that is completely lacking in *A. longispinoides.* These differences may indicate those areas that future researchers should focus on when investigating what sexual cues may be contained in JC calling drums. Are the 2 lead-in sections of *A. intermedius*' calling drum only important where it occurs with *A. longispinoides?*

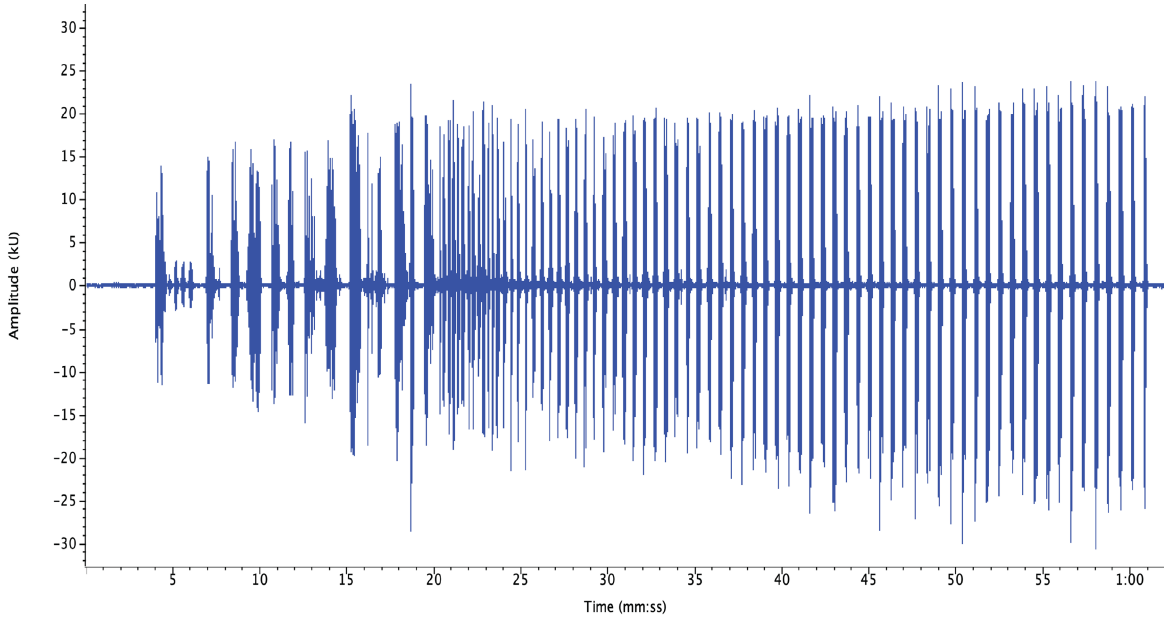


FIGURE 229. Calling drum (R12-41) from Pacifica (S12-120) adult male *A. intermedius* at 15.5°C.

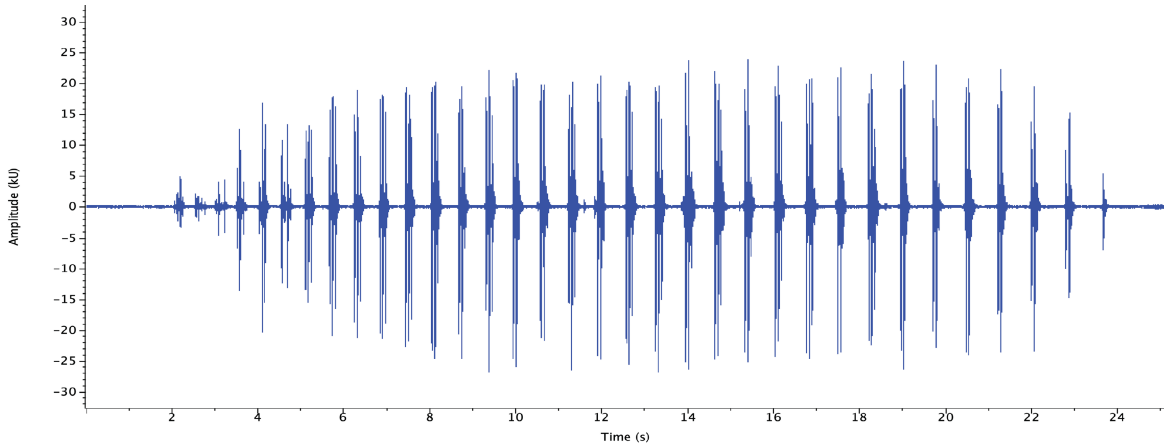


FIGURE 230. Calling drum (R12-43) from Pacifica (S12-120) adult male *A. longispinoides* at 16°C, showing 33 trills in 20.9s (1.6 trills/s), 2–3 drums/trill, drum rate 14.9. Note differences in time scale when comparing with sympatric *A. intermedius* in Fig. 229.

Both species also sympatric in the Berkeley-Oakland Hills (S98-115). Given the mating trial results of Weissman *et al.* (2008), we wonder if even the smallest male of *A. longispinoides* would be able to mate with the largest female of *A. intermedius*, because of the geometry needed for their coupling?

Derivation of name. "intermedius" apparently in reference (Davis & Smith 1926) to this species being "taken for a form intermediate between *S. fuscus* and *S. pictus.*"

Habitat. Oakland and Berkeley Hills are wooded with oaks, *Eucalyptus*, and intermittent grassland; while Mill

Valley is more open coastal scrub. Davis & Smith (1926) discussed how *A. intermedius* lived in both the flat areas and hillsides of Oakland, although we suspect with continued development over the last 100 years, its distribution is now much more restricted.

Life cycle and seasonal occurrence. Apparently with typical 2-year life cycle.

Variation. **General body color**: Dark (Fig. 215A) when comparing those from near the type locality Oakland Hills or Cerritos vs more reddish (Fig. 215B) when comparing those from Marin Co, where soil is not reddish but more brownish color. From some 40 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars with 2 ventral spurs; 1 had 3, 38 had 4 and 1 had 5 inner **rear** leg tibial spines, and 33 had 2 and 7 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. In 14 *A. intermedius* from type locality of Oakland Hills: 11 had 4 and 3 had 3 inner spines; while, in those same 14 adults, 13 had 2 and 1 had 3 outer spines.

Specimens examined. **CALIFORNIA, *Alameda Co.,*** Alameda, 2614 Eagle Ave, 13-iii-1993, 21-iii-1993, EJ Kools. Berkeley, low areas, 23-v-1999 MS Caterino. Berkeley, near Claremont Canyon, ~37.8664272 -122.235415°, 344m, 9-xi-1984 (S84-82) A Peters; 12-vi-1987 (S87-46) K. McGuire. Berkeley Hills, nr intersection Claremont Ave & Alvarado Rd, 37.862400° -122.237219°, 178m, 20-vi-2009 (S09-46). North Berkeley, 5-vi-1986 (S86-30) R. Smith. Castro Valley, Cull Canyon Rd., 1.4 km N intersection with Crow Canyon Rd., 37.713644° -122.055153°, 87m, 21-i-84 (S84-2) D. Ubick. North Oakland, 16-xi-1985 (S85-132) K. Donald. Oakland Hills, near Skyline Blvd. and Mott Place, 37.792872° -122.156791°, 363m, 18-iv-1992, 10-v-1992 (S92-48); 30-ix-1992 (S92-136); 13-xi-1992; 18-i-1993; 20-iv-1993 (S93-24); early December, 1993 (S93-93); 15-xii-1993 E. Miller. Oakland, Lake Merritt, 10m, 31-x-1992 (S92-133) M. Perez. Redwood Regional Park, 37.812864° -122.174542°, 437m, 12-xii-1998 (S98-113) DBW & M. Caterino; 0.1 m W Roberts Regional Recreational Area, 37.814381° -122.176214°, 458m, 12-xii-1998 (S98-115) DBW & M. Caterino. ***Contra Costa Co.,*** El Cerrito, 8633 Arbor Dr, 37.921919° -122.288028°, 250m, 9-ix-1985 (S85-129) L. Levit. ***Marin Co.,*** Fairfax, 16 Ace Ct, 38.0004 -122.6012, 62m, 9-iii-1997, J. Schweikert. Mill Valley, 76 Lee St., 37.920842° -122.552233°, 132m, xii-1983 (S83-161); 21-ix-1985 (S85-110); 6-x-1985 (S85-116); 12-xii-1998 (S98-116); 15-iv-1999 (S99-19) E. Ross. ***San Francisco Co.,*** San Francisco, Excelsior District, 15-iv-1994; San Francisco Zoo, 37.733110° -122.504166°, 10m, 5-viii-1986 (S86-93) T. Turowski; 9-v-1988 (S88-19) L. Saul; 9-xi-1988, N. Solberg; 5-x-1989 (S89-90) S. Bernardi. Ingleside District, 27 Broad St., 37.713027° -122.454475°, 92m, 14-v-1994 (S94-23) Q. McFrederick; Richmond District, 37.7710° -122.4680°, 72m, 6-viii-2002 (S02-62) C. Quock. Near Legion of Honor, 37.786736° -122.497924°, 93m, 6-i-2013 (S13-1); near Sanchez & 14th Streets, 37.767712° -122.431233°, 33m, 31-x-1985 (S85-121) H. Sollie. Fort Funston, 37.719544° -122.502805°, 49m, 3-iv-1994, L. Saul, M Gershenz. North end Lake Merced at Lakeshore Elementary School, 37.730588° -122.485902°, 32m, 4-v-1992, C. Brett. ***San Mateo Co.,*** Burleigh H. Murray Ranch State Park, Purisima Creek Rd x Leon Creek, ~37.433° -122.378°, 25-iv-1993, DS Brennan. Daly City, Dennis Drive, 37.651259° -122.464315°, 177m, 29-xi-2005, MM Arnaud (S05-167). Edgewood County Park, 37.464823° -122.283954°, 232m, 24-xii-1987, VF Lee. Half Moon Bay, 37.467505° -122.423112°, 19m, 28-iii-1992 (S92-38). Miramar, Quarry County Park, 37.503575° -122.462146°, 37m, 22-xii-2003 (S03-145). Pacifica, 1165 Fassler Ave, 37.599398° -122.479297°, 177m, 1-xi-2012 (S12-120) L. Lucey. San Bruno Mt., off Guadalupe Rd., 37.695731° -122.435272°, 213m, 17-ii-1985 (S85-15). San Pedro Valley County Park, 11-xii-1982, ~37.577906° -122.475723°, 57m, D. Ubick. South San Francisco, Helmit Hill, 145 Clay, 37.661182° -122.461961°, 53m, W. Manor; Sign Hill Park, 37.664722° -122.420000°, 171m, 7-ii-2006 (S06-4) PH Arnaud. Westborough District, 16-viii-1993 (S93-75) C. Moore ♀1.

Possible placement: iNaturalist lists this taxon in Golden Gate Park at 37.773512° -122.460822°, near The Conservatory of Flowers, but specimen could also be *A. longispinoides* since no size scale is included in photo.

DNA. Fig. 167, p. 136. F0871 (S98-113, type locality Oakland Hills); F1145 (S99-19, Mill Valley), F1346 (S02-64, San Francisco Co.); F1566 (S03-145, Quarry Park, San Mateo Co.) all recovered together in their own subclade within Group 3 Longispinus. and in a larger clade with *A. intermedioides* and *A. finnon.*

Karyotype. 2n♂=23. 4 Individuals examined and with some inconsistencies: T88-24 (Fig. 231, S88-19, San Francisco); T93-16 (Fig. 232, S93-24, Oakland Hills); T99-30 (Fig. 233, S98-113, Oakland Hills); T99-32 (Fig. 234, S99-19, Mill Valley) with 6 (T99-30 & T99-32) or 7 (T88-24 & T93-16) metacentric or submetacentric autosomal pairs; 4 or 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Note that while T93-16 and T99-30 are both from the type locality Oakland Hills, they appear to have 7 and 6 metacentric pairs, respectively. These potential differences invite further investigations.

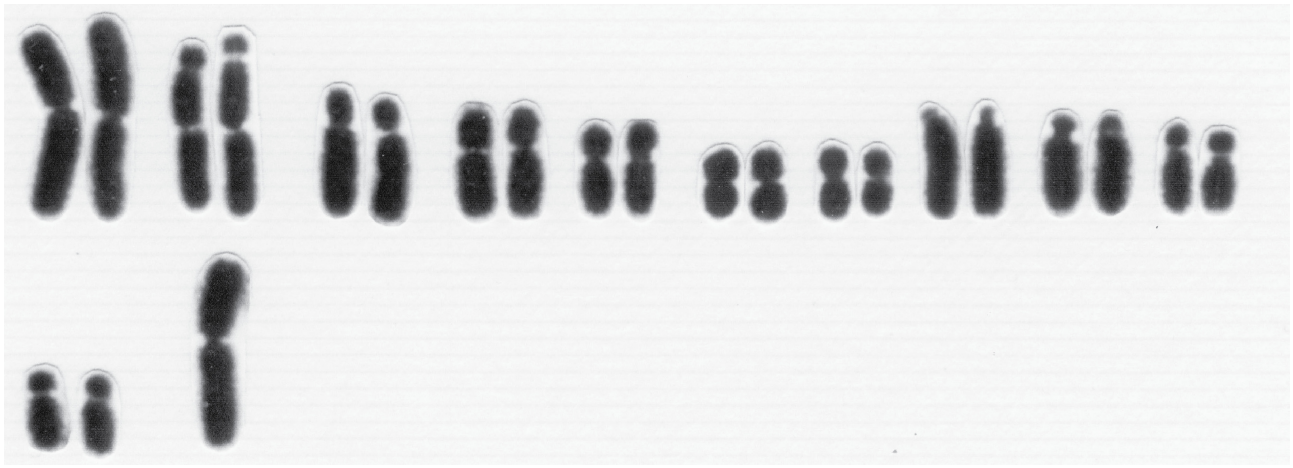


FIGURE 231. Idiogram T88-24 *A. intermedius* (S88-19, San Francisco).

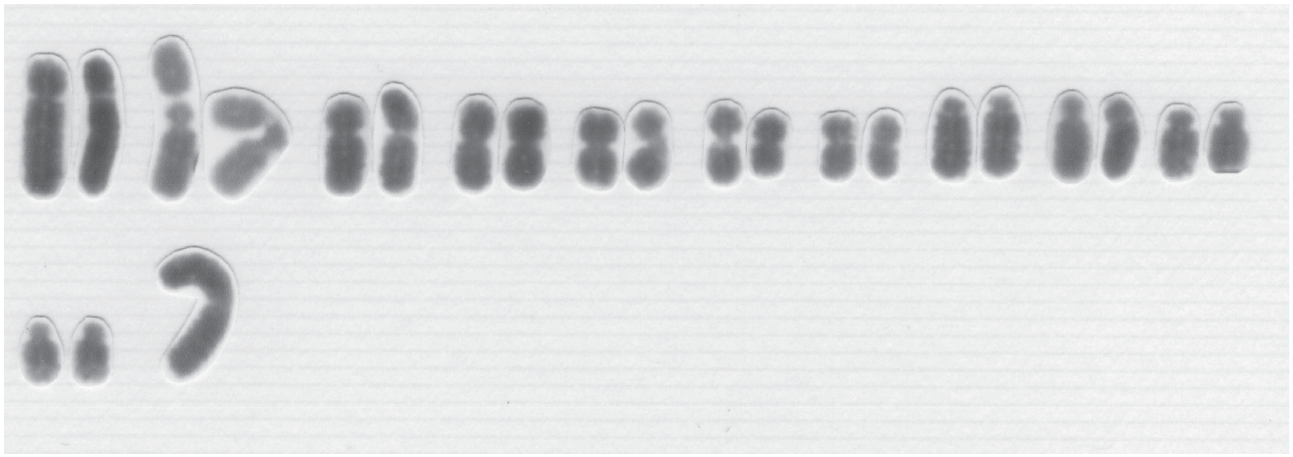


FIGURE 232. Idiogram T93-16 *A. intermedius* (S93-24, Oakland Hills).

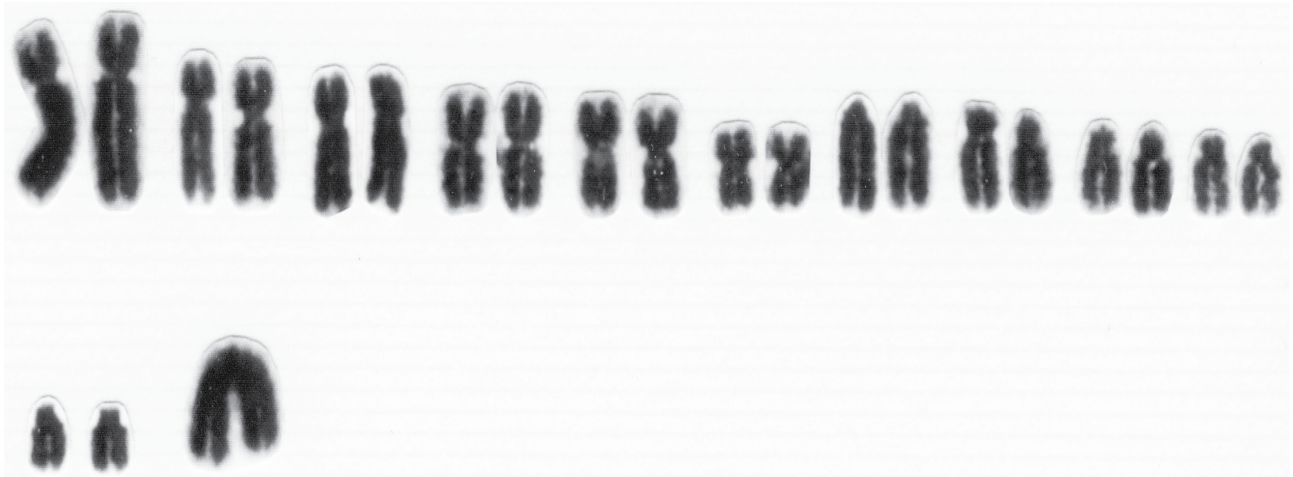


FIGURE 233. Idiogram T99-30 *A. intermedius* (S98-113, Oakland Hills).



FIGURE 234. Idiogram T99-32 *A. intermedius* (S99-19, Mill Valley).

Discussion. Found microsympatric with *A. longispinoides* in Pacifica (see Fig. 220, S12-120); at the San Francisco Zoo; and in the Oakland Hills (Davis & Smith 1926; our S98-115). In the past, found in San Francisco with *A. longispinoides* and with *A. pictus* (the latter's type locality), although we believe *A. pictus* now extinct there.

We should not be surprised to find this species to the north, east, and south of San Francisco Bay, since the age of the Bay is only about 8000 to 10000 or so years old, dating from the end of the last ice age.

Of the 11 species in the Longispinus Group, *A. intermedius* is the only taxon to have 2n♂=23; while the remaining taxa (*A. intermedioides* and *A. warnermts* are unknown) all have 2n♂=25.

***Ammopelmatus longispinoides* Weissman, sp. nov.**

Southern Long-spined Jerusalem Cricket
Figs 235–252, Tables 12, 32, 40

Species #19, Weissman 2001b.

Distribution. (Fig. 235). Widespread in Central and Northern California and southwestern Oregon.

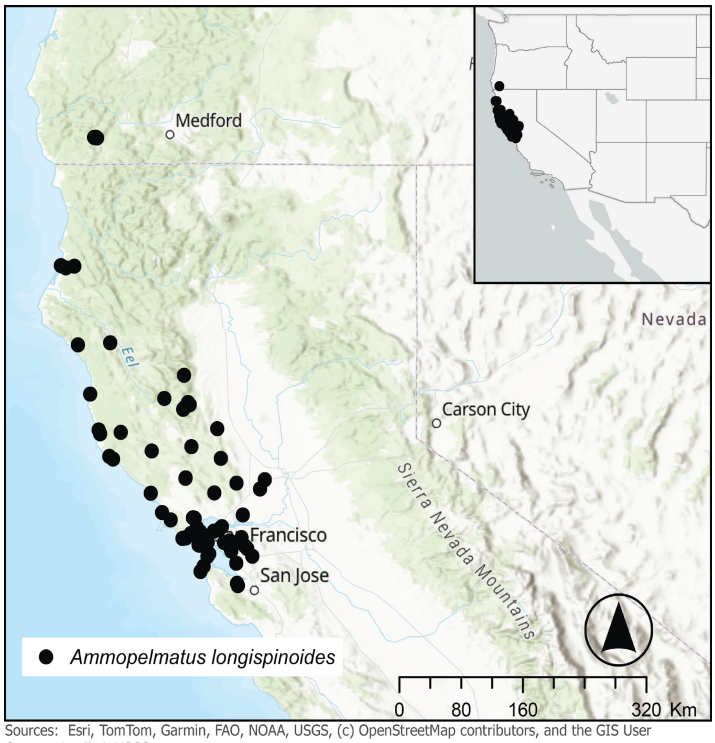


FIGURE 235. Distribution of *A. longispinoides*.

Recognition characters. Member of Longispinus Group. Medium to very large, generally dark colored, rear leg inner tibia almost always with 5 spines (Table 40), the most distal one (#1) smaller than the adjacent spine (Fig. 237); rear leg outer tibia with 2 spines. 2n♂=25. Calling drum a trill but variable and can be of two parts: many individuals start with 2–12 spaced trills of >3 drums/trill and then transition to a series of closely spaced trills of (1) 2–3 drums/trill, although drum rate (as distinguished from trill rate) the same in both long and short trills. Populations can be mixed for this pattern: see *Drum* section below. While *A. longispinoides* has 5 inner and 2 outer spines, other similar drumming Trilling Group species *A. mtshasta* has 5 inner and 4 outer spines; and the more geographically limited *A. finnon* has 4 inner and 3 outer rear leg tibial spines. Can be near-sympatric with, and separated from 2 other Trilling Group species: Differs from smaller, and sometimes sympatric, *A. intermedius* by size, chromosome number (2n♂=23), and DNA. Differs from *A. brachysocius* by drumming pattern (trills transition to single drums in latter), DNA, and presence of 4 rear leg inner tibial spines vs 5 such spines in *A. longispinoides.*

Holotype. Male (in alcohol, Fig. 236): **California, *Sonoma Co.,*** Franz Valley Road, 0.5 m W Pepperwood Ranch Natural Preserve, 38.562078° -122.691784°, 235m, 12-xii-1998 (S98-120) DBW, MS Caterino. R99-69, F1003. Molt to adult 23-ix-1999. Deposited CAS, Entomology type #20068. Measurements in mm: Body length 32.62, hind femur length 13.69, hind femur width 5.40. Foretibia with 3 spurs; middle tibia with 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 237A) with 5 inner and 2 or 3 (1 small) outer spines, 2 ventral spurs long and curved. Ringlet calcars (Fig. 237B) long and tapered.

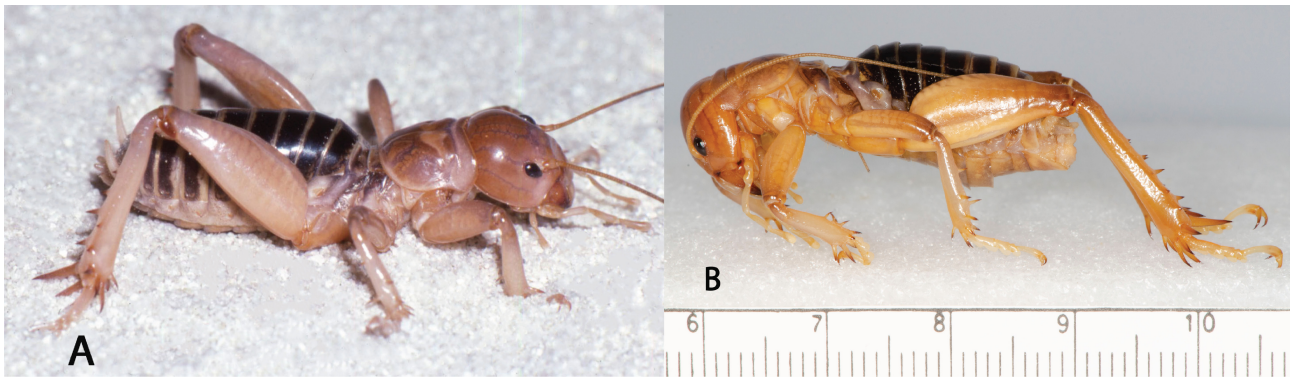


FIGURE 236. Holotype adult male *A. longispinoides.* A. When alive. B. When preserved.



FIGURE 237. Left rear leg tibia holotype adult male *A. longispinoides.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 238): **California, *Sonoma Co.,*** Pepperwood Ranch Natural Preserve, 38.567741° -122.688850°, 337m, 12-xii-1998 (S98-117) DBW, MS Caterino. R99-115, F1051. Molt to adult 22-x-1999. Deposited at CAS, CASENT #9080111. Measurements in mm: Body length 39.12, hind femur length 11.43, hind femur width 4.98. Fore tibia with 3 spurs; middle tibia with 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 239A) with 5 inner and 2 outer spines, 2 ventral spurs long, curved less than in male. Ringlet calcars (Fig. 239B) reduced compared with male. Ovipositor Fig. 240.

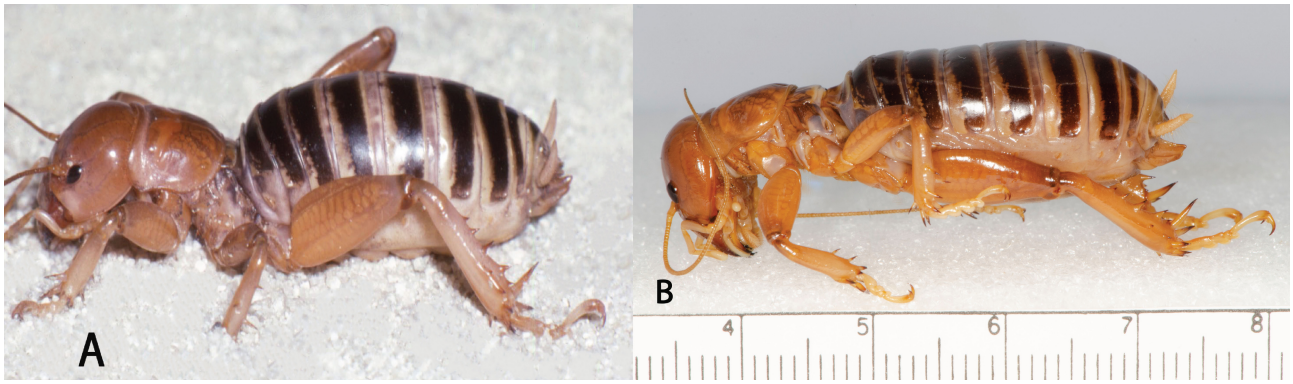


FIGURE 238. Adult female allotype *A. longispinoides.* A. When alive. B. When preserved.

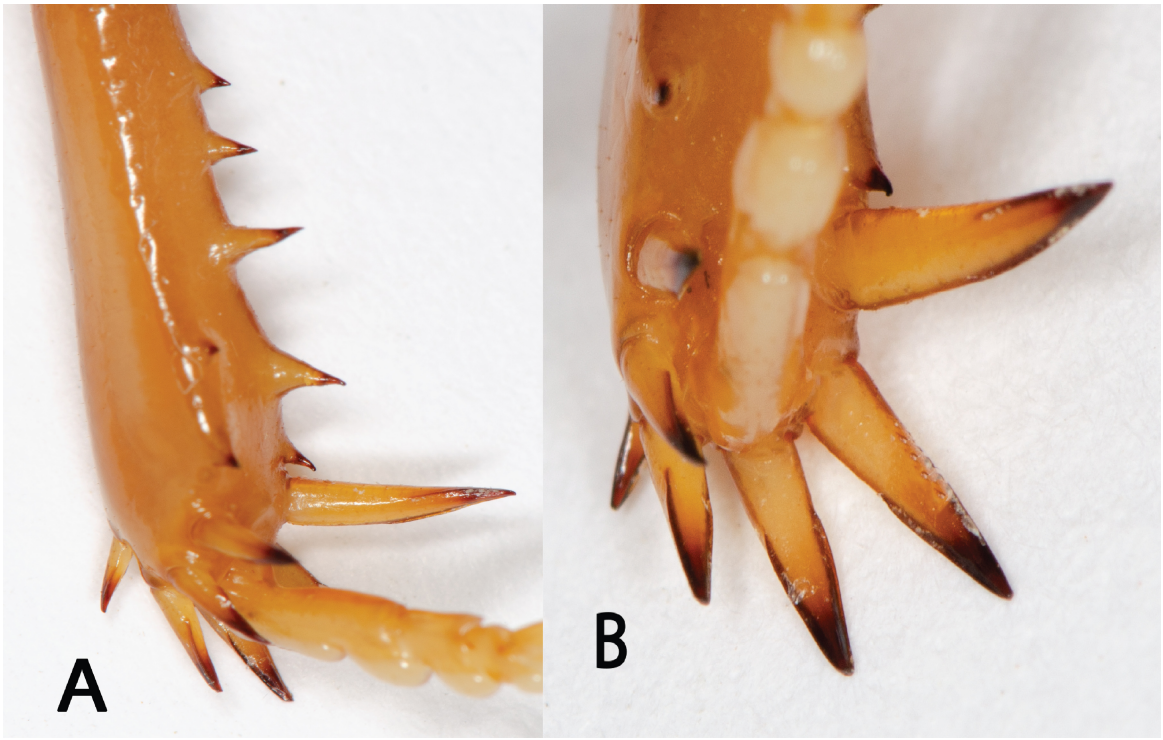


FIGURE 239. Left rear leg tibia adult female allotype *A. longispinoides.* A. Showing 2 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 240. Ovipositor allotype *A. longispinoides.*

Paratypes. ♂113 ♀166. **CALIFORNIA, *Alameda Co*.,** Dublin, Plant Cell Research Institute, 6560 Trinity Ct, 37.709292° -121.912460°, 107m, 28-vi-1982 (S82-31) R. Wilson ♂1. Hayward, 2333 Bermuda Ln, 37.633110° -122.099928°, 9m, 18-xi-2003 (S03-144) B. Tarbox ♂1. Walnut Creek, 37.913569° -122.038901°, 48m, 1-vi-2016 (S16-15) J. Mather ♀1. Oakland, 8116 Sunkist Dr, 37.766303° -122.158376°, 115m, 4-vi-2006 (S06-56) R. Sullivan ♂1. Oakland Hills, 0.1 m W Roberts Regional Recreation Area, 37.814349° -122.176178°, 449m, 12-xii-1998 (S98-115) ♀1. ***Colusa Co.,*** Candy Bucket Spring, 39.368479° -122.641557°, 636m, 30-iii-1997 (S97-31) J. Schweikert ♂1. Hwy 20, 11.1 m W of Interstate 5 at mile post 11.22, 39.105667° -122.321017°, 135m, 30-iii-2005 (S05-43) ♀4; 22-iv-2007 (S07-11) ♂3; 3-i-2010 (S10-1) ♂2 ♀2. 1 m N Letts Lake, 39.317545° -122.717849°, 1300m, 28-iv-1996 (S96-31) M. Caterino ♂1. Dixie Glade Campground, 39.335153° -122.703572°, 928m, 18-i-1997 (S97-12) J. Schweikert ♀1. ***Contra Costa Co.,*** Berkeley Hills, near Claremont Hotel, 37.859035° -122.242066°, 142m, late November, 1998 (S98-110) P. Swindelis ♂1. Danville, 37.821593° -121.999961°, 117m, 30-xi-1985 (S85-140) S. Diehl ♂1. Danville, 307 Conway Dr., 37.791606° -121.971320°, 136m, 6-iv-2009 (S09-9) H. Dorris ♀1. Moraga, 502 Augusta Dr., 37.837291 -122.146774, 202m, 24-x-2007 (S07-101) J. Lin ♂1. Orinda, 37.877317° -122.179971°, 150m, 20-xi-1982 (S82-129) D. Wentworth ♂1. Pinole, 38.005° -122.298°, 36m, 10-xi-1999 (S99-160) A. Jason ♂1. Pt. Pinole Regional Park, 37.983436° -122.360999°, 2m, 21-xii-1991 (S91-127) ♂4 ♀6. Rodeo, 38.032949° -122.266963°, 2m, 13-xi-1985 (S85-146) C. Rissanen ♀1. Walnut Creek, 1129 Alfred Ave., 37.914959° -122.081992°, 85m, 9-x-2005 (S05-159) G. Hodgson ♂1. ***Glenn Co.,*** Mendocino National Forest: Grindstone Rd, 39.690709° -122.707565°, 1011m, 22-ii-1997 (S97-20), J. Schweikert ♀1; Brittan Ranch, 39.393099° -122.661288°, 702m, 24-ii-1997 (S97-23) J. Schweikert ♂1 ♀2. ***Humboldt Co.,*** Arcata, 40.867° -124.084°, 11m, 28-viii-2003 (S03-86) J. Jacobsen ♀1. Lamphere Dunes, 40.891768° -124.141687°, 10m: 7-vii-2000 (S00-26) P. Haggard ♀1: 1-x-2000 (S00-61) P. Haggart & G. Poinar ♂2 ♀1. Hwy 299, Blue Lake, 40.885253° -123.985493°, 58m, 14-xii-1998 (S98-128) ♂1 ♀5. 20 m E Garberville, 220 Harmony Ln, 40.046664° -123.567772°, 601m, 26-x-14-xii-2007 (S07-100) L. Brannigan ♂1 ♀1. ***Lake Co***., NE side Lake Pillsbury, 39.437119° -122.937225°, 562m, 20-viii-1996 (S96-79) M. Witcosky ♀1. Kugelman Ranch, 38.909415° -122.622047°, 428m, 30-iv-2015 (S15-7) J. Hjelle ♀1. ***Marin Co.,*** Angel Island State Park, 37.863608° -122.431950°, 100m, 7-vi-2005 (S05-62) J. Starrett, ♂1. Bolinas, 37.909369° -122.686369°, 10m, 11-xi-1985 (S85-131) DD Linsdale ♀1. Bolinas Point, 1.6 m due W Bolinas, 37.903791° -122.725821°, 34m, 14-vii-1987 (S87-89) VF Lee, ♂1. Golden Gate National Recreational Area, Coastal Trail, 37.829282° -122.523849°, 46m, 28-v-1989 (S89-18) VF Lee, ♂1; Ft. Cronkite, 37.832725° -122.538281°, 10m, 31-x-2009 (S09-160) ♂3 ♀2. Inverness, Golden Hinde Inn, 12938 Sir Francis Drake Blvd, 38.106823° -122.862797°, 4m, 27-viii-1997 (S97-121) ♂2 ♀2. Inverness, 18-x-1987 (S87-110) C. Rissenen ♂1. Larkspur, 144 King St,

37.934743° -122.537829°, 18m, 25-x-2006 (S06-124) B. Howe ♂1. Burdell Mountain Open Space, 38.127080° -122.587819°, 60m, 27-x-1984 (S84-72) TS Briggs, VF Lee, D. Ubick ♀1. Mt. Burdell, 12.9 m W US Hwy 101, on San Andreas Dr., 38.130115° -122.604359°, 95m, 11-i-1986 (S86-1) TS Briggs, ♂1 ♀2. Mt Tamalpais, 37.958° -122.629°, 240m, 14-vi-1998 (S98-47) M. Caterino ♂1 ♀1. Novato, 21-xi-1996 (S96-91) VF Lee, ♂1. Novato, 1.1 m W Hwy 101 on Marin Dr., 38.121289° -122.583372°, 24m, 17-xii-1982 (S82-153) VF Lee, ♀2. Novato, 27-xi-1986 (S86-158) T. Long ♂1. Novato, 21-xi-1996 (S96-91) ♂1. Point Reyes National Seashore, McClures Beach, 38.187613° -122.963604°, 10m, 26-viii-1997 (S97-120) ♀1; Mesa Road NW Bolinas, 37.909591° -122.700683°, 59m, W. Sakai, 8-i-1991 ♀1; 8-xi-2000 (S00-70) ♂6 ♀4. San Anselmo, San Rafael Ridge, 800 Fawn Dr., 37.998204° -122.564561°, 156m, G. Freihofer, 14-iii-1982 (S82-3) ♂1; 21-iii-1982 (S82-5) ♀1; 28-ix-1982 (S82-117) ♀1; 11-x-1982 (S82-120) ♂1; 21-ii-1983 (S83-8) ♀1; 30-x-1984 (S84-71) ♀1; 19-v-1987 (S87-29) ♂1; 6-iii-1988 (S88-6) ♀1. San Rafael, near Belle & Ridge Streets, 37.977150° -122.519934°, 9-vii-1995 C. Shetterly, ♀1; Jerry Russom Memorial Park, 38.024097° -122.559498°, 45m, 6-ii-1988, VF Lee ♀1. Near Tiburon, Ring Mountain Preserve, 37.911587° -122.496161°, 110m, 27-x-1984 (S84-79) VF Lee, ♂1. Ridge between Mill Valley and Tamalpais Valley, 3-vii-1990 (S90-110) G. Georgeades ♀1. Wright's Beach, 38.399414° -123.095053°, 30m, 23-x-2011 (S11-116) DW Weissman ♂1. ***Mendocino Co.,*** Anchor Bay 3 m N Gualala, 38.802448° -123.577496°, 29m, B. Bebee, 4-ix-1991 (S91-104) ♀1; 20-ix-1991 (S91-108) ♂1 ♀1; 24-v-1992 (S92-50) ♂1 for testes. Gualala, 38.7733° -123.5340°, 63m, 24-ix-2008 (S08-68) ♂2 ♀1. MacKerricher State Park, 39.485128° -123.800744°, 14m, 14-viii-2004 (S04-88) ♂3 ♀5; 2-vii-2006 (S06-61) ♂2 ♀1. Philo, 39.066248° -123.444589°, 97m, 26-xii-1984 (S85-7) A. Oliver, ♀5; 13-xii-1998 (S98-124) ♂1 ♀5. Hwy 1, 3.6 m S junction with Philo-Greenwood Rd, 39.091969° -123.701823°, 87m, 13-xii-1998 (S98-127) ♂1. Hwy 1, 6.8 m S junction with Philo-Greenwood Rd, 39.050319° -123.684224°, 88m, 13-xii-1998 (S98-126) ♂3 ♀8. Hwy 1, 28.2 m S junction with Philo-Greenwood Rd, 13-xii-1998 (S98-125) ♀1. Hwy 128, 18 m SE Boonville, 38.861525° -123.084115°, 341m, 13-xii-1998 (S98-123) ♀1. Sinkyones Wilderness State Park, 40.023639° -123.943027°, 312m, 19-ix-1990 (S90-98) W. Sakai ♀1. ***Napa Co*.,** Lake Berryessa, Stebbins Cold Canyon Reserve (UCD), 38.509933° -122.097216°, 83m, 14-i-1983 (S83-2) ♂1 ♀9. Lake Berryessa, 19-x-1986 (S86-141) ES Ross, ♀1. Yountville, 1878 Oak Circle, 38.402868° -122.355232°, 33m, 10-x-2005 (S05-150) M. Ford ♂1. 5 m S Knoxville, 38.780680° -122.279799°, 285m, 11-i-1986 (S86-5) ES Ross, ♀1. ***San Francisco Co.,*** San Francisco, 603 Anderson St, 37.735768° -122.415302°, 42m, 3-xii-1985 (S85-137) P. Blancg, ♀1. San Francisco, 27-vii-1986 (S86-88) N. Gershenz, ♀1; 29-viii-1990 (S90-96) SC Williams ♂1; Excelsior District, July, 1993 (S93-95) S. Williams ♀1; 4-xii-1996 (S96-125) LS Saul, ♂1; 5-viii-2003 (S03-84) Ms. Kim ♂1; 13-x-2007 (S07-95) Z. Paul ♂1; Bernal Hill at Shotwell & Stovenar St., 1-ii-1986, L. Saul, ♀1; Bernal Hills, 24-ix-1991 (S91-109) ♀1; north Bernal Heights, 29-viii-1996 (S96-80) DJ Tyler, ♂1 ♀1; Bernal Heights, 37.742267° -122.416533°, 114m, 6-xi-1984 (S84-75) ♂1; Randell Junior Museum, 27-xii-1984 (S85-8) P. Bellamy, ♀1; vacant lot on Cuvier St., 23-xi-1988, T. Williams ♀1. San Francisco Zoo, 37.732997° -122.504012°, 4m, 12-vi-1989 (S89-42) ♂1; Stanton St. near Market St., 30-x-1996 (S96-126) M. Navila, ♀1. ***San Mateo Co.,*** Daly City, 27-viii-1983 (S83-136) K. Murphy ♂1; Hill Blvd., 37.706267° -122.435960°, 197m, 18-vi-1998 (S98-49) B. Brooks, ♂1. Montara, 37.542168° -122.516086°, 31m, 14-x-1987 (S87-108) LS Saul ♀1. Pacifica, 1165 Fassler Ave, 37.599398° -122.479297°, 150m, 10-xi-2010 (S10-78) ♂1; 1-10-November, 2012 (S12-120) ♂1 ♀1, L. Lucey. San Bruno Mt., 120m, 17-ii-1985 (S85-15) ♂1 ♀2; north slope, 37.698485° -122.433246°, 216m, 19-vii-1998 (S98-54) B. Brooks, ♂1. South San Francisco, 14-vi-1998 (S98-48) PH Arnaud, ♀1. ***Santa Clara Co.,*** Mountain View, Castro St., 37.387439° -122.080780°, 29m, 3-xii-1994, DW Weissman, ♀1; 2000 Rock Street, 37.412560° -122.090723°, 14m, 21-27-vii-1983 (S83-106) ♀3; i-x-1983 (S83-131) ♂1; 4-x-1983 (S83-132) ♂1; 8-x-1983 (S83-135) ♂1; 12-x-1983 (S83-137) ♂1; 15-xi-1983 (S83-147) ♂1; 28-xi-1983 (S83-153) ♀2; 21-ii-1984 (S84-7) ♀2; 3-iii-1984 (S84-10) ♀2; 9-iii-1984 (S84-13) ♂1 ♀1;19-x-1984 (S84-69) ♂1. ***Solano Co.,*** Benicia, 38.049365° -122.158578°, 21m, C. Rissanen, 21-x-1985 (S85-130) ♀1; 18-xi-1985 (S85-133) ♀1; 20-v-1987 (S87-32) ♀1; 29-v-1987 (S87-38) ♀2; 5-vi-1987 (S87-45) ♂1; 8-ix-1987 (S87-99) ♀1. Grizzly Island Rd, 38.161294° -122.023640°, 0m, 31-xii-1998 (S98-1) G. Ballmer ♂1. ***Sonoma Co.,*** Bodega Head, 38.302810° -123.063186°, 24m, 31-v-2022 (S22-10) ♀1. Cotati, 681 Portal St, 38.342175° -122.720207°, 30m, 28-x-14-xi-2004 (S04-161) T. McNeil ♂1 ♀1. Petaluma, 4707 Bloomfield Rd, 38.337497° -122.842725°, 74m 6-x-1993 (S93-80) Q. McFredrick ♂1. Sonoma, 38.291852° -122.458026°, 30m, 14-xii-1986 (S86-162) L. Saul, ♂1. Sonoma, 19250 Riverside Dr, 38.297856° -122.482455°, 30m, 6-xi-2006 (S06-127) S. Rittmann ♂1. 3.5 m W El Verano, Deer Park Dr. & Canyon Dr., 38.304137° -122.536381°, 270m, 6-ii-1988, VF Lee, ♀1. 3.7 m S intersection Hwy 116 & 121, 11-ii-1983 (S83-6) VF Lee ♀1. 5 m W Healdsburg, 330m, 1-v-1996 (S96-30) R. West ♂1. Healdsburg, 5255 Pine Flat Rd, 38.682753° -122.792503°,

294m, 8-ix-2008 (S08-60) C. Miller ♂1. Pepperwood Ranch Natural Preserve, 38.568215° -122.689050°, 340m, 18-vii-1986 (S86-91) D. Herlocker ♀1; 16-iv-1988 (S88-18) D. Herlocker ♂1; 23-vii-1988 (S88-64) D. Herlocker ♀1; 12-iv-1989 (S89-11) VF Lee ♀2; 29-viii-1990 (S90-94) G. DeNevers ♂2; 5-xi-1990 (S90-104) G. DeNevers ♀1; 15-xii-1990, G. DeNevers ♀1; 10-ii-1991 G. DeNevers ♀1; 8-iii-1991 G. DeNevers ♀1; mid-April, 1991 (S91-16) G. DeNevers, T91-3; 8-22-v-1991 (S91-21) G. DeNevers ♂2 ♀2; 9-vi-1991 (S91-50) G. DeNevers ♀1; 15-x-1991 G. DeNevers ♂1; 8-v-1993 (S93-29) VF Lee, J. Robertson, A. Penny ♂2 ♀1; 4-viii-1991 (S91-97) G. DeNevers ♀1; 12-x-1998 (S98-117) ♂1 ♀3. Calistoga, 8455 Franz Valley School Rd., 38.589612° -122.671517°, 172m, 12-xii-1998 (S98-118) ♀1. Calistoga, 7699 Franz Valley School Rd., 38.584126° -122.669930°, 166m, 12-xii-1998 (S98-119) ♀2. Franz Valley School Rd. 0.5 m W Pepperwood, 12-xii-1998 (S98-120) ♂2. Santa Rosa, near County Fairgrounds, 38.4287° -122.6951°, 58m, 27-xii-2002 (S02-73) RR White ♀5. Santa Rosa, Rincon Valley, 38.479082° -122.667763°, 84m, 10-xii-1984 (S85-10) A. Peters, ♂1. East Santa Rosa near Santa Rosa Ave., 7-xii-1984 (S85-9) A. Peters, ♀1. Hwy. 128, 22 m SE Boonville, 38.827684° -123.039306°, 115m, 13-xii-1998 (S98-122) ♀5. Above Jenner, 120-180m, 12-xii-1985 (S85-143) VF Lee ♀2. ***Trinity Co.,*** Coffee Creek, 41.082625° -122.721655°, 784m, J. Bellinger, 13-iii-2008 (S08-11) ♀1. Trinity Center, 40.990343° -122.705030°, 750m, 10-x-2007 (S07-94) J. Bellinger ♀1. ***Yolo Co.,*** Davis, 38.547312° -121.767853°, 12m, 6-xii-1985 (S85-139) E. Temeles ♂1. Dixon, 38.445589° -121.823192°, 19m, 12-vi-1981 (S81-14) ♂1. **OREGON, *Josephine Co.,*** Store Gulch Campground, 42.295640° -123.754695°, 339m, 25-vii-2022 (S22-24) ♂1. 0.9 m E Store Gulch Campground, 42.295772° -123.742001°, 356m, 27-vii-1992 (S92-81) ♂2. 1.1 m E Store Gulch Campground, 42.297723° -123.735279°, 396m, 25-vii-2022 (S22-25) ♂2. 2.3 m E Store Gulch Campground, 42.289529° -123.722732°. 467m, 25-vii-2022 (S22-26) ♀1. 2.6 m E Store Gulch Campground, 42.289789° -123.721267°, 466m, 30-v-1983 (S83-36) ♀1.

Drum. We have more recorded calling drums for *A. longispinoides*, from over a wide geographical area, and which are similar in both males and females, than for any other JC taxon. We thus present 6 oscillograms, all from the type locality, or nearby, to show both the consistency and variation found in such drums. In the following summaries, numbers in parentheses note less common condition. **Male.** [1] Holotype R99-69 (Fig. 241, S98-120), 0 long trills, 28 trills over 12.5s (2.2 trills/s) with (1, 2) 3 (4) drums/trill with drum rate of 21.7 drums/s at 19°C. [2] Paratopotype R99-87 (Fig. 242, S98-120), 2 long trills of 4-5 drums over 0.93s, then 20 trills over 8.5s (2.4 trills/s) of 2-3 drums/trill and drum rate of 26 at 19.5°C. [3] R99-96 (Fig. 243, S98-120), 2 soft long of ~6 drums, then 24 trills over 10.0s with 4 drums changing to 3 drums changing to 2 drums/trill, drum rate of 23.8 drums/s at 20.5°C. [4] R00-42 (Fig. 244, S98-117), 4 slow trills over 3.1s with 4-5 drums/trill, then 30 rapid trills over 13.8s (2.2 trills/s) with 2-3 drums/trill and drum rate of ~20 drums drums/s at 18°C. **Female.** [1] Allotype R99-115 (Fig. 245, S98-117), 5 intro trills of 2-6 drums over 3.1s, then 44 trills over 21.0s (2.1 trills/s) with 2-3 drums/trill. Drum rate ~23 at 19°C. [2] R00-1 (Fig. 246, S98-117), 8 introductory long trills over 4.3s with 3-4 (5) drums/trill, then changes to 43 trills over 24.0s of 1-2 (3) drums/trill, with greater interval than between long introductory trills. Drum rate ~15 at 15.5°C.

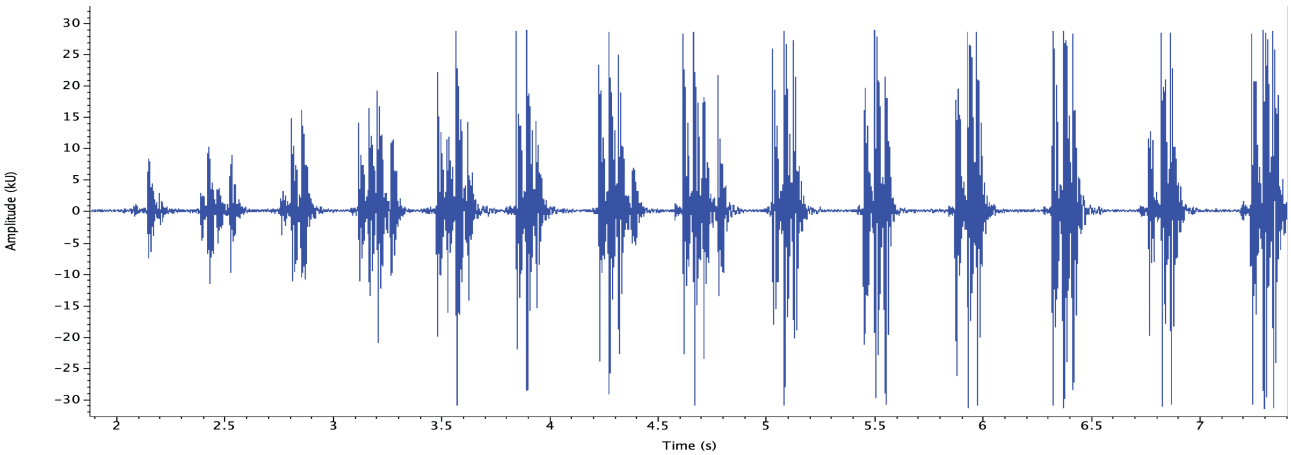


FIGURE 241. Calling drum (R99-69) adult male holotype *A. longispinoides.*

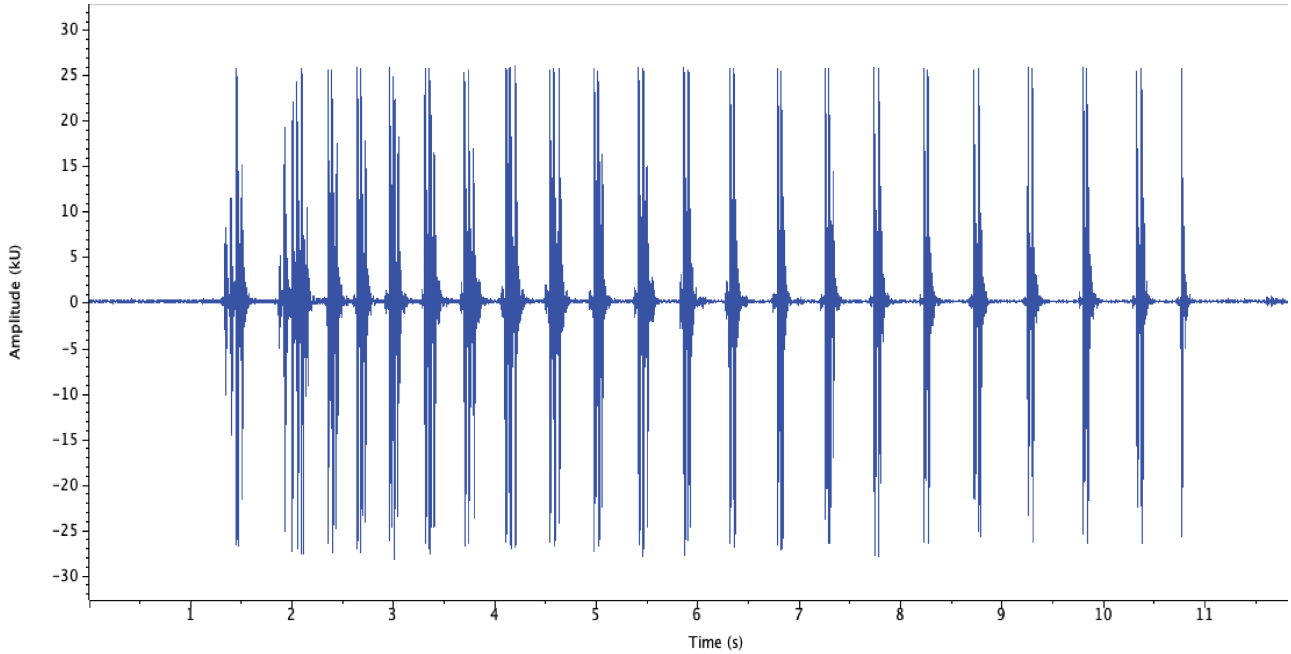


FIGURE 242. Calling drum (R99-87) adult male paratopotype *A. longispinoides*.

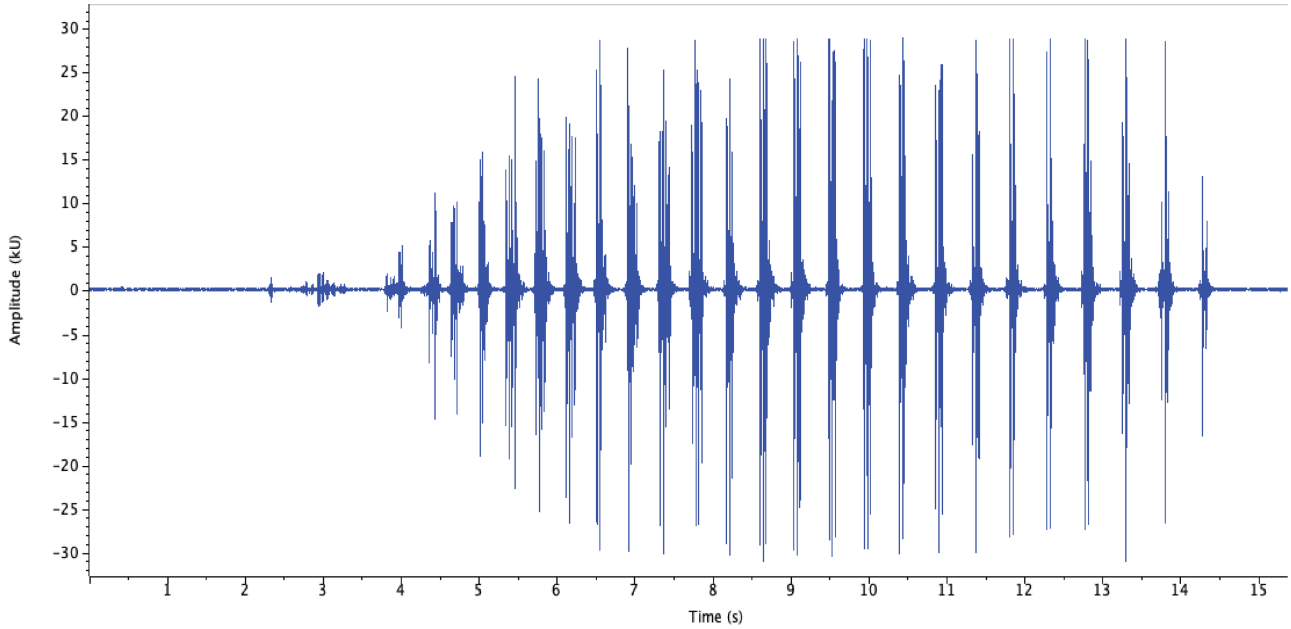


FIGURE 243. Calling drum (R99-96) adult male paratopotype *A. longispinoides*.

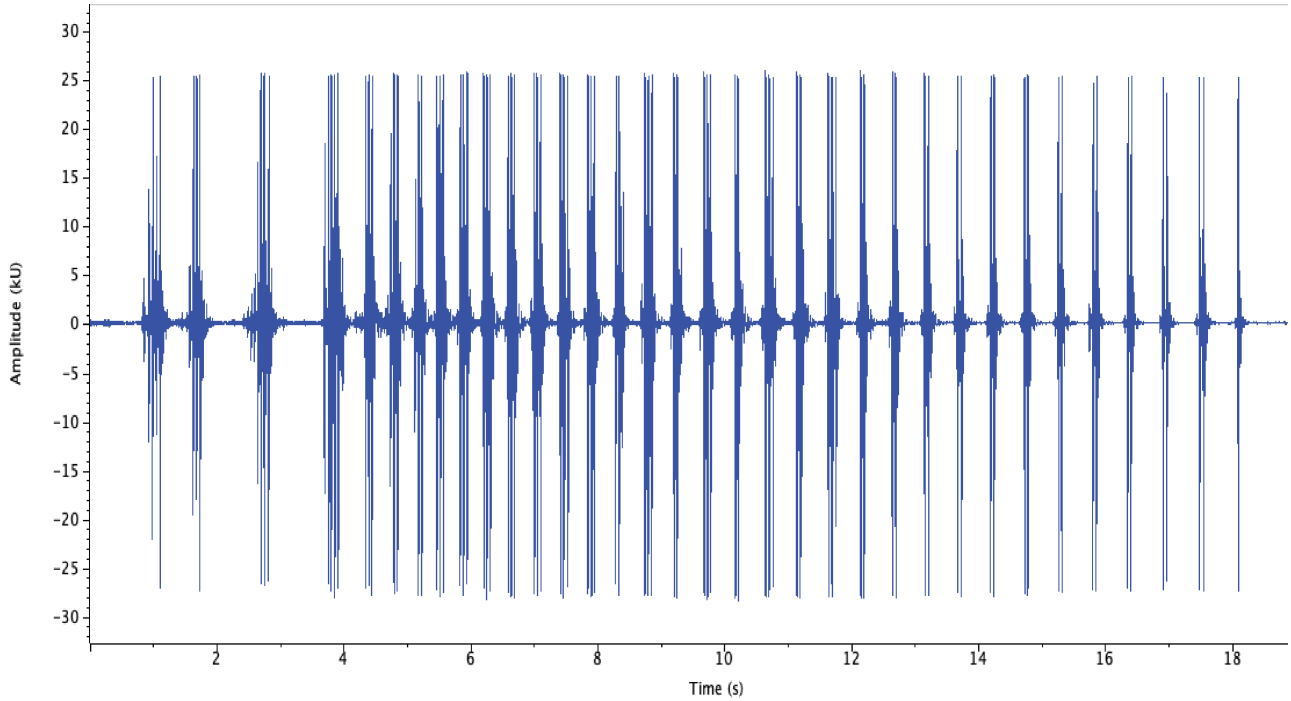


FIGURE 244. Calling drum (R00-42) adult male paratype *A. longispinoides*.

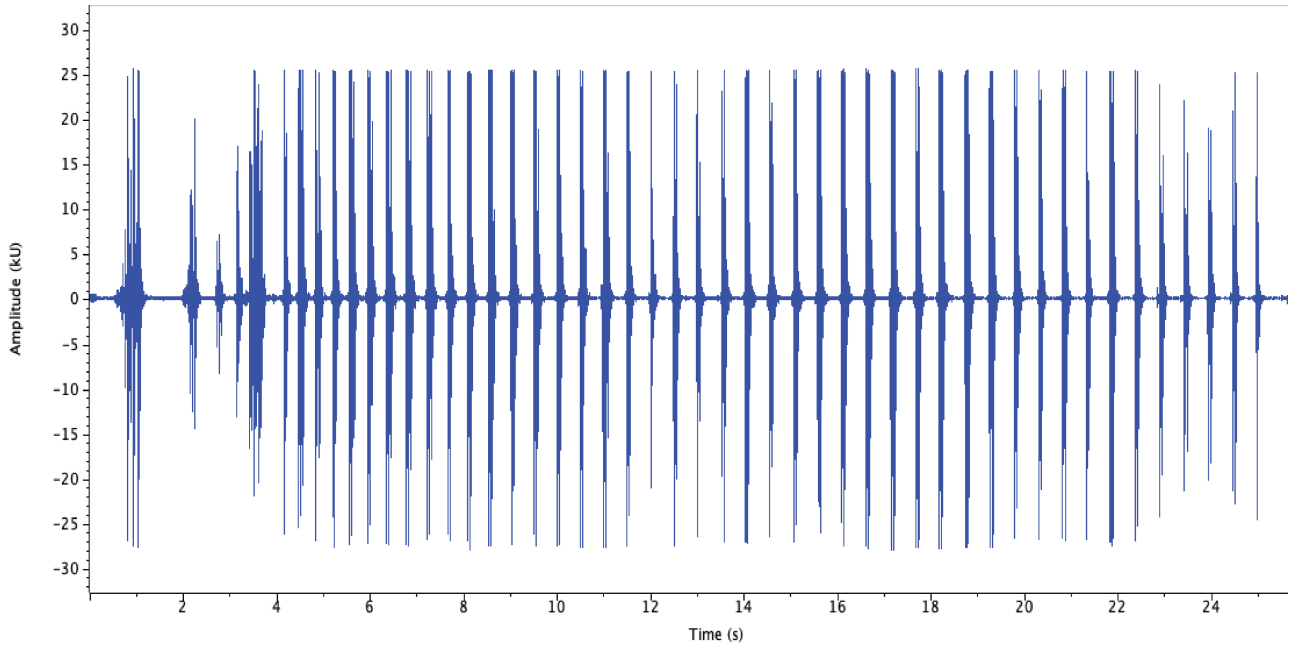


FIGURE 245. Calling drum (R99-115) adult female allotype *A. longispinoides*.

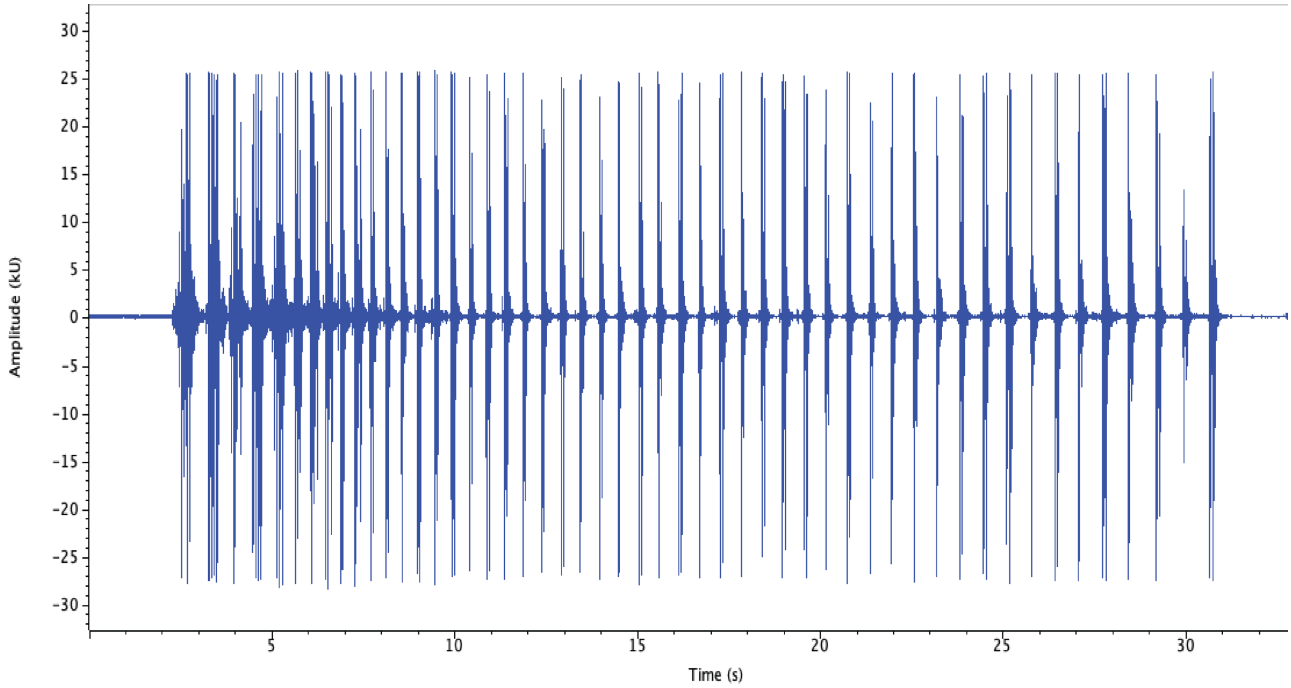


FIGURE 246. Calling drum (R00-1) adult female paratype *A. longispinoides.*

We also describe a series of calling drums from other California individuals, from various localities, to further document the range seen in *A. longispinoides*: ***Contra Costa Co.,*** Danville, female, S09-9, R09-44: 2 intro trills over 2.0s with 5 drums/trill, then 4 transition trills over 1.4s with 3 drums/trill, then 59 slow trills over 35.1s (1.7 trills/s) with 2 drums/trill, at 19°C. ***Humboldt Co.,*** Blue Lake, male, S98-128, R99-90: 1 long of 5 drums, then 4 transitions of trills over 0.9s of 3 drums/trill, then 24 trills over 10.1s (2.4 trills/s), 2–3 drums/trill; drum rate ~33 drums/s at 19.5°C. Blue Lake, female, S98-128, R99-116: 2 intro trills over 1.2s with 3–11 drums/trill, then 28 trills over 12.2s (2.3 trills/s) of (1) 2 drums/trill; drum rate ~16 drums/s at 19°C. Blue Lake, female, S98-128, R99-117: 2 long trills of 3–4 drums over 1.1s, then fast trills of 2 drums/trill at start changing to 1 drum/trill for the 2nd half. Total of 48 fast trills over 21.1s (2.3 trills/s); drum rate ~19.5 at 19°C. ***Marin Co.,*** Ft Cronkite, male, S09-160, R09-43: 39 trills over 19.6s (2.0 trills/s) with 2 drums/trills; drum rate ~21 at 19°C. ***Mendocino Co.,*** Gualala, male, S08-68, R09-41: 3 intro trills over 5.0s of 2 or 3 drums/trill, then 3 transition trills over 0.9s of 2 or 3 drums, then 21 slow trills over 9.5s (2.2 trills/s) of 3–4 drums; drum rate ~26 at 20.5°C. Gualala, female, S08-68, R09-45: 1 long trill of 5 drums, then 9 transition drums over 3.0s of 2–3 drums, then 27 slow trills over 13.1s (2.1 trills/s) with 1–2 drums/trill; drum rate ~25 at 20°C. Hwy 1, male, S98-126, R99-71: 2 long trills over 2.7s of 10–12 drums, then 6 transition trills over 1.8s of 4 drums/trill, then 21 short trills over 10.7s (2.0 trills/s) with 3 drums/trill; drum rate ~26 at 19.5°C. Hwy 1, male, S98-127, R99-86: 3 long trills of 6–8 drums over 1.5s, then 35 rapid trills over 16.4s (2.1 trills/s) of 3 drums/trill; drum rate of ~26/s at 19.5°C. Hwy 128, female, S98-123, R99-114: 2 long trills over 1.6s of 6–12 drums, then 2 transition trills of 4 drums each, then 23 trills over 10.0s (2.3 trills/s) most with 3 drums/trill; drum rate 18–20 at 19°C. Philo, male, S98-124, R99-66: 4 long trills over 4.8s, of 6–12 drums/trill, maybe 1 transition trill of 5 drums, then 27 short trills over 12.5s (2.2 trills/s) of 3 drums/trill; drum rate of ~22 at 20°C. ***San Francisco Co.,*** San Francisco, male, S07-95, R07-56: 3 slow slightly long trills in 2.2s, trills with 5 drums, then 0.6s gap, then 24 shorter trills over 15.7s with 3 (4) drums/trill; drum rate ~17.5, at 19.5°C. ***Sonoma Co.,*** Boonville, female, S98-122, R99-113: 5 introductory trills over 3.6s of 3–8 trills, then 41 trills over 21.1s (1.9 trills/s) with 2–3 drums/trill; drum rate ~17 at 19°C.

Comparing the calling drums, at similar temperatures, of microsympatric *A. intermedius* with that of *A. longispinoides*, both from Pacifica (S12-120), shows that they have similar number trills/s of around 1.6; similar drums/trill (4 for *A. intermedius* versus 2–3 for *A. longispinoides*); and similar drum rates of 20 drums/s for the smaller *A. intermedius* versus 15/s for the larger *A. longispinoides.* Where the 2 taxa significantly differ is that *A. intermedius* has both an introductory section of long trills and a transition section, the latter that is completely

lacking in *A. longispinoides.* These differences may indicate those areas that future researches should focus on when investigating what sexual cues are contained in JC calling drums. Are the 2 lead-in sections of *A. intermedius*' calling drum only important where it occurs with *A. longispinoides?*

Derivation of name. "oides" meaning resembling, having the form of, indicating that this widespread taxon looks like the nominate form of the Longispinus Group, *A. longispinus.*

Habitat. From coastal sand dunes (MacKerricher State Park) to oak-woodland-grassland areas.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. **CALLING DRUM**: See above under "Drum". Individuals within a population frequently differ in the presence or absence of long introductory trills. **COLOR:** Adults of both sexes in certain populations have the rear leg tibias a dark maroon color. **SIZE**: Individuals of both sexes from Colusa Co. are consistently the largest specimens seen of this species: females typically exceed 55mm in body length, exclusive of ovipositor, with the largest female measuring 59.2 mm.

We tabulated some 40 individuals from 2 populations: the type locality of Pepperwood and Mt. View, Santa Clara Co. All individuals had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and the rest had 5 inner **rear** leg tibial spines, and 1 had 1, 30 had 2, and 2 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 167, p. 136. F0694 (S97-23, Glenn Co.); F0861 (S98-110, Berkeley, Contra Costa Co.); F0883 & F0884 (S98-122, Sonoma Co.); F0892 (S98-126, Gualala, Mendocino Co.); F1019 (type locality S98-120, Pepperwood); F1059, F1060 (S98-128, Blue Lake, Humboldt Co.); F1098 (type locality S98-117, Pepperwood); F1105 & F1106 (S00-61, Lamphere Dunes, Humboldt Co.); F1271 & F1272 (S00-70, Pt Reyes, Marin Co.); F1534, F1558, & F1559 (S04-88, MacKerricher Beach, Mendocino Co.); F1863, F1864, & F1865 (S05-43, Colusa Co.); F1985 (S07-94, Trinity Co); F1986 (S07-95, San Francisco Co.); F2068 (S08-11, Trinity Co.); F2163 (S09-9, Danville, Contra Costa Co.); F2221 (S10-78, Pacifica, San Mateo Co.); F2689 & F2773 (S22-25, S22-26, Store Gulch, Oregon) all recovered in their own clade in Group 3 Longispinus.

Karyotype. 2n♂=25. 6 males checked with variable results: T91-3 (Fig. 247, type locality S91-16, Sonoma Co.); T93-13 (Fig. 248, S92-81, Oregon); T97-29 (Fig. 249, S97-23, Glenn Co.); T99-15 (Fig. 250, S98-126, Mendocino Co.); T99-31 (Fig. 251, S98-127, Mendocino Co.); T23-7 (Fig. 252, S22-24, Oregon) with from 5 (T91-3, T93-13, T99-15, T99-31) to 7 (T97-29, T23-7) metacentric or submetacentric autosomal pairs; 5 to 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Clearly, some of these differences appear slight and may simply be the result of differential condensing of the chromosomes. Other confirming karyotypes were seen from T92-22 (S91-127, Contra Costa Co.); T92-52 (S92-50, Mendocino Co.); T99-16 (S98-122, Sonoma Co.); T99-17 (S98-128, Humboldt Co.); T01-11 (S00-26, Humboldt Co.); T01-63 (S00-70, Marin Co.); T07-11 (S06-61, Mendocino Co.); and T10-2 (S10-1, Colusa Co.).

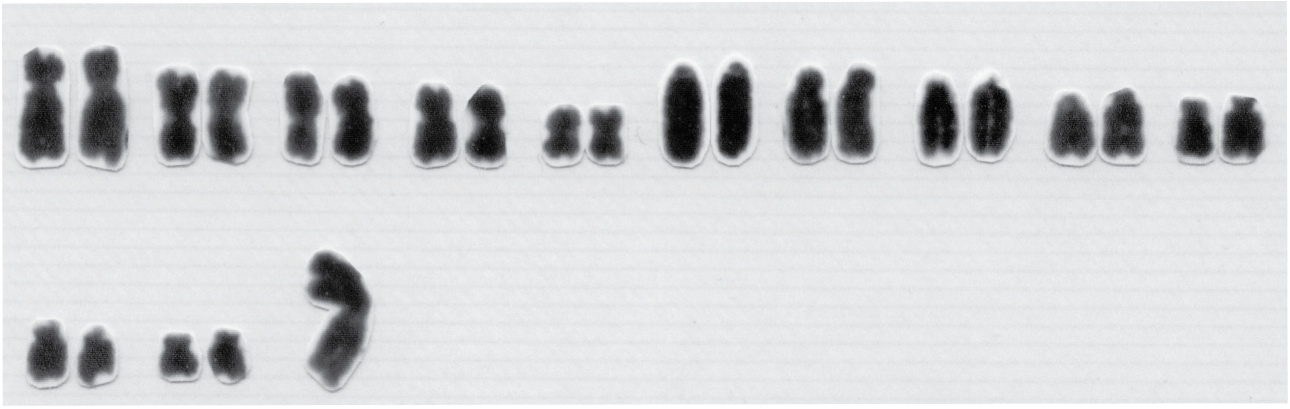


FIGURE 247. Idiogram T91-3 *A. longispinoides* (S91-16).

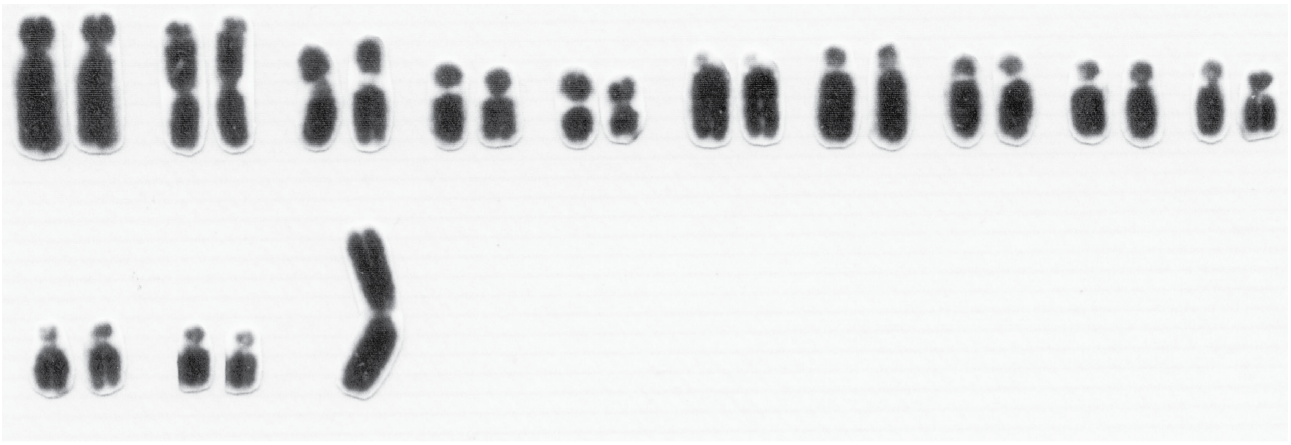


FIGURE 248. Idiogram T93-13 *A. longispinoides* (S92-81).



FIGURE 249. Idiogram T97-29 *A. longispinoides* (S97-23).

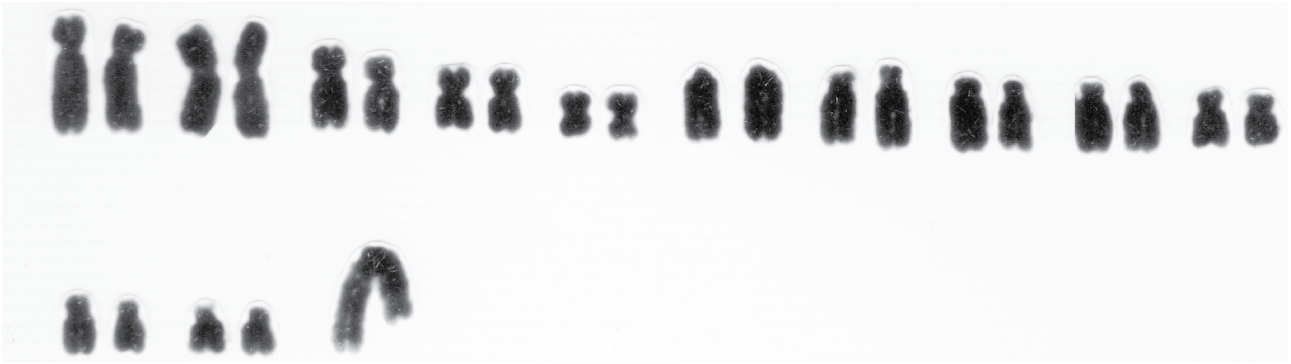


FIGURE 250. Idiogram T99-15 *A. longispinoides* (S98-126).



FIGURE 251. Idiogram T99-31 *A. longispinoides* (S98-127).



FIGURE 252. Idiogram T23-7 *A. longispinoides* (S22-24). Idiogram prepared from cell on right, using C-banding.

Discussion. Might the presence or absence of introductory trills have something to do with whether or not there is another species of sympatric JC that needs to be distinguished, by drum, from *A. longispinoides?* We have not looked at this possibility.

While the distributions of *A. longispinoides* and *A. brachysocius* broadly overlap in the Mt. View-Palo Alto area, Santa Clara Co., California, they are not known to be microsympatric although their different drums could act as premating barriers should they occur together. The 2 taxa can be separated by number of inner rear leg tibial spines: there are 3 or 4 in *A. brachysocius* vs 5 in *A. longispinoides* due to the consistent addition of 1 spine closest to calcar #1 that is absent in *A. brachysocius*. *A. longispinoides* is also recorded from Benicia (Solano Co., CA) along with *A. pictus.* Both *A. mtshasta* and *A. longispinoides* occur in Glenn Co., CA.

The only Oregon population, at Store Gulch, was sampled repeatedly. David C. Lightfoot, UNM, writes (pers. comm to DBW, June, 2020): "Store Gulch is in the Illinois River Valley, which is adjacent to, and seems biogeographically similar to the Smith River Valley just to the south in California (Siskiyou Mountains). The Ashland Area [where only *A. mtshasta* occurs] seems more like the Klamath region (Cascade Range) to the east, even though both are in the Rogue River drainage." Thus *A. longispinoides* appears to enter Oregon along the coast while *A. mtshasta* is a more inland species.

The pattern of inner rear leg tibial spine #1 being distinctly shorter than spine #2, is also seen in *A. irregularis.* The type locality (p. 750) of the latter is "Arizona", but no member of the Longispinus Group, except for *A. warnermts*, is known to occur east of the Sierra Nevada.

***Ammopelmatus longispinus* (Brunner von Wattenwyl)**
Long-spined Jerusalem Cricket
Figs 253–257, Tables 35, 40

1888. *Stenopelmatus longispina.* Verhandlungen der Kaiserlich-Koniglichen Zoologisch-Botanischen Gesellschaft in Wien 38:260. Holotype adult male pinned, with hooks (Fig. 254): (1) Vancouver Deyrolle leg Coll. Br. v. W. (2) Ile Vancouver (3) red label Type (4) 4775 (5) Stenopelmatus longispina Br. W. (6) Coll. Nat. Mus. Wien. Deposited NHMW Vienna. DBW examined the type in 1998: Megacephalic, measurements in mm: Body length 31.8, hind femur length 16.1, hind tibia length 16.3, #1 calcar length 5.45. Fore tibia with 3 ventral spurs, middle tibia with 8 calcars and 2 ventral spurs, hind tibia (Fig. 255B) with 5 inner and 4 outer spines, 2 ventral spurs. Face (Fig. 255A) without furrow. Although the original description clearly says "Patria: Vancouver" for both this species and *S. californicus*, the labels on both type specimens indicate "Ile [=Island] Vancouver" as the collection locality. There is a city of Vancouver located in both SW Washington and on the mainland of British Columbia, but neither of those would correspond to Vancouver Island.

1916. *Stenopelmatus californicus* (see p. 737). Hebard. Journal New York Entomological Society, 24:80, as a junior synonym of *S. longispina.*

2019. *Stenopelmatus longispinus.* Orthoptera Species File, Cigliano *et al.*, note spelling correction since *Stenopelmatus* is masculine.

2021. *Ammopelmatus longispinus.* Weissman *et al.* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on hind tibial spines, distribution, and DNA of related taxa.

Distribution. (Fig. 253). Southwestern British Columbia, Canada. Without a calling drum and/or DNA, we have no idea how far south *A. longispinus* ranges. The closest records that we have outside of the Northwest area, along with a calling drum and DNA, for a member of the Longispinus Group, are for *A. mtshasta* from SW Oregon, which also has a similar 5 inner and 4 outer rear leg tibial spine formula. Records for the rest of coastal Oregon and Washington are absent (Vickery & Kevan 1983), save for population-disjunct specimens from Corvallis, Oregon (p. 184). We have decided to let this name stand pending further material, and restrict its known distributional range to the Vancouver, British Columbia area, and Vancouver Island. With future, geographically intermediate specimens, *A. mtshasta* may prove to be a junior synonym of *A. longispinus*.



FIGURE 253. Distribution of *A. longispinus.*



FIGURE 254. Two views of holotype adult male *A. longispinus.*

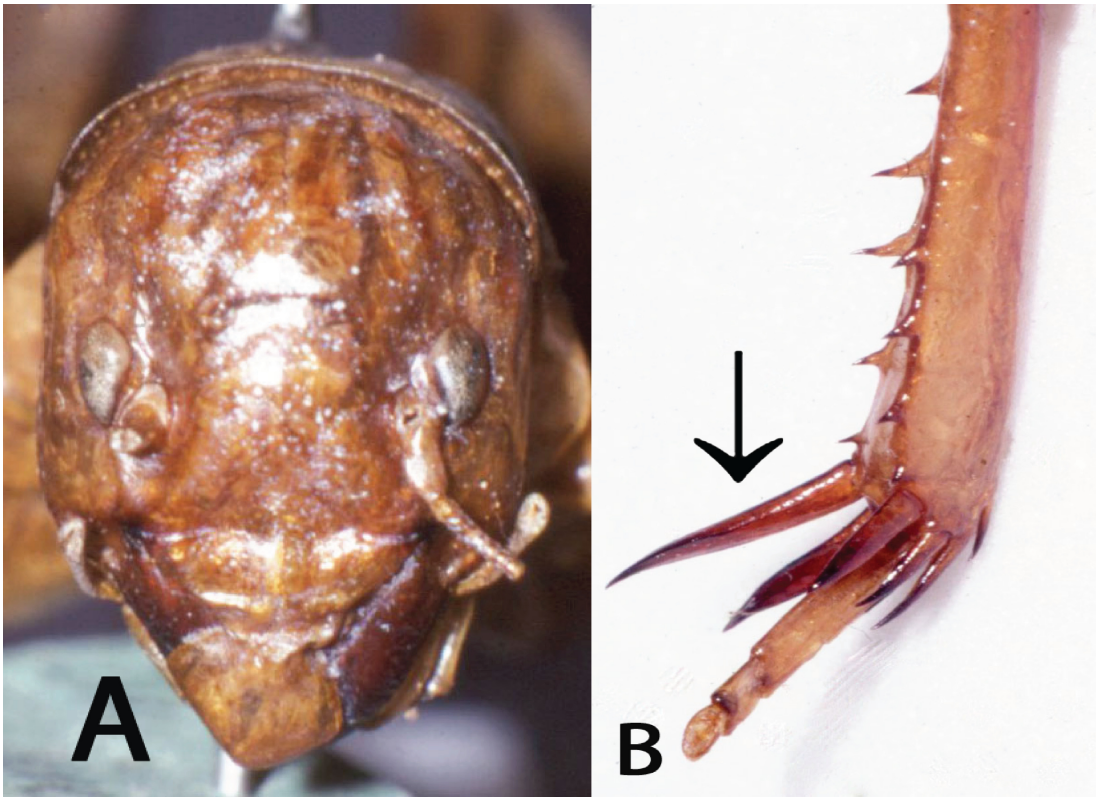


FIGURE 255. Holotype adult male *A. longispinus.* A. Face. B. Right rear leg tibia showing 5 inner and 4 outer spines. Note length of rear leg tibial calcar #1 (arrow).

Discussion. Both the male holotype and female allotype of *A. longispinus* (the female originally described as *S. californicus*—see p. 737) have 5 inner and 4 outer rear leg tibial spines, consistent with that seen in *A. mtshasta.* (The most northern, DNA-confirmed specimens of *A. mtshasta* that we have seen are from SW Oregon). Other Northwestern records, mostly from the literature, are few and include: (1) Victoria, Vancouver Island, 1905, W.A. Hanham (cited in Buckell 1930). (2) "In the vicinity of Vancouver, mainland British Columbia" (cited in Buckell 1930). (3) A photograph (Fig. 256) of an immature nymph, sent DBW by James Miskelly, and labeled Victoria [which is on Vancouver Island], B.C., 20-vii-65, R. Storey. (4) Semiahmoo Bay, Vancouver Region, Minnie Peterson (cited in Spencer 1958). Through the courtesy of S. Cannings, of the Spencer Entomological Museum, University of British Columbia, DBW examined the latter in 1988, and confirmed its identity (Fig. 257). This adult female was collected on 11-x-1955, from a potato patch, and has a body length of 33.3 mm, 3 fore leg ventral spurs, 8 middle tibia calcars, and 4 outer and 5 inner rear tibial spines. There is a printed, yellow label on the specimen which says "Origin?". In the late 1980s, DBW called some 13 Peterson's listed in the White Rock area, near Semiahmoo Bay, to see if anyone knew of a Minnie Peterson, but without success. (5) Vickery & Kevan (1983, p. 321) show some

coastal British Columbia locations but don't give specific localities. Their dots east of the Cascades represent *A. juniperdunes*.

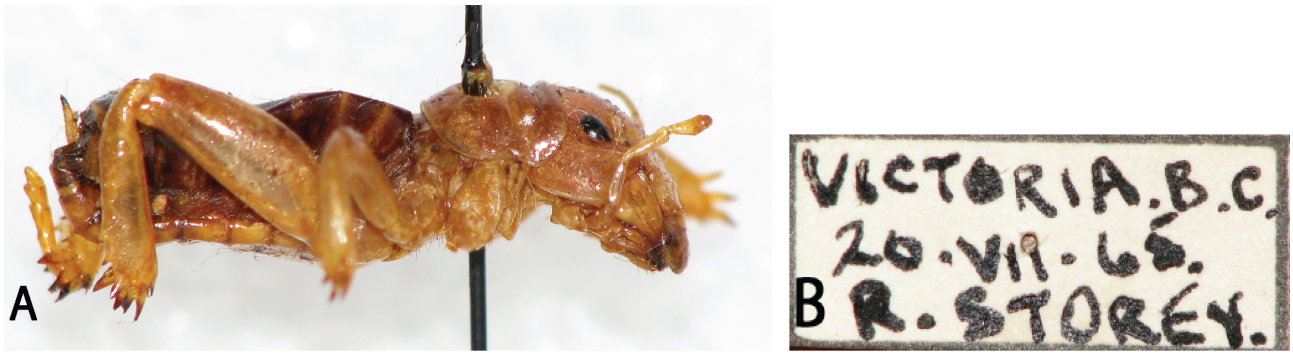


FIGURE 256. A. Immature male nymph from Victoria, Vancouver Island. B. Label for that nymph (Courtesy J. Miskelly).



FIGURE 257. Adult female, and labels, referenced by Spencer (1958).

Given so few Northwest records, and none since 1965, we even wonder if the type specimens might somehow have been introduced onto Vancouver Island, as there was a Fort Vancouver established on the Island in the 1840s (pers comm James Miskelly to DBW, 8-vi-2020). Miskelly (2012) provided a checklist for British Columbia Orthoptera, but gave no specific localities for *A. longispinus*.

Deyrolle, as noted in the original description, is a still-existing Paris, France, institution, first opened in 1831 by Jean-Baptiste Deyrolle, that continues to specialize in the sale and display of natural history specimens. It would appear that Brunner von Wattenwyl somehow acquired, from Deyrolle, a pair of JCs from Vancouver Island, Canada, since they have identical label data. Brunner von Wattenwyl subsequently described the adult male, in 1888, p. 260, as *S. longispina*; and the adult female, on p. 261, as *S. californicus*. The sexes of all species in the Longispinus Group are dimorphic with adult males having a longer, rear leg tibial #1 calcar when compared to the adult females, and typically longer hind legs (as documented for the related *A. brachysocius* [Weissman *et al.* 2008]).

***Ammopelmatus mtshasta* Weissman, sp. nov.**
Mt. Shasta Jerusalem Cricket
Figs 258–274, Tables 32, 40

Distribution. (Fig. 258). Inland Northern California, generally north of the distribution of *A. longispinoides*; in the Cascades of southwestern and central Oregon, and to the west.

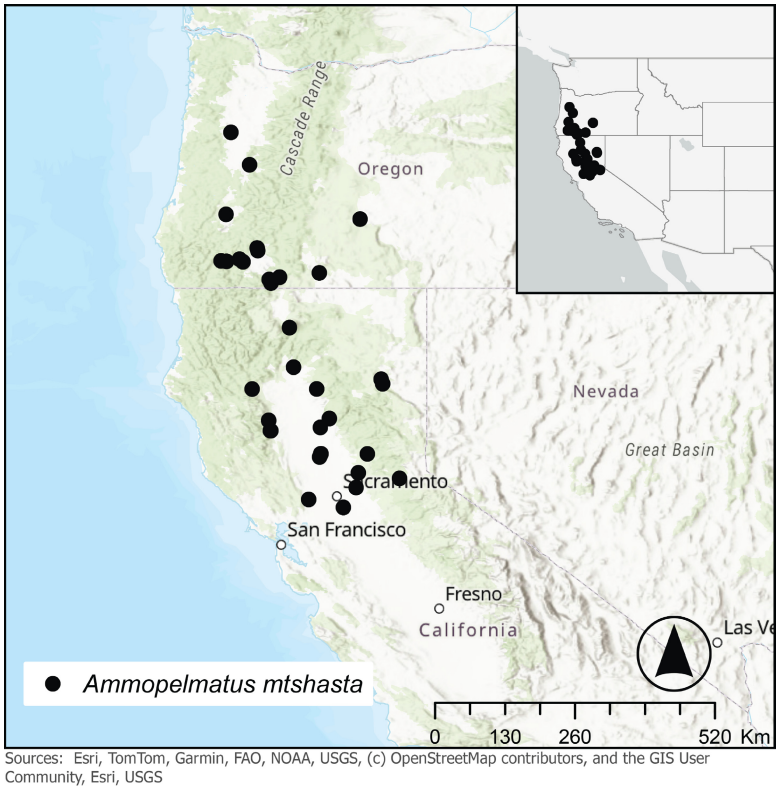


FIGURE 258. Distribution of *A. mtshasta.*

Recognition characters. One of the 5 large species in the Longispinus Group; and all in separate DNA subclades, where individuals of *A. mtshasta* usually have 5 inner and 4 outer rear leg tibial spines. For the 3 other large-sized members (excluding the geographically restricted *A. longispinus*), *A. brachysocius* usually has 4 inner and 2 outer spines, plus a different calling drum; *A. finnon* usually has 4 inner and 3 outer spines; and *A. longispinoides* usually has 5 inner and 2 outer spines. Some specimens of *A. mtshasta* (e.g., Fig. 259, S08-11, Trinity Co.) have inner rear leg tibial spine #1 distinctly shorter than spine #2, a condition more commonly seen in *A. longispinoides.*



FIGURE 259. Left rear leg tibia adult female *A. mtshasta* (S08-11, R08-37 & R08-40, F2068) showing (arrow) inner spines #1 shorter than inner spine #2.

Holotype. Male (in alcohol, Fig. 260). **California, *Siskiyou Co.,*** Shasta-Trinity National Forest, Mt. Shasta, McBride Springs Campground, 41.352347° -122.283706°, 1482m, 3-vi-1997 (S97-53). R97-77, F0518. Molt to adult 2-viii-1997. Deposited CAS, Entomology type #20107. Measurements in mm: Body length 30.71, hind femur length 12.70, hind femur width 5.23. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 261) with 5 inner and 4 outer spines, 2 ventral spurs.

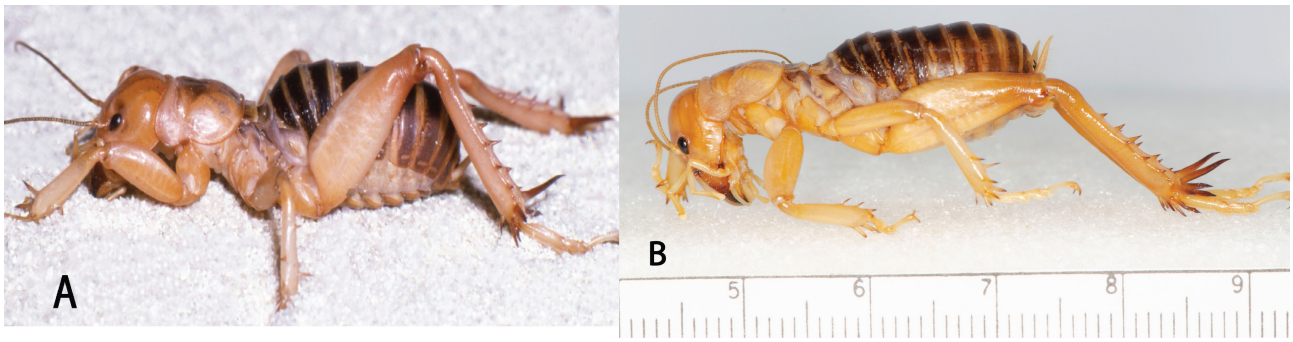


FIGURE 260. Adult male holotype *A. mtshasta.* A. When alive. B. When preserved.



FIGURE 261. Left rear leg tibia adult male holotype *A. mtshasta.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 262) Same data as holotype except R98-163, F0807. Molt to adult 30-viii-1998. Deposited CAS, CASENT #9080621. Measurements in mm: Body length 36.42, hind femur length 10.53, hind femur width 4.36. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 263) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 264.

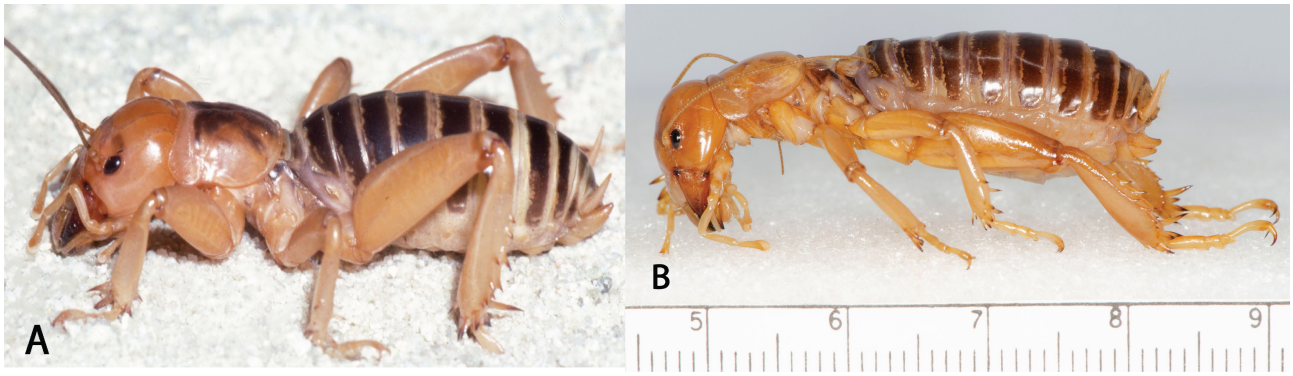


FIGURE 262. Adult female *A. mtshasta.* A. Live paratopotype (S92-72, R92-50). B. Preserved allotype.

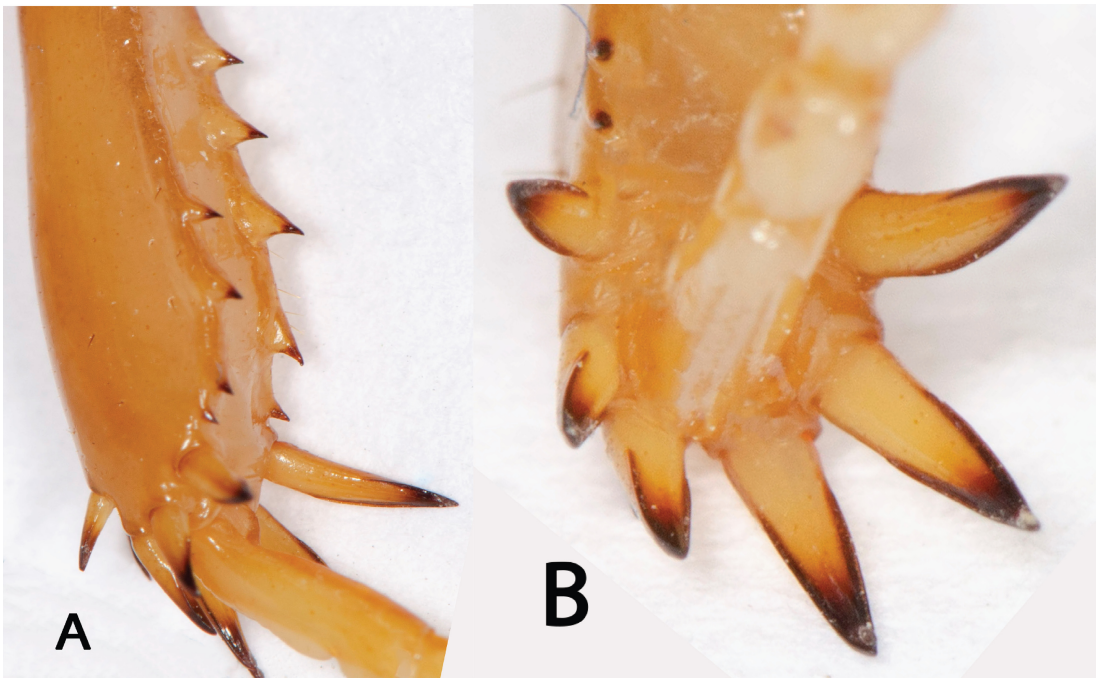


FIGURE 263. Left rear leg tibia adult female allotype *A. mtshasta.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 264. Ovipositor allotype *A. mtshasta.*

Paratypes. ♂58 ♀67. **CALIFORNIA, *Butte Co.,*** Chico, across street from 118 Honey Run Rd, 39.710598° -121.768564°, 76m, 15-xii-1998 (S98-129) ♂1 ♀6. Magalia, 39.857134° -121.617712°, 798m, 21-25-v-2005 (S05-58) C. Wemmer ♀2. ***El Dorado Co.,*** Union Valley Reservoir, 38.872636° -120.446554°, 1557m, 25-vii-1986 (S86-89) G. Buhlert ♂1. ***Glenn Co.,*** Mendocino National Forest, old Hwy 162 0.7 road M W junction with new Hwy 162, 39.658306° -122.603084°, 441m, 22-ii-1997 (S97-19) J. Schweikert ♂1. Mendocino National Forest, Hwy 162 at old Hwy 162, 3.7 m W of county road 306, 39.656757° -122.594360°, 325m, 19-i-1997 (S97-13) J. Schweikert & J. Vindum ♂1. Willows, 23-v-2005 (S05-54) J. Miller ♀1. ***Lassen Co.,*** South end Eagle Lake, 9-vii-1984 (S84-43) SJ Arnold ♀1. Eagle Lake Road (A1) near intersection with Hwy 36, 40.428583° -120.728500°, 1483m, 25-viii-2019 (S19-64) ♂15 ♀9. Eagle Lake Road (A1) 8.7 m W Hwy 36, 40.503250° -120.753633°, 1825m, 29-viii-2003 (S03-91) ♂1. ***Nevada Co.,*** Nevada City, 10567 Lost Dog Rd, 39.274112° -120.982991°, 870m, 9-ii-1992 (S92-1) J. Miller ♀1. ***Placer Co.,*** north Auburn, nr Bell Rd and Hubbard Rd, 38.963448° -121.135049°, 377m, 14-vi-2013 (S13-39) W. Icenogle ♀1. ***Sacramento Co.,*** Elk Grove, 38.393852° -121.384043°, 16m, 13-viii-2006 (S06-73) M. Elliott ♀1. Folsom Lake SRA, Beals Pt. area, 38.720667° -121.171444°, 143m, 29-iii-2005 (S05-38) ♀1. Folsom Lake, 29-v-1987 (S87-37) L. Saul ♂1. ***Shasta Co.,*** Beegum Gorge Rd, 2.2 m above Hwy 36, 40.34208° -122.90643°, 1025m, 11-viii-2018 (S18-39) ♀1. Happy Valley, 8-10-vii-1987 (S87-88) J. Walker ♀1. Redding, Cottonwood Ranch, J. Walker, February, 1986 (S86-13) ♂1; 8-vii-1986 (S86-80) ♀1; 10-x-1986 (S86-134) ♀1; 8-xi-1986 (S86-150) ♂1; 6-xii-1986 (S86-160) ♀1; 4-iv-1987 (S87-15) ♀1; 17-iv-1987 (S87-17) 1 male for testes; 26 & 27-iv-1987 (S87-22) ♀2; 20-27-x-1987 (S87-112) ♂2 ♀1. Redding, 22700 Jones Valley Trail, 40.701736° -122.214767°, 283m, 3-xi-2009 (S09-161) S. Kauffmann ♀2. 3 m N Redding, 600', 29-v-1983 (S83-32) ♂2. 15 m NE Anderson, 8-v-22002 (S02-28) E. Ross ♀1. ***Siskiyou Co.,*** type locality, 29-v-1983 (S83-33) ♂1; 2-ix-1983 (S83-119) ♂5 ♀4; 29-vi-1992 (S92-72) ♂2 ♀2; 2-vi-1997 (S97-53) ♂5 ♀4. Fort Jones, April, 1986 (S86-20) J. Walker ♀1. Scott River, (S87-84) Haycock, ♂1. ***Sutter Co.,*** Sutter Buttes, Dean Place, 39.223382° -121.781064°, 201m, 4-iv-2003 (S03-137) MC Hedin ♀1. Sutter Buttes, 5.6 m W Live Oak, 39.275333° -121.763698°, 23m, 21-i-1985 (S85-5) TS Briggs, VF Lee, D. Ubick ♂3 ♀3; Pennington Rd 5.1 m W Live Oak, 39.275671° -121.755606°, 23m, 15-xii-1998 (S98-130) ♂4 ♀6. ***Tehama Co.,*** Mendocino National Forest, Round Valley Rd 3.7 road m W Newville, 39.826353° -122.630889°, 374m, 22-ii-1997 (S97-21) J. Schweikert ♂1 ♀1. Mendocino National Forest, Forest Rd M4, 4.1 road m W Newville Rd 39.822072° -122.629071°, 405m, 23-ii-1997 (S97-22) J. Schweikert ♀1. Hwy 36, 28 road m E Red Bluff, 40.343387° -121.829381°, 871m, 30-iii-2005 (S05-41) ♂1. ***Yolo Co.,*** Winters, 217 Creekside Way, 38.524555° -121.962622°, 43m, 1-x-2005 (S05-142) C. Erickson ♀1. **OREGON, *Douglas Co.,*** Roseburg, 43.216498° -123.341739°, 167m, 6-xii-2007 (S07-109) J. Rezze ♀1. Roseburg, 29-viii-1947, MH Hatch ♂1. ***Jackson Co.,*** Ashland, 5311 Old Siskiyou Hwy, 42.086183° -122.592399°, 1032m, 27-ix-2004 (S04-133), D. Bishop ♂1. Cascade-Siskiyou National Monument, Hyatt Reservoir, Wildcat Campground area, 42.182850° -122.447741°, 1530m, 28-viii-2019 (S19-70) ♂1 ♀2. Emigrant Lake, 42.144258° -122.621352°, 697m, 27-vii-2022 (S22-34) ♂1. Gold Hill, 1212 6th Ave, 42.435331° -123.058927°, 358m, 27-ix-2004 (S04-134) S. Suppo ♀1. Rogue River, 4220 Wards Creek Rd, 42.478977° -123.116774°, 520m, 29-vi-2005 (S05-63) R. Ogden ♀1. Shady Cove, Mallory Lane, 42.620611° -122.812073°, 434m, 5-iv-2005 (S05-46) D. Conrad ♂1. Trail, 1362 Highway 227, 42.663345° -122.823851°, 489m, April-May, 2005 (S05-47) D. Conrad ♂1 ♀3. ***Josephine Co.,*** Grants Pass, 214 NW Booth St, 42.442793° -123.334017°, 294m, 1-x-2008 (S08-71), J. Boling ♀1. Grants Pass, 500 Cambridge Dr., 42.451346° -123.424891°, 319m, 11-x-2005 (S05-149), J. Rentz ♀1. ***Klamath Co.,*** Klamath Falls, 3201 Campus Dr, 42.253748° -121.785303°, 1330m, 30-ix-2005 (S05-144) D. Ross ♂1. ***Lake Co.,*** 3m NW Silver Lake, 43.13908° -121.10517°, 1352m, 16-vii-2006 (S06-66) A. Truksa ♀1.

Probable placement. **OREGON, *Benton Co.,*** Corvallis, 44.566° -123.260°, 70m, 20-viii-1955 K. Orlica ♀1. Corvallis, year given as "19__", S. Simmons, ♀1. Although the rear leg spine formation is consistent with *A. mtshasta,* the absence of drumming and DNA information for any specimen from Corvallis, in light of the nearest population of *A. mtshasta* being some 140 km to the south at Roseburg, we make this determination tentative. ***Lane Co.,*** Springfield, 4833 Jasper Rd, 44.032528° -122.949512°, 155m, mid-xi, 1999, V. Wright.

Drum. Calling drum same in both sexes except that usually more trills in male than female, which is contra the normal situation. **Male:** Holotype R97-77 (Fig. 265), 20°C. 16 trills in 5.8s (2.8 trills/s), most trills of 2, rarely 3, abdominal strikes. **Female:** Allotype R98-163 (Fig. 266), 17°C. Three consecutive series, with the tape running, showing bursts of 10 trills over 4.3s (2.3 trills/s), 9 trills of 2 drums and 1 "trill" a single drum; 7 trills over 3.0s (2.3 trills/s); and 8 trills over 3.7s (2.2 trills/s). Difference in trill rate between types possibly attributable to different recording temperatures.

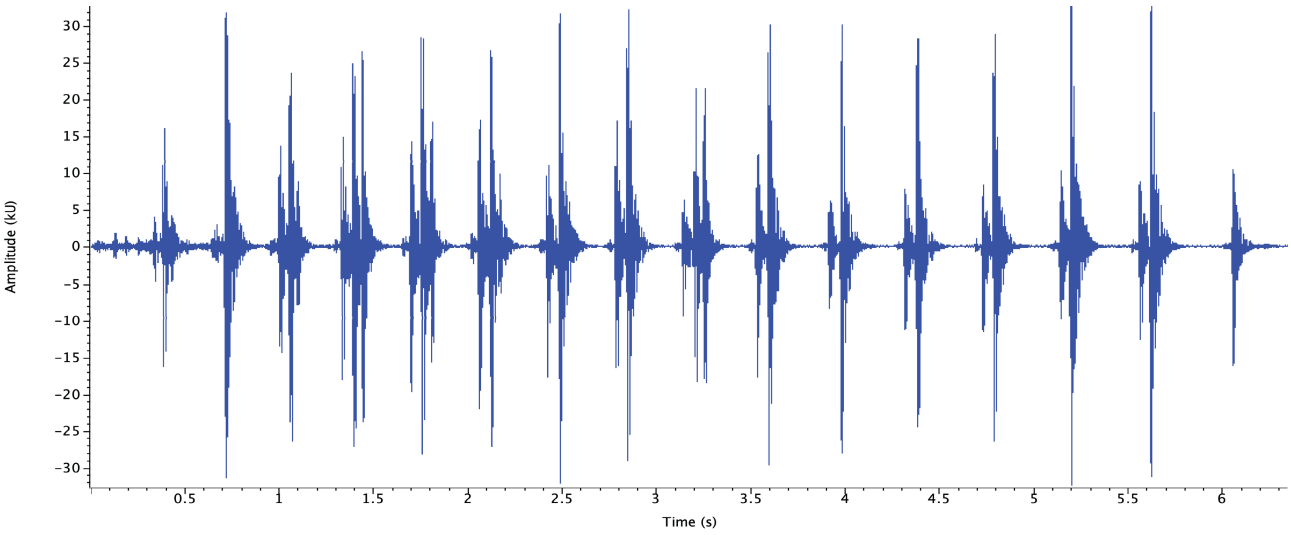


FIGURE 265. Calling drum (R97-77) adult male holotype *A. mtshasta.*

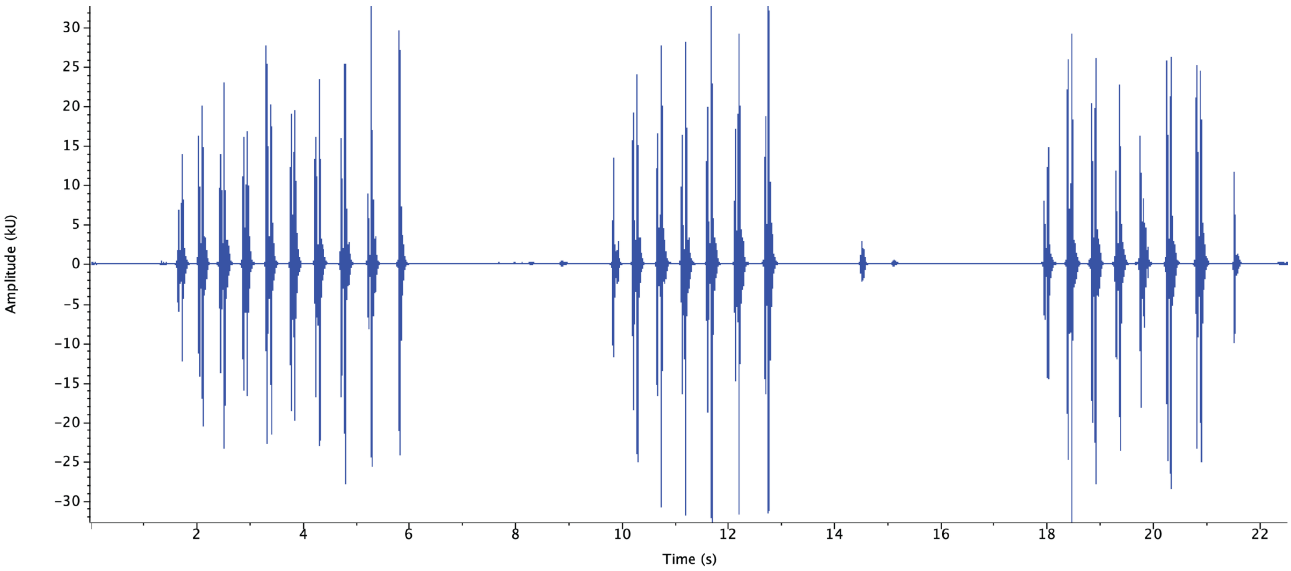


FIGURE 266. Three separate calling drums (R98-163) adult female allotype *A. mtshasta.*

Other random calling drums analyzed include: (1) **Folsom Lake** area, S05-38, **Female**: R05-93, 7 single and 1 pair over 5.1s at 19°C. (2) **Sutter Butte**, S98-130, **Male:** R99-80A, 24 short trills over 14.2s (1.7 trills/s), rarely 1, usually 2 drums/trill. Drum rate 17.5 at 19.5°C. **Female:** R99-112, repeated short series of 10 "trills" over 4.7s (2.1 trills/s). 1st and last trill with 1 drum, 2nd thru 9th trill with 2 drums. Drum rate 13 at 18°C. (3) **Chico,** S98-129, **Male:** R99-97, just 36 short trills over 28.2s (1.3 trills/s), of 2 drums/trill. Drum rate 16.7 at 18.5°C. **Female:** R99-92, just 6 trills over 2.7s (2.2 trills/s) of 1-2 drums/trill, at 20.5°C.

Derivation of name. Named after the type locality from which we have our largest series.

Habitat. Type locality of Mt. Shasta with pines, manzanita, ferns. Many JCs collected during daytime under rocks within campground but also to oatmeal trails at night, especially between Road A10 and Campground circle. Sutter Butte area is open oak woodland with grasses. The adult female (F1855) from Lake Co., Oregon (S06-66), is recovered within the *A. mtshasta* clade despite her locality being high desert.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. From some 51 individuals, 1 had 2 and 49 had 3 ventral **fore** leg tibial spurs; all 49 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs except for 1 Sutter Butte individual (S98-130) with 3; 50 had 5 and 1 had 6 inner **rear** leg tibial spines, and all 51 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Rear leg ringlet**

calcars, especially #1 and #2, are darker in adult males from Eagle Lake (Fig. 267, S19-64, R19-22) and the Oregon localities of Hyatt Reservoir (S19-70) and southwestern Oregon, but of the same length and shape, when compared with those from the type locality of Mt Shasta (Fig. 261 above). In these adult males, calcar #1 approaches, in darkness, those seen in males of the Lightfooti Group, but they are not as broad as in the latter Group species. Also, we see a yellow tinge in the **dorsal, distal adult male tergites** similar to what is seen in many Lightfooti Group adult males. In the Benton Co., Oregon (see under "Probable placement" above), adult female collected by S. Simmons, both distal rear leg inner tibial #1 spines are longer than spines # 2 and #3, leading us to wonder if this specimen might be mislabeled.



FIGURE 267. Left rear leg tibia adult male *A. mtshasta* from Eagle Lake (S19-64, R19-22) showing darkened calcars #1 and #2.

DNA. Fig 167, p. 136. F0518 (type locality S97-53, Mt Shasta); F0607 (S97-19, Glenn Co.); F0804 (type locality S97-53, Mt Shasta); F0903 (S97-21, Tehama Co.); F1023, F1024 (S98-129, Chico, Butte Co.); F1027, F1028 (S98-130, Sutter Buttes, Sutter Co.); F1360 (S03-91, Eagle Lake, Lassen Co.); F1615 (S05-47, Trail, Jackson Co., OR); F1647 (S05-41, Red Bluff, Tehama Co.); F1649, F1659 (S05-58, Magalia, Butte Co.); F1666 (S05-38, Folsom, Sacramento Co.); F1668 (S05-58, Magalia, Butte Co.); F1671 (S05-144, Klamath Falls, Klamath Co., OR); F1702 (S05-142, Yolo Co.); F1705 (S05-149, Grants Pass, Josephine Co., OR); F1855 (S06-66, Lake Co., OR); F2078 (S08-71, Grants Pass, Josephine Co., OR); F2217 (S09-161, Redding, Shasta Co.); F2354 (S13-39, Auburn, Placer Co.); F2571, F2572 (S19-70, Hyatt Reservoir, Jackson Co., OR); F2574, F2575 (S19-64, Eagle Lake, Lassen Co.); F2684 (S22-34, Emigrant Lake, Jackson Co., OR) all recovered in Group 3 Longispinus nearest to *A. briani* and *A. rentzi*.

Karyotype. 2n♂=25. Eight individuals karyotyped: T87-23 (Fig. 268, S87-17, Shasta Co.); T92-20 (Fig. 269, type locality S92-72); T93-18 (Fig. 270, type locality S92-72); T98-4 (Fig. 271, type locality S97-53); T99-10 (Fig. 272) & T99-13 (Fig. 273), both S98-130, Sutter Butte, Sutter Co.; T19-18 & T20-2 (Fig. 274, S19-64, Eagle Lake, Lassen Co). In all cases, with 9 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

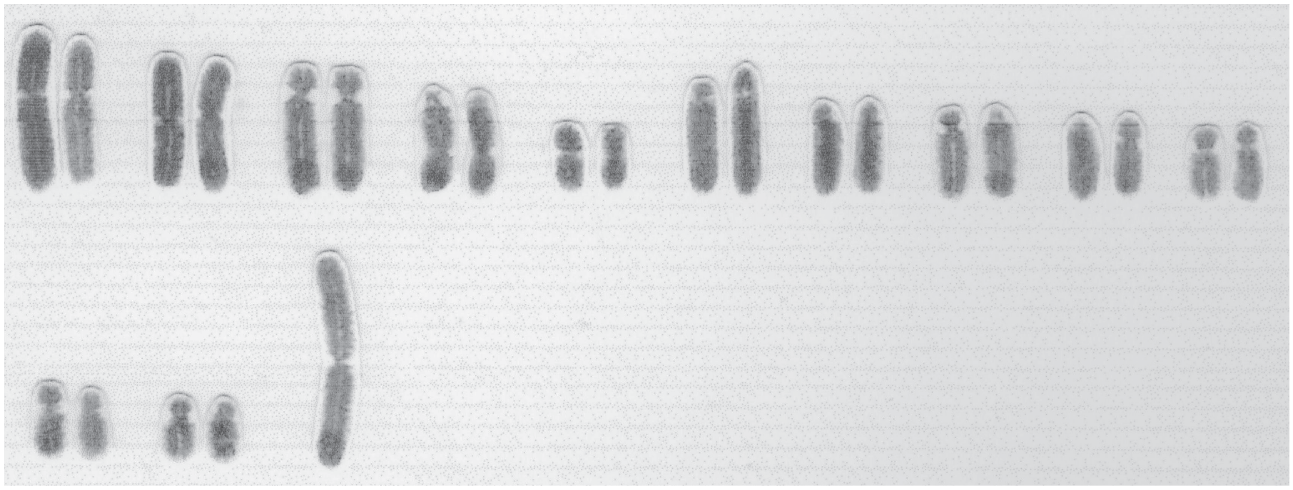


FIGURE 268. Idiogram T87-23 *A. mtshasta* (S87-17).

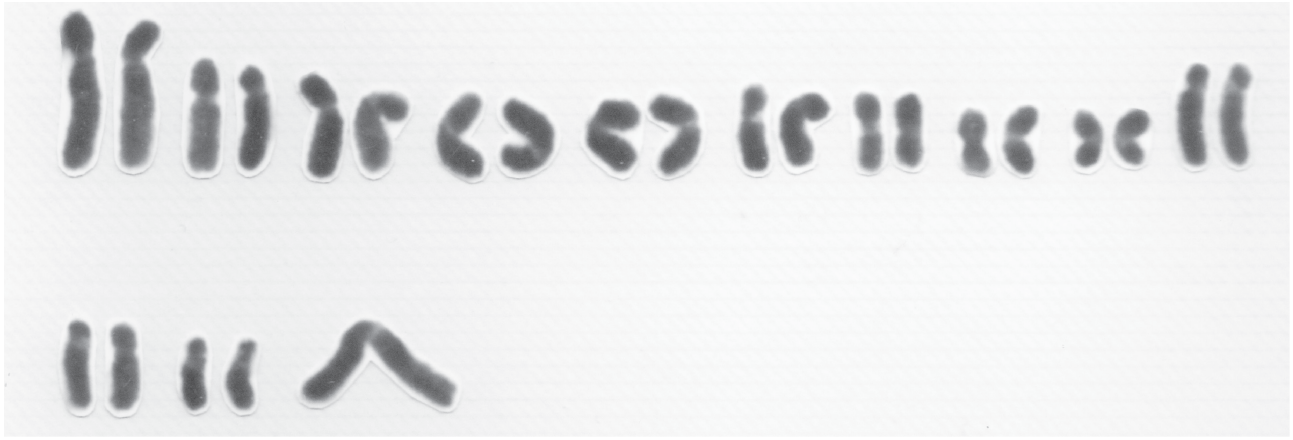


FIGURE 269. Idiogram T92-20 *A. mtshasta* (S92-72).

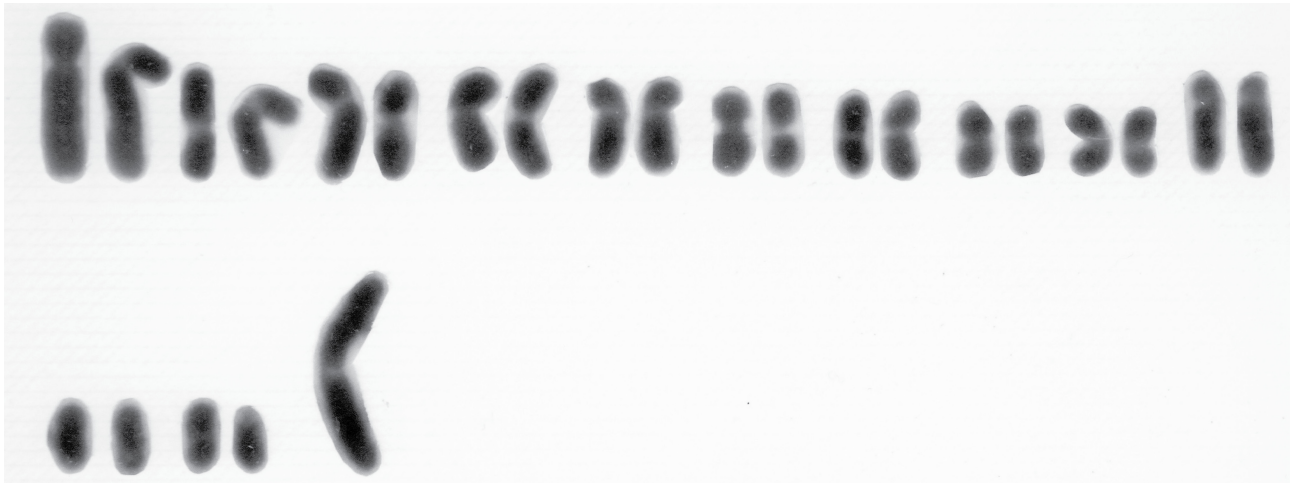


FIGURE 270. Idiogram T93-18 *A. mtshasta* (S92-72).



FIGURE 271. Idiogram T98-4 *A. mtshasta* (S97-53).

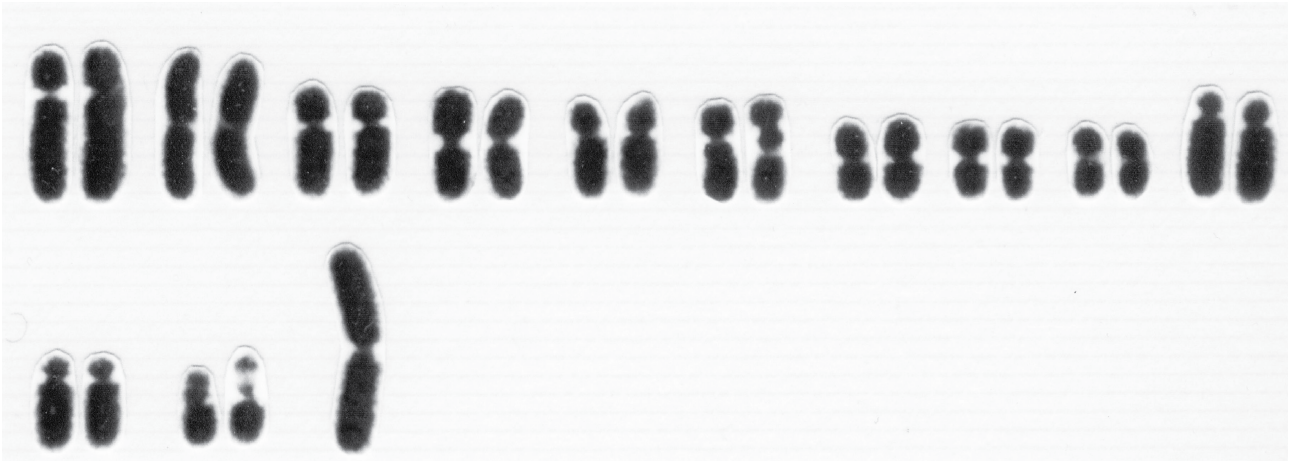


FIGURE 272. Idiogram T99-10 *A. mtshasta* (S98-130).

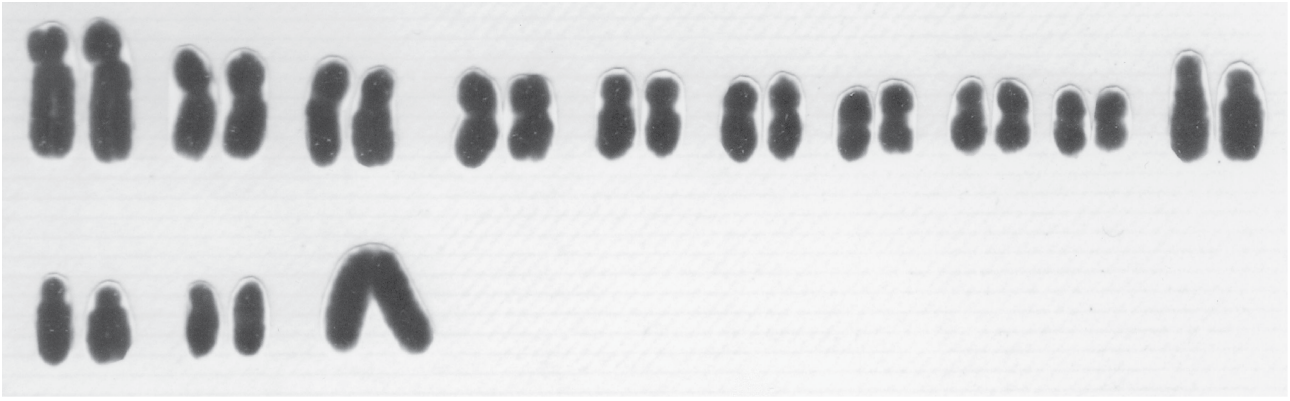


FIGURE 273. Idiogram T99-13 *A. mtshasta* (S98-130).



FIGURE 274. Idiogram T20-2 *A. mtshasta* (S19-64), with C-banding.

Discussion. The rear leg tibial spine formula of *A. mtshasta* agrees with that seen in the Vancouver Island male holotype of *A. longispinus* and female holotype of *A. californicus*, the latter two which we reconfirm as synonymous with each other (see pp 182 and 737). But given the physical separation of some 490 km between the type locality of the latter two and the most northern, confirmed locality of *A. mtshasta* (Corvallis, Oregon), we choose to give the more southern populations a new name, to avoid potential confusion. Should further investigations involving DNA, karyotype, and drumming patterns in the southwestern Canadian populations show little separation between these names, then synonymy of *A. mtshasta*, under *A. longispinus*, may be warranted.

We attempted to locate fresh material of *A. mtshasta* from around Corvallis, Benton Co., Oregon, since previous specimens from there have poor locality information. On 8-viii-2024 (S24-51), a long oatmeal trail was laid in McDonald Research Forest. Despite the area looking great, no JCs were seen.

We note that *A. warnermts* is recovered making *A. mtshasta* paraphyletic. Nevertheless, given the isolated location of the latter, and the only specimen from east of the Sierra Nevada, we choose to name it as different (see p. 218).

Although there are physical similarities between some populations of *A. mtshasta* and the species in the Lightfooti Group, mainly in the unusual yellowish coloration in the terminal abdominal segments (tergites) and the development of rear leg calcar #1, they differ as follows: (1) All populations of *A. mtshasta* are either in the Cascades (S05-144, S06-66, S19-70) or west of the Cascades, and none have a sex clarification drum. (2) All Lightfooti Group species are east of Cascades and Sierra Nevada, and all taxa have a sex clarification drum.

***Ammopelmatus nigrocapitatus* (Tinkham & Rentz)**

Black Headed Jerusalem Cricket
Figs 275–294, Tables 1, 2, 13, 40, 42

1969. *Stenopelmatus nigrocapitatus.* Pan-Pacific Entomologist, 45, 4–14. Holotype, adult male: **California, *Fresno Co.,*** Jacalitos Canyon. Deposited CAS, Entomology type #10120. Specimen examined. (Note mistaken reversal of labels in original publication [Tinkham & Rentz 1969], with *A. nigrocapitatus* in Fig. 2 and *A. pictus* in Fig. 3).

Species #21, Weissman (2001b).

2021 *Ammopelmatus nigrocapitatus.* Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on rear leg tibial spines and DNA.

Distribution. (Fig. 275). Only known from 4 counties, all on the western side of California's San Joaquin Valley.

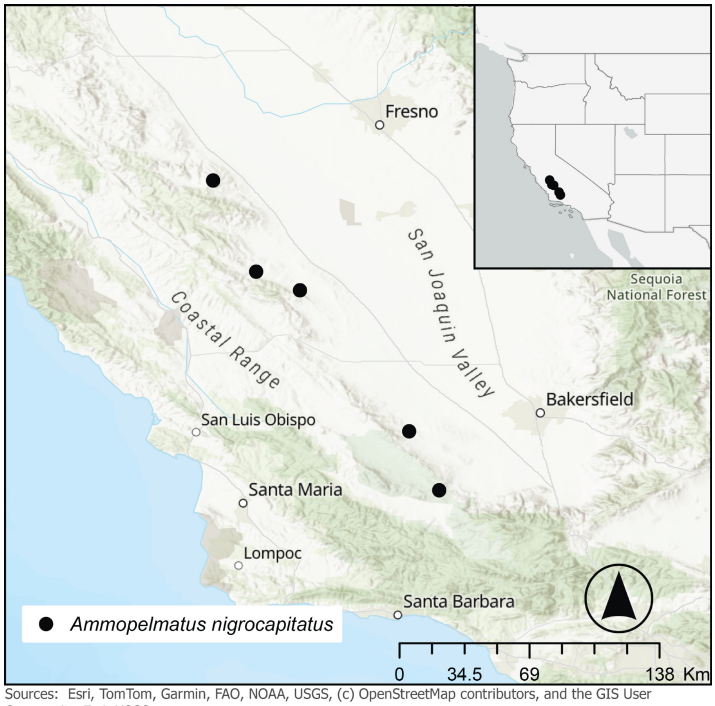


FIGURE 275. Distribution of *A. nigrocapitatus.* Tinkham & Rentz (1969) cite a record of *A. nigrocapitatus* from the east side of the San Joaquin Valley, at Hot Springs, Tulare Co. We have done extensive collecting in that area without ever finding this species. And given that Hot Springs (35.886465° -118.653982°) is located at 1090m in the Sierra foothills, we doubt the accuracy of this locality.

Recognition characters. Member of Longispinus Group. A small to medium sized JC in which only adults have characteristic black heads (Figs 276 & 277). All nymphs, including last instars (Fig. 278), lacking black heads. Nowhere sympatric with more northern sister taxon *A. pictus.* Rear leg tibia (adult male Fig. 279; adult female Fig. 280) usually with 2 outer and 3 inner spines. Ovipositor Fig. 281.



FIGURE 276. Adult male *A. nigrocapitatus* S04-29 (R04-84, Carrizo Plain).

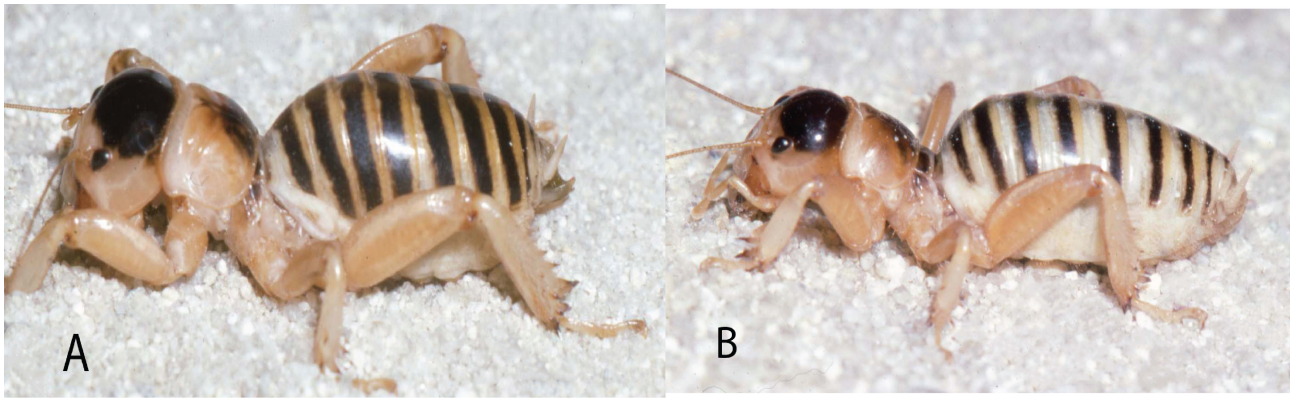


FIGURE 277. Adult females of *A. nigrocapitatus* showing variation in width of abdominal stripes and color pattern. A. From S95-9. B. From S87-12.



FIGURE 278. Last instar female *A. nigrocapitatus* (S82-128) showing absence of head and pronotum black patches.



FIGURE 279. Right rear leg tibia same adult male *A. nigrocapitatus* as in Fig. 276 (S04-29, R04-84, F1563) Carrizo Plain.



FIGURE 280. Adult female (S87-120, R88-136) *A. nigrocapitatus.* A. Left hind tibia, showing 2 outer and 3 inner spines. B. Same female, left ventral fore tibia showing 2 apical spurs.

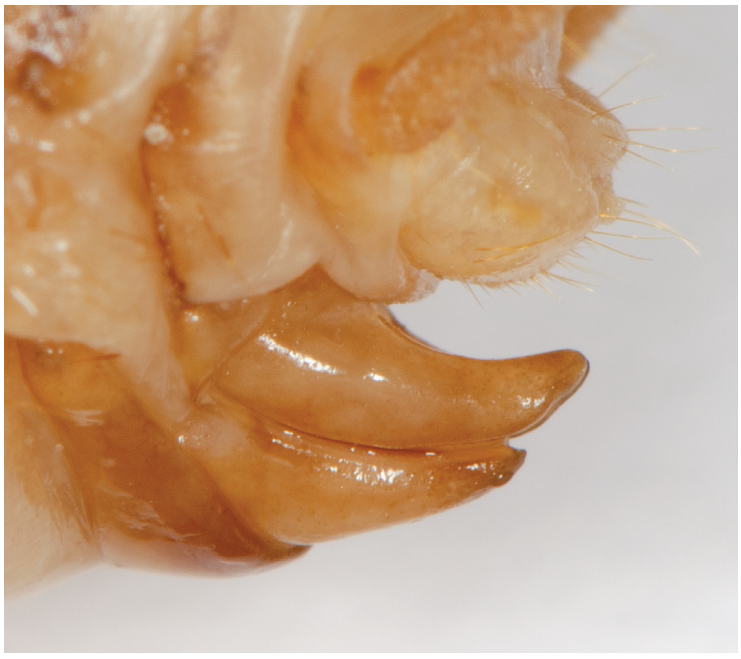


FIGURE 281. Ovipositor topotype *A. nigrocapitatus* (S87-120, R88-136).

Tinkham & Rentz (1969) gave three characters for separating *A. nigrocapitatus* from its sister species *A. pictus*: (1) In *A. pictus,* caput markings are usually discontinuous, giving a striped pattern, while this area is generally solid colored in *A. nigrocapitatus.* (2) In *A. pictus,* the hind tibia spurs are usually paired while, in *A. nigrocapitatus,* there is a single spur, or if paired, one spur is reduced in size. (3) In *A. pictus,* the ventral fore tibia has two adjacent apical spurs plus a third subapical spur, while in *A. nigrocapitatus,* only the two apical spurs are present (Fig. 280B).

Our analysis of a large series of adults of both sister taxa, shows the following regarding the 3 separation characters, in the last paragraph, listed by Tinkham & Rentz (1969): (1) This pattern generally holds but rare individuals of *A. nigrocapitatus* have a striped caput (Fig. 282) or no head markings at all (Fig. 283); while rare individuals of *A. pictus* (see Fig. 303, p. 207) may have a solid head patch. (2) Of 63 adult *A. nigrocapitatus* examined, 41 (65%) had 1 ventral hind leg tibial spur while 22 (35%) had 2 spurs. Of 32 adult *A. pictus* examined, all had 2 ventral hind leg tibial spurs. (3) Of 60 *A. nigrocapitatus* examined, 3 (5%) had the 2 + 1 fore leg tibial spur configuration, while 57 (95%) had 2 spurs. Of 32 *A. pictus* examined, 30 (94%) had the typical 2 + 1 ventral fore leg tibial spurs, while 2 (6%) had only 2 apical spurs. It thus appears that Tinkham & Rentz's (1969) criterion #3 is the most reliable morphological character for separating the two species. Additionally, trill rate in *A. nigrocapitatus* appears (Table 42) to be lower than in *A. pictus,* coupled with more drums/trill.



FIGURE 282. Variation in head markings in 3 adult *A. nigrocapitatus*, all from S87-120. Individual on left most similar to pattern seen in *A. pictus.*



FIGURE 283. Adult female *A. nigrocapitatus* (S96-112, R98-224) showing almost complete lack of black head markings.

TABLE 42. Comparison of calling drums between *A. pictus* and *A. nigrocapitatus*.

Species	Temperature range of songs	Trills/second	Drums/trill	Drum rate
A. nigrocapitatus 2♂ 3♀	12.5-20.7°C	0.54-0.85	6 to 9	10.4-18.5
A. pictus 3♂ 3♀	15-21°C	1.24	2 to 4	14.7-26.3

Drum. Calling drum in *A. nigrocapitatus* is a series of trills and similar in both sexes, although series duration usually longer in females; and rare males with a sex clarification drum (SCD). **Male:** (S14-4, R14-125) had a calling drum (Fig. 284), at 20.7°C, of 14 trills in 18.3s (0.77 trills/s), with 7–9 drums/trill (Fig. 285) with a drumming rate of 16.4 drums/s. Four days later, this same male was heard making numerous SCD (R14-127) while duetting with a female from his locality (S14-4). His SCD (Fig. 286) was composed of 2 parts: a slow part (Fig. 287) of 31 single drums in 5.3s (5.8 drums/s) and a fast part (Fig. 288) of 31 single drums in 2.4s (12.9 drums/s). The drum rate of 12.9 drums/s, during the fast part of his SCD, at 17.9°C, compares similarly to his drum rate of 16.4 drums/s, during his calling drum, at 20.7°C. Except here, there were many more drums in the fast section than during his normal trills. **Female:** (S96-112, R98-170) had a calling drum (Fig. 289), at 20.5°C, of 34 trills in 39.8s (0.85 trills/s), with 8–9 drums/trill (Fig. 290), and a drumming rate of 12.8 drums/s.

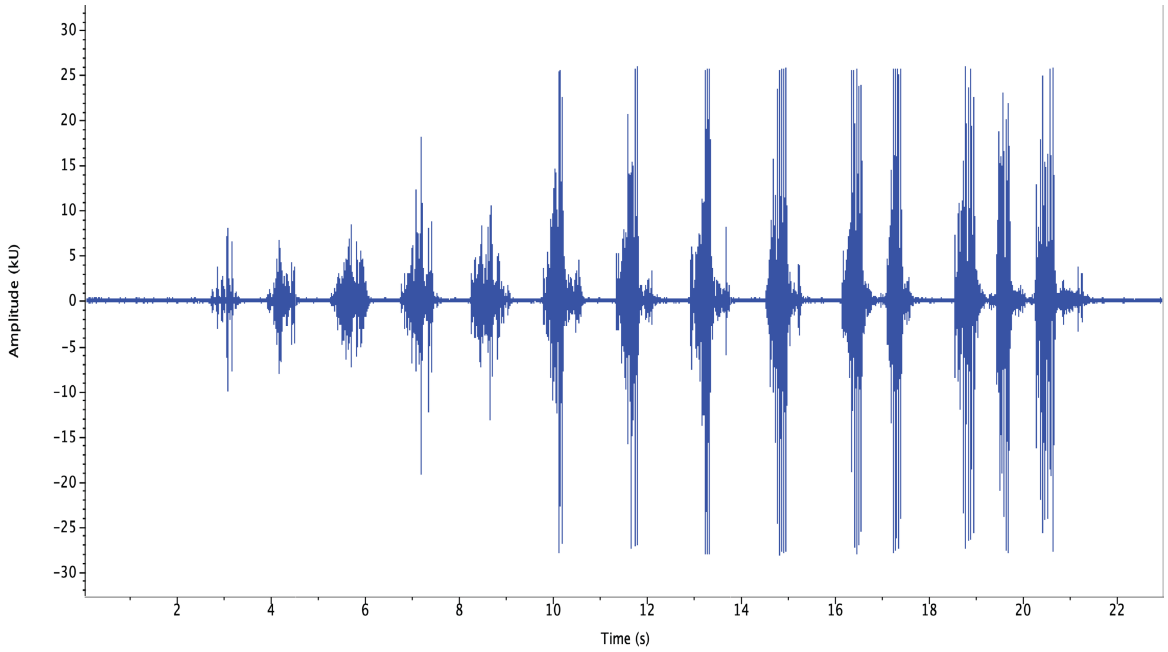


FIGURE 284. Calling drum (R14-125, S14-4) in male *A. nigrocapitatus* 20.7°C.

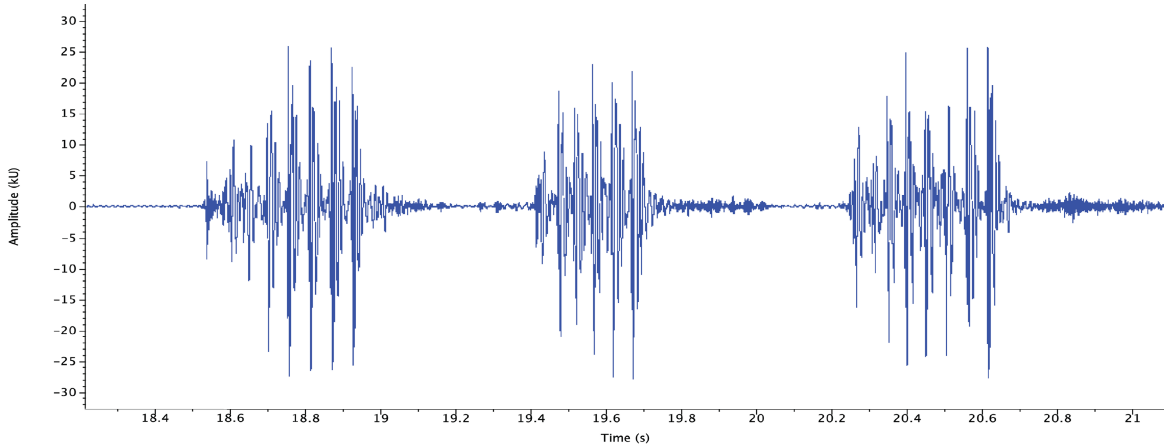


FIGURE 285. Expanded calling drum (R14-125), same male as Fig. 284.

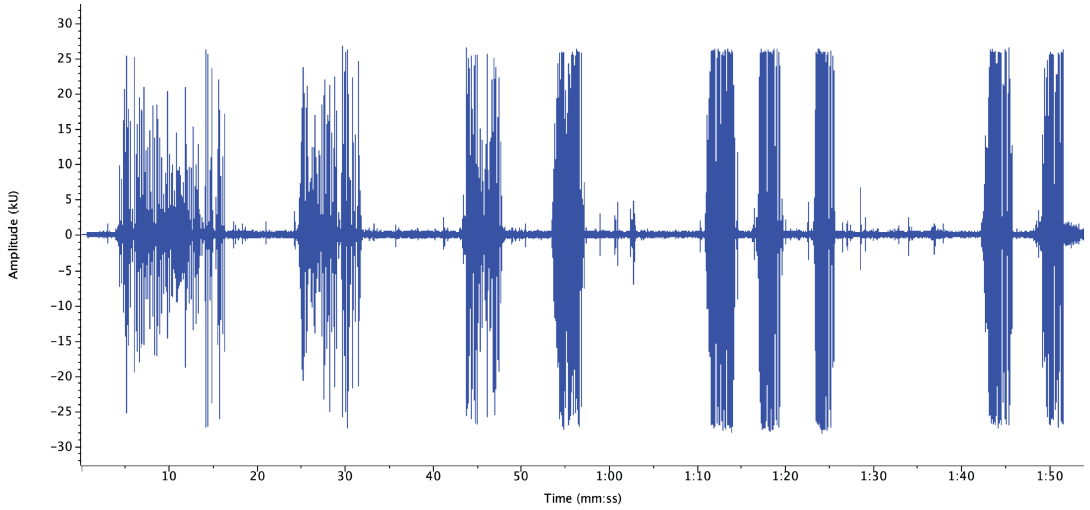


FIGURE 286. Sex clarification drum (R14-127) male *A. nigrocapitatus*, at 17.9°C, showing 2 distinct cadences: 2 slow sections followed by 7 fast sections.

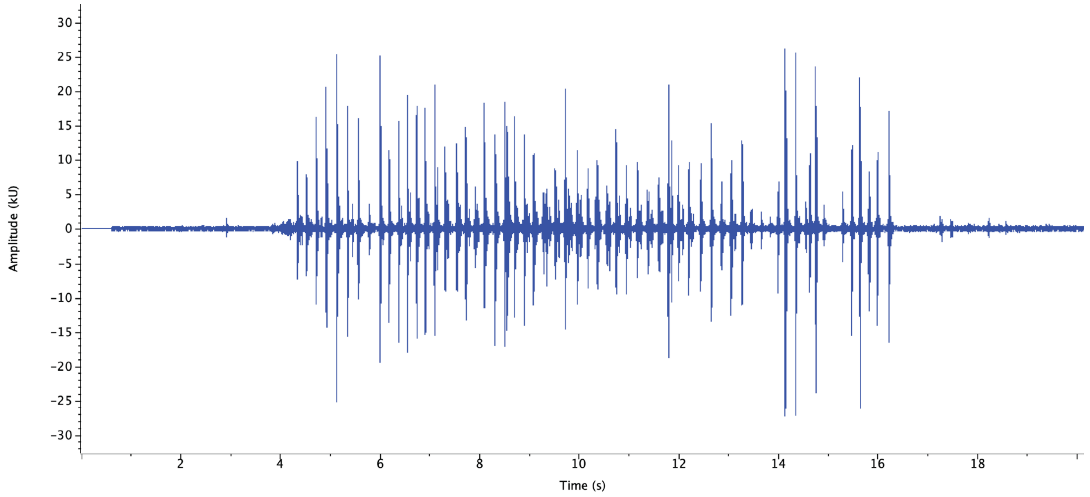


FIGURE 287. First slow section from Fig. 286, male *A. nigrocapitatus*, shows some 60 drums in 11.9s (5.04 drums/s).

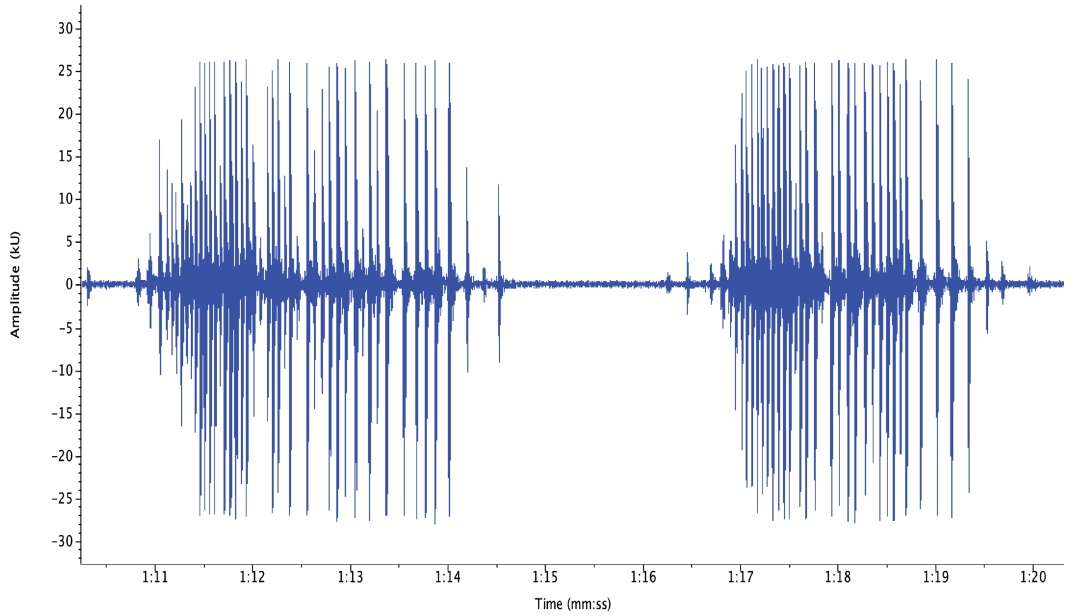


FIGURE 288. Sections 5 & 6 in Fig. 286, male *A. nigrocapitatus,* amplified to show fast drumming. Section 5 (left side) with some 31 single drums in 2.4s (12.9 drums/s).

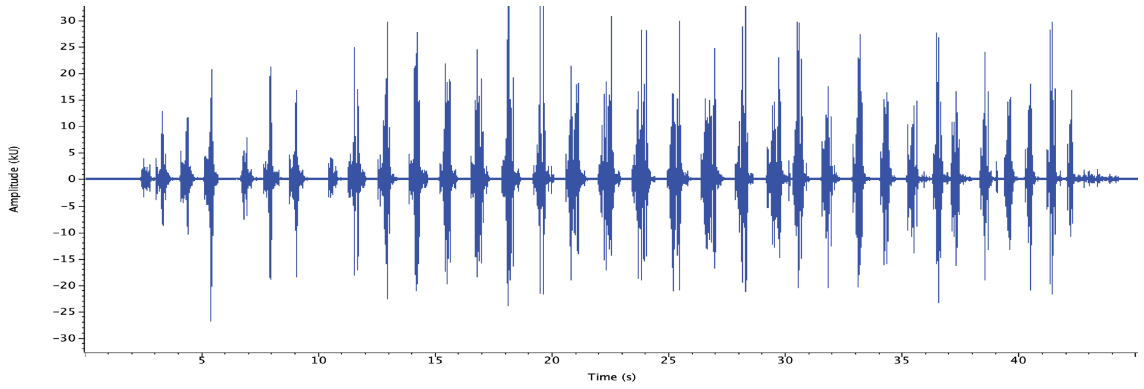


FIGURE 289. Calling drum (R98-170) in female *A. nigrocapitatus* 20.5°C.

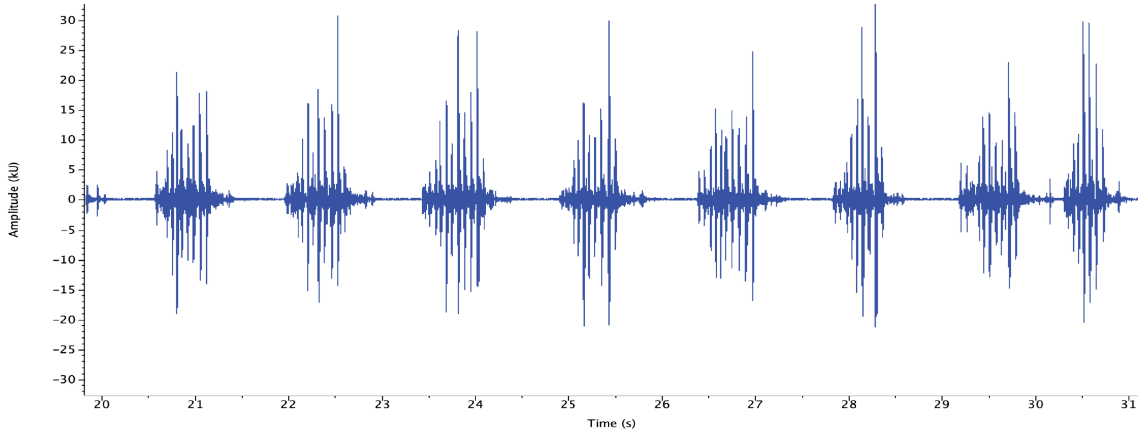


FIGURE 290. Expanded calling drum (R98-170), same female as Fig. 289.

While SCDs are not unusual in *Ammopelmatus* (see Appendix 1, p. 768), this is the first documentation of an apparent SCD with 2 different speeds. Our hypothesized purpose (Weissman 2001b) of a SCD, which are restricted to males, is to enable the drumming male to know whether or not he is duetting with a desired female or another competing male, since, with the former, he moves toward her; while, with the latter, he may want to move away. In either case, the most important aspect of the SCD is that it is different from the calling drum, which is the situation here with either the slow or fast section of the SCD in *A. nigrocapitatus.*

Favorable conditions in the laboratory may be needed to hear SCDs. Having a number of adult (and preferably virgin) males (and females) together where they can "hear" each other (remembering that JCs have no tympana and sense drums through substrate and air-borne sound transmission [Weissman 2001b]), undoubtedly facilitated our discovering SCD in *A. nigrocapitatus.*

Derivation of name. Named for the solid black markings on the top of the head.

Habitat. Most easily collected from under rocks in open, sandy habitats, like at Fig. 291 at the type locality.

Life cycle and seasonal occurrence. Adults first appearing in fall with a typical 2-year maturation period.

Variation. Most notable variation is seen in width of abdominal bands and color (see Fig. 277 above) and extent of black on the head (Fig. 282); with rare individuals (Fig. 283) almost without any black pigmentation. From some 20 topotype individuals, 15 had 2 and 4 had 3 ventral **fore** leg tibial spurs; 15 had 7 and 4 had 8 **middle** leg tibial calcars, all had 2 ventral spurs; 6 had 2 and 14 had 3 inner **rear** leg tibial spines, and 18 had 2 and 2 had 3 outer **rear** leg tibial spines, with 9 adults having 1 and 11 having 2 ventral spurs.

Specimens examined. **CALIFORNIA. *Fresno Co.,*** Ciervo Hills, 36.469727° -120.579272°, 1002m, 11-iii-2009, M. Westphal & M. Caterino. Type locality Jacalitos Canyon, 36.039763° -120.373852°, 286m, 9-iii-1982 (S82-2); 20-xi-1982 (S82-128); 18-xii-1987 (S87-120); 22-xii-1991 (S91-128); 6-iii-1992 (S92-33); 17-xii-1996 (S96-112). N end Kettleman Hills, 8-xii-1993 (S93-92) WH Tyson. North of Kettleman Hills, 27-i-1995 (S95-9) WH Tyson. ***Kern Co.,*** Hwy 58 1.5-3 m W junction Hwy 33, 35.286763° -119.644420°, 441m, 6-ii-2014 (S14-4), crawling on road at night, W. Icenogle. ***Kings Co.,*** Kettleman Hills at I-5, 1983, N. Smith & W. Peregrin. Tar Canyon

Road, 35.951793° -120.165030°, 349m, 11-iii-1985 (S85-25); 26-ii-2001 (S01-14). ***San Luis Obispo Co.,*** Carrizo Plain National Monument, Elkhorn Hills, 35.0088° -119.5012°, 914m, 24-iv-2004 (S04-29) M. Caterino ♂2.



FIGURE 291. Main collection site in type locality Jacalitos Canyon, ~9.5 km west of locked gate.

DNA. Fig. 167, p. 136. F0627 (type locality S96-112); F1134 (S01-14, Tar Canyon); F2378 (S14-4, Hwy 58) all recovered in their own subclade in Group 3 Longispinus, and closest to *A. pictus.*

Karyotype. 2n♂=25. T92-17 (Fig. 292), T92-21 (Fig. 293), both from type locality (S91-128), with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Male T92-21 also with 1 B chromosome, a rare occurrence in *Ammopelmatus* and also documented in this report for *A. leei* and *A. carsoncity.*



FIGURE 292. Idiogram T92-17 *A. nigrocapitatus* (S91-128).

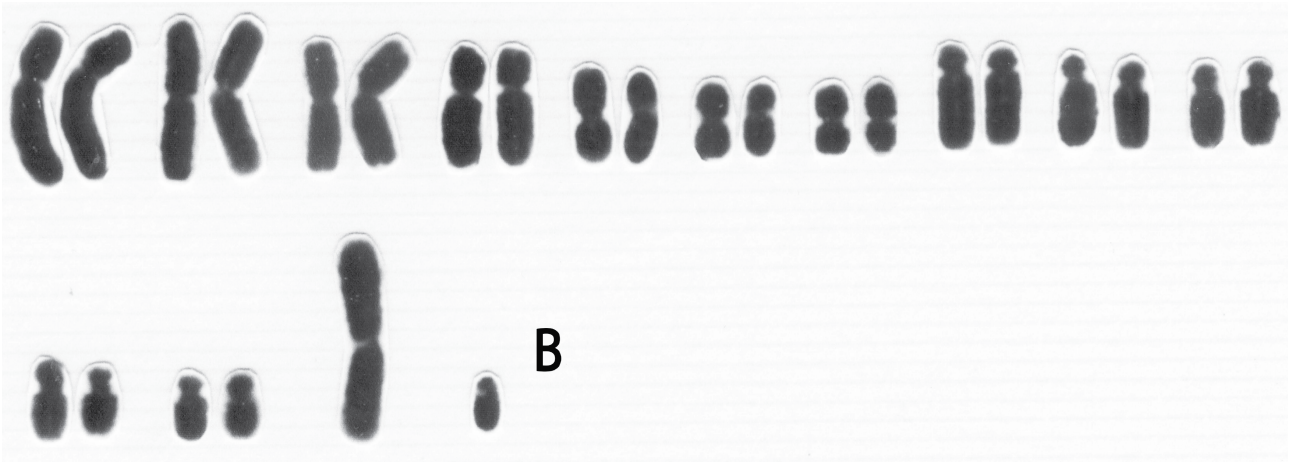


FIGURE 293. Idiogram T92-21 *A. nigrocapitatus* (S91-128). Note single B chromosome.

Discussion. Tinkham & Rentz (1969) predicted that *A. nigrocapitatus* might be found in the Jacalitos uplift, where it extends some 50–70 miles north of Jacalitos Canyon. In fact, such a prediction was prescient as shown by the record from Ciervo Hills (Fig. 294), which is some 50 km NW of Jacalitos Canyon, and represents the most northern known locality of this taxon.

According to Wikipedia, the source of Jacalitos Creek, which flows through Jacalitos Canyon, is 0.96 km north of Andrews Peak, in the Diablo Range. From there it runs east then northeast between the Jacalitos Hills and the Kreyenhagen Hills, then passes across Pleasant Valley to its confluence with Los Gatos Creek 4.2 km south of Coalinga Nose.

The type locality Jacalitos Canyon is the only known locality for the decticine katydid *Ateloplus joaquin* Rentz.



FIGURE 294. Adult female *A. nigrocapitatus* from Ciervo Hills (photo M. Westphal).

***Ammopelmatus pictus* (Scudder)**
Striped Headed Jerusalem Cricket
Figs 295–309, Tables 1, 4, 12, 14, 40, 42

1899. *Stenopelmatus pictus*. The Canadian Entomologist, 31: 116.

1916. *Stenopelmatus pictus.* Hebard selected an adult female as lectotype (Figs 295 & 296): San Francisco, California. (1) Palmer's Assorting No 1151 (2) Red label: Type 14157 (3) Sten. Pictus Scudder's type 1899 (4) Red label: Stenopelmatus pictus Sc. Selected H. 1916 Type (5) [Deposited in] ANSP.

Species #20 Weissman (2001b).

2021. *Ammopelmatus pictus.* Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on rear leg spines and geographical locality.



FIGURE 295. Lectotype adult female A. pictus.

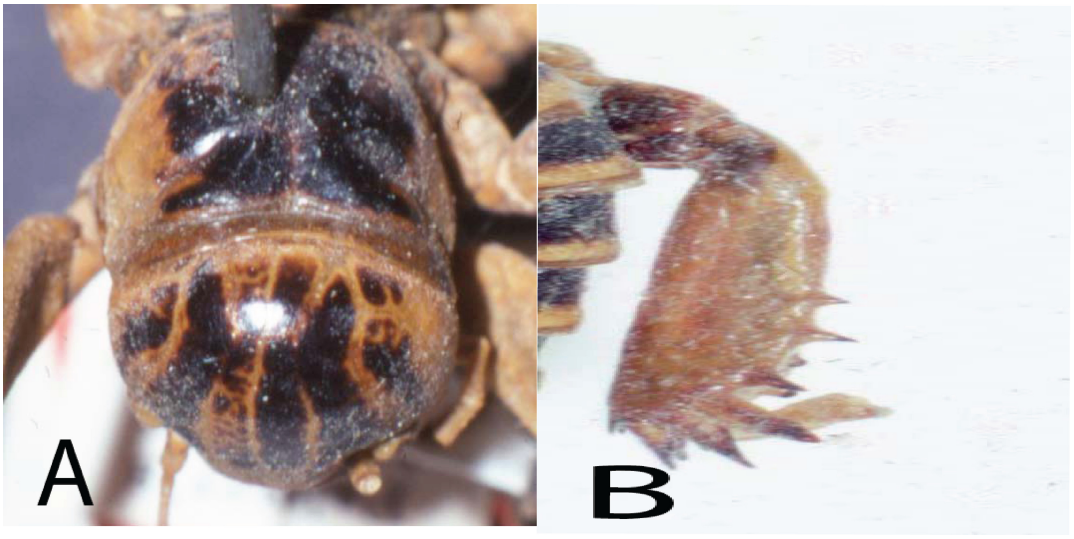


FIGURE 296. Lectotype adult female *A. pictus.* A. showing diagnostic head markings. B. Right rear leg tibia showing 3 inner and 2 outer spines.

Distribution. (Fig. 297). Central California, always west of the Sierra Nevada Mts.

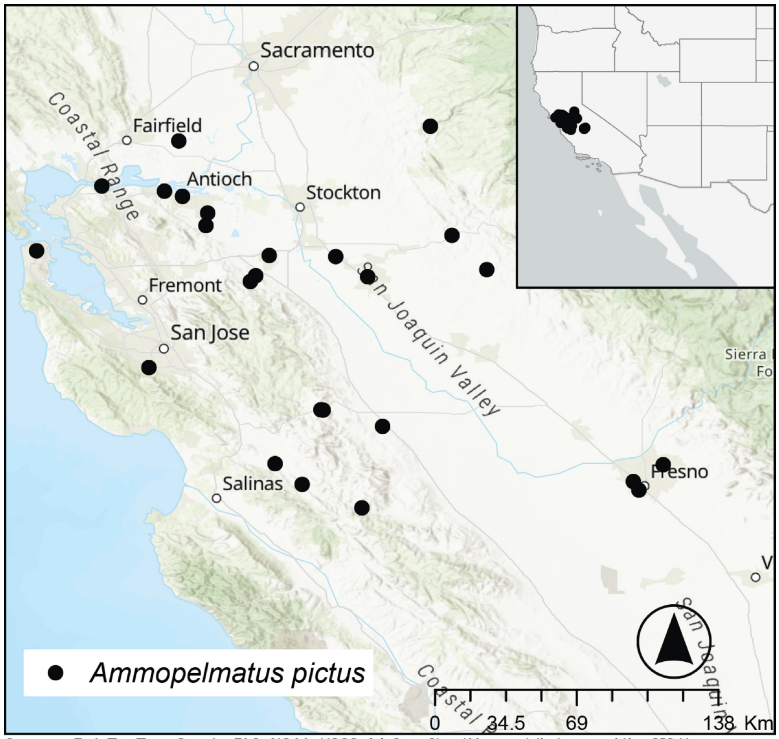


FIGURE 297. Distribution of *A. pictus*.

Recognition characters. Member of Longispinus Group. The only *Ammopelmatus* species with diagnostic head stripes when adult (Fig. 298), which also confirms adult stage. Subadults of both sexes without head stripes (Fig. 299A) or black markings on pronotum and outside of hind femur. In fact, all subadults, including last instars, are light colored. Only approached in head and pronotal markings by its sister taxon *A. nigrocapitatus*, which is a smaller species with, typically, a solid dark brown or black patch on the head. Front leg tibia usually with 3 spurs (Fig. 299B). Rear leg tibia in males (Fig. 300) similar to that of females (Fig. 301). Ovipositor Fig. 302.



FIGURE 298. Live adults *A. pictus* from same locality in Santa Clara Co. A. Male (S96-108, R96-163 & R96-167). B. Female (S92-137, R93-101).

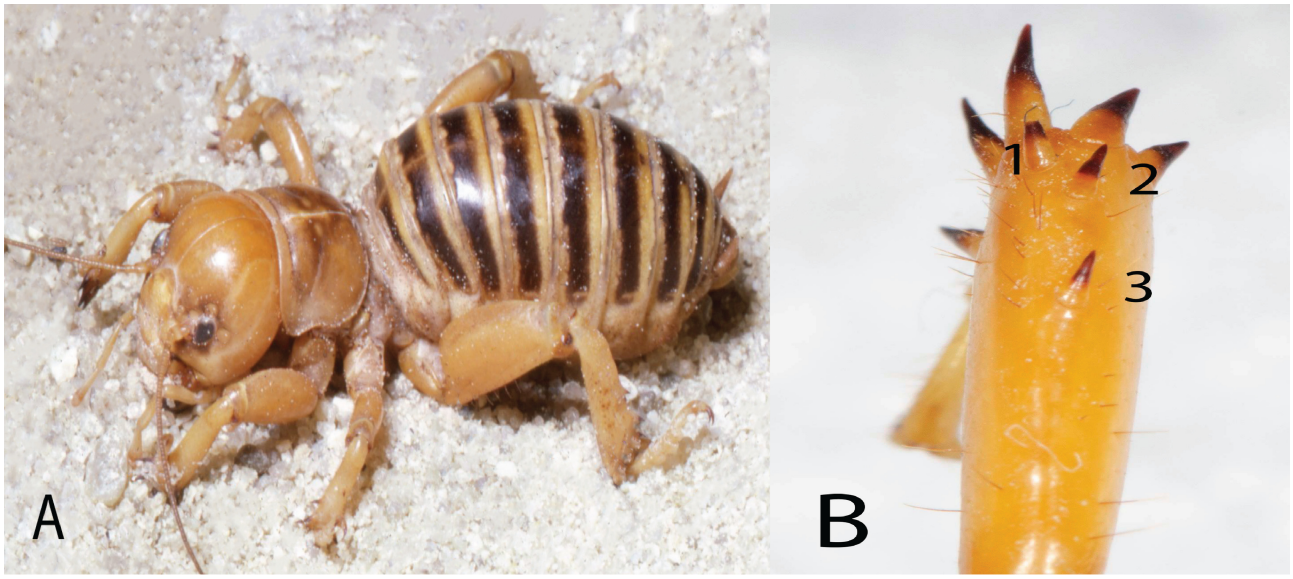


FIGURE 299. A. Last instar female *A. pictus* from San Joaquin Co. (S82-124), showing complete absence of head stripes. B. Adult male *A. pictus* (S82-124, R82-362) showing left leg fore tibia with 2 apical and 1 subapical spur.



FIGURE 300. Left rear leg tibia adult male *A. pictus.* Same individual (S96-108) as in Fig. 298A. A. Showing 2 outer and 3 inner spines. B. Showing shape of calcars.

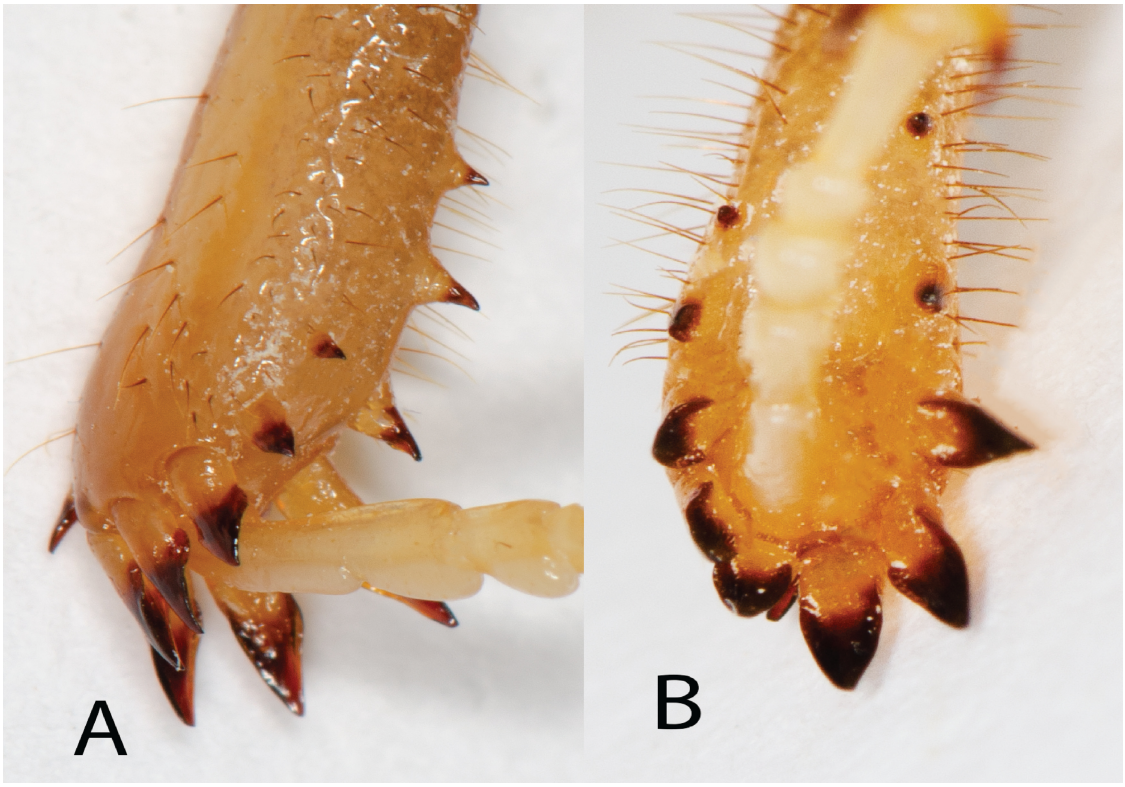


FIGURE 301. Left rear leg tibia adult female *A. pictus.* Same individual (S92-137) as in Fig. 298B. A. Showing 2 outer and 3 inner spines. B. Showing shape of calcars.

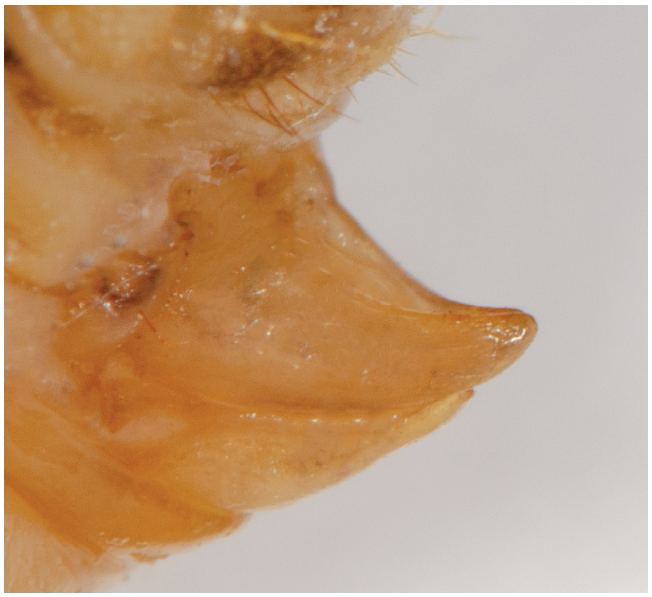


FIGURE 302. Ovipositor Santa Clara Co (S92-137, R93-96) *A. pictus.*

Tinkham & Rentz (1969) gave three characters to separate the sister species, although none is foolproof (discussed below): (1) In *A. pictus,* caput markings are usually discontinuous, giving a striped pattern, while this area is generally solid colored in *A. nigrocapitatus.* (2) In *A. pictus,* the hind leg tibia spurs are usually paired while, in *A. nigrocapitatus,* there is a single spur; or if paired, one spur is reduced in size. (3) In *A. pictus,* the ventral front tibia has two adjacent apical spurs plus a third subapical spur (Fig. 299B), while in *A. nigrocapitatus,* only the two apical spurs are present (see Fig. 280, p. 196). Our analysis of a large series of adults of both sister taxa, shows the following regarding these 3 separation characters of Tinkham & Rentz (1969): (1) This pattern generally holds but

rare individuals of *A. pictus* (Fig. 303) have a solid head patch while rare individuals of *A. nigrocapitatus* have a striped caput or no markings at all (Fig. 282, p. 197). (2) Of 32 adult *A. pictus* examined, all had 2 hind leg tibial spurs. Of 63 adult *A. nigrocapitatus* examined, 41 (65%) had 1 hind leg tibial spur while 22 (35%) had 2 spurs. (3) Of 32 *A. pictus* examined, 30 (94%) had the typical 2 + 1 ventral front tibia spurs (Fig. 299B) while 2 (6%) had only 2 apical spurs. Of 60 *A. nigrocapitatus* examined, 3 (5%) had the 2 + 1 configuration while 57 (95%) had 2 spurs. It thus appears that criterion #3 is the most reliable character for separating the two species. Additionally, the trill rate in *A. pictus* appears (Table 42, p. 198) to be faster than in *A. nigrocapitatus*, combined with fewer drums/trill.



FIGURE 303. Adult male, San Francisco, CA, showing solid black caput. We discuss this possibly mislabeled specimen in "Variation" below.

Drum. Calling drum in *A. pictus* is a series of trills and similar in both sexes, although series duration usually longer in females. Adult **male** (S96-108, R96-167) had a calling drum (Fig. 304), at 16°C, of 15 trills in 9.7s (1.5 trills/s), with trills containing from 3–4 drums (Fig. 305) and a drumming rate of 23.8 drums/s. Adult **female** (S92-137, R93-96) with 37 trills in 27.3s (1.4 trills/s, Fig. 306).

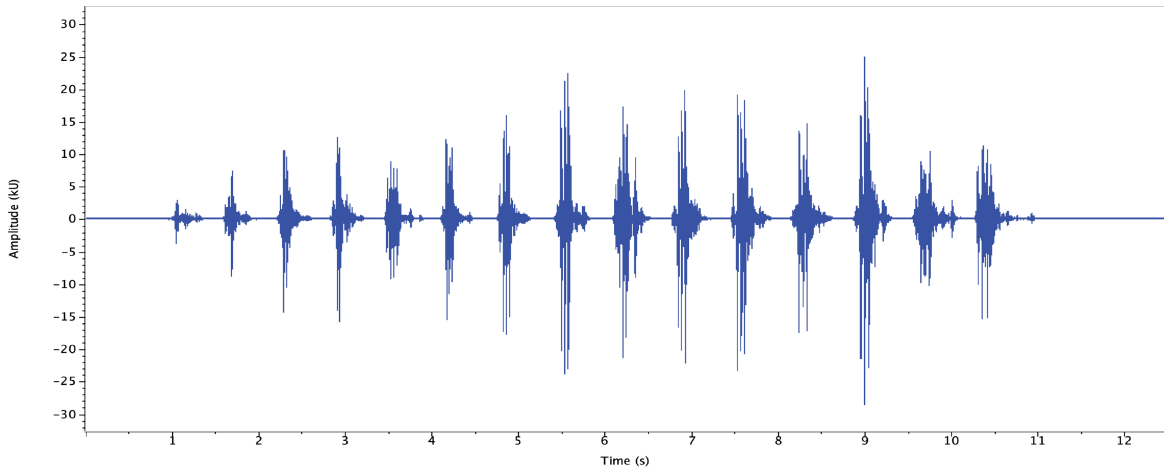


FIGURE 304. Calling drum (R96-167) in adult male *A. pictus* (S96-108) showing 15 trills in 9.7s.

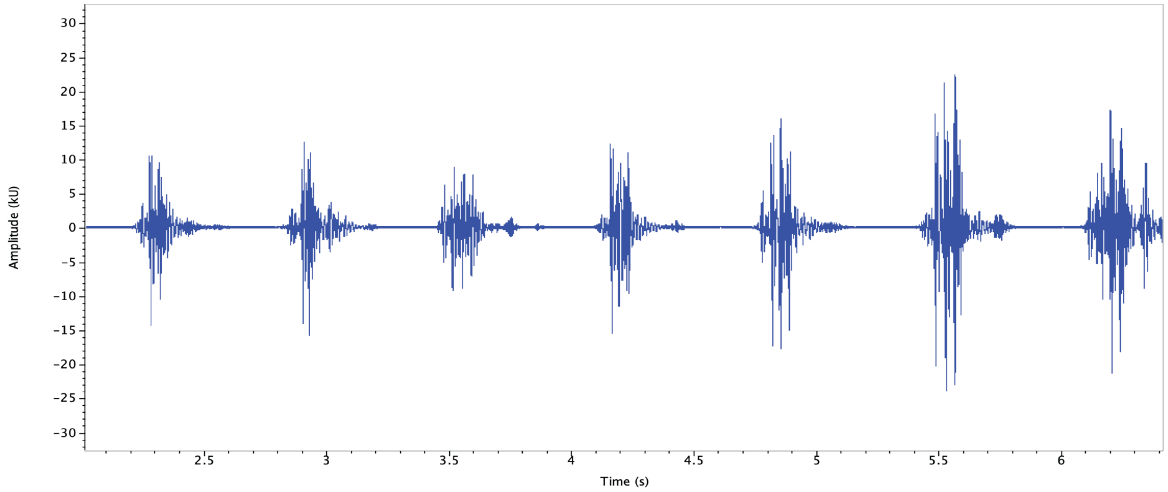


FIGURE 305. Expanded calling drum (R96-167) same adult male *A. pictus* as Fig. 304, showing 3–4 drums/trill.

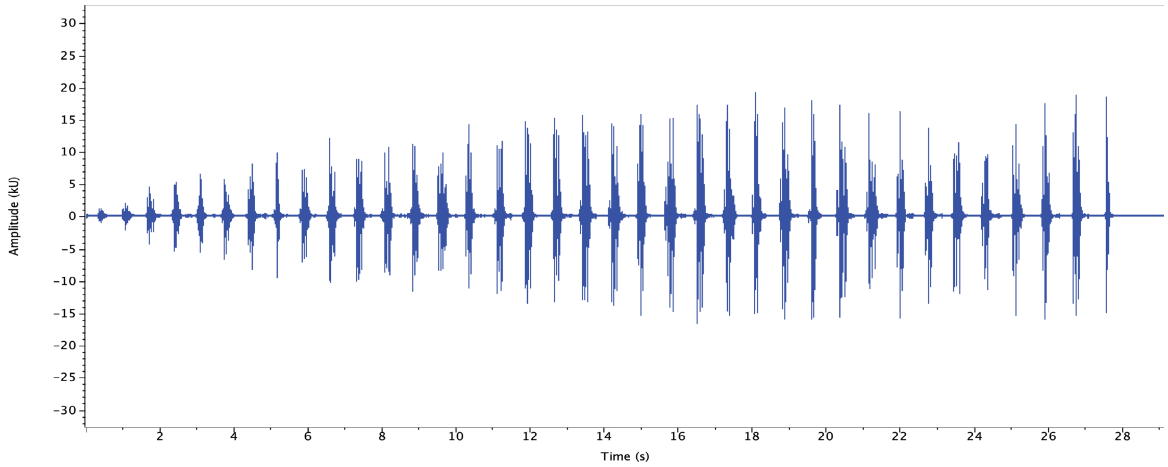


FIGURE 306. Calling drum (R93-96) in adult female (S92-137) showing 37 trills in 27.3s.

Derivation of name. "pictus" is Latin for painted or colored, we assume in reference to its head markings once adult.

Habitat. More an open grassland species than associated with oak woodlands, although the Tuolumne Co. site was open oak-woodland grassland.

Life cycle and seasonal occurrence. Adults first appearing in fall with a typical 2-year maturation period.

Variation. For 32 mostly adult but some late instars *A. pictus,* 30 specimens had 3 **fore** leg tibial spurs while 2 had only 2 spurs. Both individuals with only 2 spurs were from San Joaquin Co. (S82-124), out of 7 individuals total from that locality; **middle** leg all with 8 calcars and 2 ventral spurs**;** of 20 adults, the **rear** leg of 13 had 3 and 7 had 4 inner, while 11 had 2 and 9 had 3 outer tibial spines, with all individuals having 2 ventral spurs. **Head Stripes:** An adult female *A. pictus* from S96-108 (Santa Clara Co) with 2 barely visible head stripes. Additionally, the CAS contains a large adult male from San Francisco, 10-i-1967, that, geographically and by size, should be *A. pictus.* But he has a solid black head (Fig. 303) and 2 ventral fore tibial spurs which both resemble *A. nigrocapitatus* more than *A. pictus.* Additionally, he has 2 hind tibia spurs on both sides although one of the two is small, a condition most consistent with *A. nigrocapitatus*. We wonder if he might be mislabeled? Overall, the range of variation in head stripes is best exemplified by Fig. 307.



FIGURE 307. Recently killed adults of *A. nigrocapitatus* (two individuals on left) compared to *A. pictus* (two individuals on right), showing overlap, and continuum, in head markings.

Specimens examined. **CALIFORNIA,** ***Alameda Co.,*** Del Puerto Canyon, Patterson Pass Road, 15-x-1969, T. Davies. Patterson Pass, Corral Hollow, 37.656132° -121.485657°, 135m. 11-12 m SE Livermore, on Tesla Rd, 10-iv-1981, A. Hardy & R. Aalbu, ♀1. Pleasanton, 4-xi-1994 (S94-111) CJ Pearson. ***Calaveras Co.,*** Mokelumne River at Hwy 49, 38.313255°, -120.721390°, 201m, 26-iii-1983, J. Liebherr. ***Contra Costa Co.***, Antioch, 38.004921° -121.805789°, 13m, 5-iv-1956, 18-ii-1977, 4-iv-1982, 20-ii-1982, J. Powell. Brentwood, 37.931870° -121.695788°, 27m, 23-iii-1930. Mt. Diablo, 5-iv-1936, E.C. Van Dyke. 4 m W Byron, 37.876525° -121.703235°, 55m. Pittsburgh, 38.027976° -121.884680°, 7m, 30-xi-1985 (S85-138) J. Zellars. ***Fresno Co.,*** Clovis, 36.825228° -119.702919°, 122m, 29-xi-1984 (S84-83), N. Smith. 3 m E Calwa, 36.713709° -119.809266°, 86m, 1-xii-1993 (S93-90) W.H. Tyson. Fresno, 36.751268° -119.833679°, 85m, 25-x-1979. Panoche Canyon, 24-iv-1926; 24-iii-1967, R.R. Snelling. ***Madera Co.,*** 10 m N Madera, 16-x-2000 (S00-66) N. Smith. ***Merced Co.,*** 1.3 m E Pacheco Pass, 37.066729° -121.200336°, 356m, 17-iii-1962. Los Banos Creek, 36.993798° -120.930652°, 70m, 24-iii-1987 (S87-10) D. Giuliani; 5-v-1987 (S87-23) D. Giuliani. ***San Benito Co.***, near Hollister, 36.829746° -121.400736°, 98m, 10-v-2022, M. Westphal. Hwy 25 11.8 m S Hollister, 36.738780° -121.282356°, 219m, (S06-2) 4-iii-2006. Road J1, mile post 18.85, 36.635667° -121.021000°, 630m, 21-iii-2003 (S03-9), 1 male, molt to adult 9-ix-2003. ***San Francisco Co.,*** San Francisco, 11-iv-1919, E.P. Van Duzee, CAS. ***San Joaquin Co.,*** Ripon, 37.740423° -121.135508°, 21m, 20-v-2008 (S08-23), B. Harms; Tracy, 37.745248° -121.426379°, 14m, 18-v-2008, (S08-24) SI Weissman; Tesla Road ~17 miles SE Livermore, 37.631027° -121.508718°, 165m, 30-i-1982 (S82-1); 31-x-1982 (S82-124). ***Santa Clara Co.,*** Los Gatos, Wanda Lane near intersection Samaritan Drive and Los Gatos Blvd., 37.252435° -121.952788°, 89m, 31-x-1984 (S84-73). Palo Alto, iii-1892, ANSP. San Jose, 8-12-1948, F. Camino; 7-xii-1948, M. Long; 20-x-1953, C. Stingray; 2-x-1962. 2 m E Hwy 152 on road to San Luis Reservoir Dinosaur Point Wildlife Area, 37.065224° -121.190637°, 292m, 18-xii-1992 (S92-137); 17-xii-1996 (S96-108) DBW & M. Caterino. Hwy 152, 25.1 m W intersection with Hwy 33, 61m, 13-iii-1985 (S85-23) ♀1. ***Solano Co.,*** Benicia, 38.050404° -122.158640°, 11m, 7-xi-1986, C. Rissanen. Northwest of Rio Vista, Creed Rd, 38.24212° -121.81382°, 6m, 14-x-2025, Y. Zhang. ***Stanislaus Co.,*** Modesto, 37.651802° -120.995744°, 30m, 6-xii-1980, C. Smith. 5 m N Turlock Lake, NW La Grange, 37.682909° -120.474767°, 122m, 10-iii-1976, J. Collins. ***Tuolumne Co.,*** Hwy 108/120 ~2.5 m E Stanislaus Co. line, ~3 m W J59, 37.833620° -120.627187°, 150m, 17-ii-1995 (S95-16); 12-ii-1998 (S98-7).

DNA. Fig. 167, p. 136. F0413 (S96-108, Hwy 152, Santa Clara Co.); F0640 (S98-7, Tuolumne Co.); F2086 (S08-23, Ripon, San Joaquin Co.) all recovered together in Group 3 Longispinus, and in a larger clade with *A. nigrocapitatus*.

Karyotype. 2n♂= 25. Two males checked from same locality in Santa Clara Co: T93-3 (Fig. 308, S92-137); and

T97-4 (Fig. 309, S96-108), both with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

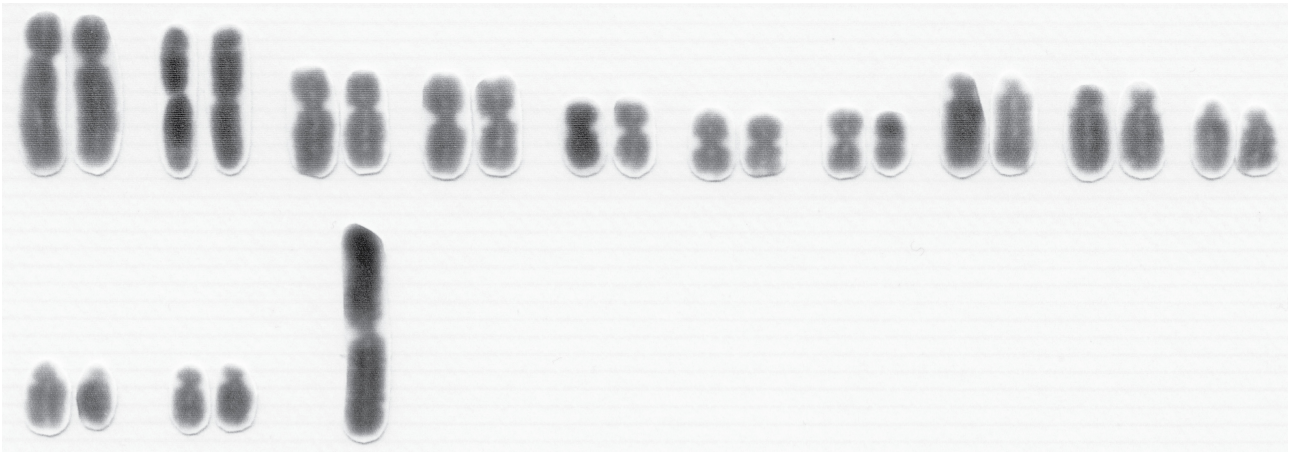


FIGURE 308. Idiogram T93-3 *A. pictus* (S92-137).

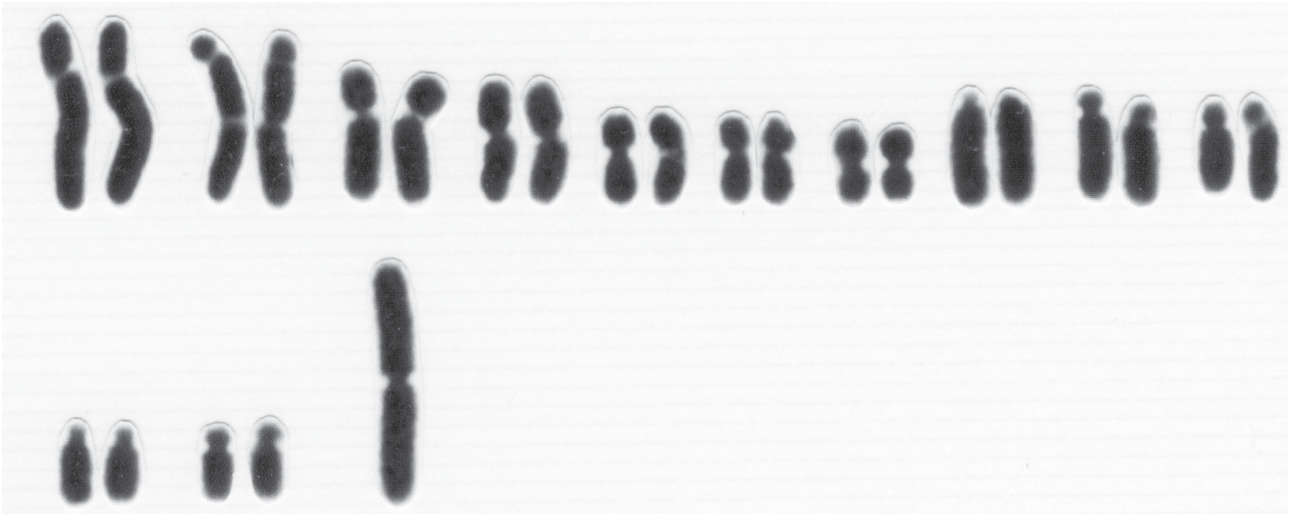


FIGURE 309. Idiogram T97-4 *A. pictus* (S96-108).

Discussion. Scudder's original description included 1♂ and 3♀ from San Francisco, California. His noting of the head being "longitudinally broadly striped" confirms not only the identity of his specimens (the small *A. intermedius* and the large *A. longispinoides* both occur in San Francisco, but neither have head stripes), but also their adult status.

A. pictus appears extinct in its type locality of San Francisco, as no recent specimens have been seen in any local collections, nor did Rentz (Tinkham & Rentz 1969) ever find it there. We suspect that urban development, favoring the flat, open grassland habitats that *A. pictus* prefers, along with alterations to the coastal sandy areas, has expedited its extinction, and that the original specimens were correctly labeled. The CAS has an adult female from San Francisco collected 11-iv-1919 by E.P. Van Duzee, and ANSP has specimens from both San Francisco and Palo Alto (Hebard 1916; J. Weintraub, pers. comm. to DBW, April, 2003). On the Bay Area Peninsula, Duncan (1923) lists a specimen from Stanford University; Hebard (1916) lists specimens from Palo Alto, CA; and DBW collected one specimen in Los Gatos (S84-73). So, while more specimens are known from the east side of San Francisco Bay (Tinkham 1966, Tinkham & Rentz 1969), past populations are documented, and may continue to exist, on the west side of the San Francisco Bay. Additionally, only adults of both sexes would be easily recognized since all subadults lack head stripes and would be difficult to confirm in collections.

At the only Tuolumne Co. site, *A. pictus* occurs microsympatric with *A. rentzi*. At S84-73 (Los Gatos, Santa Clara Co.), microsympatric with *A. brachysocius*.

***Ammopelmatus rentzi* Weissman, sp. nov.**
Long Ovipositor Jerusalem Cricket
Figs 310–324, Tables 1, 14, 40

Species #4, Weissman 2001b.

Distribution. (Fig. 310). Known from an area along the eastern side of the San Joaquin Valley floor (Modesto, S96-27, 25m), up to 1585m along Hwy 108 in the western Sierras, and at 2280m at Lake Alpine (S20-4).

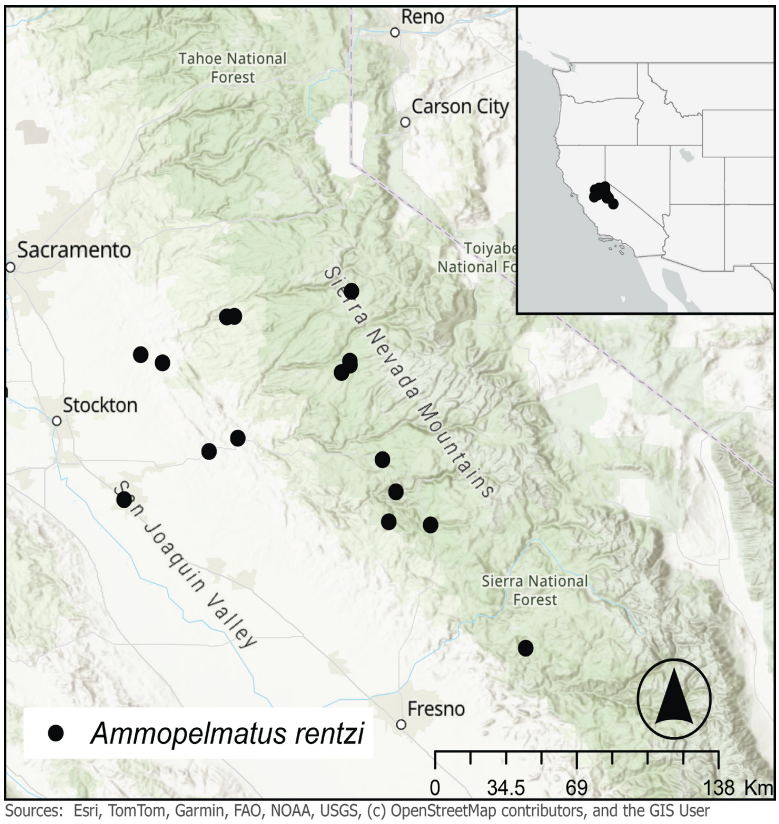


FIGURE 310. Distribution of *A. rentzi.*

Recognition characters. Member of Longispinus Group. Small to medium sized individuals, ovipositor long and extending 3–4 mm beyond apex of subgenital plate, a condition common in *Stenopelmatus* JCs but rarely seen in *Ammopelmatus* JCs. 2n♂=25. Drum unique: long, rapid trills at start of series, delivered at ~0.3 trills/s in males and ~0.6–0.7 trills/s in females, that transition to shorter trills with longer intervals between trills toward end of series. Male *A. rentzi* have the fastest drumming rate of any *Ammopelmatus* species, able to exceed 30 drums/s at 20°C. Separated from more northern sister species *A. briani* mainly by differences in drum, and DNA.

Holotype. Male (in alcohol, Fig. 311): **California, *Tuolumne Co.,*** Hwy 108/120, 2.5 road miles east of Stanislaus Co. line and ~3 m W intersection with J59, 37.833822° -120.625448°, 154m, 12-ii-1998 (S98-7) DBW. F0709. Molt to adult 24-ix-1998. Deposited CAS, Entomology type #20071. Measurements in mm: Body length 32.31, hind femur length 11.09, hind femur width 4.51. Fore tibia with 3 ventral spurs, middle tibial with 8 calcars, 2 ventral spurs, hind tibia (Fig. 312) with 5 inner and 3 or 4 outer spines and 2 ventral spurs.

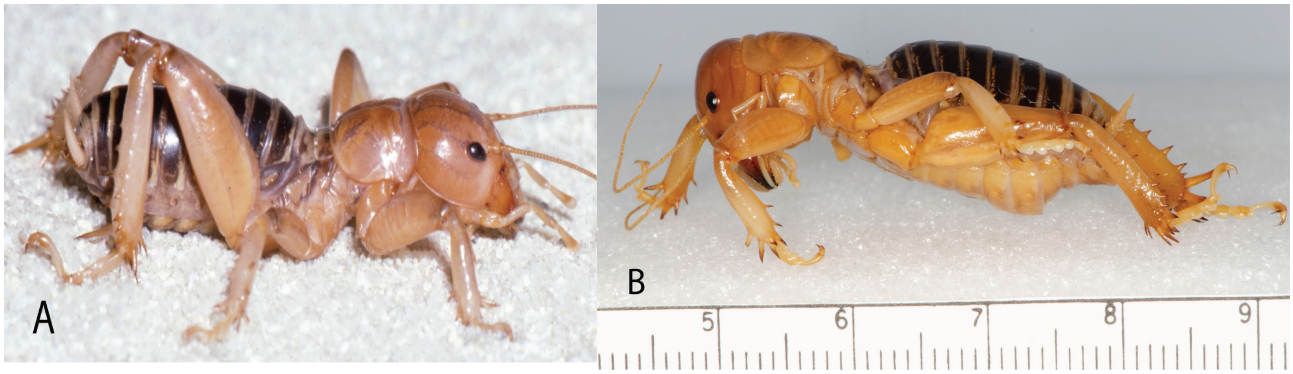


FIGURE 311. Adult male *A. rentzi.* A. Live paratype (S96-27, Stanislaus Co, R96-124). B. Preserved holotype.

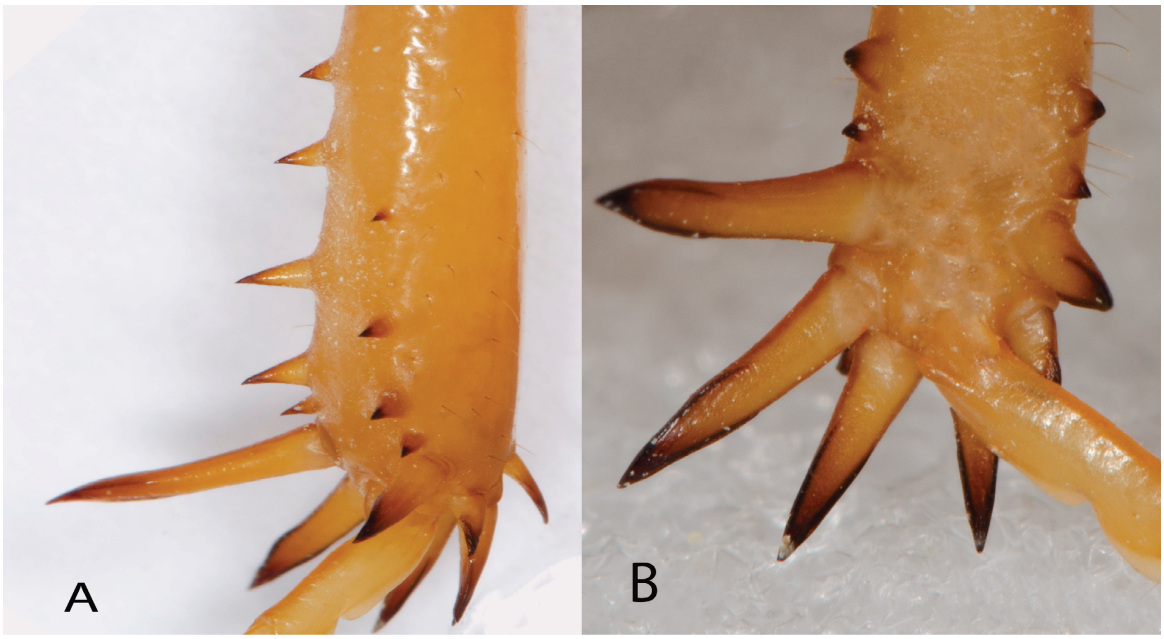


FIGURE 312. Right rear leg tibia adult male holotype *A. rentzi.* A. Showing 5 inner and 4 outer spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 313): same data as holotype except 17-ii-1995 (S95-16). R95-146, F0205. Molt to adult 12-xi-1995. Deposited CAS, CALENT# 9083286. Measurements in mm: Body length 26.69 (29.08 mm if include ovipositor), hind femur length 8.80, hind femur width 3.50. Fore tibia with 2 or 3 spurs; middle tibia with 8 calcars and 2 ventral spurs; hind tibia (Fig. 314) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 315.

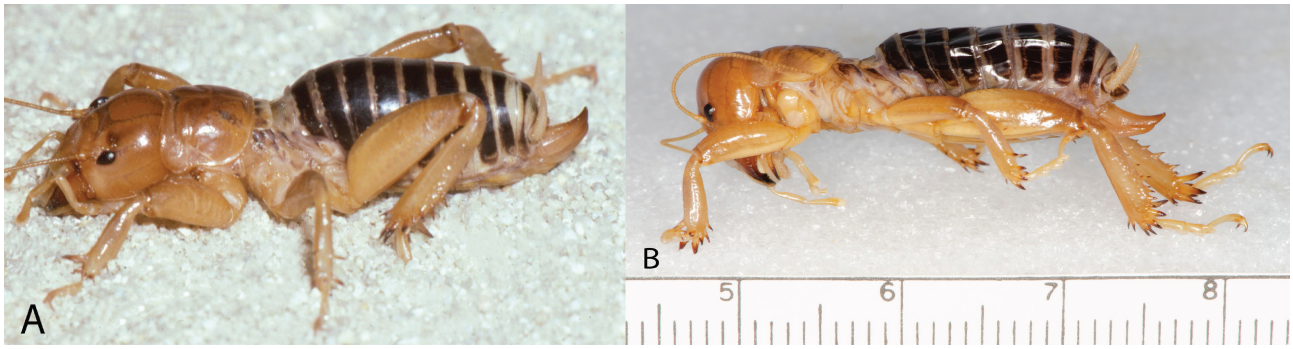


FIGURE 313. Adult female allotype *A. rentzi.* A. When alive. Note long ovipositor. B. When preserved.



FIGURE 314. Left rear leg tibia adult female allotype *A. rentzi.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 315. Ovipositor allotype *A. rentzi*

Paratypes: ♂26 ♀34. **CALIFORNIA, *Alpine Co.,*** Lake Alpine, 38.480555° -120.002223°, 2280m, 7-ix-2020 (S20-4) DW Weissman & C. Binder, ♂2. ***Calaveras Co.,*** Lake Camanche Recreational Area, 38.224667° -120.924294°, 74m, 15-vi-2013 (S13-37) DW Weissman ♂1. Valley Springs, 38.191586° -120.829103°, 207m, 15-iii-2009 (S09-6) D. Gimble ♀1. Wilseyville, 38.379510° -120.514412°, 848m, 23-ix-1994 (S94-101) P. Freitas ♂1. 2.5m SW West Point on State Hwy 26, 38.37730° -120.54778°, 764m, 8-xi-2009 (S09-162) VF Lee ♀1. ***Fresno Co.,*** Bretz Mill Campground, 37.039237° -119.240244°, 1010m, 15-17-X-2021 (S21-50) A. Abela ♀1. ***Mariposa Co.,*** El Portal, El Portal Middle School, 37.670656° -119.807910°, 539m, 25-iv-2010 (S10-12) ♂1. Jerseydale Ranch, 6506 Jerseydale Road ~8.5 air miles NE Mariposa, 37.549655° -119.839121°, 1115m, O. Shields 12-v-1986 (S86-22) ♀1; 16-vi-1986 (S86-35) ♀1; 24-vi-1986 (S86-70) ♂1 ♀1; 8-vii-1986 (S86-79) ♀1; 30-viii-1986 (S86-108) ♂1; 22-ix-1986 (S86-115) ♂1; 28-ix-1986 (S86-130) ♂1; 19-xi-1986 (S86-151) ♂1. 5 m S Jerseydale, 13-x-1985 (S85-117) D. Guiliani ♂1. Yosemite National Park: Wawona, Redwood Estates, 37.53688° -119.65626°, 1222m, 27-viii-1982 (S82-110) ♂1; 23-25-vi-1989 (S89-47) ♂1 ♀6. Hodgdon Meadows Campground, 37.800502° -119.866811°, 1470m,

11-xi-1988, W. Sakai, ♀1. ***Stanislaus Co.***, Modesto, 37.639243° -120.996791°, 25m, mid-April, 1996 (S96-27), S. Elems, ♂1 ♀1. ***Tuolumne Co.,*** type locality, 17-ii-1995 (S95-16) ♂1 ♀5; 12-ii-1998 (S98-7) ♂3 ♀3. Camp Hi-Sierra ~6 m E Long Barn, 38.152688° -120.045719°, 1529m, 4-viii-1996 (S96-75) DW Weissman ♂1; 7-vii-1997 (S97-118) ♂2 ♀2. Lair of the Golden Bear, Camp Gold, 38.183052° -120.008526°, 1690m, 15-vii-2015 (S15-83) J. Cole, ♂1. Strawberry, 38.198250° -120.009351°, 1624m, 27-iv-1997 (S97-36) ♂2 ♀3. Hwy 108/120 9.3 road miles east of Stanislaus Co. line at O'Brynes Ferry Rd turnoff, 37.887413° -120.499545°, 369m, 21-iii-1992 (S92-36) ♂1 ♀5.

Drum. Calling drum patterns similar between the sexes, but drumming rate in males around twice as fast as in females. **Male:** Type locality R95-119 (Figs 316 & 317), S95-16, 18.5°C: 7 trills over 22.7s (0.31 trills/s), first trill longest (~32 drums) in 0.99s (32.3 drums/s), 2nd trill 23 drums in 0.64s (35.9 drums/s) and gradual decrease in drum number until last trill shortest with 7 drums in 0.22s (31.8 drums/s). Simultaneously, interval between trills incrementally increases from 2.4s to 3.8s for last trill. Another male R92-122 (Fig. 318), S92-36, Tuolumne Co, 20°C.: 13 trills over 37.9s (0.3 trills/s), first trill longest ~28 drums in 0.94s (29.8 drums/s) gradually decreasing to 8 drums in last trill. **Female:** Allotype R95-127 (Fig. 319), S95-16, 17.5°C: 24 trills over 34.1s (0.7 trills/s) from 2–10 drums/trill (trills with fewer drums as series progresses). In expanded view (Fig. 320), two trills each of 9 drums in 0.52s (17.3 drums/s). In another type locality female, R95-128 (Fig. 321), S95-16, 17.5°C: 29 trills over 47.3s (0.6 trills/s) from 3–13 drums/trill (trills don't have fewer drums as series progresses). One trill of 13 drums over 0.69s (18.8 drums/s).

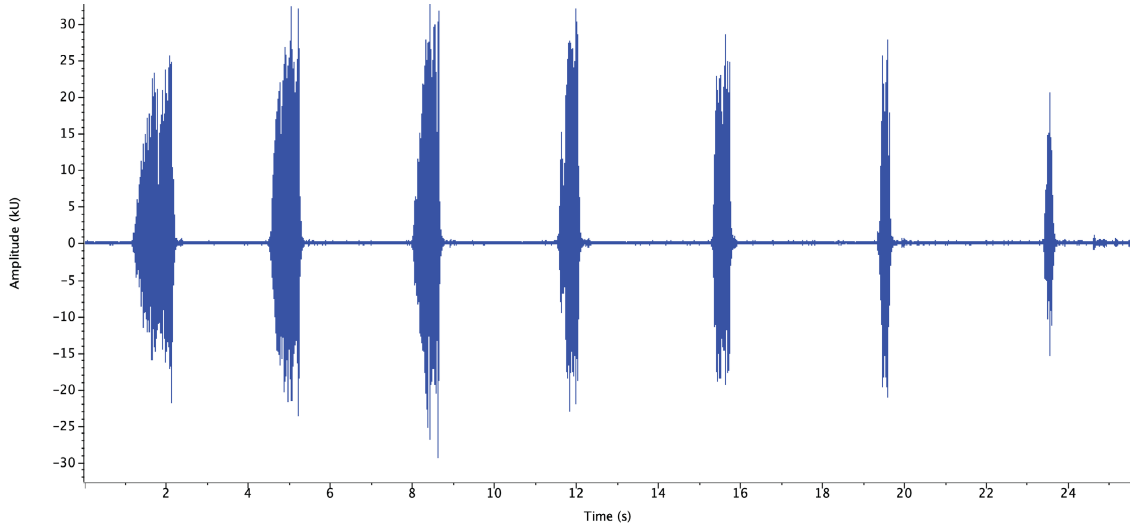


FIGURE 316. Calling drum (R95-119) adult male holotype *A. rentzi.*

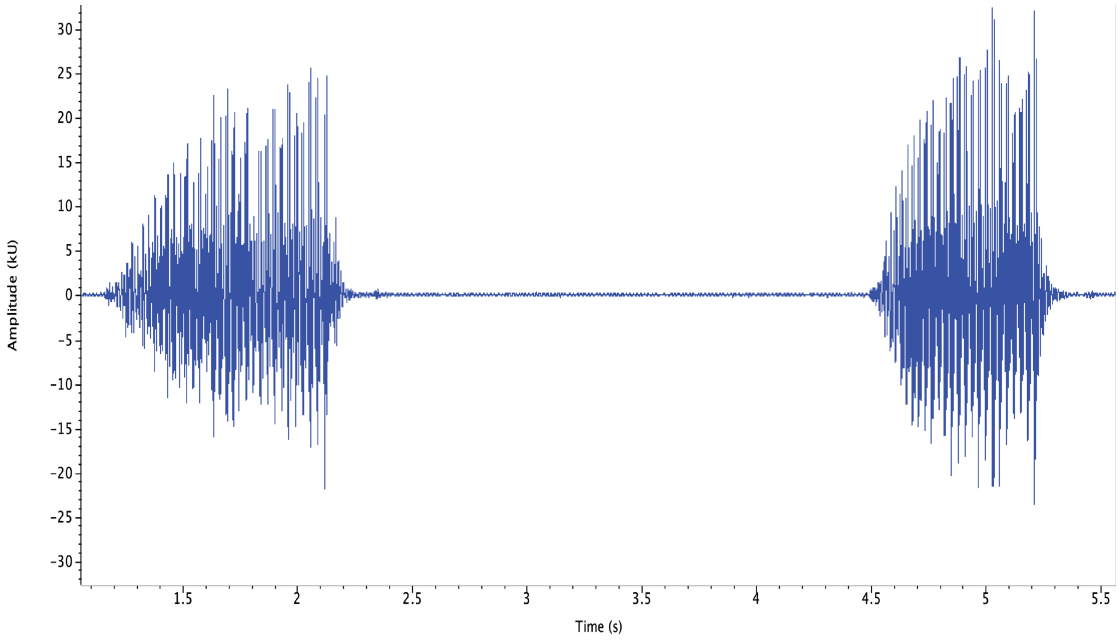


FIGURE 317. Calling drum (R95-119) adult male holotype *A. rentzi*, with first two trills from Fig. 316 enlarged to show individual drums.

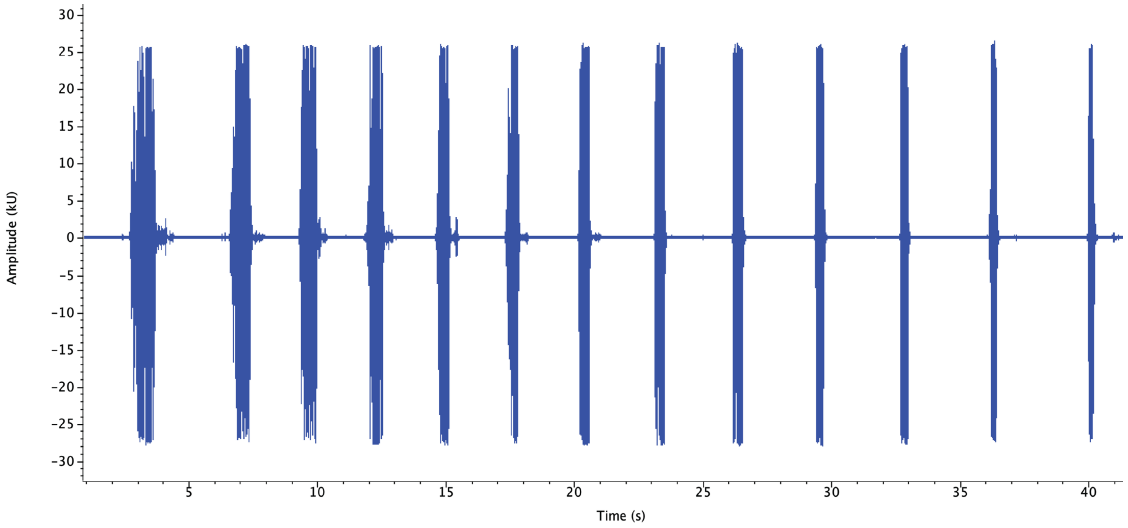


FIGURE 318. Calling drum (R92-122) adult male paratype *A. rentzi.*

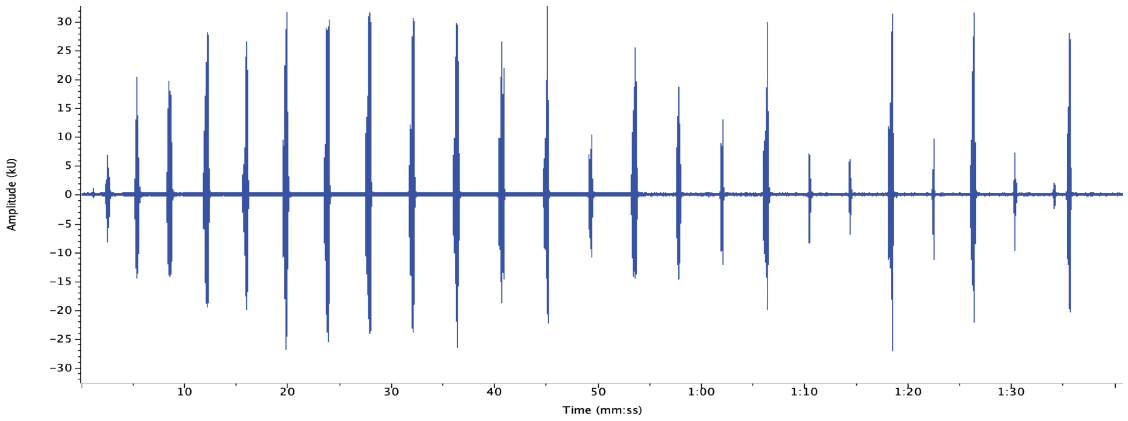


FIGURE 319. Calling drum (R95-127) adult female allotype *A. rentzi.*

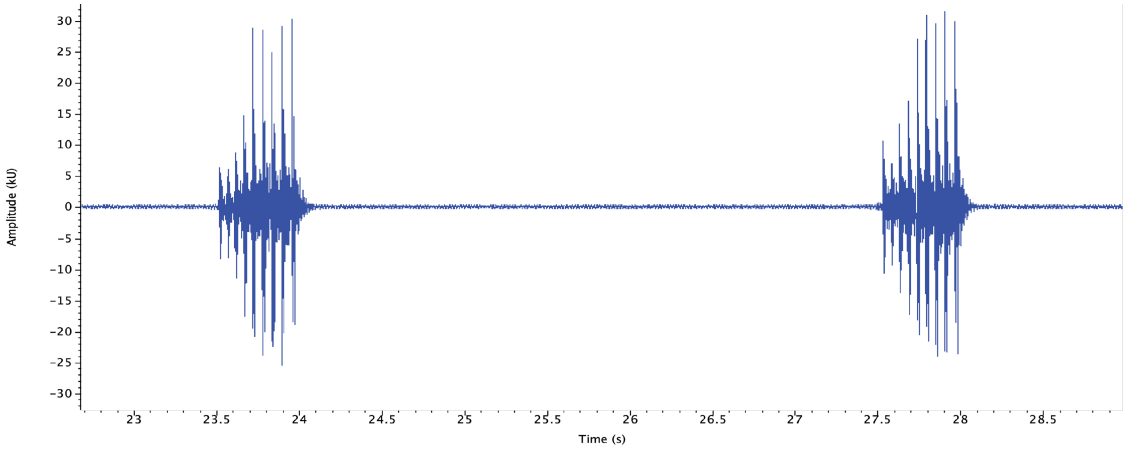


FIGURE 320. Calling drum (R95-127) adult female allotype *A. rentzi*, with first two trills from Fig. 319 enlarged to show individual drums.

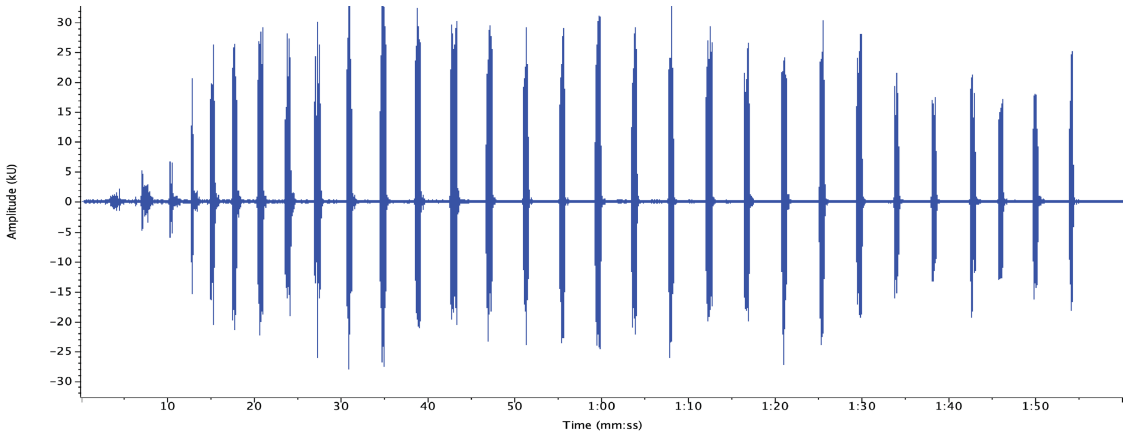


FIGURE 321. Calling drum (R95-128) topotypic adult female *A. rentzi.*

Derivation of name. Named in recognition of David C. F. Rentz, who introduced the senior author to orthopteran field work some 55 years ago, and who also first recognized this taxon as undescribed based on the long ovipositor.

Habitat. Type locality is rolling hills in deciduous oak woodland-grazed grassland, with rocks, just as leaving the Central Valley heading into the Sierra Nevada foothills. Area around Jerseydale is Ponderosa—incense cedar forest. At Bretz Mill (S21-50, Fresno Co), habitat was mixed conifers, oaks, and grassland. Found from San Joaquin Valley floor, 25m at Modesto, up to 2280m at Lake Alpine, one of the greatest elevation ranges known for any *Ammopelmatus* species.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle. Winter and spring captured half grown nymphs matured in late summer and fall of the same year.

Variation. Some adult males have hind leg tibias with reddish tint, as opposed to more typical beige-orange color. Of 30 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 29 had 8 **middle** leg tibial calcars, all with 2 ventral spurs. Of 34 adults, one had 4, 31 had 5 and 2 (both S97-36) had 6 **rear** leg inner tibial spines; while all had 4 outer tibial spines with 2 ventral spurs.

DNA. Fig. 167, p. 136. F0338 (S96-27, Stanislaus Co., Modesto); F0700 (S97-118, Tuolumne Co., Long Barn); F0708 (type locality S98-7, Tuolumne Co., E Oakdale); F2627 (S20-4, Alpine Co., Lake Alpine); F2660 (S21-5, Fresno Co., Bretz Mill) all recovered together in Group 3 Longispinus and closest to *A. briani*.

Karyotype. 2n♂=25. 3 males determined: T92-11 (Fig. 322) and T92-23 (Fig. 323), both S92-36, Tuolumne Co.; T97-10 (Fig. 324), S97-36, Tuolumne Co.: all with 9 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

Discussion. Found microsympatric at type locality, at 154m elevation, with less common *A. pictus*, where nymphs of the two species can be difficult to separate. Once adult, *A. rentzi* without head stripes while head stripes present in *A. pictus.* Nine road miles farther east along Hwy 108, at 369m elevation, only *A. rentzi* present. The single adult female from Bretz Mill (F2660, S21-50, Fresno Co) was collected at an oatmeal trail, along with 7 individuals of *A. springville.*

Separated from more northern sister taxon *A. briani* by some 40 km (Lake Alpine to Meyers).

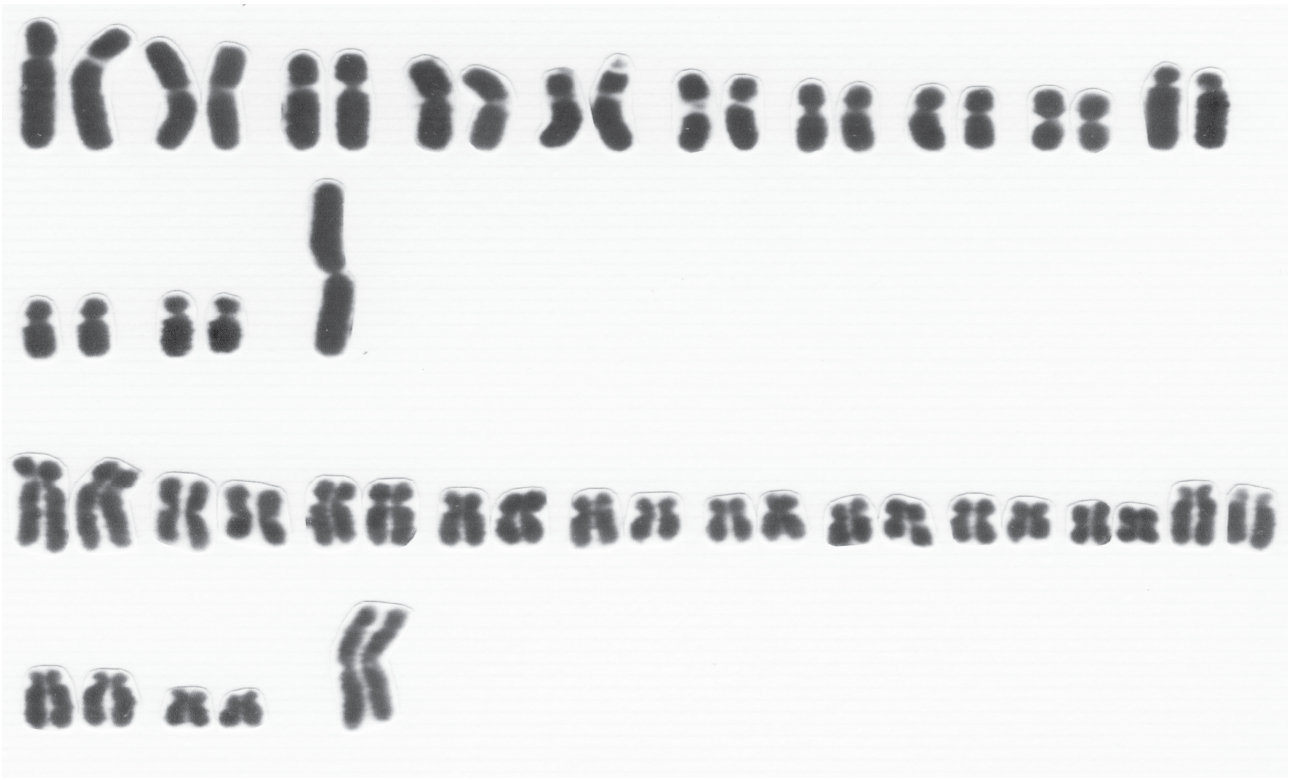


FIGURE 322. Idiogram T92-11 *A. rentzi* (S92-36), with top cell during meiosis; and bottom cell during mitosis.



FIGURE 323. Idiogram T92-23 *A. rentzi* (S92-36).



FIGURE 324. Idiogram T97-10 *A. rentzi* (S97-36).

***Ammopelmatus warnermts* Weissman, sp. nov.**
Cedar Pass Jerusalem Cricket
Figs 325–330, Table 15, 40

Distribution. (Fig. 325). Only known from the isolated Warner Mountains, Modoc County, California, on the western edge of the Great Basin, and the farthest east member of the Longispinus Group.

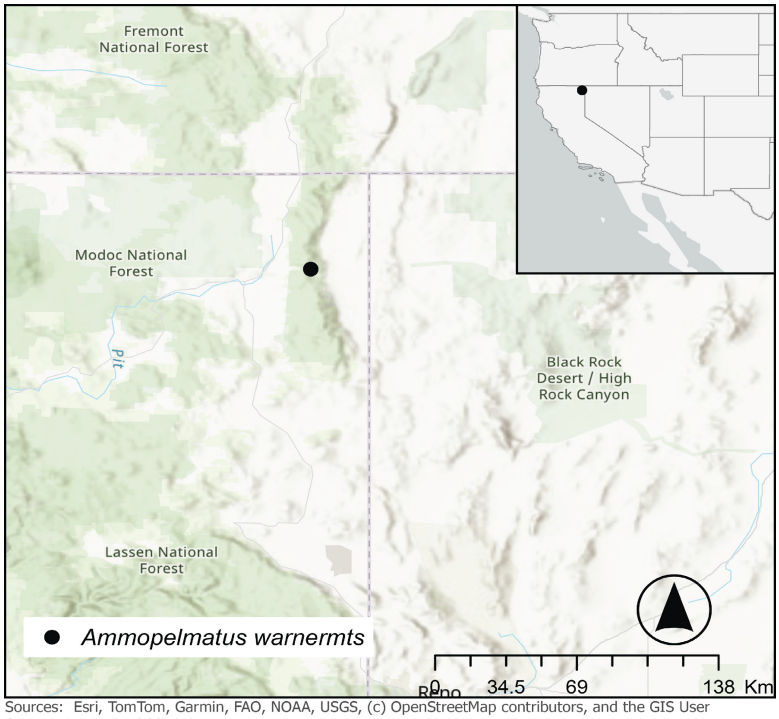


FIGURE 325. Distribution of *A. warnermts.*

Recognition characters. The only Longispinus Group member east of the Sierra Nevada. Medium sized, trilling JC isolated in the Warner Mts. Recovered in a subclade with type locality *A. mtshasta* individuals, from Mt Shasta ~170 km due west of the Warner Mts; along with *A. mtshasta* individuals from Klamath Co, Oregon; and Lassen, Tehema, and Siskiyou Counties, California. The holotype, and only specimen, has the typical *A. mtshasta* formula of 4 outer and 5 inner rear leg tibial spines, but here considered distinct based upon color and geographic isolation.

Holotype. Female (in alcohol, Fig. 326). **California, *Modoc County,*** Warner Mts, Cedar Pass area, 41.553080° -120.253804°, 1804m, 5-viii-2024 (S24-44) DBW & DC Lightfoot. R24-2, F2963. Collected as adult at oatmeal trail. Deposited CAS, Entomology type #20382. Measurements in mm: Body length 36.85, hind femur length 10.54, hind femur width 4.12. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 327) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 328.

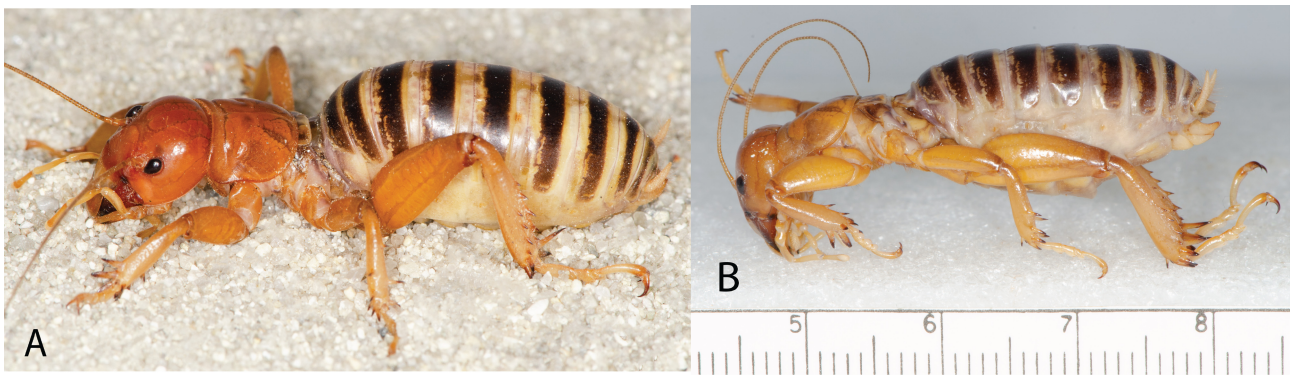


FIGURE 326. Adult female holotype *A. warnermts.* A. When alive. B. When preserved.



FIGURE 327. Left rear leg tibia adult female holotype *A. warnermts.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 328. Ovipositor allotype *A. warnermts.*

Adult male. Unknown.

Paratypes. None.

Drum. Holotype adult female, R24-2 (Fig. 329), shows 9 series of trills over 75.4s (1 series every 8.4s). Fig. 330 shows expanded series #2, with 7 trills over 2.5s (2.8 trills/s), with each trill comprised of 2 drums.

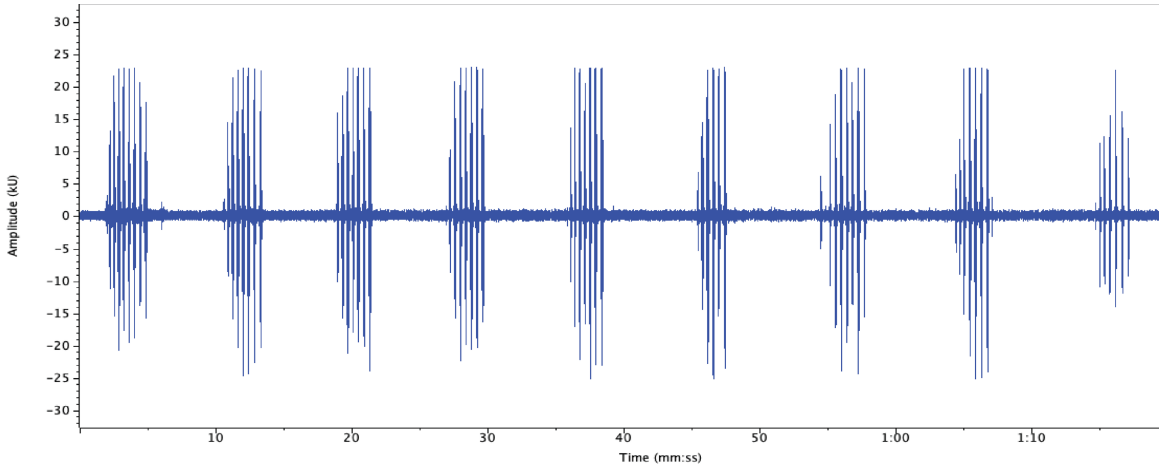


FIGURE 329. Calling drum (R24-2) adult female holotype *A. warnermts.*

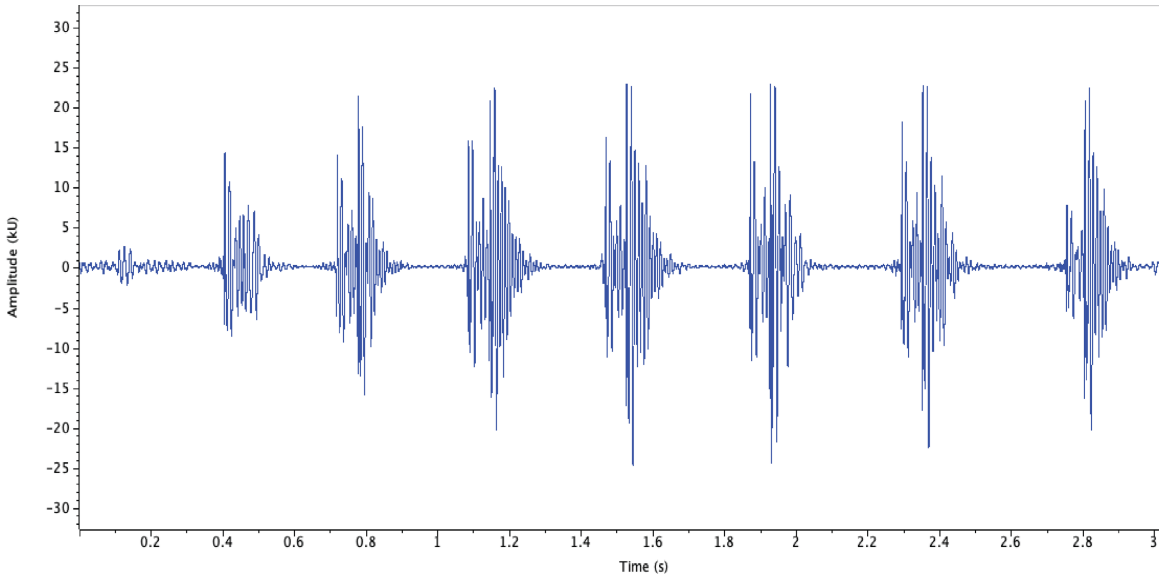


FIGURE 330. Expanded view calling drum (R24-2) from Fig. 329, showing 7 trills each composed of 2 drums.

Derivation of name. Named after the only known locality.

Habitat. To oatmeal trail on dirt road through open grassy area, near stream, with nearby aspens-ponderosa pine-juniper-fir woodland.

Life cycle and seasonal occurrence. Adult when collected on 5-viii-2024. Since she readily drummed in the laboratory, it is possible that she was a recent molt, to adult, and virgin at the time of collection. Weissman (1979) discussed a technique for determining mating status in adult females.

Variation. Known only from holotype.

DNA. Fig. 167, p. 136. F2963 recovered in Group 3 Longispinus with several *A. mtshasta* individuals.

Karyotype. Unknown.

Discussion. Two long oatmeal trails (the first at the holotype location, and the second at 41.562943° -120.271727°) were laid in the Cedar Pass area, under near perfect weather conditions. Many individuals of 2 species of *Pristoceuthophilus* camel crickets, *Steiroxys* katydids, and *Parcoblatta* cockroaches came to the trails, and may indicate an actual rarity of JCs at the site, as opposed to poor collecting methods.

Our initial impression of the collected holotype, given the geographic isolation of the Warner Mountains and the orange-reddish coloration of the female (as opposed to the typical brownish coloration of Longispinus Group members), and being located east of the Sierra Nevada, was that she could be *A. monolake* (only adult males in the Longispinus Group have the characteristic long #1 rear leg calcar). Her calling drum of trills, coupled with her DNA, confirm her placement in the Longispinus Group, and her close affinity with *A. mtshasta.* Nevertheless, we

choose to elevate her to specific status given her isolation and habitat differences, in the absence of more specimens and an adult male.

According to ChatGPT, the Warner Mts are part of the Basin and Range Province**,** geologically and geographically separate from the Sierra Nevada.

(CLADE 4) Group 4, Portal Group (Fig. 331)

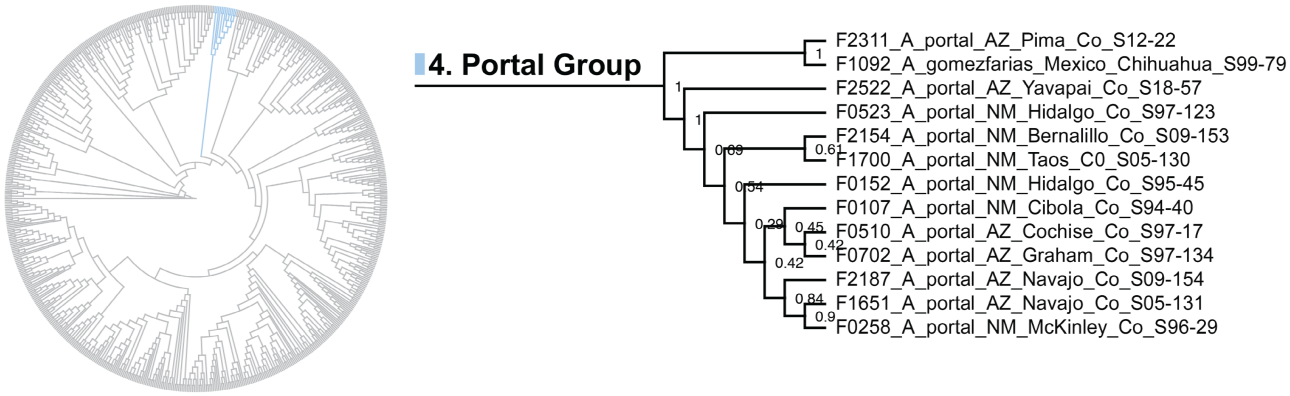


FIGURE 331. ASTRAL tree for Portal Group.

Two small species restricted to high elevations in the Southwestern US (Arizona, New Mexico, Texas, and southern Colorado), and state of Chihuahua in adjacent Mexico. The Group is characterized by (1) Long rear leg femurs in males (sexually dimorphic); (2) Complex calling drums with different cadences; (3) Sex clarification drums.

SPECIES WRITE UPS: *A. gomezfarias* (p. 221) and *A. portal* (p. 224).

***Ammopelmatus gomezfarias* Weissman, sp. nov.**

Gómez Farías Jerusalem Cricket

Figs 332–337, Table 36

Distribution. (Fig. 332). Known only from the type locality northeast of Gómez Farías, Chihuahua, Mexico.

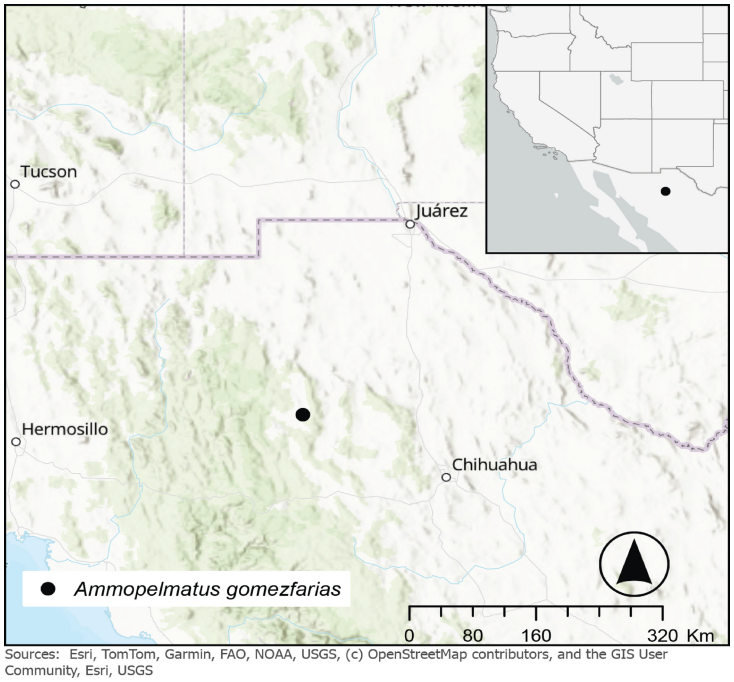


FIGURE 332. Known distribution of *A. gomezfarias.*

Recognition characters. Member of the Portal Group. Small to medium, dark body JC with a male calling song that starts with slow single drums that increase in rate, usually with a short, closing trill. Distinguished from morphologically similar *A. portal*, where calling drum in latter starts fast and transitions to slow.

Holotype. Male (in alcohol, Fig. 333): **Mexico, *Chihuahua,*** along Hwy 5, 5.5 km NE Gómez Farías at km post 169.4, 29.406199° -107.700642°, 2226m, 10-viii-1999 (S99-79) DBW & DC Lightfoot. R00-32, F1092. Molt to adult 4-ix-2000. Deposited CAS, Entomology type #20073. Measurements in mm: Body length 31.03, hind femur length 9.63, hind femur width 4.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; rear leg tibia (Fig. 334) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 333. Adult male holotype *A. gomezfarias.* A. When alive. B. When preserved.



FIGURE 334. Left rear leg tibia holotype adult male *A. gomezfarias*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Female. Unknown.

Paratypes. ♂2. **MEXICO, *Chihuahua***, type locality, 5-x-1988 (S88-111) ♂1 K. Lightfoot; 5-vi-2013 (S13-26) ♂1.

Drum. Holotype **male:** R00-32, S99-79, 19.5°C. Three series recorded (Fig. 335), and each starts out slowly and gradually gets faster. In the last series (Fig. 336) there are 12 drums over 9.9s (1.2 drums/s) ending with a trill of 5 drums over 0.4s. In another type locality male recording (R88-76, S88-111) all 3 series ended in trills. **Female:** drum unknown.

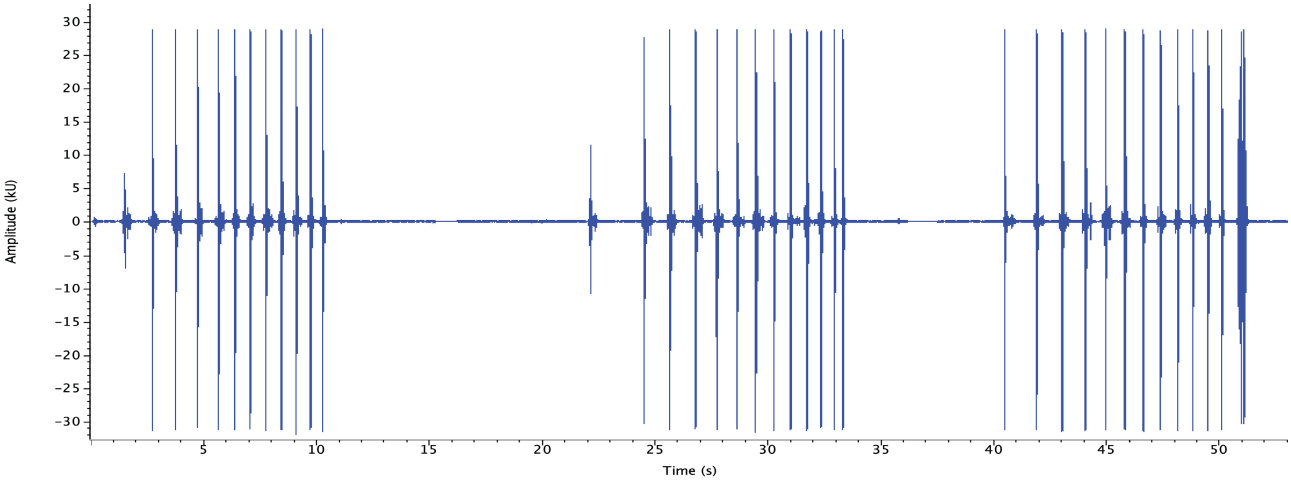


FIGURE 335. Three spliced calling drums (R00-32) holotype adult male *A. gomezfarias*.

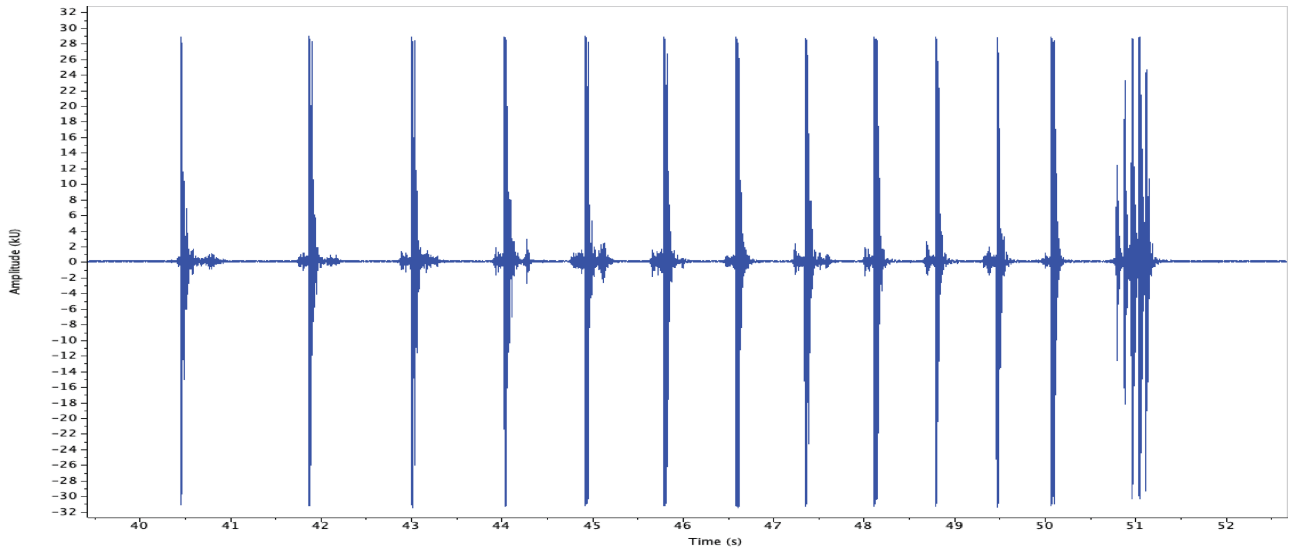


FIGURE 336. Expanded third calling drum (from Fig. 335, R00-32) holotype male *A. gomezfarias.*

Derivation of name. Named after its only known locality.

Habitat. Open oak-pine-juniper woodland, under rocks. None attracted to long oatmeal trail 5-vi-2013 (S13-26).

Life cycle and seasonal occurrence. Adult male collected 5-x-1988 (S88-111). Two juveniles collected under rocks 10-viii-1999 (S99-79). None collected 15-vii-2001 (S01-73). One dead adult male under rock 5-vi-2013 (S13-26) with area overgrazed.

Variation. Overall body **color** variable: see Fig. 337 and compare with holotype. **Fore** leg tibia all with 3 ventral spurs. **Middle** leg tibia with 7 and 8 (holotype) calcars, 2 ventral spurs. **Rear** leg tibial spines: all 3 adult males have 5 inner spines, while 2 males have 3 outer and the third male has 2 outer on one side and 4 outer spines on the other side. Always with 2 ventral spurs.



FIGURE 337. Color variation in topotypic adult male (S88-111, R88-76).

DNA. Fig. 331, p. 221. F1092 (type locality S99-79) is recovered in Group 4 Portal, with *A. portal* from Mt Lemmon, Arizona.

Karyotype. Unknown

Discussion. We have returned to the type locality on several occasions, during wet spring periods when we rolled rocks; and during dry summer periods when we placed long oatmeal trails, and have had no success in collecting more individuals.

Ammopelmatus portal **Weissman, sp. nov.**

Portal Jerusalem Cricket

Figs 338–355, Tables 25, 26, 31, 34

Species #9 and #24, Weissman 2001b.

Distribution. (Fig. 338). Only known from high elevation, sky islands in Arizona, New Mexico, southern Colorado, and Texas. May be a complex of sister species isolated in these refugia.

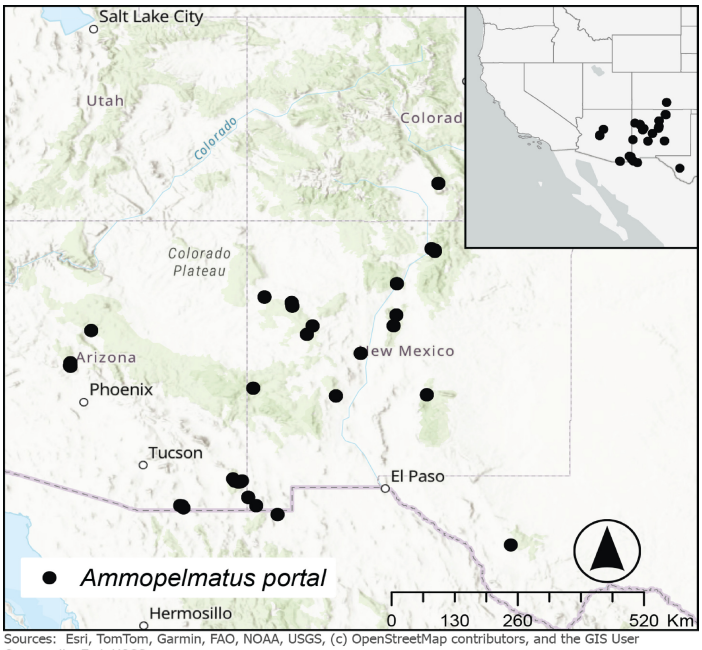


FIGURE 338. Distribution of *A. portal.*

Recognition characters. Small to medium sized, usually dark colored, high elevation JCs with a unique male calling drum composed of a variable and irregular number of introductory fast drums (~8–10 per second), that are sometimes paired or grouped, that then transitions to a longer section of slow drums at a rate around 1.4 drums/s at 20°C. Morphologically similar to *A. gomezfarias* (p. 221), but in latter, drum starts slow and gains speed until a typical closing trill. Most easily separated from sometimes sympatric *A. fuscus* by color, drum, and DNA.

Holotype. Male (in alcohol, Fig. 339): **Arizona, *Cochise Co*.,** Portal, 31.913114° -109.140995°, 1455m, 15-ii-1997 (S97-17) B. Tomberlin. R97-94 & R97-99, F0510. Molt to adult 30-viii-1997. Deposited CAS, Entomology type #20072. Measurements in mm: Body length 24.64, hind femur length 8.77, hind femur width 3.63. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; hind leg tibia (Fig. 340) with 4 inner and 3 outer spines, 2 ventral spurs.



FIGURE 339. Adult male holotype *A. portal.* A. When alive. B. When preserved.

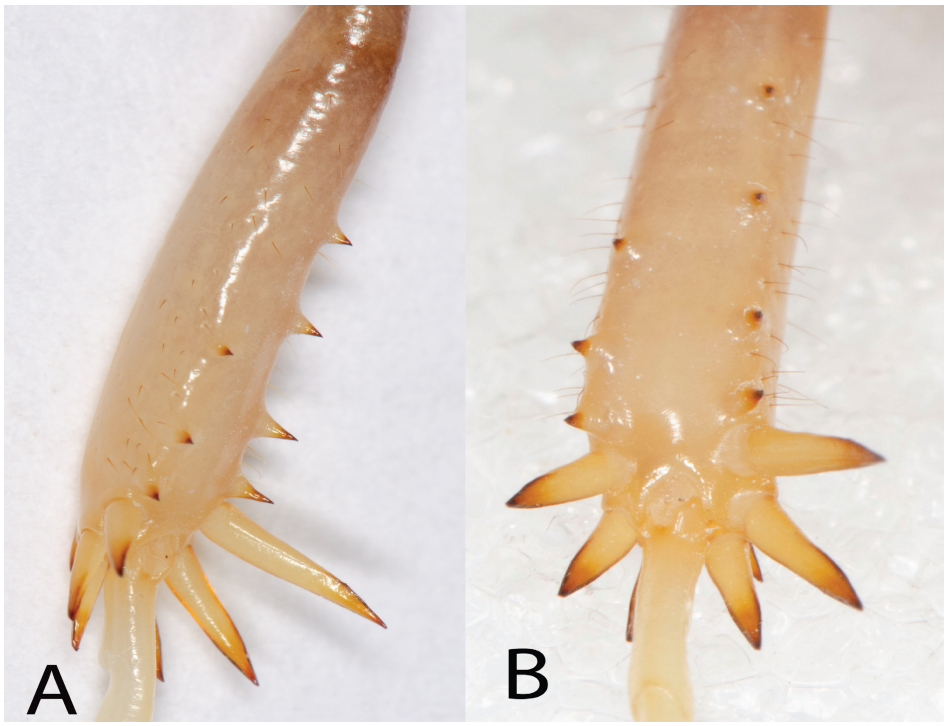


FIGURE 340. Left rear leg tibia holotype adult male *A. portal.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 341): Same data as holotype except 25-vii-1997 (S97-113) B. Tomberlin. R97-145, F0552. Molt to adult 4-ix-1997. Deposited CAS, Entomology #9080142. Measurements in mm: Body length 35.63, hind femur length 10.93, hind femur width 4.27. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars; left hind tibia with 5 inner and 3 outer spines (Fig. 342), right tibia with 6 inner and 2 outer spines, both with 2 ventral spurs. Ovipositor Fig. 343.

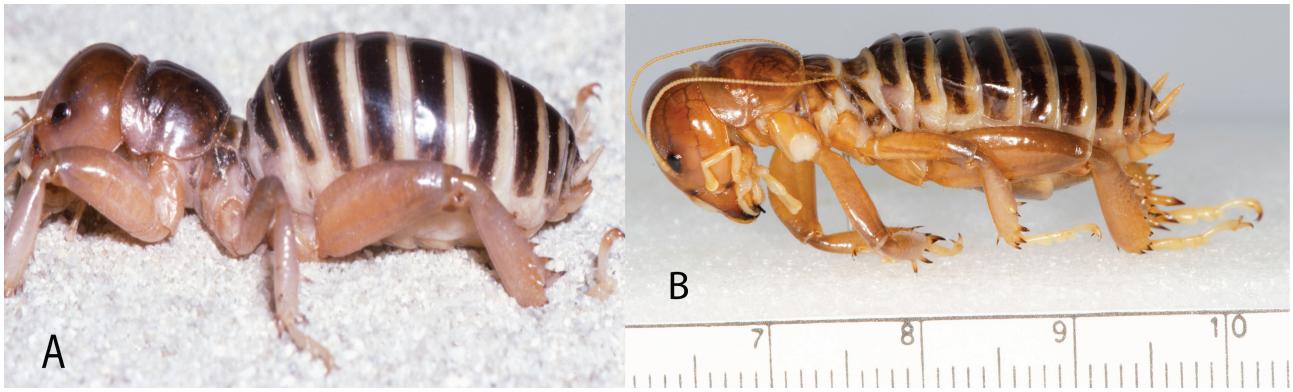


FIGURE 341. Adult female allotype *A. portal.* A. When alive. B. When preserved.

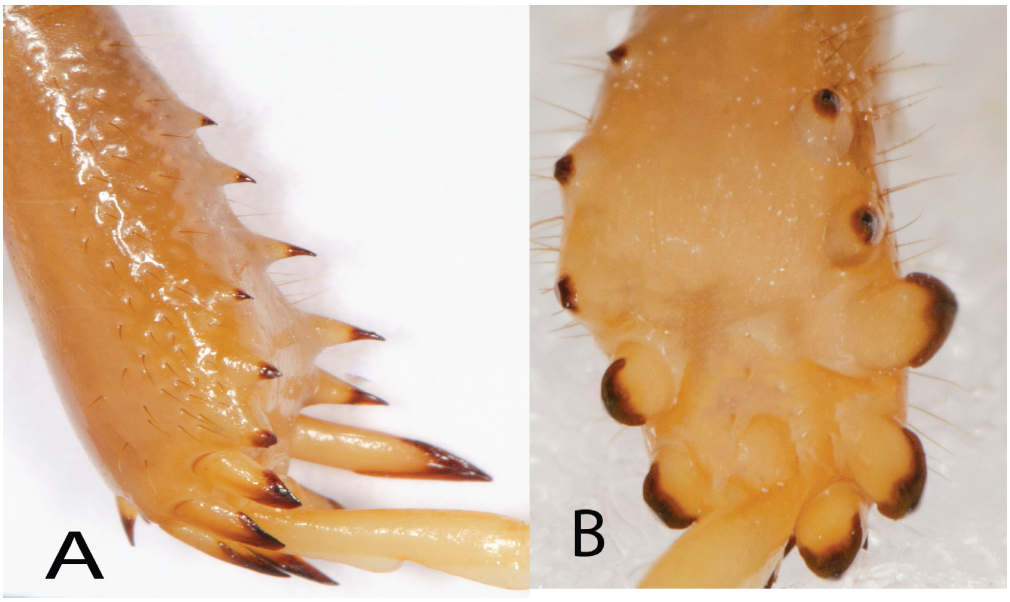


FIGURE 342. Left rear leg tibia allotype adult female *A. portal.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 343. Ovipositor allotype *A. portal.*

Paratypes. ♂122 ♀98. **ARIZONA, *Apache Co.,*** White Mts., 16-vi-1989 (S89-43) SV Vactor ♂1 ♀1. Window Rock, 35.680541° -109.052594°, 2115m, D. Kennell, 28-viii-1993 (S93-76) ♂1; 21-viii-1994 (S94-98) ♂5 ♀2. ***Cochise Co.,*** Chiricahua Mts, Cave Creek Canyon 8 m SW Portal, 31.896204° -109.163672°, 1523m, 7-xi-1999 (S99-157) B. Tomberlin ♀1. On Cave Creek Rd near Ranger Station, 9-vii-1989 (S89-52) B. Tomberlin ♂1. Pine Canyon Methodist Campground, 1828m, 8-x-1993, R. Roche ♂1. Chiricahua Mts, Pinery Canyon Rd, 31.951667° -109.31000°, 1813m, 11-viii-2016 (S16-35) A. Abela ♂3. Hereford, Huachuca Mts, Ash Canyon, 31.382128° -110.224999°, 1511m, 27-v-1989 (S89-20) N. McFarland ♂1. Hereford, 8121 S Furlong, 31.421843° -110.249281°, 1524m, 29-ix-2006 (S06-119) R. Parks ♂1. SE end Huachuca Mts, 1550m, 5-x-1992, N. McFarland ♀1. Huachuca Mts, Reef Camp, Rustler Park Recreational Area, 31.907042° -109.278373°, 2628m, 14-vii-1991 (S91-58) B. Tomberlin ♀1. Huachuca Mts, Reef Campground, 31.429570° -110.290011°, 2184m, 15-ix-2016 (S16-36) DA Gray ♂1. Southwest Research Station, 31.884063° -109.205894°, 1651m, 4-x-1987 (S87-106) DC Lightfoot, ♀2. Portal, Cave Creek Ranch, 31.904000° -109.155656°, 1491m, 16-ix-1988 (S88-109) L. Saul, ♂1; Cave Creek Ranch ~3m NW Portal, 26-x-1991 B. Tomberlin ♀1. Portal near Hatari Invertebrates, 1-x-1991 (S91-112) B. Tomberlin ♂1; Portal, various locations and dates (S97-113) B. Tomberlin ♂6 ♀7. 1 m SW Portal, 14-vii-1989 (S89-54) B. Tomberlin ♂1 ♀1. Portal, Portal Post Office, 31-v-1989 (S89-53) B. Tomberlin ♀1. Portal, general store, 2-xii-1992, B. Tomberlin, ♀1. Willcox, 32.257492° -109.837736°, 1275m, 3-viii-1987 (S87-93) S. DePue ♂1. 11 m S Willcox, 30-ix-1988 (S88-110) G. Anderson ♂1. ***Coconino Co.,*** Hwy 89 0.5 m N Flagstaff, 35.231986° -111.579591°, 2111m, 5-viii-1991 (S91-75) ♂15 ♀2. ~15 m NW Flagstaff, 35.344839° -111.792018°, 2422m, 5-viii-2011 (S11-82) K. Osborne ♀1. Oak Creek Canyon, Pine Flat Campground, 35.01426° -111.73792°, 1702m, 12-viii-2019 (S19-46) DA Gray, ♀1. ***Graham Co.,*** Graham Mts, W end of Tripp Canyon, 32.777158° -110.063841°, 1594m, 22-x-1997 (S97-134) B. Tomberlin, ♂1. ***Mohave Co.,*** Hualapai Mt Park area, 35.090806° -113.871611°, 1838m, 19-vi-1990 (S90-55) ♀2; 13-vi-2012 (S12-30) ♀1. ***Navajo Co.,*** Show Low, 34.254209° -110.029834°, 1927m, 15-v-2005 (S05-131) B. Baskin ♂1. Mogollon Rim 10 m W Heber, 34.347741° -110.735415°, 2249m, 8-ix-2009 (S09-154) J. McCarty ♂1. ***Pima Co.,*** Mt Lemmon Recreational Area, Cypress Campground, 32.372500° -110.694500°, 1786m, 11-vi-2012 (S12-22) ♀1. ***Yavapai Co.,*** Bradshaw Mts 3-3.5 m S Crown King, 34.169187° -112.327670°, 2084m, 8-viii-1990 (S90-88) ♂1; 31-viii-1990 (S90-97) T. Prentice ♀1. Bradshaw Mts above Crown King, 34.223851° -112.319382°, 1851m, 22-ix-1990 W. Icenogle ♂1. Bradshaw Mts, Lane Mtn area, eastern slope, 34.156773° -112.316443° 1955m, 21-ix-1990 W. Icenogle ♀1. 9.8 m W Sedona, 34.85611° -111.934167°, 1262m, 6-ix-2018 (S18-57) A. Abela ♂1. **COLORADO, *Alamosa Co.,*** Great Sand Dune National Monument, along Mosca Creek near Dunes Picnic area, 37.739724° -105.508250°, 2531m, 20-vii-1992 (S92-119) M. Weissmann ♂1. **NEW MEXICO, *Bernalillo Co.,*** Manzanito Mts, Carolino Canyon 22 km S Tijeras, 34.949736° -106.337378°, 2239m, 31-viii-2008 (S08-57) DC Lightfoot ♂2. 6 m NE Cedar Crest, 35.160050° -106.286011°, 2145m, all DC Lightfoot: 15-ix-2009 (S09-153) ♂1; 1-ix-2010 (S10-60) ♂2 ♀1; 19-v-2018 (S18-9) ♀1; mid-August, 2021 (S21-46) ♀1. ***Catron Co.,*** Gila National Forest, Rd 4040, 33.72817° -108.93514°, 2368m, 13-viii-2019 (S19-45) DA Gray, ♂1. ***Cibola Co.,*** El Malpais National Monument 10 m S I-40 on Hwy 117, Sandstone Bluffs Overlook, 34.945606° -107.837865°, 2100m, DC Lightfoot, 21-viii-1991 (S91-102) ♀1; 26-viii-1992 (S92-124) ♂1; near mile post sign 31 on Hwy 117, bordering lava bed, 34.781189° -107.941468°, 2168m, 18-viii-1993 (S93-72) ♀2; 1-vii-1994 (S94-40) ♀1. ***Hidalgo Co.,*** 3 m E Cloverdale near San Luis Pass, Gray Ranch, 31.426990° -108.880387°, 1580m, 4-v-1994 to 10-vi-1995 (S94-17, S94-20, S94-22, S94-26, S94-104, S95-45) B. Tomberlin ♂22 ♀15. 6 m E Cloverdale, Gray Ranch, 31.2530° -108.4852°, 1463m, 21-viii-2004 (S04-101) G. Ballmer & M. Gates ♀1. Peloncillo Mts, Pony Canyon south off Skeleton Canyon Rd., 31.588820° -109.028207°, 1490m, B. Tomberlin, 31-viii-1997 (S97-123) ♂2; 26-ix-1999 (S99-149) ♀1. ***Lincoln Co.,*** 12 m W Capitan off Hwy 380, 0.6 m E mile post 79, 33.597058° -105.722003°, 1883m, 25-viii-1991 (S91-101) DC Lightfoot ♂2. ***McKinley Co.,*** Gallup, 1607 Red Rock Dr, 35.511698° -108.726963°, 2067m, D. Kennell, 9-ix-1995 (S95-95) ♂4 ♀2; 28-ix-1995 (S95-102) ♂5 ♀10; (S96-29) ♂2 ♀1; 23-iv-1997 (S97-33) ♂1 ♀6. Thoreau, 35.402527° -108,223401°, 2184m, 15-viii-1989 (S89-62) W. Sakai ♂3 ♀7. Thoreau, Cottonwood Gulch, 35.334415° -108.211091°, 2270m, W. Sakai 6-viii-1990 (S90-86) ♂3 ♀1; August, 1992 ♂5; 7-viii-1993 ♂3. ***Sandoval Co.***, Bandelier National Monument, 0.5m SW Visitor Center, 35.775° -106.276°, 6450', all DC Lightfoot: 29-viii-13-x-2014 ♀1; 7-viii-8-x-2015 ♂1 ♀1; 9-ix-28-x-2015 ♀1; 30-vi-24-viii-2016 ♀1; 24-viii-20-x-2016 ♀3. ***Socorro Co.,*** Oscura Mts, North Oscura Peak, 2560m, 3-v-1989 (S89-12) D. Lightfoot ♂1. San Mateo Mts., Rock Springs, 1-ix-1988 (S88-102) DC Lightfoot ♀1; Springtime Campground, 33.575344° -107.404481°, 2256m, 10-ix-1988 (S88-107) DC Lightfoot ♂6 ♀4. Sevilleta Wildlife National Refuge, Site 222, 34.408333° -106.945278°, 1568m, 15-viii-1993 (S93-66) ♂1 ♀1. ***Taos Co.,*** El Prado, 24822 US Hwy 64

West, 36.459550° -105.635983°, 2177m, A. Hillings, 25-viii-6-x-2005 (S05-130) ♀3; 9-xi-2007 (S07-106) ♀1. El Prado, 36.431793° -105.574686°, 2136m, S. Basehart, 13-vii-2006 (S06-65) ♂1; 11-viii-2006 (S06-71) ♂1 ♀1. Taos, 36.407806° -105.572873°, 2128m, 14-ix-2005 (S05-135) JL Aaron ♀1; 28-ix-2010 (S10-72) P. Tredwin ♂1. **TEXAS, *Jeff Davis Co.,*** Davis Mts Preserve, 30.657° -104.167°, 1954m, 14-viii-2025 (S25-4) B. Woo ♂3.

Drum. Calling drum can be different between the sexes. Males have a unique, sometimes three or four-part calling drum that is more variable than in any other JC species discussed in this paper. Males frequently start with a fast (10 drums/s), introductory part, that is not seen in females, and is apparently just a long sex clarification drum (SCD). That can be followed by a short section of fast (8 drums/s) drums; then a short section of grouped drums, similar to a few short trills; which is followed by a section of slow (2 drums/s) drums. In contrast, females typically have a two-cadence drum consisting of an initial fast (2.5 drums/s) and irregular section; followed by a slow (1.4 drums/s) section. Individuals of both sexes are very reactive to other drumming adults, especially isolated virgin males who when hearing drums of other individuals, usually extend their introductory SCD. **Male**: holotype R97-94 (Fig. 344), S97-17, 20°C, SCD only: 83 fast drums in 8.1s (10.2 drums/s). Next day, same male R97-99 (Fig. 345) at 20°C, without a SCD, but starts with a fast section (only measured part of this irregular 1fast section, with 25 drums in 3.1s (8.1 drums/s), then drum slows to include 3 trills of 3 grouped drums, then transitions to 11 slow drums over 5.3s (2.1 drums/s). Examples of other males, to demonstrate range of variation, include: R06-56 (Fig. 346), S06-71 (El Prado, Taos Co, NM), 20.5°C, with 7 pairs and triplets over 5.3s, then 14 single drums over 7.8s (1.8 drums/s). Gray Ranch (S94-26), Hidalgo Co, NM, 21°C, SCD of 34 drums over 4.9s (6.9 drums/s), then later (Fig. 347, R94-57) 14 fast drums over 2.3s (6.1 drums/s) transitioning to 23 slow drums over 10.1s (2.3 drums/s). **Female:** allotype R97-145 (Fig. 348), S97-113, 20.5°C: ~27 fast and irregular drums over 10.4s (2.6 drums/s), then 170 slow drums over 121s (1.4 drums/s). Other females include R94-79 (Fig. 349), S94-26 (Gray Ranch, Hidalgo Co, NM), 19°C, 22 fast drums over 7.5s (2.9 drums/s), transitioning to 9 slow drums over 5.9s (1.5 drums/s). R97-52 (Fig. 350), S97-33 (Gallup, McKinley Co, NM), 20.5°C, some 15 irregular and fast drums transitioning to ~83 slow drums over 59s (1.4 drums/s).

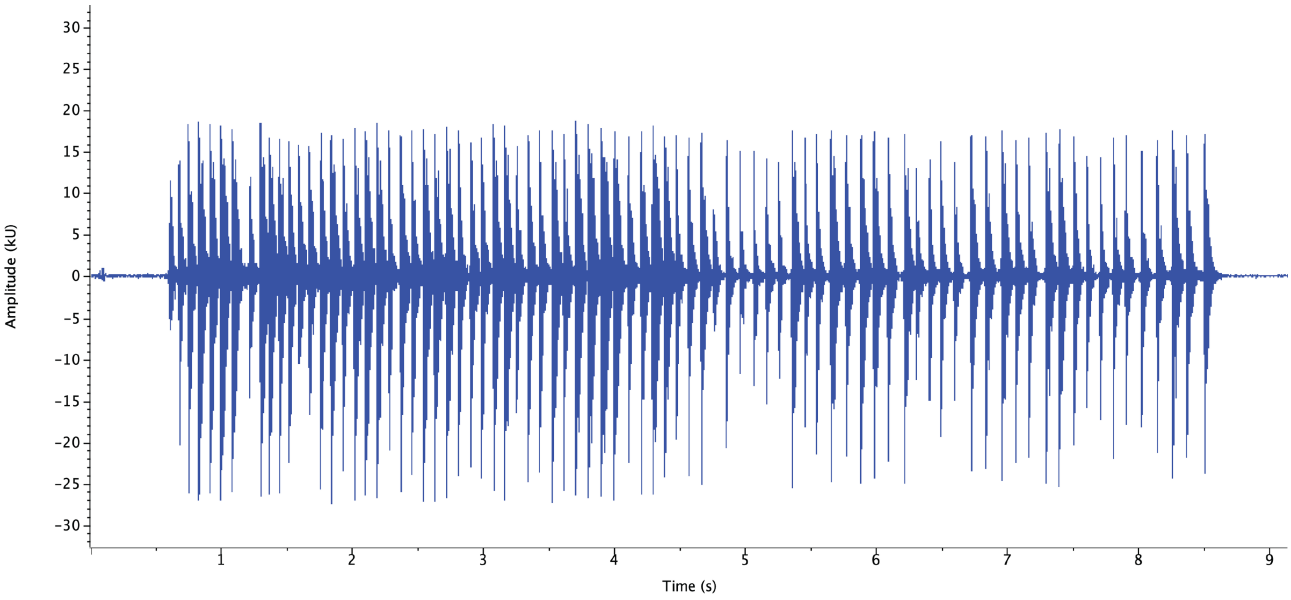


FIGURE 344. Long sex clarification drum (R97-94) in holotype adult male *A. portal*.

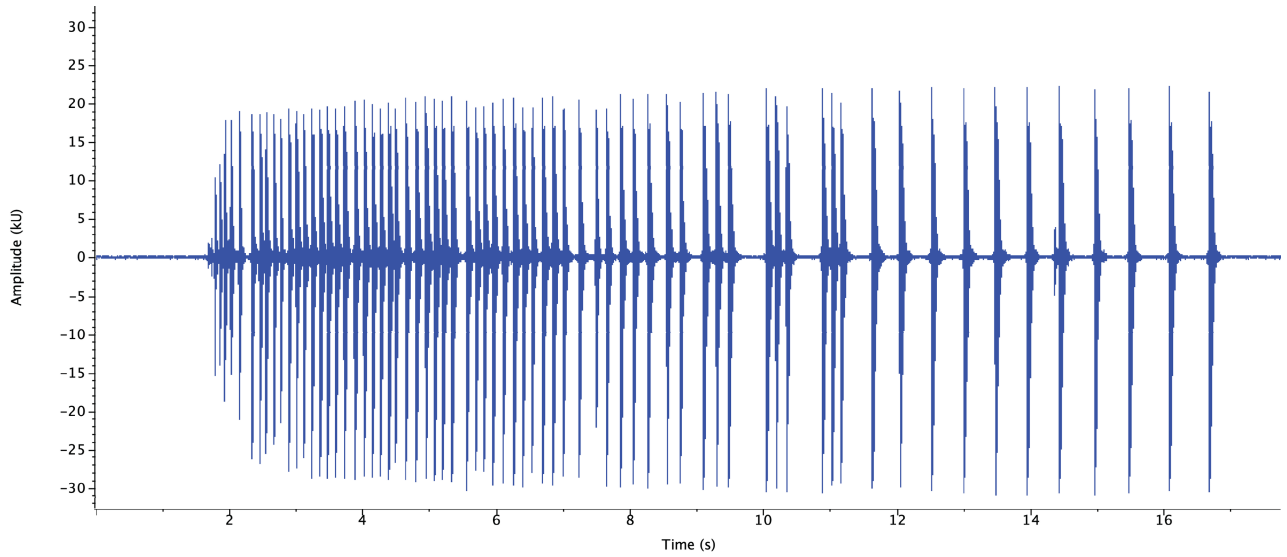


FIGURE 345. Calling drum (R97-99) holotype adult male *A. portal*.

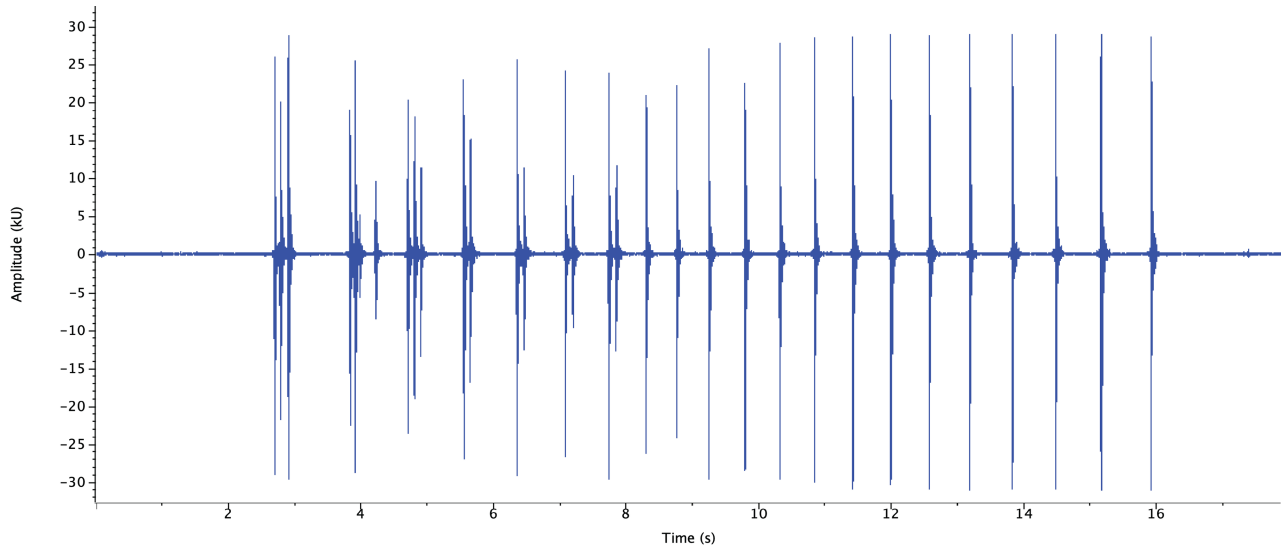


FIGURE 346. Calling drum (R06-56, S06-71) adult male *A. portal.*

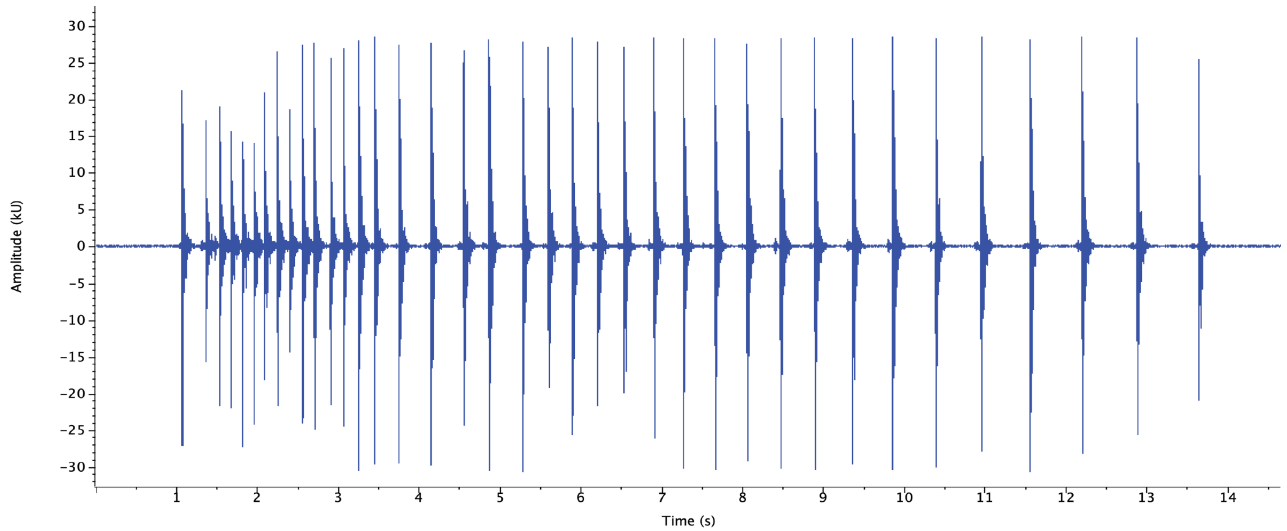


FIGURE 347. Calling drum (R94-57) adult male *A. portal*.

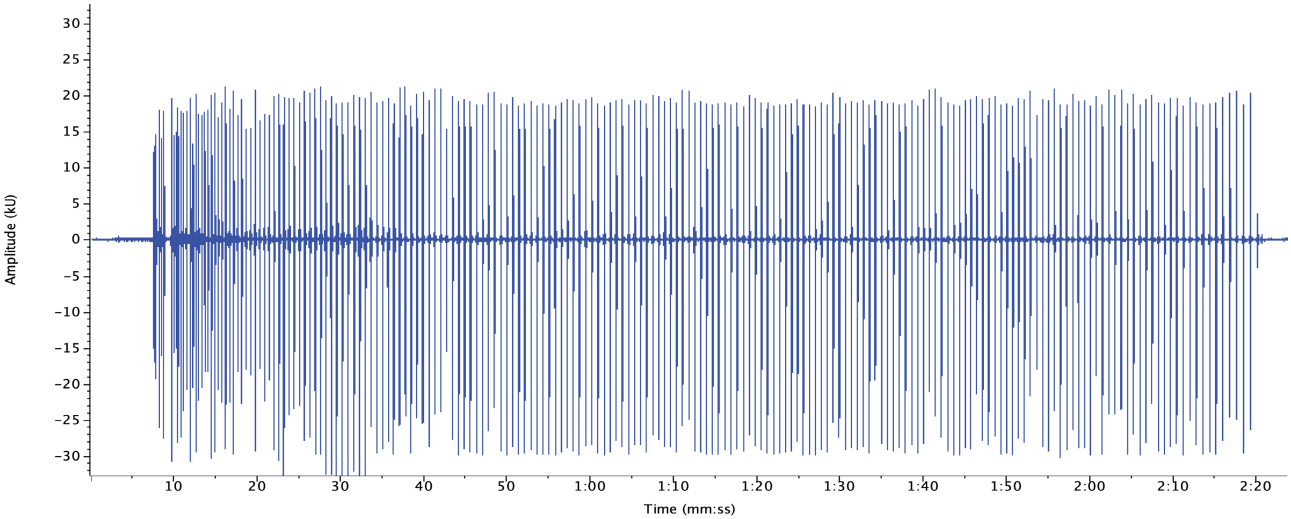


FIGURE 348. Calling drum (R97-145) allotype adult female *A. portal*.

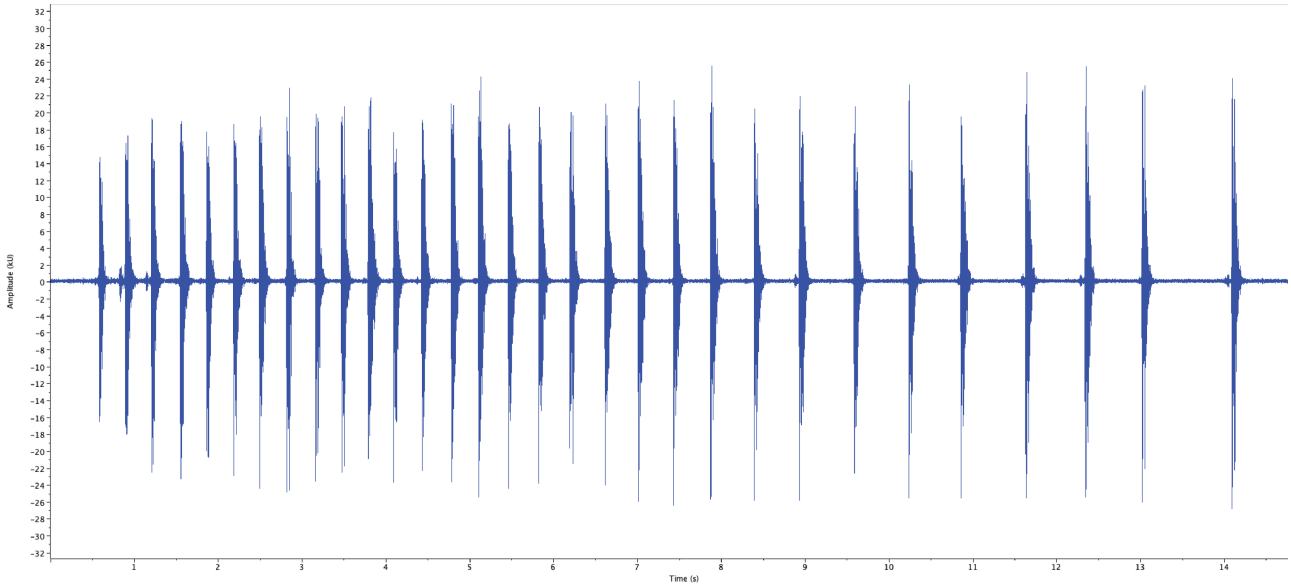


FIGURE 349. Calling drum (R94-79) adult female *A. portal.*

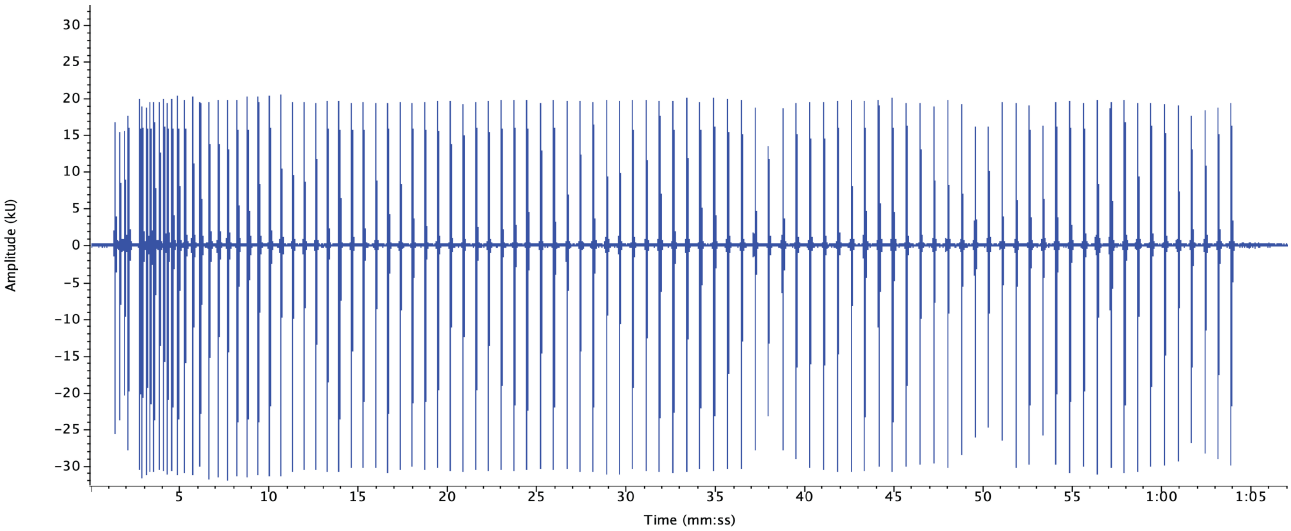


FIGURE 350. Calling drum (R97-52) adult female *A. portal.*

Derivation of name. Named after the type locality.

Habitat. Always above 1250m, usually in forested areas of mixed oak and pines. The Bandelier National Monument samples were from pinyon-juniper woodland, on volcanic soil. The largest sample, from the former Gray Ranch in New Mexico, 3 m E Cloverdale, is unusual in habitat. While the collector, Barney Tomberlin, founder of Hitari Invertebrates, did long-term pit fall trapping on the Gray Ranch, in grasslands, dense oak woodland, and open rocky foothills with junipers, he only obtained JC specimens from pit fall traps on sand dunes. Not surprisingly, these sand dune individuals had lighter (Fig. 351) limbs and lighter overall body color than those collected elsewhere off sand. At the lone Texas site, according to Brandon Woo, the main trees were Gray oak, Alligator juniper, Mexican pinyon, and southwestern Ponderosa pine.



FIGURE 351. Adult male *A. portal*, from Gray Ranch, New Mexico (S94-26, R94-75), showing wider area between abdominal black bands (compare with holotype male above).

Life cycle and seasonal occurrence. Usual 2-year life cycle.

Variation. **Fore legs**: All 30 tabulated adults with 3 ventral spurs. **Middle tibia**: Of 41 tabulated adults, 6 had 7 calcars and 35 had 8 calcars, all with 2 ventral spurs. **Rear legs** were tabulated in our largest sample from the Gray Ranch, New Mexico. Of 22 collected adult males, 3 had 4 inner spines, 16 had 5, and 3 had 6; while 19 had 3 outer spines and 3 had 4, all with 2 ventral spurs. Of 15 collected adult females, 2 had 4 inner spines, 11 had 5, and 2 had 6; while 12 had 3 outer spines and 3 had 4, all with 2 ventral spurs. **Abdominal band pattern** (as in Fig. 351, above from the Gray Ranch).

DNA. Fig. 331, p. 221. Because the calling song of *A. portal* is so geographically and intrapopulation variable, especially when combined with its sex clarification drum, we sequenced individuals from 12 populations: F0107 (S94-40, Cibola Co., NM); F0152 (S95-45, Hidalgo Co., NM); F0258 (S96-29, McKinley Co., NM); F510 (holotype S97-17, Cochise Co., AZ); F0523 (S97-123, Hidalgo Co., NM); F0702 (S97-134, Graham Co., AZ); F1651 (S05-131, Navajo Co., AZ); F1700 (S05-130, Taos Co., NM); F2154 (S09-153, Bernalillo Co., NM); F2187 (S09-154, Navajo Co., AZ); F2311 (S12-22, Yavapai Co., AZ); F2522 (S18-57, Yavapai Co., AZ). All 12 individuals recovered together in the Group 4 Portal, and there is suggestion of at least 3 subclades. Given the diversity of habitats involved, and the isolation of many of these sites in sky islands, we wonder if further work won't demonstrate that *A. portal* is a complex of several sister species, analogous to the situation seen for the similarly distributed, sky island field cricket *Gryllus montis* Weissman & Gray (2019).

Karyotype. 2n♂=23. 6 testes examined: T93-32 (Fig. 352, S93-66, Sevilleta, Socorro Co, NM); T94-5 (Fig. 353) & T94-18 (both S94-20, Gray Ranch, Hidalgo Co, NM); T96-8 & T97-27 (Fig. 354, both S97-33, Gallup, McKinley Co., NM; T18-3 (Fig. 355, S18-9, Cedar Crest, Bernalillo Co., NM); and all basically agree: with 6 or 7 metacentric or submetacentric autosomal pairs; 4 or 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

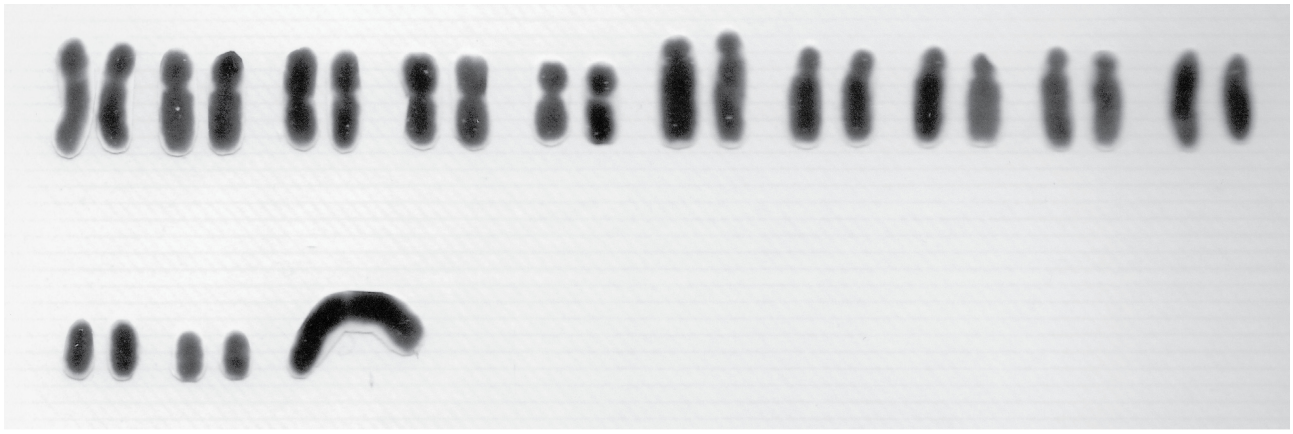


FIGURE 352. Idiogram T93-32 *A. portal* (S93-66).

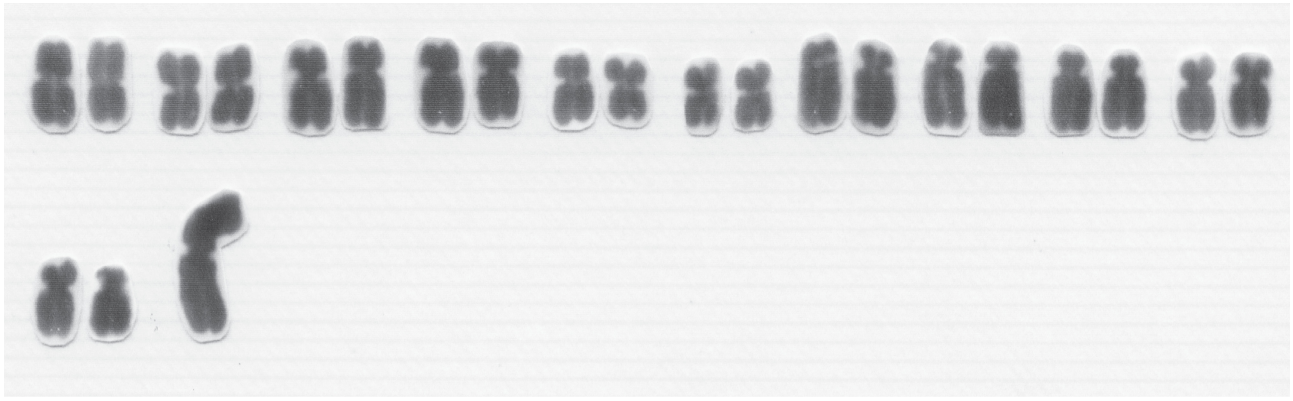


FIGURE 353. Idiogram T94-5 *A. portal* (S94-20).



FIGURE 354. Idiogram T97-27 *A. portal* (S97-33).

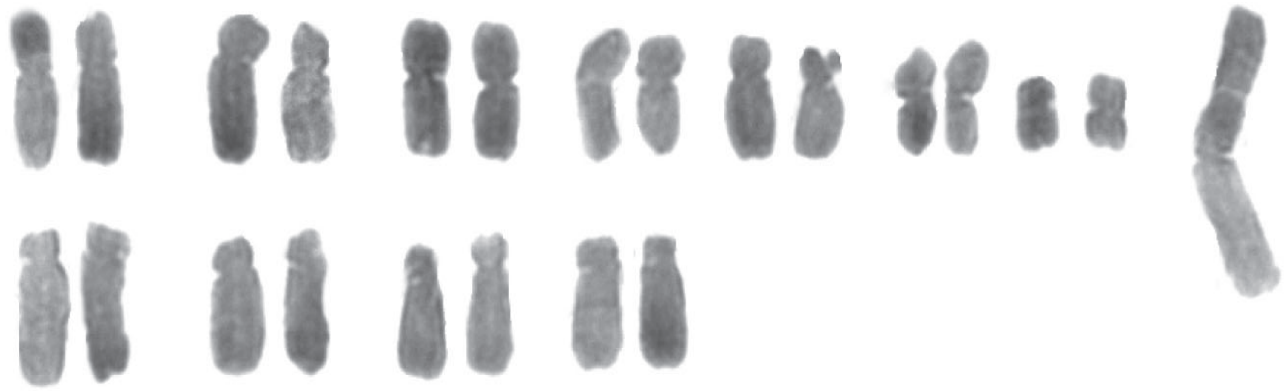


FIGURE 355. Idiogram T18-3 *A. portal* (S18-9).

Discussion. When several adult males of *A. portal* are together in the car, where they can "hear" each other drumming while in their separate vials or tubs, there can be loud, extended SCDs day and night.

In Ponderosa pine/juniper forest just north Flagstaff (S91-75), oatmeal was place in intermittent piles ~2–3 m apart, as opposed to a continuous trail. Of 17 individuals collected, only 2 were at the trail with the rest walking around and, in several cases, situated between piles. After this experience, we never placed oatmeal piles again but only laid a continuous oatmeal trail.

Two JC species occur in Tripp Canyon, Arizona: From S97-134 (R98-139, F0702) we report *A. portal*; while from S98-109, within 400m of S97-134, we report *A. grayi* (R98-209, F0859). Occurs with *A. fuscus* at four separate sites in New Mexico: Bandelier (Sandoval Co); El Malpais (Cibola Co); Gallup (McKinley Co); and Sevilleta (Socorro Co).

The old 500 square mile Gray Ranch is now protected by the Nature Conservancy and has been renamed the Diamond A Ranch: https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/diamond-a-ranch/

(CLADE 5) Composed of 2 groups: Group 5, Argus Group (Fig. 356)

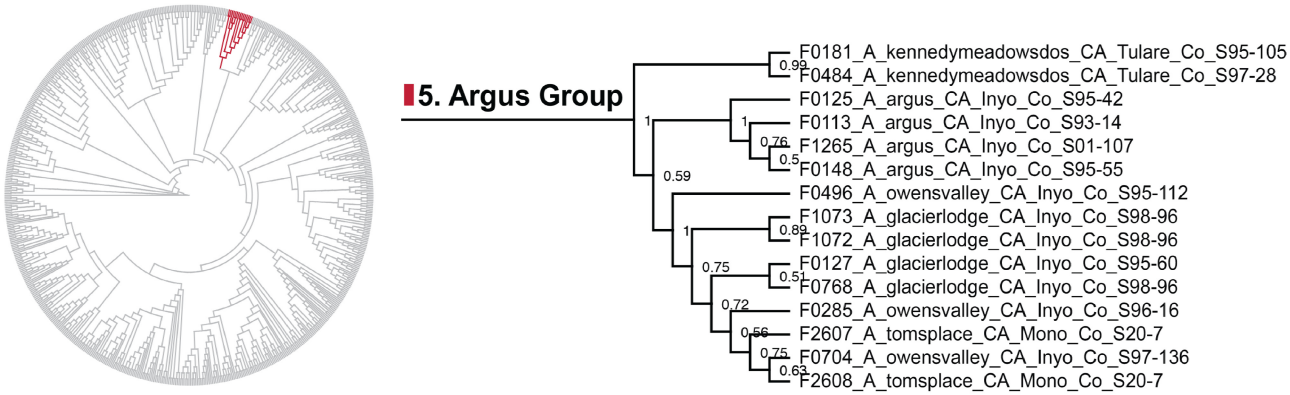


FIGURE 356. ASTRAL tree for Argus Group.

This Group is composed of 5 Southern California species, all east of the Sierras, and, uniquely, where the female's drum in the 3 known taxa (*A. argus, A. glacierlodge,* and *A. owensvalley*) is faster than the male's drum. Unfortunately, data are incomplete for several metrics: *A. tomsplace* (2n♂=23) with a known SCD, but female drum rate unknown; *A. glacierlodge* with 2n♂=25; *A. owensvalley* with 2n♂=23; but karyotype unknown in *A. argus* and *A. kennedymeadowsdos.*

SPECIES WRITE UPS: *A. argus* (p. 234); *A. glacierlodge* (p. 239); *A. kennedymeadowsdos* (p. 244); *A. owensvalley* (p. 247); and *A. tomsplace* (p. 253).

***Ammopelmatus argus* Weissman, sp. nov.**
Argus Mountains Jerusalem Cricket
Figs 357–365, Table 15

Distribution. (Fig. 357). Only known from the Argus, Coso, and Nelson Mountain Ranges of Inyo Co, California.

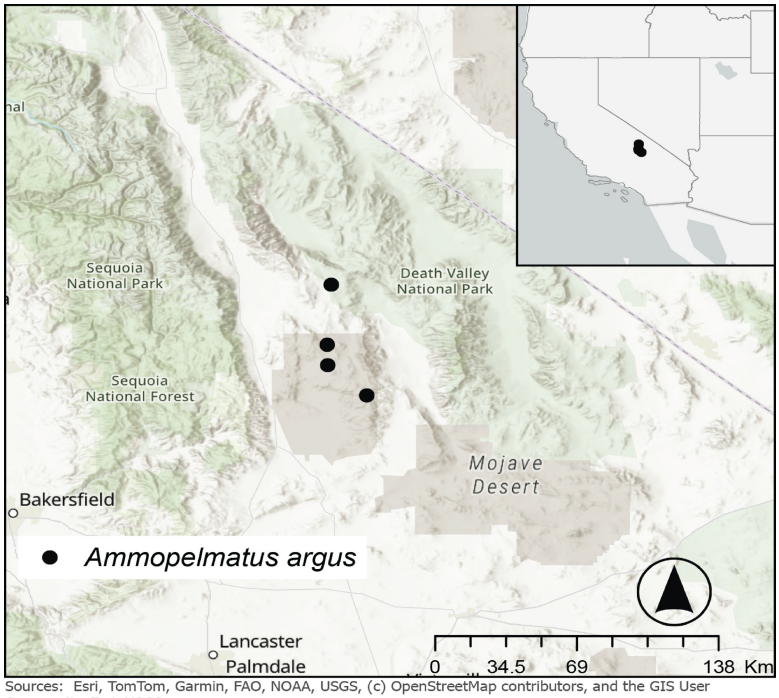


FIGURE 357. Known distribution of *A. argus.*

Recognition characters. A medium-large JC from high elevation, western Great Basin Desert, with prominent black abdominal stripes, calling drum rate between 2.5–3.4 drums/s, at 20°C, and usually with 5 inner and 3 outer rear leg tibial spines.

Holotype. Male (in alcohol, Fig. 358). **California, *Inyo Co.,*** Naval Air Weapons Center, China Lake, Argus Range, Birchum Springs, 35.935222° -117.472882°, 1687m, 7-8-vii-1995 (S95-55), GF Pratt. R95-61, F0134. Molt to adult 3-ix-1995. Deposited CAS, Entomology type #20116. Measurements in mm: Body length 33.24, hind femur length 12.39, hind femur width 4.45. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 359) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

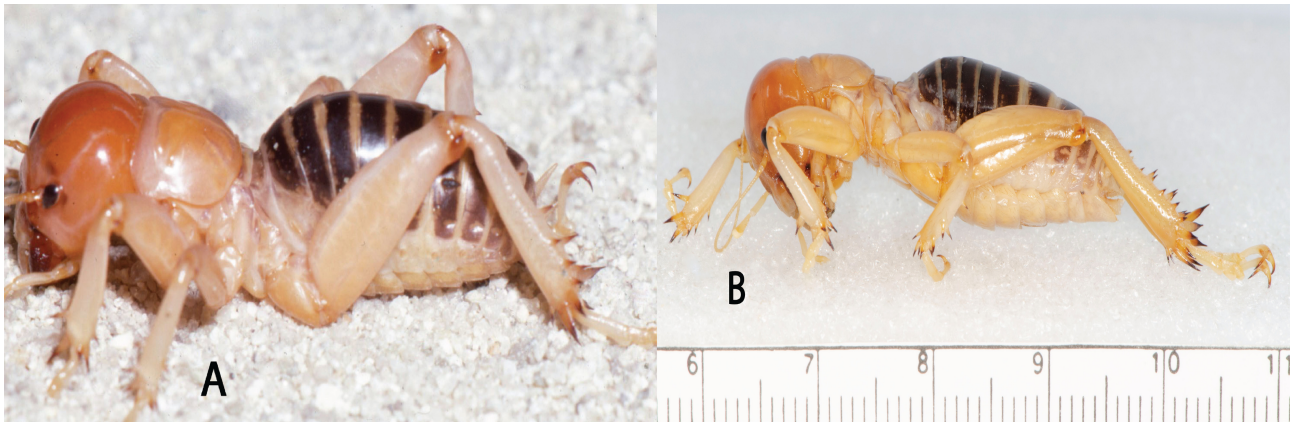


FIGURE 358. Holotype adult male *A. argus.* A. When alive. B. When preserved.



FIGURE 359. Left rear leg tibia adult male holotype *A. argus.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 360). Same data as holotype except R95-74, F0136. Molt to adult 10-ix-1995. Deposited CAS, CASENT #9084018. Measurements in mm: Body length 40.36, hind femur length 13.42, hind femur width 4.93. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 361) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 362.

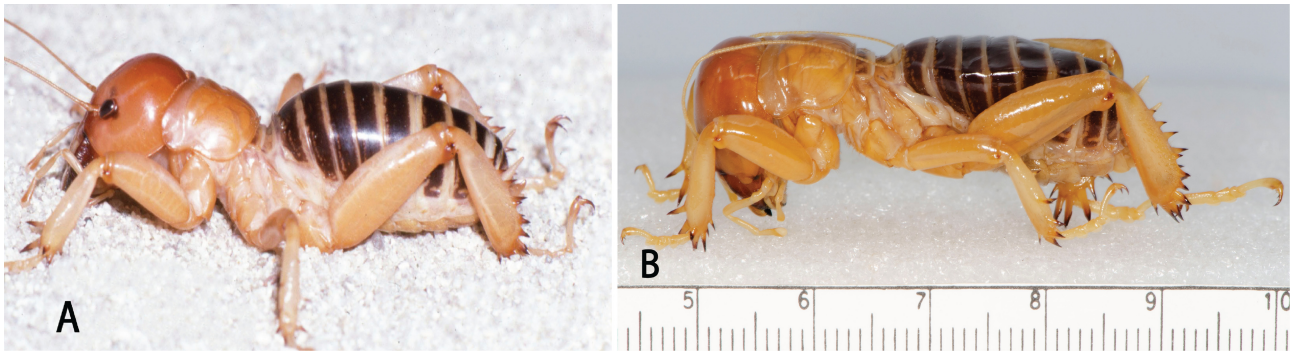


FIGURE 360. Adult female allotype *A. argus.* A. When alive. B. When preserved.



FIGURE 361. Left rear leg tibia allotype *A. argus.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 362. Ovipositor allotype *A. argus.*

Paratypes. ♂5 ♀21. All ***Inyo Co.*, California**. Same locality as types, ♂3 ♀6; 5-ix-1997 (S97-126) ♀1. Argus Range, 2 m S Maturango Peak, 36.079273° -117.643737°, 1775m, 5-ix-1997 (S97-125) GF Pratt ♀1. Naval Air Weapons Center, China Lake, Coso Range, Coles Spring, 36.176923° -117.646029°, 1771m, early May, 1995 (S95-42) GF Pratt ♂1 ♀1. Nelson Range, South Pass, 36.463211° -117.628179°, 1615m, 23-iii-1993 (S93-14) ♀8; 20-xii-1994 (S94-121) ♀1; 15-iii-1996 (S96-10) ♂1 ♀1. Nelson Range, Grapevine Canyon, ~1500m, October, 2001 (S01-107) K. Emmerich ♀2.

Drum. Calling drum similar in both sexes, except faster in females (Fig. 363), and males with a sex clarification drum (SCD). **Male:** Holotype (R95-61, Fig. 364) with 3 or 4 short SCD then 29 drums over 12.3s (2.4 drums/s) at 19°C. **Female:** Allotype (R95-74, Fig. 365) with 31 drums over 9.1s (3.4 drums/s) at 20°C.

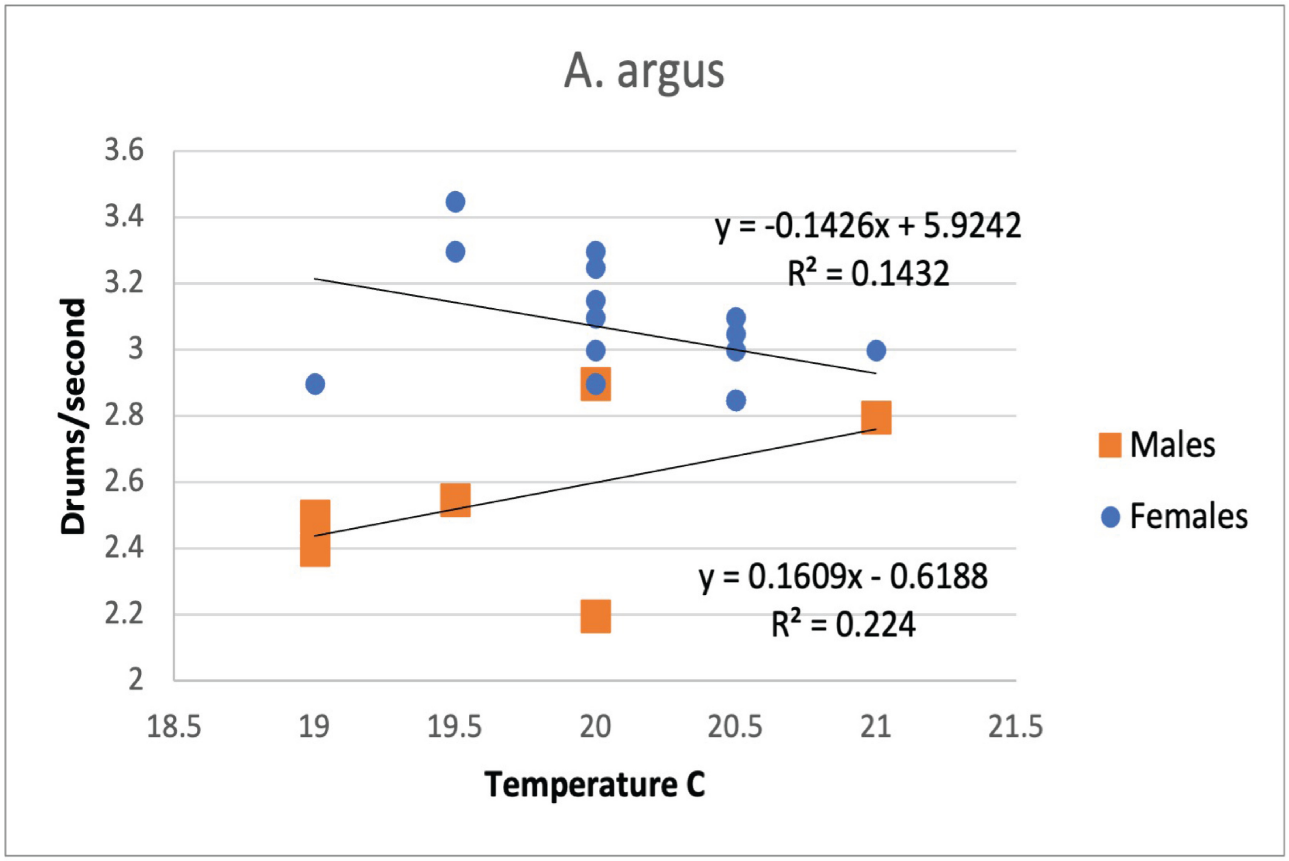


FIGURE 363. Drumming rate in adult *A. argus*.

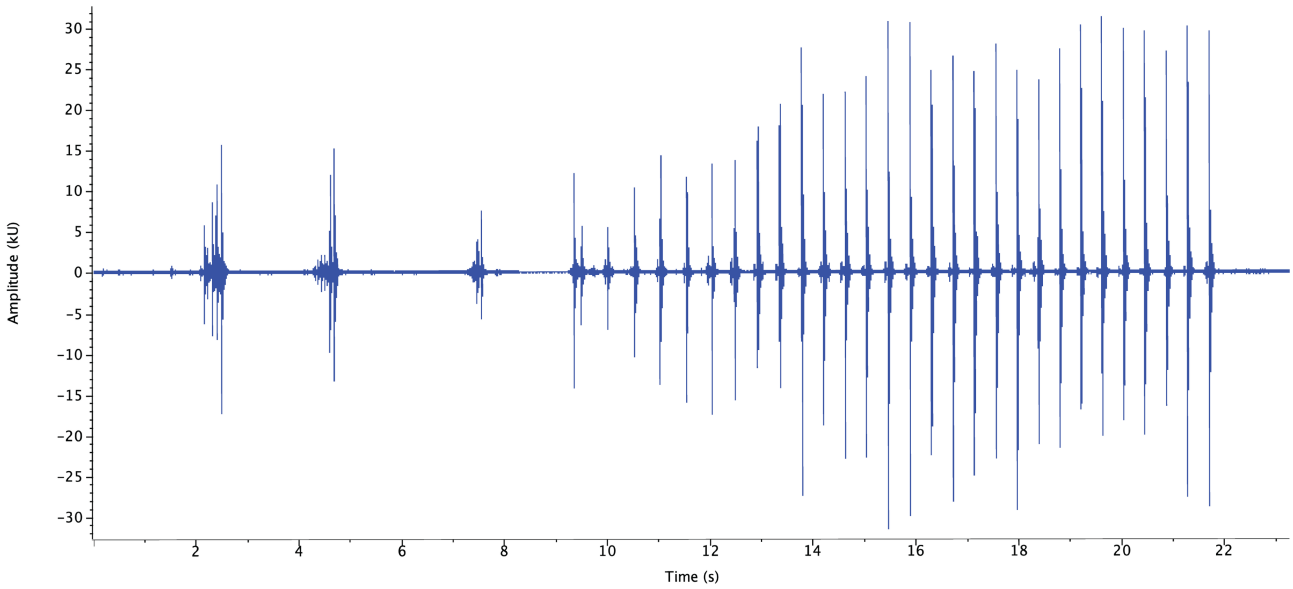


FIGURE 364. Calling drum (R95-61), with SCD, in holotype adult male *A. argus*.

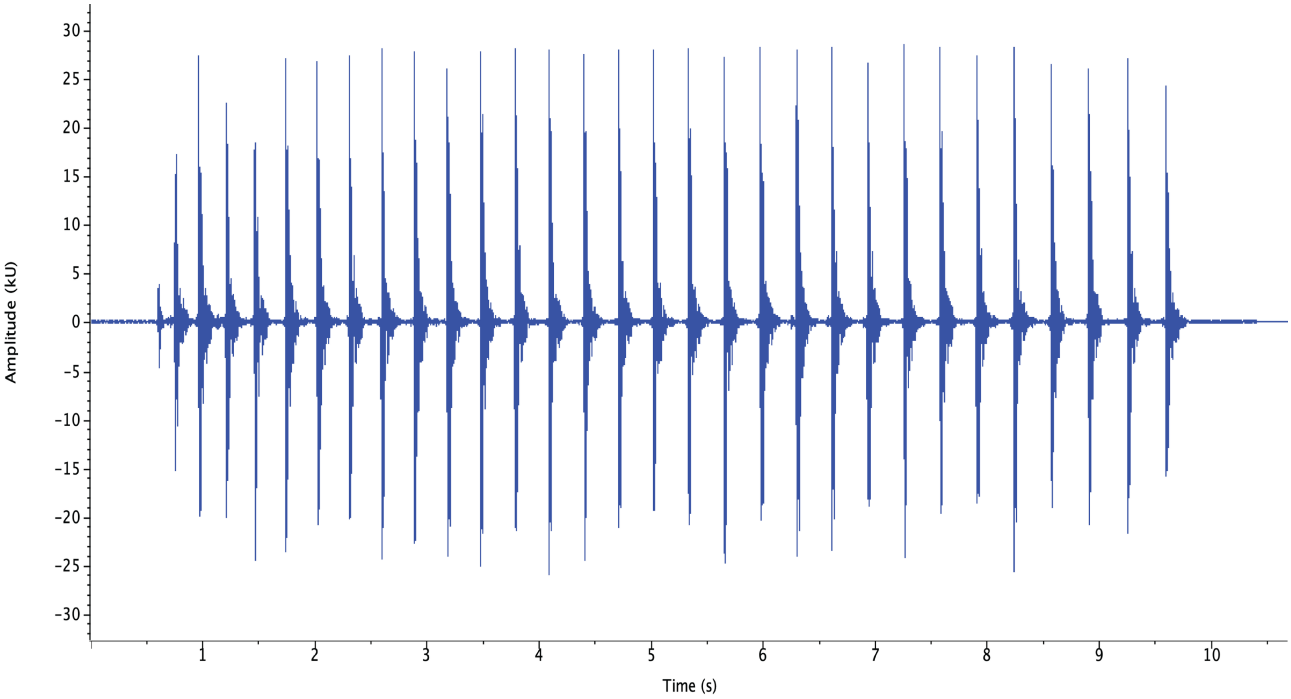


FIGURE 365. Calling drum (R95-74) in allotype adult female *A. argus.*

Derivation of name. Named in reference to the type locality

Habitat. High elevation, sandy Great Basin Desert with Joshua tree, *Artemisia,* and other shrubs. JCs to oatmeal trail at Birchum Springs and Coles Spring; under cow pies and rocks in Nelson Range (South Pass).

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. From some 26 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 25 had 5 and 1 had 6 inner **rear** leg tibial spines, while 25 had 3 and 1 had 4 outer **rear** leg tibial spines, and 25 with 2 and 1 with 3 ventral spurs.

DNA. Fig. 356, p. 233. F0113 (Nelson Range, S93-14); F0125 (Coso Range, S95-42); Topotypic F0148 (Argus Range); and F1265 (Nelson Range, S01-107, Grapevine Canyon) all recovered in their own subclade in Group 5 Argus.

Karyotype. Unknown.

Discussion. Despite the fact the 3 paratype localities are all in different named mountain ranges, we believe that one taxon is involved. These ranges are geographically close to each other, with a north-south separation of ~60 km, and could have been connected through the Darwin Plateau in the past. The various JCs have similar drums and DNA, and cannot be morphologically separated.

Gordon Prat, UCR, commented (pers comm to DBW, 19-x-2020) about the biogeography of this area: "The Coso Mountains and Argus Mountains are quite distinct from each other. Junipers are common in the Coso Mountains and absent from the Argus Mountains. *Eriogonum kennedyi* is common in the Coso Mountains but absent from the Argus Mountains. The butterflies are also quite distinct. *Polydryas arachne* (Edwards), which is rare in California and only known from Kennedy Meadows, is common in the Coso Mountains, but not found in the Argus Mountains."

"To me this area is pretty much Great Basin Desert. Pinon trees are present everywhere above 6,000 feet elevation. These trees can be found down to 5,000 feet in some areas, particularly on north facing slopes. Some of the moths such as Glover's silkmoth, *Hyalophora gloveri* (Strecker), stop in the Argus and Coso Mountains. I believe this moth is common throughout the Great Basin Desert. There are a bunch of other moths that extend south to the Argus and Coso Mountains, but do not go farther south. As soon as you go south of the Coso Mountains the habitat turns to the typical dry western Mojave Desert. There are no plants in the Coso and Argus Mountains that are typical of the western Mojave Desert. There are two *Eriogonum umbellatum* races, *nevadensis* and *subaridum*, that are common in the Great Basin but do not go farther south into the Mojave. They are basically replaced by different varieties of *Eriogonum umbellatum* such as *munzi* to the south."

A. argus, along with *A. glacierlodge* and *A. owensvalley*, is one of only 3 *Ammopelmatus* species where adult females consistently drum faster than adult males, and all 3 taxa are recovered as closest relatives to each other. While *A. owensvalley* and the fourth member of the Argus Group, *A. tomsplace*, both have 2n♂=23, *A. glacierlodge* has 2n♂=25 (karyotype unknown in *A. argus* and female drum unknown in *A. tomsplace*).

***Ammopelmatus glacierlodge* Weissman, sp. nov.**

Glacier Lodge Jerusalem Cricket
Figs 366–376, Table 15

Distribution. (Fig. 366). Known from the area around Glacier Lodge and 14 km north at Coyote Creek, both localities on the eastern side of the Sierra Nevada Mts in Inyo Co., California.

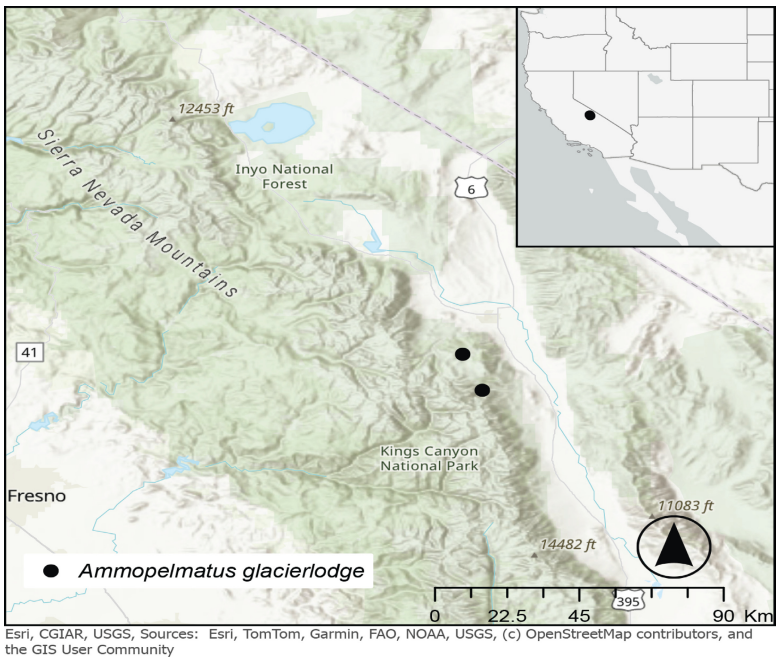


FIGURE 366. Distribution of *A. glacierlodge.*

Recognition characters. Large JCs with broad black abdominal stripes and 2n♂=25. Similar to *A. kennedymeadowsdos* but differs in drum rate, habitat, and DNA. Distal abdominal tergites with dark yellow areas between black bands, similar to *A. tomsplace*; also with similarly well-developed #1 calcar, but larger, without sex clarification drum (SCD), and karyotype 2n♂=25 vs 2n♂=23 in *A. tomsplace*. Compared to *A. owensvalley,* 2n♂=23 in latter vs 2n♂=25 in *A. glacierlodge.* SCD absent in *A. glacierlodge* but present in *A. owensvalley*, and habitat different (pine forests for former vs Great Basin Desert for latter).

Holotype. Male (in alcohol, Fig. 367). **California, *Inyo Co.,*** Big Pine Creek Canyon, area around Glacier Pack Train Station, 37.123949° -118.437864°, 2384m, 17-ix-1998 (S98-96) DBW, VF Lee. R99-30, F0947. Molt to adult 6-viii-1999. Deposited CAS, Entomology type #20127. Measurements in mm: Body length 36.87, hind femur length 12.89, hind femur width 5.04. Fore leg tibia with 3 or 6 (six) ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 368) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

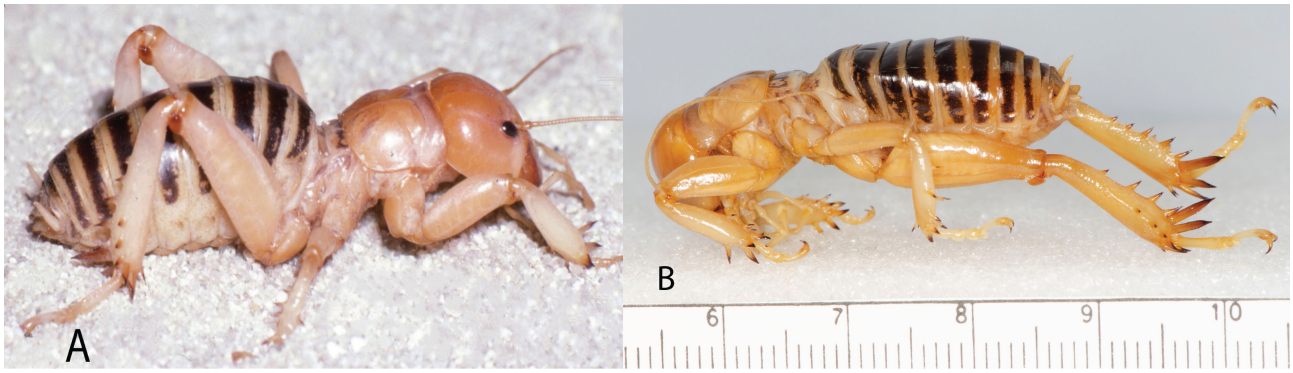


FIGURE 367. Holotype adult male *A. glacierlodge.* A. When alive. B. When preserved.



FIGURE 368. Left rear leg tibia holotype *A. glacierlodge.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 369). Same data as holotype except R00-16, F1073. Molt to adult 25-viii-2000. Deposited CAS, CASENT #9080002. Measurements in mm: Body length 46.47, hind femur length 14.53, hind femur width 5.42. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 370) with 4 or 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 371.

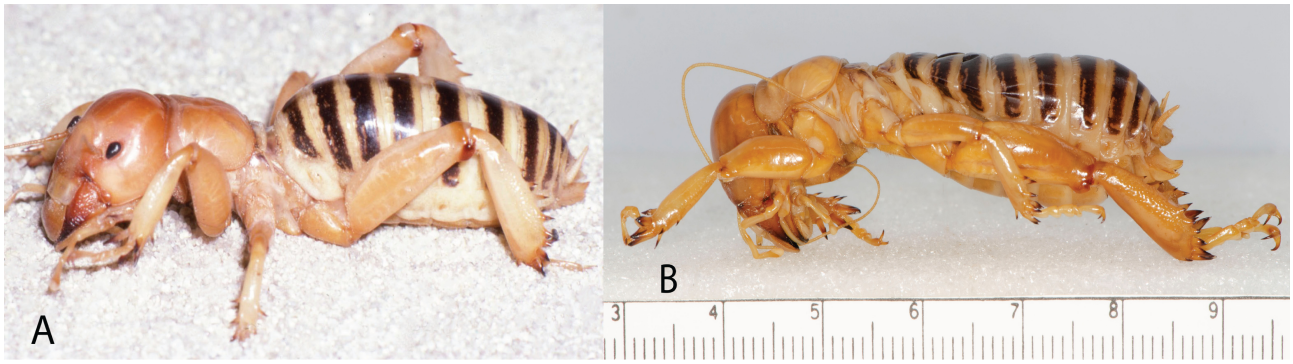


FIGURE 369. Adult female allotype *A. glacierlodge.* A. When alive. B. When preserved.



FIGURE 370. Left rear leg tibia allotype female *A. glacierlodge.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars (note missing calcar #2).



FIGURE 371. Ovipositor allotype *A. glacierlodge.*

Paratypes. ♂6 ♀4. **CALIFORNIA, *Inyo Co*.**, type locality, 9-x-1995 (S95-113) ♂1; type locality 17-ix-1998 (S98-96) ♂5 ♀3. Coyote Creek, Coyote Flat, 4.5 m W and 7 m S Bishop, probably around 37.243546° -118.492820°, 2920m, 21-vii-1995 (S95-60) D. Guiliani ♀1.

Drum. Calling drum similar in both sexes although female drums faster (Fig. 372). **Male:** Holotype (R99-30, Fig. 373) with 34 drums in 13.4s (2.5 drums/s) at 19.5°C. **Female:** Allotype (R00-16, Fig. 374) with 32 drums in 10.2s (3.1 drums/s) at 20.5°C. Other same-temperature series from this female were 16 drums in 5.3s (3.0 drums/s) and 17 drums in 5.6s (3.0 drums/s).

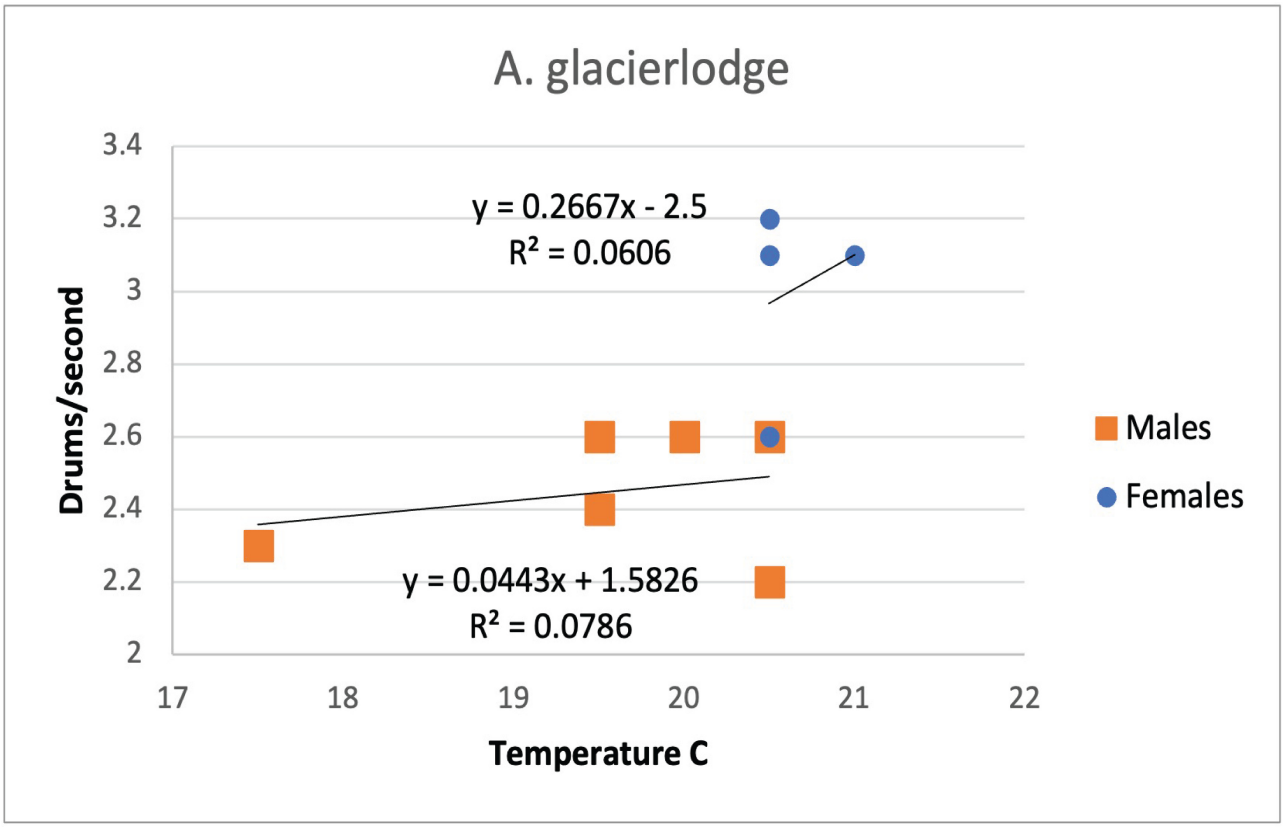


FIGURE 372. Drumming rates in adult *A. glacierlodge*: male vs female.

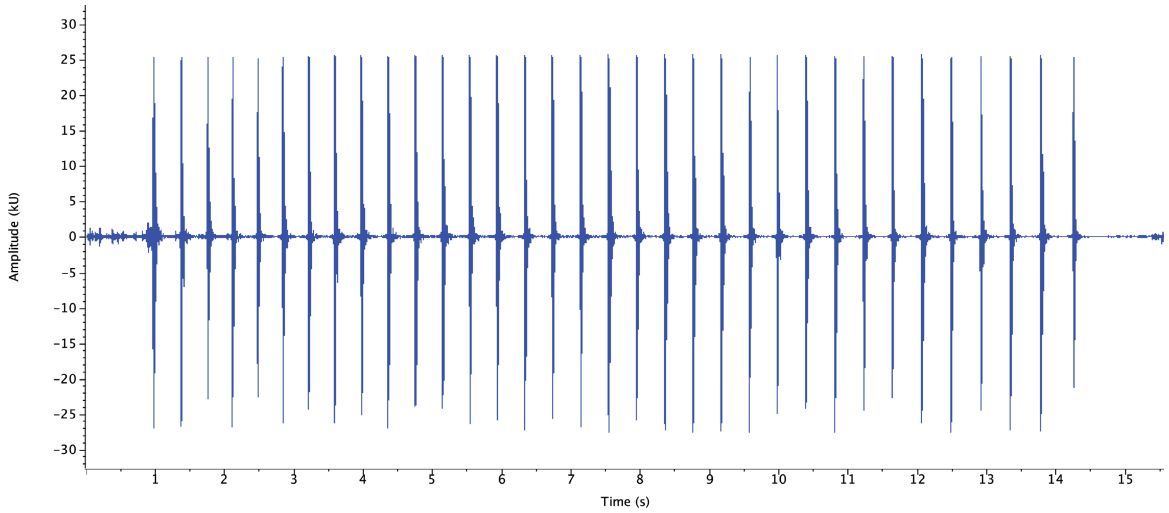


FIGURE 373. Calling drum (R99-30) in adult male holotype *A. glacierlodge*.

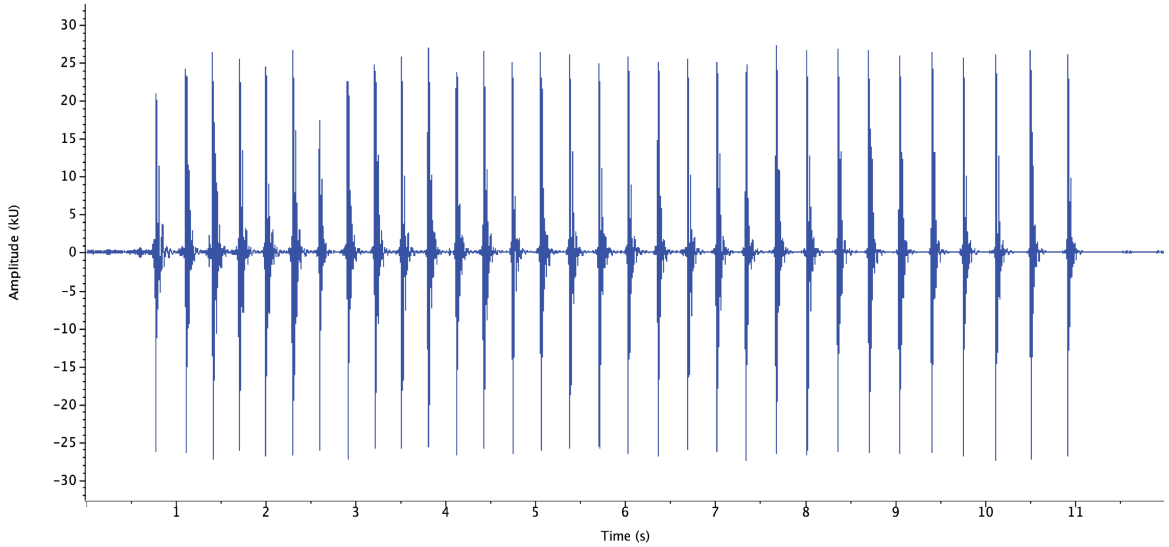


FIGURE 374. Calling drum (R00-16) adult female allotype *A. glacierlodge*.

Derivation of name. Named after the type locality.

Habitat. High elevation, riparian area with cottonwoods; dryer slopes with Jeffrey pine and chaparral. Mostly collected under objects around Glacier Train Station.

Life cycle and seasonal occurrence. On 17-ix-1998, we collected 1 adult male and 1 adult female, 7 late instars, 3 mid instars, and 1 early instar. Probably 3-year life cycle as allotype collected as mid-late instar but did not molt to adult until almost 2 years later.

Variation. Of 11 adult individuals, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 8 had 8 **middle** leg tibial calcars, and 1 had 1 and 9 had 2 ventral spurs; 1 had 4 and 10 had 5 inner **rear** leg tibial spines, and 1 had 2 and 10 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 356, p. 233. F0127 (S95-60, Coyote Creek some 14 km N Glacier Lodge); F0768, F1072, and F1073 (all 3 individuals type locality S98-96) recovered in Group 5 Argus where adult females drum faster than adult males. Other similarly drumming taxa in this Group are *A. argus, A. kennedymeadowsdos, A. owensvalley,* and *A. tomsplace.*

Karyotype. 2n♂=25. 2 males from type locality (S98-96) examined: T99-6 (Fig. 375) and T99-7 (Fig. 376) both show 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

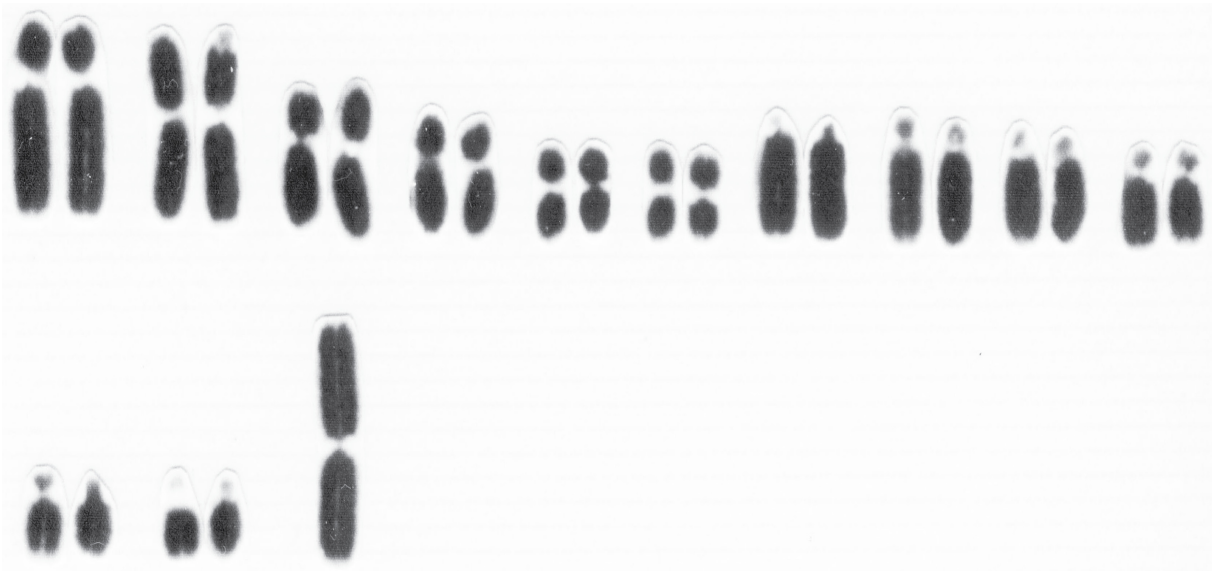


FIGURE 375. Idiogram T99-6 *A. glacierlodge* (S98-96).

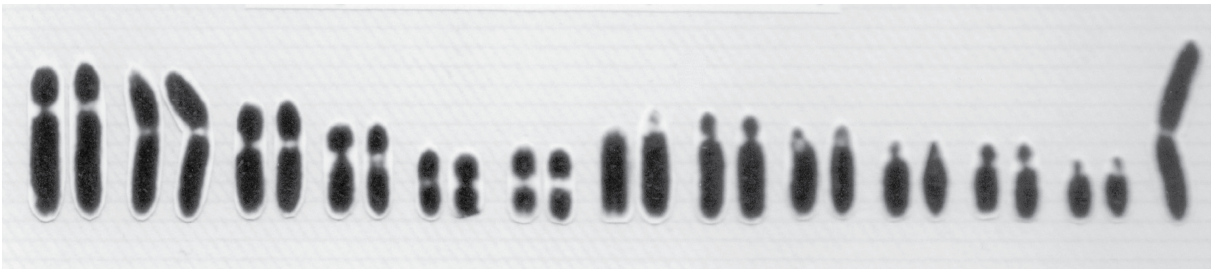


FIGURE 376. Idiogram T99-7 *A. glacierlodge* (S98-96).

Discussion. A. glacierlodge, along with *A. owensvalley* and *A. argus*, is one of only 3 *Ammopelmatus* species where adult females consistently drum faster than adult males, and all 3 taxa are recovered as closest relatives to each other. While *A. owensvalley* and the fourth member of the Argus Group, *A. tomsplace*, both have 2n♂=23, *A. glacierlodge* has 2n♂=25 (karyotype unknown in *A. argus*, female drum unknown in *A. tomsplace*, and male drum and karyotype unknown in *A. kennedymeadowsdos*).

***Ammopelmatus kennedymeadowsdos* Weissman, sp. nov.**
Large Kennedy Meadows Jerusalem Cricket
Figs 377–381, Tables 9, 15

Distribution. (Fig. 377). Known from a narrow area around Kennedy Meadows, Tulare Co., California.

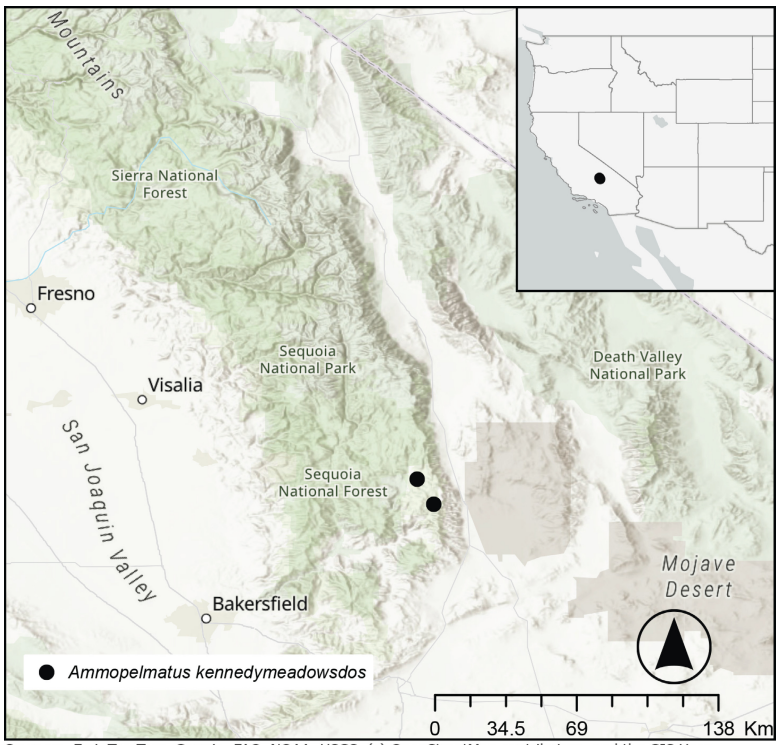


FIGURE 377. Distribution *A. kennedymeadowsdos.*

Recognition characters. Large species with broad, black abdominal stripes, that can occur sympatric with *A. kennedymeadows.* Drumming rate of 5.0 drums/s in *A. kennedymeadowsdos* vs 4.2 to 7.7 drums/s in *A. kennedymeadows.* We collected 1 adult female of *A. kennedymeadowsdos* at the type locality (S95-105) of *A.*

kennedymeadows, and her DNA (F0181) matches that of the adult female holotype (F0484) collected ~13 m SE of Kennedy Meadows (S97-28), at 1524m, in similar habitat. Both females of *A. kennedymeadowsdos* are larger than any *A. kennedymeadows* adult females, and have broader, darker black bands; and both females have 3 fore tibial leg spurs, 8 mid leg tibial calcars, and 5 rear leg inner tibial spines. Individuals of *A. kennedymeadows* typically have 2 front leg tibial spurs, 7 middle leg calcars, and 3 rear leg inner tibial spines. These physical differences between the two taxa are concordant with their DNA differences.

Holotype. Female (in alcohol, Fig. 378). **California, *Tulare Co.,*** Kennedy Meadows Road 13 m SE Kennedy Meadows, 35.872706° -118.023903°, 1979m, March, 1997 (S97-28) DC Hawks. R97-46, F0484. Molt to adult 25-vii-1997. Deposited CAS, Entomology type #20126. Measurements in mm: Body length 34.46, hind femur length 10.20, hind femur width 3.90. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 379) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 380.



FIGURE 378. Adult female holotype *A. kennedymeadowsdos.* A. When alive. B. When preserved.



FIGURE 379. Left rear leg tibia holotype adult female *A. kennedymeadowsdos.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 380. Ovipositor holotype *A. kennedymeadowsdos*.

Male. Unknown

Paratypes. ♀1. **CALIFORNIA, *Tulare Co.,*** Kennedy Meadows Rd, area around Kennedy Meadows, 35.982419° -118.096486°, 1956m, 7-x-1995 (S95-105) ♀1.

Drum. **Female:** Holotype: R97-46 (Fig. 381) 23 drums in 4.6s (5.0 drums/s) at 21°C.

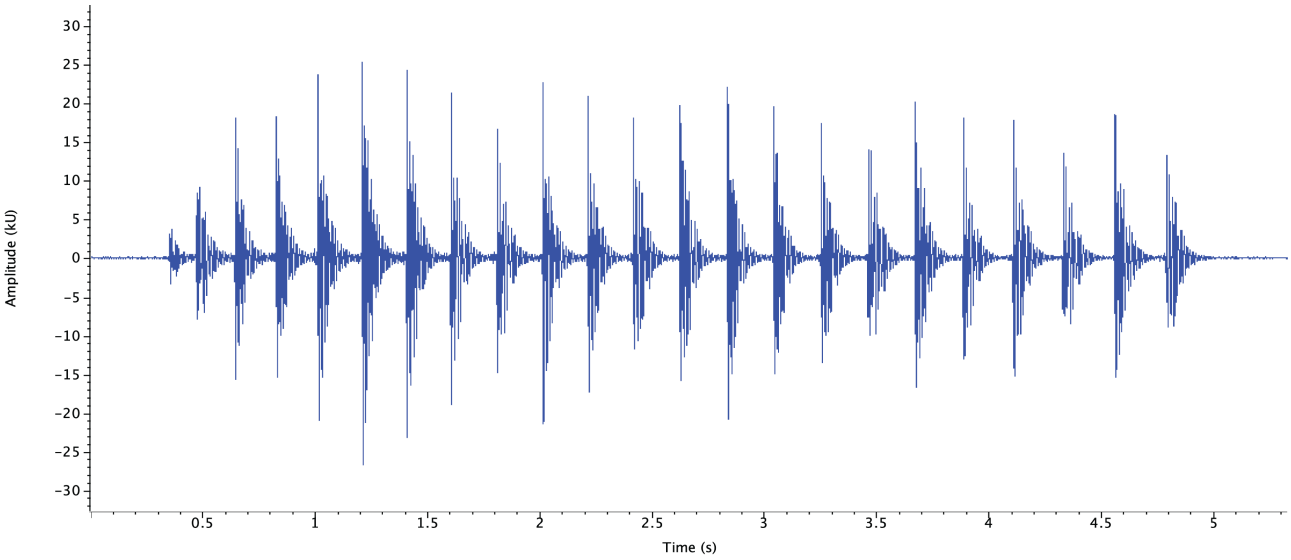


FIGURE 381. Calling drum (R97-46) adult female holotype *A. kennedymeadowsdos.*

Derivation of name. Named with reference to this being a second, and very rare JC species from the Kennedy Meadows area.

Habitat. Type locality is dirt and decomposed granite with sagebrush and pinon pine; paratype locality is open pinyon pine with rabbitbrush and sagebrush.

Life cycle and seasonal occurrence. We assume the typical 2-year life cycle.

Variation. Of 2 individuals, both had 3 ventral **fore** leg tibial spurs; both had 8 **middle** leg tibial calcars, and 2 ventral spurs; both had 5 inner **rear** leg tibial spines and 3 outer **rear** leg tibial spines with 2 ventral spurs.

DNA. Fig. 356, p. 233. F0181 (S95-105) and F0484 (holotype) both recovered together in Group 5 Argus along with four Argus Group taxa: (*A. argus, A. glacierlodge, A. owensvalley,* and *A. tomsplace*), where females drum faster than males. Because we have no adult male drum, we can't verify if *A. kennedymeadowsdos* is behaviorally like other members of the Argus Group.

Karyotype. Unknown

Discussion. Given the rarity of collected specimens, in the absence of DNA, we would not have the confidence to recognize this taxon as distinct.

Ammopelmatus owensvalley **Weissman, sp. nov.**

Owens Valley Jerusalem Cricket
Figs 382–394, Table 15

Species #17, Weissman 2001b.

Distribution. (Fig. 382). Only known from the floor of the Owens Valley and into the western foothills of the White Mountains.

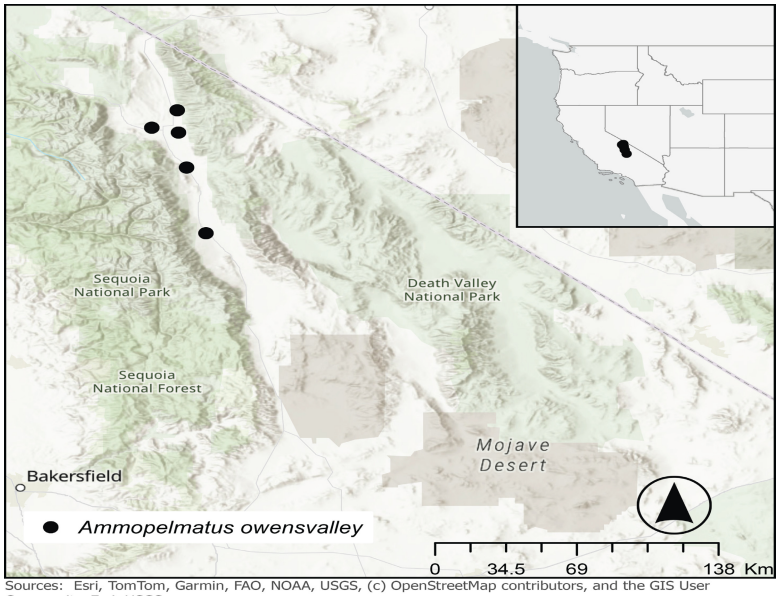


FIGURE 382. Distribution of *A. owensvalley.*

Recognition characters. A large, light-colored species without spatulate calcars, but calcar #1 long, 2n♂=23. Sex clarification drum (SCD) present. Distinguished from near DNA relative *A. glacierlodge* by habitat, 2n♂=25 in latter, and presence of a SCD in *A. owensvalley*. From *A. tomsplace* (2n♂=23) by overall body color and elevation, and possibly by karyotype. From *A. monolake* by drum rate, 2n♂=25 in latter, and DNA. From smaller *A. kennedymeadows* by size and 2n♂=25 in latter.

Holotype. Male (in alcohol, Fig. 383). **California, *Inyo Co.,*** Owens Valley, Big Pine, 170 Flower Alley, 37.165092° -118.291706°, 1221m, 9-x-1995 (S95-112) DBW & VF Lee. R95-121, F0187. Collected as adult. Deposited CAS, Entomology type #20128. Measurements in mm: Body length 35.05, hind femur length 12.92, hind femur width 4.56. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 384) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 383. Adult male holotype *A. owensvalley.* A. When alive. B. When preserved

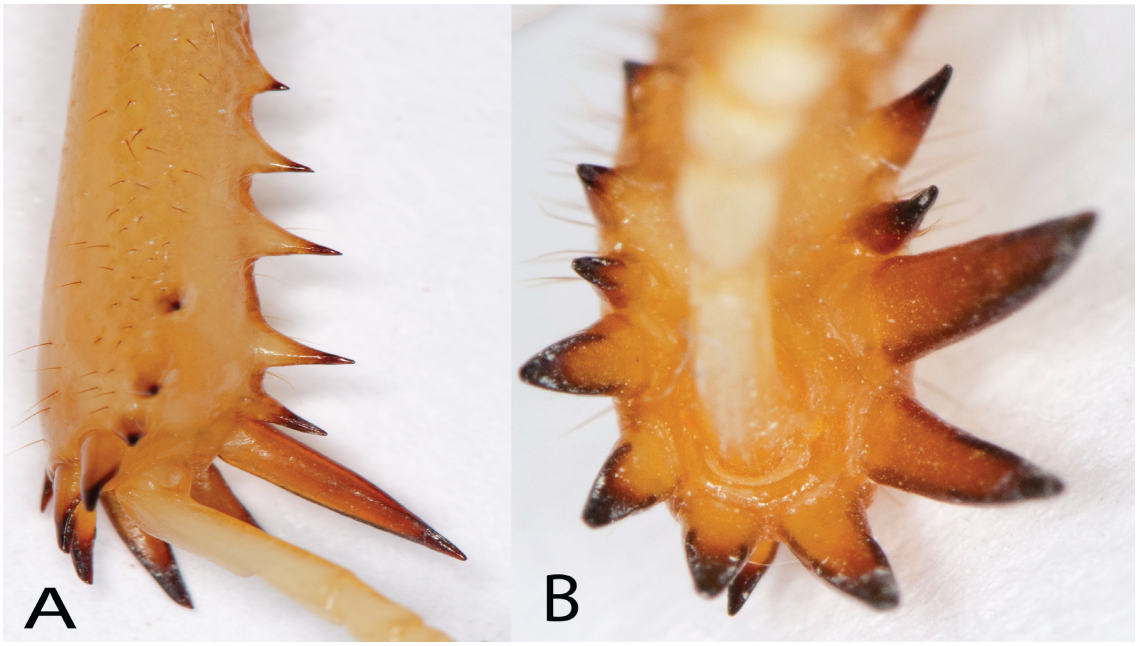


FIGURE 384. Left rear leg tibia adult male holotype *A. owensvalley.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 385). Same locality data as holotype except 22-iii-1993 (S93-12). R94-67. Molt to adult 4-ix-1994. Deposited CAS, CASENT #9082867. Measurements in mm: Body length 44.67, hind femur length 13.95, hind femur width 5.02. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 or 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 386) with 5 inner and 2 or 3 outer spines, 2 ventral spurs. Ovipositor Fig. 387.



FIGURE 385. Allotype adult female *A. owensvalley.* A. When alive. B. When preserved

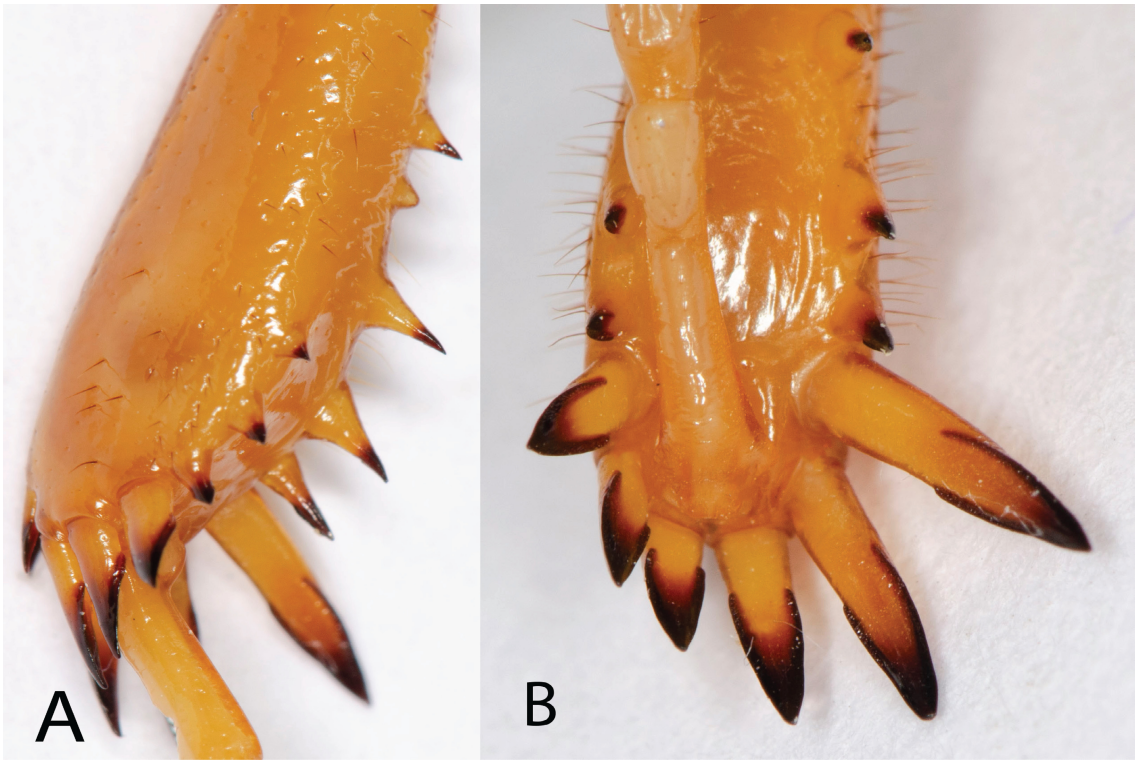


FIGURE 386. Left rear leg tibia adult female allotype *A. owensvalley.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 387. Ovipositor allotype *A. owensvalley*.

Paratypes. ♂15 ♀17. **CALIFORNIA, *Inyo Co.*,** type locality, 7-x-1982 (S82-125) D. Guiliani ♀1; 18-iv-1983 (S83-28) D. Guiliani ♀1; 7-vi-1983 (S83-76) D. Guiliani ♀1; 5-8-xi-1983 (S83-146 & S83-148) D. Guiliani ♂1 ♀2; 3-iii-1984 (S84-12) ♂1; 19-iii-1984 (S84-14) ♀2; 24-vi-1985 (S85-72) D. Guiliani ♀1; 30-ix-1986 (S86-131) D. Guiliani ♂1; 22-iii-1993 (S93-12) ♂2 ♀5; 9-x-1995 (S95-112) ♂4 ♀1; 17-iii-1996 (S96-14) ♂1; 19-iv-1998 (S98-30) ♂1 ♀1. Bishop, in town, 37.388° -118.444°, 1313m, late September (S84-65) RE Love, ♂1. Bishop, White Mt Research Station, 3000 E Line St, 37.360692° -118.327116°, 1240m, 29-x-1997 (S97-136) JM Szewczak ♂1; 30-iv-2023 (S23-60), JG Betz, ♀1. Independence Creek Campground, 36.797722° -118.207039°, 1226m, 17-iii-1996 (S96-16), ♂2 ♀1.

Probable placement: **California, *Mono Co.,*** ~6 air miles NE Laws, 37.485489° -118.332761°, 1373m, 1-ix-1982 (S82-123) ♀1; 5-vi-1983 (S83-57) ♂3 ♀3; 26-vi-1992 (S92-63) ♂2 ♀7. 2n♂=23 from T92-19 (Fig. 394 below, S92-63). Nevertheless, the absence of confirming DNA prevents us from making this assignment definitive.

Doubtful placement: **California, *Inyo Co.,*** Cartago, 36.322011° -118.026818°, 1111m, 17-iii-1996 (S96-17) ♀2. Although still in the Owens Valley, neither collected adult female drummed and DNA (F0229) from one specimen recovered in the adjacent Group 6 Mojave Desert clade.

Drum. One of only 3 taxa (along with *A. glacierlodge* and *A. argus*) where female calling drum is typically more rapid, at the same temperature, than that of males (Fig. 388). Seven of 11 adult males from the type locality readily made a sex clarification drum (SCD). One of the 2 late instar males from Independence Campground (S96-16) also performed a SCD, on 12-xi-1996. **Male:** Holotype (R95-121, Fig. 389) with two short SCDs followed by a calling drum of 33 drums in 14.6s (2.3 drums/s) at 21°C. A second type locality male (R95-107) with SCD (Fig. 390) composed of 9 drums in 0.70s (12.9 drums/s) at 19.5°C. **Female:** Allotype (R94-67, Fig. 391) had 26 drums in 7.7s (3.4 drums/s) at 20°C.

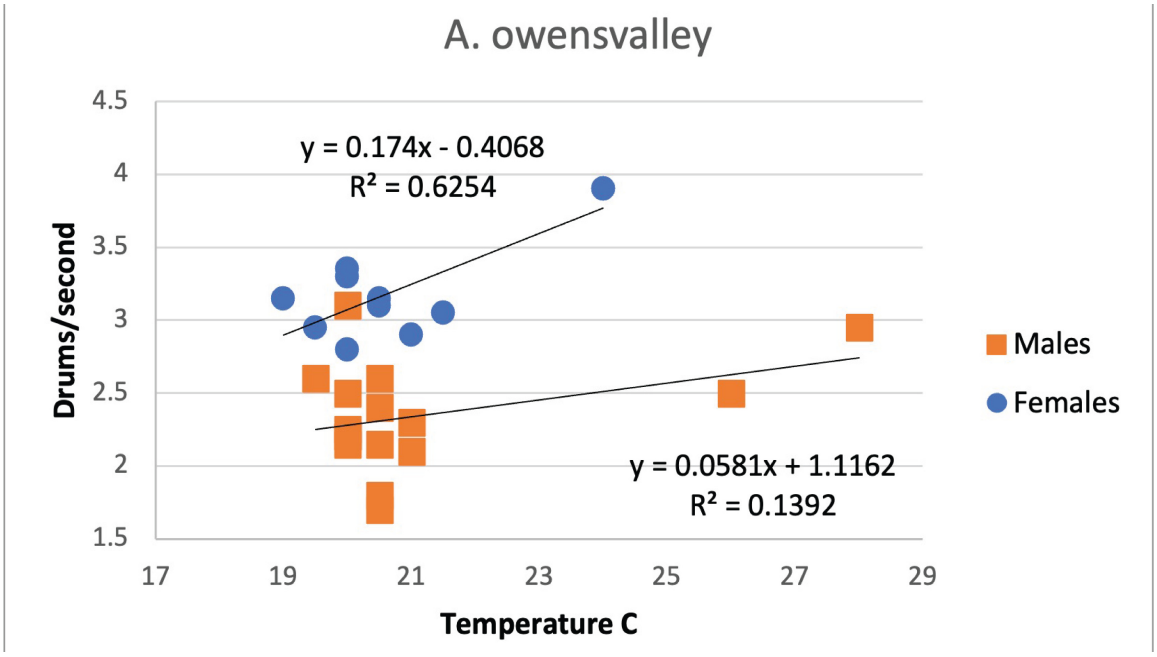


FIGURE 388. Regression of drumming rate vs temperature, by sex, in *A. owensvalley.*

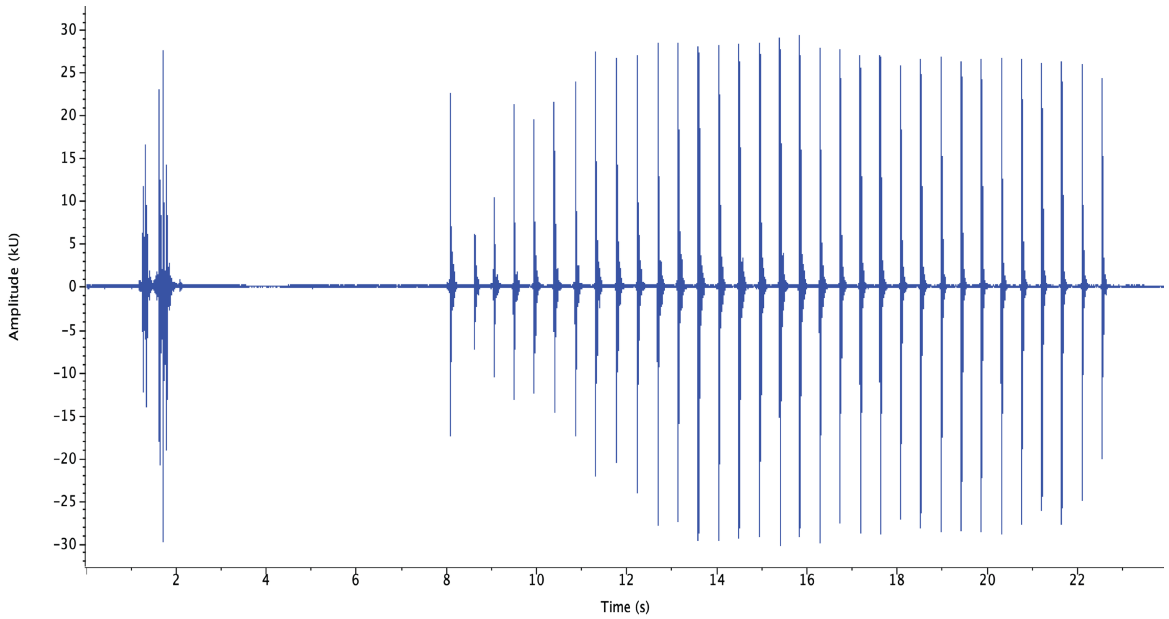


FIGURE 389. SCD and calling drum (R95-121) in adult male holotype *A. owensvalley.*

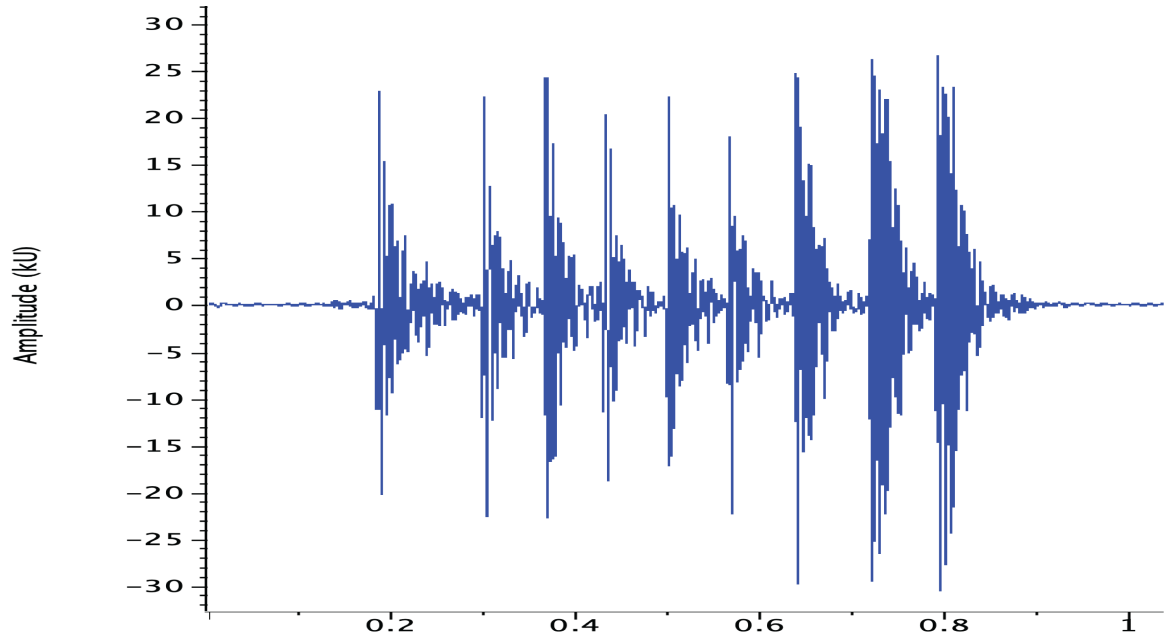


FIGURE 390. Long SCD (R95-107) in paratopotypic adult male *A. owensvalley.*

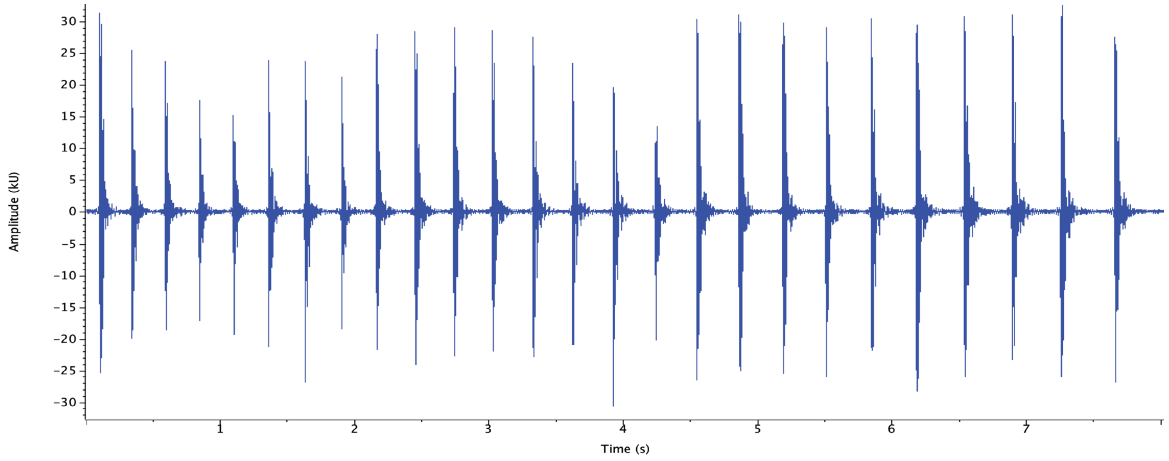


FIGURE 391. Calling drum (R94-67) in adult female allotype *A. owensvalley.*

Derivation of name. The collection localities are all in the Owens (River) Valley. Different species of JCs (see Table 15, p. 39) are found along the foothills of the Sierra Nevada toward the west and the various mountain ranges toward the east.

Habitat. Type locality is in the town of Big Pine, a residential watered garden area where Derham Giuliani lived. At Independence Creek Campground, JCs found under rocks, with grasses and annuals, in wet areas around dripping water hookups. The NE of Laws (Mono Co.) locality is a tree-shaded, watered yard situation surrounded by sagebrush.

Life cycle and seasonal occurrence. Apparent typical 2-year JC life cycle.

Variation. Of 20 Valley floor individuals, 1 had 2 and 19 had 3 ventral **fore** leg tibial spurs; 1 had 6, 1 had 7, and 18 had 8 **middle** leg tibial calcars; 2 had 1 and 18 had 2 ventral spurs; 1 had 4, 17 had 5 and 1 had 6 inner **rear** leg tibial spines, and 17 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Of 15 Laws individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars and 2 ventral spurs; 14 had 5 and 1 had 6 inner **rear** leg tibial spines, and 1 had 2, 11 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs

DNA. Fig. 356, p. 233. F0285 (S96-16, Independence Campground); F0496 (type locality S95-112, Big Pine); F0704 (S97-136, White Mt. Research Station) all recovered in Group 5 Argus, a mixed, large clade with *A. argus*, *A. glacierlodge*, *A. kennedymeadowsdos,* and *A. tomsplace.*

Karyotype. 2n♂=23. Two type locality individuals examined: T93-9 (Fig. 392, S93-12); T96-7 (Fig. 393, S95-112) both with 7 metacentric or submetacentric autosomal pairs; 4 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Also examined T96-2 (no photo available) from S96-16, Inyo Campground, with identical results. Probable *A. owensvalley,* T92-19 (Fig. 394) from S92-63, with similar results.



FIGURE 392. Idiogram T93-9 *A. owensvalley* (S93-12).



FIGURE 393. Idiogram T96-7 *A. owensvalley* (S95-112).



FIGURE 394. Idiogram (from mitotic cell) T92-19 *A. owensvalley* (S92-83).

Discussion. A. owensvalley, along with *A. argus* and *A. glacierlodge*, is one of only 3 *Ammopelmatus* species where adult females consistently drum faster than adult males, and all 3 taxa are recovered as closest relatives to each other. While *A. owensvalley* and the fourth member of the Argus Group, *A. tomsplace,* both have 2n♂=23, *A. glacierlodge* has 2n♂=25 (karyotype unknown in *A.* argus; male drum and karyotype unknown in *A. kennedymeadowsdos*; and female drum unknown in *A. tomsplace*). But *A. owensvalley* has 7 metacentric autosomal pairs while *A. tomsplace* may only have 6 pairs.

***Ammopelmatus tomsplace* Weissman, sp. nov.**
Mono County Jerusalem Cricket
Figs 395–403, Table 15

Distribution. (Fig. 395). Only known from Mono Co., California, between Crowley Lake and Toms Place.

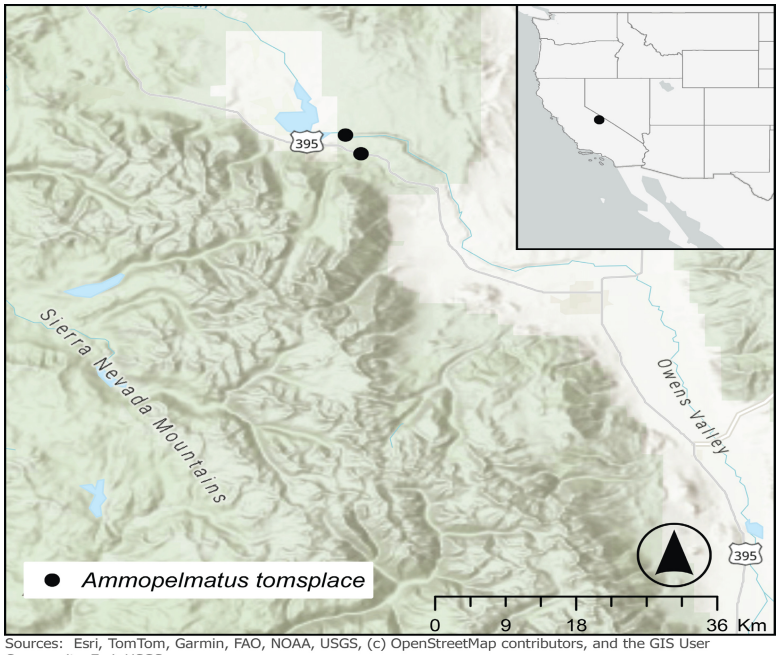


FIGURE 395. Distribution of *A. tomsplace.*

Recognition characters. A small-medium sized, high elevation JC whose males drum around 2.0–2.7 drums/s, with a sex clarification drum (SCD), and whose rear leg tibial calcars #1 & #2 are developed similar to those seen in some Longispinus and Lightfooti Group taxa. They differ in that Longispinus Group taxa without a SCD and with different DNA. Last few male abdominal tergites in *A. tomsplace* with dark yellow toning between black bands, as seen in Lightfooti Group taxa, but DNA different and without a reduced subgenital plate. 2n♂=23 in *A. tomsplace*, which separates them from nearby *A. glacierlodge*, which has 2n♂=25 and no SCD. Separated from *A. owensvalley* (2n♂=23) by lighter body color in *A. tomsplace* and higher elevation, and possibly by karyotype. Closest distance of 31 km separates *A. tomsplace* (paratype locality, S86-98) and probable *A. owensvalley* (paratype locality ~6 air miles NE Laws). Separated from similarly high elevation, Mono Co. *A. dogtown* by DNA, red head, slower drum, and absence of SCD in latter.

Holotype. Male (in alcohol, Fig. 396). **California, *Mono Co.,*** adjacent to Owens River Gorge between Crowley Lake and Toms Place, 37.585556° -118.689722°, 2131m, 3-4-ix-2020 (S20-7) A. Abela. R20-9, F2608. Collected as adult. Deposited CAS, Entomology type #20117. Measurements in mm: Body length 30.39, hind femur length 10.64, hind femur width 3.76. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 397) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 396. Adult male holotype *A. tomsplace.* A. When alive. B. When preserved.

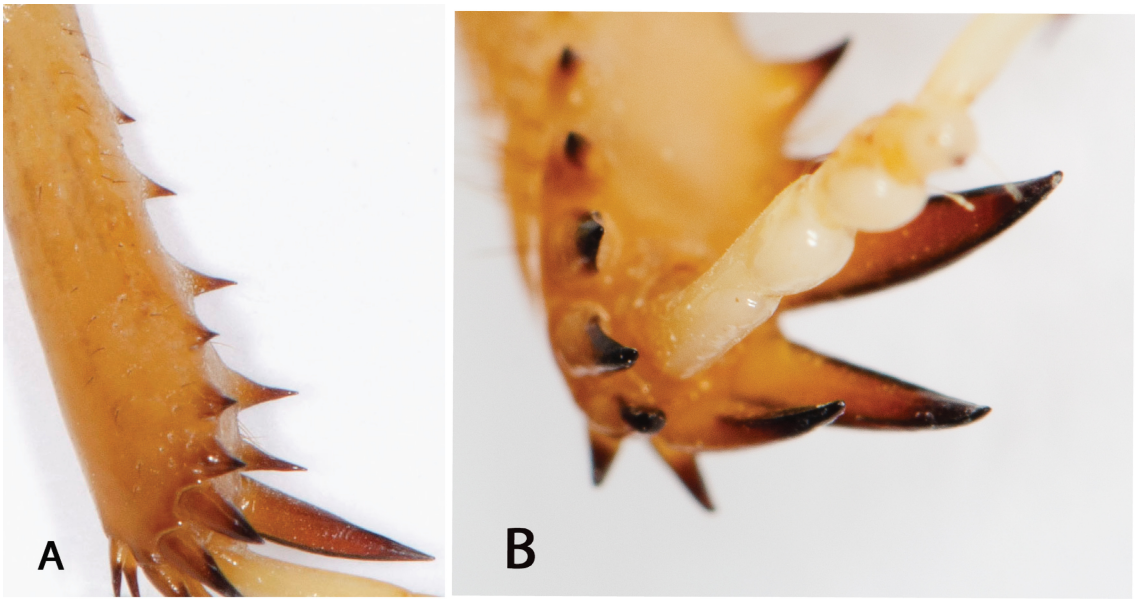


FIGURE 397. Left rear leg tibia adult male holotype *A. tomsplace.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 398). Same collection data as holotype. Collected as adult. Deposited CAS. Measurements in mm: Body length 34.02, hind femur length 9.95, hind femur width 3.77. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 399) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 400.

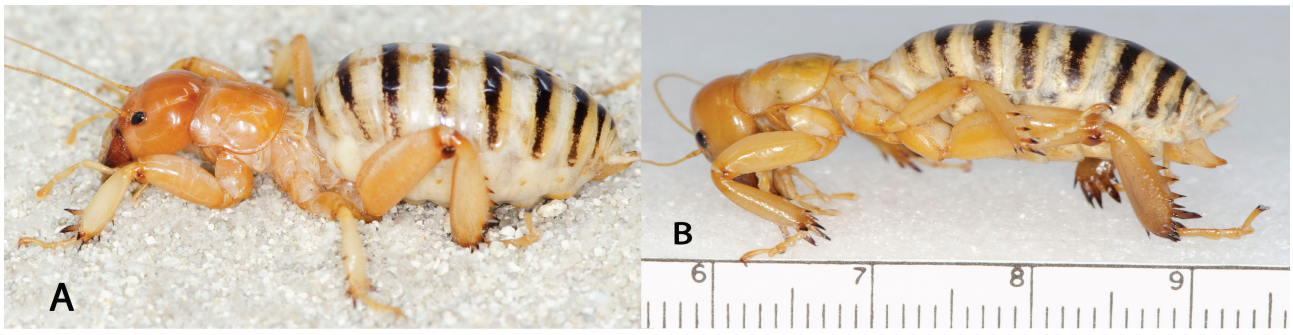


FIGURE 398. Adult female allotype *A. tomsplace.* A. When alive. B. When preserved.



FIGURE 399. Left rear hind tibia adult female allotype *A. tomsplace.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

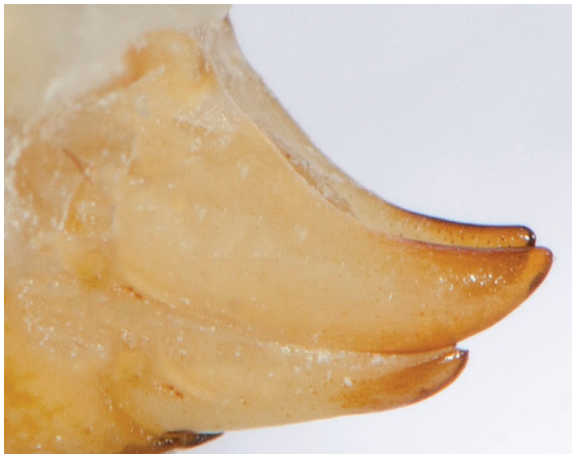


FIGURE 400. Ovipositor allotype *A. tomsplace.*

Paratypes. ♂14. **CALIFORNIA, *Mono Co*.,** Holotype locality, A. Abela, ♂13. Toms Place, 37.560596° -118.671906°, 2141m, 28-viii-1986 (S86-98) ♂1.

Drum. Calling drum probably similar in both sexes but female's unknown. Given the fact the male has a SCD, we feel confident that the female's drum is similar to the male's drum since this is the general pattern seen where males have a SCD. **Male:** Holotype R20-9 (Fig. 401): 2 short SCD of 5 and 4 drums followed by 26 drums over 11.5s (2.3 drums/s) at 20.7°C. **Female:** Unknown.

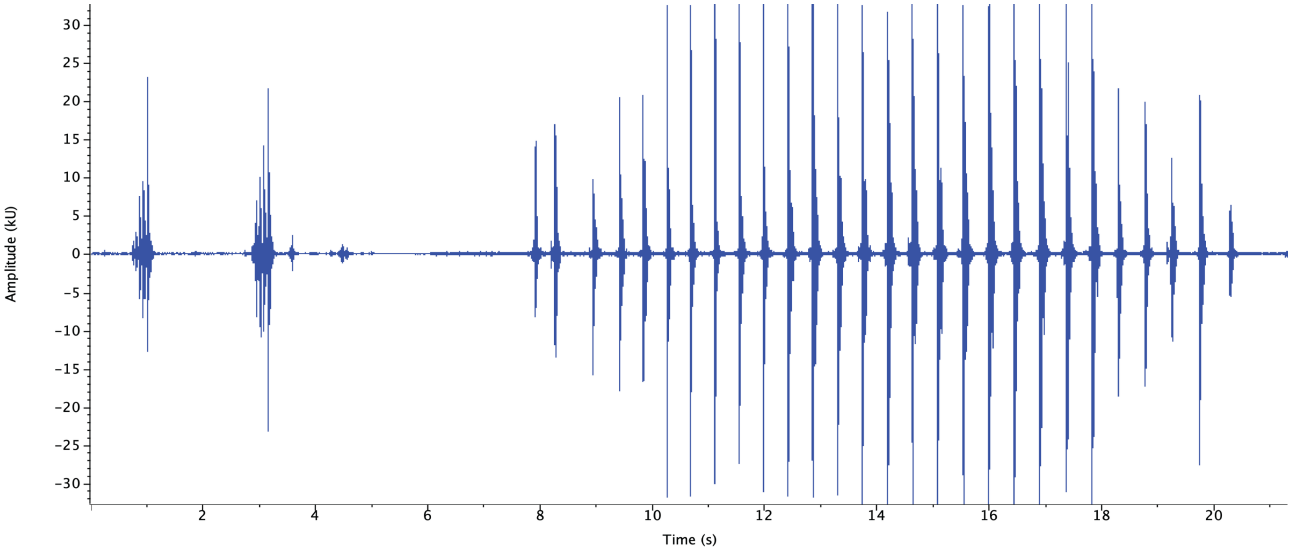


FIGURE 401. SCD and calling drum (R20-9) adult male holotype *A. tomsplace.*

Derivation of name. Named for the paratype locality since there is no named town near the type locality.

Habitat. According to Alice Abela (pers. comm., 2020), individuals to an oatmeal trail in area of mixed low growing *Purshia* and Great Basin sagebrush with a scattered yellow flowering Asteraceae. Substrate loose, fine deep sandy soil; vegetation with heavy sheep grazing damage.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 16 individuals, 15 had 3 and 1 had 4 ventral **fore** leg tibial spurs; 1 had 7 and 15 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 15 had 5 inner **rear** leg tibial spines, and 15 had 3 and 1 had 4 outer **rear** leg tibial spines, and all with 2 ventral spurs.

DNA. Fig. 356, p. 233. F2607 & F2608 (type locality S20-7) recovered in Group 5 Argus, with *A. argus, A. owensvalley*, and *A. glacierlodge*, where females drum faster than males in those 3 taxa. Unfortunately, we have no drum rate for any female of *A. tomsplace*, or any male of *A. kennedymeadowsdos* to compare.

Karyotype. 2n♂=23. T21-4 (Fig. 402), T22-4 (Fig. 403) (both from type locality S20-7) both with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 402. Idiogram T21-4 *A. tomsplace* (S20-7), using C-banding.

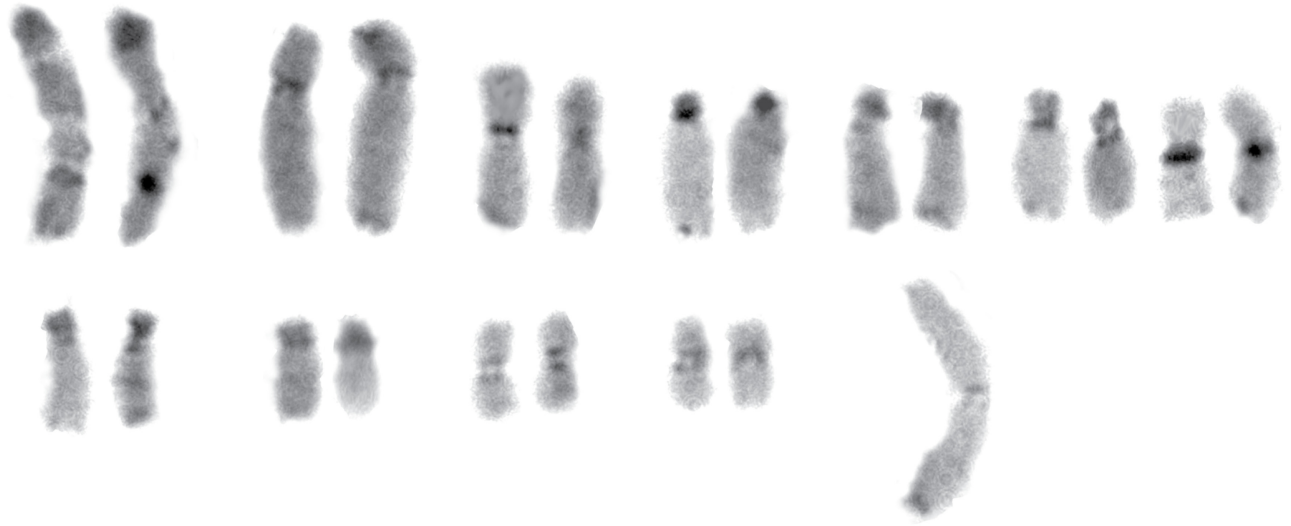


FIGURE 403. Idiogram T22-4 *A. tomsplace* (S20-7), using C-banding.

Discussion. Further studies may show that *A. tomsplace* and *A. owensvalley* are synonymous; but we believe that they are each valid species given their ecological, elevational, and drumming rate differences, and ~68 km separation. Plus, *A. owensvalley* has 7 metacentric autosomal pairs while *A. tomsplace* only has 6 pairs.

Group 6, **Mojave Desert Group** (Fig. 404)

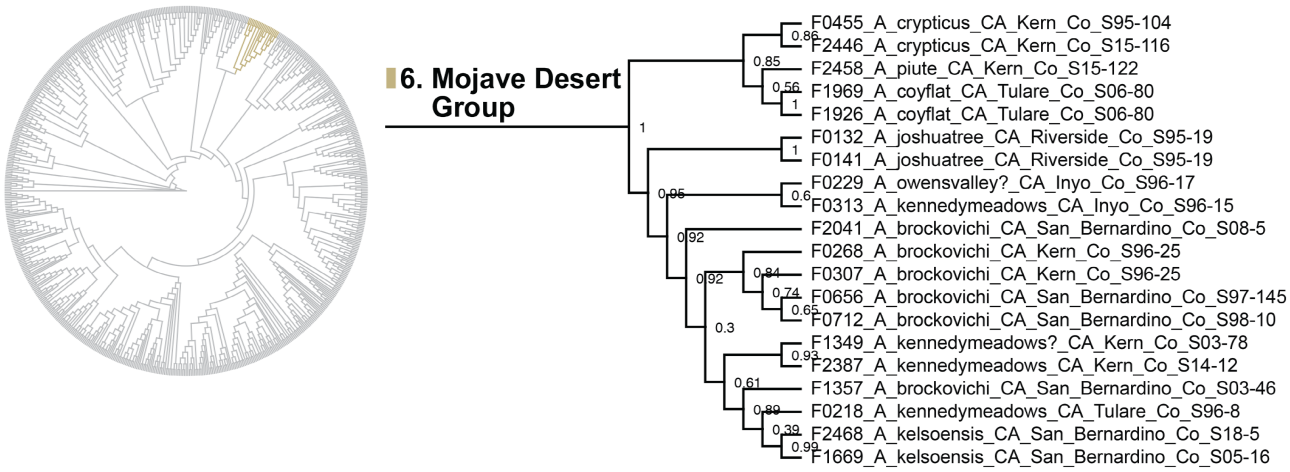


FIGURE 404. ASTRAL tree for Mojave Desert Group.

This Group is composed of 8 Southern California species with slow or fast drums; from mid elevation, hot, sandy deserts to high elevation, cool mountain habitats.

SPECIES WRITE UPS: *A. brockovichi* (p. 258); *A. chinalake* (tentatively placed here, p. 264); *A. coyflat* (p. 266); *A. crypticus* (p. 271); *A. joshuatree* (p. 276); *A. kelsoensis* (p. 281); *A. kennedymeadows* (p. 288); and *A. piute* (p. 293). All known taxa (4 species) with 2n♂=25.

***Ammopelmatus brockovichi* Weissman, sp. nov.**
PG&E Jerusalem Cricket
Figs 405–415, Tables 2, 6, 16

Distribution. (Fig. 405). Known from a limited area of Kern and San Bernardino Counties, California.

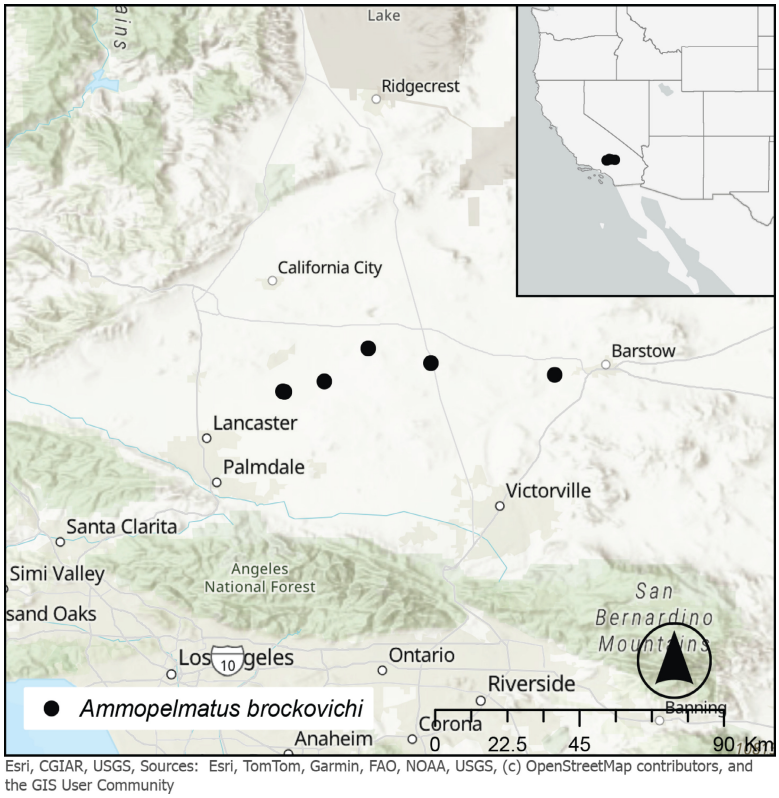


FIGURE 405. Known distribution of *A. brockovichi.*

Recognition characters. One of several JC species known only from sand dunes and sandy habitats in the Colorado and Mojave Deserts, the others being *A. cahuilaensis, A. chinalake, A. joshuatree, A. kelsoensis,* and *A. pratti*. Small to medium sized JC with 7 middle leg tibial calcars, hind tibia with the frequent, unusual situation of more outer than inner spines. Morphologically similar to *A. kelsoensis* with rear leg tibial calcars spatulate but less so than in *A. kelsoensis*; and with different DNA, and drumming rate faster in *A. brockovichi* (1.1–2.1 drums/s) than *A. kelsoensis* (0.85 drums/s). Inner rear leg tibial spine #1 similar in shape and orientation (parallel to tibial axis) as calcar #1 but always shorter in length while this same spine, in *A. kelsoensis*, usually has its posterior face flattened and perpendicular to the long axis of the tibia (compare Figs 409B and 454B below). Outer rear leg tibia spine #1 rotated, but not as much as in *A. mescaleroensis.* Our sample of *A. brockovichi* had almost equal numbers of individuals with 1 (n=31) or 2 (n=18) hind leg tibial inner spines while all (n=11) *A. kelsoensis* had 1. Lastly, 45 of 49 *A. brockovichi* adults had 2 rear leg tibial spurs (4 had 1 spur) while 8 of 12 *A. kelsoensis* had 2 rear leg tibial spurs and 4 had 1 spur. Differs from *A. pratti* in rear leg spines, drumming rate, presence of sex clarification drum, and DNA; and not known to be anywhere sympatric.

Holotype. Male (in alcohol, Fig. 406) **California, *San Bernardino Co.,*** Mojave River dry river bed S Hinkley, 34.871011° -117.170355°, 677m, 4-ii-2008 (S08-5), DBW. R08-35. Molt to adult 9-x-2008. Deposited CAS, Entomology type #20110. Measurements in mm: Body length 23.12, hind femur length 6.73, hind femur width 2.27. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 407) with 2 inner and 2 outer spines, 2 ventral spurs.

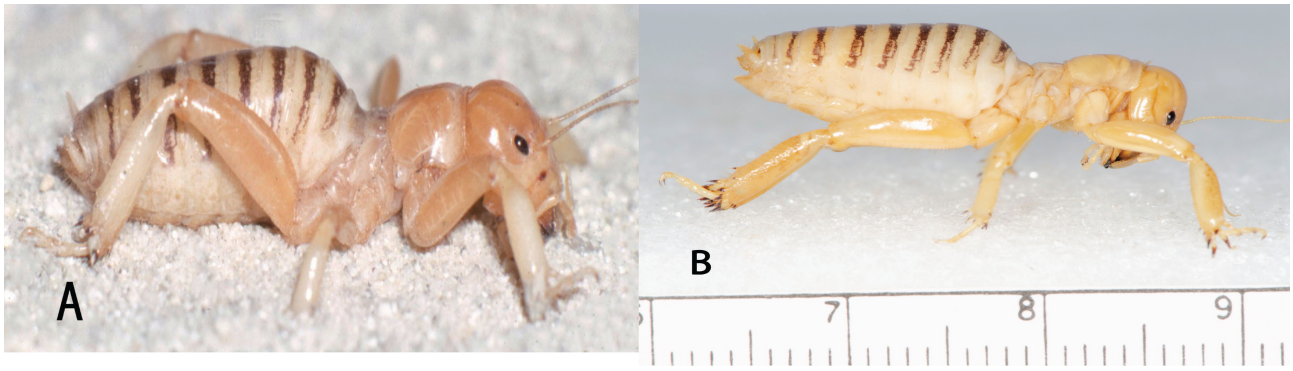


FIGURE 406. Holotype adult male *A. brockovichi.* A. When alive. B. When preserved.

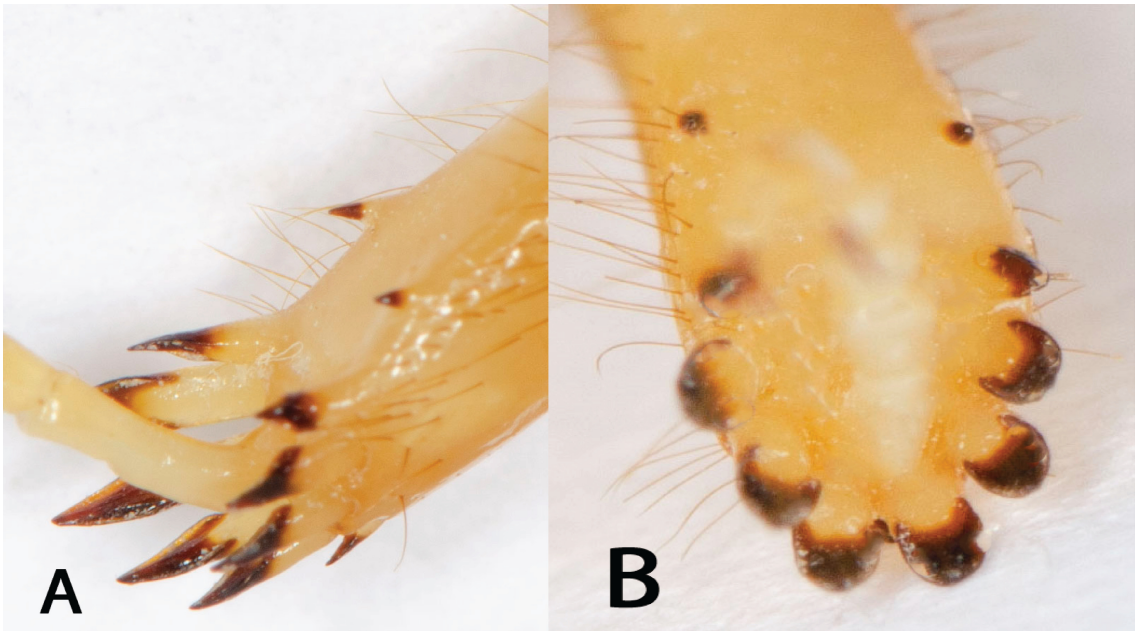


FIGURE 407. Left rear leg tibia holotype male. A. Showing 2 outer and 2 inner spines. B. Showing spatulate shape of calcars and hirsuteness of tibia.

Allotype. Female (in alcohol, Fig. 408) Same data as holotype except R08-10, F2041. Molt to adult 6-ix-2008. Deposited CAS, CASENT 8413875. Measurements in mm: Body length 35.67, hind femur length 9.00, hind femur width 3.75. Fore leg tibia with 1 or 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 409) with 3 inner and 3 outer spines on left side, 1 inner and 2 outer spines right side, 2 ventral spurs. Ovipositor Fig. 410.

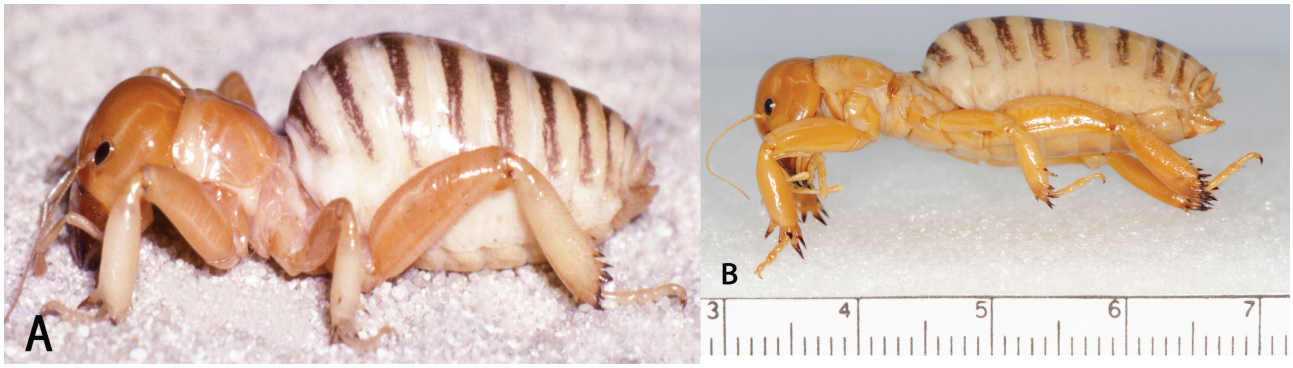


FIGURE 408. Allotype female *A. brockovichi.* A. When alive. B. When preserved.

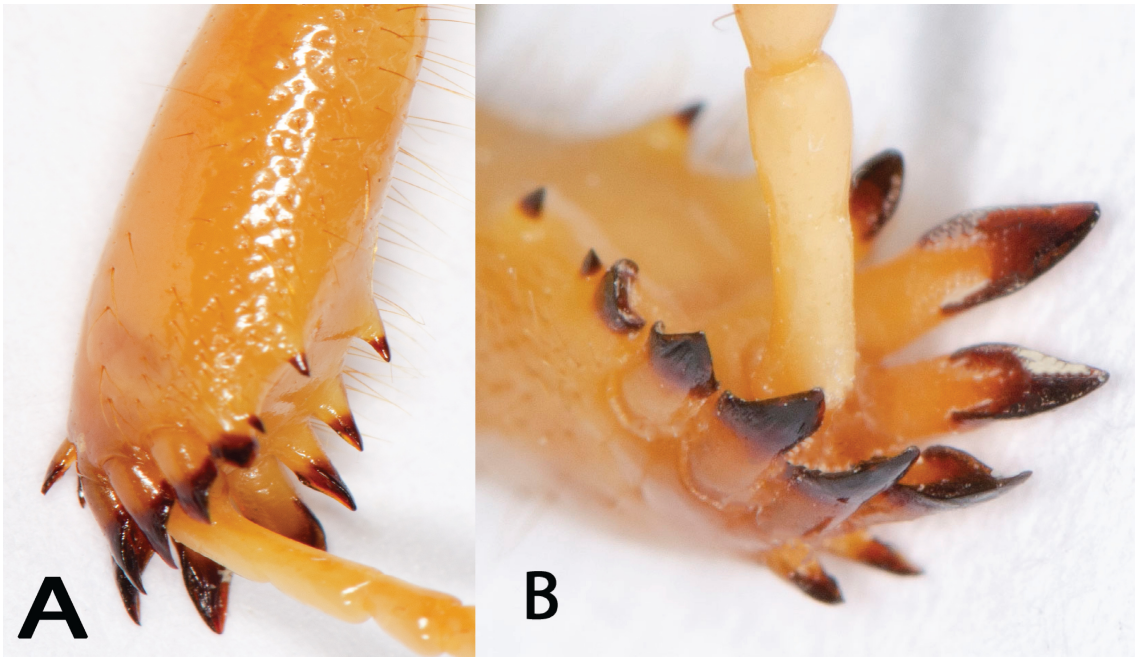


FIGURE 409. Left rear leg tibia allotype female *A. brockovichi*. A. Showing 3 outer and 3 inner spines. Note how both inner and outer spine #1 are both concave and rotated for better sand propulsion. B. Showing shape of calcars.



FIGURE 410. Ovipositor allotype *A. brockovichi.*

Paratypes. ♂5 ♀44. **CALIFORNIA, *Kern Co.,*** Edwards Air Force Base, Branch Memorial Park, GF Pratt, 34.824487° -117.926719°, 700m, 30-v-1996 (S96-33) ♂1 for testes, ♀1; 13-i-1997 (S97-8) ♀7. Edwards Air Force Base, Leuhman Ridge, 34.943175° -117.692236°, 894m, 1-v-1998 (S98-39) GF Pratt ♀1. Edwards Air Force Base, 0.3 m NW Branch Memorial Park, 34.825625° -117.931092°, 699m, 16-iv-1996 (S96-25) GF Pratt & C. Pierce ♂1 ♀1. Edwards Air Force Base, SE side Rogers Dry Lake, 34.852975° -117.815142°, 696m, 13-i-1997 (S97-9) GF Pratt ♀1. Edwards Air Force Base, NW portion, 800m, March, 1998 (S98-35) GF Pratt ♂1. Edwards Air Force Base, 1 m E Pole Line and Sopp Rd, 21-v-1998 (S98-44) GF Pratt ♀1. ***San Bernardino Co.,*** type locality, 3-v-2003 (S03-46) A. Pece, ♀1; 4-ii-2008 (S08-5) ♂1 ♀7 ♂1 for testes. Kramer Hills, Hwy 395 ~4.5-7 m S Kramer Junction, 34.903048° -117.516755°, 927m, 17-iv-1993 (S93-21) GR Ballmer ♂1; 27-i-1995 (S95-6) G. Pratt ♀16; 29-xii-1997 (S97-145) GR Ballmer ♀1; 12-iii-1998 (S98-10) ♂1 ♀1; 1-iii-2004 (S04-8) ♀1; 8-i-2005 (S05-9) ♀2; 4-ii-2008 (S08-6) ♀1; 23-i-2010 (S10-3) ♀2.

Possible placement. **CALIFORNIA, *Los Angeles Co.,*** Devil's Punchbowl County Park, 0.5 m N Headquarters, 34.418572° -117.863198°, 1404m, 22-xii-1997, J. Farley. These 2 small adult females are morphologically most similar to *A. brockovichi*, while geographically closest to *A. pratti*. Both have 7 middle leg calcars; and 3 inner and 2 outer rear leg tibial spines; which compares to *A. brockovichi* with its normal 7 middle leg calcars, along with 1 or 2 inner and typically 2 outer rear leg tibial spines. In *A. pratti*, the typical arrangement is 8 middle leg calcars and 3 or 4 inner and 3 (rarely 4) outer spines. The habitat is similar to that of the nearby Antelope Valley, where *A. pratti* is documented. Unfortunately, no DNA or drum information is available.

Drum. Both sexes drum at a similar rate except, contrary to the norm, males with longer series. Five adult males, from 3 localities, had series of 21 to 88 drums; while 22 adult females, from the same 3 localities, had series of 8 to 26 drums. Also, males with a sex clarification drum (SCD). **Male:** Holotype, R08-35 (Fig. 411), 19°C: 21 drums over 19.1s (1.1 drums/s). **Female:** Allotype, R08-10 (Fig. 412), 20°C: 14 drums over 10.2s (1.4 drums/s).

Drum rates (Fig. 413) for females from Edwards Air Force Base and Kramer Hills (~38 km apart) are combined, and measured at 1.7–2.2 drums/s; while those for type locality females, from near Hinkley, which is ~32 km due east of Kramer Hills) are 1.1–1.5 drums/s. We are unsure of the significance of these differences, but legs from individuals from these 3 sites are recovered as each other's nearest relatives in the ASTRAL tree (Fig. 404, p. 257).

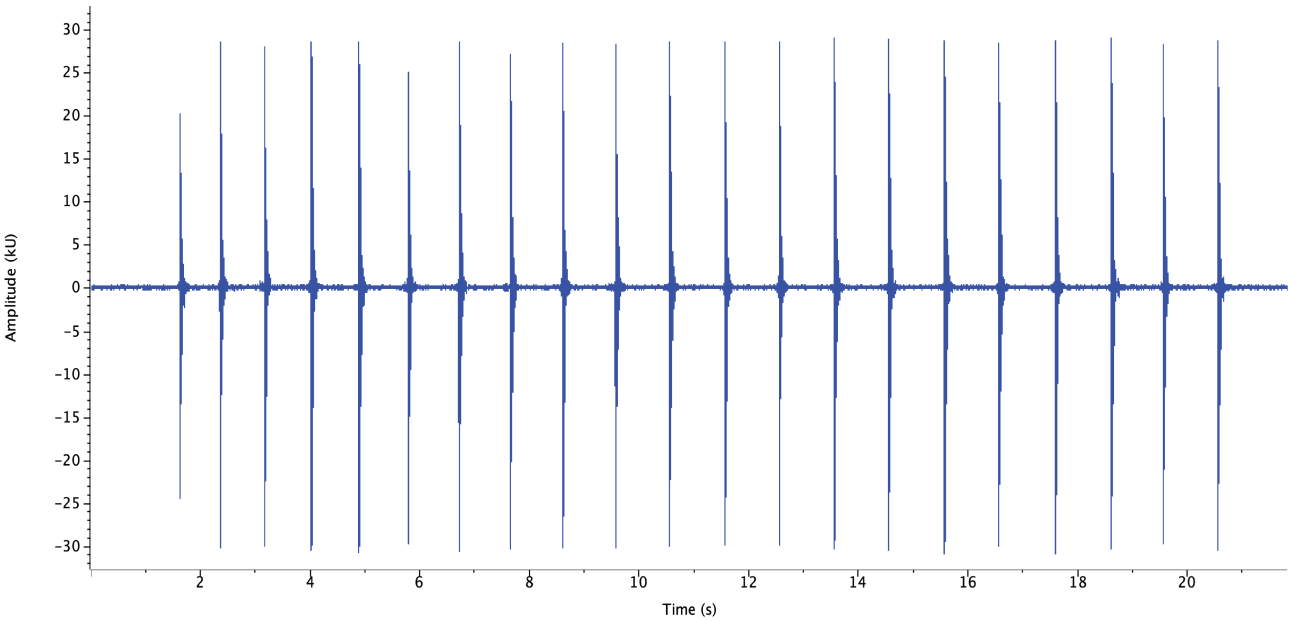


FIGURE 411. Calling drum (R08-35) holotype male.

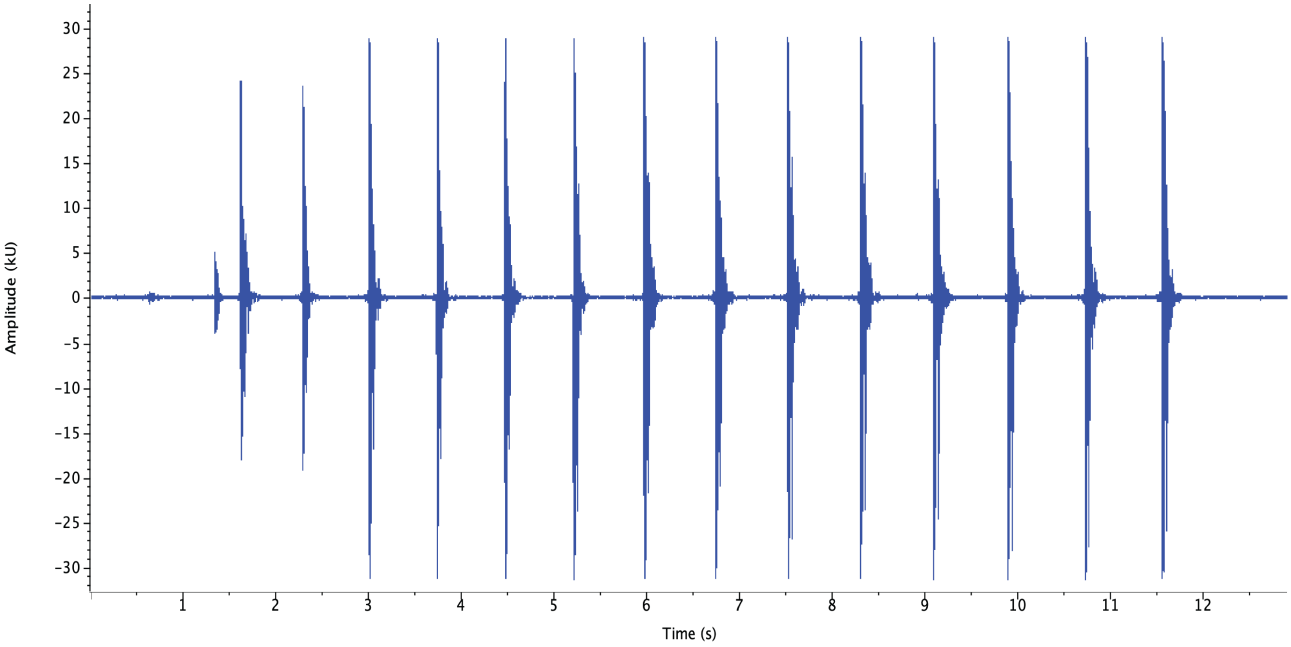


FIGURE 412. Calling drum (R08-10) allotype female.

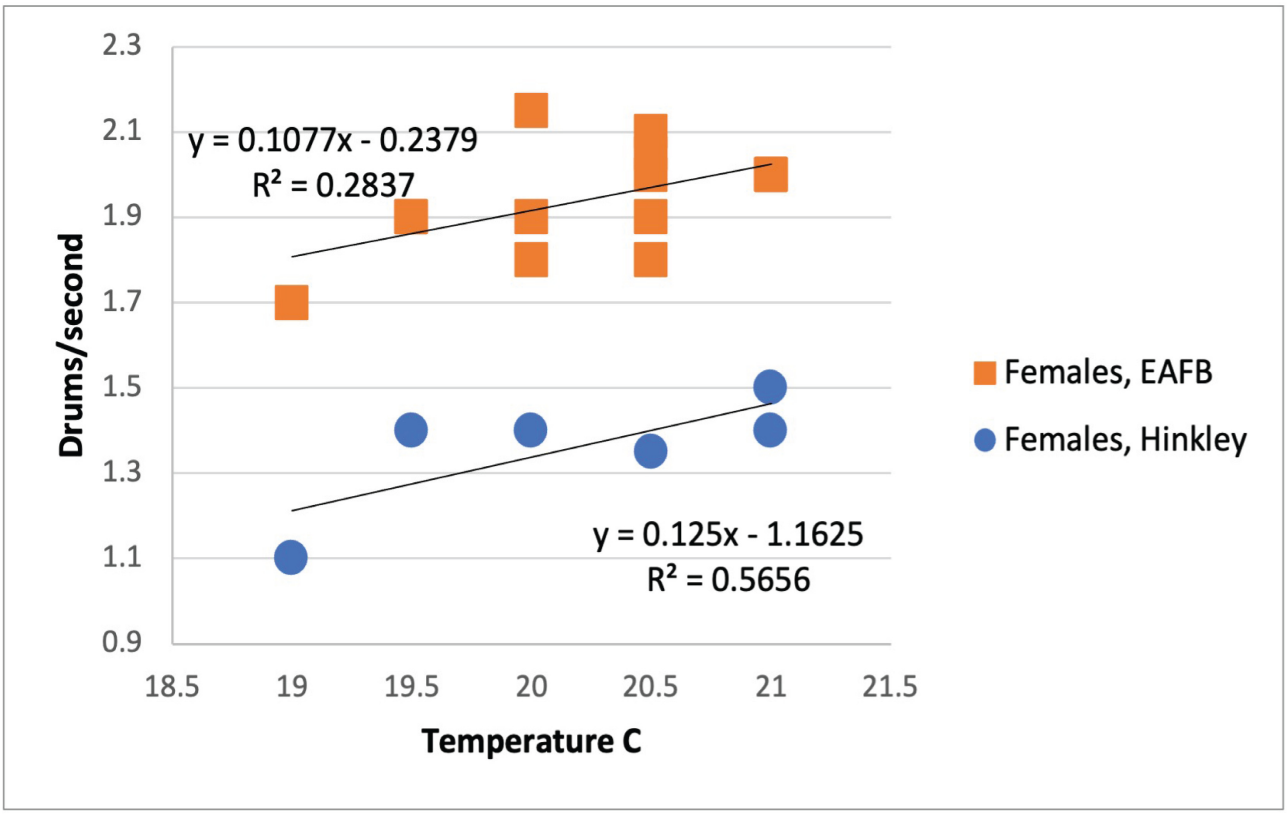


FIGURE 413. Drum rate for females of *A. brockovichi* in response to temperature. Females from Edwards Air Force Base (EAFB) and Kramer Hills are combined.

Derivation of name. Type locality is near Hinkley, the infamous site of Erin Brockovich's heroic efforts against PG&E and their hexavalent chromium groundwater contamination saga.

Habitat. Type locality is along the shoulders of the Mojave River, specifically on winter rain moistened sand, under boards, in swales, in mixed shrub area where old construction material deposited. We got no JCs under

aluminum siding, rocks, or concrete slabs. Air temperature probably close to freezing, at 07:00, when we arrived on 4-ii-2008. In 2.5 man-hours, we collected 12 JCs total: 2 adult females, 4 late instar females, 2 mid instar males and 4 mid instar females. The Kramer Hills site, at ~4.5–7m S Kramer Junction, is an area of large rolling sand dunes with *Larrea*, Joshua trees, and various shrubs. JCs there found under fallen Joshua tree limbs and under trash.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. From some 49 adults, 1 had 0, 11 had 1, and 37 had 2 **fore** leg tibial spurs; 5 had 6 and 41 had 7 **middle** leg tibial calcars, and 4 had 1 and 41 had 2 ventral spurs; 31 had 1 and 18 had 2 inner **rear** leg tibial spines, and 3 had 1, 43 had 2, and 3 had 3 outer **rear** leg tibial spines, and 4 had 1 and 45 had 2 ventral spurs.

DNA. Fig. 404, p. 257. F0268 & F0307 (both S96-25, Edwards Air Force Base); F0656 (S97-145, Kramer Hills); F0712 (S98-10, Kramer Hills); F1357 (type locality S03-46); F2041 (type locality S08-5) all recovered in a Mojave Desert Group 6 that also includes *A. coyflat, A. crypticus, A. joshuatree, A. kelsoensis*, *A. kennedymeadows*, and *A. piute.*

Karyotype. 2n♂=25. Two males examined: Edwards Air Force Base T97-13 (Fig. 414, S96-33); and type locality T08-8 (Fig. 415, S08-5). Both with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. In both idiograms, the metacentrics, submetacentrics, and acrocentrics are intermingled, emphasizing the somewhat arbitrary nature of this class assignment.

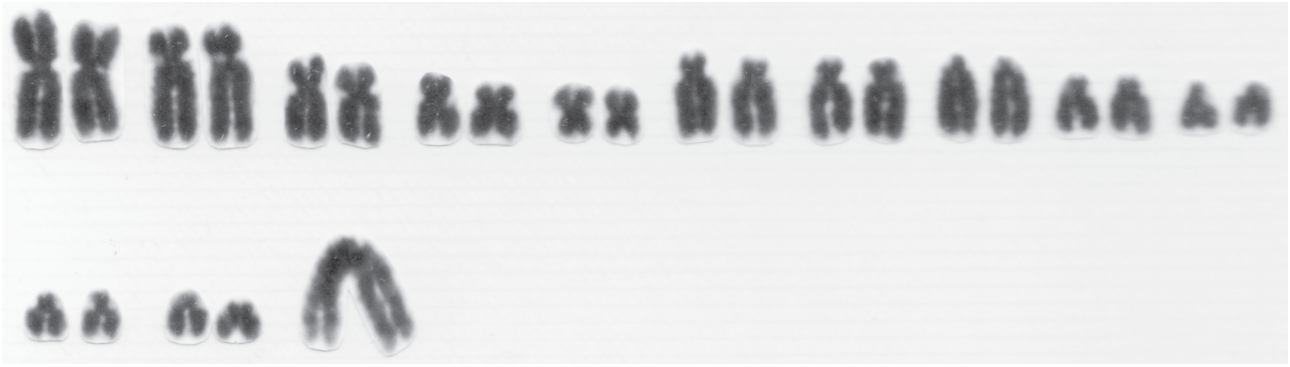


FIGURE 414. Idiogram T97-13 *A. brockovichi* (S96-33).



FIGURE 415. Idiogram T08-8 *A. brockovichi* (S08-5).

Discussion. While it is common to find distorted sex ratios in field-collected adults of many JC taxa, depending on the time of year, *A. brockovichi* may be the only taxon where we also found a distorted juvenile sex ratio, with a predominance of juvenile females when compared to juvenile males. Tinkham (1965) found a similar situation in near relative *A. kelsoensis* where his type series was composed of 13 juvenile and adult females and no males. Once we started sifting sand for *A. kelsoensis* during the winter, juvenile sex ratios were closer to 50:50. The Kelso Dunes are ~130 km due east of the type locality of *A. brockovichi.* The Cronise Dunes, also a possible locality for *A. kelsoensis* (see p. 281), are ~85 km NE of the type locality for *A. brockovichi.*

***Ammopelmatus chinalake* Weissman, sp. nov.**
China Lake Jerusalem Cricket
Figs 416–420, Tables 2, 16

Distribution. (Fig. 416). Known only from U. S. Naval Weapons Center, China Lake, Range Access Dunes, Kern Co. California.

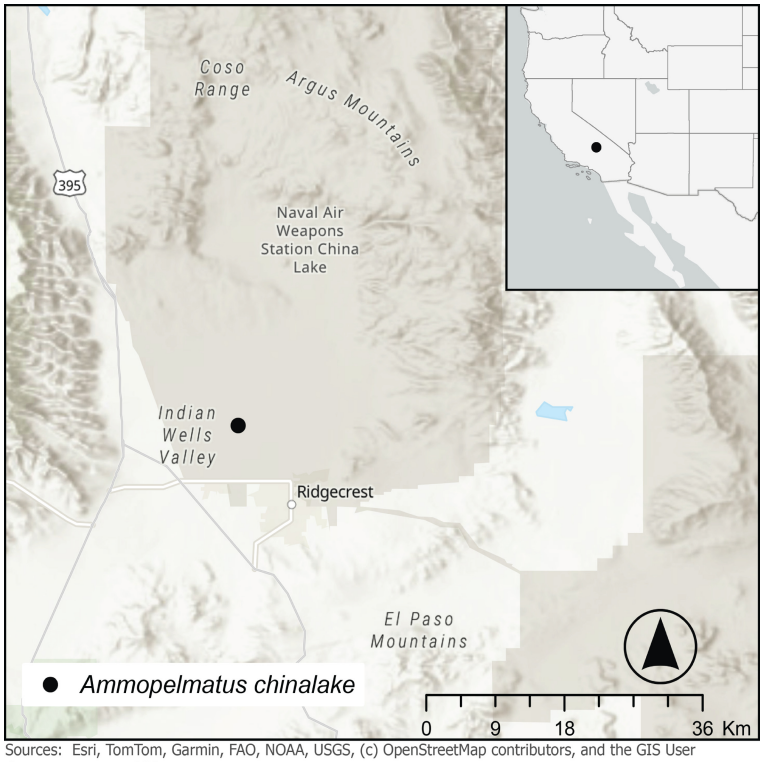


FIGURE 416. Known distribution of *A. chinalake.*

Recognition characters. Medium sized, light colored Mojave Desert sand dune obligate taxon with spatulate rear leg calcars and a drumming rate of 2 drums/s in females. Morphologically most similar taxon *A. brockovichi* is located some 100 km due south of the type locality of *A. chinalake*. DNA and karyotype should be compared between the 2 species but the rear leg spine differences (Table 16, p. 40) appear great enough to justify calling them distinct.

Holotype. Female (in alcohol, Fig. 417). **California, *Kern Co.,*** U. S. Naval Weapons Center, China Lake, Range Access Dunes, ~35.715253° -117.732448°, 676m, 5-iii-1992 (S92-24) DBW, VF Lee. R92-34. Molt to adult 30-viii-1992. Deposited CAS, Entomology type #20118. Measurements in mm: Body length 29.73, hind femur length 8.24, hind femur width 3.14. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 418) with 2 inner and 2 outer spines, 2 ventral spurs. Ovipositor Fig. 419.

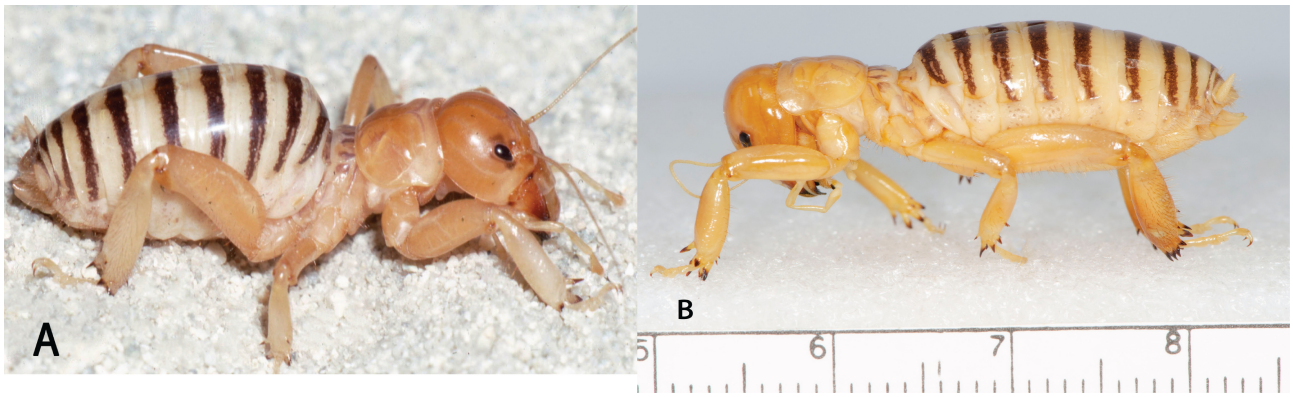


FIGURE 417. Holotype adult female *A. chinalake.* A. When alive. B. When preserved.



FIGURE 418. Left rear leg tibia holotype *A. chinalake.* A. Showing 2 outer and 2 inner spines. B. Showing shape of calcars.



FIGURE 419. Ovipositor holotype *A. chinalake.*

Male. Unknown.

Paratypes. ♀6. **CALIFORNIA, *Kern Co*.**, all China Lake, 26-ix-1981 to 3-ii-1982, pitfall traps, D. Giuliani ♀2. Same locality as holotype except 19-xii-1986 (S86-166) ♀4.

Drum. **Female:** Holotype R92-34 (Fig. 420) 30 drums in 14.4s (2.1 d/s) at 20°C. Two other adult females (R87-9, R87-11) drummed similar to holotype.

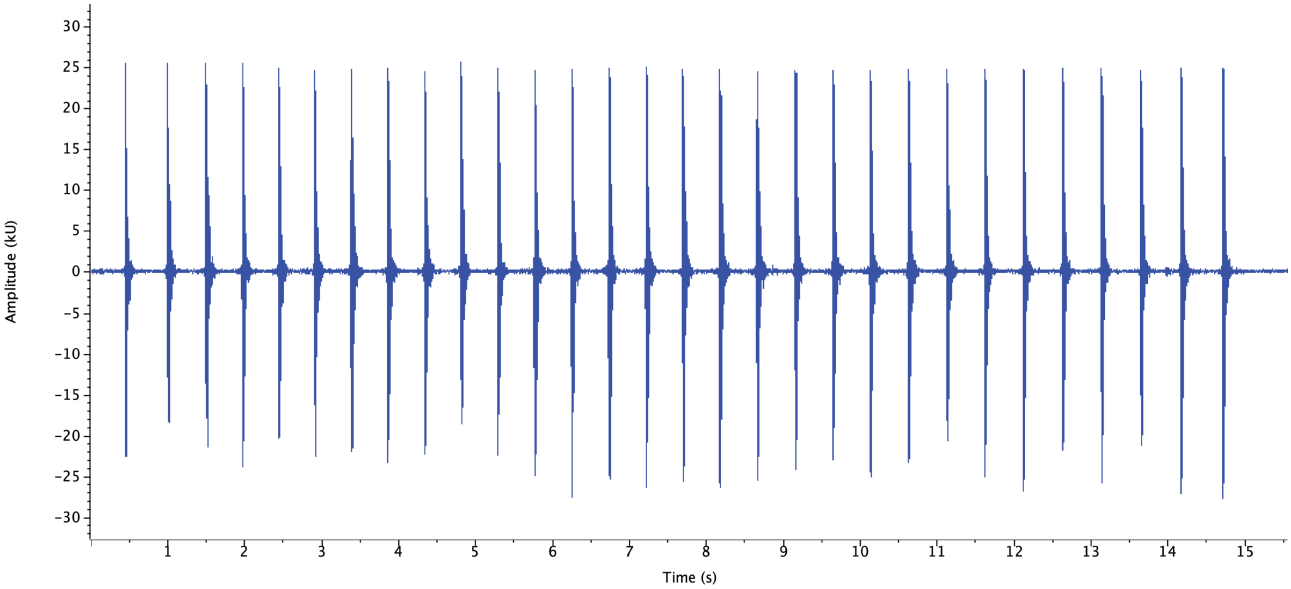


FIGURE 420. Calling drum (R92-34) holotype adult female *A. chinalake.*

Derivation of name. Named after type locality.

Habitat. Somewhat heavily vegetated sand dunes—individuals sifted from under 2 species of *Atriplex*, while those collected by D. Giuliani, which included ~8 juveniles, were from anti-freeze baited pitfall traps, from the same dune system.

Life cycle and seasonal occurrence. Probably 2-year life cycle.

Variation. From 7 individuals, 1 had 1 and 6 had 2 ventral **fore** leg tibial spurs; all 7 had 7 **middle** leg tibial calcars, and 1 had 1 and 6 had 2 ventral spurs; 6 had 2 and 1 had 3 inner **rear** leg tibial spines, and 4 had 2 and 3 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Unknown.

Karyotype. Unknown.

Discussion. Despite our lack of an adult male, and his calling drum, in addition to DNA and karyotype information, this taxon appears restricted to the Naval Weapons Center based on its distinctive constellation of female calling drum and rear leg tibial spines, when compared (Table 16) with other low elevation, light colored Mojave Desert sand dune obligate species.

There are several nearby sand dune systems at China Lake Naval Weapons Center, and we would predict this JC to occur in these other dunes as well; especially the Paxton Ranch Dunes because of its greater plant diversity than that seen on the Range Access Dunes.

Ammopelmatus coyflat Weissman, sp. nov.

Coy Flat Jerusalem Cricket

Figs 421–430, Tables 9, 14

Distribution. (Fig. 421). Known only from the Coy Flat Campground area, Tulare Co., on the western side of the Sierra Nevada, California.

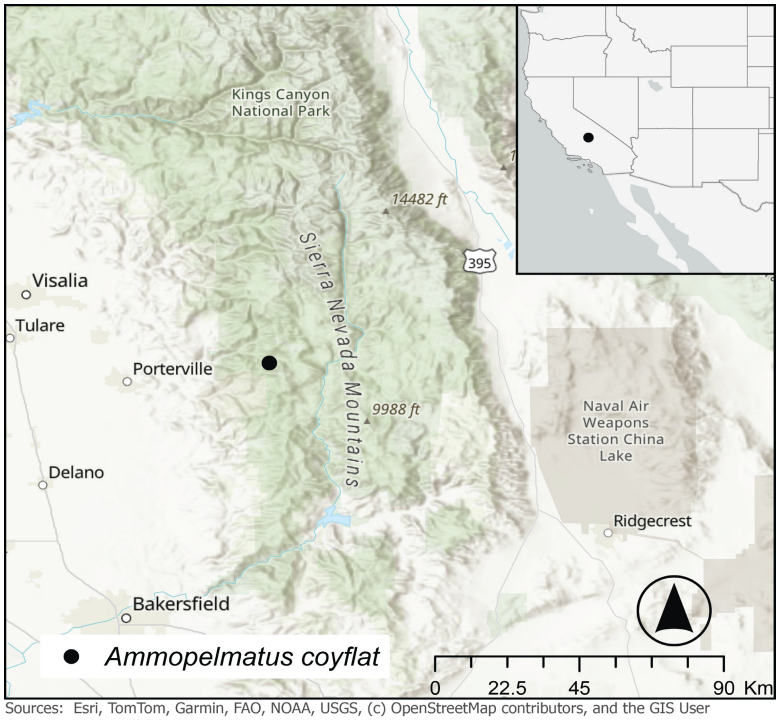


FIGURE 421. Known distribution of *A. coyflat.*

Recognition characters. Along with *A. santarosaplateau,* the fastest drumming JC species (drum rate of 7.5 to 9.9 drums/s) that is not in the Big Sur, Fast Drumming, or Longispinus Groups. A large JC whose males have a sex clarification drum, broadened calcar #1, usually 6 inner rear leg tibial spines, and 2n♂=25. Distinguished from nearest relatives *A. crypticus* and *A. piute* by habitat, drum rate, rear leg inner tibial spine number, and male calcar #1 development. Physically separated from *A. crypticus* by ~120 km; and from *A. piute* by some 80 km.

Holotype. Male (in alcohol, Fig. 422). **California, *Tulare Co.,*** Forest Route 21S94 off Hwy 190, Coy Flat Campground, 36.127878° -118.618506°, 1422m, 20-viii-2006 (S06-80), DBW & DC Lightfoot. R06-65. Collected as adult. Deposited CAS, Entomology type #20129. Measurements in mm: Body length 4.13, hind femur length 14.94, hind femur width 5.21. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 423) with 6 inner and 3 or 4 outer spines, 1 ventral spur both sides.



FIGURE 422. Adult male holotype *A. coyflat.* A. When alive. B. When preserved.

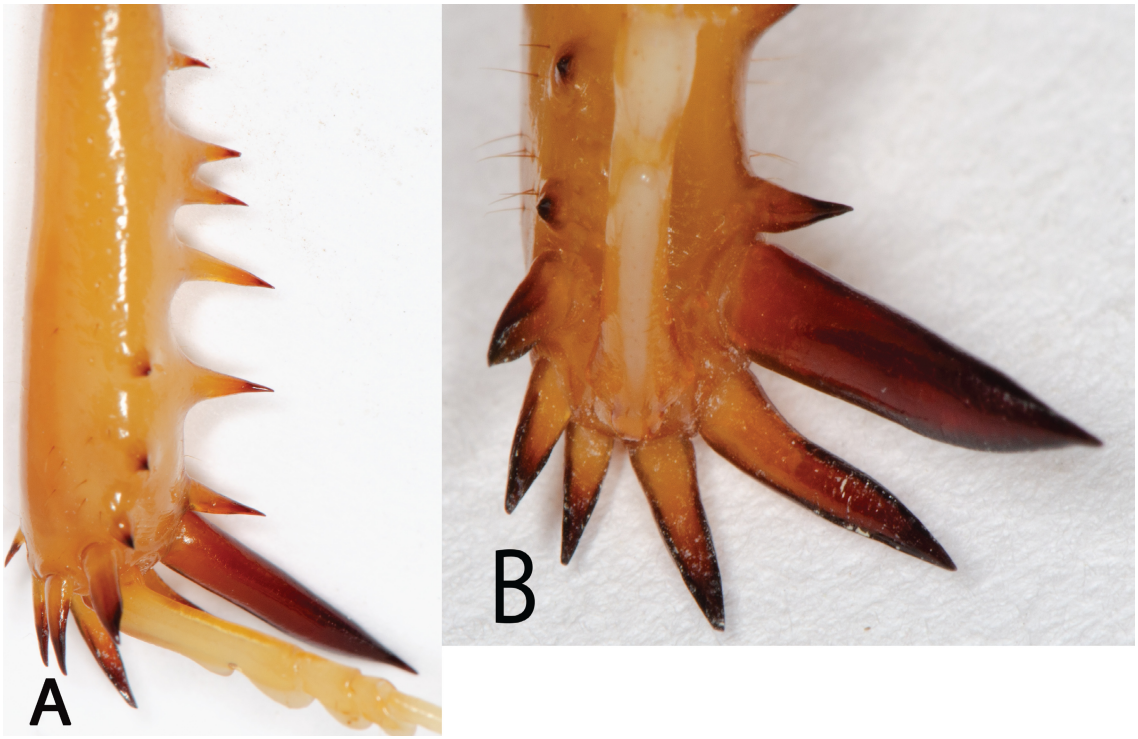


FIGURE 423. Left rear leg tibia holotype male. A. Showing 3 outer and 6 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 424A of a live paratype; Fig. 424B preserved allotype). Same data as holotype except R07-39 & R07-43, F1970. Molt to adult 29-viii-2007. Deposited CAS, CASENT #8413849. Measurements in mm: Body length 39.93, hind femur length 12.46, hind femur width 4.82. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 425) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 426.

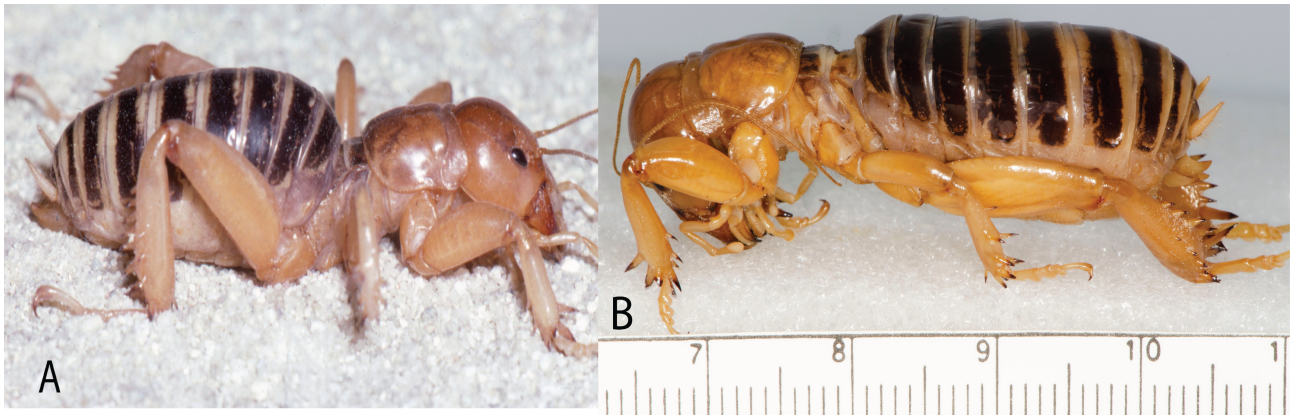


FIGURE 424. Adult female *A. coyflat.* A. Live paratype (S99-6, R99-16, F0938). B. Preserved allotype.

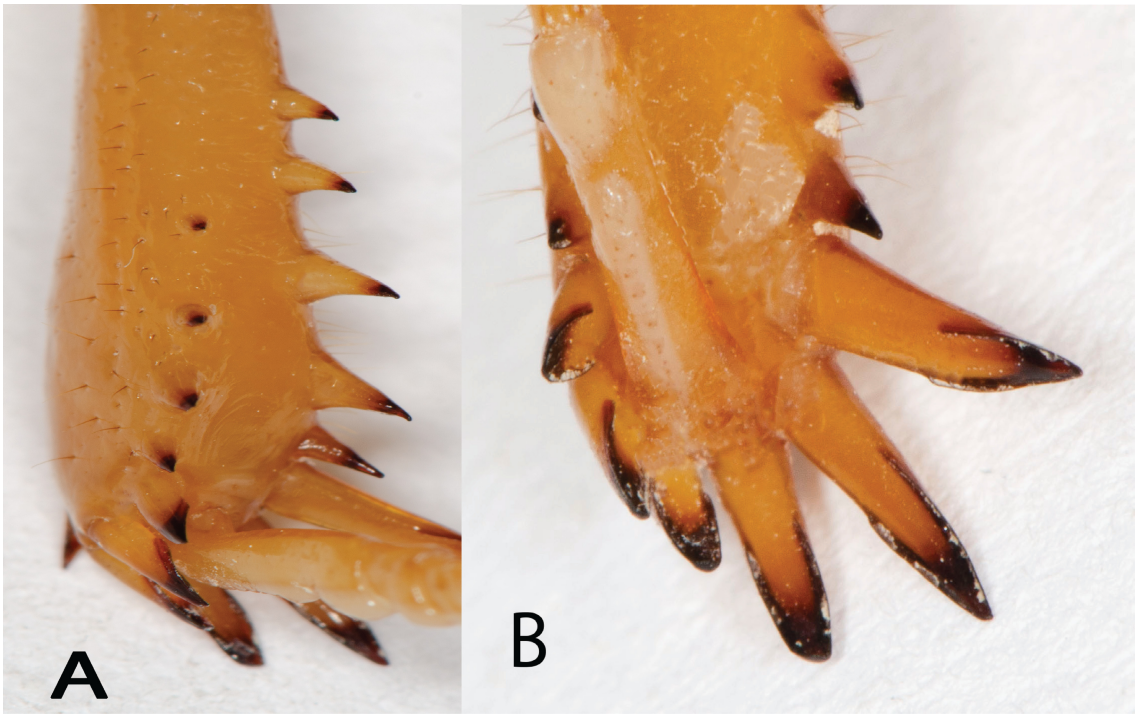


FIGURE 425. Left rear leg tibia allotype female *A. coyflat*. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

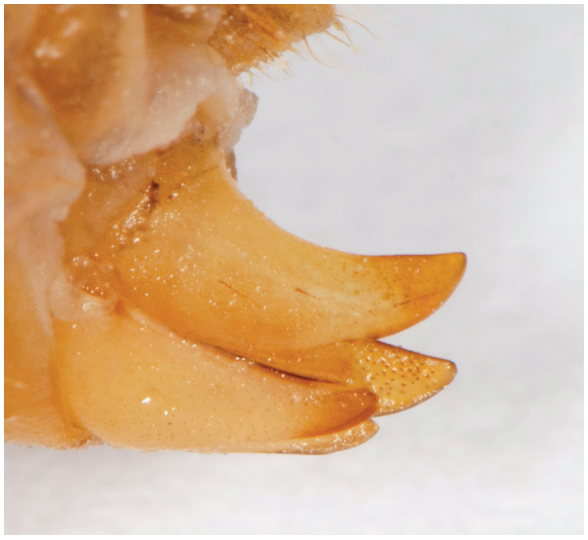


FIGURE 426. Ovipositor allotype *A. coyflat*.

Paratypes. ♂2 ♀2. Same data as types except 14-iii-1999 (S99-6) I. Swift ♀1; 20-viii-2006 (S06-80) ♂2 ♀1, 3 late instar males for testes.

Drum. Calling drum similar in both sexes except males with longer series, longer intervals between series, and a sex clarification drum. **Male:** Holotype R06-65 (Fig. 427), 119 drums over 12.0s (9.9 drums/s) at 20.5°C. **Female:** Allotype R07-43 (Fig. 428), 2 typical short series, with interval of 3.8s between series, of 18 drums in 2.4s (7.5 drums/s) and 17 drums in 2.2s (7.7 drums/s) at 20.5°C.

This is one of the few JC species where males' calling drum series are longer than females. Of the 3 males recorded, they produced series of 79, 108, 119, and 127 drums. Of the 3 females recorded, they produced series of 17, 18, 37, 41, 42, 45, and 50 drums. As we speculate (Weissman 2001b), we wonder if in this taxon, the shorter drumming females approach the longer drumming males?

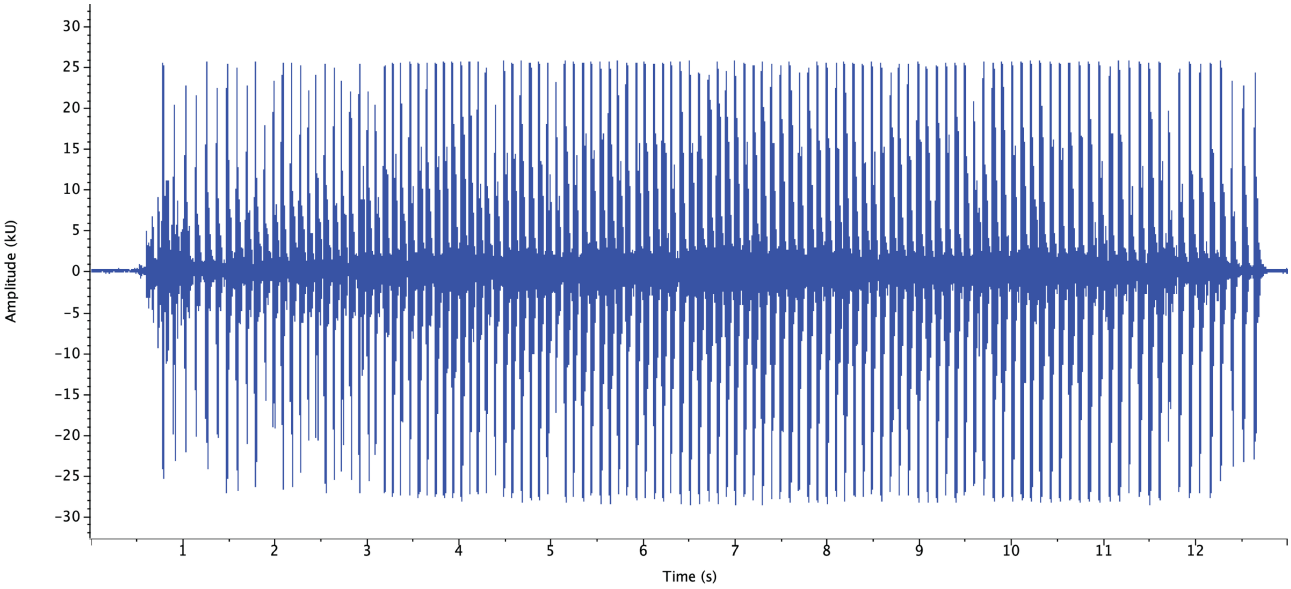


FIGURE 427. Calling drum (R06-65) in holotype male *A. coyflat*.

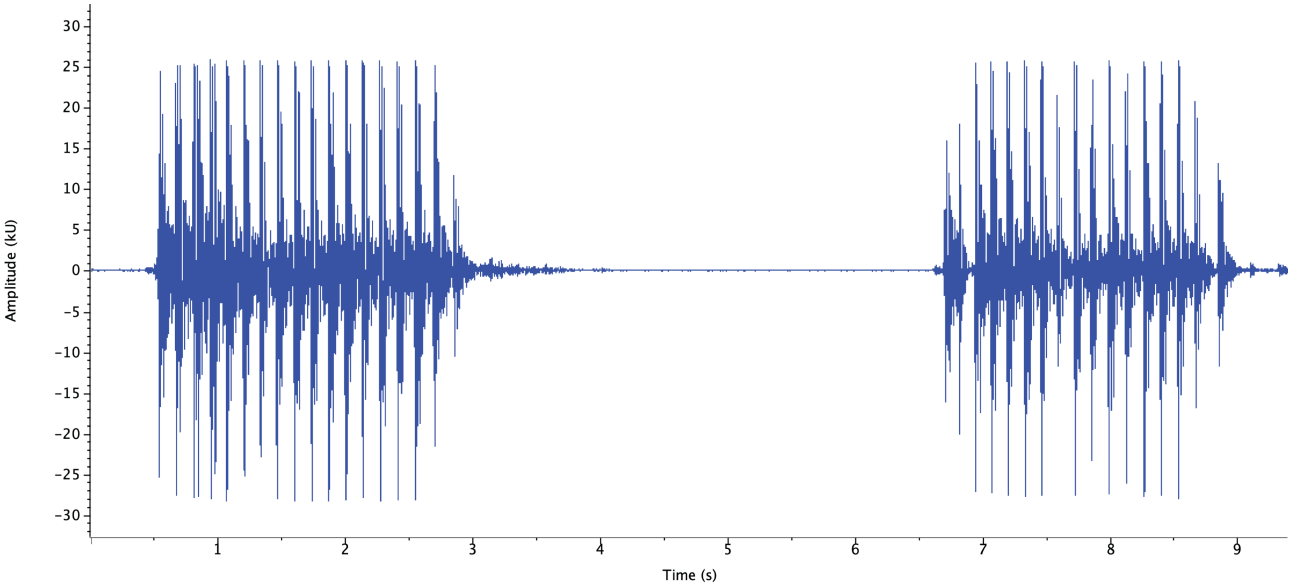


FIGURE 428. Calling drum (R07-43) allotype female *A. coyflat*.

Derivation of name. Named for the only known locality.

Habitat. Mixed incense cedar-oak forest with diverse understory vegetation.

Life cycle and seasonal occurrence. On 20-viii-2006, we laid a 9 kg long oatmeal trail along Forest Route 21S94, adjacent to the Campground. Half of the trail was above the gate into the Campground, and half below the gate. On first walk at 20:30 got 2 adult males and 5 late instars; on second walk at 22:00 got 1 adult male and 1 late instar. All oatmeal-trail collected individuals were above the gate.

Variation. Of 6 adults, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 5, 4 had 6, and 1 had 7 inner **rear** leg tibial spines, and all had 4 outer **rear** leg tibial spines, all with 2 ventral spurs except the holotype that has 1 spur bilaterally.

DNA. Fig. 404, p. 257. F1926 (from male testes T07-6) and F1969, both type locality (S06-80), recovered in Group 6 Mojave Desert with similar high elevation *A. crypticus*, from Tehachapi Mt Park; and near to *A. piute*, from the Piute Mts.

Karyotype. 2n♂=25. Two type locality (S06-80) males examined: T07-4 (Fig. 429) & T07-5 (Fig. 430). Both

agree with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric and telocentric autosomal pairs; and 1 metacentric X chromosome.

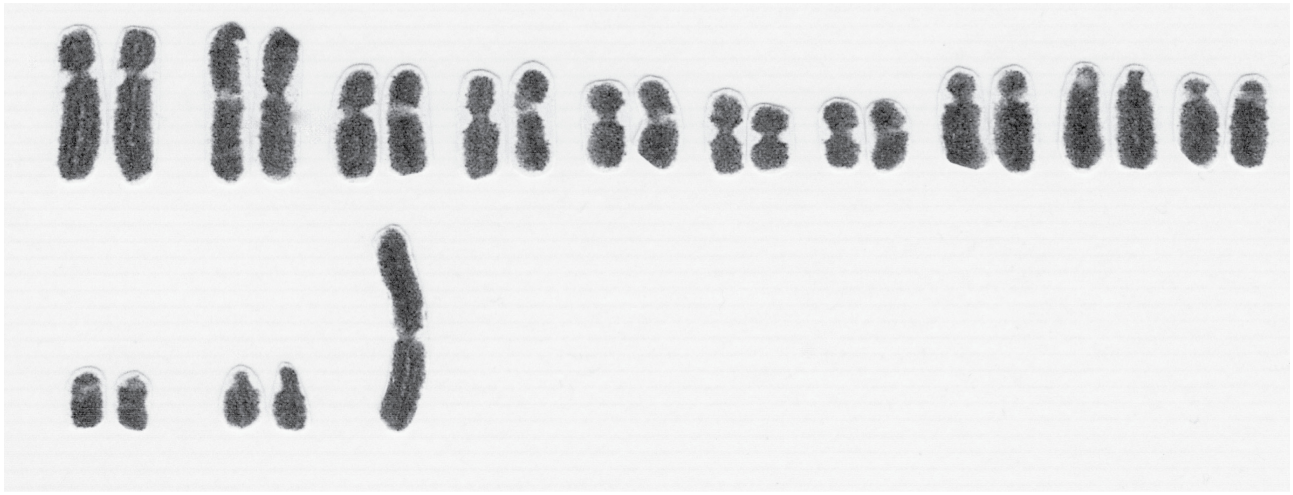


FIGURE 429. Idiogram T07-4 *A. coyflat* (S06-80).



FIGURE 430. Idiogram T07-5 *A. coyflat* (S06-80).

Discussion. Coy Flat Campground is also the type locality of the decticine katydid *Neduba sequoia* Cole, Weissman, and Lightfoot.

***Ammopelmatus crypticus* Weissman, sp. nov.**
Tehachapi Mountains Cryptic Jerusalem Cricket
Figs 431–439. Tables 2, 24

Distribution. (Fig. 431). Only known from Tehachapi Mountain Park, Kern Co., California. Possibly found on The Grapevine along I-5 (see Possible placement below, S01-13).



FIGURE 431. Known distribution of *A. crypticus.*

Recognition characters. Medium-large JC, calling drum rate 3–4 drums/s, males with sex clarification drum (SCD) and a broader calcar #1 than sympatric *A. grapevine* or *A. tehachapi*, 2 or 3 fore leg tibial spurs (vs 2 spurs in *A. grapevine*), and different DNA. *A. crypticus* recovered closest to *A. coyflat* but those two taxa differ in drum rate, number of rear leg inner tibial spines, and male calcar #1 development, and the latter is only known from its type locality on the western side of the Sierra Nevada, some 120 km from *A. crypticus.*

Holotype. Male (in alcohol, Fig. 432). **California, *Kern Co.,*** Tehachapi Mt. Park, 35.06607° -118.48029°, 1370m, 22-viii-2015 (S15-116) JA Cole, T. Farwell, K. Halsey. R15-31, F2446. Collected as adult. Deposited CAS, Entomology type #20088. Measurements in mm: Body length 32.19, hind femur length 11.72, hind femur width 4.45. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 433) with 5 inner and 3 outer spines, 2 ventral spurs.

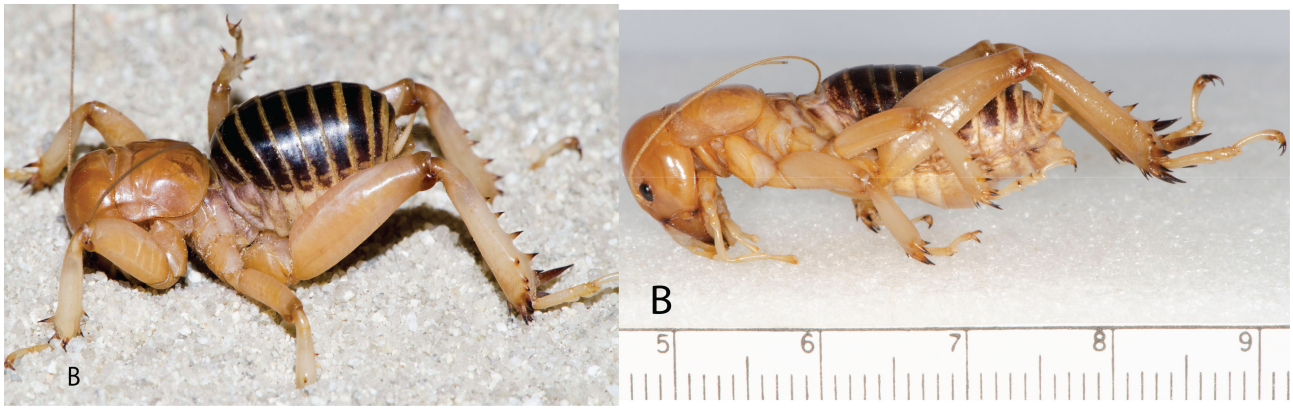


FIGURE 432. Holotype adult male *A. crypticus.* A. When alive. B. When preserved.



FIGURE 433. Left rear leg tibia holotype *A. crypticus.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

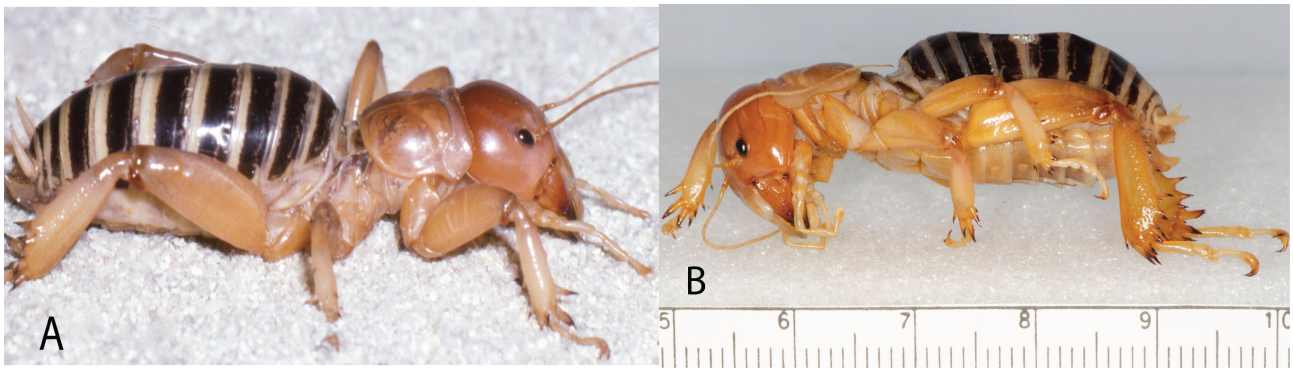


FIGURE 434. Adult female allotype *A. crypticus.* A. When alive. B. When preserved.



FIGURE 435. Left rear leg tibia allotype *A. crypticus.* A. Showing 3 outer and 6 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 434). **California, *Kern Co.,*** Tehachapi Mt. Park, 35.071747° -118.487147°, 1699m, 7-x-1995 (S95-104) DBW & VF Lee. R97-72, F0455. Molt to adult 12-viii-1997. Deposited CAS, Entomology #9081865. Measurements in mm: Body length 38.16, hind femur length 11.99, hind femur width 4.76. Fore leg tibia with 3 ventral spurs; middle leg tibia with probably 8 calcars (missing right middle leg [taken for DNA] and left middle leg calcar #6 missing, but has typical calcar #8), 2 ventral spurs; hind leg tibia (Fig. 435) with 6 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 436.



FIGURE 436. Ovipositor allotype *A. crypticus.*

Possible placement. **CALIFORNIA, *Kern Co*.**, I-5 ("Grapevine") 2.3 m N Fort Tejon, pullout west side of freeway, 34.897591° -118.922817°, 768m, 26-ii-2001 (S01-13) ♂1 for testes (T01-73). We were unable to recover DNA from this specimen in 2024. The karyotype of this male is discussed below, and on p. 943.

Drum. Calling drum similar in both sexes except male with sex clarification drum (SCD); calling drum begins slow and transitions to faster rate in female. **Male:** Holotype (R15-31) with calling drum (Fig. 437) of 28 drums in 9.1s (3.1 drums/s) and SCD (Fig. 438) of 5 and 4 drums over 0.41s (12.2 drums/s) and 0.31s (12.9 drums/s), all at 21.5°C. **Female:** Allotype (R97-72, Fig. 439) with 38 drums over 9.4s (4.0 drums/s) at 20.5°C.

Derivation of name. "cryptic", in reference to its cryptic appearance when compared to sympatric *A. grapevine* and *A. tehachapi.*

Habitat. Holotype on trail in oak woodland at night; allotype under rocks in open grassland with deciduous oaks during daytime.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. From the two type individuals, both had 3 ventral **fore** leg tibial spurs; both had 8 **middle** leg tibial calcars, with 2 ventral spurs; 1 had 5 and 1 had 6 inner **rear** leg tibial spines, and both had 3 outer **rear** leg tibial spines, both with 2 ventral spurs. **Fore** leg tibial spurs number 3 in the holotype and allotype.

DNA. Fig. 404, p. 257. F0455 (allotype, S95-104, R97-72); F2446 (holotype, S15-116, R15-31). Both from the type locality and recovered in Group 6 Mojave Desert with *A. coyflat* and *A. piute*. All 3 taxa are from high elevation mountain habitats.

Karyotype. 2n♂=23 (possibly this species). T01-73 (Fig. 439, S01-13, Grapevine) with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. At the Grapevine site where T01-73 was secured, both *A. grapevine* (with 2 fore leg tibial spurs and 2n♂=25), and *A. tehachapi* (with 3 fore leg tibial spurs and 2n♂=25), also occur. The late instar male that T01-73 came from has 2 fore leg tibial spurs.

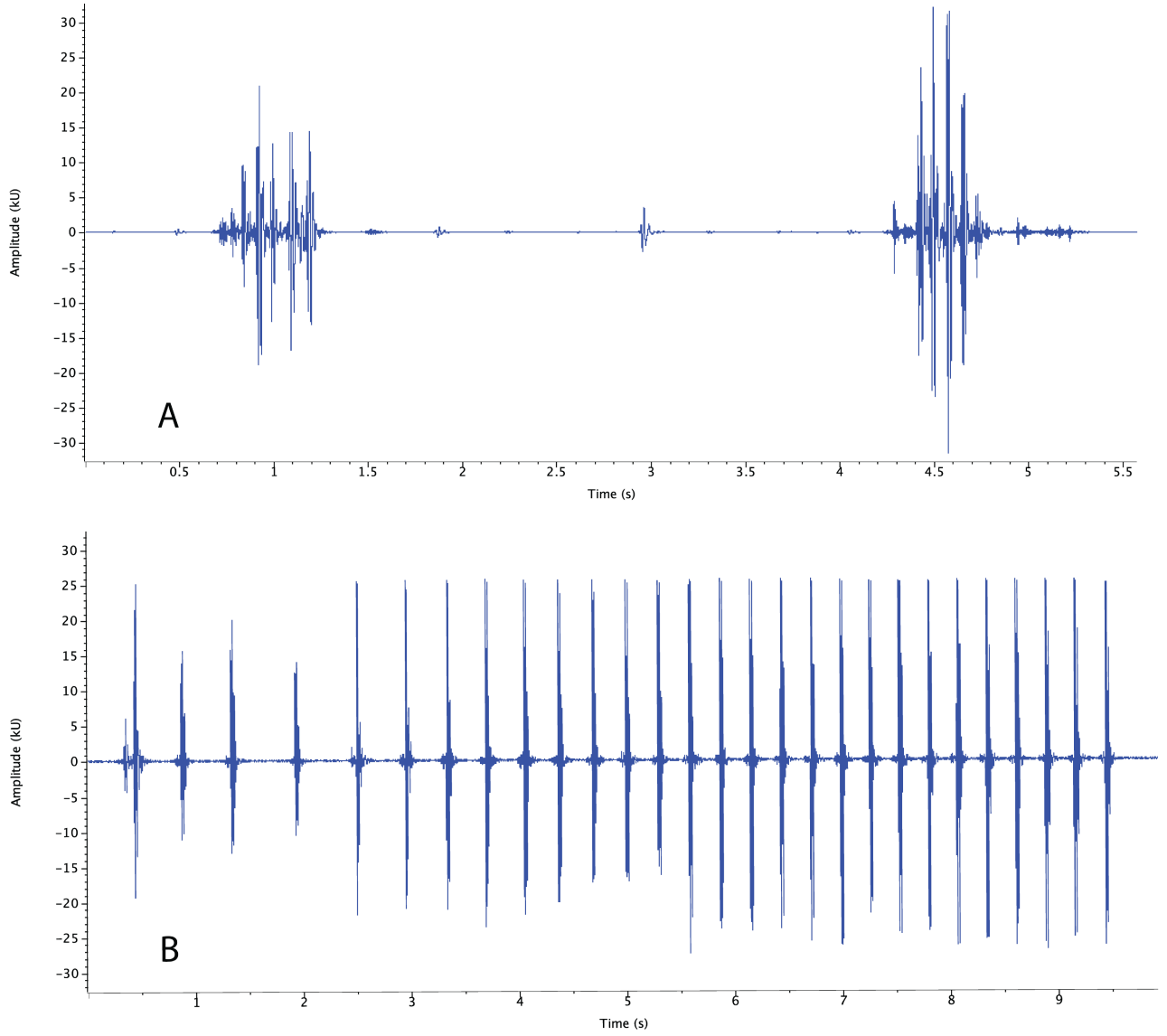


FIGURE 437. Drumming (R15-31) in adult male holotype *A. crypticus.* A. Two sex clarification drums. B. Calling drum *A. crypticus.*

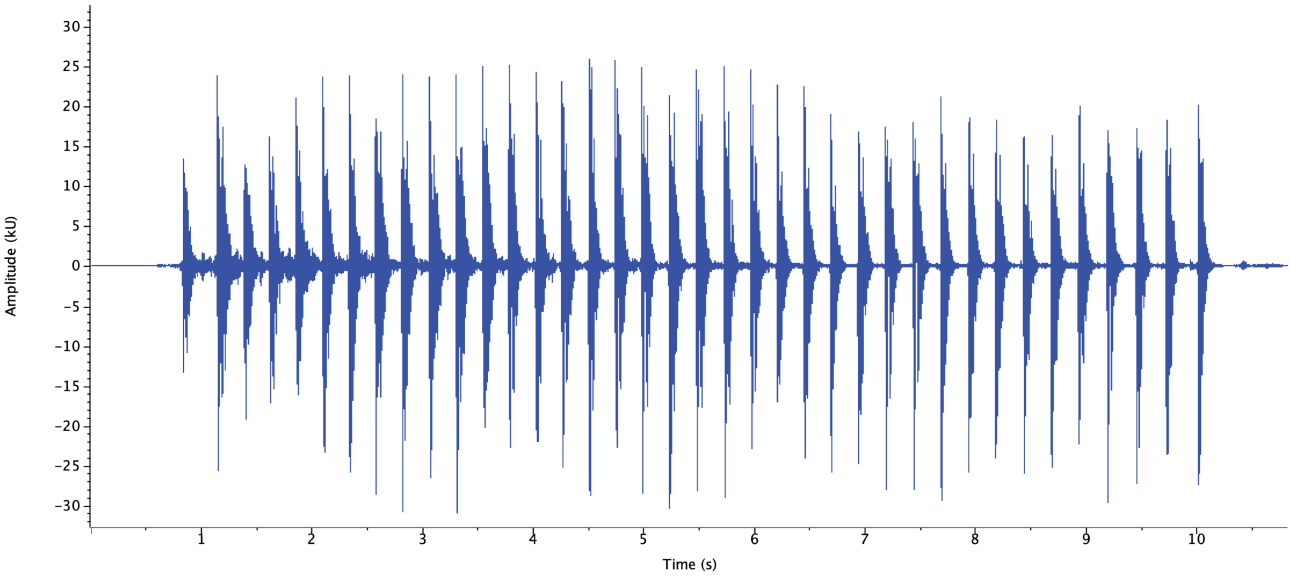


FIGURE 438. Calling drum (R97-72) in allotype female *A. crypticus.*

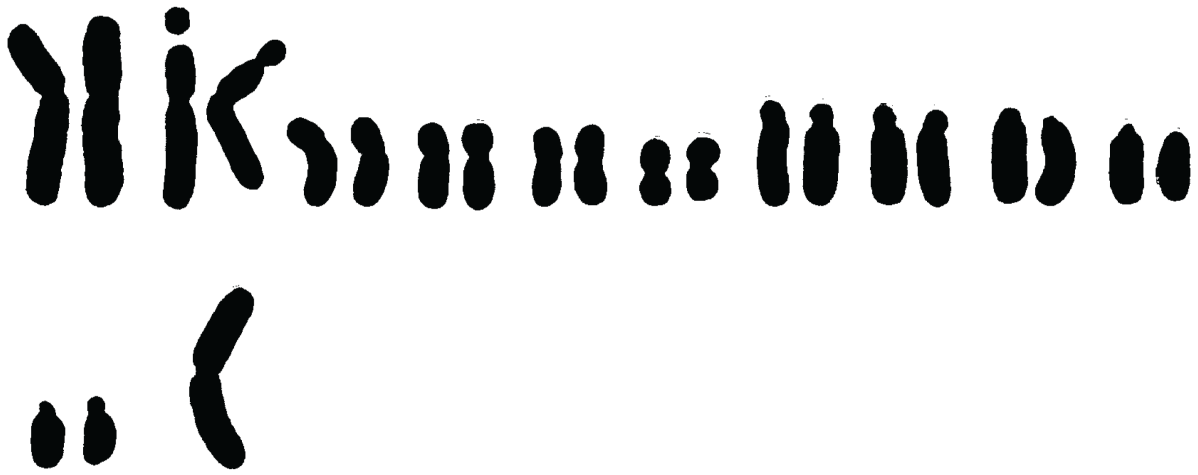


FIGURE 439. Idiogram T01-73, possibly *A. crypticus* (S01-13).

Discussion. While some folks would argue that most species of *Ammopelmatus* are already cryptic, we find this taxon even more so than normal. Initially separated from sympatric *A. grapevine* and *A. tehachapi* on basis of adult female drumming rate, but was then thought to be a possible hybrid (Weissman 2001b, p. 359) between those two taxa. Specific status was subsequently confirmed by the collection of the morphologically distinctive adult male combined with DNA analysis, which recovered the 3 sympatric Tehachapi Mt Park taxa in different locations in the ASTRAL tree.

***Ammopelmatus joshuatree* Weissman, sp. nov.**
Joshua Tree National Park Jerusalem Cricket
Figs 440–449, Tables 6, 16

Distribution. (Fig. 440). Only known from sandy areas in Pleasant Valley, Joshua Tree National Park, California.

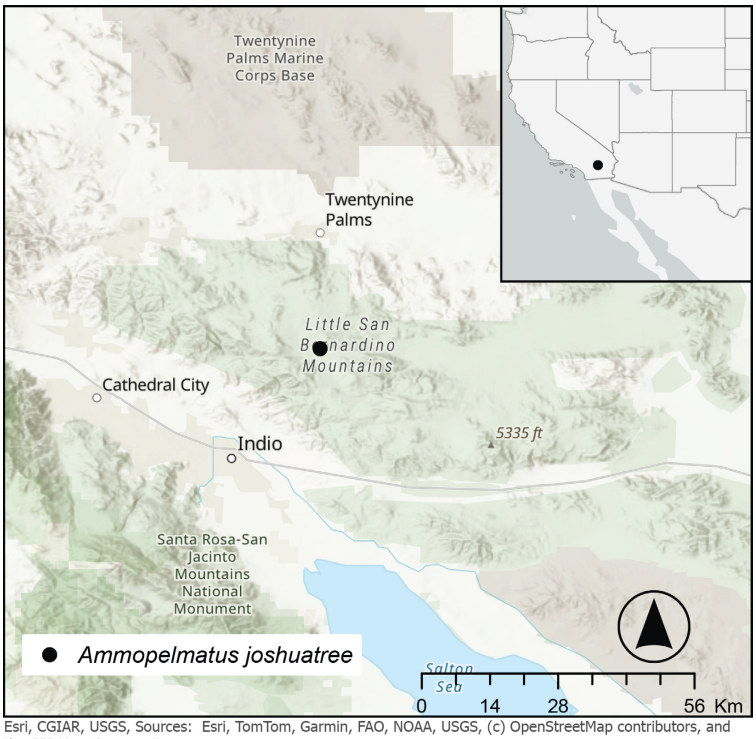


FIGURE 440. Distribution of *A. joshuatree.*

Recognition characters. A small, light-colored JC with spatulate rear leg tibial calcars and a slow calling drum. Distinguished from Joshua Tree National Park *A. whitewater*, which is larger, has a slightly faster calling drum (1.1 drums/s vs 0.7 drums/s), more distinct abdominal bands, different habitat (sandy in *A. joshuatree*), and different DNA.

Holotype. Male (in alcohol, Fig. 441). **California, *San Bernardino Co.,*** Joshua Tree National Park, Geology Tour Road ~2.1 km E Squaw Tank, 33.921464° -116.054603°, 993m, 16-ii-1995 (S95-15) GF Pratt. R95-78, F0141. Molt to adult 4-ix-1995. Deposited CAS, Entomology type #20012. Measurements in mm: Body length 23.57, hind femur length 6.94, hind femur width 2.7. Fore leg tibia with 1 or 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 442) with 2 or 3 inner and 3 outer spines, 2 ventral spurs.



FIGURE 441. Holotype adult male *A. joshuatree.* A. When alive. B. When preserved.



FIGURE 442. Left rear leg tibia adult male holotype *A. joshuatree.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 443). Same data as holotype except 15-ii-1990 (S90-14) DBW & VF Lee. R91-64. Molt to adult 24-ix-1991. Deposited CAS, CALENT #9083333. Measurements in mm: Body length 27.28, hind femur length 8.04, hind femur width 2.67. Fore leg tibia with 1 ventral spur; middle leg tibia with 7 calcars, 1 or 2 ventral spurs; hind leg tibia (Fig. 444) with 3 inner and 2 outer spines, 2 ventral spurs. Ovipositor Fig. 445.

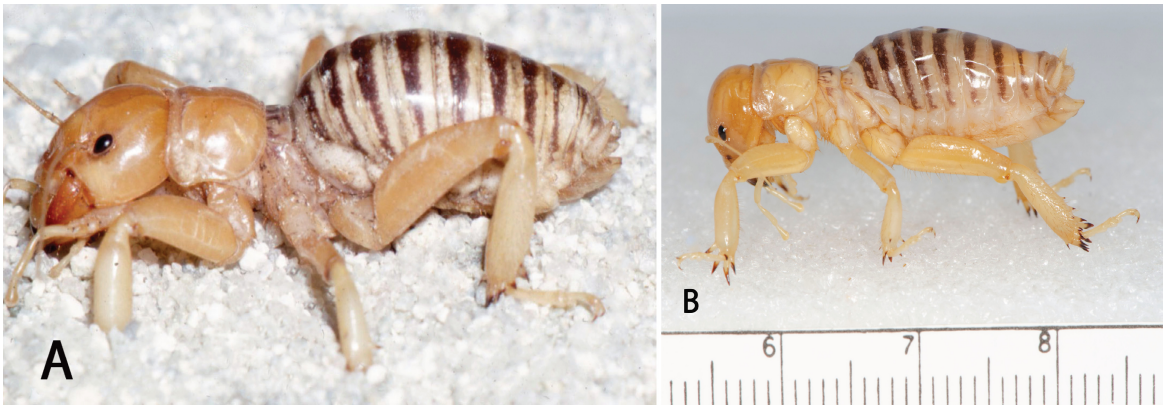


FIGURE 443. Adult female allotype *A. joshuatree.* A. When alive. B. When preserved.

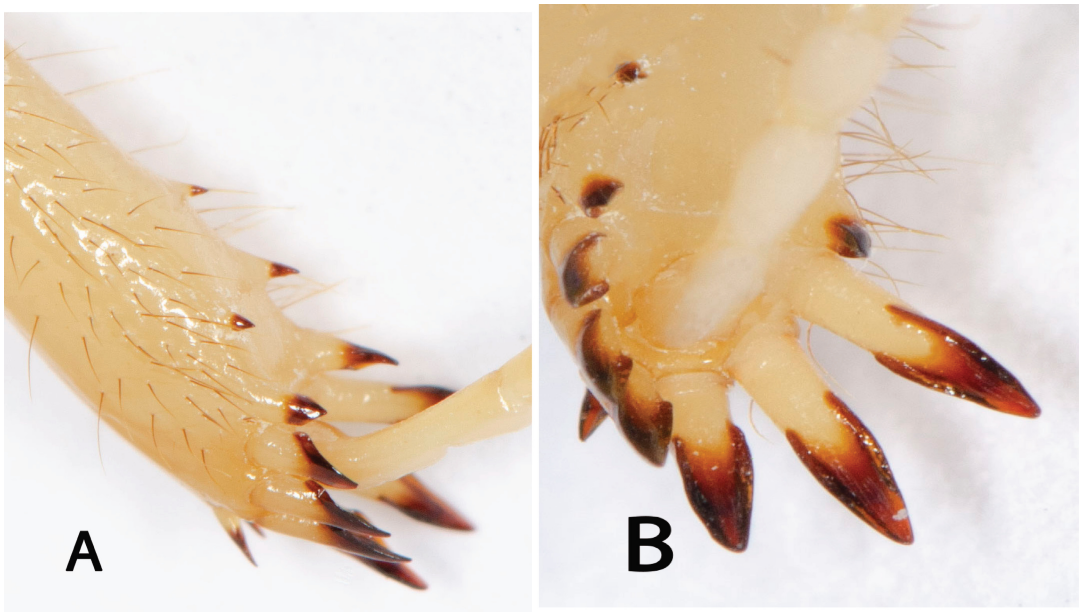


FIGURE 444. Left rear leg tibia adult female allotype *A. joshuatree.* A. Showing 2 outer and 3 inner spines. B. Showing shape of calcars.



FIGURE 445. Ovipositor allotype *A. joshuatree.*

Paratypes. ♂1 ♀5. **CALIFORNIA, *San Bernardino Co*.**, same data as holotype except 20-xii-1986 (S86-168) ♂1 ♀3; 4-iii-1992 (S92-22) ♀1; 16-ii-1995 (S95-19) ♀1, late instar male for testes.

Drum. Calling drum similar in both sexes except that males have a sex clarification drum (SCD). **Male:** Holotype R95-78 (Fig. 446), 20°C, shows 23 drums (1 double near end) over 33.0s (0.70 drums/s). Fig. 447 shows a drum with elements of both the calling and SCD drums. One male nymph drummed similarly (R87-10) on 2-ii-1987 at 14.5°C. **Female:** Allotype R91-64 (Fig. 448), 20°C, shows 18 drums over 23.0s (0.78 drums/s).

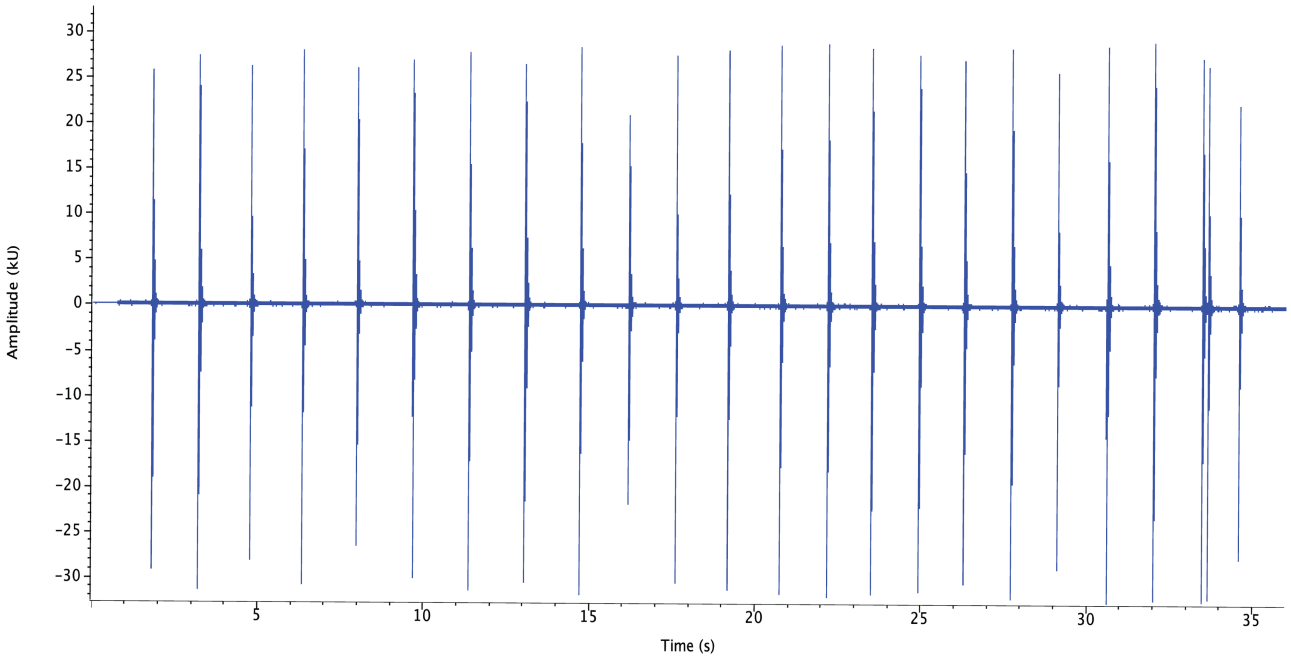


FIGURE 446. Calling drum (R95-78) adult male holotype *A. joshuatree.*

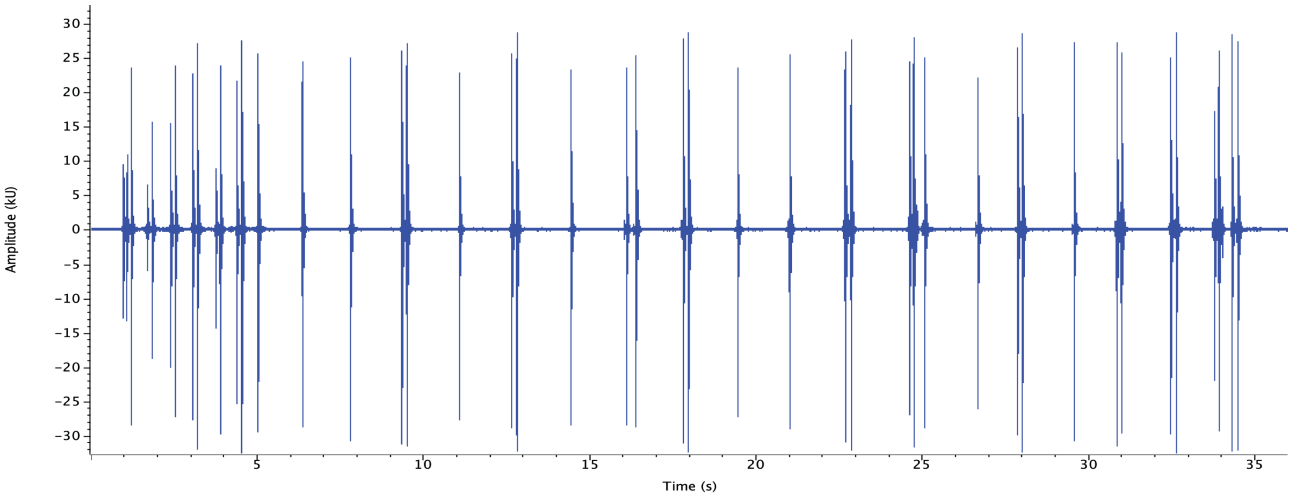


FIGURE 447. Calling drum (R95-78) adult male holotype *A. joshuatree* showing elements of sex clarification drum at beginning of drum.

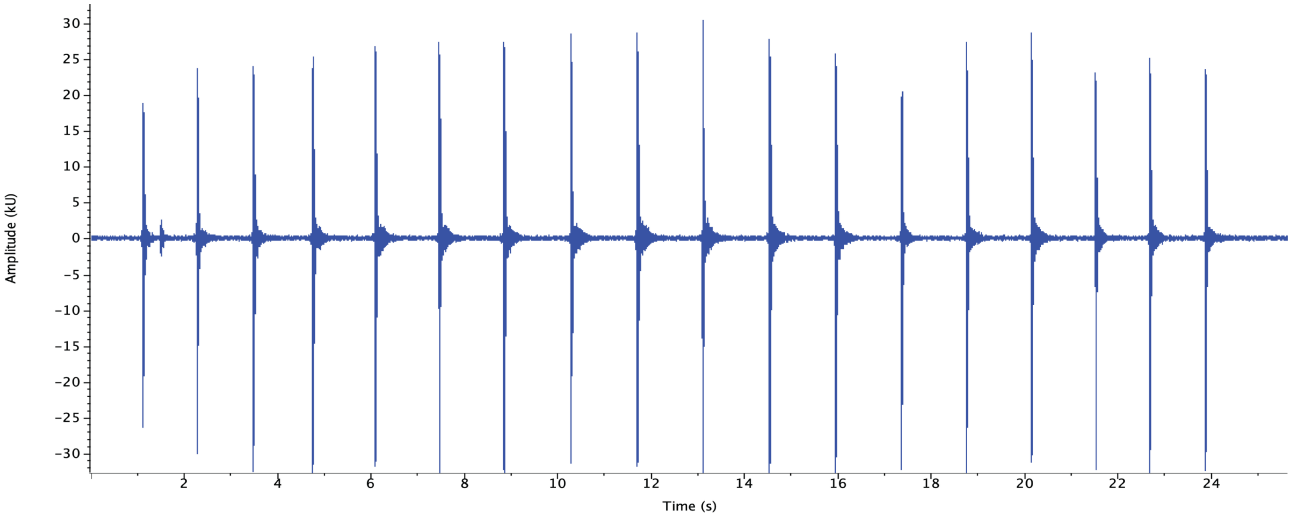


FIGURE 448. Calling drum (R91-64) adult female allotype *A. joshuatree.*

Derivation of name. Named after its only known locality.

Habitat. In Pleasant Valley, known only from a restricted area with sandy substrate which, in 1986, was heavily vegetated with bunch grass and other shrubs. Google Earth images, dated 11-xii-2019 and 2-iv-2023, show extensive ATV tracks in this specific area of the Park, despite the supposed protection afforded by a National Park. In 1995, 3 nymphs collected under Joshua Tree limbs.

Life cycle and seasonal occurrence. In 1986, we collected 3 adult females and 5 nymphs in 90 minutes of shallow sand sifting, only successful under bunch grass. On 15-ii-1990 (S90-14), we collected 16 nymphs in 2 hours of sifting, again all shallow and under bunch grass. It was so cold at 08:00, that day, that the JCs were immobile. They were placed in the car for the rest of the day. By 19:00 that night, the abdomens of 6 were black and all were dead by the next day, with the last individual dying in the next 2 days. We surmise that all of these individuals may have been frozen when excavated. On both occasions, the surface sand was dry; but in 1990, the sand was dry even 20 cm down. We wonder how often individuals are caught too close to the surface during the winter and frozen. If our 1990 individuals had been left in place to slowly thaw, would they still have died? There must be a balance between being close to the surface, and having easier surface access for wandering, versus the risk of being too close to the surface and when temperatures drop, being too cold to be able to dig deeper and avoid freezing.

Variation. For 8 adult individuals, 6 had 1 and 2 had 2 ventral **fore** leg tibial spurs; 1 had 6 and 7 had 7 **middle** leg tibial calcars, all with 2 ventral spurs; 5 had 2 and 3 had 3 inner **rear** leg tibial spines, and all 8 had 2 outer **rear** leg tibial spines, and 1 had 1 and 7 had 2 ventral spurs.

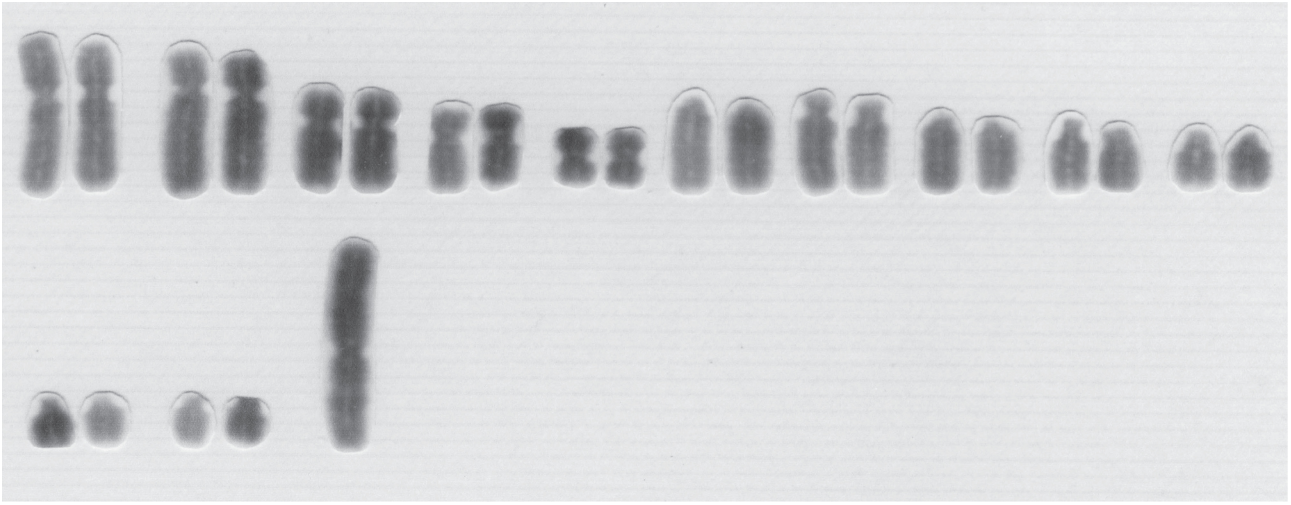


FIGURE 449. Idiogram T95-38 *A. joshuatree* (S95-19).

DNA. Fig. 404, p. 257. Type locality F0132 (S95-19, same male as T95-38) and F0141 (holotype) both recovered in Group 6 Mojave Desert, and nearest *A. brockovichi, A. kelsoensis,* and *A. kennedymeadows.*

Karyotype. 2n♂=25. T95-38 (Fig. 449, S95-19) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

Discussion. Given the limited known distribution of this species, and the obvious continued ATV damage to this area, as documented on Google Earth, we believe the status of this taxon should be reviewed. At a minimum, the type locality area needs improved protection from off road vehicles.

The type locality is ~110 air km due south of the Kelso Dunes, type locality of *A. kelsoensis,* although the Pleasant Valley site is not as sandy as are the dunes at Kelso.

***Ammopelmatus kelsoensis* Tinkham**

Kelso Dunes Jerusalem Cricket
Figs 450–461, Tables 6, 16

1965 *Ammopelmatus kelsoensis* Great Basin Naturalist, 25, 63–72. Holotype adult female (in alcohol): California, San Bernardino Co., Kelso Dunes, 27-iv-1963, ER Tinkham. Deposited at CAS, Entomology type #16450. Specimen examined. Tinkham called this the allotype, because the specimen is a female, but she is properly the holotype, regardless of sex, because his description is based upon her. Tinkham had no male specimens of any stage.

Species #2, Weissman 2001a.

Distribution. (Fig. 450). Kelso Dunes are the only previously recognized locality. We have an additional potential locality, which we now discuss:

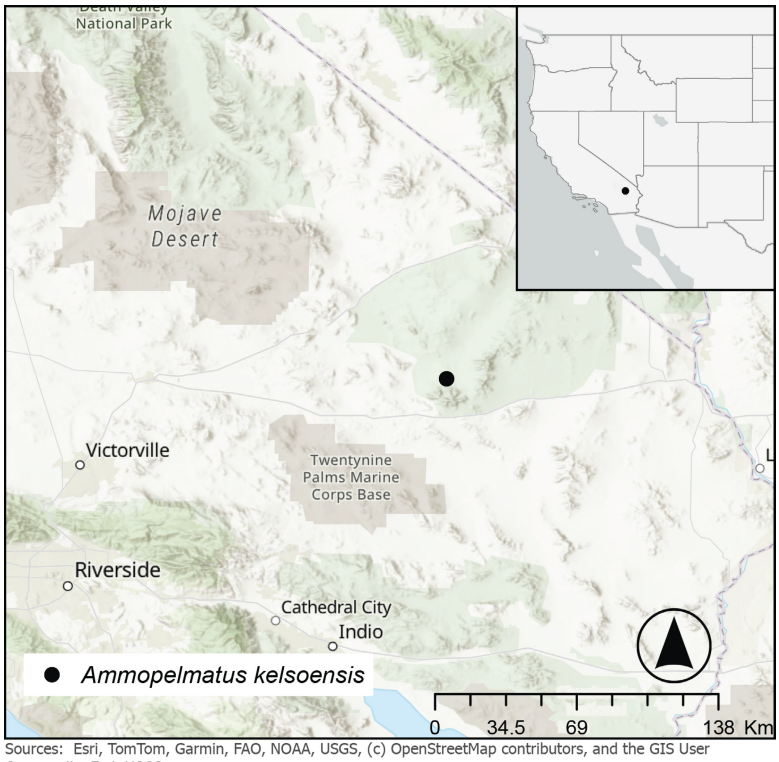


FIGURE 450. Distribution of *A. kelsoensis.*

Possible placement. "Cronise Sta. S. Bdo. Co. Calif. IV-28-1956 B.J. Adelson Coll." 1 late instar female. CAS. V.F. Lee of the CAS writes (pers. comm to DBW, 21-iv-2003):

According to USGS website, there is a "Cronise (historical) listed as a populated place and located ca. 8 mi. NE of the Afton interchange on I-15. GPS is 35.115556° -116.272500°, 332m (Cave Mountain quad). Other place names with "Cronise" (rarely also spelled Cronese) are Cronise Mountains and Cronise Valley which are, of course, in the

vicinity. It appears that the sands of the Mojave River Wash connect with the Kelso Dunes. My guess about "Cronise Station" is that it was either made up by the collector or there might be a sign hung in the town of Cronise for a restaurant, etc. Certainly, there's no evidence from USGS nor California Place Names that it is an "official" name.

There is also a Google Earth locality marked East Cronise Lake at 35.129053° -116.284289°, 328m, just north of "Cronise" and some 57 km NW of the Kelso Dunes, that looks like it could have a sand connection to the Kelso Dunes. In any case, this late instar female has 1 fore tibial spur; 7 middle leg calcars and 2 ventral spurs; and 1 inner and 1 outer rear leg tibial spines, with 2 ventral spurs. Her rear leg calcars are most consistent with *A. kelsoensis* but her 1 rear leg tibial outer spine is not consistent with either *A. kelsoensis* or *A. brockovichi*, both which almost exclusively (in 41 out of 42 specimens) have 2 outer spines. We await further information related to drum and DNA, which will require more specimens.

Recognition characters. Restricted to the Kelso Dunes, San Bernardino Co, California, and the only JC species there. A small to medium sized JC with light colored legs and body, usually minimal black abdominal stripes in females, and spatulate rear leg tibial calcars in both sexes. This was the defining character of this species, when Tinkham (1965) described it in his newly erected genus. Calling drum rate ~0.8 drums/s at 20°C. Rear leg tibia with posterior aspect of outer spine #1 flattened, and rear facing, as seen in *A. mescaleroensis*, apparently to increase propulsion through sand. Fore tibia usually with 2 ventral spurs. Rear leg tibia with 1 inner and 2 outer spines, 1 or 2 ventral spurs.

Topotypic male (Fig. 451). Collected 13-iii-1985 (S85-28, R85-24). Molt to adult 16-viii-1985. Rear leg tibia (Fig. 452) with typical 2 outer and 1 inner spine, spatulate calcars.



FIGURE 451. Topotypic (S85-28, R85-24) adult male *A. kelsoensis.* A. When alive. B. When preserved.

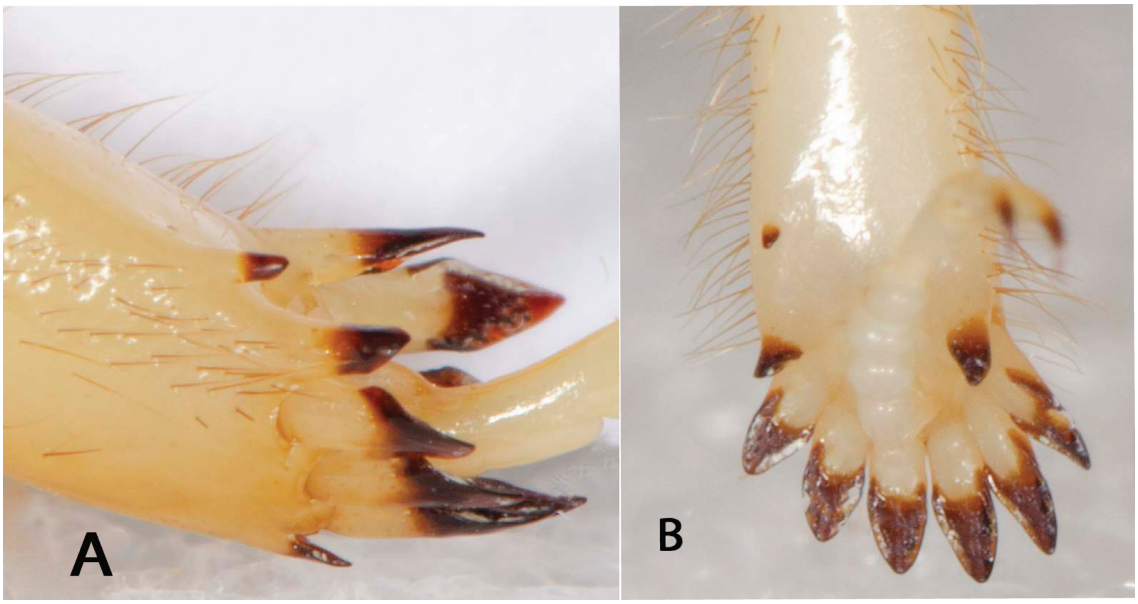


FIGURE 452. Left rear leg tibia adult male topotype *A. kelsoensis* (S85-28, R85-24). A. Showing 2 outer and 1 inner spine. B. Showing shape of calcars.

Topotypic female (Fig. 453). Collected 4-iii-1992 (S92-23, R92-84). Molt to adult 10-ix-1992. Rear leg tibia (Fig. 454) with typical 2 outer and 1 inner spine, spatulate calcars. Ovipositor Fig. 455.



FIGURE 453. Topotypic (S92-23, R92-84) adult female *A. kelsoensis.* A. When alive. B. When preserved.

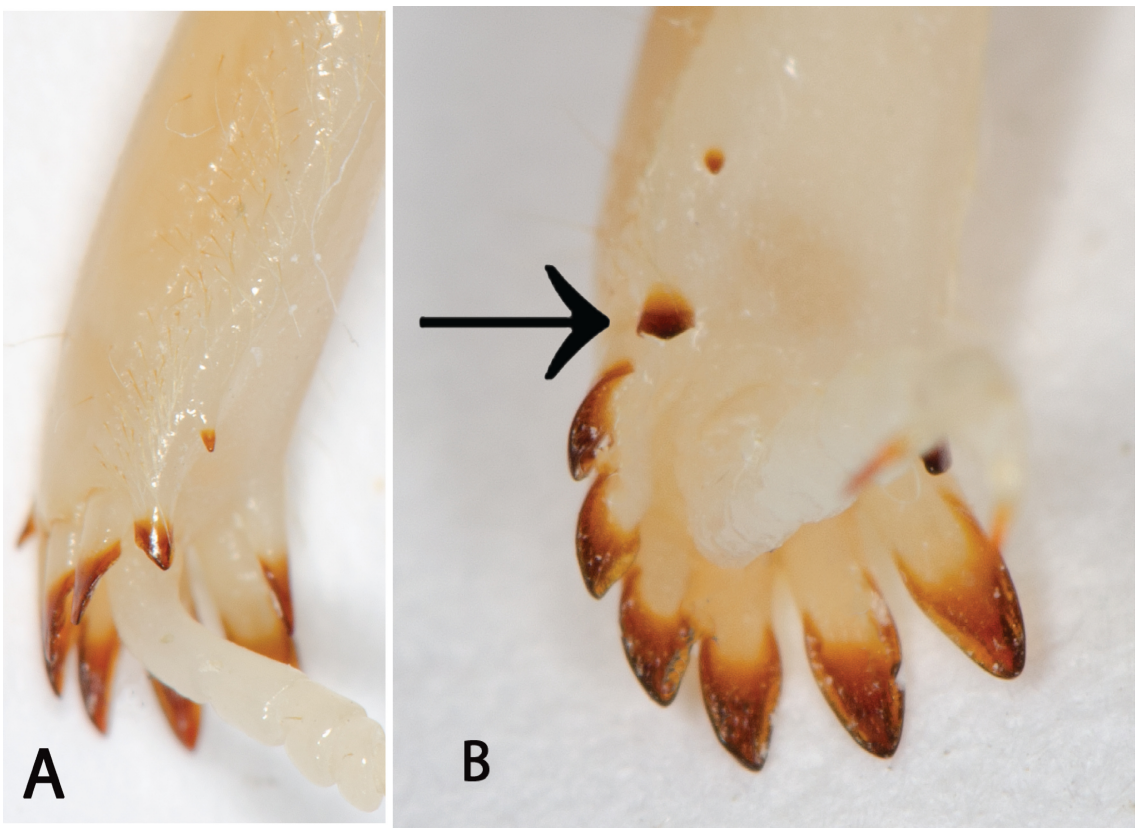


FIGURE 454. A. Left rear leg tibia adult female (S92-23, R92-84). A. Showing 2 outer and 1 inner spine. B. Showing shape of calcars. Note how outer distal spine #1 (arrow) is posteriorly flattened.



FIGURE 455. Ovipositor topotype *A. kelsoensis.*

Drum. Calling drum similar in both sexes. An adult **male** spontaneous drummed (R85-24) 8 times in 2.5 hours. His series lengths (Fig. 456) varied from 17–25 drums, delivered at a rate of 0.79–0.83 drums/second at 20°C. The interval between series varied from 4–22 minutes. A second adult male (R93-31) had 3 series recorded, each one after finger tapping performed to induce drumming. His series were irregular (Fig. 457), especially at the start, but settled into regular trills (enlarged in Fig. 458) of (1) 2–3 drums/trill, and a length of 21 trills over 28.5s (rate of 0.74 trills/s). In retrospect, we now believe that these 3 series were all sex clarification drums, even if atypical, because of the shortness and uniformity of trills: (1) all 3 series followed finger tapping; (2) males and females of *A. kelsoensis* have similar calling drums; (3) the drum rate was much faster than the rate during a calling drum; and (4) each series commenced immediately after finger tapping ceased. Unfortunately, we heard no series in response to the drumming of another adult. An adult **female** (R92-84) drummed (Fig. 459) 3 times with 19–27 drums/series at a rate of 0.87–0.92 drums/second at 20°C. A second adult female (R05-90) drummed once with 16 drums over 16.6s (0.96 drums/s) at 20.5°C.

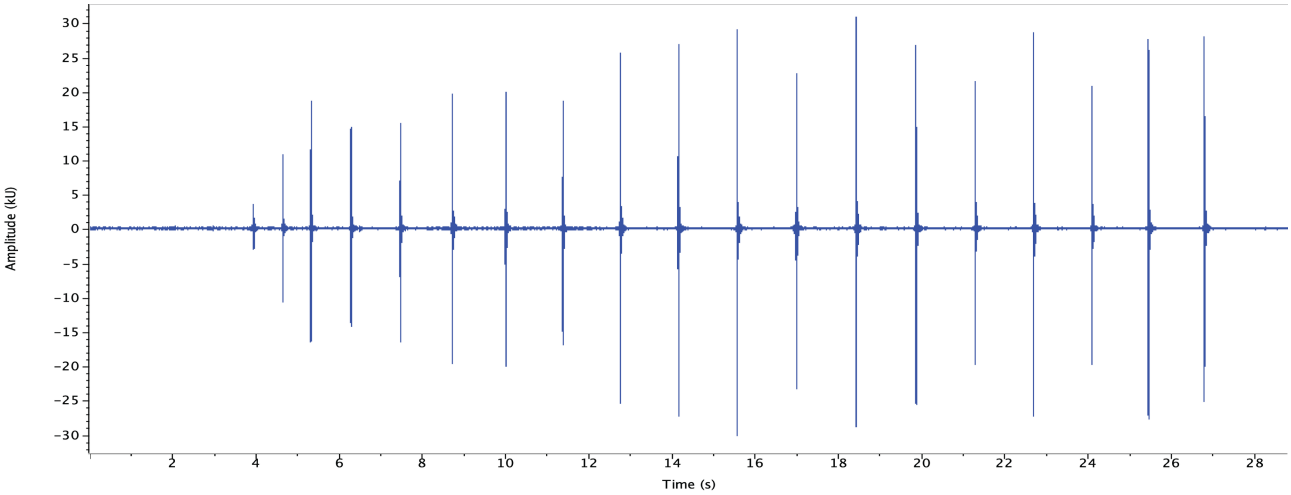


FIGURE 456. Calling drum (R85-24) type locality adult male *A. kelsoensis*, at 20°C. This series of 19 single drums in ~23s (0.8 drums/s).

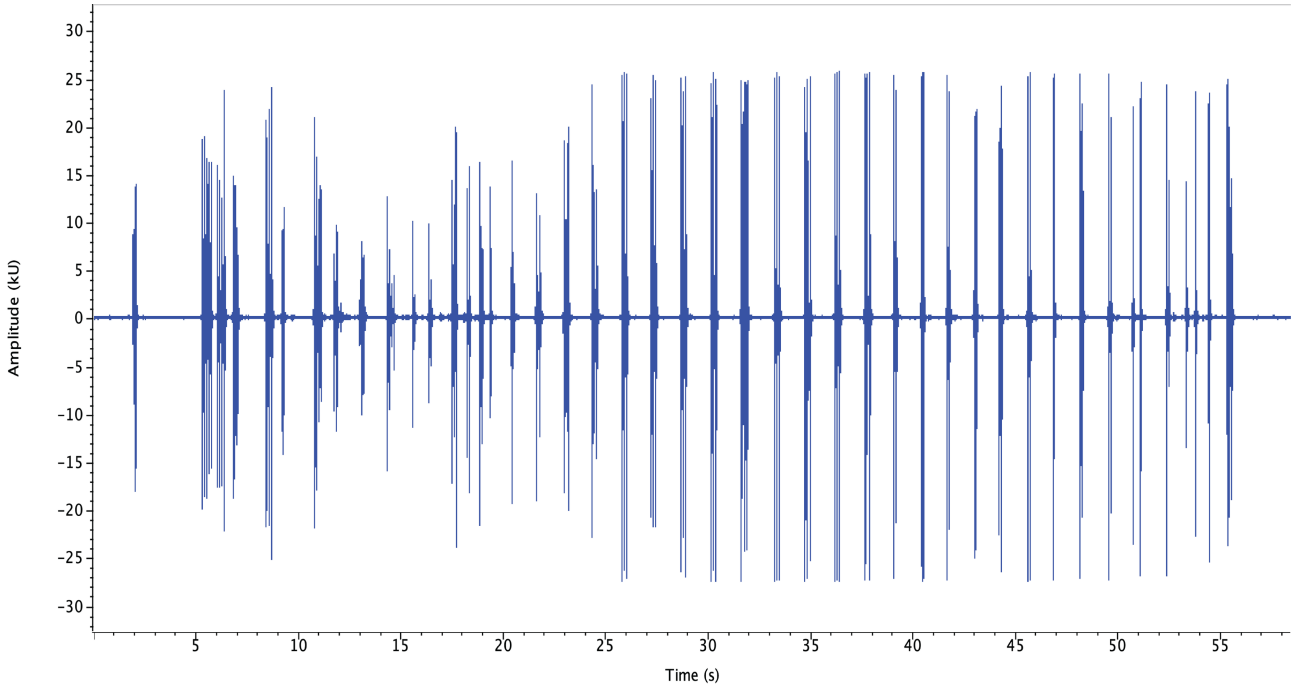


FIGURE 457. Adult male sex clarification drum (R93-31) *A. kelsoensis,* at 21°C.

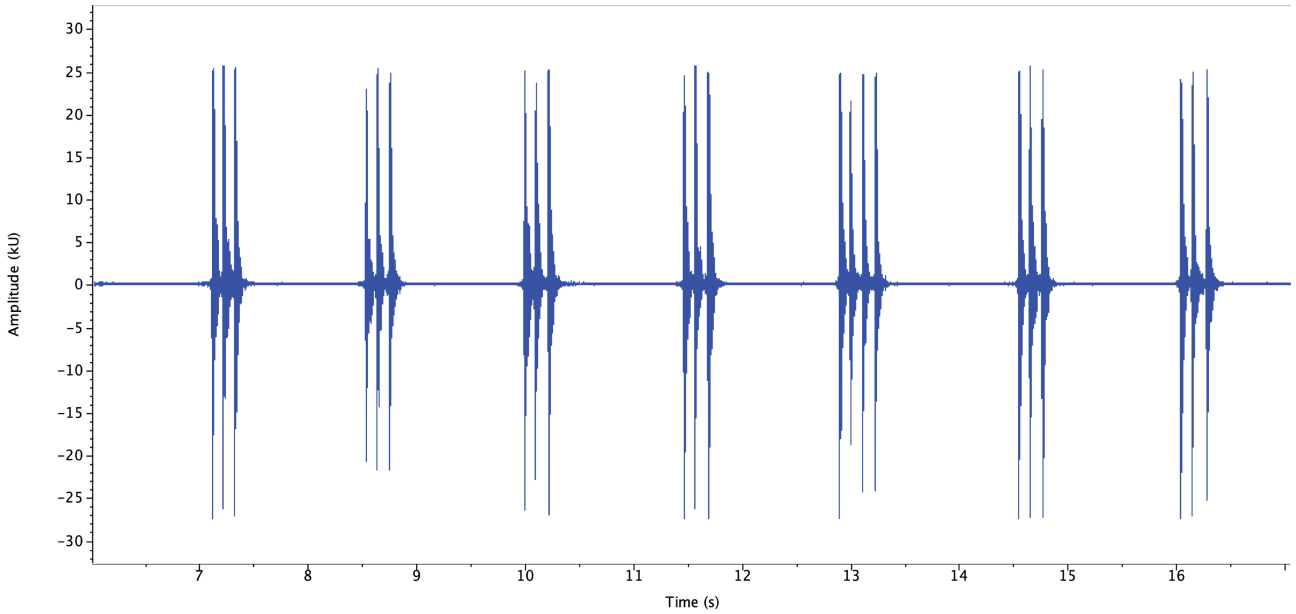


FIGURE 458. Enlarged portion of Fig. 457, adult male *A. kelsoensis,* showing that sex clarification drums are composed of 3 (4) drums/trill.

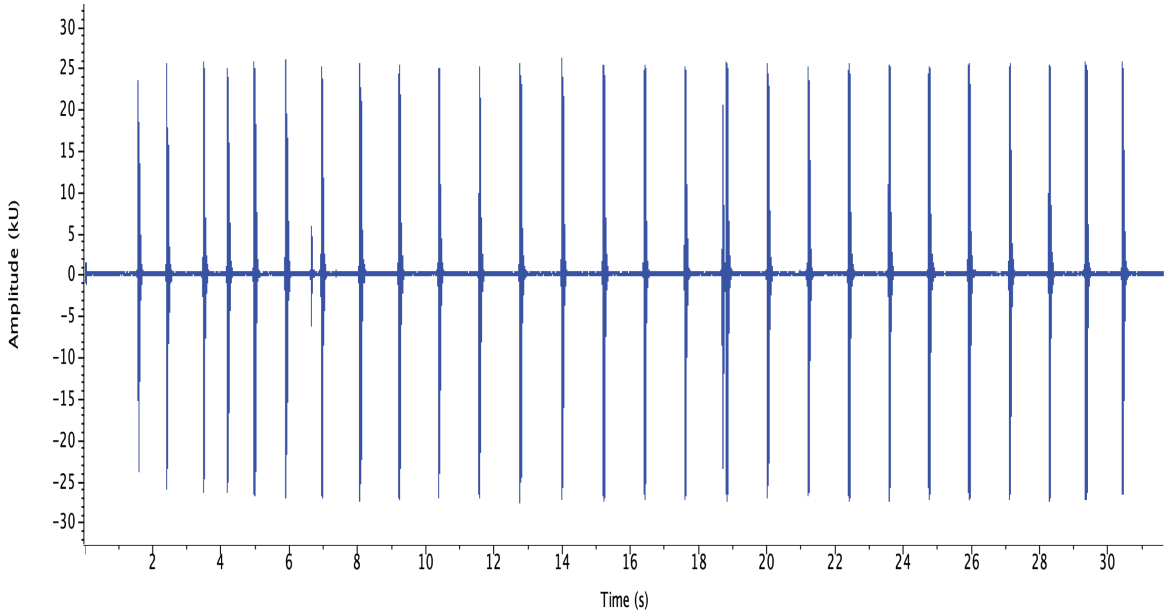


FIGURE 459. Calling drum (R92-84) of type locality (S92-23) adult female *A. kelsoensis,* at 20°C.

Derivation of name: Tinkham described this as a monotypic genus, with *Ammopelmatus* being a play on "ammophilous", which means living or growing in the sand or in dry sandy places; "pelmatus" was a continuation of the long-standing JC *Stenopelmatus* name. "kelsoensis" is for the Kelso Dunes.

Habitat. Generally associated with low, rolling sand dunes, and not on the highest, unvegetated dune areas. Our greatest success was sifting during the winter (see Fig. 3.1 in Weissman 2001a) under Basin wildrye *Leymus cinerus* (determined B. Bartholomew, CAS Botany Department) on SW-S facing 20-degree dune slopes with as much grass cover as we could find. Also, some JCs sifted from under an unidentified, leafless bush. JCs were usually as deep as where the sand just starts to get dark secondary to being moist—this varied from 5–25 cm in depth. If sand didn't get damp quickly, then no JCs were found. If shoveled sand readily passed through the 6.3 mm X 6.3 mm sifter mesh, then the sand was apparently too dry and no JCs were collected. Despite placing long oatmeal trails many times during the summer months, we had no success with this technique, although Alice Abela did get 1 adult female to an oatmeal trail on 25-v-2018.

Behavior. Field collected individuals were aggressive, readily biting. Alice Abela photographed predation (Fig. 460) by the scorpion *Paruroctonus arenicola nudipes* on an adult female JC on the Kelso Dunes on 27-iii-2016, at 34.888611° -115.720556°. She followed JC surface tracks, starting around 07:30, and then used her fingers to try and dig up the JC, but got both individuals. Chris Grinter, after dark on 28-iv-2023, at 34.8929° -115.6999°, 795m, on hard sand, encountered 2 JCs along the Kelso Dunes Trail.



FIGURE 460. Predation by scorpion on adult female *A. kelsoensis* (photo A. Abela).

Life cycle and seasonal occurrence. Tinkham (1965) gave collection data for 12 paratype females, raising the early possibility that this species might be parthenogenetic. All of his specimens appear to have been collected walking on the dune surface at night. We sifted the Kelso Dunes during the coldest, wettest part of winter and early spring, and collected almost equal numbers of male and female nymphs: S85-28, 13-iii-1985, 13 individuals, 4 as adult females, 5 male nymphs, 4 female nymphs; S86-167, 20-xii-1986, 16 individuals, 3 as adult females, 7 male nymphs, 6 female nymphs; S92-23, 4-iii-1992, 5 individuals, 3 female nymphs, 1 male nymph, 1 too small to determine; S05-16, 27-ii-2005, 1 late instar female. Clearly, the number of specimens collected fell off during the years, for unknown reasons. Whether the actual numbers in the dunes decreased is difficult to say since this species is so hard to collect, only coming close to the surface with good rainfall. But it appeared that during this period, the Basin wildrye grass, which the individuals were closely associated, also decreased in amount. In any case, Prentice *et al.* (2011) developed a survey method that could also prove useful for *A. kelsoensis* survey work.

Tinkham (1965) proposed a 4-year life cycle, from egg laying to egg laying. Our data clearly show that *A. kelsoensis* has the typical 2-year life cycle similar to most USA *Ammopelmatus*; although individuals in some high elevation taxa may require a third year. We have a simple explanation for Tinkham's anomalous findings, all attributable to the conditions under which he raised his individuals: (1) Raising JCs under conditions of no exogenous water, is against what Weissman & Lightfoot (2007) recommend; (2) feeding JCs only lettuce, and probably not even organic during the 1960s; and (3) letting ambient temperature rise and fall with outside conditions. Tinkham's residence in Indio, California, is hot Mojave Desert, and DBW doesn't recall him having AC during his 3 visits there. In fact, given his laboratory-raising conditions, we are impressed that he was able to keep any individuals alive for a sustained period.

Variation. From 11 Kelso Dunes adults, 3 had 1, and 8 had 2 **fore** leg tibial spurs; all had 7 **middle** leg tibial calcars and 2 ventral spurs; all with 1 inner and 2 outer **rear** leg tibial spines, while 4 had 1 and 7 had 2 ventral spurs. Some variation exists in the width of adult male abdominal stripes (Fig. 461A); as well as variation in overall body color of adults (Fig. 461B).

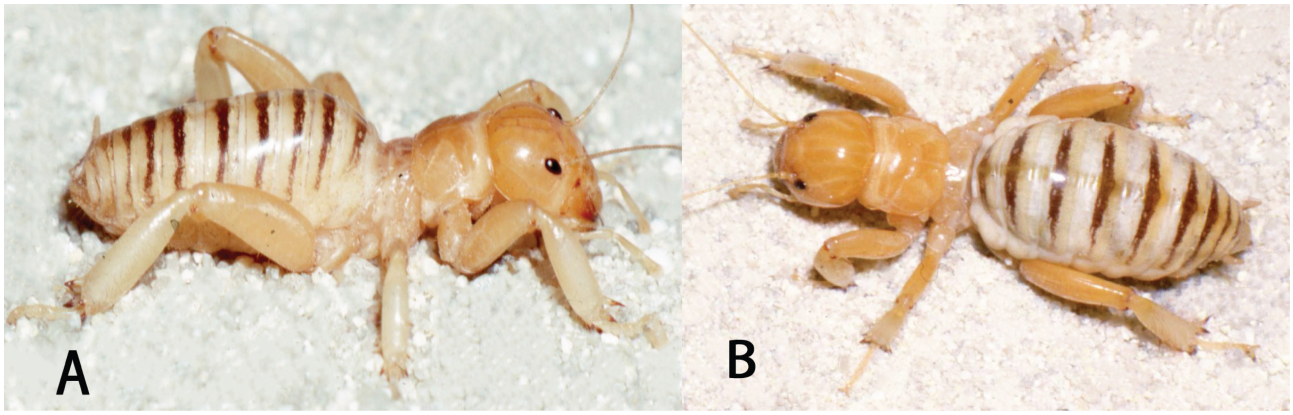


FIGURE 461. Color variation in topotypic adults of *A. kelsoensis.* A. Adult male (S92-23, R93-31) compared with Fig. 451A. B. Adult female (S85-28) compared with Fig. 453A.

Specimens examined. **CALIFORNIA, *San Bernardino Co.,*** Kelso Dunes, generally in the area around 34.8886° -115.7195°, 765m: 13-iii-1985 (S85-28) ♂1 ♀3; 20-xii-1986 (S86-167) ♀3; 4-iii-1992 (S92-23) ♂1 ♀2; 27-ii-2005 (S05-16) ♀1; 25-v-2016 (S18-5) A. Abela ♀1.

DNA. Fig. 404, p. 257. F1669 (S05-16) and F2468 (S18-5) both recovered in Group 6 Mojave Desert clade with *A. joshuatree, A. kennedymeadows,* and *A. brockovichi.*

Karyotype. Unknown.

Discussion. This taxon is the type species of the genus *Ammopelmatus.* Tinkham (1965) wrote "…if a certain species shows a marked departure from the normal spination characteristic of the genus *Stenopelmatus,* then that creature must be accorded new generic rank." There are, of course, no formal requirements as to what delimits one genus from another. Usually, it is the researcher who makes that determination based on their extensive experience with that genus. Clearly, *A. kelsoensis* has specific adaptations for its arenicolous environment. But there are other JC species, such as *A. muwu*, *A. descansodunes, A. clarki, A. davewerneri, A. joshuatree*, etc., with similarly developed

sand adapted calcars. But what influenced us the most, and why we moved all of the USA JCs into *Ammopelmatus,* were the unifying characters discussed in Weissman *et al.* (2021) showing the uniformity of *Ammopelmatus* (when compared vs *Stenopelmatus*), combined with the fact that all USA taxa, including *A. kelsoensis,* were recovered in the same clade in Vandergast *et al.* (2017). To isolate *A. kelsoensis* in a monotypic genus simply obscures the monophyletic relationship that it shares with all the other USA taxa. And combining all of the sand adapted taxa with rear leg spatulate calcars into their own genus, is also not supported by their different group affinities in the multilocus tree. Basically, if you live exclusively in sand, then you are very likely to have convergent, sand adapted morphological features, even if you have different nearest relatives. We used this same logic to also support our action (Weissman *et al.* 2021) of reclassifying the Baja California sand obligate *Viscainopelmatus* Tinkham (see p. 73) as a junior synonym of *Ammopelmatus.*

According to Wikipedia, the Kelso Dunes are thought to be some 25,000 years old, rise around 200 m above the surrounding habitat, and are part of a much larger sand transport system that originated from the Mojave River sink near Afton Canyon, to the west of the Kelso Dunes' current location. King (2004) discussed how the Kelso Dunes are one of only seven known booming dunes in the USA.

The Kelso Dunes are also the only known locality of two other orthopteran taxa described by Tinkham: the sand treader *Macrobaenetes kelsoensis* and the decticine katydid *Eremopedes kelsoensis*. We wonder if there might be some acoustical interaction between the drumming of *A. kelsoensis* and the drumming of the kangaroo rats that occurs on the Kelso Dunes, and elsewhere (Randall 2014)?

Ammopelmatus kennedymeadows **Weissman, sp. nov.**

Small Kennedy Meadows Jerusalem Cricket
Figs 462–473, Tables 9, 15

Distribution. (Fig. 462). Known from an 85 km long, mid elevation stretch along the eastern side of the Sierras between Kennedy Meadows, Tulare Co., and west of Independence, Inyo Co. As we discuss below under "Possible Placement", this taxon could extend south to Walker Pass and Red Rock Canyon. If that range extension is correct, then *A. kennedymeadows* would be known along a 150 km line on the eastern side of the Sierras.

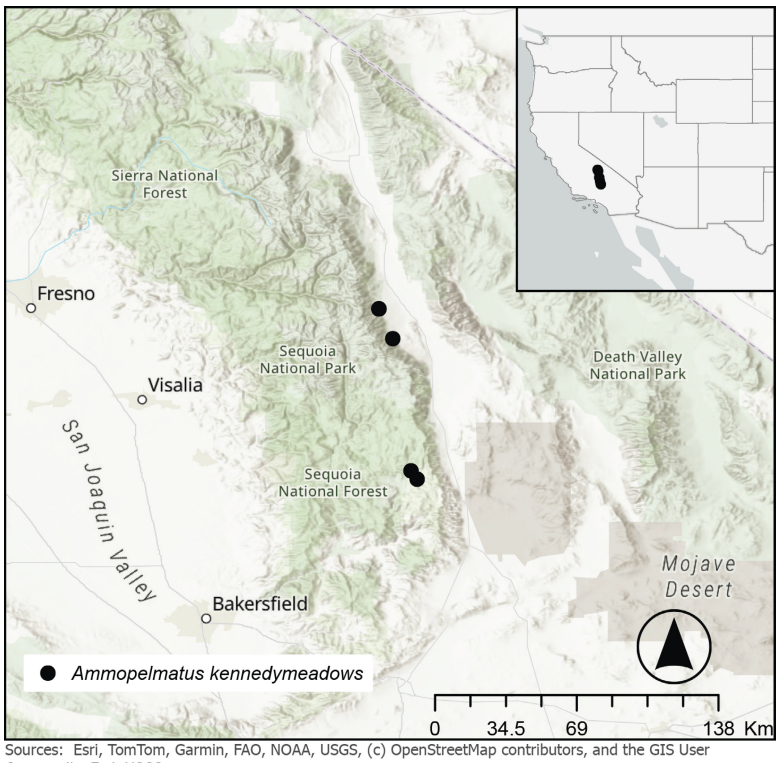


FIGURE 462. Distribution of *A. kennedymeadows.*

Recognition characters. A small, light colored, moderately fast drumming (4.2–7.7 drums/s) JC from the eastern side of the southern Sierra Nevada. Individuals typically have 2 front leg tibial spurs, 7 middle leg calcars, and 3 rear leg inner tibial spines. Male calling drum longer than females. We collected 1 adult female of *A. kennedymeadowsdos* at the type locality (S95-105) of *A. kennedymeadows*, whose DNA (F0181) matches that of an adult female (F0484) collected ~13 m SE of Kennedy Meadows (S97-28), at 1524m, in similar habitat. Both females of *A. kennedymeadowsdos* are larger than any *A. kennedymeadows* adult females with broader, darker black bands, and both have 3 fore tibial leg spurs, 8 mid leg tibial calcars, and 5 rear leg inner tibial spines. The female of *A. kennedymeadowsdos* from S97-28 drummed (R97-46, Fig. 381) at 5.0 drums/s at 21°C, and is further discussed on p. 245.

Holotype. Male (in alcohol, Fig. 463) **California, *Tulare Co.,*** Kennedy Meadows Rd, area around Kennedy Meadows, 35.982419° -118.096486°, 1957m, 13-iii-1996 (S96-8) DBW & VF Lee. R96-15, F0245. Molt to adult 9-vii-1996. Deposited CAS, Entomology type #20125. Measurements in mm: Body length 21.92, hind femur length 6.56, hind femur width 2.65. Fore leg tibia with 1 or 2 ventral spurs; middle leg tibia with 7 calcars, 1 ventral spur; hind leg tibia (Fig. 464) with 3 inner and 2 or 3 outer spines, 2 ventral spurs.



FIGURE 463. Adult male holotype *A. kennedymeadows.* A. When alive. B. When preserved.

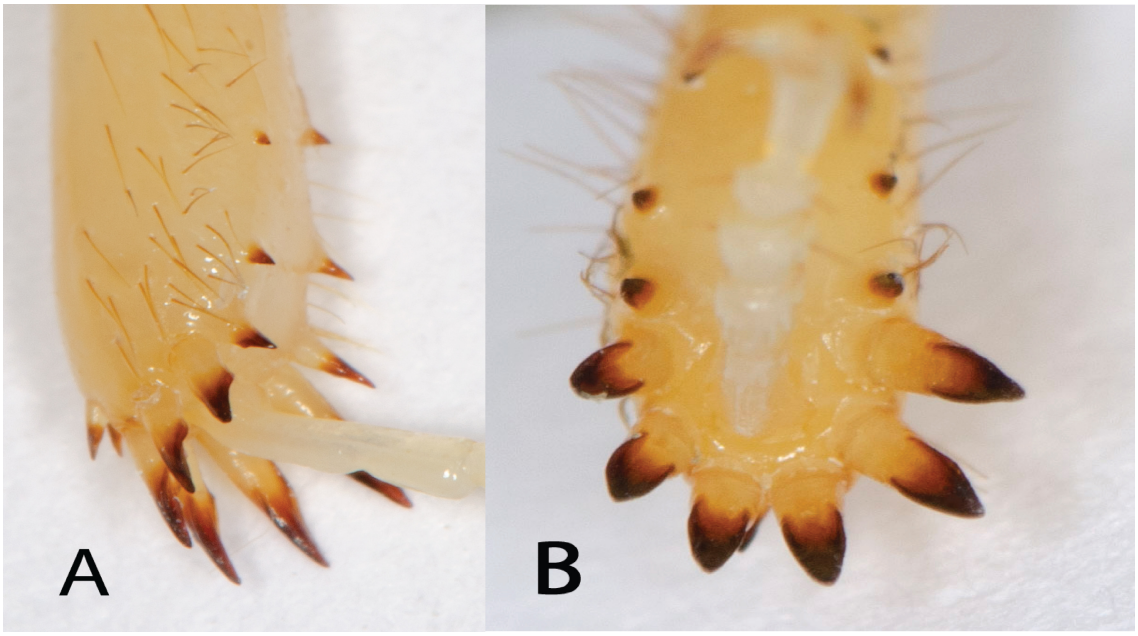


FIGURE 464. Left rear leg tibia adult male holotype *A. kennedymeadows.* A. Showing 3 inner and 3 outer tibial spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 465). **CALIFORNIA, *Tulare Co.,*** Kennedy Meadows General Store, 36.018930° -118.123369°, 1876m, 7-x-1995 (S95-106) DBW & VF Lee. R96-45, F0263. Molt to adult 3-viii-1996. Deposited CAS, CASENT #9084031. Measurements in mm: Body length 28.1, hind femur length 7.88, hind femur width 2.96. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 466) with 1 or 2 inner and 2 outer spines, 2 ventral spurs. Ovipositor Fig. 467.

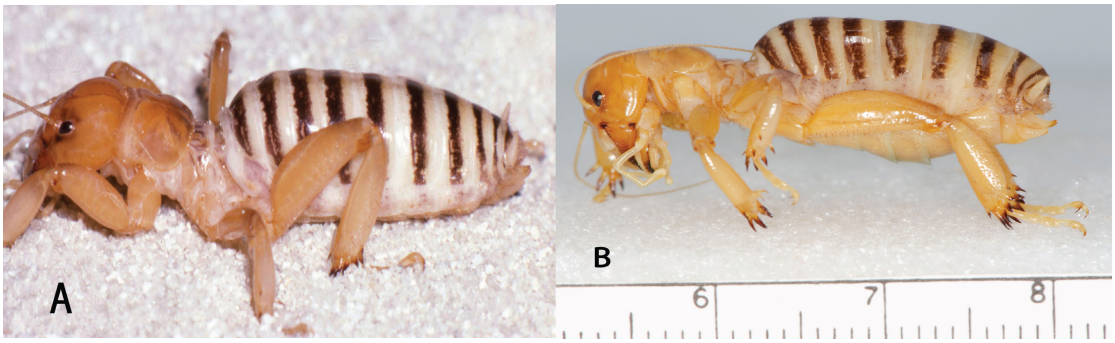


FIGURE 465. Adult female allotype *A. kennedymeadows.* A. When alive. B. When preserved.



FIGURE 466. Left rear leg tibia allotype adult female *A. kennedymeadows.* A. Showing 2 outer and 2 inner spines. B. Showing shape of calcars.



FIGURE 467. Ovipositor allotype *A. kennedymeadows.*

Paratypes. ♂10 ♀43. **CALIFORNIA, *Inyo Co.,*** Whitney Portal Road 8 m W Lone Pine, 36.597235° -118.203183°, 1976m, 29-viii-2005 (S05-104) ♀1. Onion Valley Rd 4.3 m W Independence, then 3.6 m S on Foothill Rd, 36.727642° -118.263703°, 1788m, 23-iii-1993 (S93-13) ♂2 ♀2; 17-iii-1996 (S96-15) ♂2 ♀15. ***Tulare Co.,*** Type locality, 7-x-1995 (S95-105) ♂1 ♀3; 13-iii-1996 (S96-8) ♂5 ♀21. Allotype locality, 7-x-1995 (S95-106) ♀1.

Possible placement. ***Kern Co.,*** Dove Springs, drainage area just W Red Rock Canyon State Park, 35.412668° -117.984044°, 944m, 20-vi-2003 (S03-78) D. Clark ♀2. Red Rock Canyon State Park, north boundary, 35.380102° -117.960689°, 800m, 3-iii-1992 (S92-25) ♀1, under *Atriplex*. Walker Pass, 35.67759° -118.04449°, 1442m, early March, 2014 (S14-12) T. Papenfuss, J. Parham, ♀1, under legless lizard cardboard. Unfortunately, as expected, since they were collected as adults, none of these 4 females drummed. That void, coupled with the absence of adult males, leaves us unable to make a definitive identification. On the other hand, legs from both Red Rock Canyon (F1349) and Walker Pass (F2387) were recovered in a clade with *A. kennedymeadows,* which they could be given their small size, similar habitats and elevation, coupled with their similar spine and calcar patterns (see Table 15). Walker Pass is 35 air km directly south of the type locality of *A. kennedymeadows.*

Drum. Calling drums similar in both sexes except, notably, usually longer in males. **Male:** Holotype (R96-15) had (Fig. 468) 84 drums in 12.6s (6.7 drums/s) at 19°C. **Female:** Allotype (R96-45) had (Fig. 469) 23 drums in 3.4s (6.8 drums/s) at 20.5°C. There may be a north-south cline in drumming rate: 4 males from the most northern area, west of Independence (S93-13 and S96-15), drummed between 4.3 and 5.1 drums/s at 20°C; while 5 females from there drummed between 4 and 5 drums/s at 20°C. The lone adult female from intermediate locality Whitney Portal (S05-104) drummed (R05-46) 29 times in 6.1s (4.8 drums/s) at 20°C. Seven males from the southernmost, type locality (S95-106 and S96-8) drummed 5.7 to 7.0 drums/s at 20°C; while 15 females from there drummed 5.5 to 7.7 drums/s at 20°C. We wonder if this could be a situation of character displacement related to the sympatric occurrence of *A. kennedymeadowsdos* (see p. 244), at the type locality, where the latter drums around 5 drums/s at 20°C?

Derivation of name. Named for the general area where the type series was collected.

Habitat. Type locality is open pinyon pine with rabbitbrush and sagebrush; at Independence site, JCs under rocks on open slopes with bitterbrush and sagebrush.

Life cycle and seasonal occurrence. Probably 2-year life cycle but 1 small female nymph collected on 7-x-1995 (S95-106) molted to adult 22-vii-1998.

Variation. Of 54 individuals, 2 had 1 and 52 had 2 ventral **fore** leg tibial spurs; 1 had 6, 52 had 7 and 1 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 1, 13 had 2, and 40 had 3 inner **rear** leg tibial spines, while 42 had 2, 10 had 3, and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

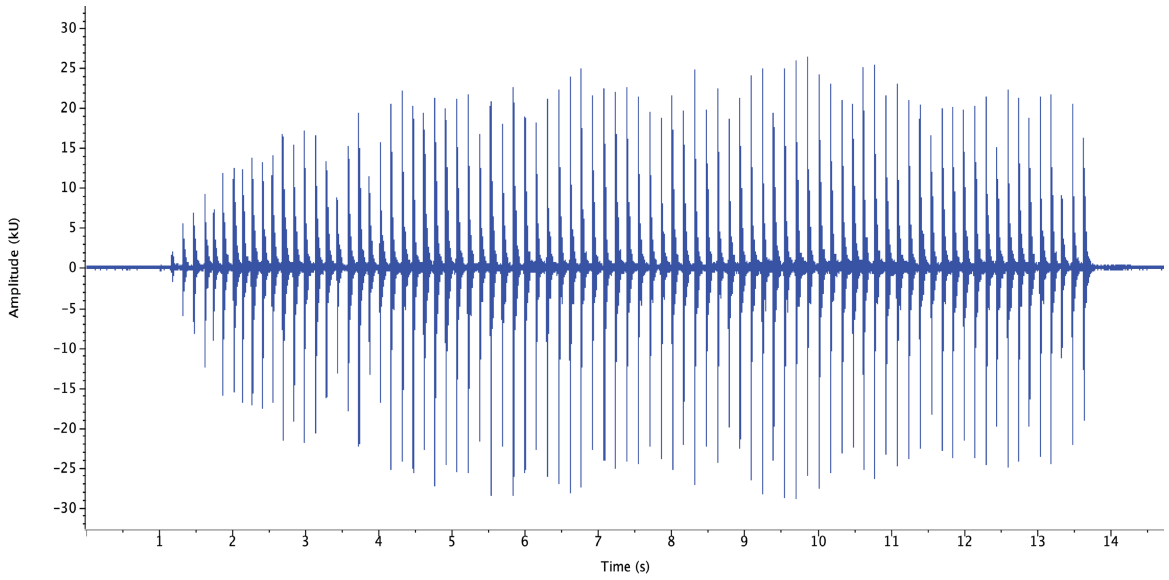


FIGURE 468. Calling drum (R96-15) adult male holotype *A. kennedymeadows.*

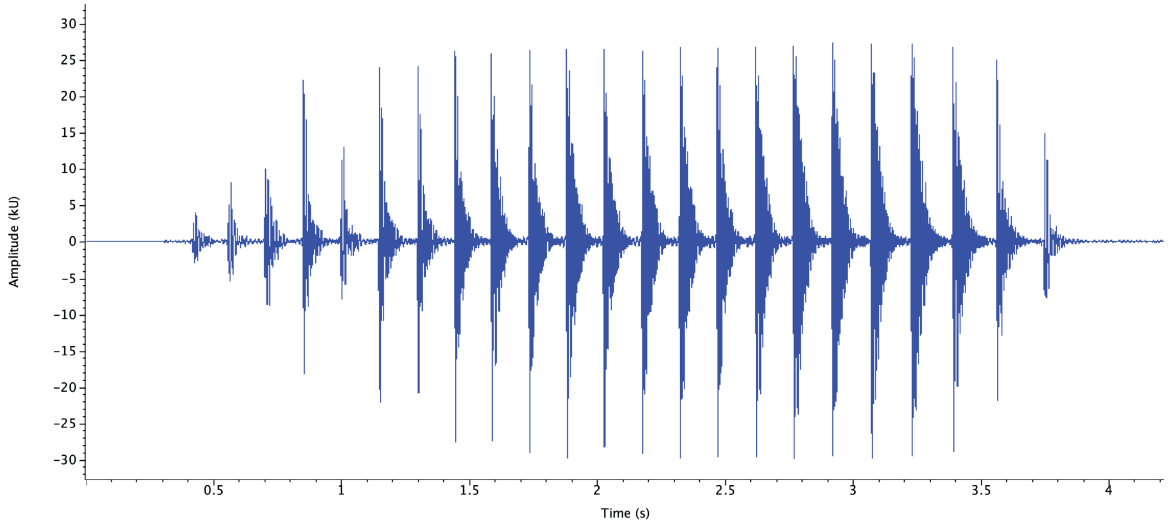


FIGURE 469. Calling drum (R96-45) adult female allotype *A. kennedymeadows.*

DNA. Fig. 404, p. 257. F0218 (type locality S96-08); F0313 (S96-15, Independence); F1349 (S03-78, Red Rock Canyon); and F2387 (S14-12, Walker Pass) recovered in same clade as *A. brockovichi* and *A. kelsoensis.*

Karyotype. 2n♂=25. Two type locality (S96-8) males (T96-12, Fig. 470, and T96-13 (Fig. 471); and 2 Independence males (T93-22, S93-13, Fig. 472, and T96-3, S96-15, Fig. 473) determined, and all identical: 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

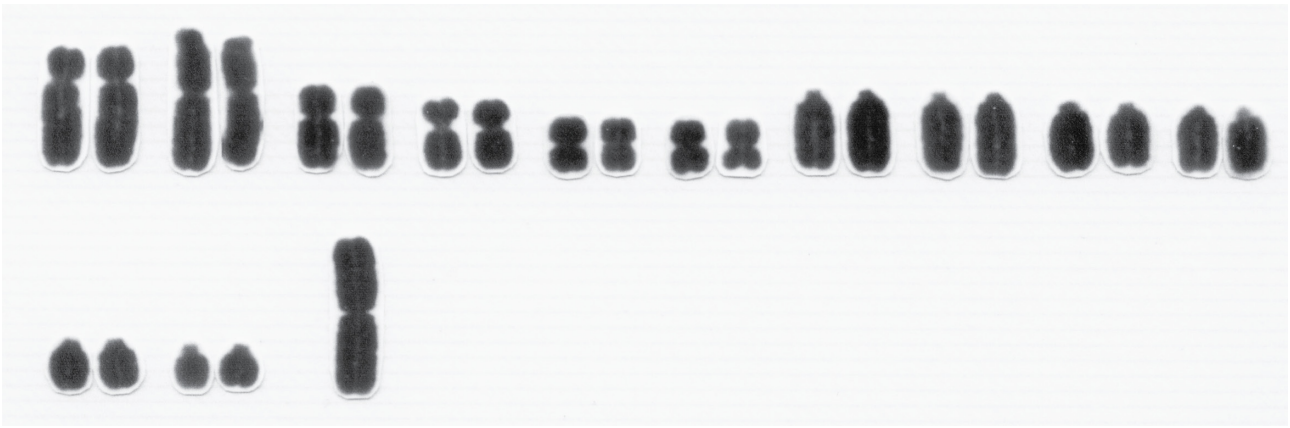


FIGURE 470. Idiogram T96-12 *A. kennedymeadows* (S96-8).



FIGURE 471. Idiogram T96-13 *A. kennedymeadows* (S96-8).



FIGURE 472. Idiogram T93-22 *A. kennedymeadows* (S93-13).

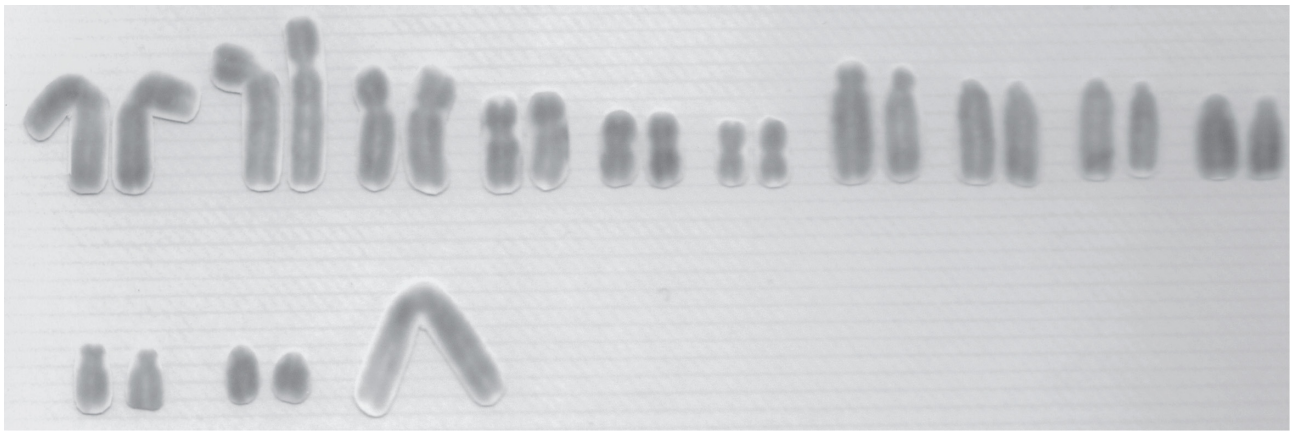


FIGURE 473. Idiogram T96-3 *A. kennedymeadows* (S96-15).

Discussion. When we collected the type locality on 13-iii-1996, it was actively snowing with 1–2 cm of snow on the ground. That day we collected 6 adult females, 3 late instars, 4 mid instars, and 1 small nymph under small rocks in an area we had collected the previous year (S95-105). We returned to this site 4 days later, on 17-iii-1996, after 2 or 3 warm days, and in the same area, in the absence of snow, collected another 4 adult females, 6 late instars, and 5 mid instars.

This is one of few species where the male's calling drum is longer than the females, and may indicate that females do the searching instead of the more typically postulated males (Weissman 2001b).

***Ammopelmatus piute* Weissman, sp. nov.**
Piute Mountains Jerusalem Cricket
Figs 474–478, Table 2

Distribution. (Fig. 474). Known only from the Piute Mountains, Kern County, California.

Recognition characters. By DNA, a member of the Mojave Desert Group, although the type locality is located at the western edge of the Mojave Desert. Large, medium fast drumming (5.2–5.9 drums/s) JC recovered in a clade with faster drumming *A. coyflat* (7.7–9.9 drums/s) and slower drumming *A. crypticus* (3.1–4.0 drums/s).

Holotype. Female (in alcohol, Fig. 475) **California, *Kern Co,*** Piute Mts, Lander's Campground, 35.455809° -118.320957°, 1882m, 24-x-2015 (S15-122) R. Lepe. R16-2, F2458. Molt to adult 19-viii-2016. Deposited CAS, Entomology type # 20386. Measurements in mm: Body length 52.37, hind femur length 13.41, hind femur width

4.92. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 476) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 477.

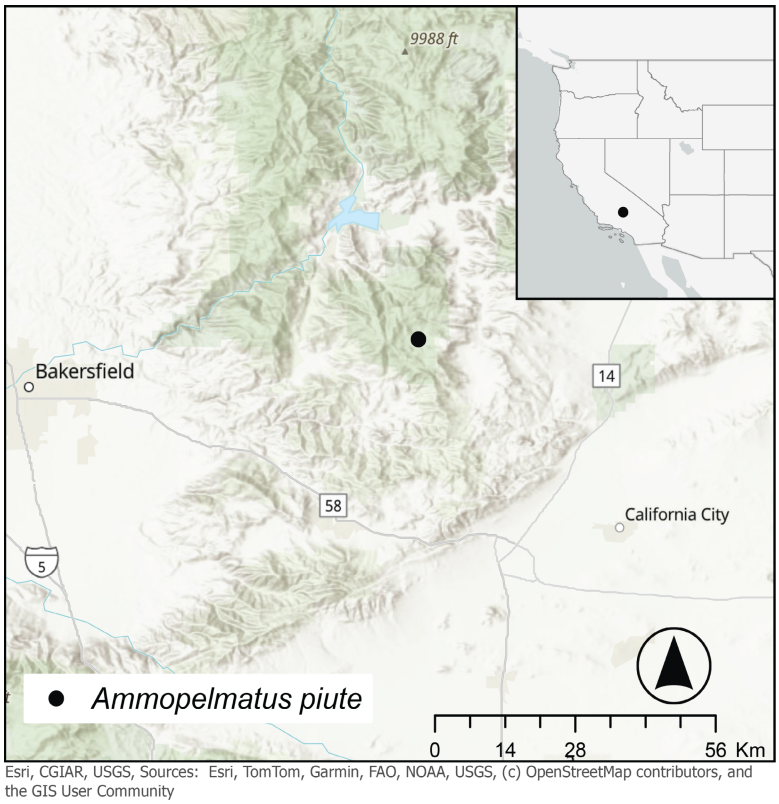


FIGURE 474. Distribution of *A. piute.*



FIGURE 475. Preserved adult female holotype *A. piute.*



FIGURE 476. Left rear leg tibia holotype adult female *A. piute.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 477. Ovipositor holotype *A. piute.*

Male. Unknown
Paratypes. None
Drum. R16-2 (Fig. 478) shows 5.2–5.9 drums/s at 21°C.

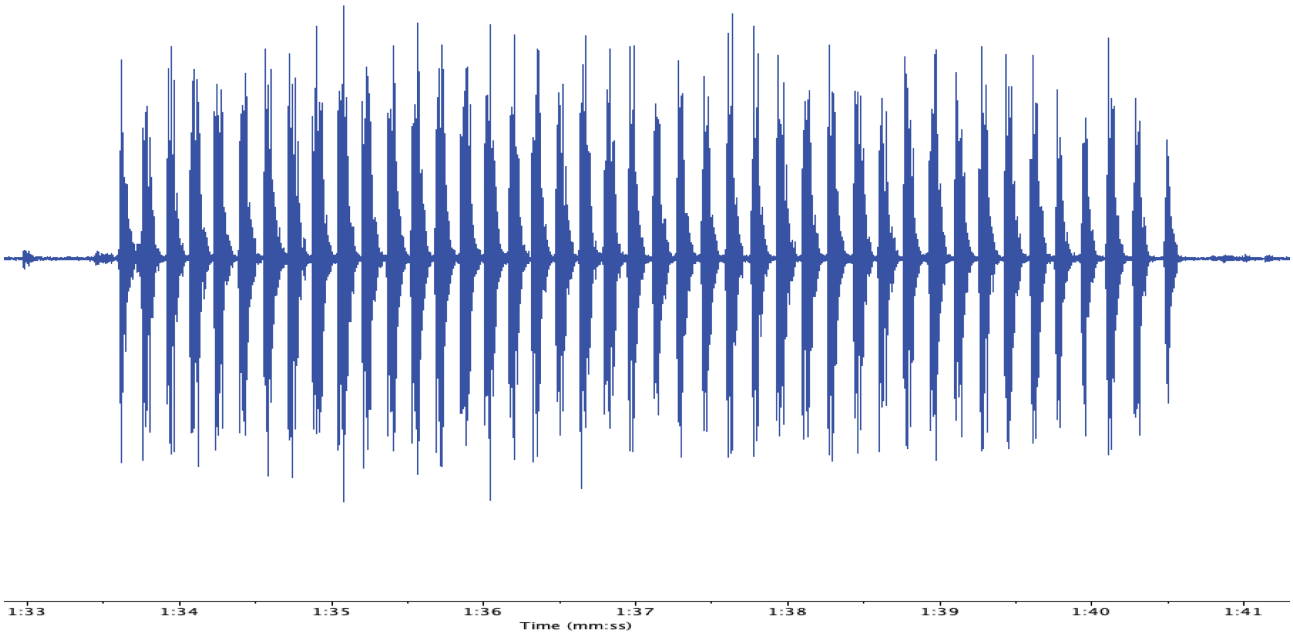


FIGURE 478. Calling drum (R16-2) holotype adult female *A. piute.*

Derivation of name. Named in reference to the only known mountain range where they occur.

Habitat. Open pine forest. Holotype under log during daytime.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Type only known individual.

DNA. Fig. 404, p. 257. F2458 recovered in Group 6 Mojave Desert, in a subclade with *A. coyflat* and *A. crypticus.*

Karyotype. Unknown.

Discussion. On the night the type female was collected, Rigo Lepe reported seeing several other individuals walking around the campground area.

(CLADE 6) Composed of 2 groups: Group 7, Springville Group (Fig. 479)

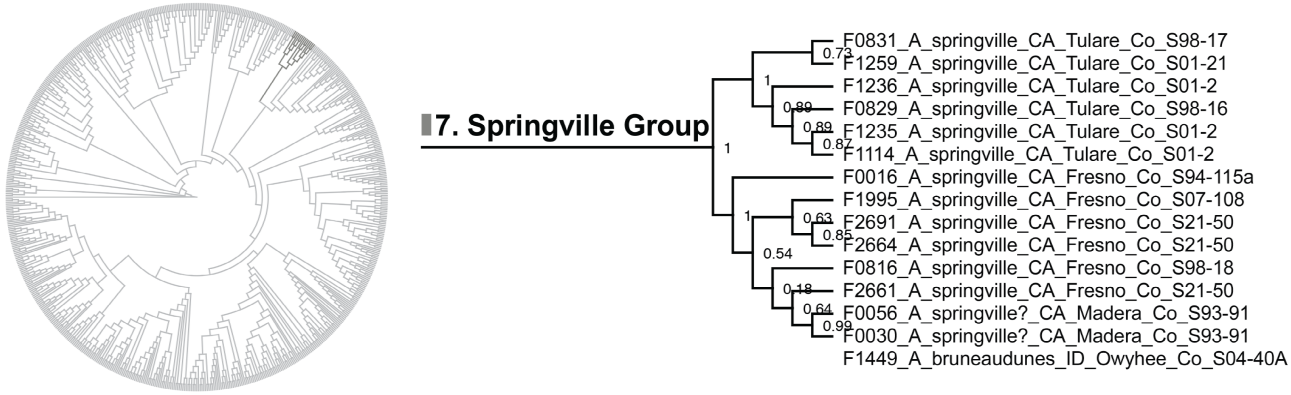


FIGURE 479. ASTRAL tree for Springville Group.

This Group is represented by a single California San Joaquin Valley taxon, but with an unresolved, possibly cryptic sister species to the east of the Central Valley in the Sierra foothills.

SPECIES WRITE UP: *A. springville* (p. 297).

***Ammopelmatus springville* Weissman, sp. nov.**
Central Valley Jerusalem Cricket
Figs 480–495, Tables 1, 9, 14

Distribution. (Fig. 480). Known only from contiguous Fresno and Tulare Counties, on the floor of the San Joaquin Valley, California. Specimens from the contiguous Madera County-Sierra Nevada foothills are discussed below under "*Questionable placement*".

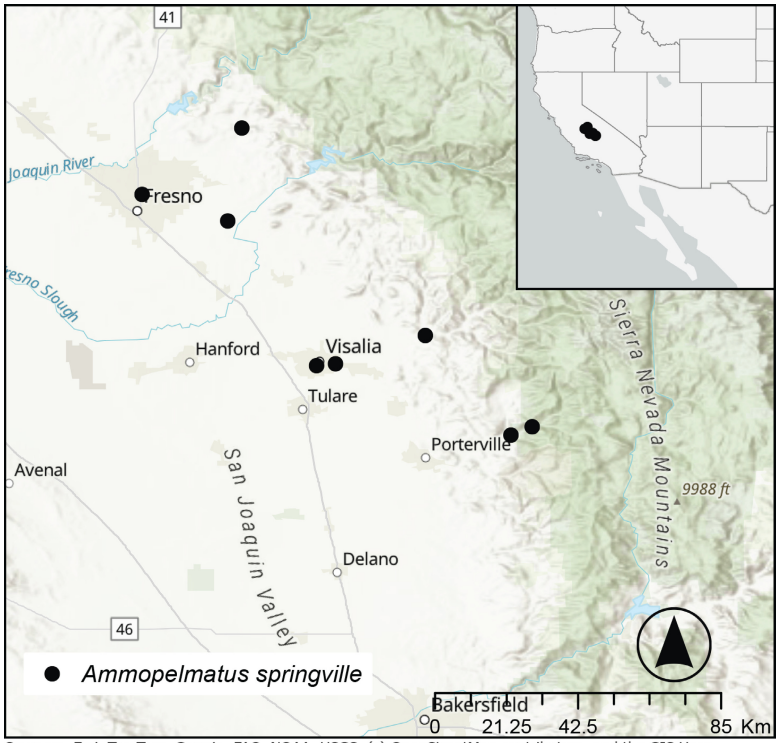


FIGURE 480. Distribution of *A. springville.*

Recognition characters. Medium to medium-large JC with rear leg tibial calcar #1 (and sometimes calcar #2) usually completely dark and broad, calling drum around 3.5 drums/s, males with a sex clarification drum (SCD), 2n♂=25. Rear leg inner tibia spines #2 and #3 frequently longer, and with a broader base, than most distal inner spine #1, the latter which is frequently the longest in other JC species. Distinguished from *A. smithi*, to the south, by DNA, longer ovipositor, and not broadened calcar #1. Distinguished from *A. coyflat,* at higher elevation to the east, by DNA and faster drum rate. Distinguished from *A. rentzi*, to the north, by drum and DNA. Distinguished from *A. pictus*, to the west, by drum and absence of head stripes. *A. springville* is found in similar habitat and at a similar elevation as *A. glennville,* but they differ in DNA and male rear leg ringlet calcar #1 and #2 being less broad in *A. glennville*.

There are two unresolved issues dealing with the species' boundary in *A. springville.* (1) Astral analysis indicates that two sister subclades exit: those individuals from more southern Tulare Co. (including the type locality); vs those specimens from more northern Fresno and Madera Counties. (2) Similar appearing specimens, listed and discussed in "*Questionable placement*" below, with DNA recovered in both subclades of *A. springville,* were collected at 4 localities in the Sierra foothills to the east of the San Joaquin Valley, between 499 and 1439 m elevation, but with drums that are faster than Valley floor *A. springville.* Because specimens from both "issues" (1) and (2) are intermingled in the tree, we consider them all conspecific; although Sierra foothill specimens are not considered paratypes.

Holotype. Male (in alcohol, Fig. 481). **California, *Tulare Co.,*** Hwy 190, ~5 km E Springville, 36.13333723° -118.788056°, 363m, 23-ii-2001 (S01-2) DBW, VF Lee. R01-94, F1211. Molt to adult 11-ix-2001. Deposited CAS, Entomology type #20202. Measurements in mm: Body length 32.13, hind femur length 11.19, hind femur width 4.04. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 482) with 5 inner and 3 outer spines, 2 ventral spurs. Inner rear leg tibial spine #1 longest.

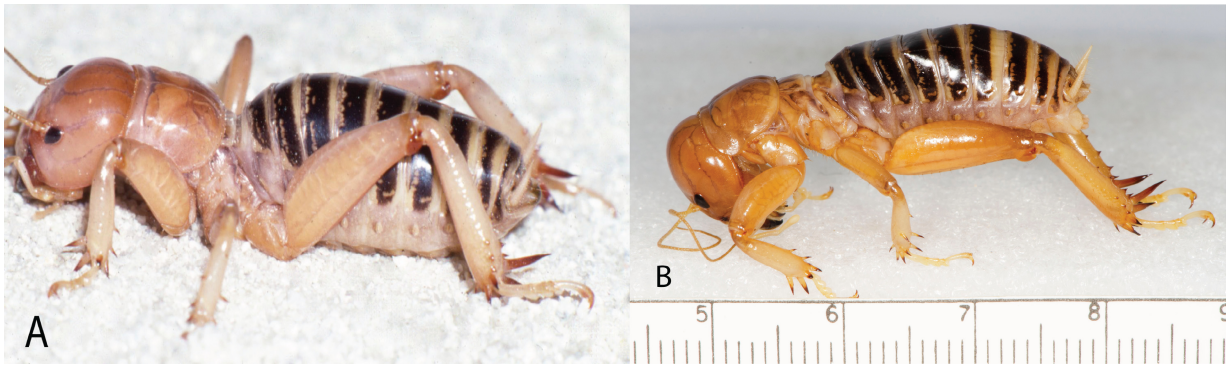


FIGURE 481. Adult male holotype *A. springville.* A. When alive. B. When preserved.

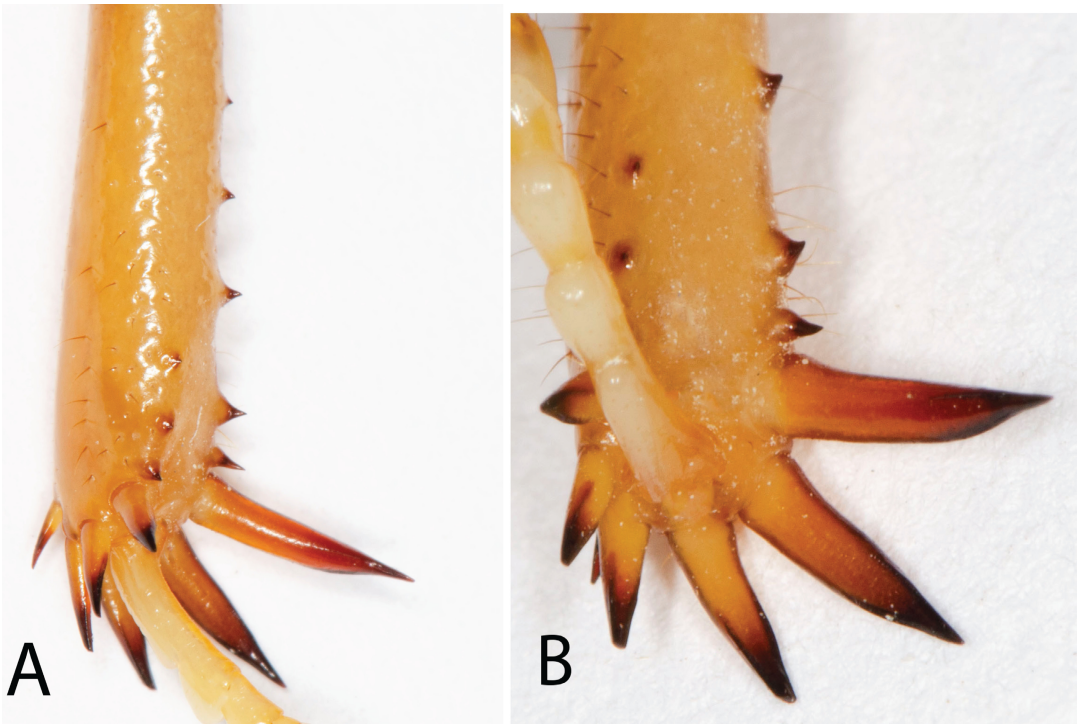


FIGURE 482. Rear left leg tibia adult male holotype *A. springville.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 483). Same data as holotype except R01-120, F1236. Molt to adult 10-x-2001. Deposited CAS, CASENT #9078772. Measurements in mm: Body length 31.92, hind femur length 9.87, hind femur width 3.42. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 484) with 5 inner and 4 outer spines, 2 ventral spurs. Inner rear leg tibial spine #2 longest. Ovipositor Fig. 485.

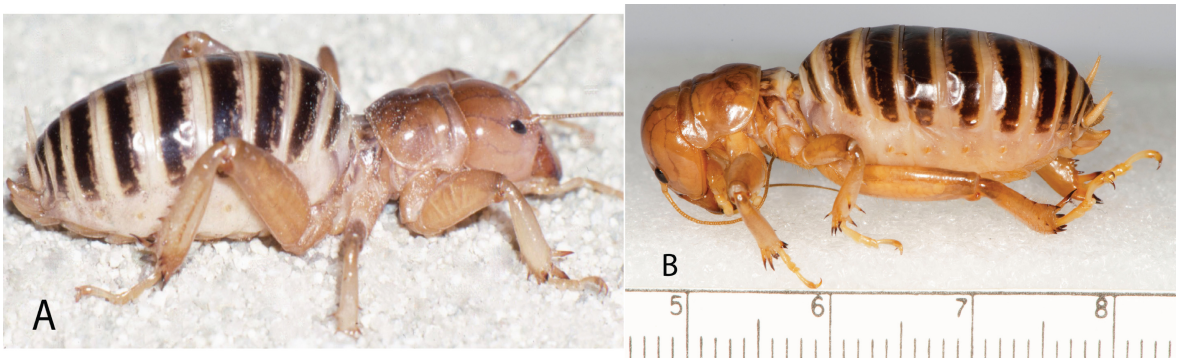


FIGURE 483. Adult female allotype *A. springville.* A. When alive. B. When preserved.

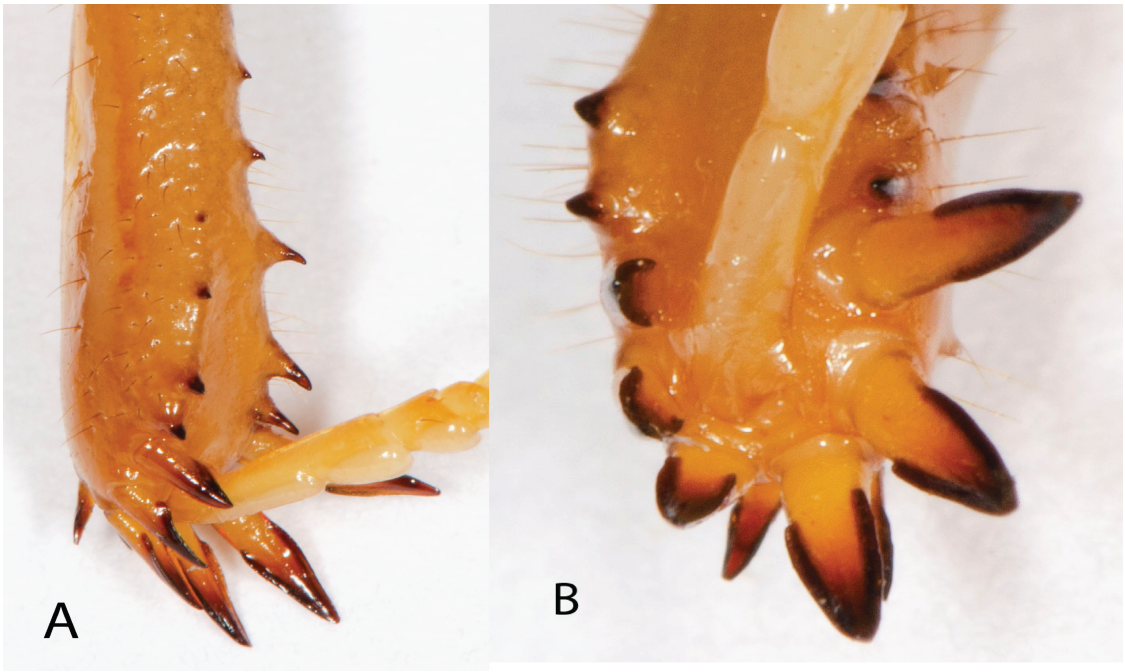


FIGURE 484. Left rear leg tibia adult female allotype *A. springville.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 485. Ovipositor allotype *A. springville*.

Paratypes. ♂24 ♀54. **CALIFORNIA, *Fresno Co.,*** East Sanger, 36.7051° -119.5443°, 115m, 9-xii-1994 (S94-115) J. Jones ♂3 ♀1. Fresno, 36.776° -119.773°, 110m, 19-xi-2007 (S07-108) L. DeFehr ♂1. Sanger River bed bottom, 4-x-2000 (S00-60) J. Jones ♀1. Hwy 168 5.9 m NE Academy at junction of Toll House Rd and Millerton, 36.953208° -119.506733°, 239m, 14-xii-1983 (S83-159) NJ Smith ♀5; 22-xii-1983 (S83-162) ♂2 ♀9; 18-xii-1986 (S86-163) ♂2 ♀3; 18-xii-1992 (S92-138) ♂2 ♀6; 14-iii-1998 (S98-18) ♂4 ♀6. ***Tulare Co.,*** type locality, same data, (S01-2) ♂3 ♀4. Hwy 190, 9.2m W Pierpoint Springs, 36.155530° -118.731413°, 650m, 4-v-2003 (S03-29) ♂1. Visalia, 250’ 13-x-1996 (S96-86) J. Brigman ♀1. Visalia, 1428 W Howard Ave, 36.318723° -119.307143°, 100m, 8-xii-2003, K. Kirkpatrick ♀1. Visalia, 745 S Vista, 36.323647° -119.256576°, 105m, all N. Cross, 3-xii-1998 (S98-111) ♂1; 3-v-2000 (S00-6) ♀1; 21-vi-2000 (S00-17) ♂1 ♀1; 2-iv-16-v-2001 (S01-21) ♀12. Hwy 198, 2m NE Lemon Cove, 36.399348° -119.016727°, 154m, 14-iii-1998 (S98-16) ♂4 ♀3.

Probable placement. **CALIFORNIA, *Fresno Co.,*** Friant Dam, 37.00078° -119.70486°, 169m, 27-ii-1985 (S85-36), N. Smith ♂1 ♀2. This male drummed (R85-4) at 4.5 drums/s at 18°C. While this drum rate is fast for *A. springville*, and we have no material for genetic comparison, his collection at low elevation on the Central Valley floor is most consistent with *A. springville.*

Questionable placement. Individuals from the following 4 localities are recovered in the same Group 7 clade as *A. springville.* Nevertheless, their faster drum rate raises the possibility of an unrecognized, cryptic sister taxon restricted to the higher elevation foothills of the Sierra Nevada, all to the east of lower elevation Central Valley *A. springville.* **CALIFORNIA, *Fresno Co.,*** Bretz Mill Campground, 37.039237° -119.240244°, 1010m, 15-17-x-2021 (S21-50) A. Abela ♂4 ♀2. A male drummed (R21-19, F2664) at 5.3 drums/s at 20.8°C; while 2 females drummed at 6.8–7.3 drums/s (R22-31, F2691); and 6.5 drums/s (R22-36), both at 22.1°C. ***Madera Co.,*** Coarsegold, 5 m SW at 43315 Ranger Circle Dr, 37.204267° -119.752931°, 499m, all WH Tyson, early xi-1993 (S93-86) ♂1 ♀1; 4-15-xii-1993 (S93-91, Fig. 486) ♂2 ♀5; 9-xii-1994 (S94-116) ♂1 for testes (T95-7, see below) ♀1. Male drummed (R94-92) 5.8 drums/s at 20°C, and also had a SCD; second male drummed (R94-97) 5.8 drums/s at 20°C; female drummed (R95-1) 4.4 drums/s at 14°C. ***Tulare Co.,*** Johnsondale, 35.974722° -118.540000°, 1439m, 14-v-1986 (S86-25) N. Smith, D. Haines ♂1 ♀1. Male drummed (R86-21) at 4.4–4.6 drums/s at 19°C, and also had a SCD; female drummed (R86-18) at 5–5.3 drums/s at 19.5°C. Sequoia National Park 11.2 m NE Ash Mountain Entrance, 36.542854° -118.782988°, 1437m, 14-iii-1998 (S98-17) ♂2. One male drummed (R98-187, F0832) at 4.6 drums/s at 15°C; and later drummed (R98-204) at 4.4–4.7 drums/s at 20.5°C. The second male drummed (R98-190, F0831) at 4.7 drums/s at 16°C.

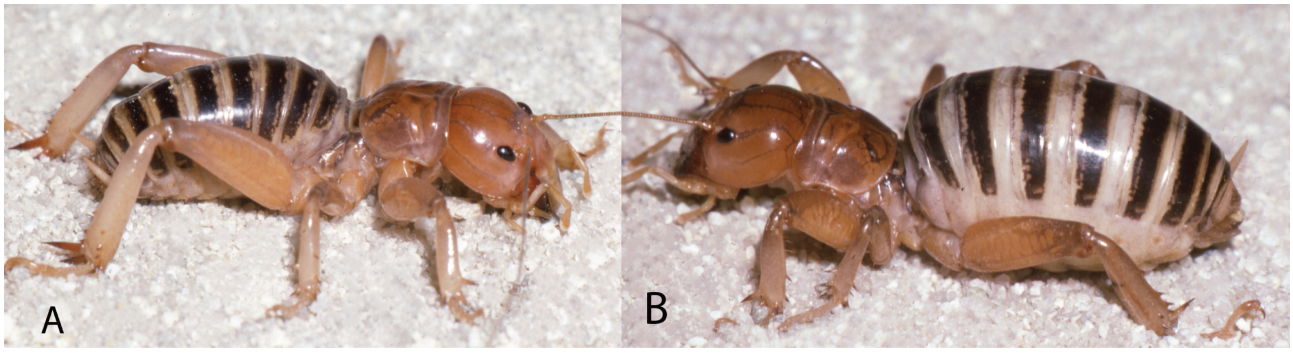


FIGURE 486. Adult questionable placement *A. springville*, both S93-91 (Coarsegold). A. Male R94-92. B. Female.

Drum. Calling drum rate similar in both sexes but series longer in females; males with a sex clarification drum (SCD). **Male:** Holotype (Fig. 487, R01-94) with 27 drums over 7.3s (3.7 drums/s) at 19.5°C. Paratopotype male (Fig. 488, R01-116) with 39 drums over 11.4s (3.4 drums/s) at 18°C. SCD in same male of 20 drums (Fig. 489) over 1.5s (13.3 drums/s), also at 18°C. **Female:** Paratopotype (Fig. 490, R01-128) with 49 drums over 13.8s (3.6 drums/s) at 18°C.

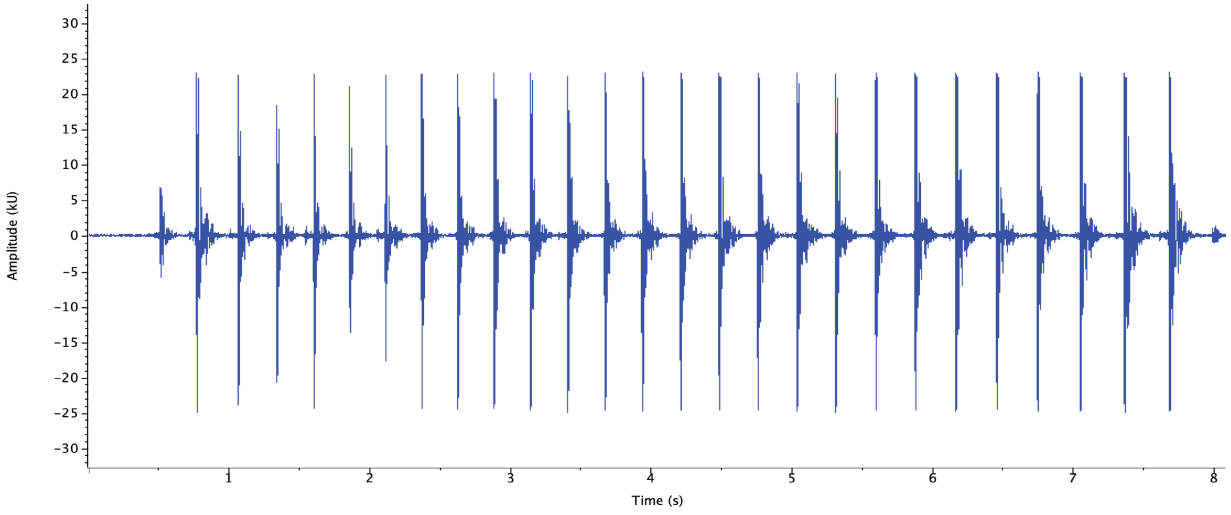


FIGURE 487. Calling drum (R01-94) adult male holotype *A. springville.*

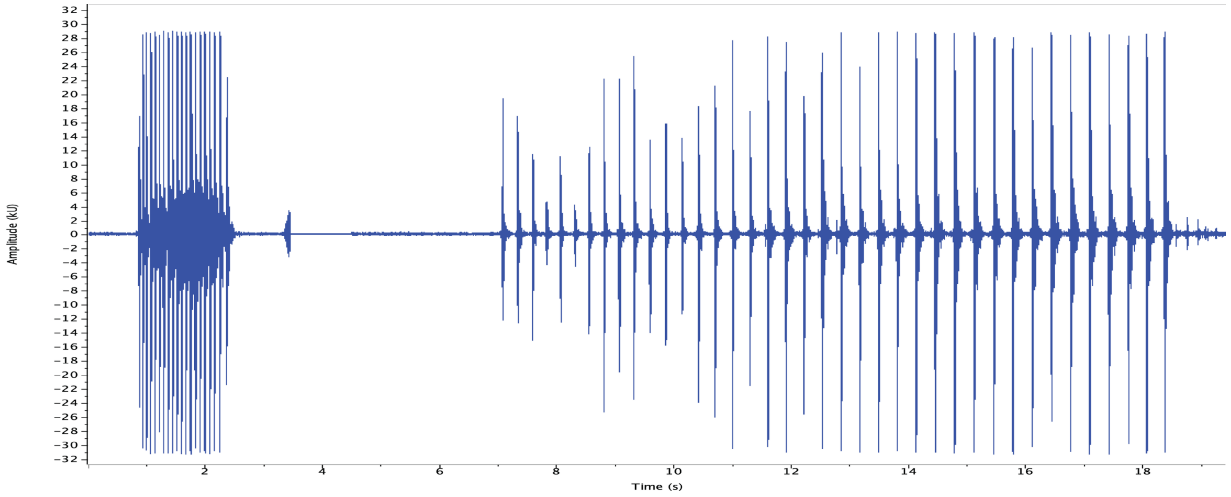


FIGURE 488. Calling drum (R01-116) paratopotype adult male *A. springville*, showing a SCD followed by a calling drum.

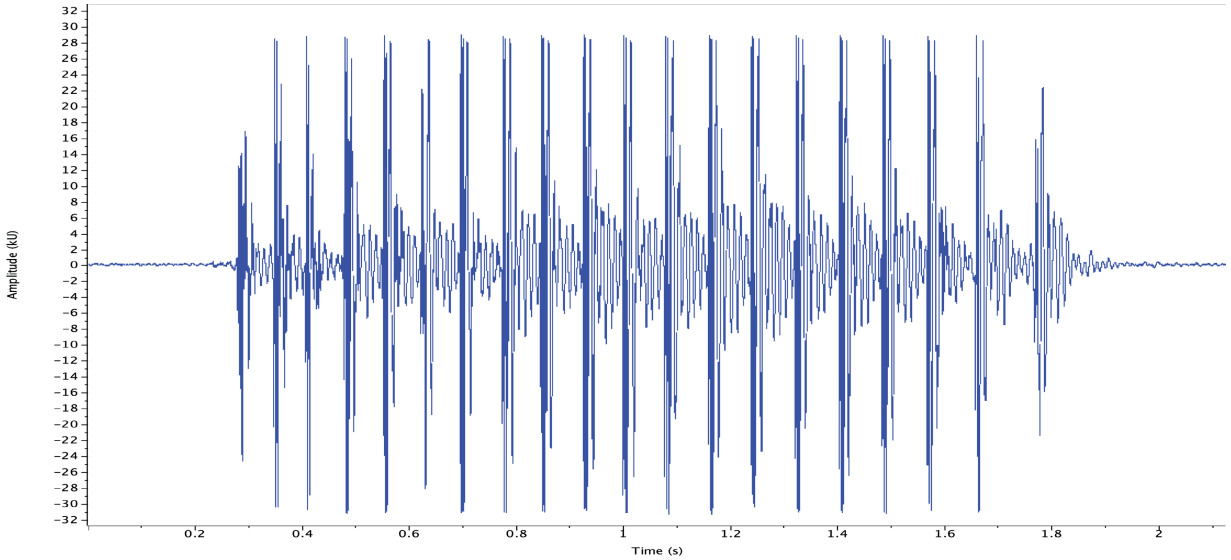


FIGURE 489. Enlarged portion of SCD (R01-116), from previous Fig. 488.

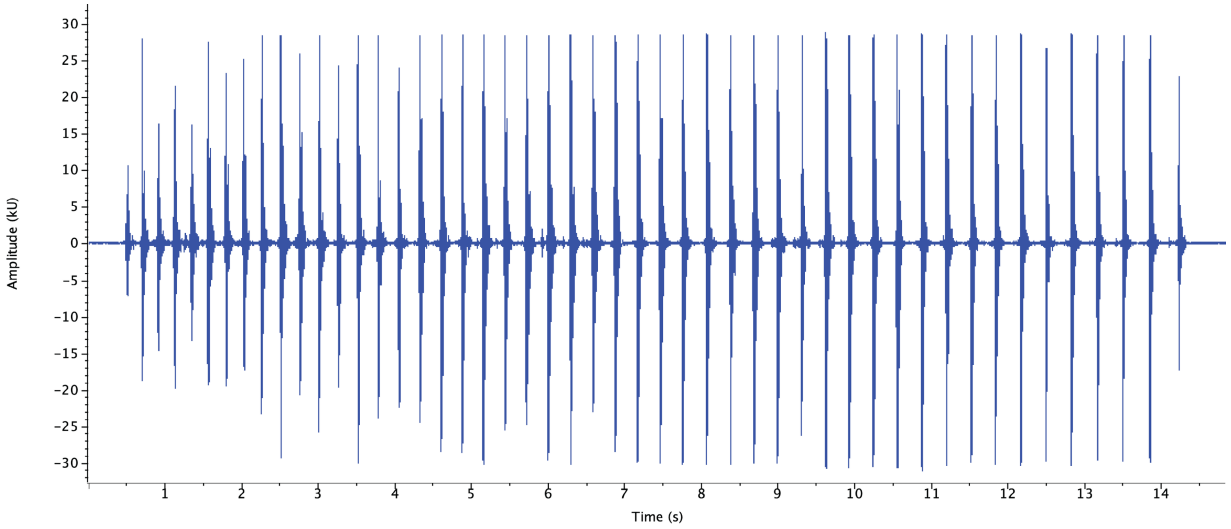


FIGURE 490. Calling drum (R01-128) from paratopotype adult female.

Derivation of name. Named with reference to the closest town to the type locality.

Habitat. Under rocks in open grassland (type locality); under rocks in oak woodland (S98-16, northeast of Lemon Cove).

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. For 80 **paratype** individuals, 79 had 3 and 1 had 4 ventral **fore** leg tibial spurs; 1 had 7 and 78 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 75 had 5 and 2 had 6 inner **rear** leg tibial spines, and 2 had 2, 71 had 3 and 7 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. In 25 adults, inner rear leg tibial spine #1 was the longest while in 52 adults, spines 2 or 3 were longer. **Spines:** Even when spine #1 is longest, spines #2 or #3 have more surface area since they have a larger base. Rear leg tibial calcars somewhat variable: compare holotype with male (Fig. 491) S01-2, R01-119. For 15 **possible placement** individuals, 13 had 3 and 2 had 4 ventral **fore** leg tibial spurs; 15 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 13 had 5 and 2 had 6 inner **rear** leg tibial spines, and 14 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

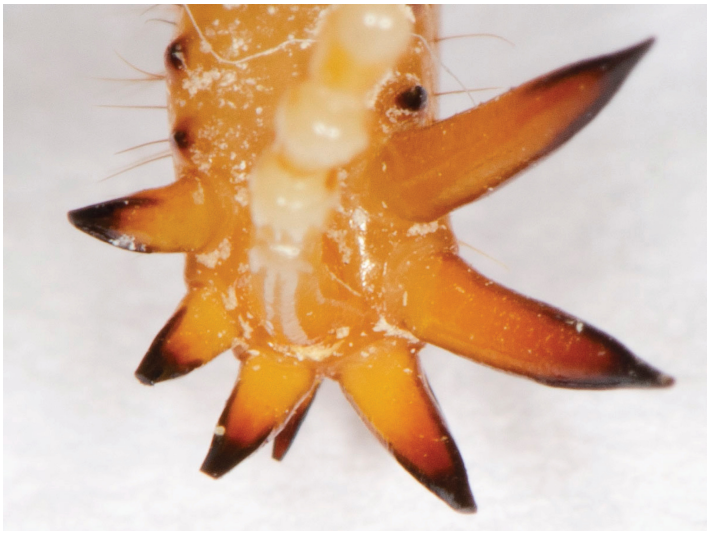


FIGURE 491. Left rear leg tibia adult male topotype (S01-2) showing calcars with less pigmentation then seen in holotype.

DNA. Fig. 479, p. 296. *Subclade 1*: F0829 (S98-16, Lemon Cove, Tulare Co.); F1114, F1235, and F1236 (all S01-2, type locality Springville, Tulare Co.); F1259 (S01-21, Visalia, Tulare Co.). *Subclade 2*: F0016 (S94-115, Sanger, Fresno Co.); F0816 (S98-18, NE Academy, Fresno Co.); F1995 (S07-108, Fresno, Fresno Co.) all recovered together in Group 7 Springville.

DNA. Questionable placement, faster drumming group: F0030 and F0056 (S93-91, nr Coarsegold, Madera Co); F0831 (S98-17, Sequoia, Tulare Co.); F2661, F2664, and F2691 (all S21-50, Bretz Mill, Fresno Co.).

Karyotype. 2n♂=25. Testes from 4 males examined: T93-4 (Fig. 492) & T93-11 (Fig. 493), both Academy, S92-138; T01-15 (Fig. 494) & T01-45, both type locality, S01-2. All with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

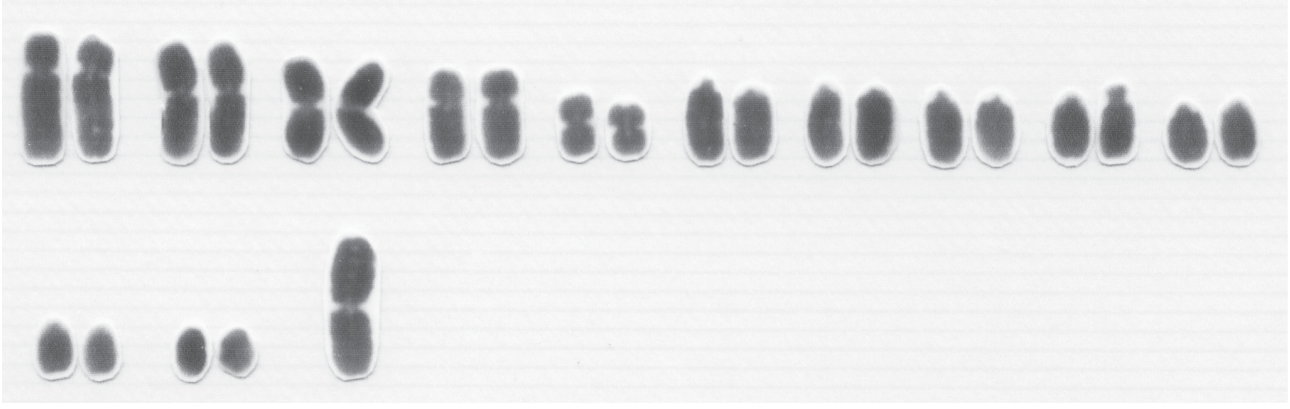


FIGURE 492. Idiogram T93-4 *A. springville* (S92-138).

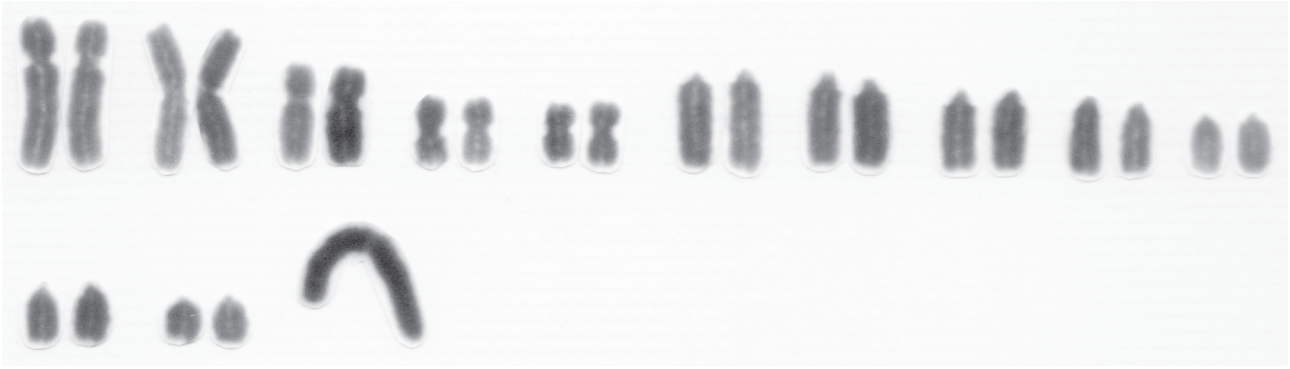


FIGURE 493. Idiogram T93-11 *A. springville* (S92-138).

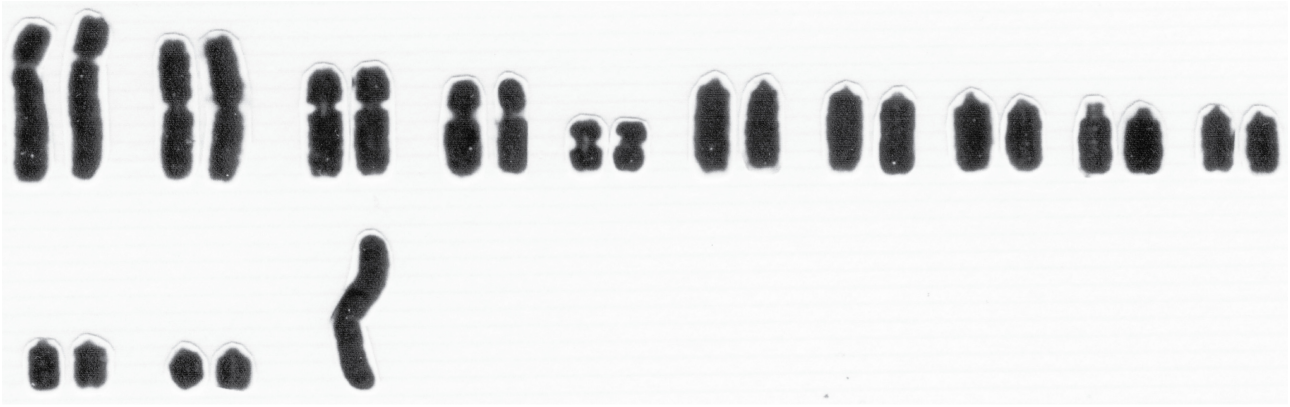


FIGURE 494. Idiogram T01-15 *A. springville* (S01-2).

Karyotype, of *Questionable placement.* 2n♂=25. T95-7 (Fig. 495), S94-116, Coarsegold, Madera Co. This individual has 4 metacentric or submetacentric autosomal pairs, vs the typical 5 pairs seen in lower elevation *A. springville.*



FIGURE 495. Idiogram T95-7, questionable placement *A. springville* (S94-116).

Discussion. We were surprised to see this taxon recovered in its own Group, and at a distance from the three Smithi Group taxa given the two Groups physical similarities and geographical closeness.

At Bretz Mill (S21-50, Fresno Co.), 7 individuals to oatmeal trail, over 3 nights, along with one individual of *A. rentzi* (F2660).

Group 8, Lightfooti Group (Fig. 496)

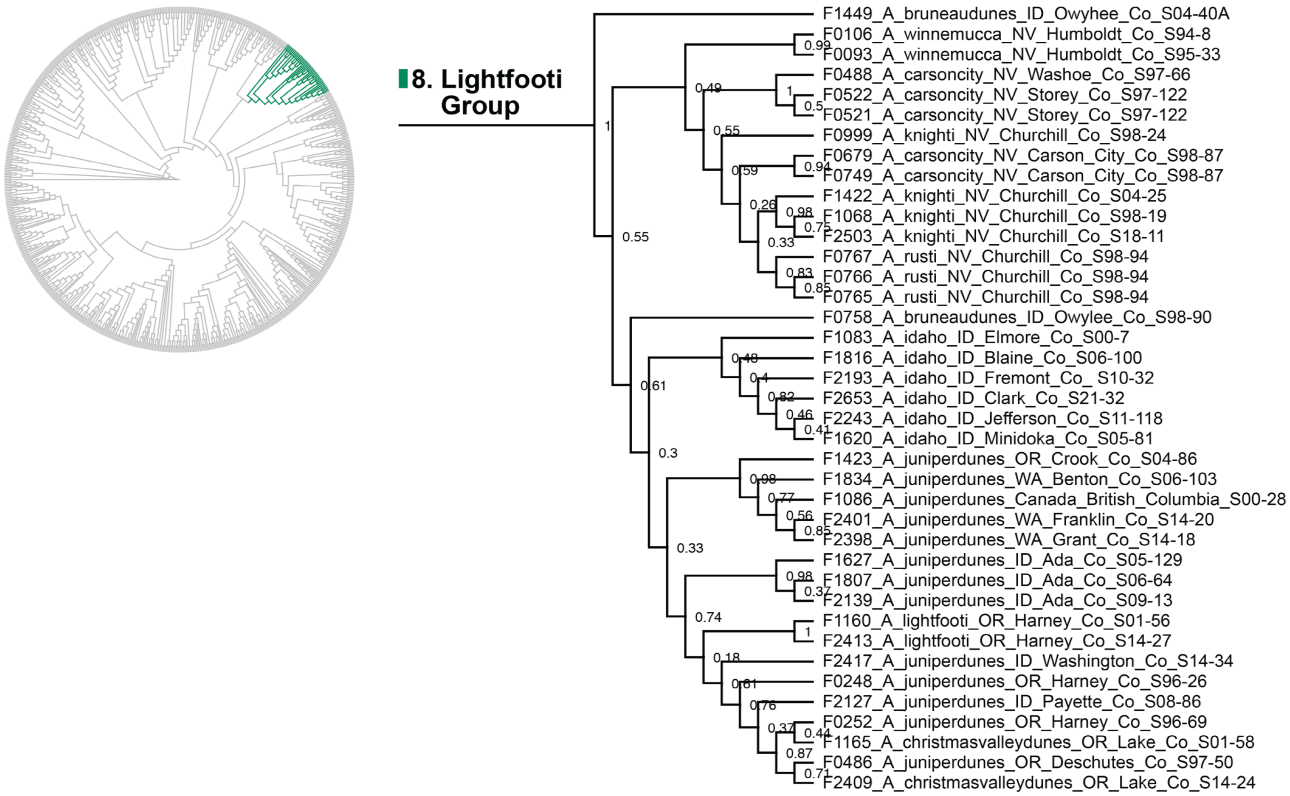


FIGURE 496. ASTRAL tree for Lightfooti Group.

This Group is composed of 10 species, all east of the Cascades and Sierras, from British Columbia, Canada, and the northwestern USA states of Washington, Oregon, Idaho, and Nevada. These taxa are characterized by: (1) Small to large sized individuals, generally light colored and usually always associated with sandy habitat. (2) Male subgenital plate usually not visible from dorsal perspective; while, in side view, reduce compared to all other JCs, resulting in a diagnostic "funny butt" appearance. (3) Male rear leg calcars #1 and #2 dark and broadened (Fig. 497), perhaps analogously acting like the sand basket of sand treader camel crickets; corresponding calcars in female unmodified. (4) Easily seen male adult hooks (Fig. 497). (5) Yellow abdominal tergite bands gets darker and more extensive on distal abdomen (Fig. 497). (6) Calling drum same for males and females of the same species and always consisting of single drums. (7) Sex clarification drum in males of all species. (8) Some species with reduced chromosome numbers—only JC Group where any species has 2n♂=19 and 2n♂=21 chromosomes. A tabulation of the number of chromosome arms (Fundamental number) in males (see Table 39, p. 51) indicates that these karyotype changes are not the result of simple centric fusions. (9) Male hind femur appears proportionately longer than in females, although not statistically tested.

Ecological tolerance in Lightfooti Group: Despite perfect conditions, no JCs came to oatmeal trails at two sandy, suitable looking localities: (1) **MONTANA, *Beaverhead Co.,*** Red Rock Lakes National Wildlife Refuge, 44.65404° -111.69595°, 2026m, 26-viii-2021 (S21-34). According to DC Lightfoot, this site is the most northern known locality for the sand dune obligate band winged grasshopper *Trimerotropis arenacea* Rehn. (2) **WYOMING, *Sweetwater Co.,*** Killpecker Dunes, 41.98444° -109.26138°, 2057m, 9-viii-2023. We suspect that both localities were simply too high (and cold) for JCs.

SPECIES WRITE UPS: *A. bruneaudunes* (p. 305); *A. carsoncity* (p. 310); *A. christmasvalleydunes* (p. 316); *A. evansi* (p. 320): *A. idaho* (p. 322); *A. juniperdunes* (p. 328); *A. knighti* (p. 334); *A. lightfooti* (p. 340); *A. rusti* (p. 344); and *A. winnemucca* (p. 348).

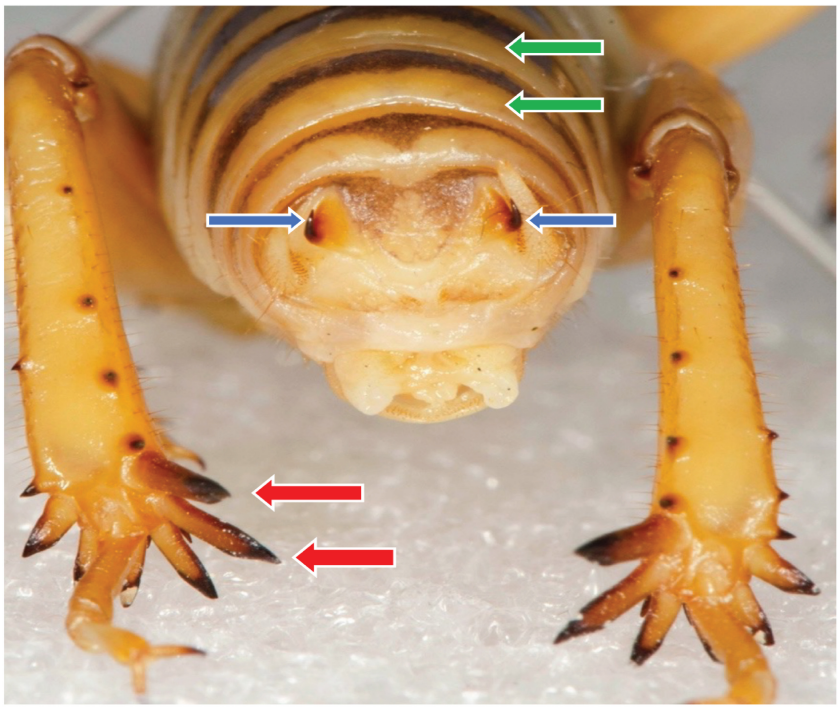


FIGURE 497. Adult male *A. lightfooti* showing several characteristics of the Lightfooti Group: (1) Prominent rear leg tibial calcars #1 & #2 (red arrows); (2) Easily seen adult male hooks (blue arrows); (3) Dark yellow bands on terminal edge of abdominal tergites ((green arrows). Note partial spontaneous extrusion of internal male genitalia after killing by injection.

Ammopelmatus bruneaudunes **Weissman, sp. nov.**

Bruneau Dunes Jerusalem Cricket
Figs 498–507, Tables 27, 39

Species #10, Weissman 2001a.

Distribution. (Fig. 498). Only known from Bruneau Dunes State Park in southwestern Idaho.

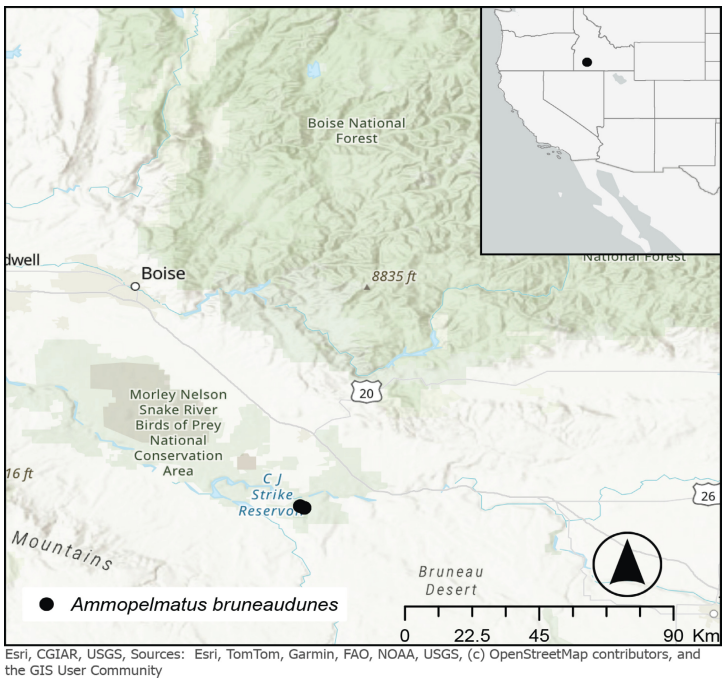


FIGURE 498. Known distribution of *A. bruneaudunes*.

Recognition characters. Member of Lightfooti Group. Only JC species at Bruneau Dunes, and apparently restricted to there. Small to medium sized, light colored JC with 2n♂=21. This chromosome count is also found in *A. juniperdunes* and *A. winnemucca*, both members of the Lightfooti Group and found some distance away.

Holotype. Male (in alcohol, Fig. 499) **Idaho, *Owyhee Co.,*** Bruneau Dunes State Park, Observatory Picnic area, 42.903889° -115.692875°, 761m, 29-vii-1992 (S92-91) DBW, DC Lightfoot. R92-9. Collected as adult. Deposited CAS, Entomology type #20094. Measurements in mm: Body length 27.32, hind femur length 9.84, hind femur width 3.43. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 500) with 4 and 5 inner and 3 and 5 outer spines, 2 ventral spurs.

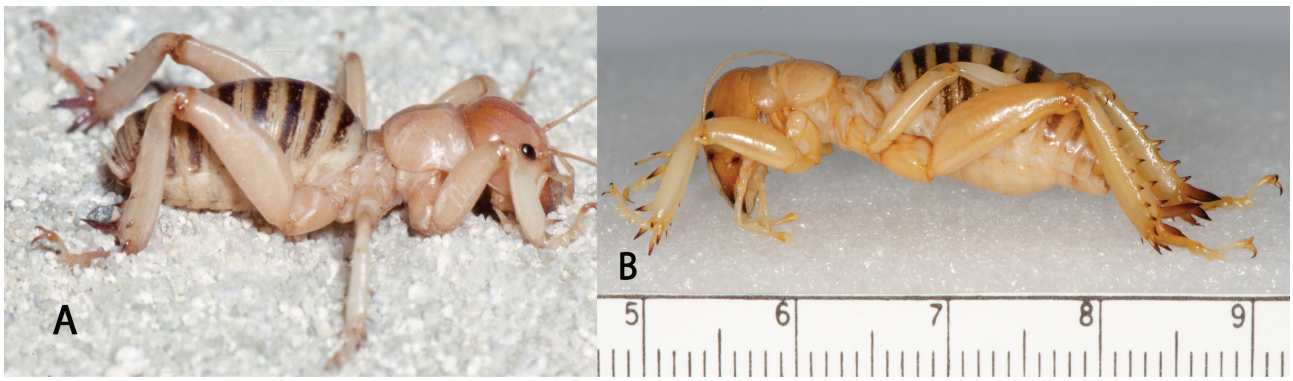


FIGURE 499. Holotype adult male *A. bruneaudunes.* A. When alive. B. When preserved.

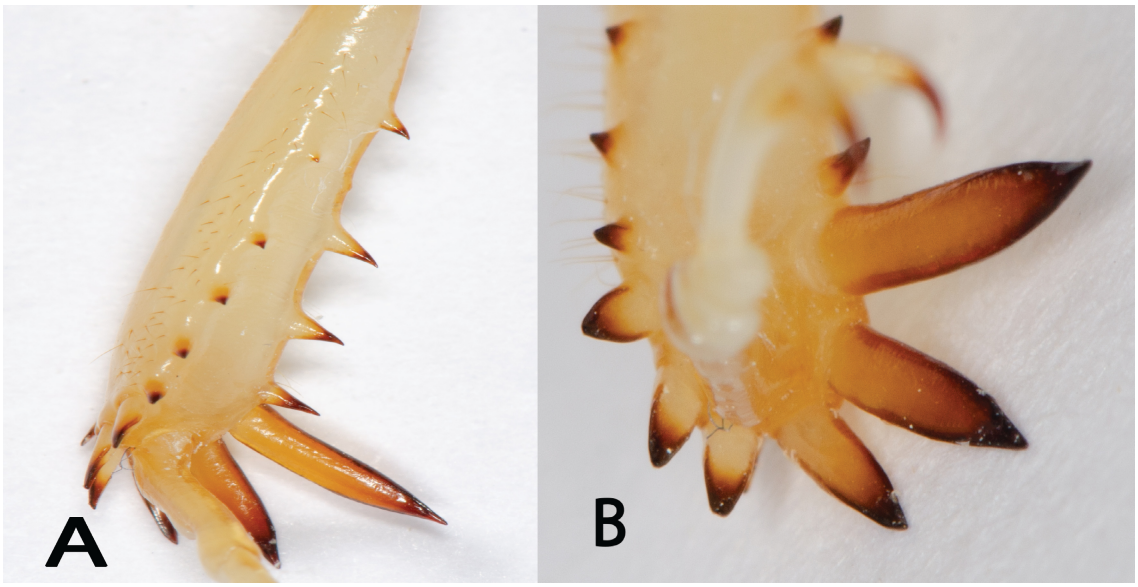


FIGURE 500. Left rear leg tibia holotype adult male *A. bruneaudunes.* A. Showing 5 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 501) Same data as holotype except 12-vi-2004 (S04-40A), open sandy grassland, 42.909367° -115.705002°, 765m, DBW, DC Lightfoot. R04-25, F1449. Molt to adult 15-viii-2004. Deposited CAS, Entomology #9079350. Measurements in mm: Body length 37.42, hind femur length 10.57, hind femur width 3.46. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 502) with 5 and 6 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 503.

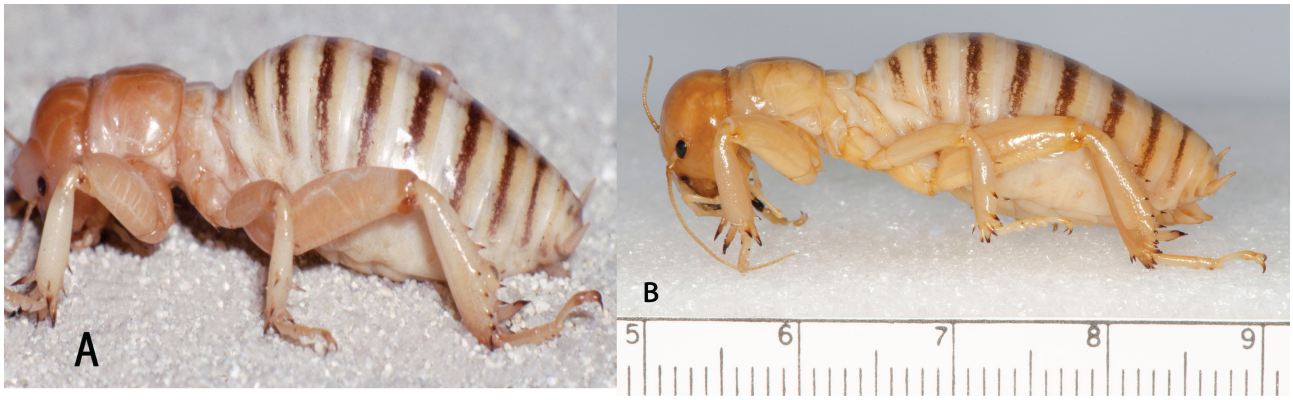


FIGURE 501. Allotype adult female *A. bruneaudunes.* A. When alive. B. When preserved.

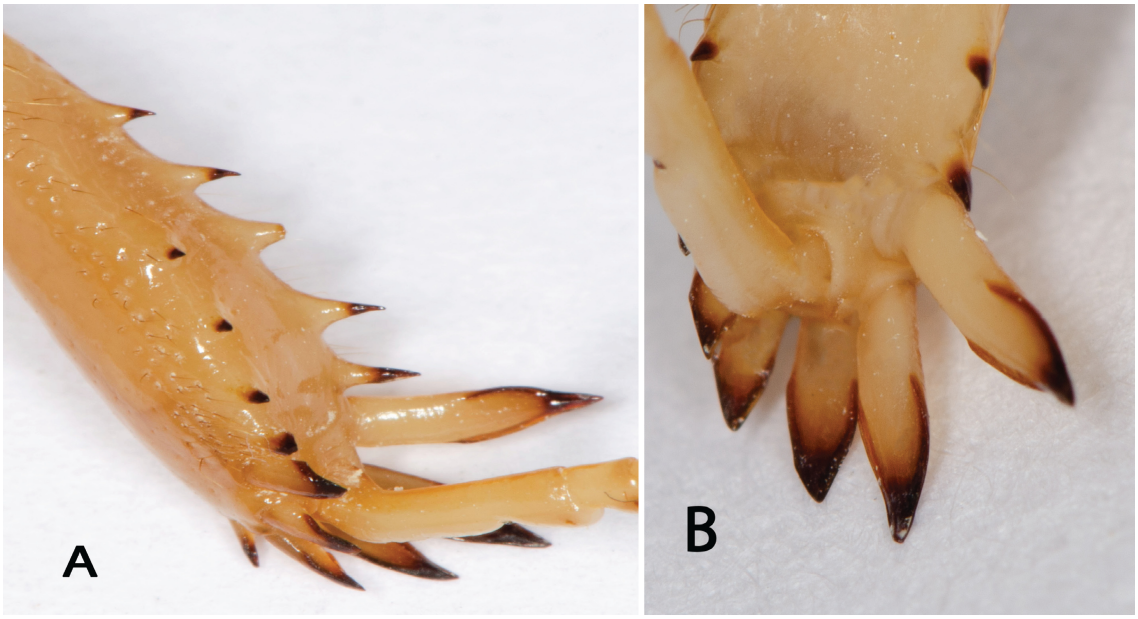


FIGURE 502. Left rear leg tibia allotype female. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 503. Ovipositor allotype *A. bruneaudunes.*

Paratypes. ♀1. **IDAHO, *Owyhee Co.***, Bruneau Dunes State Park: 7-vi-1996 (S96-39) ♂1 for testes (T97-5). Holotype locality, 13-ix-1998 (S98-90), near Observatory Picnic area, ♀1. Allotype locality, 12-vi-2004 (S04-40A), ♂1 for testes (T05-1).

Drum. Calling drum similar in both sexes except males with a sex clarification drum (SCD). **Male:** Holotype, R92-9 (Fig. 504), 20°C: SCD of 5 drums in 0.51s (9.8 drums/s) transitioning to 37 drums in 10.0s (3.7 drums/s). **Female:** Allotype, R04-25 (Fig. 505), 20°C: 37 drums in 9.4s (3.9 drums/s).

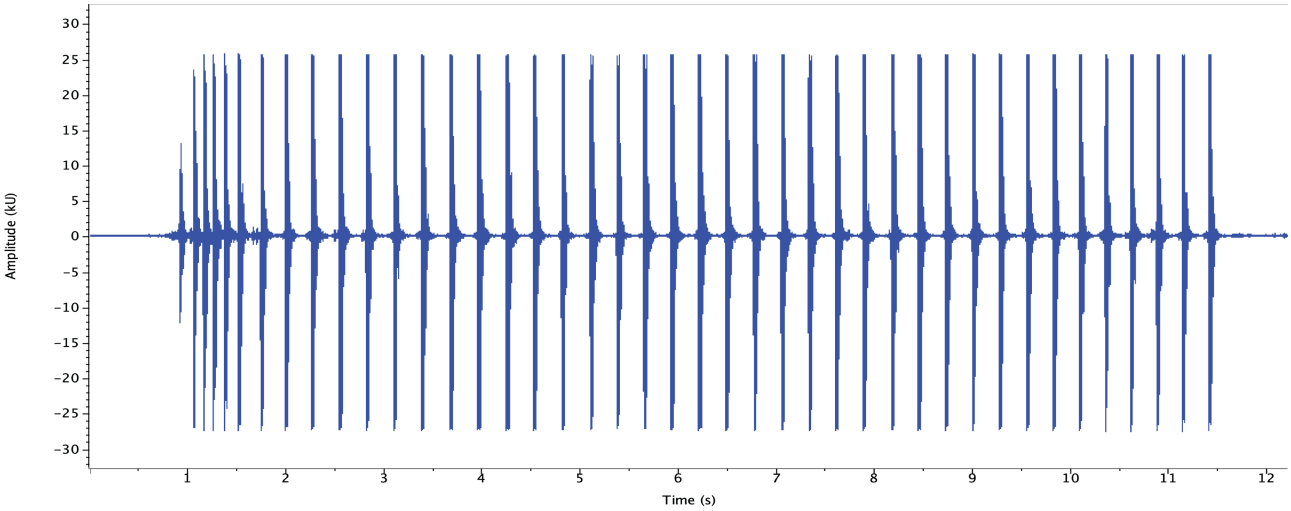


FIGURE 504. Calling drum (R92-9) holotype adult male *A. bruneaudunes*.

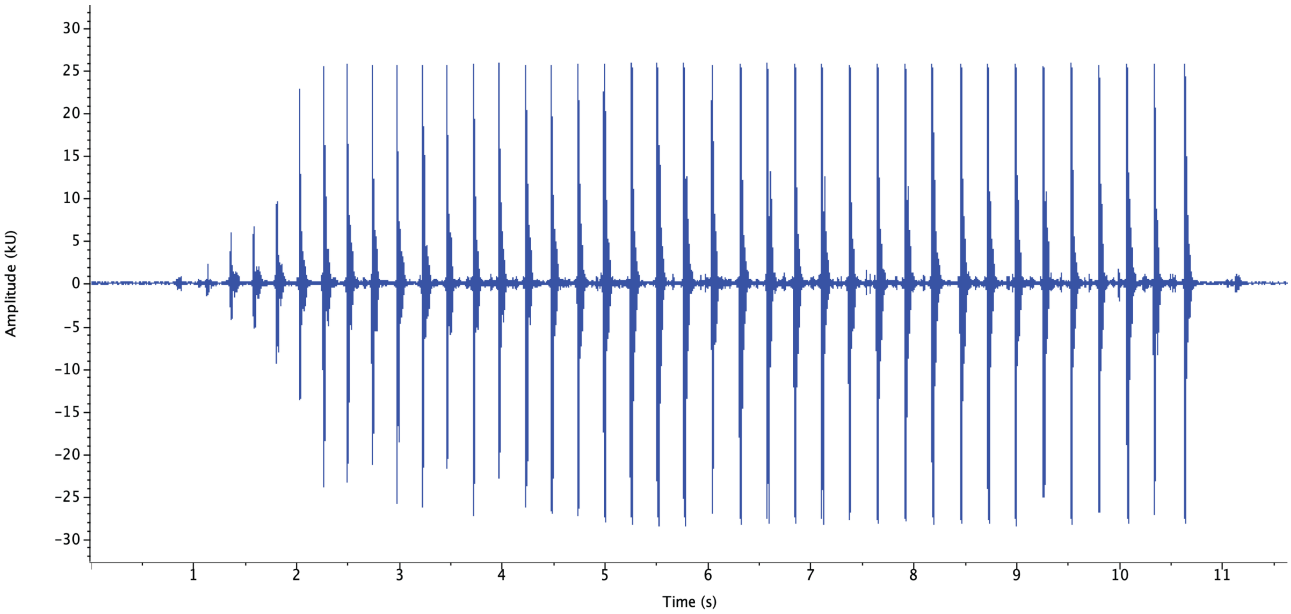


FIGURE 505. Calling drum (R04-25) allotype adult female *A. bruneaudunes*.

Derivation of name. Named for the type, and only known locality.

Habitat. Open rolling dunes with grasses and sparse vegetation combined with major dune some 140m in elevation. Over the years we have laid oatmeal trails in many different areas of the Park but what little success we did have, was best at S04-40A, a fairly flat area of grassland on sand, and locality for the allotype female. In 2014 (S14-29), we laid 20 kg of oatmeal in 3 main locations, including S04-40A, and got no JCs. We laid a thick trail because there are lots of kangaroo rats but, apparently, this JC is either rare or just doesn't do a lot of surface wandering when we were there.

Life cycle and seasonal occurrence. Apparent typical 2 year life cycle.

Variation. From 3 adults, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2

ventral spurs; 1 had 5 and 2 had 6 inner **rear** leg tibial spines, and 2 had 4 and 1 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. Type locality F0758 (S98-90) and F1449 (S04-40A) recovered in two different subclades, and part of the larger Group 8 Lightfooti.

Karyotype. 2n♂=21. Two type locality males examined with slightly different results: T97-5 (Fig. 506, S96-39), with idiograms from 2 mitotic and 1 meiotic cell, shows 7 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T05-01 (Fig. 507, S04-40A) shows 6 metacentric or submetacentric autosomal pairs; 4 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. We are unsure about the significance of such differences; but T97-05 clearly demonstrates how mitotic divisions, when compared with meiotic divisions, with their different amounts of condensation of the chromosomes, may result is slightly better assessments of centromere positions.



FIGURE 506. Three idiograms all from same male T97-5 *A. bruneaudunes* (S96-39). Top two are mitotic cells and bottom is a meiotic cell, all showing 7 metacentric autosomal pairs.

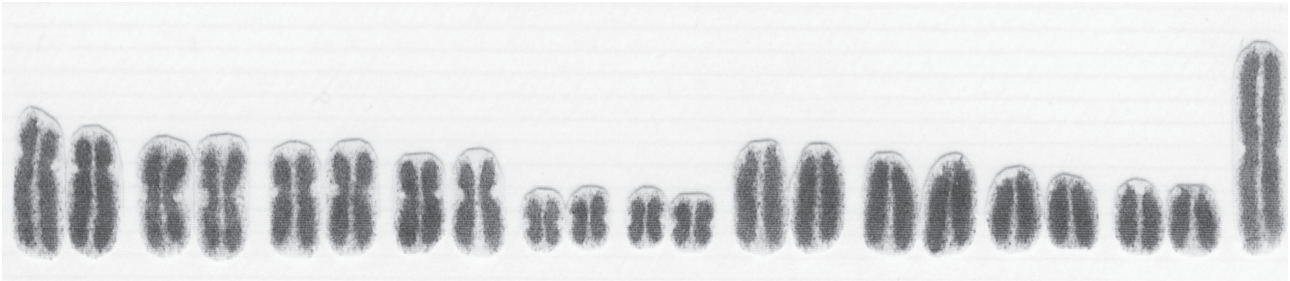


FIGURE 507. Mitotic idiogram T05-1 *A. bruneaudunes* S04-40A) showing 6 metacentric autosomal pairs

Discussion. The use of oatmeal trails, and not just in sand dune habitats, is crucial to successful collecting of JCs. Yet even by our standards, collecting just 5 JCs total in 5 collecting visits, using probably some 38 kg of oatmeal flakes, is pathetic. Especially since we laid oatmeal in many different locations in Bruneau Dunes State Park and consistently returned to those areas where we had previous success. By way of comparison, in 2014, when we collected the sand dunes of eastern Washington and Oregon, over 8 nights, we placed 110 kg of oatmeal trails and collected 120 JCs, mostly *A. juniperdunes.*

***Ammopelmatus carsoncity* Weissman, sp. nov.**
Carson City Jerusalem Cricket
Figs 508–518, Tables 30, 39

Species #13, Weissman 2001b.

Distribution. (Fig. 508). Restricted to a three-county area (Carson City, Storey, and Washoe Counties) of western Nevada from Carson City to Sparks.

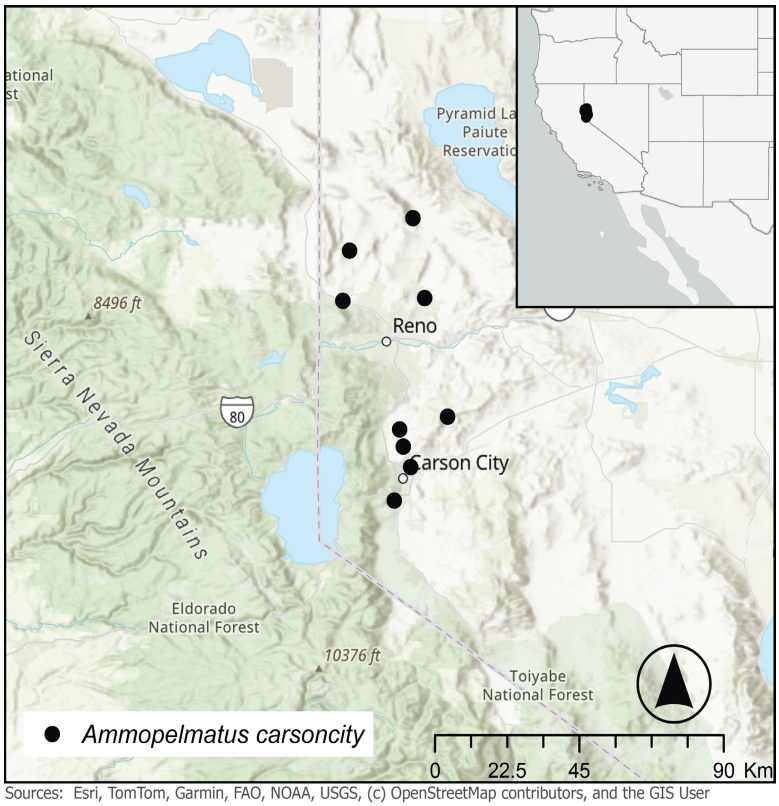


FIGURE 508. Known distribution of *A. carsoncity.*

Recognition characters. Member of Lightfooti Group. 2n♂=23. Calling drum similar in both sexes at ~4 drums/s at 20°C, which separates it from the usually less common, sympatric *A. reno*, where the latter (1) drums at 1.5 drum/s; (2) whose males lacks a sex clarification drum; (3) adult males lack developed rear leg tibial calcars # 1 & 2 (because they are not in the Lightfooti Group); and (4) has wider, darker black abdominal bands (Fig. 509) frequently with a dark reddish coloration to head, pronotum, and legs; (5) both sexes are invariably megacephalic; and (6) has 2n♂=25. Can't always morphologically distinguish between adult females of these 2 species (Fig. 509, from Carson City); but males, without drums, can be easily separated by the rear leg tibial calcars. Separated from the only two other Lightfooti Group taxa with 2n♂=23, by larger size in *A. rusti* and faster drum rate (6 drums/s); and from *A. lightfooti* by DNA and the latter's isolation in a restricted sand dune system in SE Oregon some 400 km from the nearest *A. carsoncity. A. carsoncity* recovered in a subclade closest to *A. knighti,* but the latter with 2n♂=25.



FIGURE 509. Sympatric *Ammopelmatus* species in Carson City, NV. Left: adult female *A. reno* (S87-77, R87-18). Right: adult female *A. carsoncity* (S87-44, R87-23).

Holotype. Male (in alcohol, Fig. 510): **Nevada, *Storey Co*.**, Reno-Stead, 39.634222° -119.935192°, 1670m, early August, 1997 (S97-122) S. Bateman. R97-79 & R97-87, F0521. Collected as adult. Measurements in mm: Body length 32.08, hind femur length 11.43, hind femur width 4.23. Deposited CAS, Entomology type #20090. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 511) with 4 inner and 3 outer spines, 2 ventral spurs.

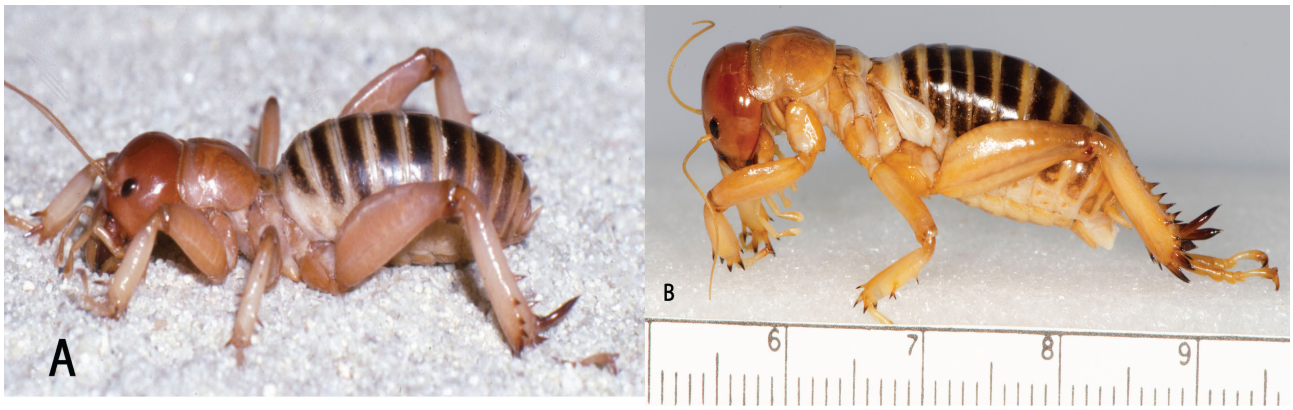


FIGURE 510. Adult male holotype *A. carsoncity.* A. When alive. B. When preserved.

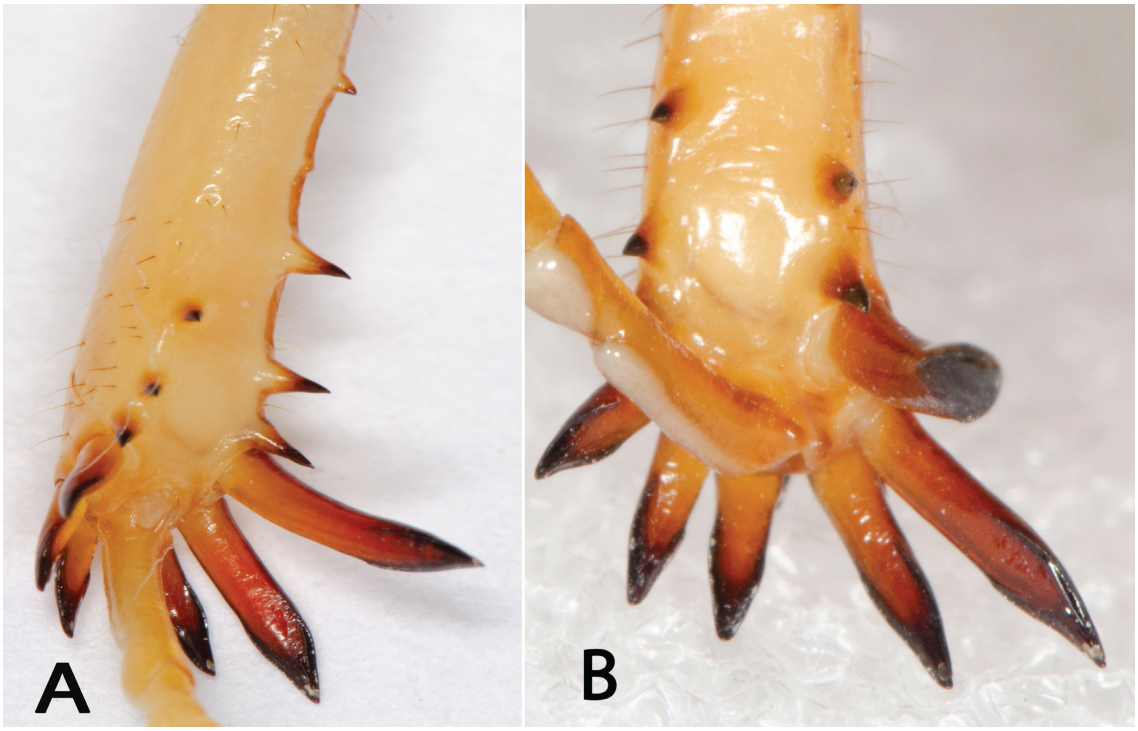


FIGURE 511. Left rear leg tibia holotype adult male *A. carsoncity.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 512B; live female photo (Fig. 512A) is paratype from S89-86, R89-89) same data as holotype except R97-88, F0522. Collected as adult. Measurements in mm: Body length 32.34, hind femur length 10.08, hind femur width 3.86. Deposited CAS, Entomology #9080214. Fore leg tibia with 2 and 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 513) with 4 and 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 514.



FIGURE 512. Allotype adult female *A. carsoncity.* A. Live adult female paratype from S89-86. B. Preserved allotype S97-122.



FIGURE 513. Left rear leg tibia adult female allotype *A. carsoncity.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 514. Ovipositor allotype *A. carsoncity.*

Paratypes. ♂19 ♀46. **NEVADA**, ***Carson City Co.,*** Carson City, various locations, all R. Arkell: 3-vii-1986 (S86-77) ♀1; 5-ix-1986 (S86-112) ♀2; 17-ix-1986 (S86-114) ♀1; 16-x-1986 (S86-142b) ♀2; 3-xi-1986 (S86-146) ♀1; 8-vi-1987 (S87-44) ♀4; 19-vi-1987 (S87-48) ♀2; 10-vii-1987 (S87-83) ♂1; 28-viii-1987 (S87-98) ♀1; 24-v-1988 (S88-21) ♀2; 31-viii-1988 (S88-100) ♀1; 7-vi-1989 (S89-39) ♀1; 4-x-1989 (S89-86) ♀2; 30-vi-1990 (S90-62) ♂1; 15-viii-1990 (S90-89) 9-iv-1991 (S91-15) ♂1; 28-vi-1991 (S91-54) ♂2; 30-viii-1991 (S91-100) ♂1; 19-ix-1991 (S91-107) ♀2; 28-ix-1991 (S91-110) ♀1; 24-x-1991 (S91-118) ♂1 ♀1; 6-v-1992 (S92-46) ♂1; 4-vi-1992

(S92-53) ♀1. City Plywood on Hwy 50, 39183581° -119.709677°, 1407m, 16-vi-1986 (S86-37) R. Arkell ♂1; 13-vi-1988 (S88-49) R. Arkell, ♀1; Carson City Airport, 39.194875° -119.745298°, 1435m, 27-ix-1986 (S86-123) R. Arkell ♀1. Carson City, 3675 Cindy's Trail, 39.106412° -119.791390°, 1506m, 24-viii-1998 (S98-81) D. Thain ♂1; 26-viii-1998 (S98-87) D. Thain ♂1 ♀1. ***Storey Co.,*** Virginia City, 39.328029° -119.641985°, 1827m, 9-iii-1994 (S94-9) G. DeSutter, ♂1. Type locality, ♂1. ***Washoe Co.,*** Cold Springs Valley, 39.766777° -119.916591°, 1911m, 30-vii-1997 (S97-117) S. Bateman, ♂1. Dry Valley, 40.234165° -119.856607°, 1315m, 6-15-vii-1997 (S97-129) S. Bateman ♀2. Washoe Lake, 39.249023° -119.765979°, 1535m, 25-ix-1986 (S86-118) R. Arkell ♀2; 14-vi-1988 (S88-50) R. Arkell, ♂2 ♀6. Washoe Valley, Wild Animal Infirmary, intersection of Eagle St & Puma Dr, 39.294392° -119.776234°, 1555m, 1-vii-1986 (S86-76) R. Arkell ♂1 ♀2. Washoe Valley, E side, 20-vii-1997 (S97-116) C. & D. Anderson, ♀1. Washoe Valley, ~20m S Reno, 1539m, 14-iv-1993 (S93-30) RG & EB Knight ♂1 ♀1. 20 m N Reno at base of Dogskin Mt, 39.852628° -119.738901°, 1380m, 6-vii-1997 (S97-66) S. Bateman, ♂1 ♀2. Reno, NW part of town, 6-ix-2000 (S00-48) L. Ariz ♀1. Sparks, 435 Rockwell Blvd, 39.641585° -119.706190°, 1374m, 14-iv-2001 (S01-22) M. Eisner ♀1.

Drum. Both sexes have similar calling songs of around 4 drums/s at 20°C, except that adult males have a sex clarification drum (SCD). **Male**: Holotype R97-87 (Fig. 515), S97-122, 20°C. SCD of 8 drums over 0.67s (11.9 drums/s) transitioning to a calling drum of 26 single drums over 5.6s (4.6 drums/s). **Female**: Allotype R97-88 (Fig. 516), S97-122, 21.5°C; 89 drums over 22.2s (4.0 drums/s).

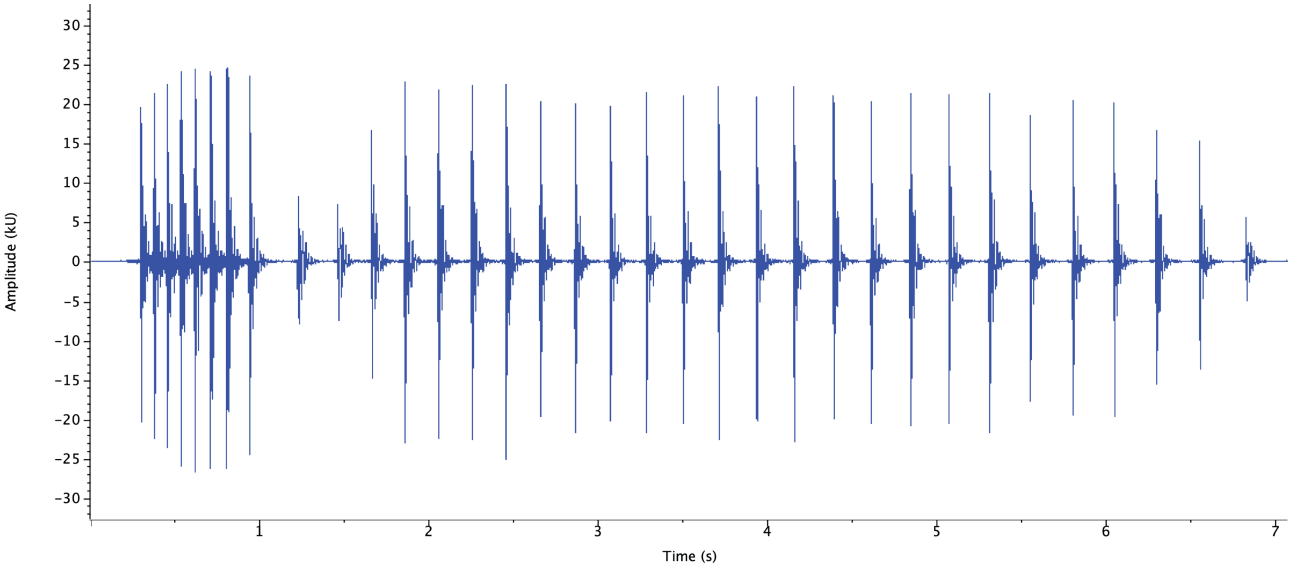


FIGURE 515. Calling drum (R97-87) holotype adult male *A. carsoncity*: Eight sex clarification drums followed by calling drum.

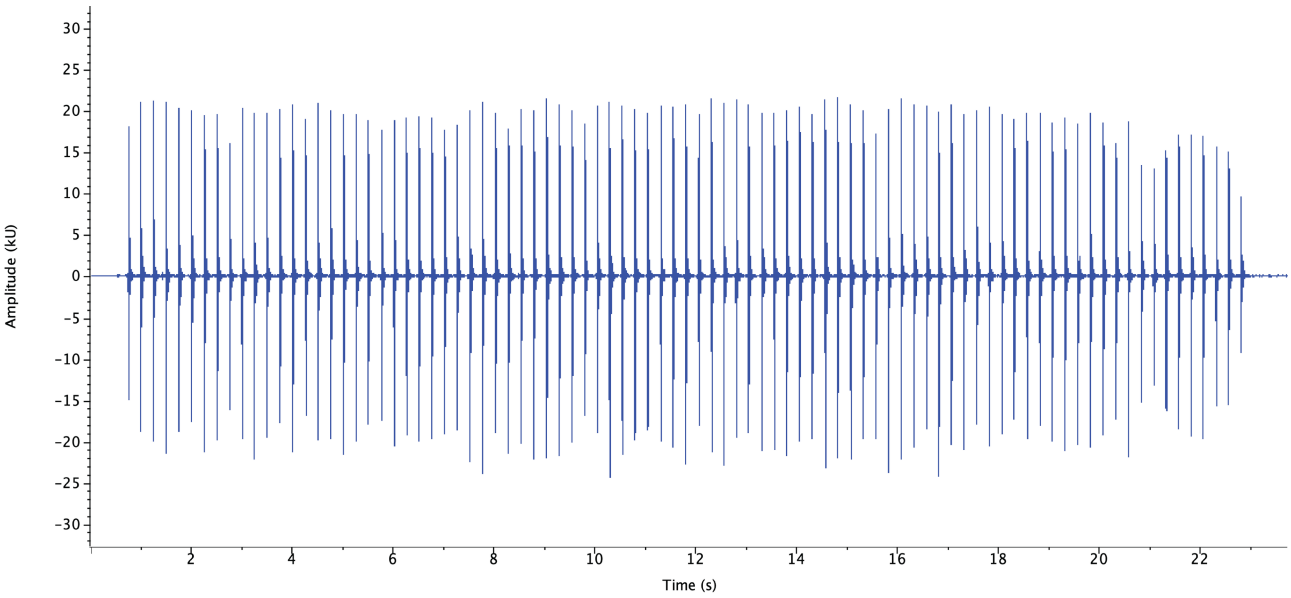


FIGURE 516. Calling drum (R97-88) in adult female allotype *A. carsoncity.*

Derivation of name. Named after the city from which most paratypes were collected.

Habitat. Variable—sagebrush, bitterbrush & cactus; juniper sagebrush transition (S97-66), on sandy or clay-like substrates.

Life cycle and seasonal occurrence. Both types were adult when collected. Probably typical 2-year life cycle.

Variation. Abdomen variable for color and width of stripes. Of some 30+ tabulated individuals, 12 had 2 and 21 had 3 **fore** leg ventral tibial spurs; all 33 individuals had 8 **middle** leg tibia calcars and 2 ventral spurs; and 2 individuals had 4, 30 had 5, and 1 had 6 **rear** leg inner tibia spines, while 1 had 2, 25 had 3 and 12 had 4 **rear** leg outer tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. F0488 (S97-66, Washoe Co.); holotype F0521 and F0522 (both S97-122, Storey Co.); F0679 and F0749 (both S98-87, Carson City) all recovered together in Group 8 Lightfooti, and closest to 3 other Lightfooti Group taxa.

Karyotype. 2n♂=23. Two males (S88-50, Washoe Lake) examined and both similar, with 5 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T88-20 is one of the rare *Ammopelmatus* specimens, of any species, that has documented B chromosomes, nicely seen in the idiogram (Fig. 517), and in a diplotene-diakinesis (Fig. 518a) and metaphase I cell (Fig. 518b). The second karyotyped male (T88-21) from this site had no B chromosomes.



FIGURE 517. Idiogram T88-20 *A. carsoncity* (S88-50) showing 1 documented B chromosome.

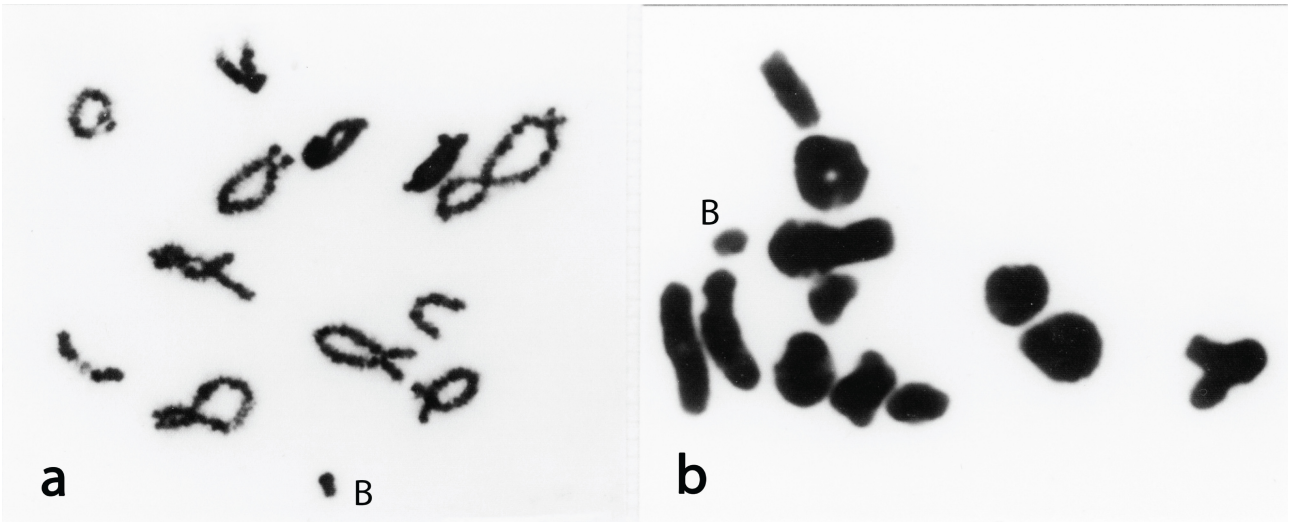


FIGURE 518. Meiosis in T88-20 *A. carsoncity* (S88-50). a. Showing single B chromosome at diplotene-diakinesis. b. Metaphase I in same male, with B chromosome marked.

Discussion. At ~50% of the sites where *A. carsoncity* was collected, the rarer, slow drumming *A. reno* was also collected.

***Ammopelmatus christmasvalleydunes* Weissman, sp. nov.**
Christmas Valley Dunes Jerusalem Cricket
Figs 519–527, Tables 32, 39

Distribution. (Fig. 519). Only known from the Christmas Valley Dunes in central Oregon.

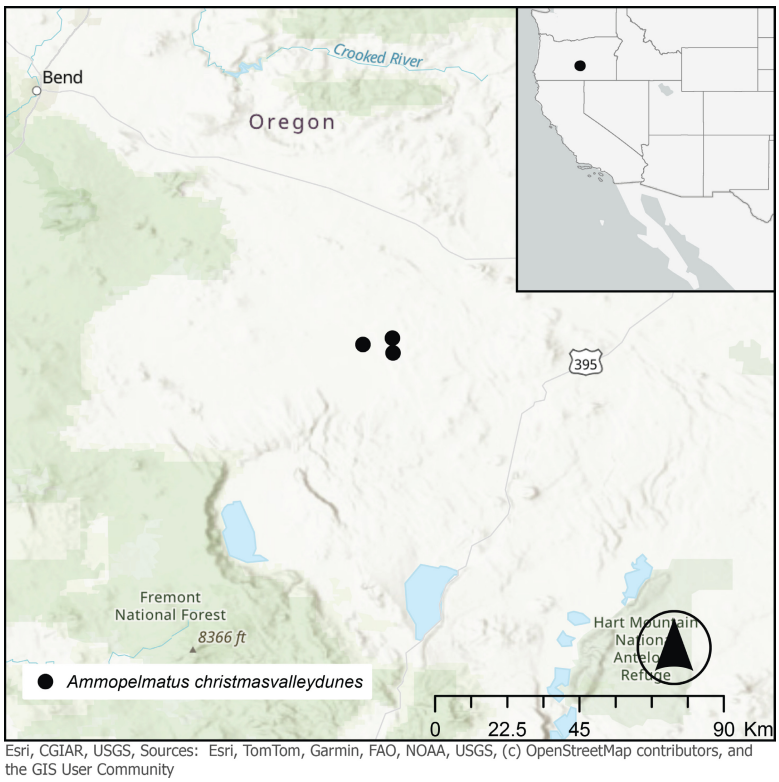


FIGURE 519. Known distribution of *A. christmasvalleydunes.*

Recognition characters. Member of Lightfooti Group. Small–medium, light colored species with 2n♂=19, and only known from the type locality. Distinguished from *A. idaho,* the only other JC taxon with 2n♂=19, by DNA and a separation distance of some 420 km. Multilocus DNA of *A. christmasvalleydunes* recovered closest to *A. juniperdunes,* from which it differs in karyotype (2n♂=19 in *A. christmasvalleydunes* vs 2n♂=21 in *A. juniperdunes*), and a separation distance of some 350 km.

Holotype. Male (in alcohol, Fig. 520). **Oregon, *Lake Co.,*** Christmas Valley sand dunes 30 m NE Christmas Valley, 43.324937° -120.317722°, 1369m, 16-vi-2001 (S01-58) DBW, BI Weissman. R01-18, F1164. Molt to adult 12-vii-2001. Deposited CAS, Entomology type #20104. Measurements in mm: Body length 31.25, hind femur length 10.58, hind femur width 4.03. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 521) with 5 or 6 inner and 3 or 5 outer spines, 2 ventral spurs.



FIGURE 520. Adult male holotype *A. christmasvalleydunes.* A. When alive. B. When preserved.

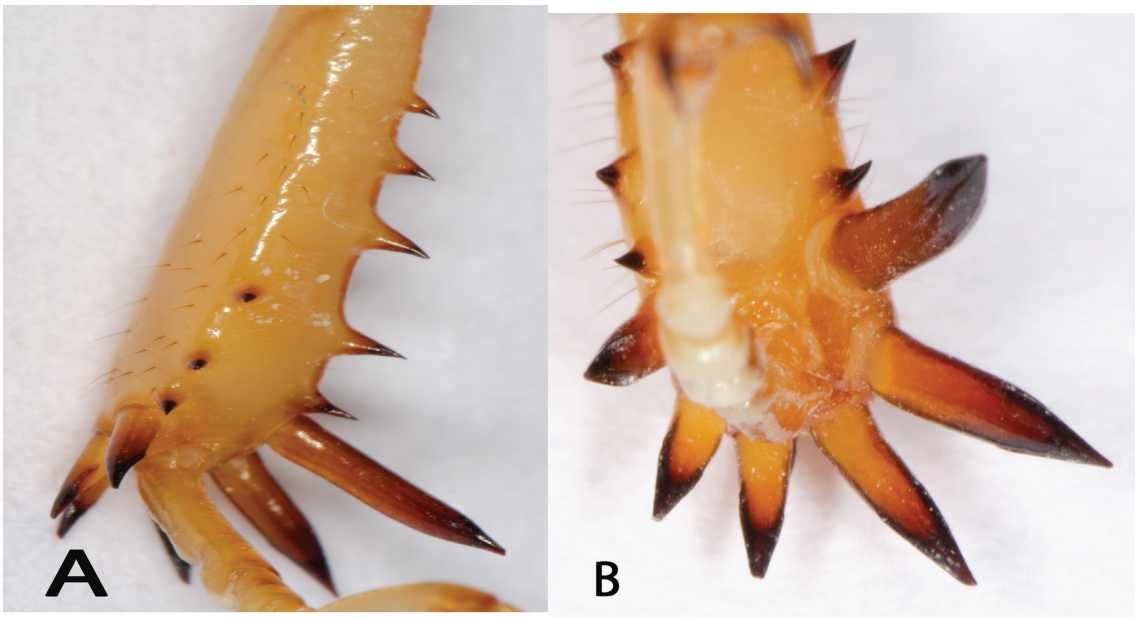


FIGURE 521. Left rear leg tibia holotype *A. christmasvalleydunes.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 522) Same data as holotype except R01-25, F1172. Molt to adult 1-viii-2001. Deposited CAS, Entomology #9079460. Measurements in mm: Body length 33.19, hind femur length 9.34, hind femur width 3.58. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 523) with 5 & 6 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 524.

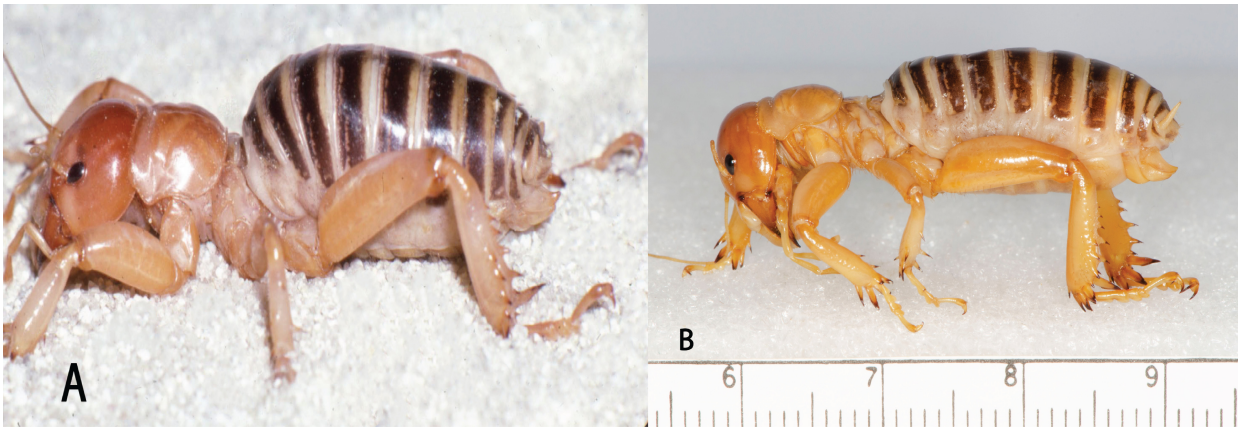


FIGURE 522. Allotype adult female *A. christmasvalleydunes.* A. When alive. B. When preserved.

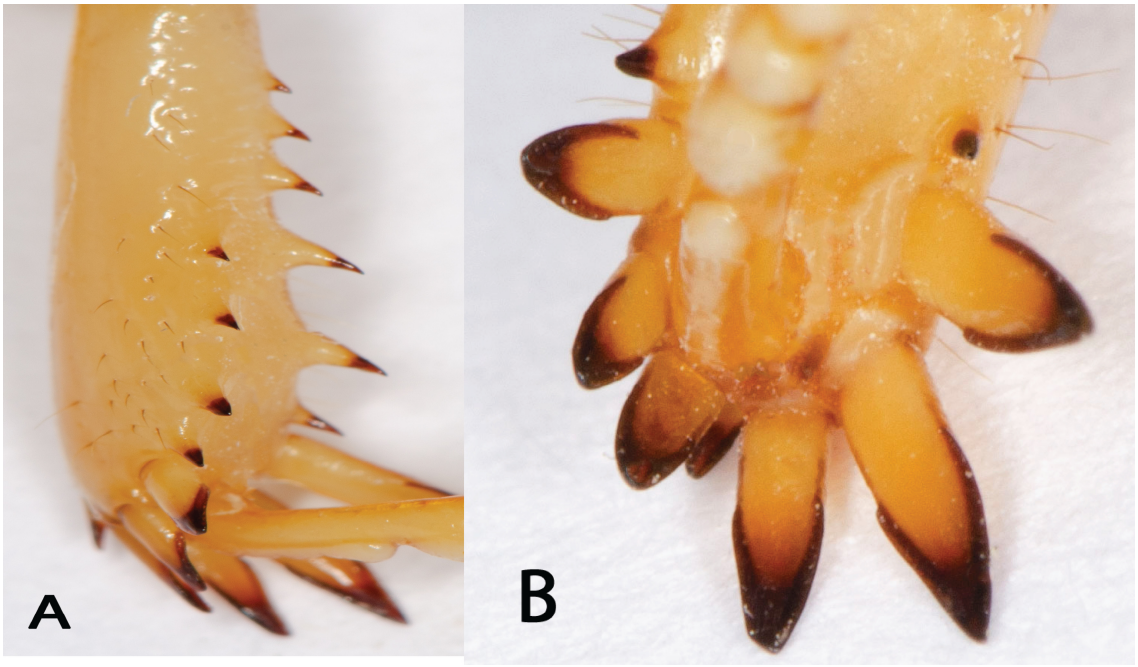


FIGURE 523. Rear left leg tibia in allotype *A. christmasvalleydunes.* A. Showing 4 outer and 6 inner spines. B. Showing shape of calcars.



FIGURE 524. Ovipositor allotype *A. christmasvalleydunes.*

Paratypes. ♂3 ♀11. **OREGON, *Lake Co.,*** same data as types, 16-vi-2001 (S01-58) ♂1 ♀8; 18-vi-2004 (S04-59) ♂1. Christmas Valley Dunes, 43.348545° -120.401912°, 1312m, 23-vi-2014 (S14-24) ♂1 ♀1. Lost Forest RNA ~26 m NE Christmas Valley, 43.366330° 120.319409°, 1355m, 16-vi-2001 (S01-59) ♀2.

Drum. Similar drumming rate in both sexes plus males with sex clarification drum. **Male:** holotype R01-18 (Fig. 525) 20°C: 35 drums in 9.6s (3.6 drums/s). **Female:** allotype R01-25 (Fig. 526) 20°C: 40 drums in 11.9s (3.4 drums/s).

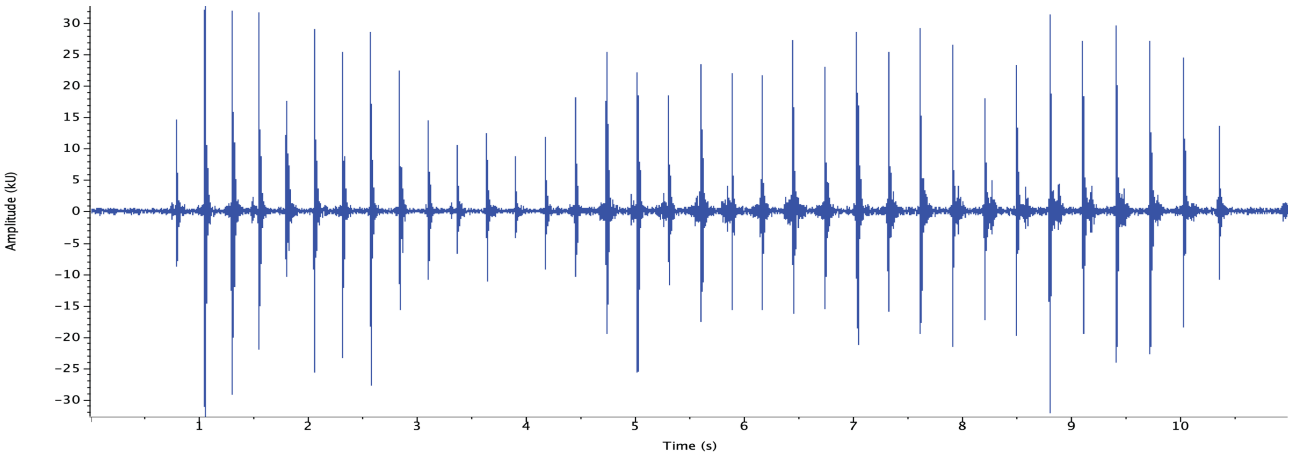


FIGURE 525. Calling drum (R01-18) holotype *A. christmasvalleydunes.*

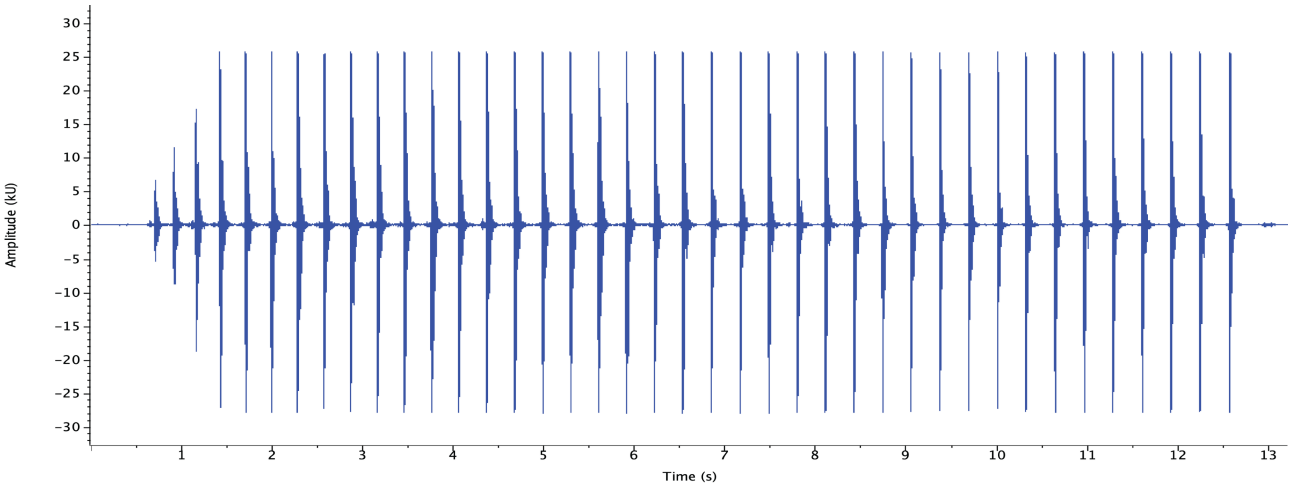


FIGURE 526. Calling drum (R01-25) allotype *A. christmasvalleydunes.*

Derivation of name. Named for their only known locality

Habitat. The type locality is a combination flat, sandy area with dense sagebrush and other shrubs transitioning into open, large rolling dunes. On 16-vi-2001, 13 JCs collected in flat areas with 1 JC collected in open dunes, despite longer oatmeal trail there. S01-59 is open ponderosa pine- juniper forest with sandy substrate. S14-24 is low rolling open dunes with sagebrush, rabbitbrush, and *Sarcobatus*.

Life cycle and seasonal occurrence. All individuals collected on 16-vi-2001 (S01-58) were late instars.

Variation. Of 16 individuals, 14 had 3 and 1 had 4 ventral **fore** leg tibial spurs; all 15 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 1 had 4, 5 had 5 and 9 had 6 inner **rear** leg tibial spines; and 1 had 3, 10 had 4 and 4 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. F1165 (S01-58) & F2409 (S14-24), both from the type locality, recovered together in Group 8 Lightfooti, and nearest to 2n♂=21 *A. juniperdunes.*

Karyotype. 2n♂=19. One type locality (S01-58) male checked: T01-7 (Fig. 527) shows 9 metacentric or submetacentric autosomal pairs; and 1 metacentric X chromosome.

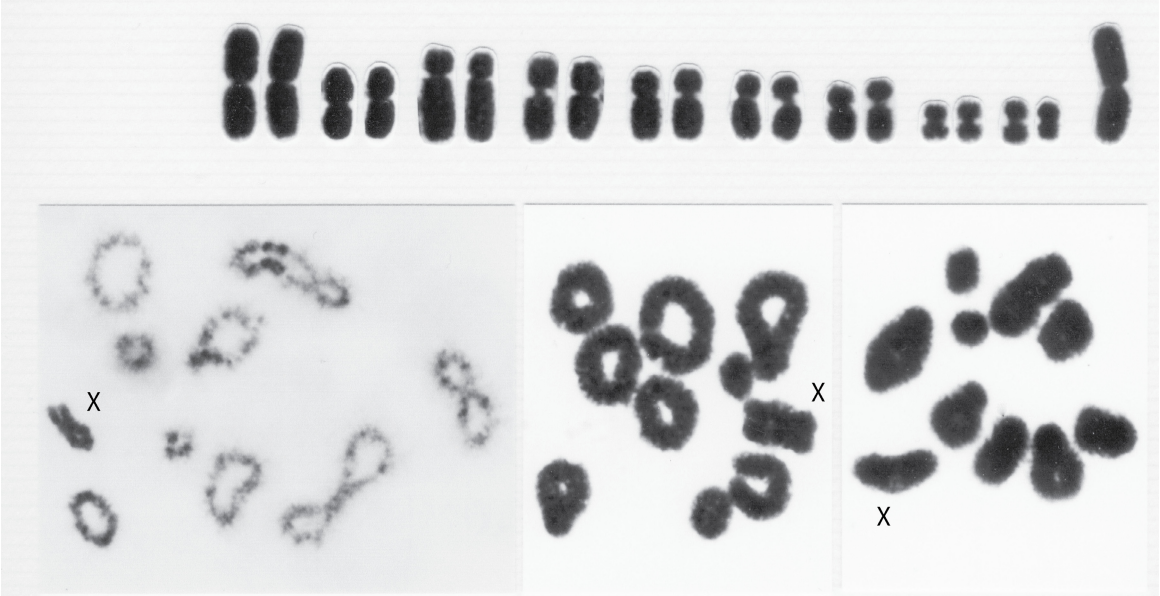


FIGURE 527. Idiogram T01-7 *A. christmasvalleydunes* (S01-58), and 3 meiotic cells all showing 2n♂=19. In the 3 bottom cells, the single, metacentric X chromosome is marked.

Discussion. At the type locality, the more common *A. christmasvalleydunes* (3.5 drums/s) occurs microsympatric with 1.5–1.9 drums/s *A. monolake*. In the absence of DNA or drum, adult males can be separated by rear leg calcars, widths of abdominal stripes, and size.

***Ammopelmatus evansi* Weissman, sp. nov.**
Crescent Dunes Jerusalem Cricket
Figs 528–531, Tables 30, 39

Distribution. (Fig. 528). Only known from Crescent Dunes, Nye Co., Nevada.

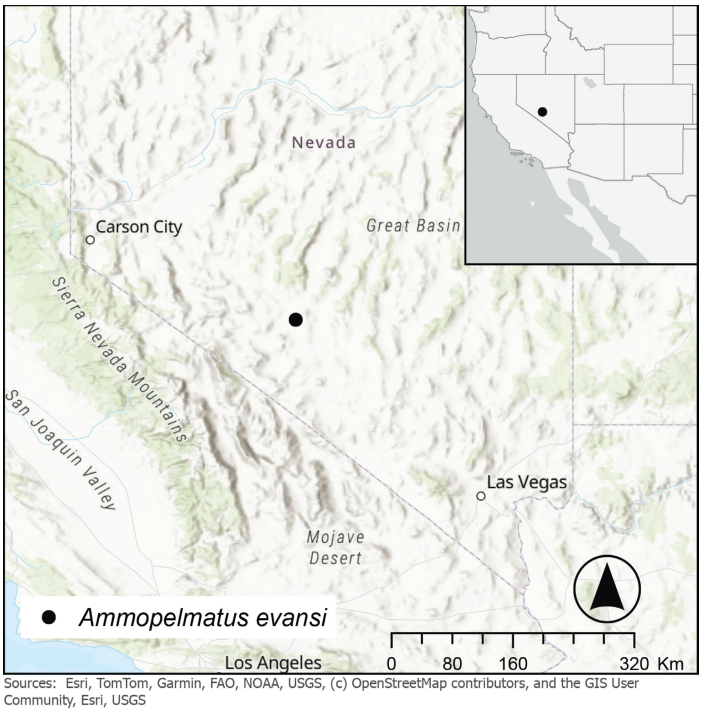


FIGURE 528. Distribution of *A. evansi.*

Recognition characters. Member of Lightfooti Group. A small, dark stripped, fast drumming, apparent sand dune obligate with typical modified rear leg tibial calcars #1 and #2. This is one of the fastest drumming (along with *A. rusti*); and the most southernly distributed member of this Group.

Holotype. Male (in alcohol, Fig. 529). **Nevada, *Nye Co.,*** Crescent Dunes, 38.230444° -117.333767°, 1547m, 29-iii-1983 (S83-23) AV Evans. R83-456. Molt to adult 15-ix-1983. Deposited CAS, Entomology type #20199. Measurements in mm: Body length 26.56, hind femur length 9.71, hind femur width 3.59. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 530) with 5 inner and 3 outer spines, 2 ventral spurs. Left rear leg tibial spines and calcars distorted.

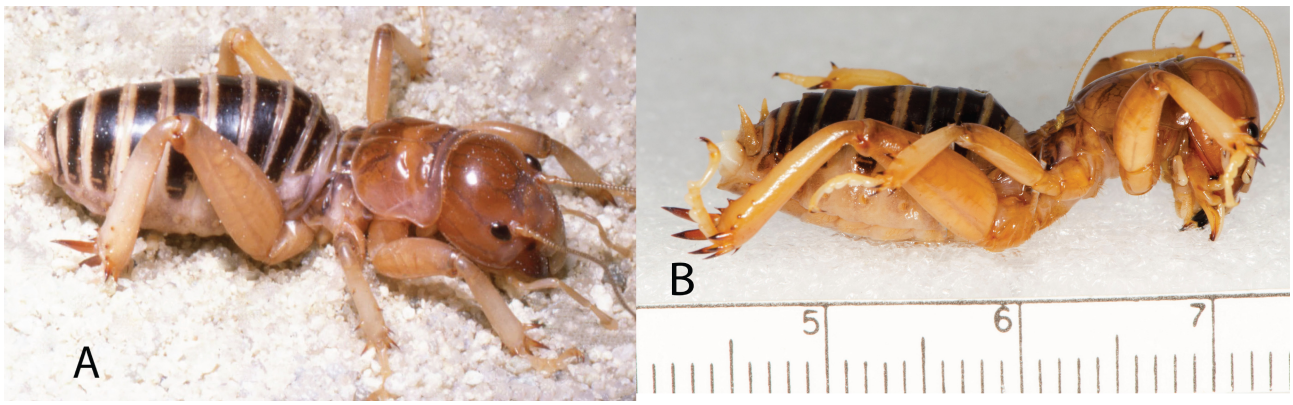


FIGURE 529. Holotype adult male *A. evansi.* A. When alive (photo ES Ross). B. When preserved.



FIGURE 530. Right rear leg tibia in holotype *A. evansi.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.

Female. Unknown.

Paratypes. None.

Drum. **Male:** Holotype (Fig. 531, R83-456) with 70 drums over 10.9s (6.4 drums/s) at 23°C.

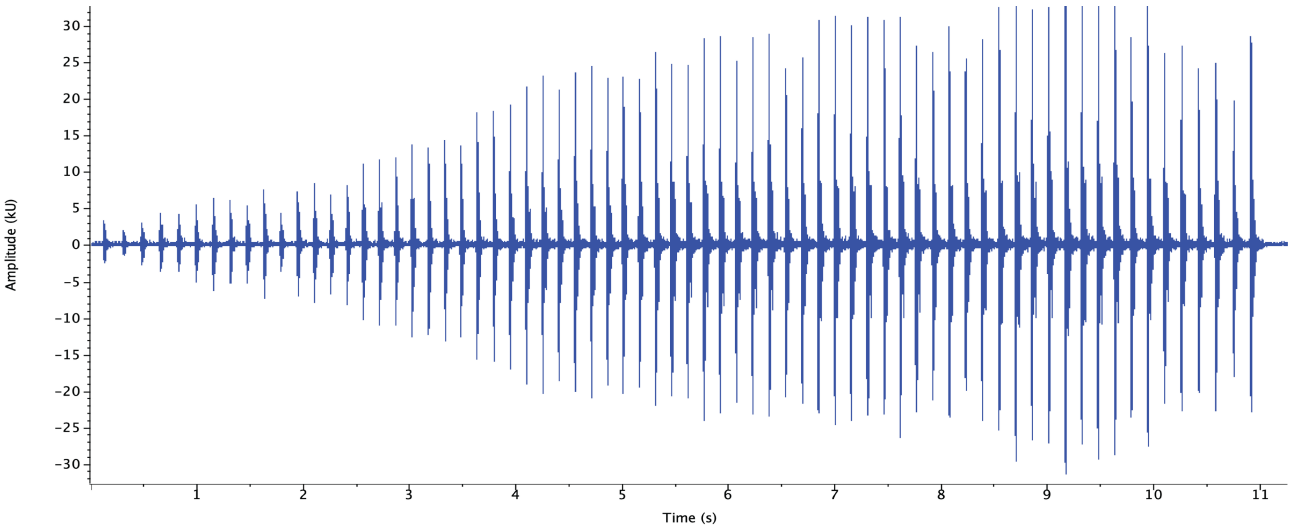


FIGURE 531. Calling drum (R83-456) adult male holotype *A. evansi.*

Derivation of name. Named after Arthur V. Evans, who collected the only known individual.

Habitat. According to A. Evans (pers. comm. to DBW), the holotype was sifted from moist sand at the base of the main dune

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. Holotype unique.

DNA. Unknown.

Karyotype. Unknown.

Discussion. We are surprised that the holotype is not lighter colored like other Nevada sand dune obligate species *A. winnemucca* and *A. knighti*, which are also in the Lightfooti Group. If *A. evansi* is not a sand dune obligate, then we know of no other Nevada JC that this could be based upon its calling drum rate and smaller size relative to the similarly fast drumming *A. rusti* from more northern Blow Sand Mt, Nevada.

We have subsequently visited the Crescent Dunes on 3 occasions, during the spring and summer, employing sifting, rock rolling, and nocturnal oatmeal trails, and have collected no more individuals. These visits were before construction of the adjacent Crescent Dunes Solar Energy Project, the world's first utility-scale molten salt facility (Strickland 2018).

We consider *A. evansi* to be a species of conservation concern, given its apparent limited distribution and proximity to the Crescent Dunes Solar Energy Project.

***Ammopelmatus idaho* Weissman, sp. nov.**

Idaho Jerusalem Cricket

Figs 532–543, Tables 27, 39

Species #7, Weissman 2001a.

Distribution. (Fig. 532). Only known from southern Idaho; but not from the southwestern corner, where *A. juniperdunes* is found.

Recognition characters. Member of Lightfooti Group. Small–medium sized JC with 2n♂=19. The only other JC species with 2n♂=19 is the restricted Lightfooti Group *A. christmasvalleydunes*, from Oregon, some 700 km away; and from which it differs by DNA. *A. idaho* individuals typically with 6 inner and 5 outer rear leg tibial spines, ~3.7 drums/s. JCs from the southwestern corner of Idaho are *A. juniperdunes* (2n♂=21), based on DNA and karyotype, and treated as such in this paper (see p. 328).

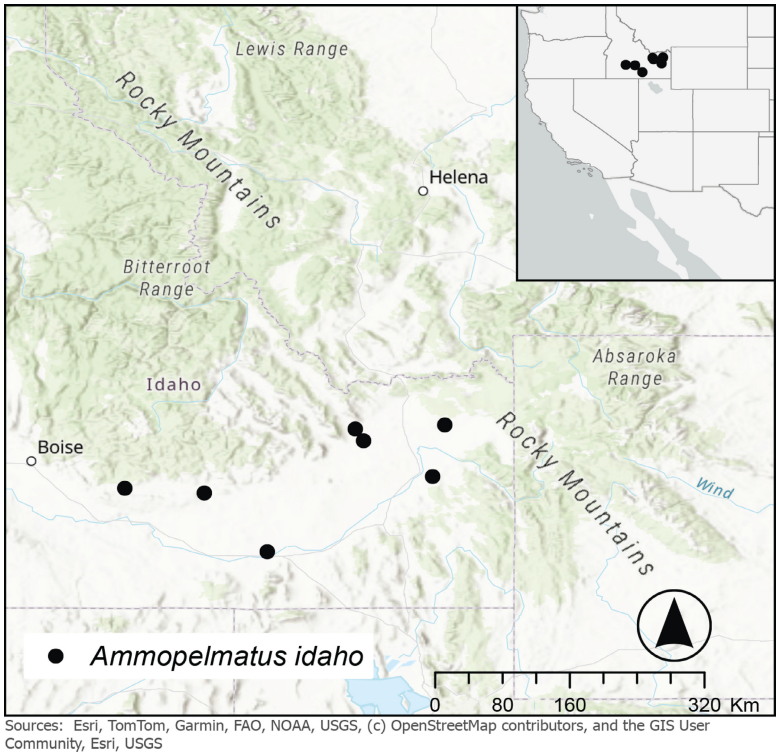


FIGURE 532. Distribution of *A. idaho.*

Holotype. Male (in alcohol, Fig. 533): **Idaho, *Fremont Co.,*** St. Anthony Sand Dunes, 44.015944° -111.788028°, 1500m, 9-viii-2010 (S10-32) DBW, DC Lightfoot. R10-5. Collected as adult. Deposited CAS, Entomology type #20102. Measurements in mm: Body length 30.85, hind femur length 10.77, hind femur width 4.08. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 534) with 5 & 6 inner and 3 & 5 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 535): Same data as holotype except R10-9, F2193. Collected as adult. Deposited CAS, Entomology #9077139. Measurements in mm: Body length 34.91, hind femur length 10.28, hind femur width 3.89. Fore leg tibia with 2 & 3 ventral spurs; middle leg tibia with 8 calcars, 3 ventral spurs (second side missing as leg taken for DNA); hind leg tibia (Fig. 536) with 5 inner and 5 outer spines, 2 ventral spurs. Ovipositor Fig. 537.

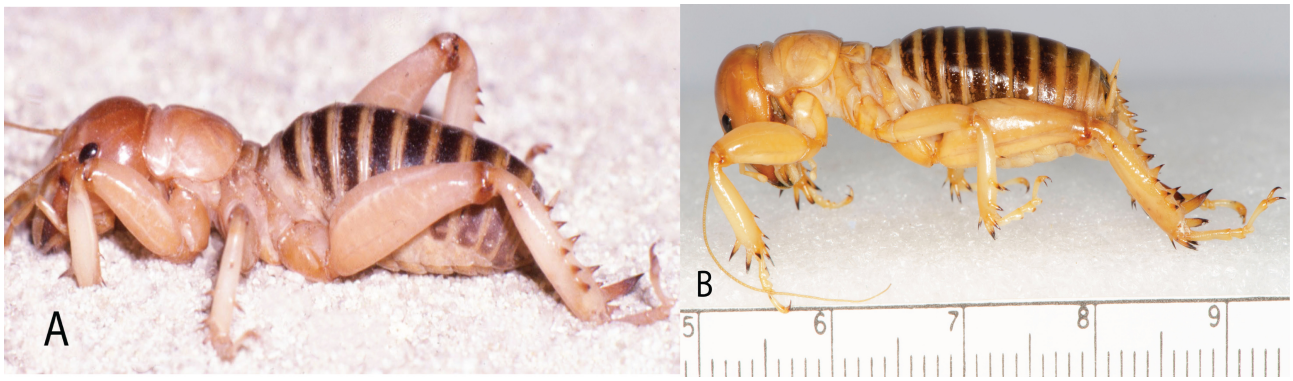


FIGURE 533. Adult male holotype *A. idaho.* A. When alive. B. When preserved.



FIGURE 534. Right rear leg tibia holotype adult male *A. Idaho.* A. Showing 6 inner and 5 outer spines. B. Showing shape of calcars.



FIGURE 535. Adult female allotype *A. idaho.* A. When alive. B. When preserved.

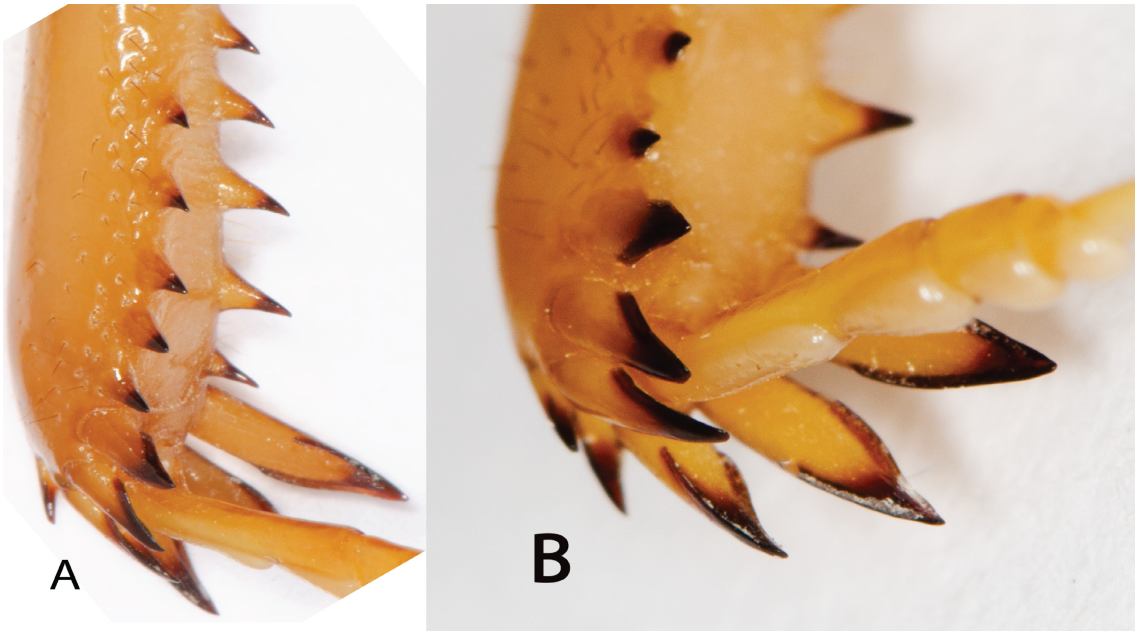


FIGURE 536. Left hind leg tibia allotype *A. idaho.* A. Showing 5 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 537. Ovipositor allotype *A. idaho.*

Paratypes. ♂15 ♀24. **IDAHO, *Blaine Co.***, Magic Reservoir, 43.266329° -114.355648°, 1485m, 16-viii-2006 (S06-100) DM Thornborrow ♀1. ***Bonneville Co.***, Idaho Falls, 5511 S. Tappan Falls Dr, 43.447749° -111.917859°, 1560m 24-vi-2006 (S06-58) C. Assante ♀1. INEL, T3N, R34E, S9, 1588m, 1-vi-1993 (S93-37) PE Blom ♀1. ***Butte Co.,*** INEL, T7N, R31E, S23, 1483m, 30-v-1993 (S93-36) PE Blom ♂1. INEL, Rd T-11 1.2m NW Hwy 20/26, 1542m, 30-ix-1989 (S89-87) W. Clark ♀1. ***Clark Co.***, Hwy 22 2.15 km SW Hwy 23, 43.971139° -112.743667°, 1553m, 25-viii-2021 (S21-32) ♀2. ***Elmore Co.***, Hwy 20 34 m E Mt Home at mile post 130.3, 43.318100° -115.204585°, 1678m, 16-v-2000 (S00-7) ♂1 ♀2. ***Fremont*** Co., Type locality ♂2 ♀3. ***Jefferson Co.,*** Idaho National Laboratory, Jct. Hwy 33 & Rd T-17, near Circular Butte, 43.84106° -112.65510°, 1472m, 2-xi-2011 (S11-118) WH & ME Clark ♀2; 1-vii-2013 (S13-40) WH & ME Clark ♂5 ♀6. 0.5 m W Circular Butte, T6N R32E Section 24, near Jefferson Co. and Butte Co. line, 1470m, 22-vi-4-vii-1989 (S89-48) WH Clark & PE Blom ♂3 ♀2; 8-iv-1990 (S90-32) WH Clark & PE Blom, ♂1 juvenile for testes; 17-v-2000 (S00-9) ♂1. ***Minidoka Co.,*** Rupert, ~42.619501° -113.683650°, 1268m, 17-viii-2005 (S05-81) M. Bench ♂1.

Drum. Calling drum similar in both sexes except that adult males have a sex clarification drum. **Male:** Holotype R10-5 (Fig. 538) 21°C: 49 drums over 12.7s (3.9 drums/s). **Female:** Allotype R10-9 (Fig. 539) 19°C: 38 drums over 10.5s (3.6 drums/s).

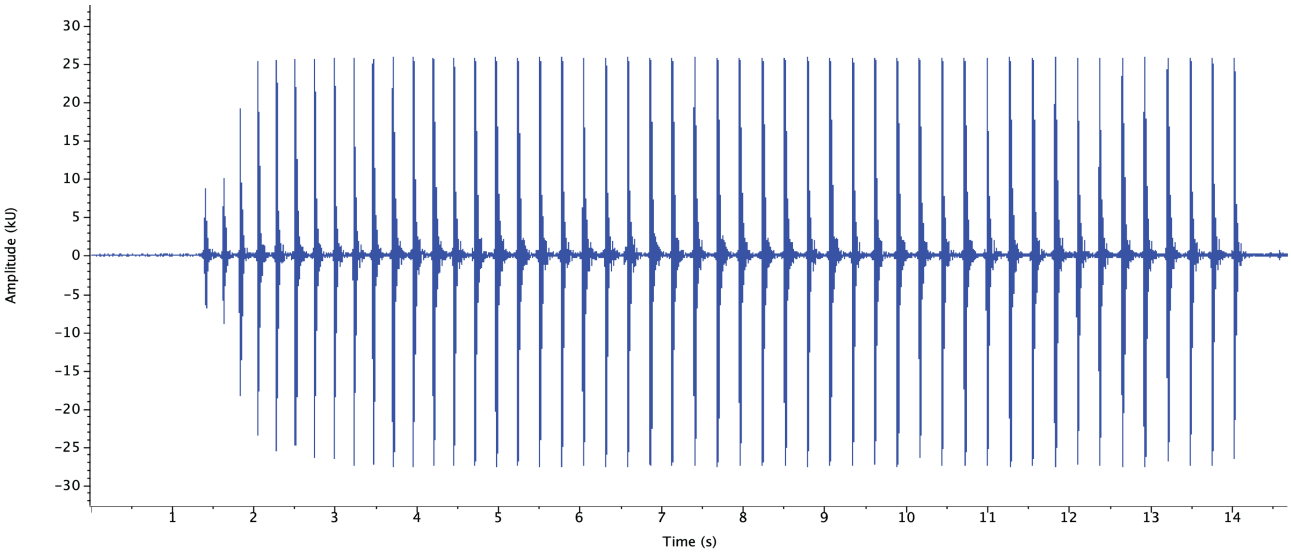


FIGURE 538. Calling drum (R10-5) adult male holotype *A. idaho.*

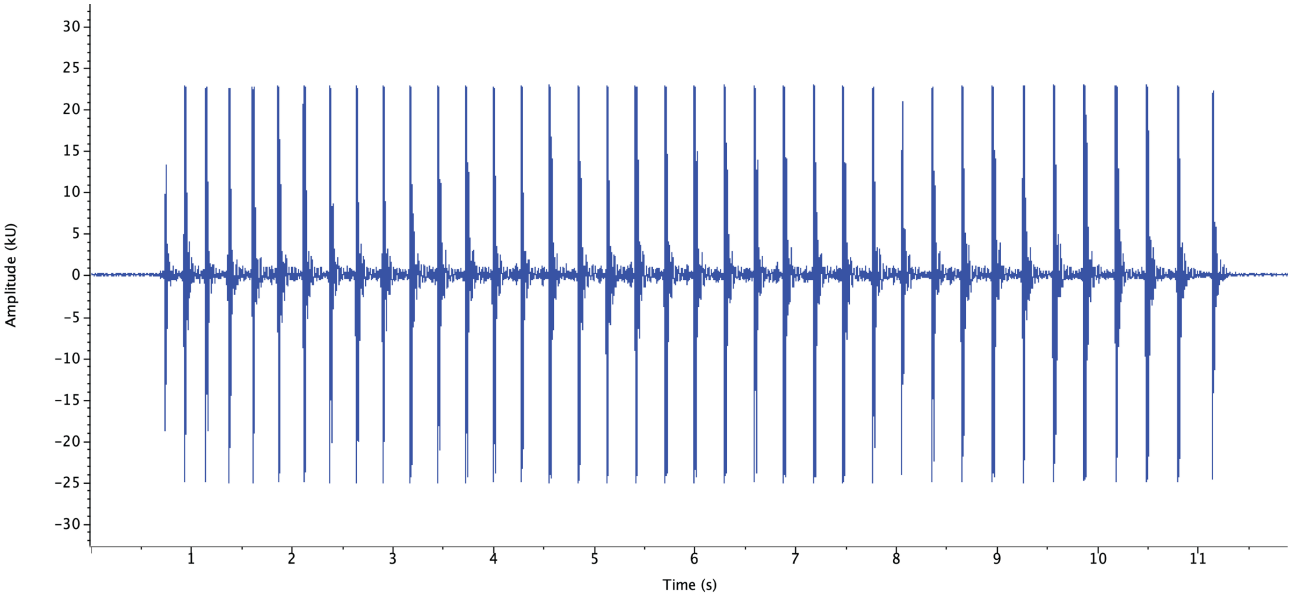


FIGURE 539. Calling drum (R10-9) adult female allotype *A. idaho.*

Derivation of name. Named after the type locality.

Habitat. The type locality St. Anthony Sand Dunes consists of 4290 hectares (10,600 acres) of clear, shifting, white quartz sand. Although much of the sand dunes are managed as a BLM wilderness study area, the remainder is popular for high off-road vehicle use. In any one JC species, it is unusual, but not unknown, to find populations living both on and off sand dune areas. As such, we believe that further efforts should be directed at off dune localities, such as Rupert (S05-81), to ensure that such populations are consistent with those at the type locality, even if their DNA and drum generally match. Elsewhere (e.g., S89-48 and S11-118, Circular Butte), *A. idaho* occurs on sandy substrate with sagebrush (*Artemisia tridentata*) and winterfat (*Krascheninnikovia lanata*). Area east of Mt Home (S00-07) was grazed, open sandy sagebrush habitat.

Life cycle and seasonal occurrence. The whole type locality series, collected on 9-viii-2010, was adult except for 1 mid instar male, whose testes were removed in 2011 for karyotyping.

Variation. Of some 21–24 individuals, 21 had 3 ventral **fore** leg tibial spurs; 22 had 8 and 2 had 9 **middle** leg tibial calcars, 21 had 2 and 1 had 3 ventral spurs; 8 had 5 and 16 had 6 inner **rear** leg tibial spines; and 7 had 4, 16 had 5 and 1 had 6 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. F1083 (S00-7, Mt Home); F1620 (S05-81, Rupert, in restaurant); F1816 (S06-100, Blaine Co); F2193 (type locality S10-32); F2243 (S11-118, Circular Butte); and F2653 (S21-32, Clark Co.) recovered in their own subclade, within Group 8 Lightfooti, and closest to *A. christmasvalleydunes, A. juniperdunes,* and *A. lightfooti.*

Karyotype. 2n♂=19. 4 individuals examined: T90-7 (Fig. 540, S90-32, Circular Butte); T01-1 (Fig. 541, S00-9, Circular Butte); T02-1 (Fig. 542, S00-7, Mt Home); T11-3 (Fig. 543, topotypic S10-32) all with 9 metacentric or submetacentric autosomal pairs and 1 metacentric X chromosome.

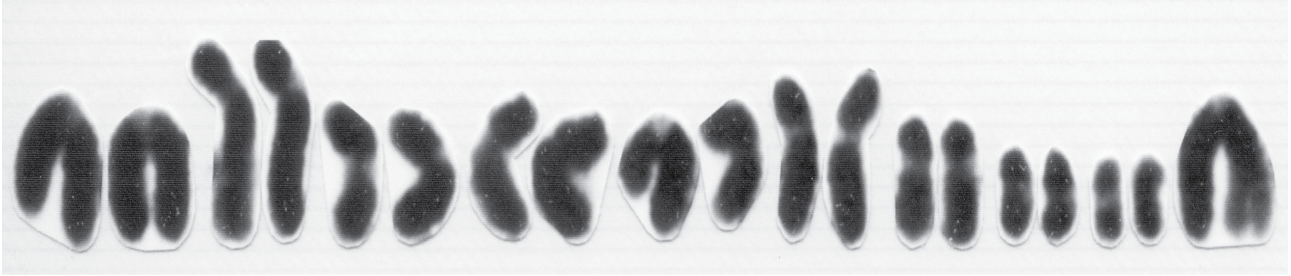


FIGURE 540. Idiogram T90-7 *A. idaho* (S90-32).

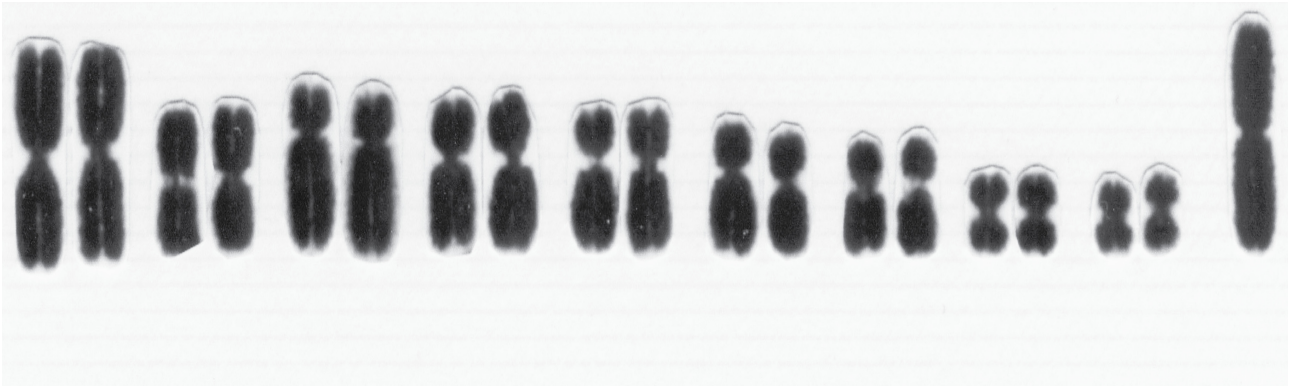


FIGURE 541. Idiogram T01-1 *A. idaho* (S00-9).

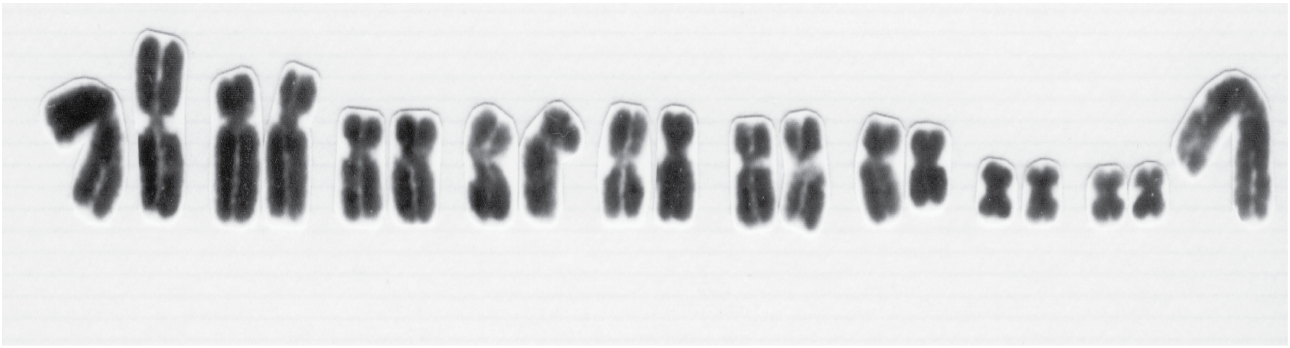


FIGURE 542. Idiogram T02-1 *A. idaho* (S00-7).

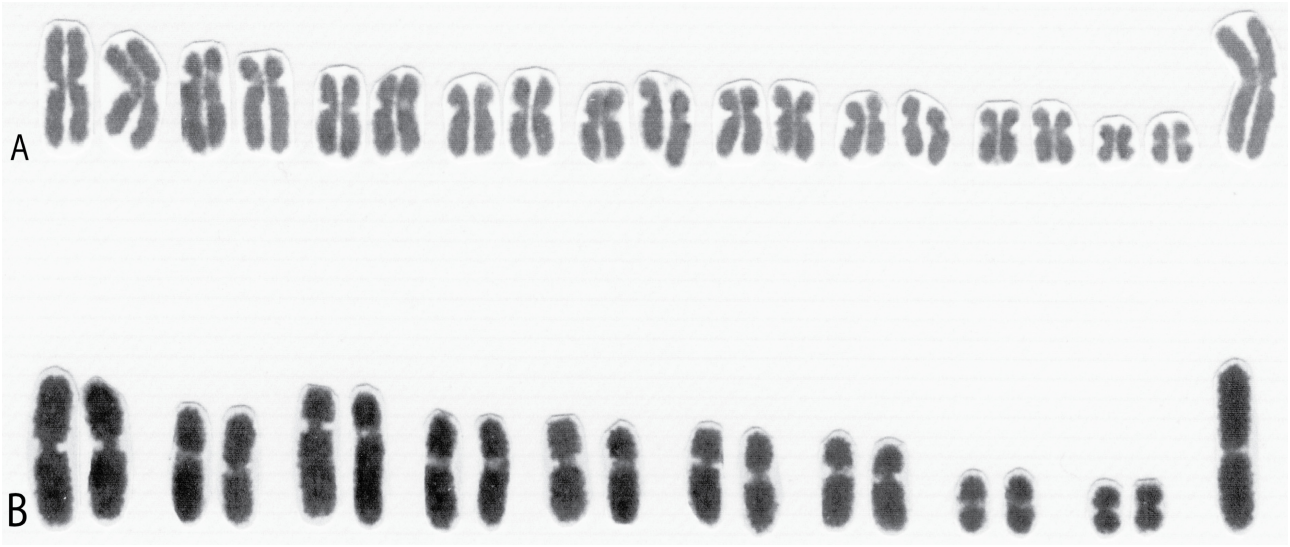


FIGURE 543. Idiogram T11-3 *A. idaho* (S10-32). A. From cell during mitosis. B. From cell during meiosis.

Discussion. At Circular Butte (S89-48 & S00-09) individuals were excavated living within the nest of the harvester ant, *Pogonomyrmex salinus* Olsen; similar to that described by Clark & Tinkham (1977) for *A. yubalake* living with *P. salinus* [= *P. owyheei* Cole] in northern Nevada. The excavators report (pers comm to DBW from W.H. Clark, 1989, 2023, and 2024), for S89-48, that over a 2-week period, at Circular Butte, they sifted 27, 1x1 square meter plots to a depth of ~30 cm. The first plot was centered over the ant mound with a second plot 2m from the mound and a third plot 4m from the mound. All 12 encountered JCs were found in the first plot, indicating a clear association with the ants. The soil was damp at 10–15 cm depth.

***Ammopelmatus juniperdunes* Weissman, sp. nov.**
Juniper Dunes Jerusalem Cricket
Figs 544–558, Tables 27, 32, 35, 39

Species #8, Weissman 2001a
Species #28, Weissman 2001b.

Distribution. (Fig. 544). British Columbia, Washington, Oregon, and western Idaho, all east of the Cascades.

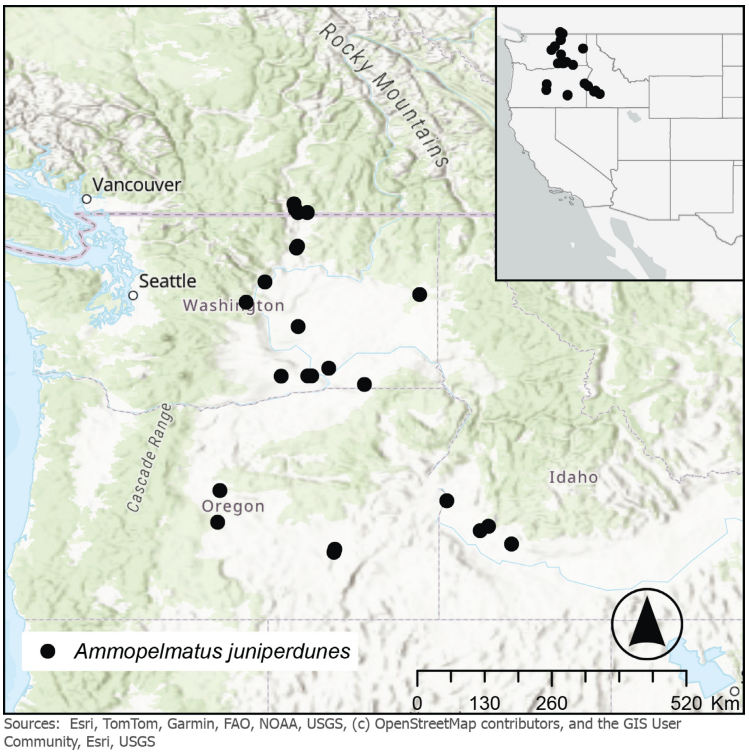


FIGURE 544. Distribution of *A. juniperdunes.*

Recognition characters. Member of Lightfooti Group. Medium sized JC with 2n♂=21, drum rate ~4 drums/s at 20°C. While *A. juniperdunes* has the same 2n number as the restricted *A. bruneaudunes* and *A. winnemucca*, *A. juniperdunes* has all 10 autosomal pairs metacentric while the former two have only 7 metacentric autosomal pairs. The taxa are also separated by DNA.

Holotype. Male (in alcohol, Fig. 545): **Washington**, ***Franklin Co***., Juniper Dunes, 46.344333° -118.939472°, 211m, 22-vi-2014 (S14-20) DBW, DC Lightfoot. R14-19. Molt to adult 4-viii-2014. Deposited CAS, Entomology type #20101. Measurements in mm: Body length 30.35, hind femur length 10.67, hind femur width 3.78. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 546) with 5 or 6 inner and 4 outer spines, 2 ventral spurs.



FIGURE 545. Adult male holotype *A. juniperdunes.* A. When alive. B. When preserved.



FIGURE 546. Left rear leg tibia adult male holotype *A. juniperdunes.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 547): same data as holotype except R14-25. Molt to adult 4-viii-2014. Deposited CAS, Entomology #8414040. Measurements in mm: Body length 35.71, hind femur length 8.99, hind femur width 3.52. Fore leg tibia with 2 & 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 548) with inner and outer spines, 2 ventral spurs. Ovipositor Fig. 549.

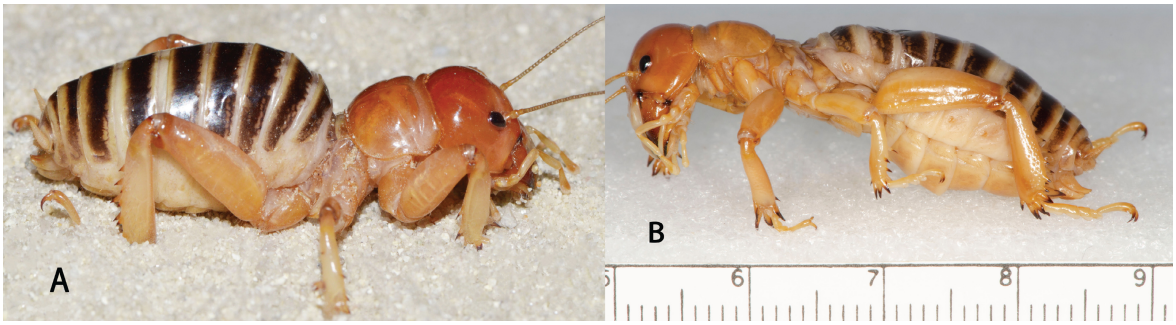


FIGURE 547. Allotype adult female *A. juniperdunes.* A. When alive. B. When preserved.



FIGURE 548. Left rear leg tibia adult female allotype *A. juniperdunes.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 549. Ovipositor allotype *A. juniperdunes.*

Paratypes. ♂40 ♀61. **CANADA, *British Columbia,*** Haynes Lease Ecological Reserve 3 m N Osoyoos, 49.094147° -119.521653°, 414m, 26-viii-2000 (S00-27) ♀1. Oliver, 49.182353° -119.542230°, 305m, 1-vi-1994 (S94-25) J. King, male for testes; 14-vi-1994 (S94-30) W. Charles ♀1. Osoyoos, Desert Center, 49.03244° -119.31158°, 355m, 26-viii-2000 (S00-28) ♂1 ♀1; 24-viii-2001 (S01-101) G. Scudder ♂3 ♀9; 19-vi-2004 (S04-61) ♂1 for testes, ♀1. Osoyoos, 49.032321° -119.473581°, 302m, 7-v-1986 (S86-26) S. Connings ♂1 ♀1. White Lake area, ~50.882026° -119.299486°, 482m, W. Charles, early July, 1994 (S94-63) ♂1; 8-ix-1994 (S94-99) ♂1. **IDAHO, *Ada Co.***, Boise, 2044 Mortimer Dr, 43.613133° -116.165680°, 889m, 5-ix-2005 (S05-129) E. Bosch ♀1. Boise, 10260 Huntwood Dr, 43.537730° -116.310109°, 837m, 11-v-2009 (S09-13) L. Turner ♀1. Dry Creek, ~43.307° -115.766°, 1080m, 9-vii-2006 (S06-64) WH Clark ♀1. ***Payette Co.,*** Payette, 44.054454° -116.889584°, 690m, D. Morse, 4-ix-2008 (S08-59) ♂1; 18-x-2008 (S08-59) ♀1; 20-xi-2008 (S08-86) ♂1. ***Washington Co.,*** Weiser Dunes OHV Play Area, 44.297361° -117.208945°, 657m, 27-vi-2014 (S14-34) ♂5 ♀12. **OREGON, *Crook Co***., Davis Loop Rd SE Prineville, 44.230988° -120.829276°, 1116m, early August (S04-86) V. Trampush ♂1. ***Deschutes Co.***, 2.8m E Millican, 43.683332° -120.868235°, 1337m, 1-vi-1997 (S97-50) ♀1. ***Harney Co.,*** East edge Malheur Refuge, 43.166° -118.849°, 1262m, 18-iv-1996 (S96-26) G. Ivey ♂1. East edge Malheur Refuge, 43.217° -118.833°, 1258m, 5-vi-1996 (S96-69) G. Ivey ♂1. **WASHINGTON, *Asotin Co.,*** Clarkston, 1507 Scenic Way, 46.398668° -117.069528°, 301m, 17-x-2009 (S09-158) C. Krohn ♀2, ***Benton Co.,*** Kennewick, 211 S. Bermuda Rd., 46.210760° -119.303284°, 239m, C. McCoy (S06-101) ♂2. Kennewick, 8412 WE Bruneau Place, 46.211715° -119.236106°, 174m, 20-viii-2007 (S07-81) J. Laws ♂1. Prosser, 1411 Dudley Ave, 46.206526° -119.765273°, 207m, 27-viii-2006 (S06-103) J. Hulse ♀1. ***Chelan Co.,*** Chelan, 1917 W Woodin Ave, 47.834899° -120.046444°, 343m, 3-ix-2005 (S05-125) D. Thorson ♀1. Wenatchee, 1519 American Fruit Rd, 47.483713° -120.373254° 275m, 2-vi-2005 (S05-56) S. Osborn ♀1. ***Franklin Co.***, type locality, same data as types (S14-20), ♂13 ♀10. ***Grant Co.,*** Soap Lake, 28-ix-2006 (S06-113) D. Kramer ♀1. Sand dunes west end of Potholes Reservoir, 47.063416° -119.470861°, 361m, 21-vi-2014 (S14-18) ♂2 ♀7. ***Okanogan Co.,*** Omak, 16 Bentham Rd., 48.420309° -119.499197°, 296m, A. Russell, 8-viii-5-xi-2005 (S05-79) ♀3; 7-iv to 28-viii-2006 (S06-10) ♂4 ♀2. 2m N Omak, 168A Old Riverside Hwy, 48.452064° -119.480468°, 342m, 27-viii-2008 (S08-56) ♀1. 7 m E Twisp, in Finley Canyon, 820m, 18-x-2007 (S07-105) L. Brannigan ♀1. ***Spokane Co.,*** Spokane, 510 E Joanne Ct, 47.738678° -117.402690°, 604m, 4-x-2004 (S04-141) D. Carnes ♀1. Spokane, 47.616889° -117.360948°, 699m, 23-vi-2010 (S10-17) B. & M. Williams ♀1. ***Walla Walla Co.,*** Walla Walla, 515 S. Division, 46.063556° -118.319603°, 308m, A. Hanson ♂1. ***Yakima Co.,*** Yakima, 46.632° -120.681°, 533m, 22-x-2008 (S08-75) Paula ♀1.

Possible placement. **IDAHO, *Washington Co.*,** Mann Creek SE, Idaho Quadrangle, T.11N. R.4W. Sec. 23 N ½ of the NW ¼, 19-iii-1998 (S98-20) ♀1. This specimen was collected by the Payette High School Sophomore Class

and sent to DBW by George Stephens. She drummed (R98-27) at 4 drums/s at 19.5°C; and morphologically agrees with *A. juniperdunes*, which is documented from the Weiser Sand Dunes some 27 km due west.

Drum. **Male:** Holotype R14-19 (Fig. 550) 21°C: 2 sex clarification drums (SCD) of 6 drums over 0.45s (13.3 drums/s) and 5 drums over 0.36s (13.9 drums/s); plus calling drum of 39 drums over 9.7s (4.0 drums/s). SCDs in this male ranged from 4-8 drums/burst. A late instar male from Okanogan (S86-26) also with a SCD (R86-6). **Female:** Allotype R14-25 (Fig. 551), 20.5°C: 2 series of 18 drums in 4.4s (4.1 drums/s) and 14 drums in 3.2s (4.4 drums/s).

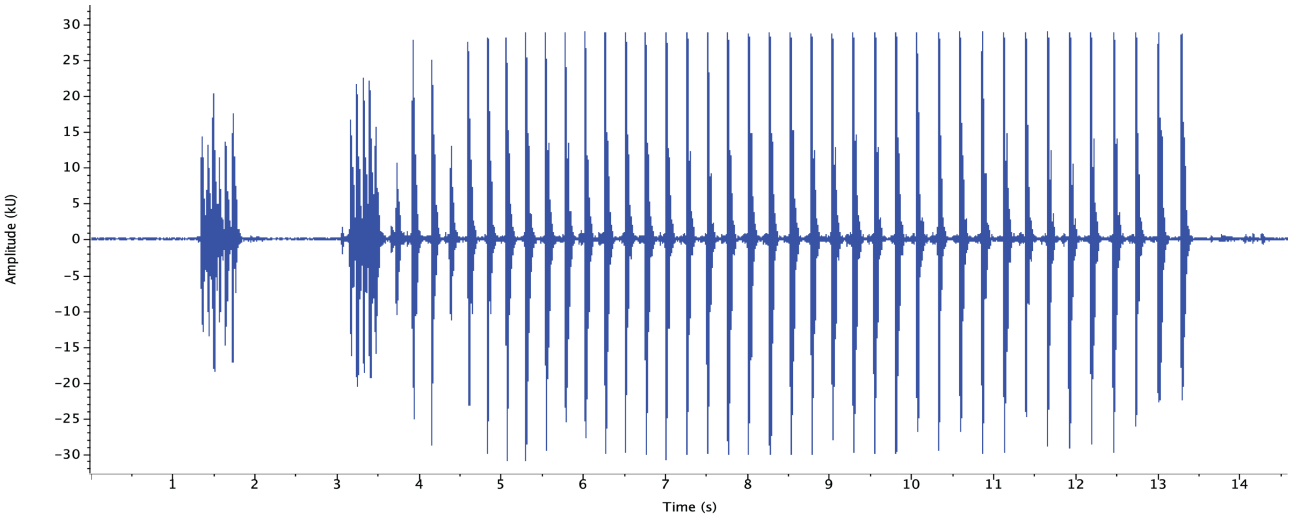


FIGURE 550. Calling drum (R14-19) adult male holotype *A. juniperdunes.*

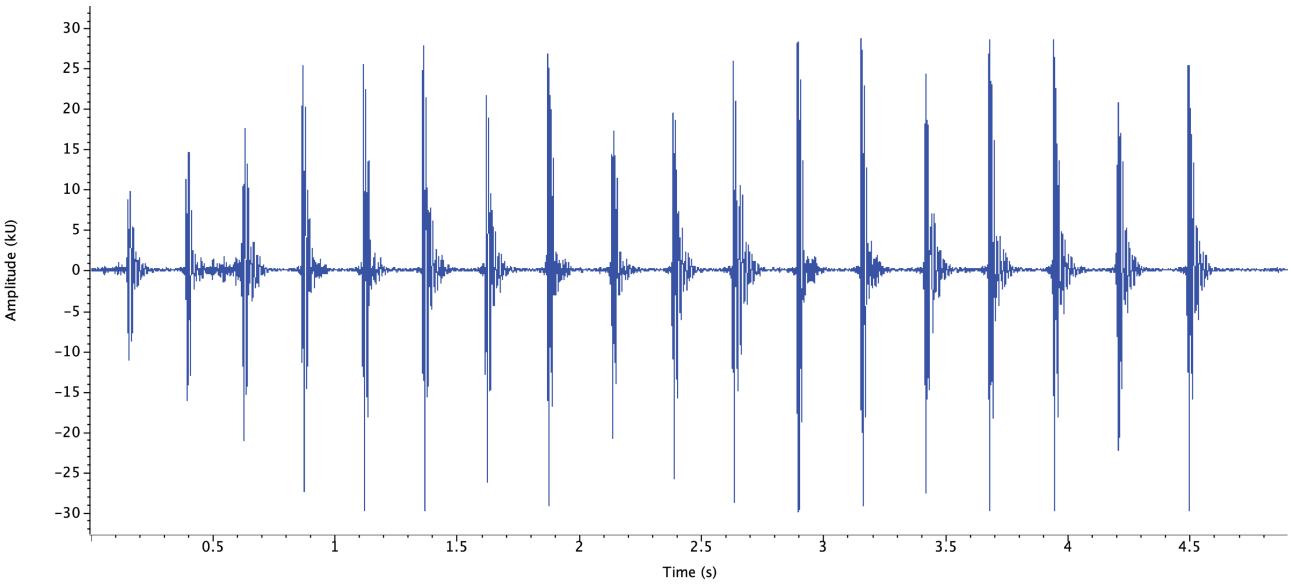


FIGURE 551. Call drum (R14-25) adult female allotype *A. juniperdunes.*

Derivation of name. Named for the locality where we collected the largest number of individuals of this species. While the specific type locality is part of the unprotected Juniper Dunes OHV Area, under management by BLM, it is adjacent to the larger, protected Juniper Dunes Wilderness area and the Area of Critical Environmental Concern. All 3 areas total an impressive 7930 hectares (=19,600 acres). We simply could not reach the Wilderness area without 4 WD but the JCs appear to be doing fine in the OHV area, along with a lot of Mormon crickets (*Anabrus*) that also came to our oatmeal trails.

Habitat. Sandy and sand dune habitat with varying amounts of surface cover of sagebrush, greasewood, and grasses, including cheat grass. At the type locality, we just laid oatmeal in the ATV partially vegetation-denuded areas.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle. On 22-vi-2014, at our 15 kg long oatmeal trail, on our only walk at 21:45, we collected 19 last and 1 mid instar male, along with 19 last and 1 mid instar female. We estimate that we left another 20 last instar individuals at the oatmeal trail.

Variation. From some 25 individuals from the type locality, 1 had 2 and 24 had 3 ventral **fore** leg tibial spurs; 1 had 6 and 24 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4, 20 had 5, and 4 had 6 inner **rear** leg tibial spines, and 3 had 3, 20 had 4, and 2 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs. For the paratype localities, notable was the fact that while 4 individuals from Weiser Dunes (S14-34) had the typical 5 inner rear leg tibial spines, 13 individuals had 6 spines.

DNA. Fig. 496, p. 304. F0248 (S96-26, Harney Co); F0252 (S96-69, Malheur); F0486 (S97-50, Millican); F1086 (S00-28, Osoyoos); F1423 (S04-86, Prineville); F1627 (S05-129, Boise); F1807 (S06-64, Dry Creek); F1834 (S06-103, Benton Co); F2127 (S08-86, Payette); F2139 (S09-13, Boise); F2398 (S14-18, Potholes); F2401 (S14-20, type locality Juniper Dunes); F2417 (S14-34, Weiser Dunes) all recovered together in Group 8 Lightfooti, a large, mixed, poorly supported clade with 2n♂=19 *A. christmasvalleydunes* and *A. idaho*; and 2n♂=23 *A. lightfooti*.

Karyotype. 2n♂=21. Nine testes examined, although only 6 photographed, with variable results: 8 (T04-4, T14-8, T14-11, T14-12) or 10 (T94-4, T14-13) metacentric or submetacentric autosomal pairs; 0 or 2 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome: T94-4 (Fig. 552, S94-25, Oliver); T01-72 (S01-101, Osoyoos); T04-4 (Fig. 553, S04-61, Osoyoos); T14-8 (Fig. 554, S14-18, Potholes Dunes); T14-11 (Fig. 555) & T14-12 (Fig. 556), both from S14-34, Weiser Dunes; T14-13 (Fig. 557), T14-19, T14-25, all 3 from S14-20, type locality Juniper Dunes.

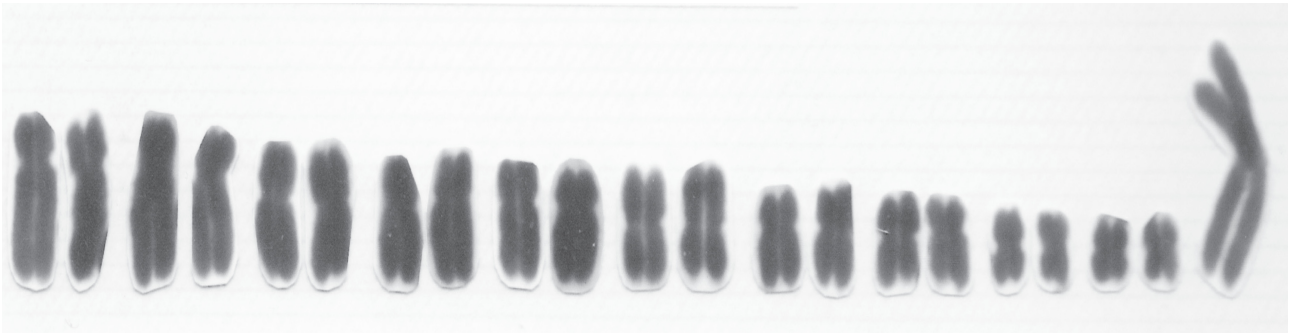


FIGURE 552. Idiogram T94-4 *A. juniperdunes* (S94-25).

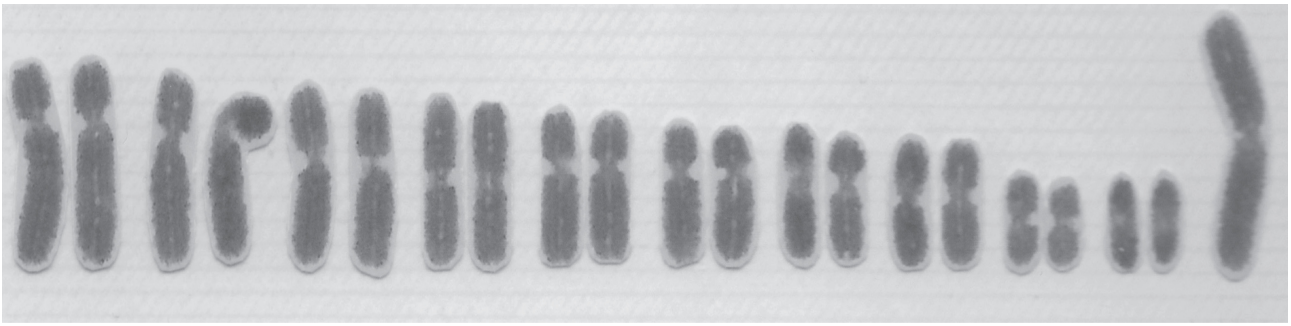


FIGURE 553. Idiogram T04-4 *A. juniperdunes* (S04-61).

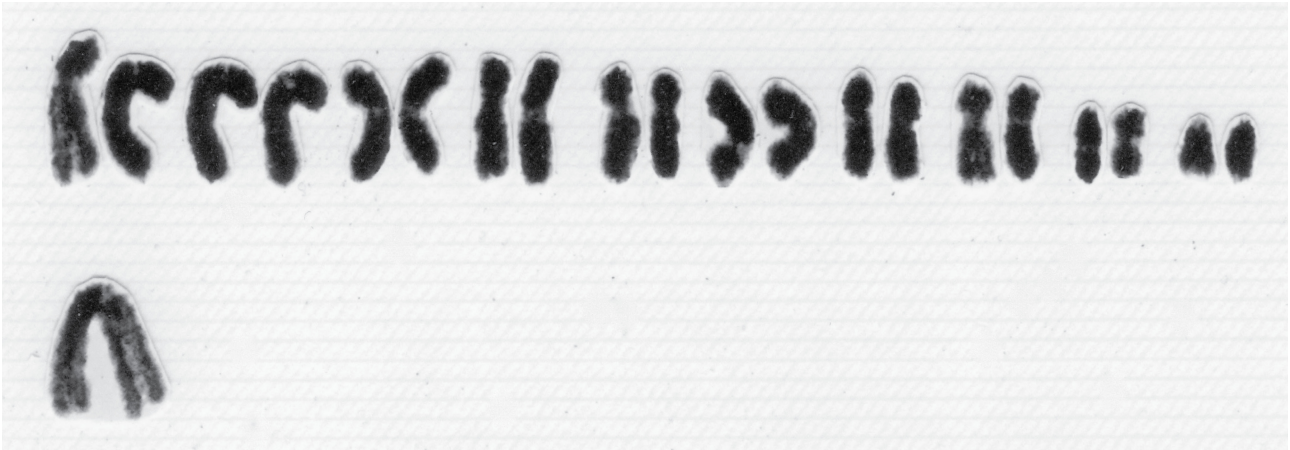


FIGURE 554. Idiogram T14-8 *A. juniperdunes* (S14-18).

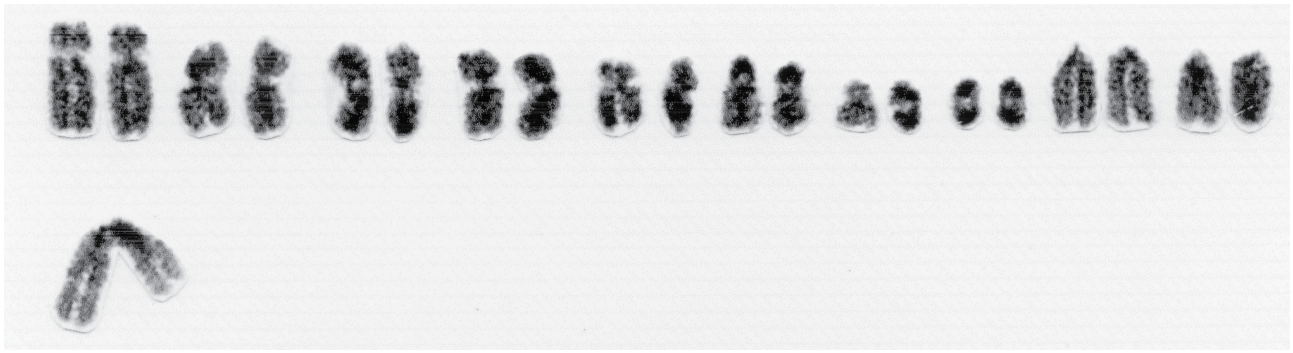


FIGURE 555. Idiogram T14-11 *A. juniperdunes* (S14-34).

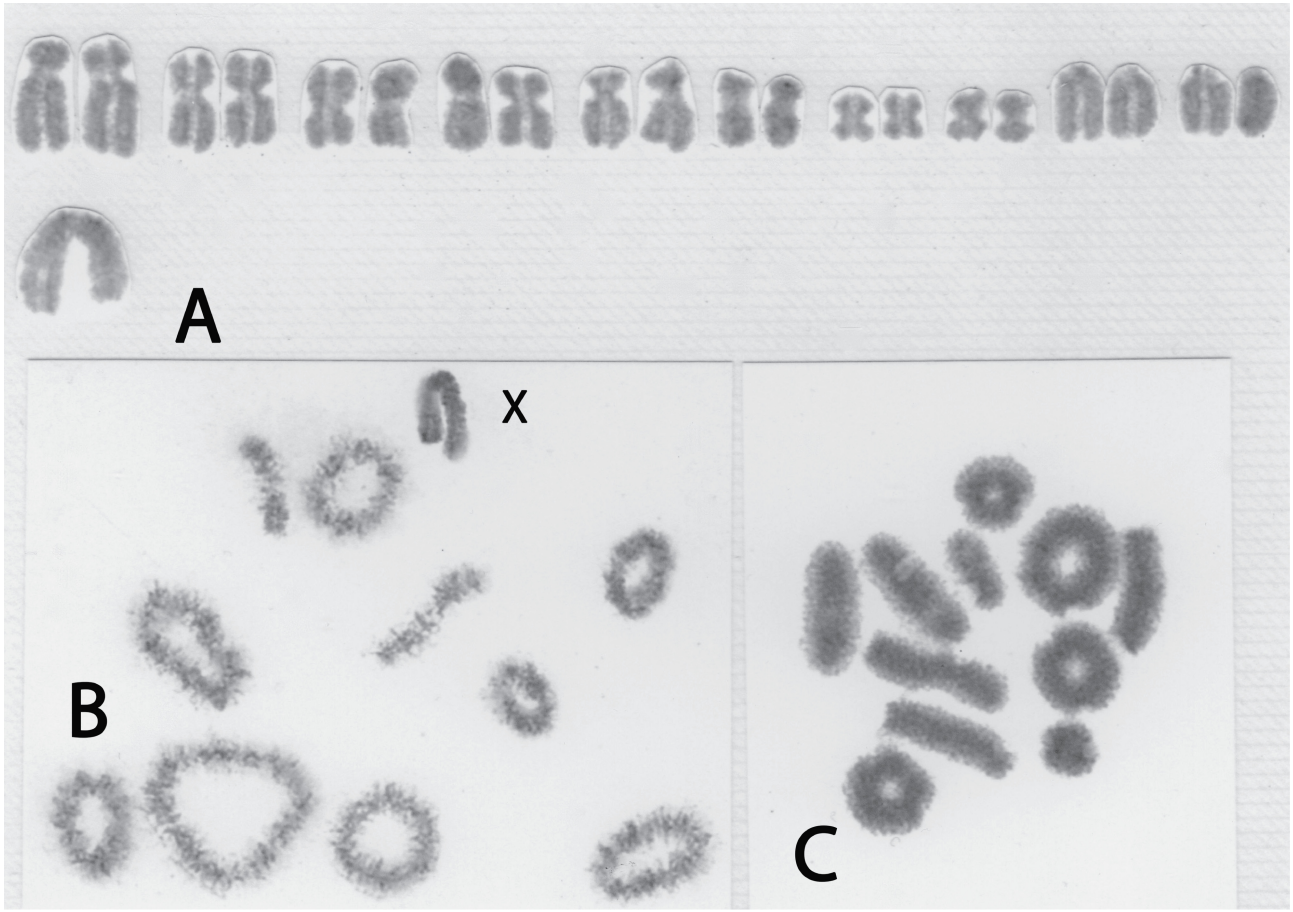


FIGURE 556. Preparations from T14-12 *A. juniperdunes* (S14-34). A. Idiogram. B. Diplotene (with X chromosome marked). C. Diakinesis-metaphase.



FIGURE 557. Idiogram T14-13 *A. juniperdunes* (S14-20).

Discussion. Under the name *A. juniperdunes,* we have included all those Lightfooti Group populations from sandy habitats in eastern Washington and Oregon, and southwestern Idaho, that have a documented karyotype of 2n♂=21 chromosomes (Osoyoos and Oliver, British Columbia; Potholes and Juniper Dunes, Washington; Weiser Dunes, Idaho); or those populations, without a documented karyotype, but which geographically lie between the southernmost 2n♂=19 population of *A. christmasvalleydunes* and those northern populations of *A. juniperdunes* from Osoyoos and Weiser Dunes, and are recovered close to those from the type locality. While not entirely satisfactory, in the absence of morphological or drumming characters to separate these semi-isolated sand dune populations, we do not know what else to do. But we wouldn't be surprised if we have missed identifying several cryptic, sister taxa. And for those populations where it has been impossible to get more than 3 late instar males, we have given preference to raising all of them for adult morphology and drumming as opposed to taking testes from any late instars for karyotyping. This strategy is especially important for localities around Prineville, Powell Butte, and Malheur, Oregon, where 2 *Ammopelmatus* taxa are sympatric and almost impossible to distinguish when subadult, unless one is fortunate to hear a juvenile drum (see discussion on p. 19). Over the last few years, we have simultaneously taken testes and a leg for species' identification, to obviate this problem, since these 2 *Ammopelmatus* taxa are in either the Lightfooti or Monolake Group, with their very different DNAs.

Adult males of this species have some of the longest #1 rear leg tibial calcars (see, e.g., Fig. 558, adult male from Payette, ID, S08-59, F2033) seen in any species. We wonder if this long calcar might somehow be involved in improving detection of calling song drums made by other males and females, and not just as an improved means for movement through their sandy habitat?

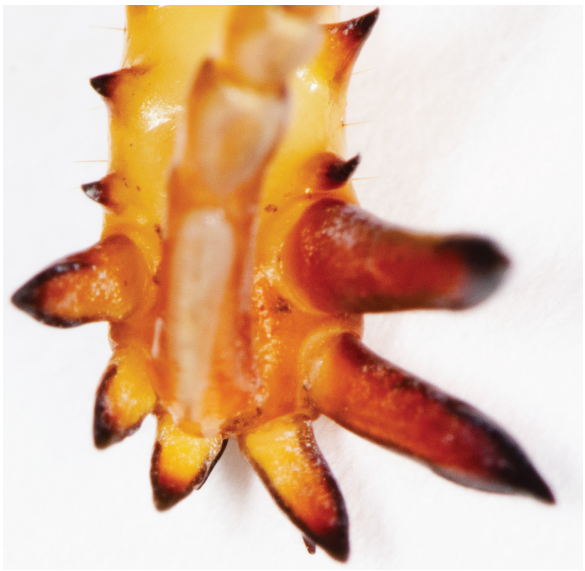


FIGURE 558. Adult male *A. juniperdunes* (Payette, S08-59, F2033) showing long left rear leg tibial calcars #1 and #2.

***Ammopelmatus knighti* Weissman, sp. nov.**
Fallon Jerusalem Cricket
Figs 559–571, Tables 30, 39

Distribution. (Fig. 559). Only known from sandy habitats in Churchill Co, Nevada.

Recognition characters. Member of Lightfooti Group. A medium to large JC with well-defined abdominal stripes, even in very early instars (S04-25). Calling drum rate similar to sympatric, and larger, *A. rusti*; but 2n♂=25 in *A. knighti* while 2n♂=23 in *A. rusti*, with the abdominal stripping pattern different between the 2 taxa.

Holotype. Male (in alcohol, Fig. 560). **Nevada, *Churchill Co.,*** Fallon, 2301 Lima Lane, 39.455866° -118.837359°, 1214m, 31-iii-2004 (S04-25) D. Keele. R04-13, F1428. Molt to adult 4-viii-2004. Deposited CAS, Entomology type #20093. Measurements in mm: Body length 34.58, hind femur length 12.5, hind femur width 4.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 561) with 5 inner and 3 outer spines, 2 ventral spurs.

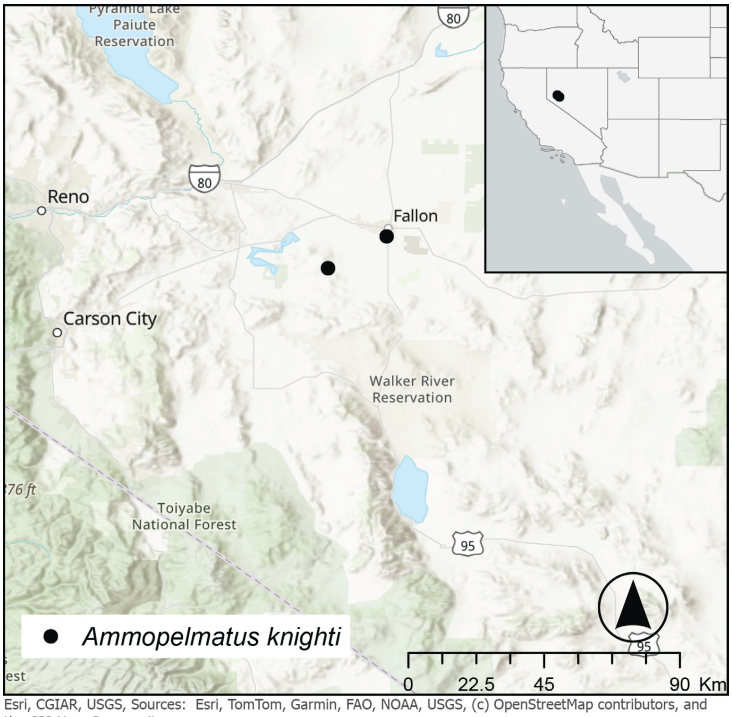


FIGURE 559. Distribution of *A. knighti.*



FIGURE 560. Adult male holotype *A. knighti.* A. When alive. B. When preserve

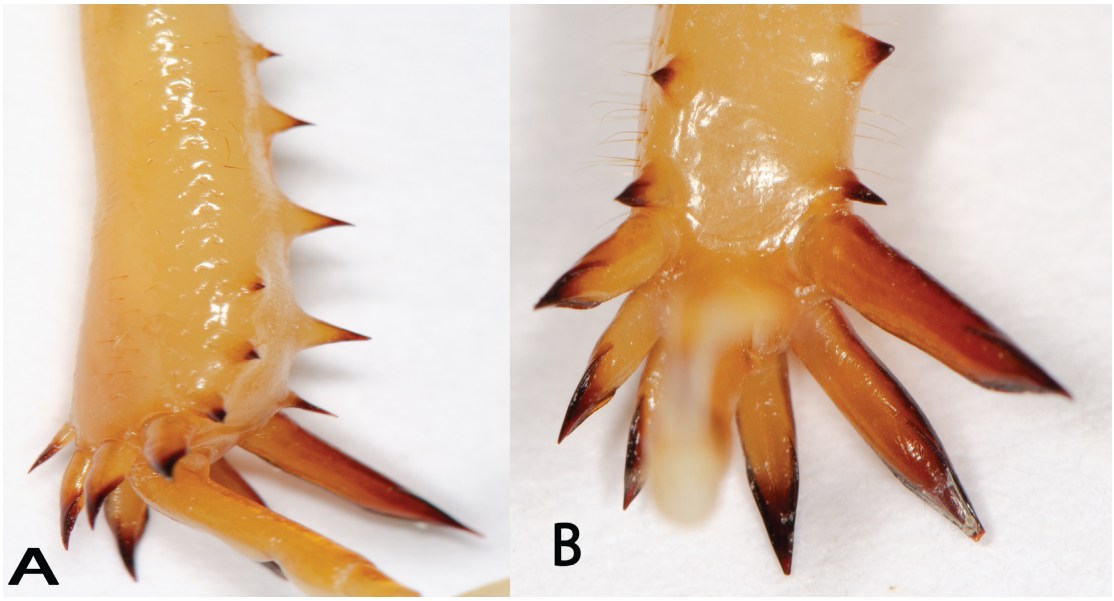


FIGURE 561. Left rear leg tibia adult male holotype *A. knighti.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 562). Same data as holotype except R04-16, F1429. Molt to adult 3-viii-2004. Deposited CAS, Entomology #9079198. Measurements in mm: Body length 41.9, hind femur length 12.1, hind femur width 4.59. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 563) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 564.

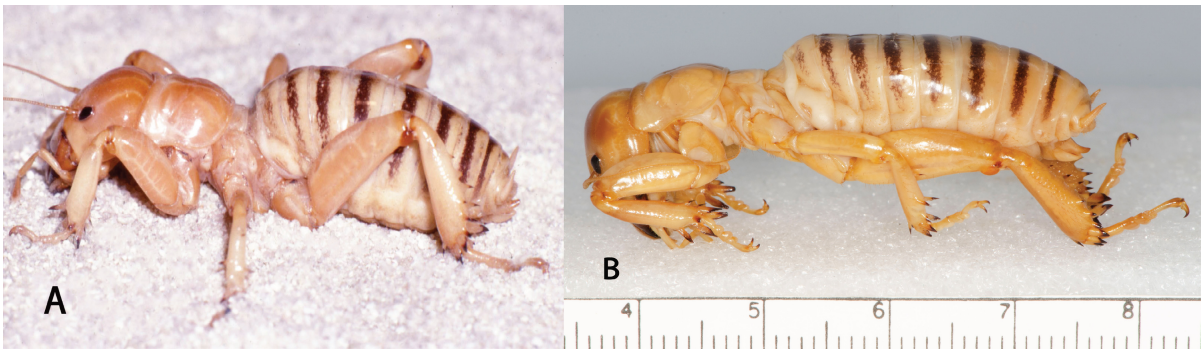


FIGURE 562. Adult female allotype *A. knighti.* A. When alive. B. When preserved.

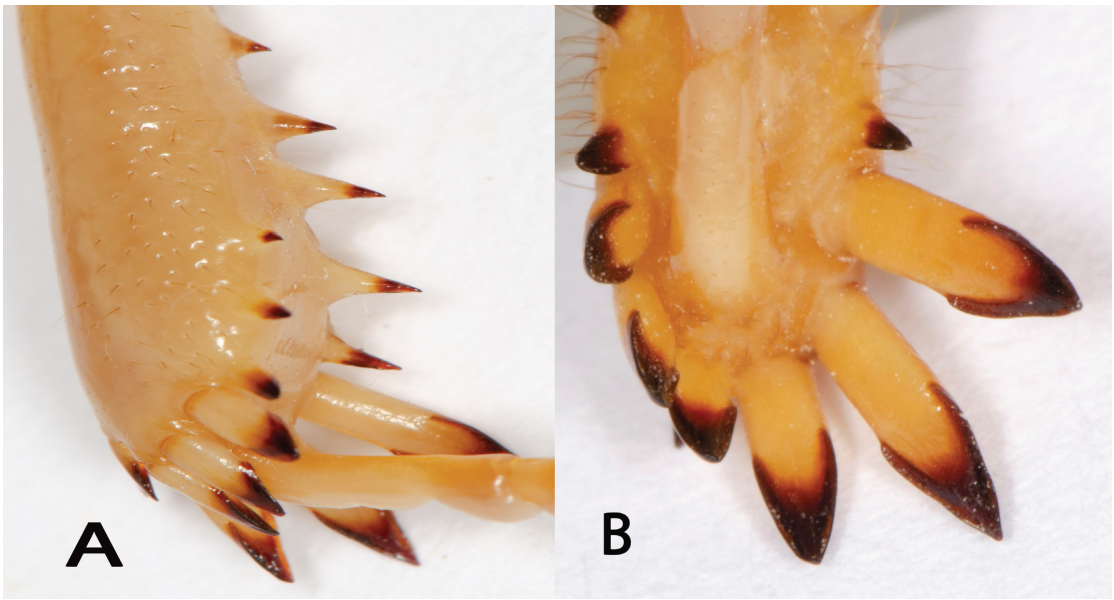


FIGURE 563. Left rear leg tibia adult female allotype *A. knighti.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 564. Ovipositor allotype *A. knighti.*

Paratypes. ♂5 ♀18. **NEVADA, *Churchill Co.,*** Fallon, 355 Drumm Ln, 39.446476° -118.774963°, 1208m, 27-ix-2000 (S00-59) T. Quiroz ♀2. Fallon, 30-ix to 14-x-2004 (S04-140) D. Keele ♀8; Hwy 116 1.3 m E Hwy 50, 39.47959° -118.66888°, 1213m, 1-iii-2005 (S05-22) ♂2 ♀4; 4688 Solias Rd., 39.420585° -118.838952°, 1211m, 26-ii-2005 (S05-24) D. Keele ♀1; type locality, 2301 Lima Lane, 1-iii-2005 (S05-26) ♂2 ♀2; 2255 Sheckler Rd, 39.459842° -118.805439°, 1212m, 4-v-2005 (S05-48) D. Keele ♂1. Fallon Range Training Complex, 39.355833° -118.960556°, 1333m, 25-v-2018 (S18-11) A. Abela ♀1.

Possible placement. **NEVADA, *Churchill Co.,* (1)** Blow Sand Mt Dunes, Hwy 95, ~19.5 m S Fallon, 39.18153° -118.74447°, 1190m, 17-iv-1998 (S98-24) DBW, VF Lee. ♂1 ♀1. These 2 specimens are slightly smaller and with less pronounced abdominal stripes than those from Fallon. They also have a slightly faster calling drum than topotypic material: **Male:** R99-18 (Fig. 565), 20°C, shows one SCD of 6 drums over 0.49s (12.2 drums/s) followed by 61 drums in 11.9s (5.1 drums/s). Unfortunately, no material was taken for DNA analysis. **Female:** R99-77 (Fig. 566), 20.5°C, shows 17 drums in 3.0s (5.7 drums/s). While this female Blow Sand Mt specimen was recovered (F0999) with topotypic *A. knighti,* our lack of a karyotype gives us pause because this Group is known for its karyotypic diversity. Which is unfortunate as we would have preferred to make the natural habitat of Blow Sand Mt the type locality as opposed to the nearby town of Fallon. **(2)** Stillwater Wildlife Management Area, 39.701850° -118.420514°, 1183m, 15-iii-1998 (S98-19) R. Rust, large adult female (Fig. 567), R00-14, 4.8–5.4 drums/s at 20.5°C. Her DNA (F1068) recovered in clade with other *A. knighti* specimens. Sifted from under *Sarcobatus.*

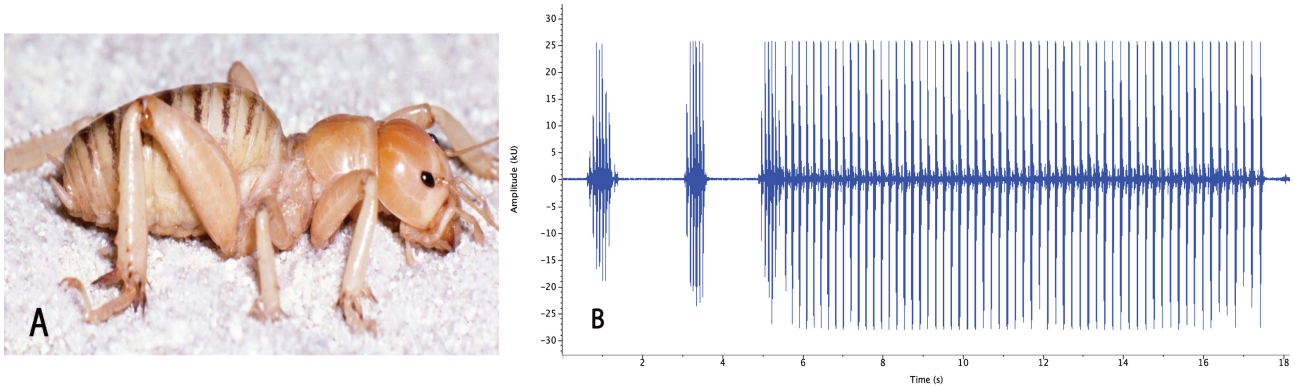


FIGURE 565. Adult male probably *A. knighti* from Blow Sand Mt (S98-24). A. When alive. B. SCD and calling drum (R99-18).

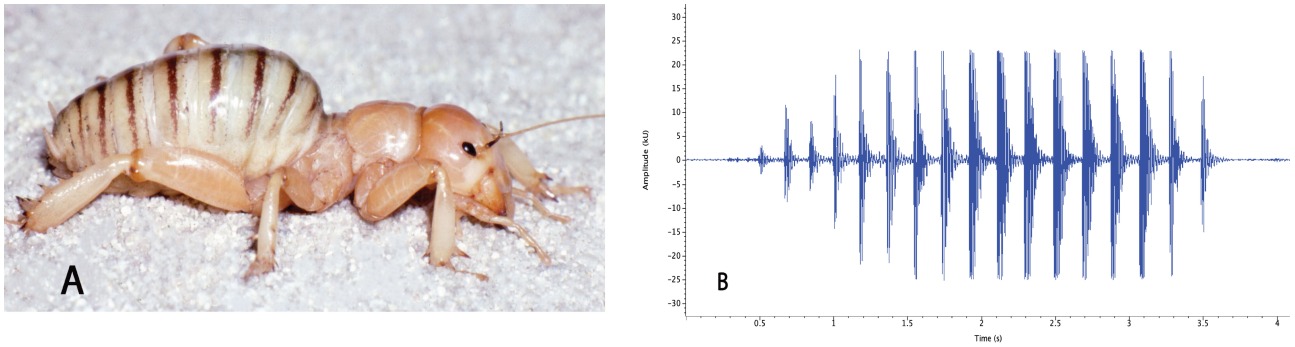


FIGURE 566. Adult female probably *A. knighti* from Blow Sand Mtn (S98-24). A. When alive. B. Calling drum (R99-77).



FIGURE 567. Large adult female, probably *A. knighti*, from Stillwater Wildlife Management Area (S98-19).

Possible placement. **NEVADA, *Churchill Co.,*** Sand Mt dunes, ~25 m SE Fallon, 39.3333° -118.3333°, 1340m, 27-iii-1983 (S83-24) A. Evans & KA Smith, 2 nymphs from sifting. Same locality, 21-iii-1993 (S93-11), 3 nymphs while sifting, DBW and VF Lee. Unfortunately, none of these nymphs were successfully raised to adult, so we have no calling drum, adult male specimen, or DNA, so Group unknown, although we suspect Lightfooti Group. The abdominal bands appear lighter than in topotypic *A. knighti*.

Drum. Drumming similar in both sexes except for sex clarification drum (SCD) produced by males. **Male:** Holotype, R04-13, 21.5°C (Fig. 568) 60 drums in 13.2s (4.5 drums/s). **Female:** Allotype, R04-16, 20°C (Fig. 569) 88 drums in 19.5s (4.5 drums/s).

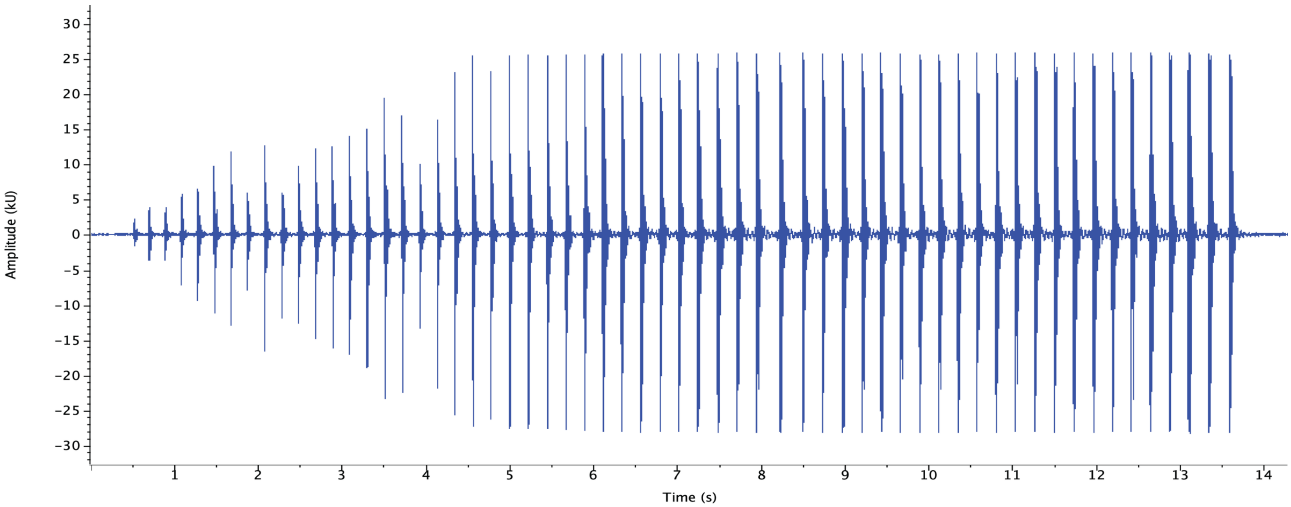


FIGURE 568. Calling drum (R04-13) adult male holotype *A. knighti.*

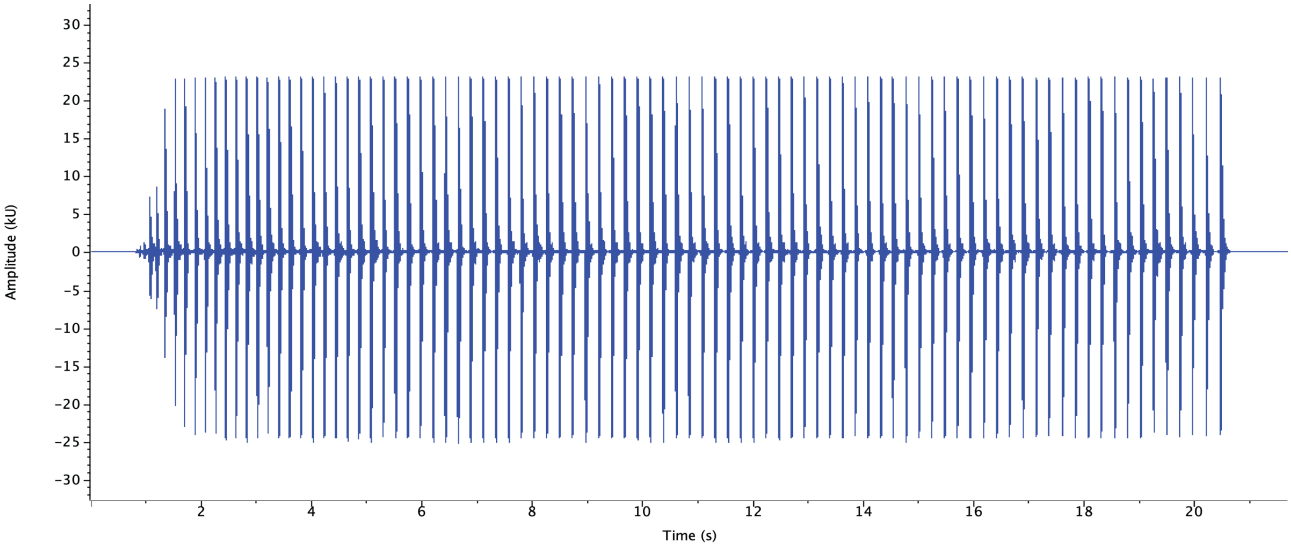


FIGURE 569. Calling drum (R04-16) adult female allotype *A. knighti.*

Derivation of name. Named for Jeffrey B. Knight, who assisted DBW with field work, and forwarded many live specimens, brought to him by the public, to DBW.

Habitat. Sand dunes and sandy substrates both within town of Fallon and in natural habitats. At Blow Sand Mt Dunes (S98-24), we found 3 *A. knighti* juveniles and 1 *A. rusti* juvenile while sifting under various shrubs, most successfully under *Tetradymia.* At Fallon Range (S18-11), 1 late instar female to oatmeal trail in sandy flats with smoke bush and cheat grass.

Life cycle and seasonal occurrence. Apparent typical 2 -year life cycle.

Variation. For 21 individuals, 3 had 2 and 18 had 3 ventral **fore** leg tibial spurs; all 22 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 18 had 5 and 1 had 6 inner **rear** leg tibial spines, and 19 had 3 and 3 had 4 outer rear leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. F0999 (S98-24, Blow Sand Mt); F1068 (S98-19, Stillwater); F1422 (topotypic S04-25, Fallon); and F2503 (S18-11, Fallon Range) recovered together in Group 8 Lightfooti, in a subclade with *A. carsoncity* and *A. rusti.*

Karyotype. 2n♂=25. 2 type locality individuals examined, possibly with inconsistent results: T04-2 (Fig. 570, S04-25) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T05-4 (Fig. 571, S05-48) with 9 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. These differences may be the result of different amounts of condensing in the chromosomes, coupled with differences in interpretation. In any case, future sampling would be good to ensure the absence of a mis-labeling.

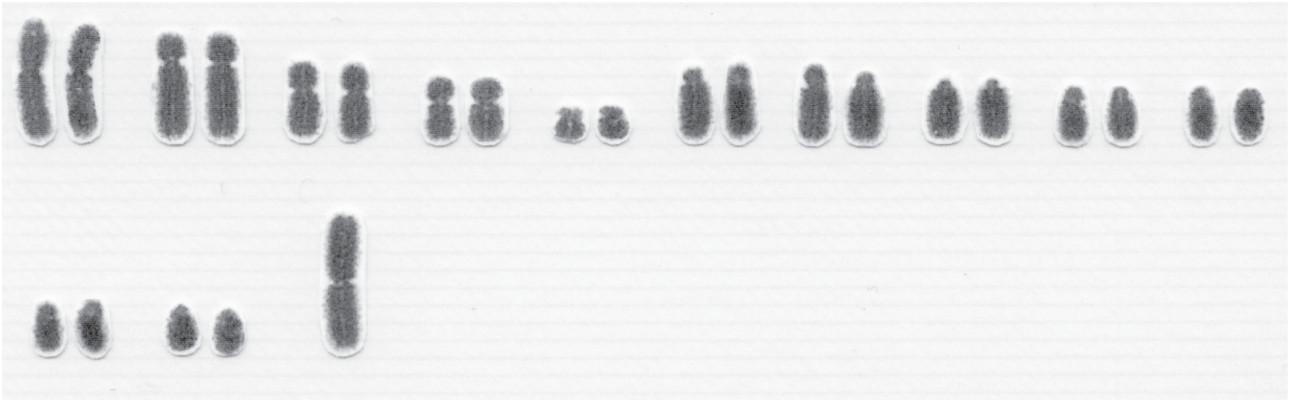


FIGURE 570. Idiogram T04-2 *A. knighti* (S04-25).

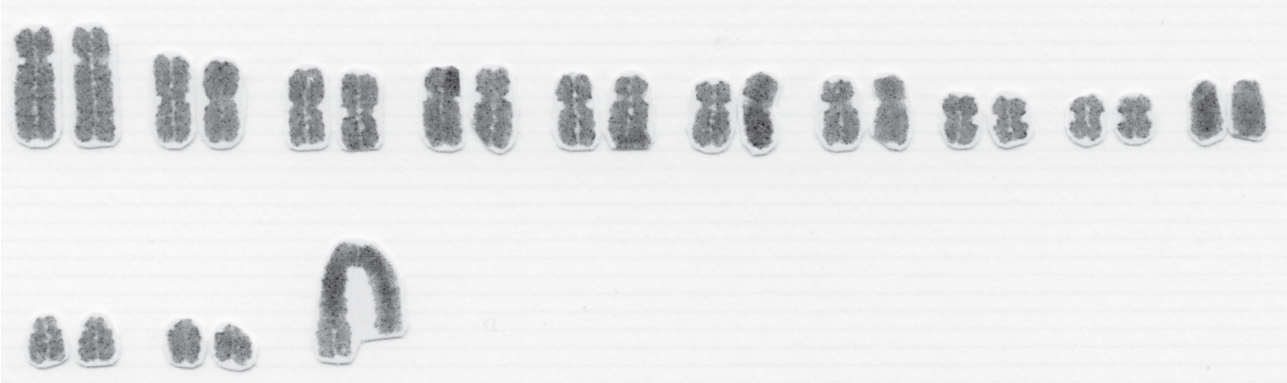


FIGURE 571. Idiogram T05-4 *A. knighti* (S05-48).

Discussion. Although *A. knighti* and *A. rusti* are recovered as nearest relatives, they differ (Table 39) in chromosome number and color pattern of both juveniles and adults. This may be the rare situation where 2 distinct, yet sympatric, JC taxa have similar calling drums. But, given the size differences in adults, we suspect that even a medium-sized male *A. rusti*, because of its larger size, would be physically incapable of mating with even the largest female *A. knighti*, as described in Weissman *et al.* 2008.

Sympatric with *A. monolake* at Fallon Range Training Complex (S18-11).

Nevada sand dune endemic orthopteroid insects were discussed by Bechtel *et al.* (1981), Rust (1986), and Rahn & Rust (2000), including those from the paratype locality of Blow Sand Mt.

Ammopelmatus lightfooti **Weissman, sp. nov.**
Alvord Lake Dunes Jerusalem Cricket
Figs 572–581, Tables 32, 39

Distribution. (Fig. 572). Only known from the sand dunes around Alvord Lake, Harney Co., in southeastern Oregon.

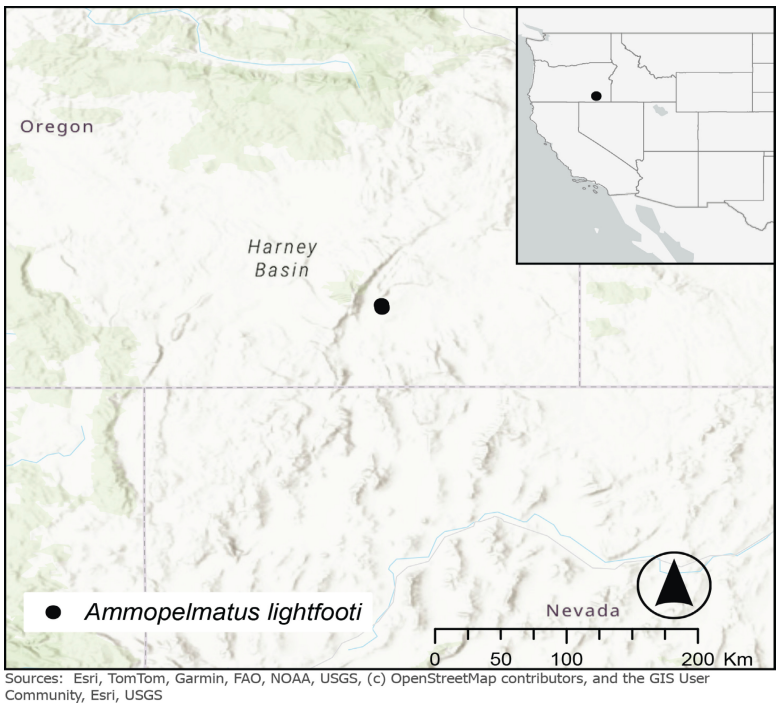


FIGURE 572. Distribution of *A. lightfooti.*

Recognition characters. Member of Lightfooti Group. Medium sized, light colored, sand obligate taxon with a calling song of 3–3.2 drums/s, usually 3 outer rear leg tibial spines, and 2n♂=23. Most closely related to three other Lightfooti Group taxa: The more northern *A. juniperdunes* has a faster calling drum, 2n♂=21, and 4 outer rear leg tibial spines; the more eastern *A. idaho* has 2n♂=19; while the more western *A. christmasvalleydunes* has a slightly faster calling drum, 2n♂=19, and 4 or 5 outer rear leg tibial spines.

Holotype: Adult male (in alcohol, Fig. 573): **Oregon, *Harney Co.,*** Alvord Lake Dunes, on dirt road between 42.618767° -118.380967° and 42.598283° -118.377333°, 1220m, 13-vi-2004 (S04-45), DBW and DC Lightfoot. R04-11. Molt to adult 29-vii-2004. Deposited CAS, Entomology type #20089. Measurements in mm: Body length 31.35, hind femur length 10.31, hind femur width 3.65. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 574) with 5 and 6 inner and 3 and 4 outer spines, 2 ventral spurs.



FIGURE 573. Holotype adult male *A. lightfooti.* A. When alive. B. When preserved.

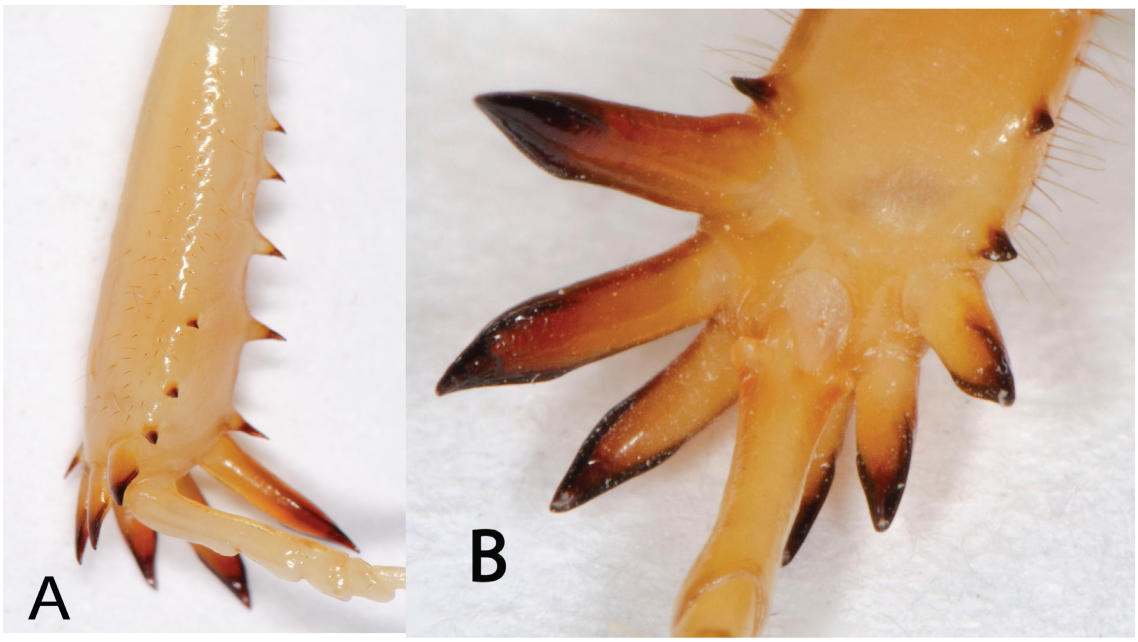


FIGURE 574. Right rear leg tibia holotype adult male *A. lightfooti.* A. Showing 6 inner and 3 outer spines. B. Showing shape of calcars.

Allotype: Adult female (in alcohol, Fig. 575): same data as holotype except R04-23. Molt to adult 25-viii-2004. Deposited CAS, Entomology #9079348. Measurements in mm: Body length 32.15, hind femur length 8.96, hind femur width 3.37. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 576) with 4 and 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 577.



FIGURE 575. Allotype adult female *A. lightfooti*. A. When alive. B. When preserved.

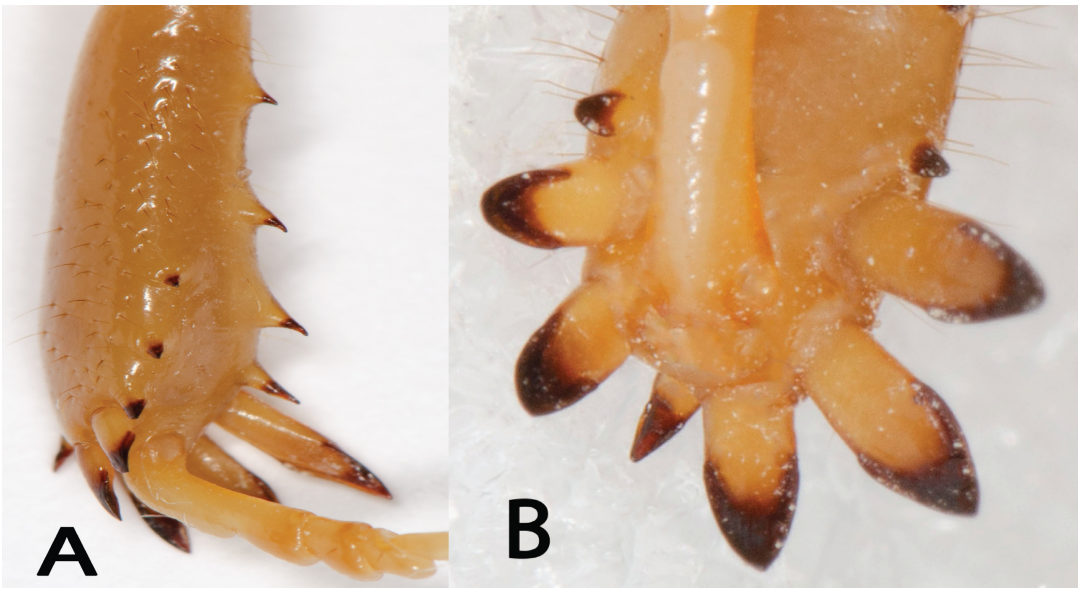


FIGURE 576. Left rear leg tibia allotype adult female *A. lightfooti.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 577. Ovipositor allotype *A. lightfooti*.

Paratypes. ♂4 ♀25. **OREGON, *Harney Co.***, all individuals collected over a 2.6 km stretch of road as specified above under holotype. 10-viii-1983 (S83-109) DC Lightfoot ♀4; 14-ix-1998 (S98-91A) ♀4; 5-ix-1999 (S99-102) ♀8; 15-vi-2001 (S01-56) ♂1; 13-vi-2004 (S04-45) ♂2 ♀3; 25-vi-2014 (S14-27) ♂1 ♀6.

Drum. Male and female calling drums similar except males with a sex clarification drum (SCD). **Male:** Holotype R04-11 (Fig. 578) had 14 SCDs (to finger drumming) at a rate of ~12.5 drums/s, and then 1 calling drum (Fig. 579) of 31 single drums over 10.0s (3.1 drums/s) at 21°C. Longest SCD was 22 drums in 1.74s (12.6 drums/s). **Female:** Allotype R04-23 (Fig. 580) had 46 single drums over 14.6s (3.2 drums/s) at 20°C.

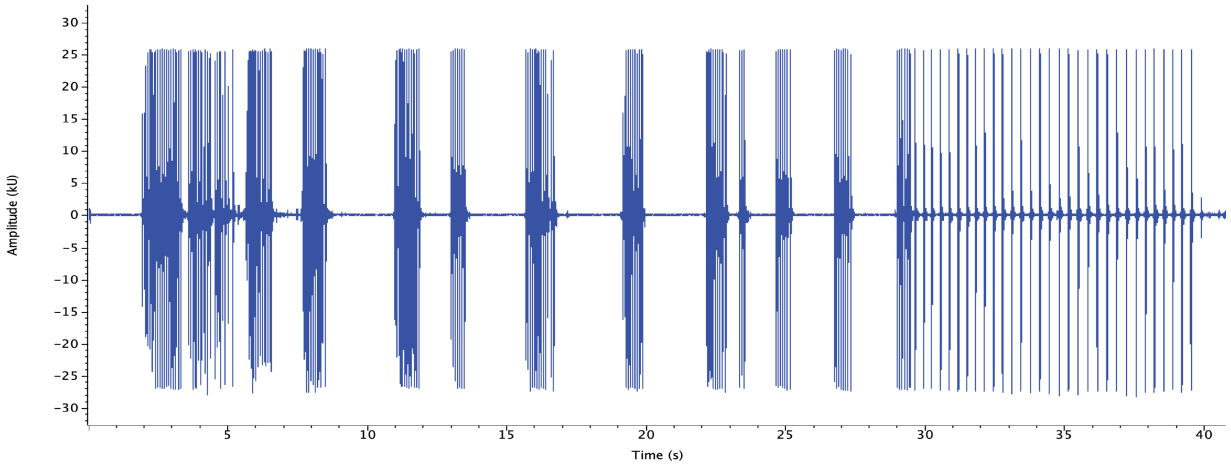


FIGURE 578. Fourteen sex clarification drums (R04-11) transitioning to calling drum in adult male holotype *A. lightfooti.*

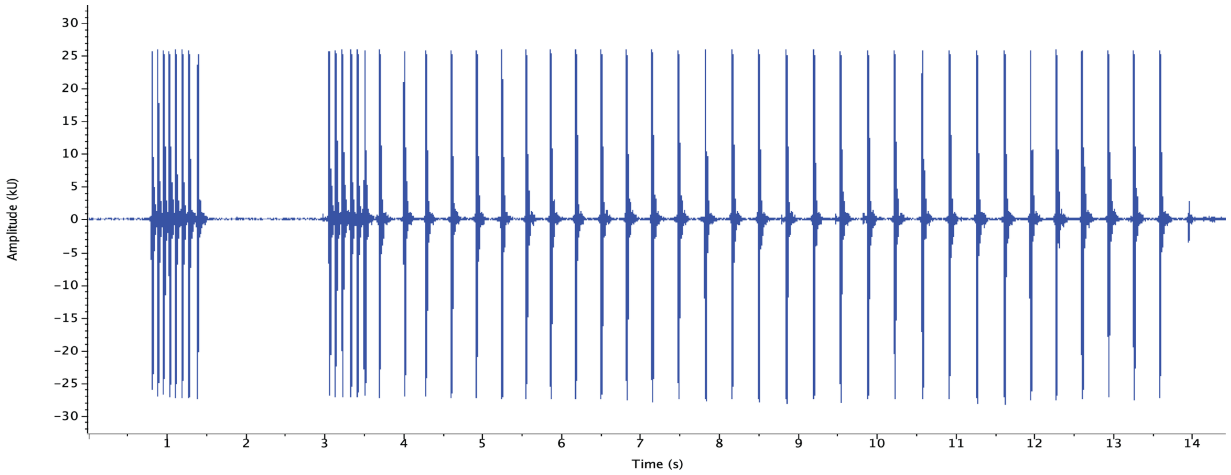


FIGURE 579. Expanded sex clarification drum (R04-11) and calling drum from Fig. 578, holotype *A. lightfooti.*

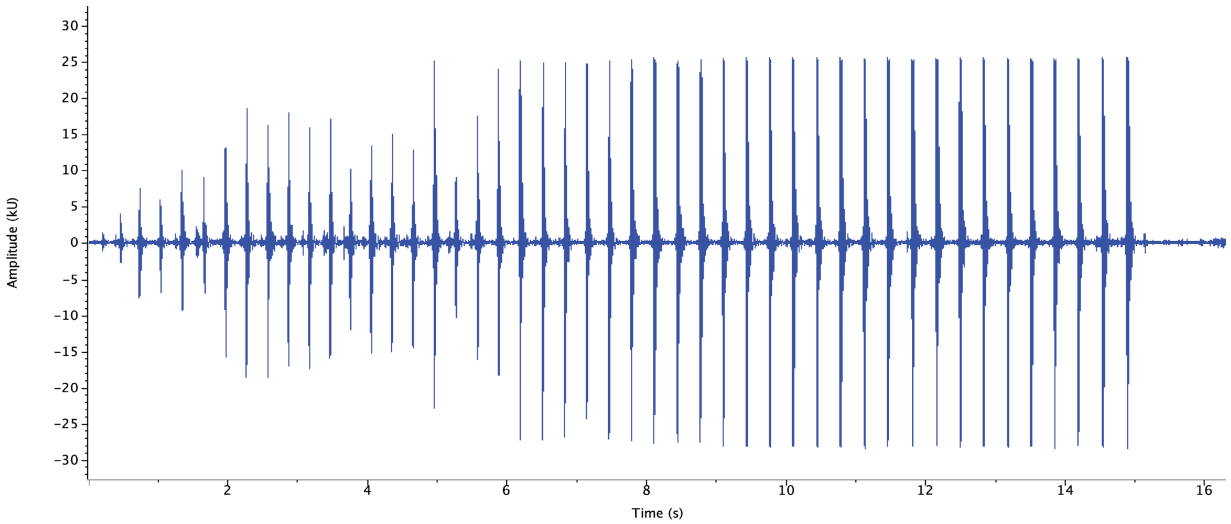


FIGURE 580. Calling drum (R04-23) of allotype adult female *A. lightfooti*.

Derivation of name. Named after David C. Lightfoot, who discovered this species, and also in appreciation for his many years of field companionship and collegiality.

Habitat. Over the years, we have laid various oatmeal trails over a 2.6 km stretch of sandy road between northern site 42.618767° -118.380967°, 1230m; and southern site 42.598283° -118.377333°, 1227m. Collected individuals always associated with sand, but results variable. For instance, on 5-ix-1999 (S99-102), we got 8 adult females at an oatmeal trail on large dunes and none collected elsewhere. In other years, we were most successful in getting late instars, earlier in the season, in areas with just a minimal depth of sand while having no or little success on large dunes. Perhaps mated adult females move to large dunes for oviposition since they probably oviposit deep in the sand?

Life cycle and seasonal occurrence. On 5-ix-1999 (S99-102) we collected 8 adult females. On 13-vi-2004 (S04-45), we collected 2 adult males and 4 adult females, 1 mid-late instar male and female, and 1 mid instar female. On 25-vi-2014 (S14-27), we collected 1 late instar male and 5 late instar females and 1 mid instar female.

Variation. For 31 individuals, 10 had 2 and 20 had 3 **fore leg** tibial ventral spurs; 29 had 8 **middle leg** calcars and 2 ventral spurs; and for 31 specimens, 3 had 4, 26 had 5, and 2 had 6 **hind leg** inner spines, while 28 had 3 and 3 had 4 outer spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304). Type locality F1160 (S01-56) and F2413 (S14-27) recovered in Group 8 Lightfooti; and most closely related to other Lightfooti Group taxa *A. christmasvalleydunes* (2n♂=19) and *A. juniperdunes* (2n♂=21), while *A. lightfooti has* 2n♂=23.

Karyotype. 2n♂=23. One type locality male checked: T01-48 (Fig. 581, S01-56) with 8 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

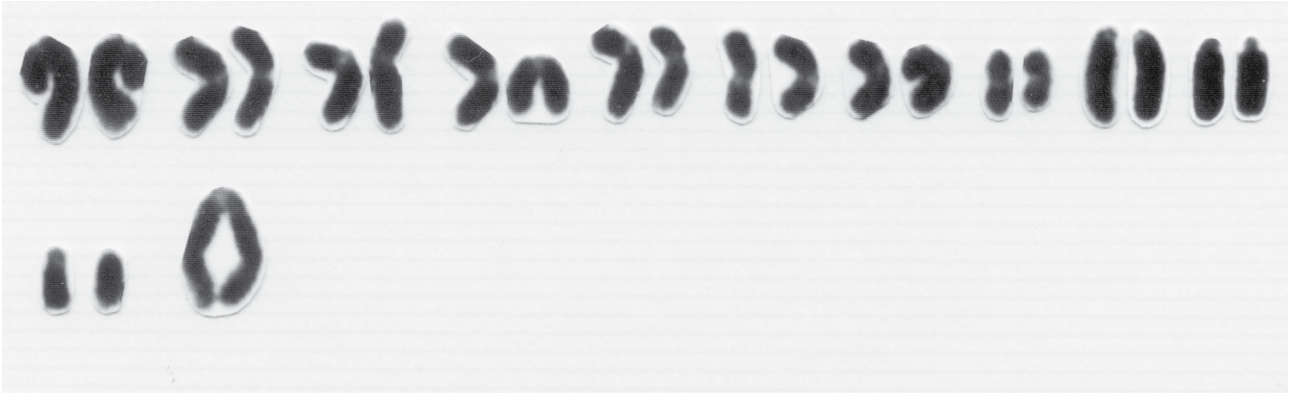


FIGURE 581. Idiogram T01-48 *A. lightfooti* (S01-56).

Discussion. Near the most northern end of our 2.6 km long oatmeal trail transect, and not on sand, DC Lightfoot collected (S83-110, 10-viii-1983) one adult female of *A. monolake*; while DBW and VF Lee collected (S98-91B, 14-ix-1998) an adult male of *A. monolake* in the same area, again off sand. Interestingly, only *A. monolake* has been found, and in moderate numbers, on nearby Crescent Dunes (S98-92), some 65 km due south of the Alvord Lake Dune area.

More information on the Alvord Basin Sand Dune ecosystem can be found in Cobb *et al.* 1981. The Alvord Dunes are part of the Lahontan Basin that also contains Blow Sand Mountain and Sand Mountain, Nevada (Rahn & Rust 2000). Two species (*A. rusti* and *A. knighti*) in the Lightfooti Group of JCs occur at Blow Sand Mt, while one species (identity unknown since no adult males, drum, or DNA) occurs at Sand Mt.

***Ammopelmatus rusti* Weissman, sp. nov.**

Blow Sand Mt Jerusalem Cricket
Figs 582–587, Tables 30, 39

Distribution. (Fig. 582). Known only from the sand dunes around Blow Sand Mountain in Churchill Co., Nevada.

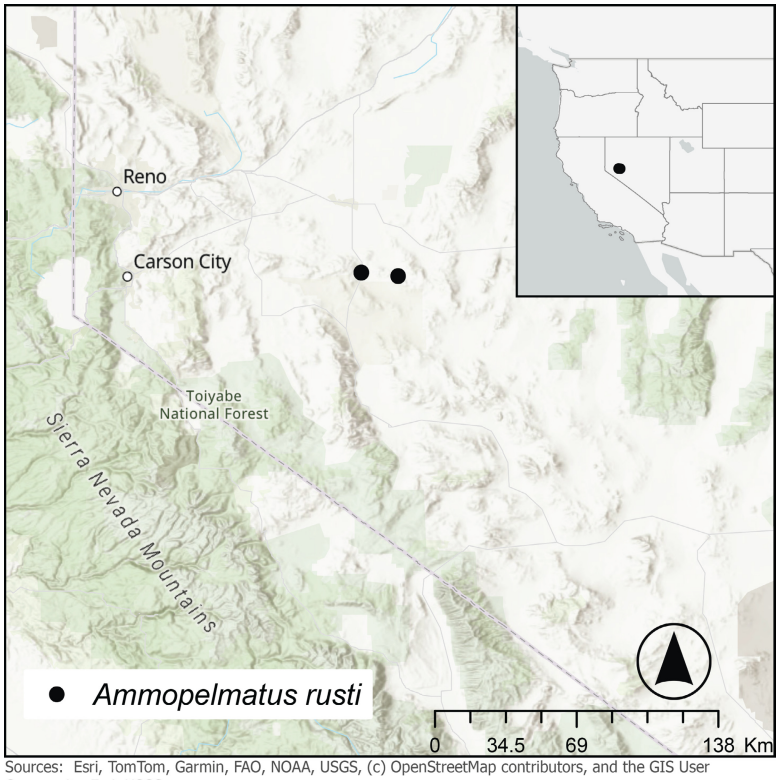


FIGURE 582. Distribution of *A. rusti.*

Recognition characters. One of the largest members of the Lightfooti Group. Can be distinguished from sympatric *A. knighti* by color pattern of both juveniles and adults (compare Fig. 583 below with Fig. 560, p. 335, of *A. knighti*); and karyotype (2n♂=23 in *A. rusti* vs 2n♂=25 in *A. knighti*).

Holotype. Male (in alcohol, Fig. 583) **Nevada, *Churchill Co.,*** Blow Sand Mt, 39.166729° -118.583316°, 1455m, 4-iv-1993 (S93-18) JB Knight, RW Rust, H. Britton. R95-32, F0111. Molt to adult 1-viii-1995. Deposited CAS, Entomology type #20092. Measurements in mm: Body length 37.06, hind femur length 13.78, hind femur width 4.73. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 584) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 583. Adult male holotype *A. rusti.* A. When alive. B. When preserved.

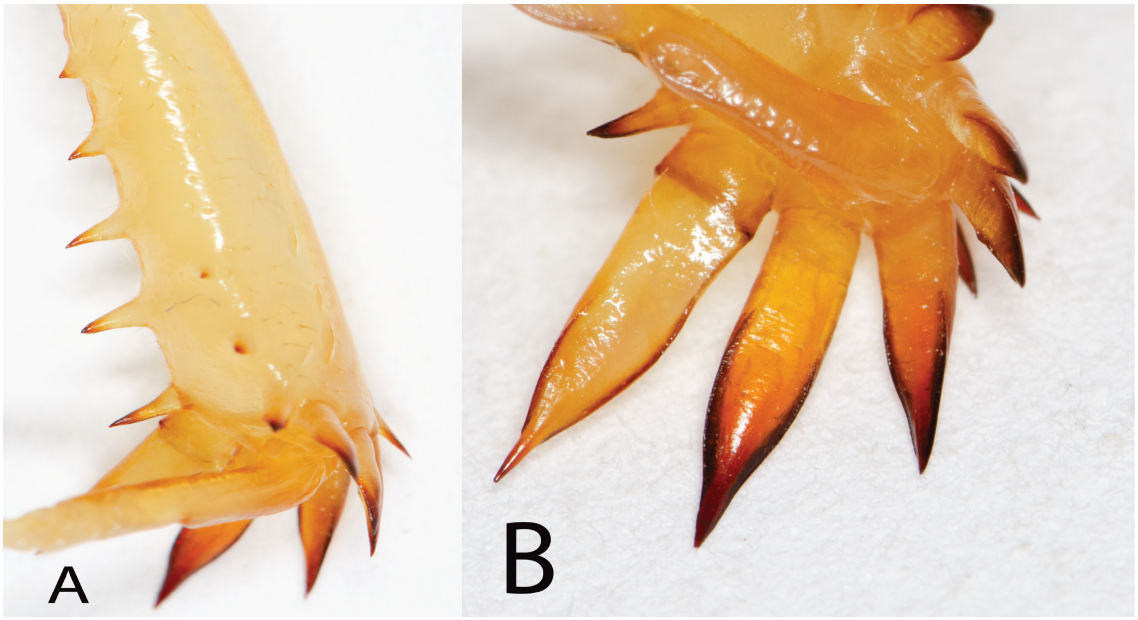


FIGURE 584. Right rear leg tibia adult male holotype *A. rusti.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.

Female: Unknown.

Paratypes. ♂5. **NEVADA, *Churchill Co.,*** Blow Sand Mt, Hwy 95, ~19.5 m S Fallon, 39.18153° -118.74447°, 1188m, 17-iv-1998 (S98-24) ♂1, testes taken for karyotype. Near locality S98-24 but 16-ix-1998 (S98-94), as follows: 1 adult male to oatmeal trail near mile marker 5.5, and 3 adult males on highway between mile markers 4.0 and 5.4 (which is from 4.0 to 5.4 miles north of the Lyon Co–Churchill Co line), ♂4. Same locality but 4-ix-1999 (S99-97) ♂1. The type locality is some 13.3 km due east of our paratype locality, with Google Earth showing near continuous sandy habitats between the two localities.

Drum. Holotype R95-32 (Fig. 585), S93-18, 20°C: short sex clarification drum (SCD) of 3 rapid drums followed by calling drum of 36 drums in 6s (6.0 drums/s). Longest recorded SCD was 7 drums in 0.51s (13.7 drums/s).

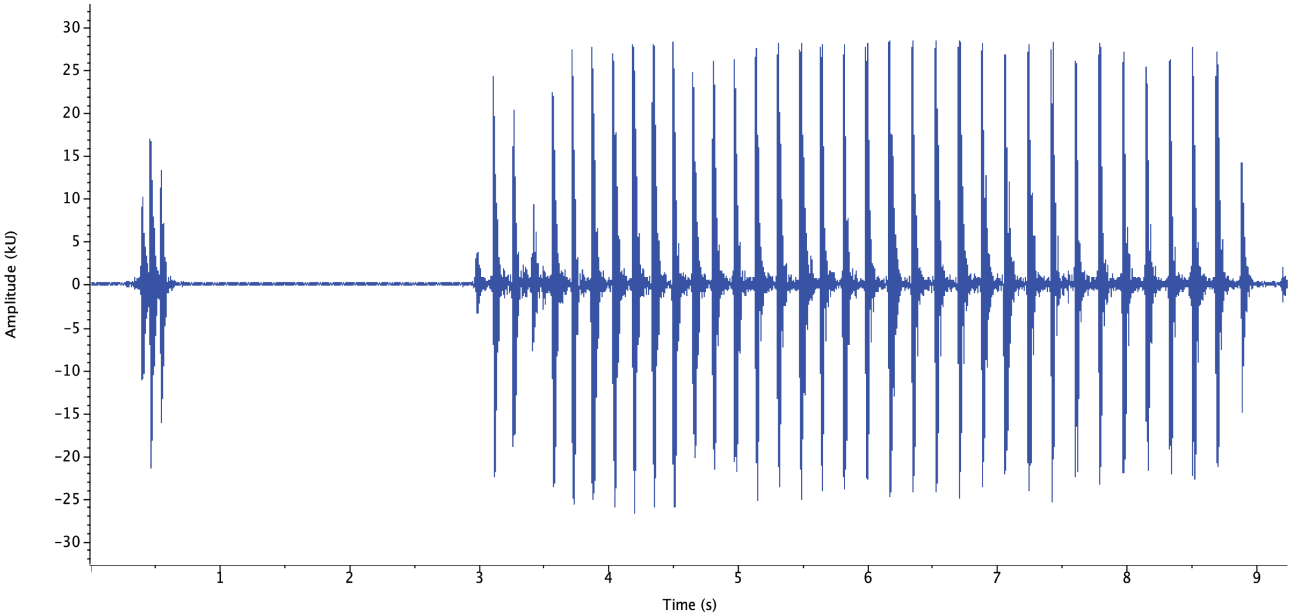


FIGURE 585. Calling drum (R95-32) adult male holotype *A. rusti.*

Derivation of name. Named for Richard W. Rust who has collected many sand inhabiting JCs in western Nevada and sent them alive to DBW.

Habitat. Nymphs (from S93-18 and S98-24) were obtained by sifting the top 30 cm of sand, mostly under *Tetradymia.* Four other individuals collected on the highway at night and 1 at an oatmeal trail laid in the Blow Sand Mt dunes.

Life cycle and seasonal occurrence. Could this species have a 3-year life cycle, given the fact that the holotype male, when collected in 1993, had already molted several times, consistent with hatching from an egg laid sometime in 1992, and that he didn't molt to adult until August, 1995? Juveniles were kept in moist sand starting in 1991, so the situation discussed under *A. kelsoensis* (see p. 281), where raising conditions were non-optimal, probably didn't apply, although food sources have been modified, and hopefully improved, over time.

Variation. **Body length:** For the 6 adult males we have, the range is 33.06–37.06 mm. The last instar male whose testes were taken for karyotyping, is 29.66 mm. Of our 6 adult males, 4 had 2 and 2 had 3 **fore** leg tibia ventral spurs; 5 had 8 **middle** leg tibia calcars and 1 had 9, all with 2 ventral spurs; and 5 had 5 inner **rear** leg tibia spines while 1 had 6 spines; and 5 had 3 outer and 1 had 4 outer rear leg tibial spines, all with 2 ventral spurs. Most individuals have limited abdominal stripes (Fig. 583).

DNA. Fig. 496, p. 304. F0765, F0766, & F0767 (all paratype locality S98-94) recovered in Group 8 Lightfooti closest to the Fallon Jerusalem Cricket, *A. knighti*. Both taxa may be sympatric at Blow Sand Mt (see Discussion below).

Karyotype. 2n♂=23. T00-1 (Fig. 586, S98-24) with 10 metacentric or submetacentric autosomal pairs; 1 acrocentric or telocentric autosomal pair; and 1 metacentric X chromosome. This last instar male is morphologically more consistent (Fig. 587 below) with *A. rusti*, for size and color pattern, than *A. knighti*, since no DNA available to confirm identity. Besides, topotypic *A. knighti* with 2n♂=25.

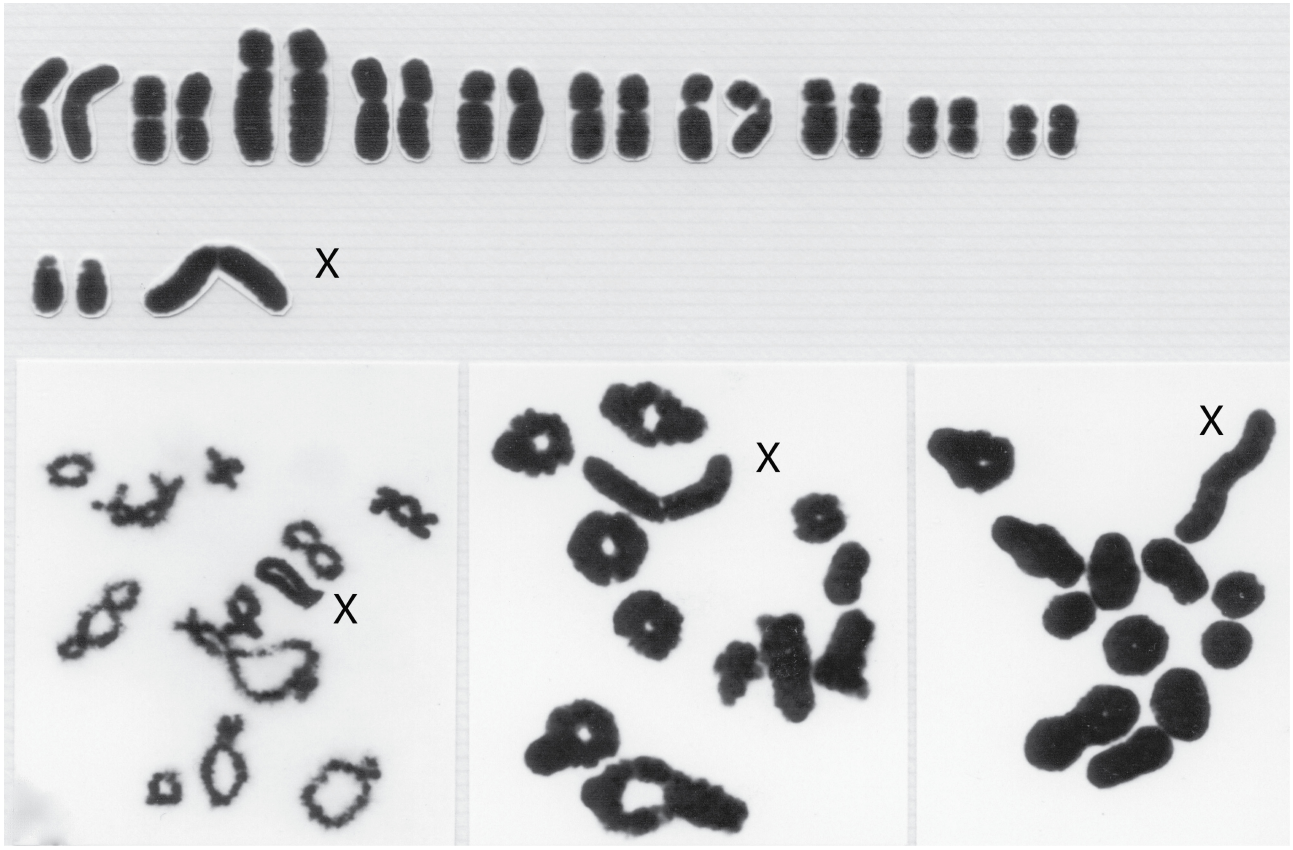


FIGURE 586. Idiogram T00-1 (top photo) *A. rusti* (S98-24). Bottom photos: three stages of meiosis all confirming chromosome count in topotypic male. X sex chromosome is indicated in all photos.

Discussion. At S98-24, we found 1 *A. rusti* juvenile sympatric with 3 presumptive (see p. 339 for discussion) *A. knighti* juveniles while sifting under various shrubs, most successfully under *Tetradymia.* At S98-94, on a Wednesday

night, Highway 95 was full of trucks and cars, making road cruising harrowing, but still productive. We collected (S98-94) our first road adult at dusk and the last at 21:30, even though the weather was perfect: overcast, not windy, warm, and without a moon. Besides the 3 live adults that we collected on the road, we saw at least 2 other dead adults. But with so many 18 wheelers on the highway, we suspect that many more individuals were crushed and quickly swept from the road. At S99-98, Labor Day weekend with much less traffic than S98-94, we collected only 1 adult male on the highway, at 19:30, despite multiple driving transects. Interestingly, while we had collected the decticine katydids *Plagiostira* and *Zacycloptera* at S98-94, we heard none in 1999 despite similar and near perfect-collecting weather conditions.

We have considered if *A. rusti* and *A. knighti* could be conspecific given their similar drums and how close their DNAs are recovered. Nevertheless, the different chromosome counts, different sizes, and different color patterns seen between the two taxa convince us that they are distinct. In fact, the color pattern, especially of the subadult (Fig. 585) of *A. rusti,* is unique, and probably represents the lightest colored *Ammopelmatus* species known; although some *A. abelai*, *A. davewerneri, A. navajo*, *and A. yubalake* (from Dugway) can also be very light colored. Additionally, when both species were collected sympatrically at S98-24; and DBW's contemporaneous notes reflect that the lack of abdominal stripes in the nymph of *A. rusti,* was recognized as different from *A. knighti*. At Blow Sand Mt, all 6 adult males of *A. rusti* are longer than the only adult male of *A. knighti* known from there; and the last instar of *A. rusti*, from whom testes were taken for karyotyping, is also almost as long as the [presumptive] adult male of *A. knighti.*



FIGURE 587. Last instar male *A. rusti,* from which testes (T00-1) for the karyotype were obtained.

Nevada sand dune endemic orthopteroid insects are discussed by Bechtel *et al.* (1981), Rust (1986), and Rahn & Rust (2000), including those from the type locality of Blow Sand Mountain. The Blow Sand Mountain Dunes are part of the Lahontan Basin, that also contains Sand Mountain and the Oregon Alvord Dunes (Rahn & Rust 2000). *A. lightfooti*, also in the Lightfooti Group of JCs, occurs at the Alvord Dunes; while a JC species, identity unknown (since no adult males, drum, or DNA), occurs at Sand Mountain Dunes.

Ammopelmatus winnemucca Weissman, sp. nov.

Winnemucca Jerusalem Cricket
Figs 588–596, Tables 30, 39

Species #9, Weissman 2001a.

Distribution. (Fig. 588). Known only from the Winnemucca Sand Dunes, Humboldt Co., Nevada. These are the largest dune fields in Nevada, which are comprised of a series of valleys, many with their own dune fields, and distinct names. We have specimens from Silver State Dunes along Hwy 95, the type locality of Desert Valley Dunes, and Paradise Valley Dunes.

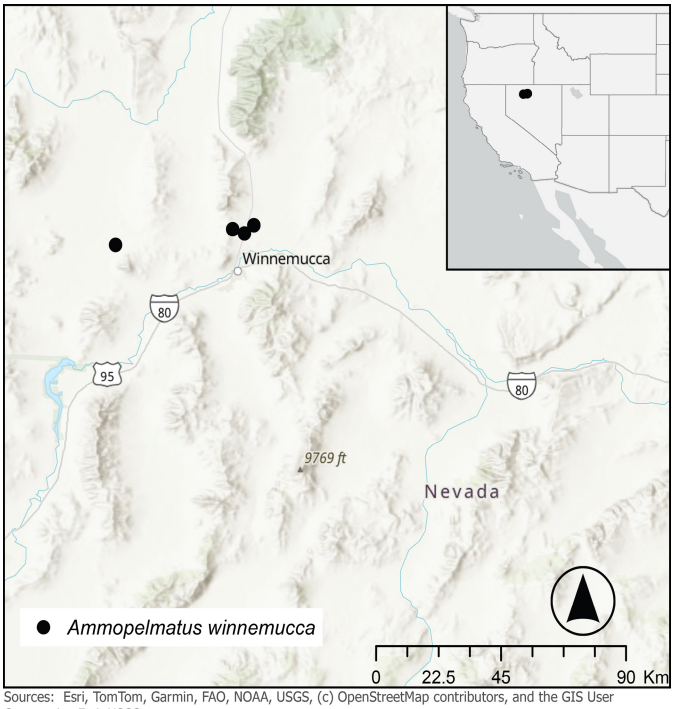


FIGURE 588. Distribution of *A. winnemucca.*

Recognition characters. Small-medium sized, sand dune obligates, presence of a sex clarification drum (SCD), 2n♂=21. Distinguished from *A. monolake,* from just north of Winnemucca (S98-23), which is on sand, but not in actual dunes, by slower drum rate, absence of SCD, 2n♂=25, DNA, and not in Lightfooti Group. Distinguished from sister species *A. knighti*, found some 200 km southwest of the Winnemucca Dunes, by 2n♂=21 in *A. winnemucca* vs 2n♂=25 in *A. knighti,* and DNA. Distinguished from sister species *A. carsoncity* and *A. rusti*, by DNA and 2n♂=23 in the latter two taxa.

Holotype. Male (in alcohol, Fig. 589). **Nevada, *Humboldt Co.,*** Desert Valley Dunes, R34E T37N S15, ~41.050828° -118.123961°, 1225m, 5-iv-1995 (S95-33) RW Rust. R95-22, F0093. Molt to adult 23-vii-1995. Deposited CAS, Entomology type #20105. Measurements in mm: Body length 28.08, hind femur length 9.70, hind femur width 3.42. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 590) with 4 & 5 inner and 3 & 4 outer spines, 2 ventral spurs.

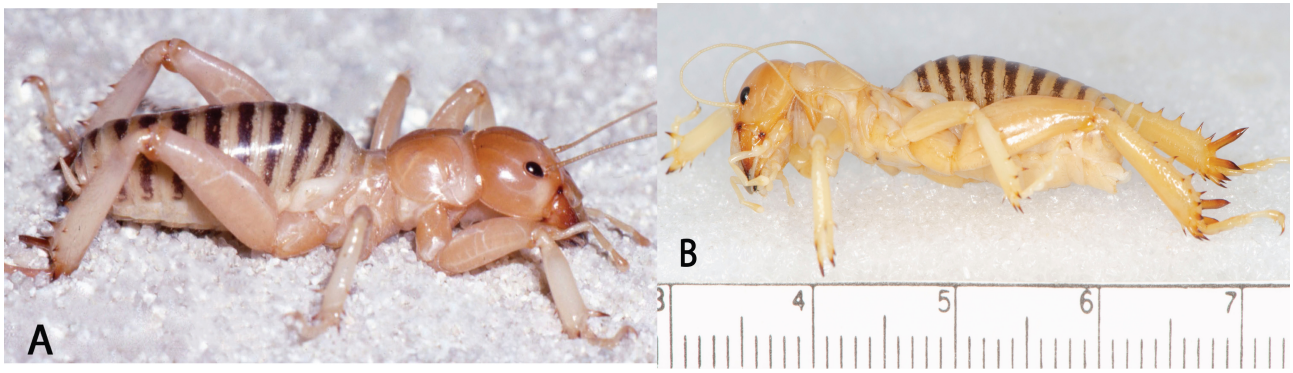


FIGURE 589. Holotype adult male *A. winnemucca.* A. When alive. B. When preserved.



FIGURE 590. Left rear leg tibia holotype adult male *A. winnemucca*. A. Showing 4 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 591). **Nevada, *Humboldt Co.,*** Silver State Dunes along Hwy 95, 7.5 m N Winnemucca, mile post 8.9, 41.085288° -117.707025°, 1335m, 20-iii-1993 (S93-10) DBW & VF Lee. R93-10. Molt to adult 14-vii-1993. Deposited CAS, Entomology #9082877. Measurements in mm: Body length 30.29, hind femur length 8.53, hind femur width 3.12. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 & 8 calcars, 1 & 2 ventral spurs; hind leg tibia (Fig. 592) with 4 or 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 593.

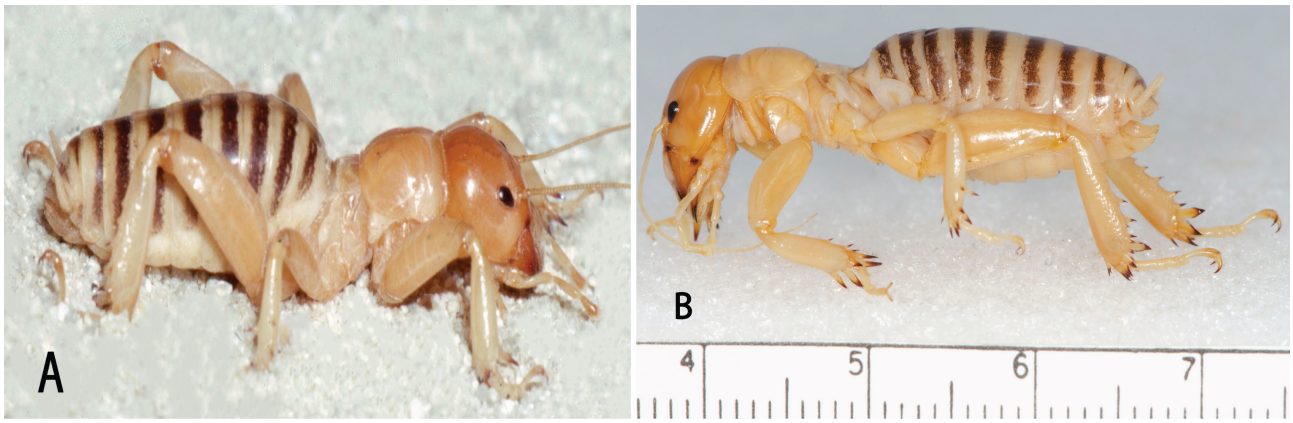


FIGURE 591. Allotype adult female *A. winnemucca.* A. When alive. B. When preserved.

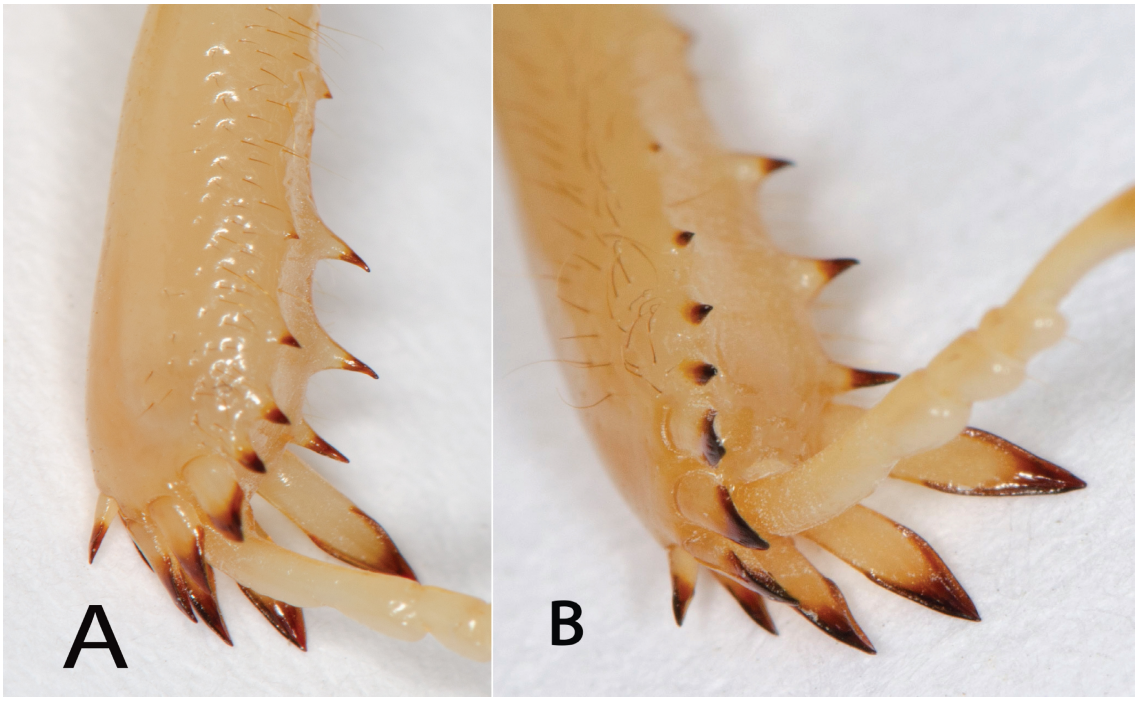


FIGURE 592. Left rear leg tibia adult female allotype *A. winnemucca.* A. Showing 4 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 593. Ovipositor allotype *A. winnemucca.*

Paratypes. ♂1 ♀5. **NEVADA, *Humboldt Co.,*** same data as holotype, late male for testes T95-2. Same data as allotype, ♂1 ♀1; 24-iv-1993 (S93-31) R. Rust, ♀2. Silver State Dunes, T37N R37 & 36E, ~41.098104° -117.745175°, 1492m, 20-iii-1994 (S94-8) R. Rust, H. Britton, J. Porter ♀1. Paradise Valley Dunes, T37N R38E, ~41.109965° -117.676582°, 1328m, 20-iii-1994 (S94-7) R. Rust, H. Britton, J. Porter, ♀1.

Drum. Male and female drums similar except for (SCD) in male. **Male**: Holotype R95-22 (Fig. 594), S95-33,

20°C: 2 SCD of 4 drums in 0.26s (15.4 drums/s) and 9 drums in 0.62s (14.5 drums/s) followed by 26 calling drums in 8.3s (3.1 drums/s). **Female:** Allotype R93-10 (Fig. 595), S93-10, 20°C: 2 series each of 37 drums in 9.4s (3.9 drums/s) and 9.6s (3.9 drums/s).

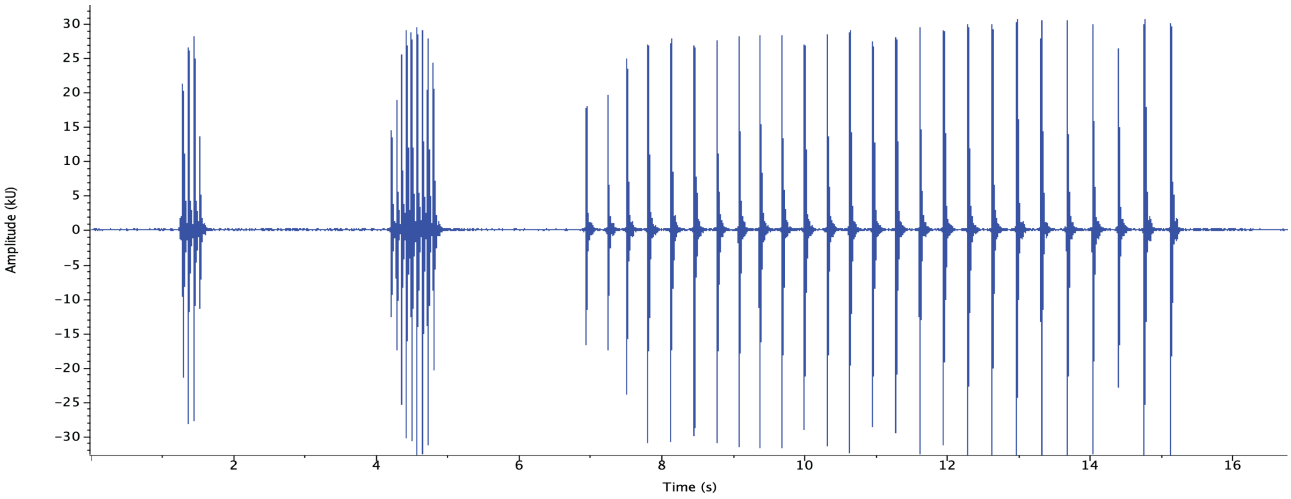


FIGURE 594. Calling drum (R95-22) adult male holotype *A. winnemucca.*

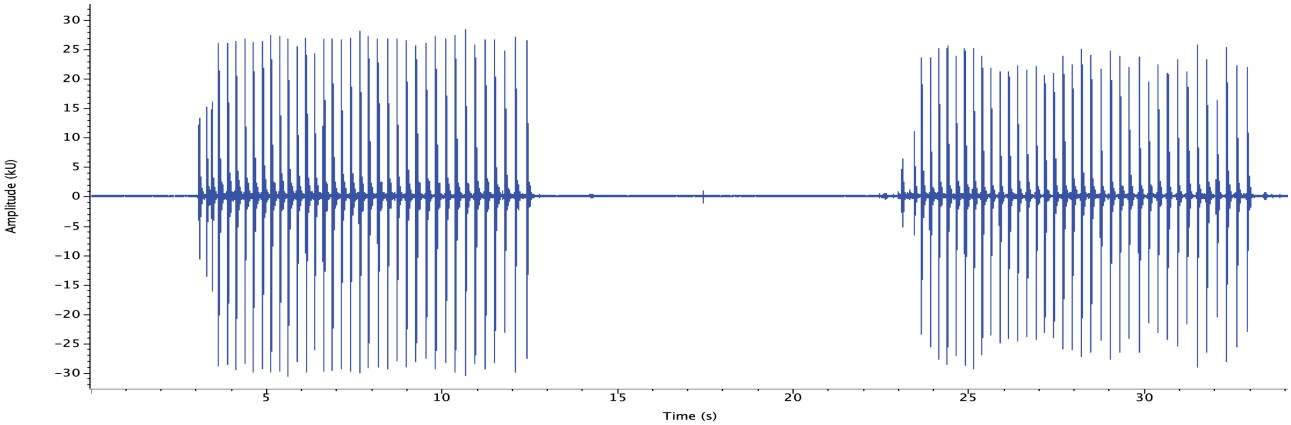


FIGURE 595. Calling drum (R93-10) adult female allotype *A. winnemucca.*

Derivation of name. Named in reference to the landmark town of Winnemucca. The extensive Winnemucca sand dune system starts some 13 km north of town, off Highway 95, and runs east and (mostly) west on both sides of the highway for about 45 km.

Habitat. Low rolling sand dunes, with JCs usually sifted from under *Tetradymia tetrameres* (dune horsebrush).

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. From 8 individuals, all had 3 ventral **fore** leg tibial spurs; 8 **middle** leg tibial calcars, with 2 ventral spurs; and 6 had 5 and 2 had 6 inner **rear** leg tibial spines, and 1 had 3, 6 had 4, and 1 had 5 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 496, p. 304. F0093 (holotype S95-33); F0106 (allotype S94-8) recovered in Group 8 Lightfooti, in their own subclade within the larger Lightfooti Group clade.

Karyotype. 2n♂=21. T95-02 (Fig. 596, type locality S95-33) with 7 metacentric or submetacentric autosomal pairs; 3 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

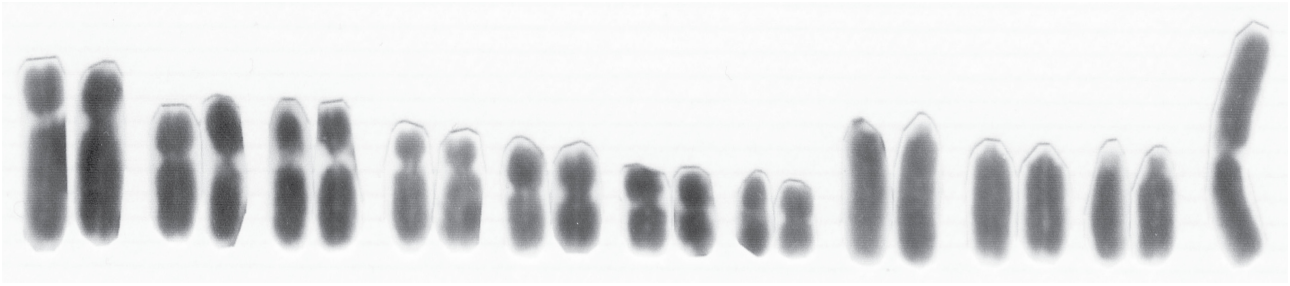


FIGURE 596. Idiogram T95-2 *A. winnemucca* (S95-32).

Discussion. Nevada sand dune orthopteroid insects were discussed by Bechtel *et al.* (1981), Rust (1986), and Rahn & Rust (2000).

(CLADE 7) Group 9, Smithi Group (Fig. 597)

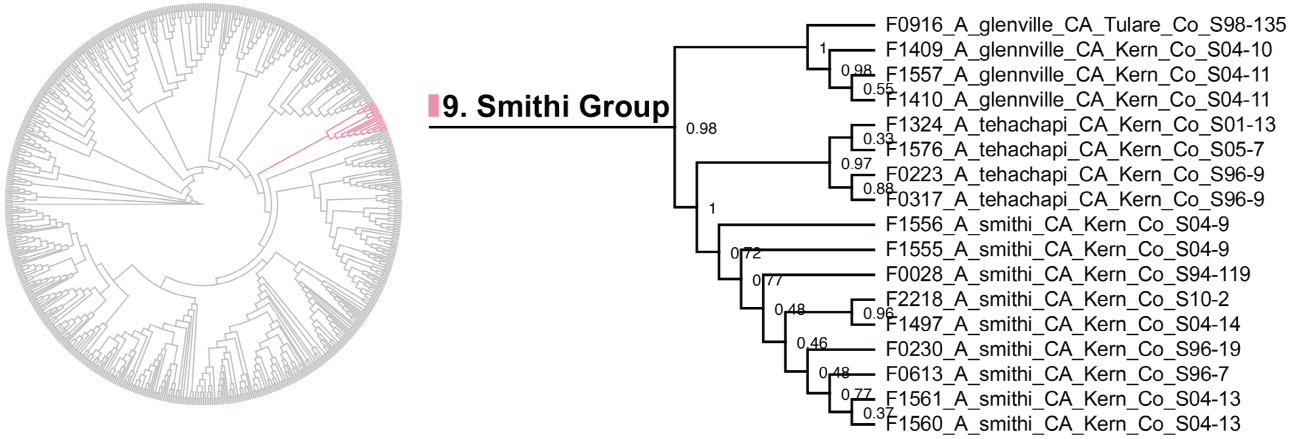


FIGURE 597. ASTRAL tree for Smithi Group.

This Group of 3 species is restricted to the San Joaquin Valley, with the following characteristics: (1) On the floor of Valley east into Sierra foothills. (2) All three taxa with 2n♂=25. (3) Drumming rates from 1.5 drums/s (*A. tehachapi*) to 4–5 drums/s (*A. glennville* and *A. smithi*). (4) All species with a sex clarification drum.

SPECIES WRITE UPS: *A. glennville* (p. 353); *A. smithi* (p. 358); and *A. tehachapi* (p. 366).

***Ammopelmatus glennville* Weissman, sp. nov.**
Glennville Jerusalem Cricket
Figs 598–606, Tables 2, 9, 14

Distribution. (Fig. 598). Known from a limited, mid-elevation area in the southern Sierra Nevada foothills between the towns of Posey (Tulare Co.) and Glennville (Kern Co.), California.

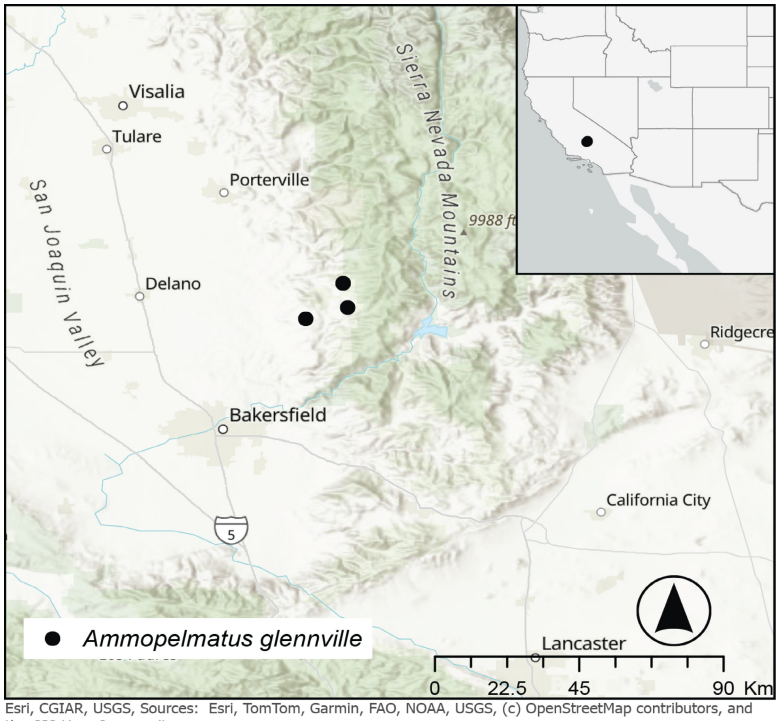


FIGURE 598. Distribution of *A. glennville.*

Recognition characters. A. glennville is in the Smithi Group (where all 3 taxa have 2n♂=25, with sex clarification drums) but differs, from *A. smithi*, in DNA, the suggestion of a slightly slower drum rate (although sample size is small), and possibly in karyotype. The 2 taxa are otherwise morphologically indistinguishable (male calcars #1 & #2 seem similarly narrow in both species). Differs from third species in the Smithi Group, the morphologically similar *A. tehachapi*, by DNA and drum rate: 4–5 drums/s in *A. glennville* and *A. smithi* vs 1.5 drums/s in *A. tehachapi.* The type locality for *A. glennville* is 40 km almost due south of *A. springville*, which is in its own Group, where the latter is found in similar habitat and at a similar elevation as *A. glennville,* but they differ in DNA and male rear leg ringlet calcar #1 and #2 being not as broad in *A. glennville* as seen in *A. springville.*

Holotype. Male (in alcohol, Fig. 599). ***California, Kern Co.,*** Hwy 155, 5.0 road km E Glennville, 35.733350° -118.669917°, 1092m, 1-iii-2004 (S04-11), DBW & VF Lee. R04-1, F1417. Collected as adult. Measurements in mm: Body length 23.76, hind femur length 9.83, hind femur width 3.39. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; rear leg tibia (Fig. 600) with 3 outer and 5 inner spines, 2 ventral spurs. Deposited CAS, Entomology type #20236.



FIGURE 599. Adult male holotype *A. glennville.* A. When alive. B. When preserved.



FIGURE 600. Left hind leg tibia male holotype *A. glennville*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 601). Same data as holotype except collected as late instar and molt to adult September, 2004. R04-125, F1557. Deposited CAS, Entomology #9079248. Measurements in mm: Body length 37.8, hind femur length 9.62, hind femur width 3.72. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; rear leg tibia (Fig. 602) with 3 outer and 5 inner spines, 2 ventral spurs. Ovipositor Fig. 603.



FIGURE 601. Preserved adult female allotype *A. glennville.*



FIGURE 602. Left rear leg tibia allotype *A. glennville.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

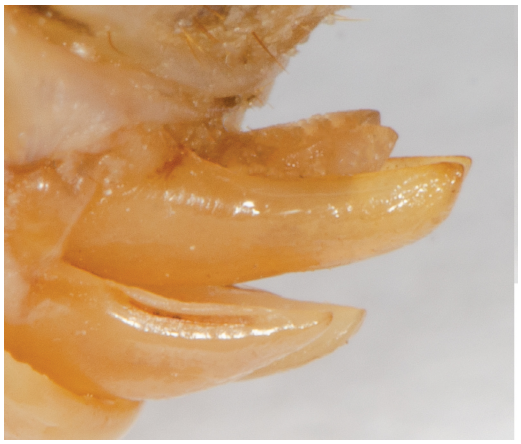


FIGURE 603. Ovipositor allotype *A. glennville.*

Paratypes. ♂5 ♀11. **CALIFORNIA, *Kern Co.,*** same data as holotype, ♂2 ♀5. Hwy 155, 7.9 km E Woody, 35.700016° -118.787249°, 927m, 1-iii-2004 (S04-10) ♀1. Hwy 155, 5.0 km E Glennville, 35.733394° -118.669888°, 1090m, 1-iii-2004 (S04-11) ♂2 ♀4. ***Tulare Co.,*** Posey, 35.804674° -118.682866°, 1094m, 25-x-1990 (S90-107) N. Smith, D. Mitchell ♀1. Posey, near post office, 35.805618° -118.682460°, 1102m, 13-xi-1998 (S98-135) I. Swift ♂1.

Drum. Similar in both sexes, but longer in female; and rare male (R04-1, S04-11) with a sex clarification drum (not recorded). Holotype R04-1 (Fig. 604) shows 32 drums over 8.2s (3.9 drums/s) at 20°C. Allotype R04-125 (Fig. 605) shows 98 drums over 37.9s (2.6 drums/s) at 13°C.

Derivation of name. Named for the town nearest the type locality.

Habitat. Under rocks on a grazed, oak grassland hillside.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. Of 11 individuals in the type series, all had 2 ventral **fore** leg tibial spurs; 1 had 7 and 10 had 8 **middle** leg tibial calcars, 10 with 2 and 1 with 3 ventral spurs; 9 had 5 and 2 had 6 inner **rear** leg tibial spines, and 10 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 597, p. 353. F0916 (S98-135, Posey); F1409 (S04-10, E Woody); F1410 and allotype F1557 (both type locality S04-11), all recovered in Group 9 Smithi; and in a larger clade that includes *A. smithi* and *A. tehachapi*, the 2 other members of the Smithi Group.

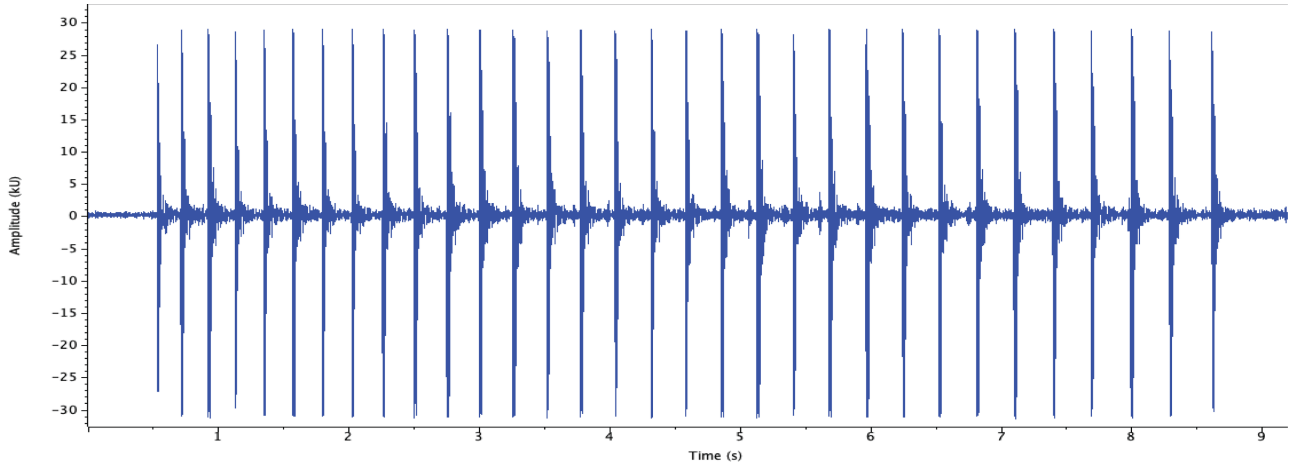


FIGURE 604. Calling drum (R04-1) holotype adult male *A. glennville.*

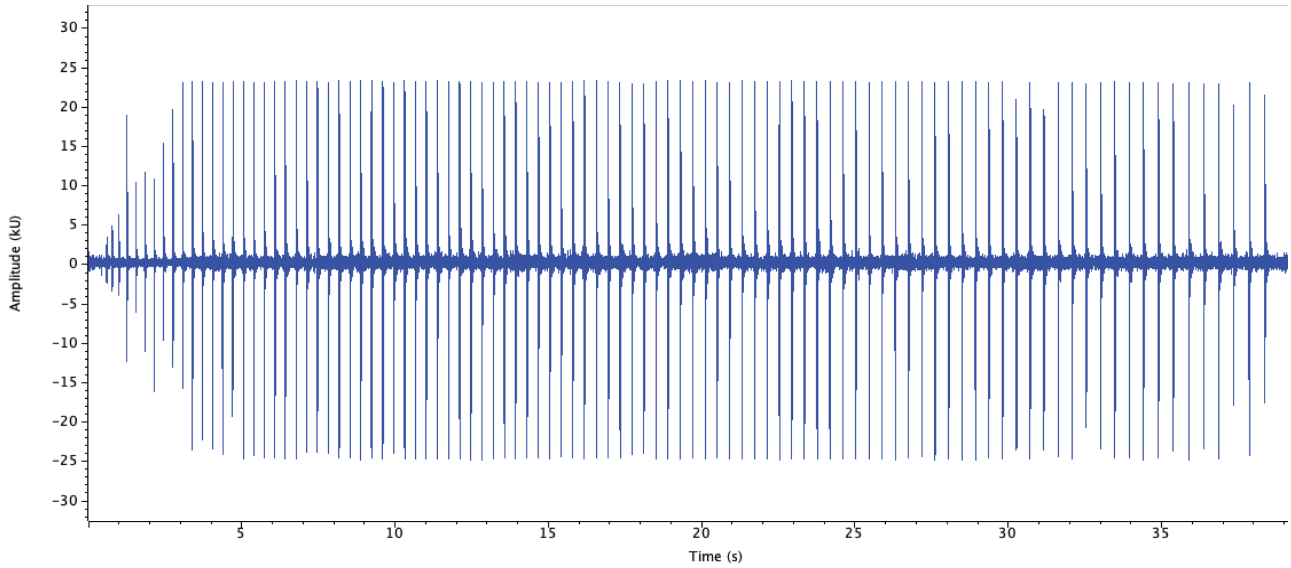


FIGURE 605. Calling drum (R04-125) allotype adult female *A. glennville.*

Karyotype. 2n♂=25. T04-9 (type locality S04-11) (Fig. 606) has 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. In contrast, 5 karyotypes of *A. smithi* (p. 364) appear to have 5, or rarely, 6 metacentric or submetacentric autosomal pairs.

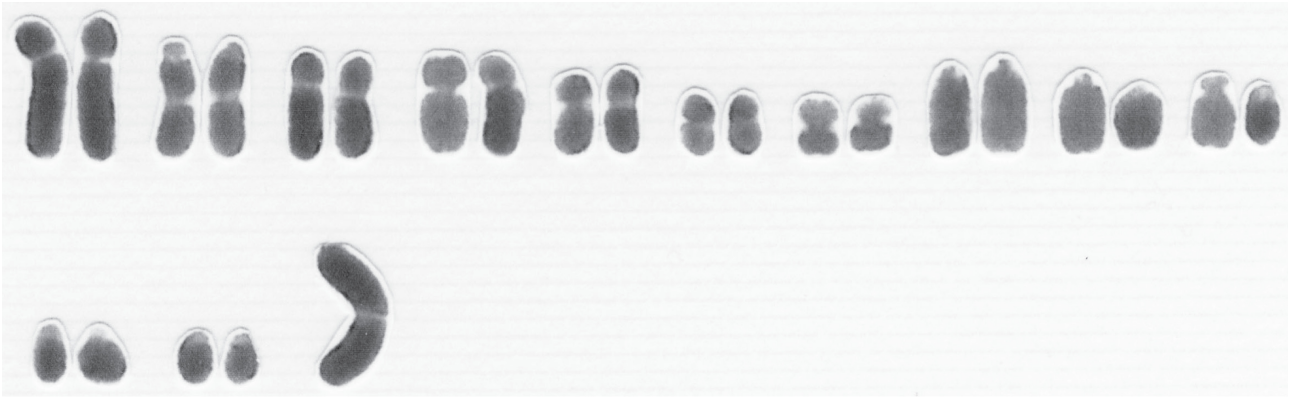


FIGURE 606. Idiogram topotype T04-9 *A. glennville* (S04-11).

Discussion. A. smithi (S04-9, at 306m) is separated by some 13-air km from the nearest known locality of *A. glennville* (S04-10, at 927m).

***Ammopelmatus smithi* Weissman, sp. nov.**
Sand Ridge Jerusalem Cricket
Figs 607–623, Tables 2, 14

Distribution. (Fig. 607). Known from a limited area of California's southern San Joaquin Valley, Kern Co., around Hwy 58, between Bakersfield and Tehachapi.

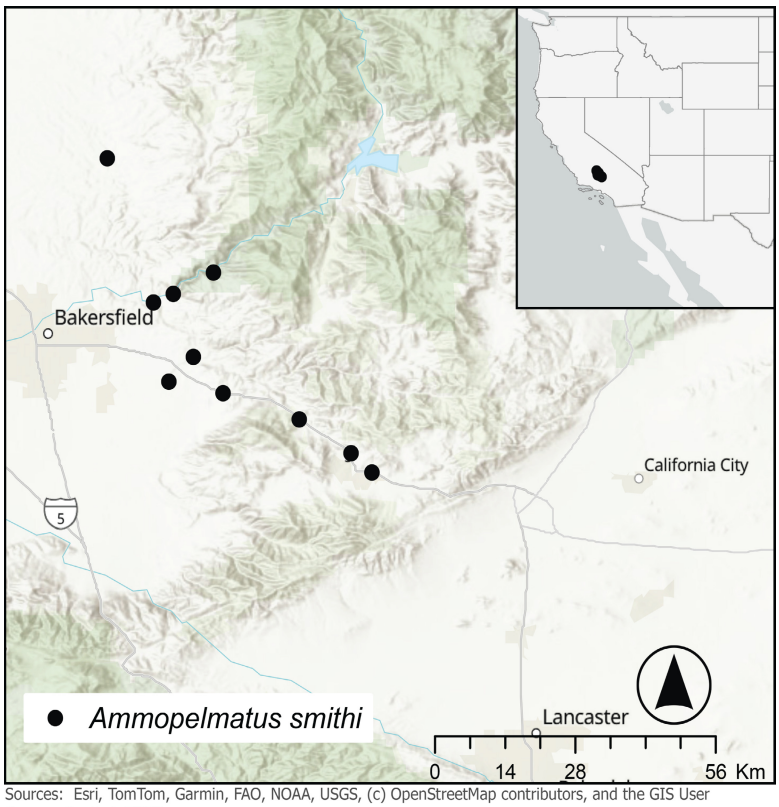


FIGURE 607. Distribution of *A. smithi.*

Recognition characters. Small to medium sized JC that drums around 4.5–5.5 drums/s, and with a sex clarification drum (SCD). Differs from *A. glennville* by DNA and the suggestion of a slightly slower drum rate (Figs 608 & 609, although sample size is small in both sexes of *A. glennville*), and possibly in karyotype. Morphologically similar to third Group member *A. tehachapi* but with different DNA and latter drums 1/3 rate of *A. smithi. A. smithi* can have a well-developed calcar #1, but not darkened and broad as seen in the more northern *A. springville*, from which it also differs in DNA.

Holotype. Male (in alcohol, Fig. 610). **California, *Kern Co.,*** Caliente Sand Ridge ~10.3 km E Edison, 35.333778° -118.758611°, 296m, 16-ii-1990 (S90-17) DBW & VF Lee. R90-70 & R90-73. Molt to adult 8-x-1970. Deposited CAS, Entomology type #20077. Measurements in mm: Body length 30.96, hind femur length 9.94, hind femur width 3.68. Fore tibia with 3 ventral spurs; middle tibia with 8 calcars and 2 ventral spurs; rear leg tibia (Fig. 611) with 2 outer and 5 inner spines, 2 ventral spurs.

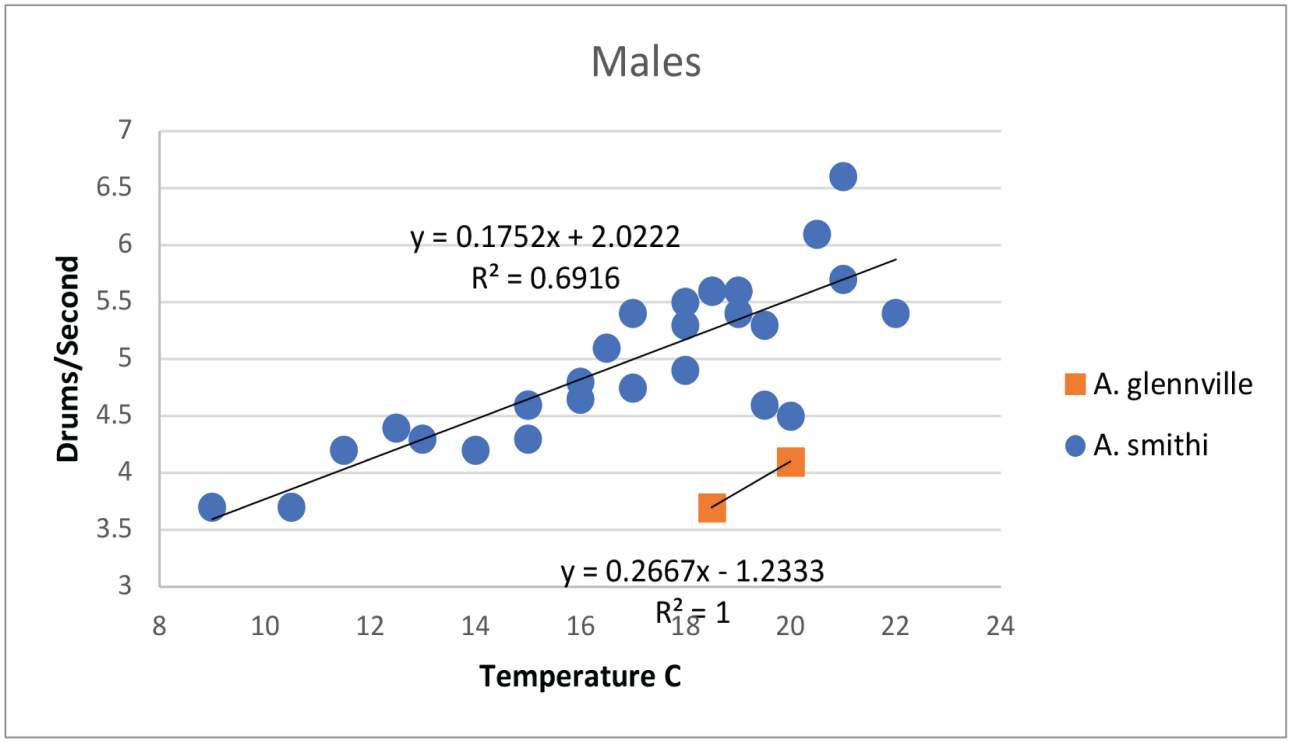


FIGURE 608. Comparison of male drumming rates in *A. smithi* vs *A. glennville.*

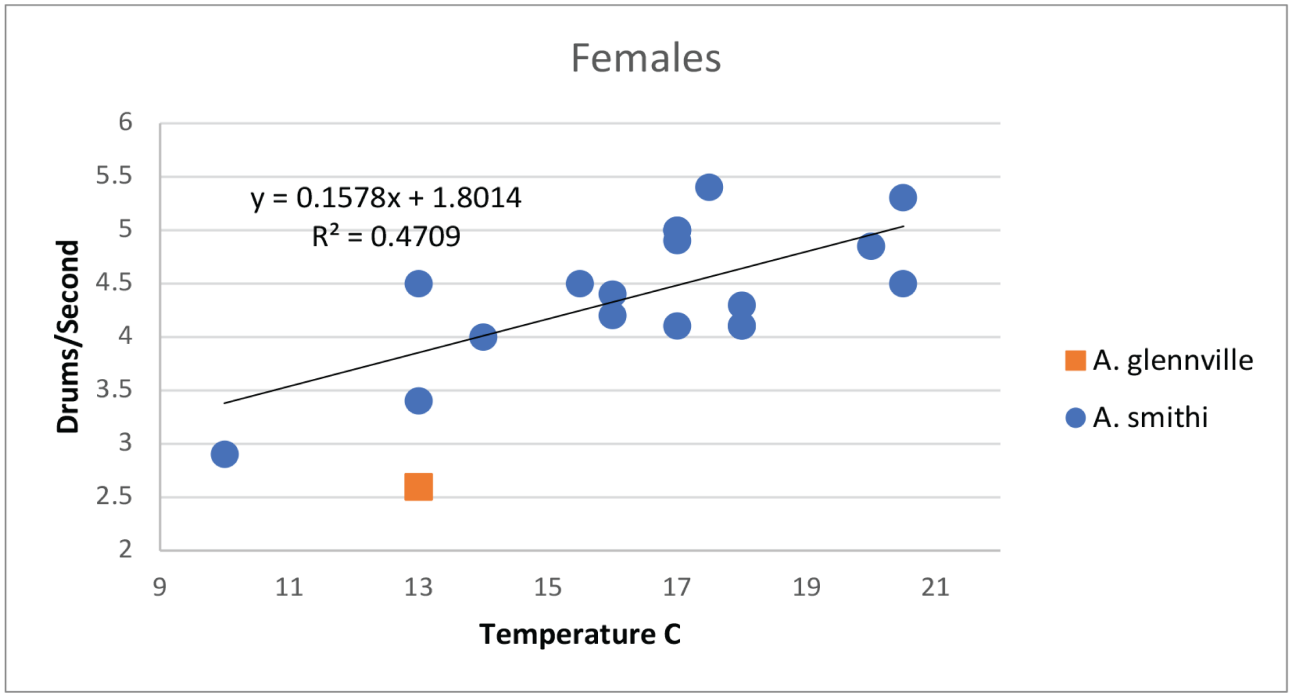


FIGURE 609. Comparison of female drumming rates in *A. smithi* vs *A. glennville.*

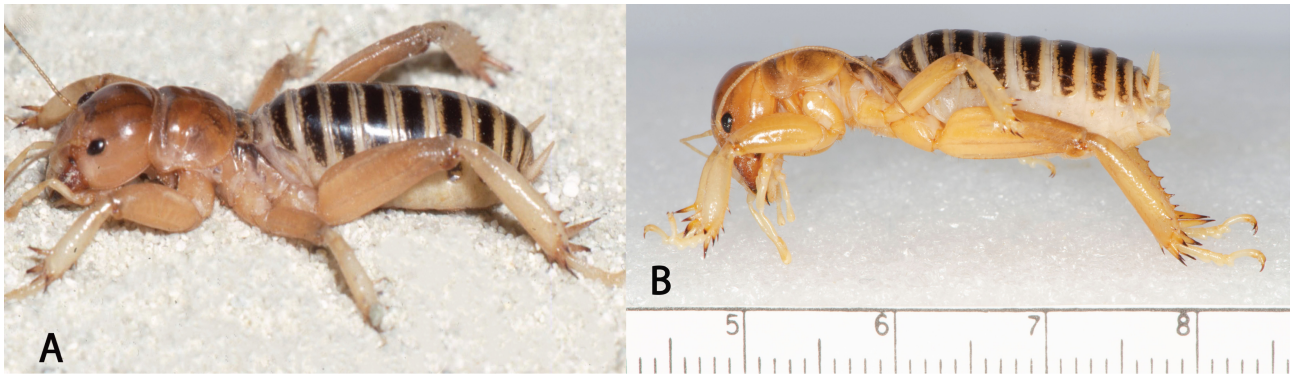


FIGURE 610. Adult male holotype *A. smithi.* A. When alive. B. When preserved.

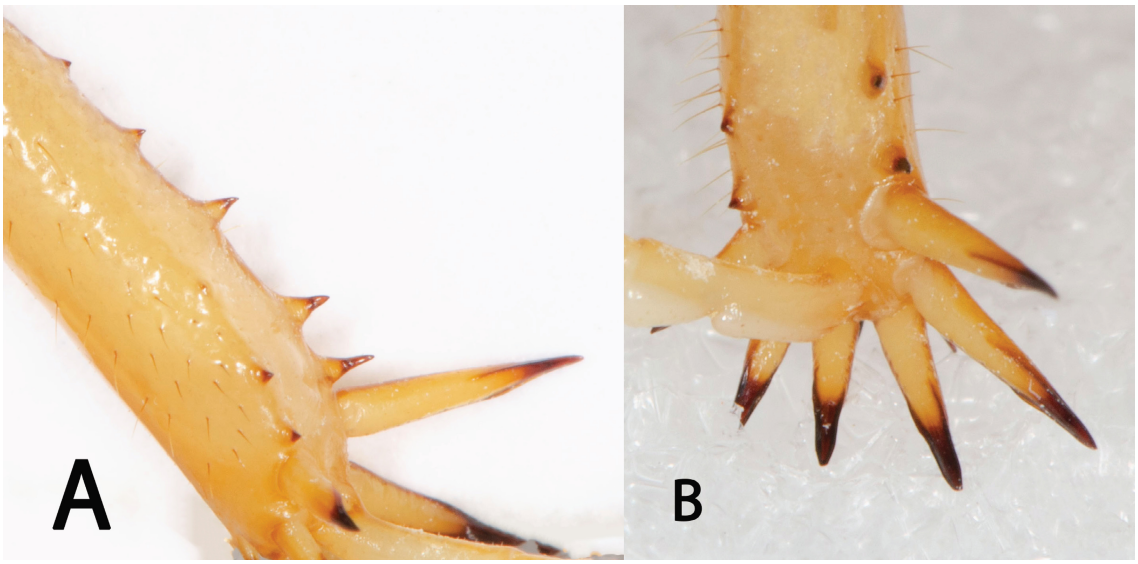


FIGURE 611. Left rear leg tibia adult male holotype *A. smithi.* A. Showing 2 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 612). Same data as holotype except 18-xii-1988 (S88-124) DBW, BI Weissman. Collected as adult. Deposited CAS, Entomology type #9085600. Measurements in mm: Body length 34.09, hind femur length 9.28, hind femur width 3.58. Fore tibia with 2 and 3 ventral spurs; middle leg tibia with 9 calcars and 2 ventral spurs; rear leg tibia (Fig. 613) with 3 outer and 5 inner spines, 2 ventral spurs. Ovipositor Fig. 614.

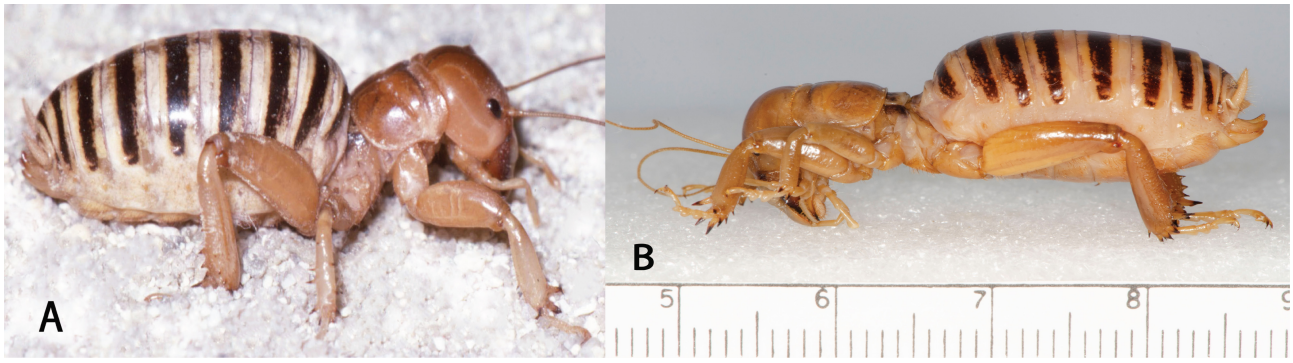


FIGURE 612. Adult female allotype *A. smithi.* A. When alive. B. When preserved.



FIGURE 613. Rear leg tibia adult female allotype *A. smithi.* A. Left side showing 3 outer and 5 inner spines. B. Right side showing shape of calcars.



FIGURE 614. Ovipositor allotype *A. smithi.*

Paratypes. ♂41 ♀62. **CALIFORNIA, *Kern Co.,*** Caliente Creek area, 35.2888° -118.6300°, 450m, 29-ii-2004 (S04-14) M. Caterino ♂1. Caliente Sand Ridge, ~5 m E Edison, on north and south sides of Hwy 58, 215-295m: North side is type locality; South side 35.291889° -118.802472°, 215m (S83-30 & S94-120 only) is Sand Ridge Wildflower Preserve, under Center for Natural Lands Management protection. North side, type locality: 22-12-1983 (S83-163) ♂1 ♀2; 11-iii-1985 (S85-26) ♂2 ♀2; 18-xii-1986 (S86-164) ♂1 ♀1; 18-xii-1987 (S87-122) ♂1 ♀2; 18-xii-1988 (S88-124) ♂1 ♀5; 16-ii-1990 (S90-17) ♂2 ♀3; 18-xii-1994 (S94-119) ♂1 ♀4; South side, Sand Ridge Wildflower Preserve, 20-iv-1983 (S83-30) NJ Smith, AR Gilbert, D. Poore, ♀2; 18-xii-1994 (S94-120) ♂1. Hwy 58 at mile post 72.8, 35.27231° -118.70539°, 474m, 23-i-2010 (S10-2) ♂1. Hwy 58 0.2 m N Keene turnoff, 35.228054° -118.568849°, 771m, 16-17-xii-1982 (S82-135) ♂4 ♀5; 22-xii-1991 (S91-129) ♂2 ♀5; 6-iii-1992 (S92-29) ♀1; 17-iii-1996 (S96-19) ♀2. Hwy 58 6.3 m E Keene, mile post 88.5, 1066m, 17-xii-1982 (S82-138) ♂5 ♀3; 18-xii-1986

(S86-165) ♂4 ♀6; 16-ii-1990 (S90-16) ♀2. 2.2 m NW Tehachapi, 35.170837° -118.476006°, 1103m, 29-ii-2004 (S04-6) ♀3. Tehachapi, rocky hill between Hwy 58 and airport on south side of Hwy 58, 35.138283° -118.438574°, 1217m, 29-ii-2004 (S04-7) ♂1 ♀2. Bakersville-Glennville Rd 5.4 m SW Woody, 35.669600° -118.912867°, 306m, 1-iii-2004 (S04-9) ♂4 ♀3. Hwy 178 at Cottonwood Creek crossing, 35.440333° -118.794561°, 242m, 13-iii-1996 (S96-6) ♂2 ♀3. Kern Canyon, Hwy 178, Upper Richbar Picnic Area, 35.476376° -118.722576°, 442m, 18-xii-1988 (S88-123) ♂3 ♀2; 13-iii-1996 (S96-7) ♂2 ♀2; 27-ii-2004 (S04-13) M. Caterino ♂2 ♀1. Lower Kern River Hwy 178 at Rancheria Rd, 35.4258° -118.8301°, 165m, 27-ii-2004 (S04-12) M. Caterino ♀1.

Drum. Holotype **male:** S90-17, R90-70 (Fig. 615), 19°C: 90 drums over 16.4s (5.5 drums/s). Holotype also with SCD (R90-70, Fig. 616), 19°C: 16 drums over 1.1s (14.5 drums/s)—can see 'finger drums' that triggered male. Topotypic **female:** (S90-17) R90-72 (Fig. 617), 20.5°C: 66 drums over 13.0s (5.1 drums/s).

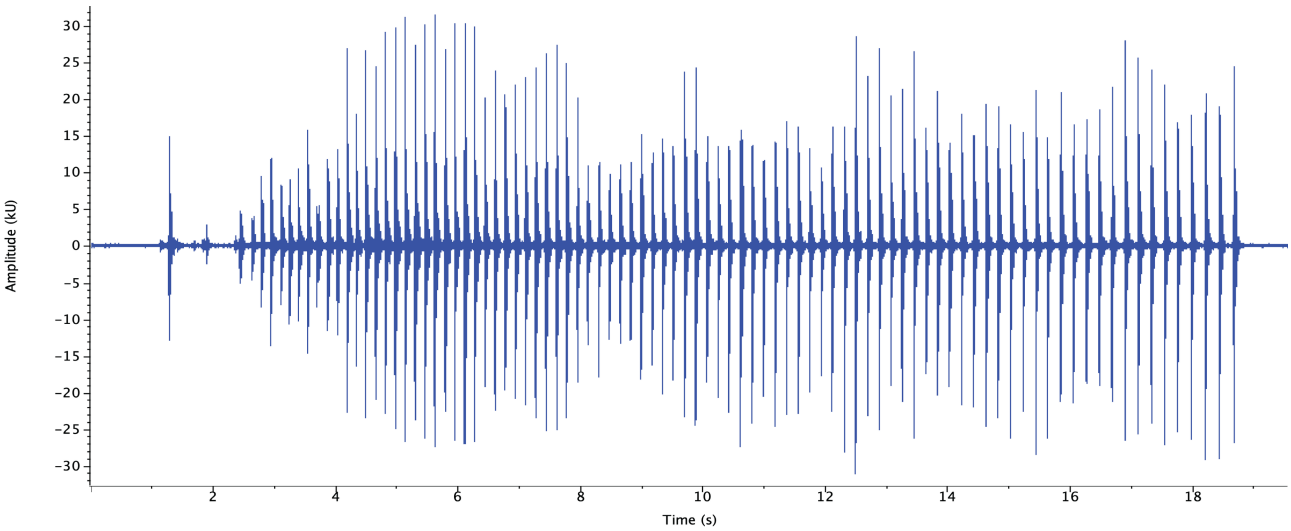


FIGURE 615. Calling drum (R90-70) holotype adult male *A. smithi.*

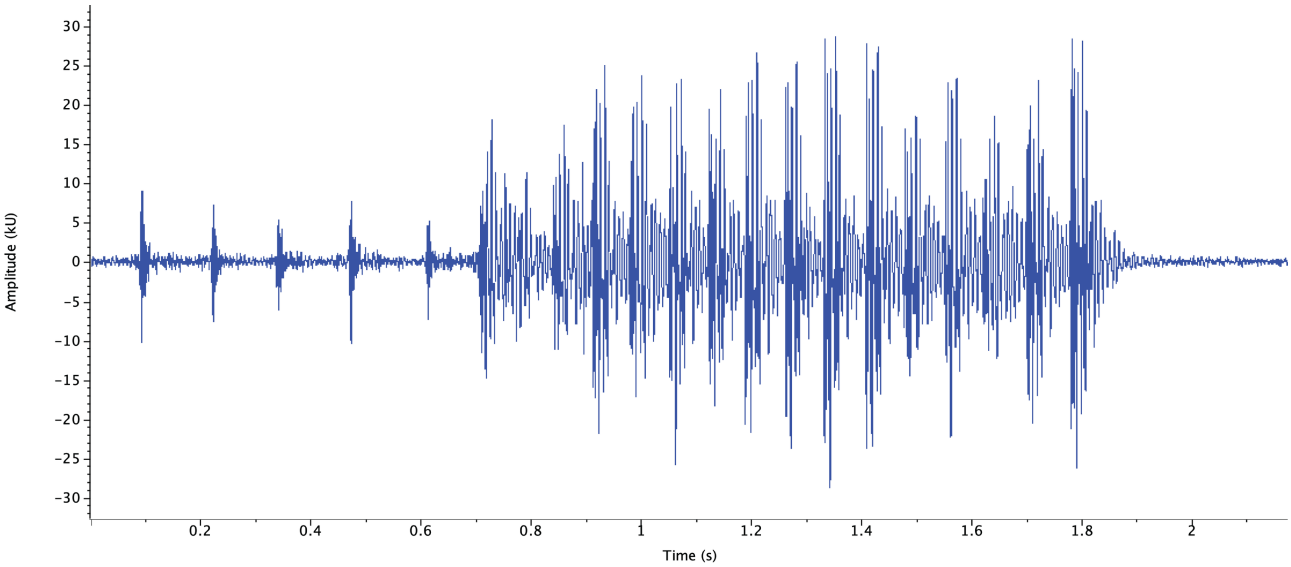


FIGURE 616. Sex clarification drum (SCD) (R90-73) in holotype adult male *A. smithi.* Initial 5 spikes actual finger tapping, at female's calling drum speed, which stimulated male's response with a SCD.

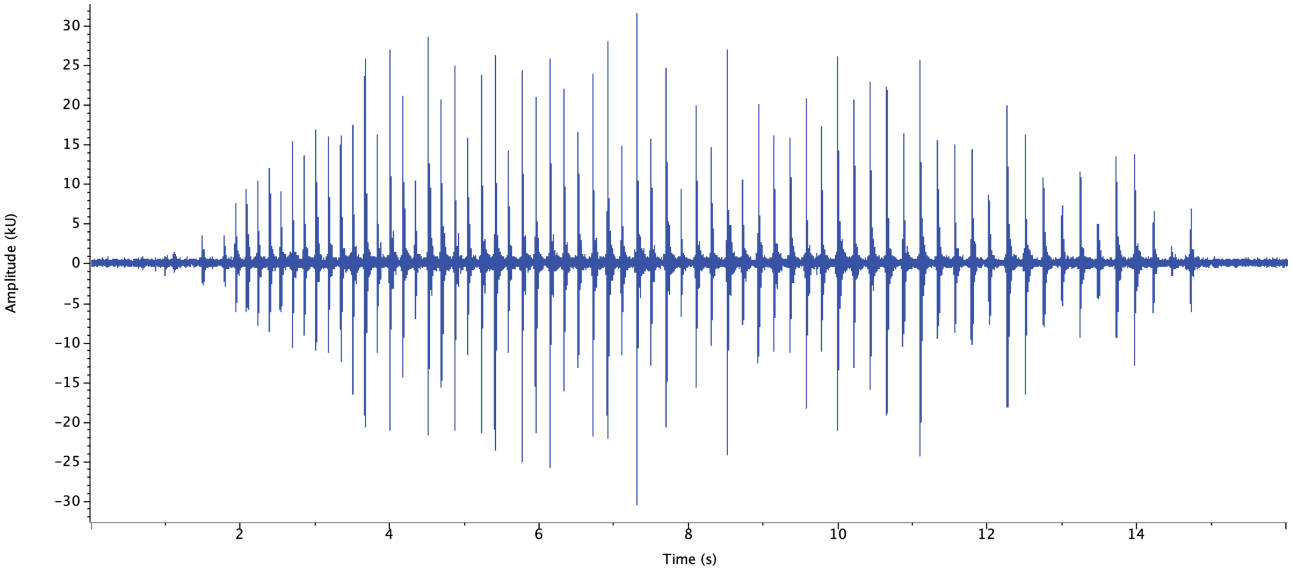


FIGURE 617. Calling drum (R90-72) topotypic female *A. smithi.*

Derivation of name. Named for Norman J. Smith, who first discovered this species, in 1983, at type locality Sand Ridge.

Habitat. The most productive Sand Ridge habitat had JCs under debris, such a pipes and boards, near the orange tree orchid on the north side of Hwy 58. We only found 3 specimens on the south side of Hwy 58, probably because of less surface debris and junk. The 2013 Draft Environmental Impact Report described the Sand Ridge soil as "unique", consisting "primarily of unconsolidated sands ranging from fine to coarse particle size, which allows for very rapid drainage." Paratype habitats between Keene and Tehachapi are deciduous oak-pine woodland grassland where, in winter, JCs under rocks and logs, sometimes 8 cm below surface in vertical holes. On occasion, ground frozen solid (e.g., 16-ii-1990, S90-16) during winter and we were unable to turn most rocks; although at S90-16, with no snow on the ground, still collected 2 mid instar females that were OK.

Life cycle and seasonal occurrence. Field collected nymphs molted to adult 24-viii to 5-xi in various years. Probably typical 2-year life cycle.

Variation. Of 30 adults from Sand Ridge and 34 adults from around Keene and elsewhere, all but 2 (1 adult each from Sand Ridge and Keene) had 3 **fore** leg tibial spurs while the remaining 2 had 2 spurs. The single adult male from an area (S10-2) between Sand Ridge and 7 m SSE Arvin (type locality of *A. tehachapi*) had 2 fore tibial spurs but drummed (R10-40) consistent with *A. smithi*, and his DNA (F2218) was recovered in the *A. smithi* clade. **Middle** leg tibia: of 63 adults from above areas, 1 had 7 and 1 had 9 calcars while 61 had 8 calcars; while all had 2 ventral spurs. **Hind** leg tibia: of 65 adults from all areas, 1 had 4, 61 had 5 and 3 had 6 inner spines; while 13 had 2, 51 had 3, and 1 had 4 outer spines; while all had 2 ventral spurs.

DNA. Fig. 597, p. 353. F0028 (type locality S94-119); F0230 (S96-19, Keene); F0613 (S96-7, Upper Richbar); F1497 (Caliente Creek, S04-14); F1555 and F1556 (S04-9, both Woody); F1560, and F1561 (S04-13, both Upper Richbar); F2218 (S10-2, Intersection Hwy 58 and Hwy 223) all recovered together in Group 9 Smithi, and closest to *A. tehachapi*.

Karyotype. 2n♂=25. Five males determined: T87-21 (Fig. 618, S86-165, near Keene); T95-3 (Fig. 619, S94-119) and T95-5 (Fig. 620, S94-120), both from type locality; T96-4 (Fig. 621. S96-7, Upper Richbar); T05-3 (Fig. 622, S04-7, Tehachapi) all with 5 metacentric or submetacentric autosomal pairs (except for T87-21, which has 6 pairs); 7 acrocentric or telocentric autosomal pairs (T87-21 with 6 pairs); and all with 1 metacentric X chromosome. We are unsure of the significance of these differences, especially since all specimen's DNA recovered together.

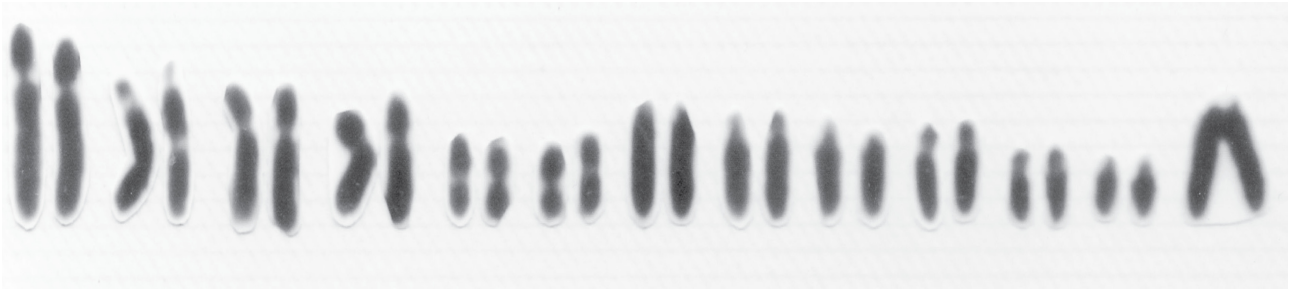


FIGURE 618. Idiogram T87-21 *A. smithi* (S86-165).

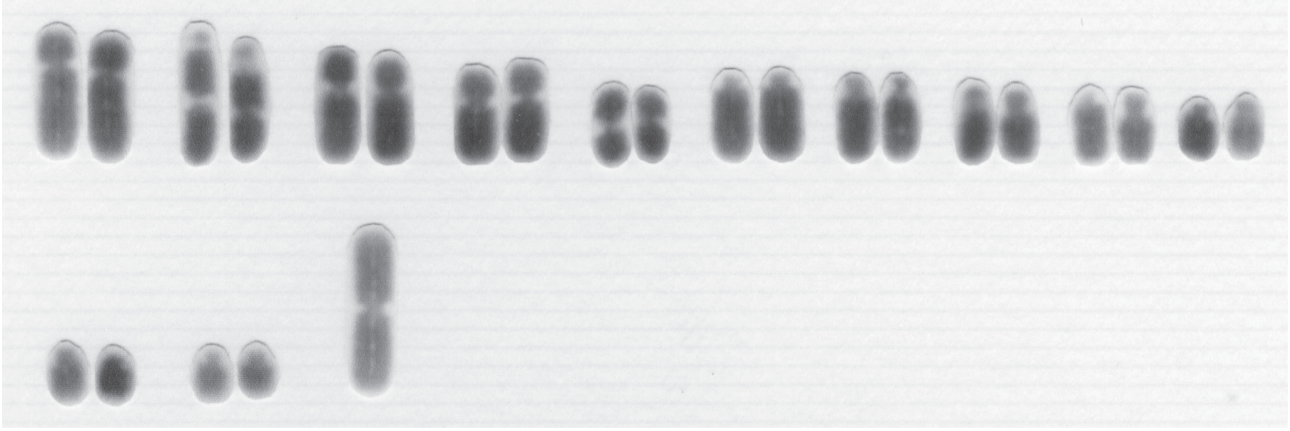


FIGURE 619. Idiogram T95-3 *A. smithi* (S94-119).



FIGURE 620. Idiogram T95-5 *A. smithi* (S94-120).



FIGURE 621. Idiogram T96-4 *A. smithi* (S96-7).

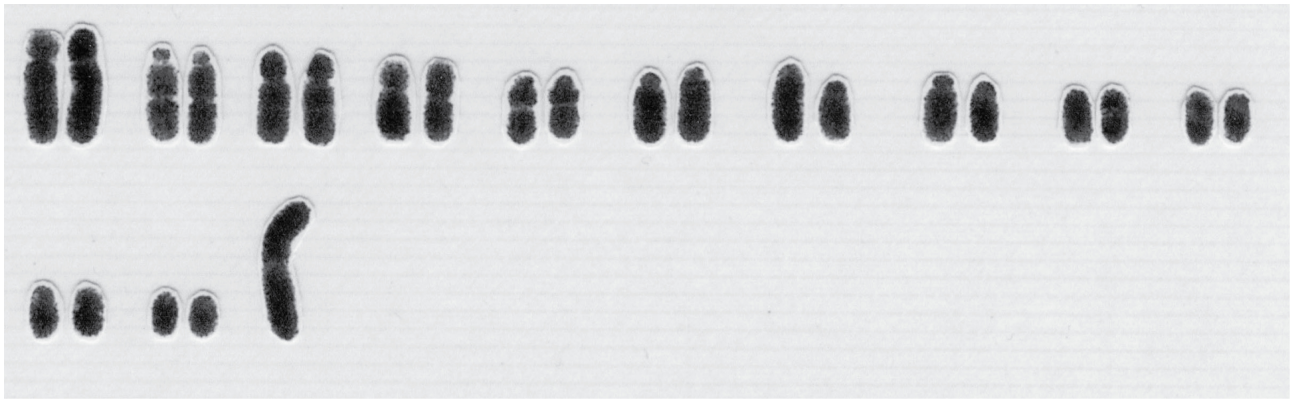


FIGURE 622. Idiogram T05-3 *A. smithi* (S04-7).

Discussion. Although the microhabitat for the population from Sand Ridge is very different from the oak woodland areas between Keene and Tehachapi, we can find no differences between their adults for morphology, drum, color patterns, karyotypes, and DNA, and thus conclude that one species is involved.



FIGURE 623. While sifting for the Valley Mydas Fly, *Rhaphiomidas trochilus*, G. R. Ballmer and associates collected a nymph of *A. smithi* almost 1.5 m deep.

The type locality Caliente Sand Ridge is an elongated aeolian dune formation consisting of sand deposited from wind born sediment from the exposed Caliente Creek bed. The 261-acre Sand Ridge Wildflower Preserve (SRWP), with Caliente Creek running along the eastern boundary, is owned and protected by the Center for Natural Lands Management, and was originally set aside for the federally endangered Bakersfield cactus (*Opuntia basilaris* var.

treleasei). The site is adjacent to a sand quarry owned by Caliente Sand and Mineral Company. An application for quarry expansion was submitted in 2013 with expansion efforts being monitored by the Sierra Club/Kern Kaweah Chapter, California Native Plant Society, Kern Chapter, Center for Biological Diversity, and other interested local parties.

While it would have been ideal to designate the holotype from the protected SRWP, we did not have an adult male, with drum, from there although testes T95-5 is from a subadult male from the SRWP. We do have 1 adult male and 2 adult females from the SRWP, which morphologically match those from the nearby (4.9 km northeast on the north side of Hwy 58) type locality, where we have more adult specimens, drumming, karyotypes, and DNA. Nevertheless, we suspect that *A. smithi* is more common in the SRWP, but the problem is finding them. The technique of Prentice *et al.* (2011), in addition to late summer and fall oatmeal trails and winter sifting (Weissman 2001a, Weissman & Lightfoot 2007) could be effective. Greg R. Ballmer and associates sifted (Fig. 623) the SRWP dunes, on 21-v-2006, looking for larvae of the Valley Mydas fly, *Rhaphiomidas trochilus* (Coquillett), and found a Jerusalem cricket almost 1.5 m below the sand surface. Given the scant rainfall in the area (average site rainfall from 1937 to 2006 was 158 mm), in combination with high summer temperatures (monthly mean of 29–32°C, with extreme temperatures of well over 40°C [Kern County Draft Environmental Impact Report, CUP No. 12, Map No. 126, PP03265, p. 3-8, 2013]), all coupled with JC's tendencies to dehydrate, we are not surprised that Ballmer found them that deep.

The SRWP is the only known locality for both the Valley Mydas Fly, *R. trochilus* (G.R. Ballmer, pers. comm. to DBW), and the Bakersfield legless lizard, *Anniella grinnelli* Papenfuss & Parham (2013).

***Ammopelmatus tehachapi* Weissman, sp. nov.**

Tehachapi Mountains Slow Drumming Jerusalem Cricket
Figs 624–636, Tables 2, 24

Distribution. (Fig. 624). Known only from a small area of Kern County's Tehachapi Mountain's foothills, bordered by Arvin, the I-5 Grapevine, and higher elevations within Tehachapi Mt. Park.

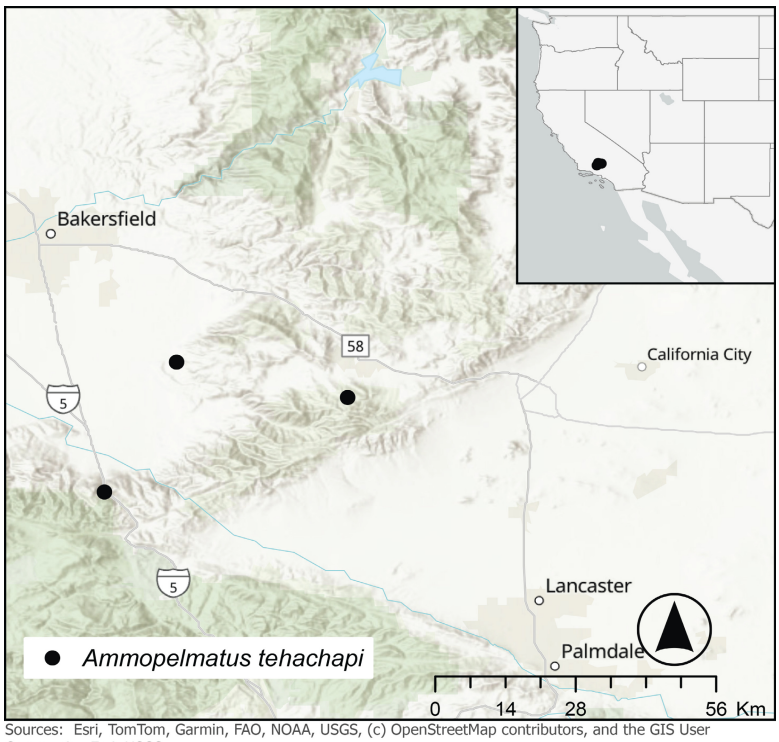


FIGURE 624. Distribution of *A. tehachapi.*

Recognition characters. A small to (rarely) large JC, morphologically indistinguishable from allopatric sister species *A. glennville* and *A. smithi* (Fig. 625), but separated by DNA and calling drum pattern: A drumming rate of 1.5 drums/s in *A. tehachapi* vs 4.5–6 drums/s in both *A. glennville* and *A. smithi.* Males of all 3 taxa have sex clarification drums (SCD) and 2n♂=25. The karyotypes of *A. tehachapi* and *A. smithi* may differ slightly (see below) but more specimens need to be compared.



FIGURE 625. Comparison of recently killed adult females: Left, allotype (R05-140) *A. tehachapi.* Right, paratype *A. smithi* (S04-6, R05-145).

Holotype. Male (in alcohol, Fig. 626). **California, *Kern Co.,*** 8.2 air km SSE Arvin, on Comanche Point Road, 35.136806° -118.793583°, 301m, 7-i-2005 (S05-7) DBW. R05-1& R05-3. Collected as adult. Deposited CAS, Entomology type #20087. Measurements in mm: Body length 26.53, hind femur length 9.76, hind femur width 3.4. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 627) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 626. Adult male *A. tehachapi.* A. Topotype (S05-7, R05-127) when alive. B. Holotype when preserved.



FIGURE 627. Left rear leg tibia holotype adult male *A. tehachapi.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 628). Same data as holotype except R05-140. Molt to adult 4-ix-2005. Deposited CAS, CASENT #9079018. Body length 42.19, hind femur length 10.56, hind femur width 4.1. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 629) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 630.

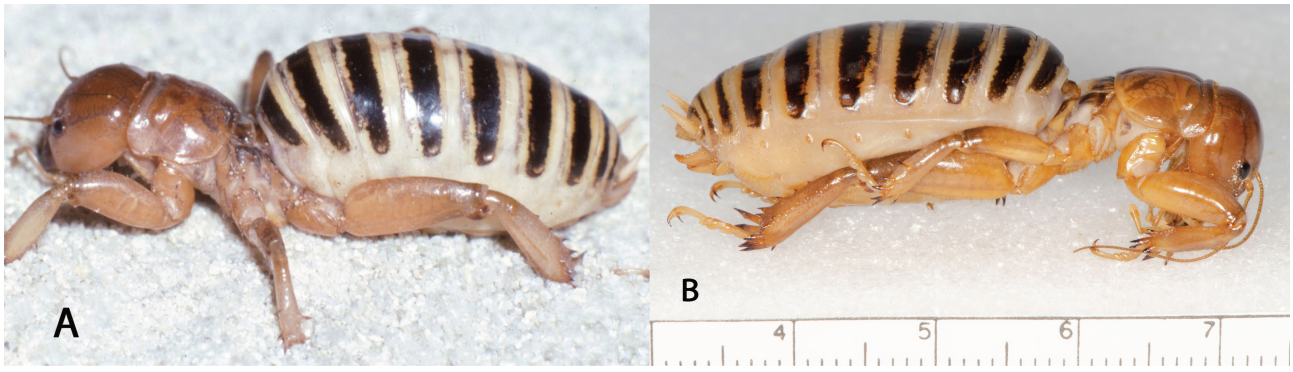


FIGURE 628. Adult female allotype *A. tehachapi.* A. When alive. B. When preserved.

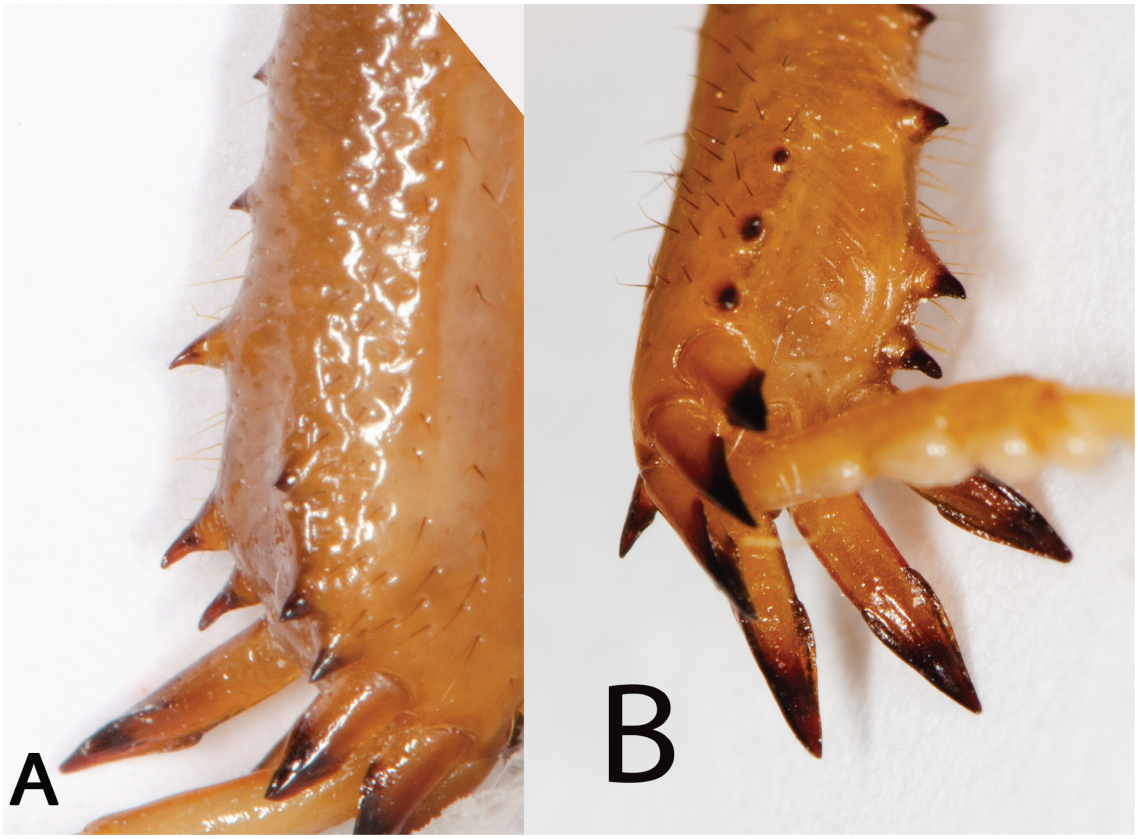


FIGURE 629. Right rear leg tibia allotype *A. tehachapi.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.



FIGURE 630. Ovipositor allotype *A. tehachapi.*

Paratypes. ♂10 ♀15. **CALIFORNIA, *Kern Co.***, Type locality, 25-xi-1998 (S98-121) R. Aalbu ♂2 ♀1; 23-ii-2001 (S01-4) ♀1; 7-i-2005 (S05-7) ♂4 ♀6. Hwy I-5 ("Grapevine") 2.3 m N Fort Tejon, pullout west side of freeway, 34.897591° -118.922817°, 768m, 9-ii-1990 (S90-2) ♂1; 26-ii-2001 (S01-13) ♂1. Tehachapi Mt Park, 35.071747° -118.487147°, 1698m, 6-iii-1992 (S92-28) ♂1; 13 & 18-iii-1996 (S96-9) ♂1 ♀7.

Drum. Calling drum similar in both sexes, except males also with a SCD. **Male:** Holotype, R05-3 (Fig. 631, S05-7) 17°C: 19 drums in 12.3s (1.5 drums/s); another burst of 17 drums in 11.3s (1.5 drums/s). Holotype SCD, R05-3, S05-7) 17°C: 1 series of 22 drums (Fig. 632) in 2.7s (8.1 drums/s); another SCD series of 17 drums in 1.9s (8.9 drums/s). **Female:** Allotype, R05-140 (Fig. 633, S05-7) 18°C: 70 drums over 50.9s (1.4 drums/s).

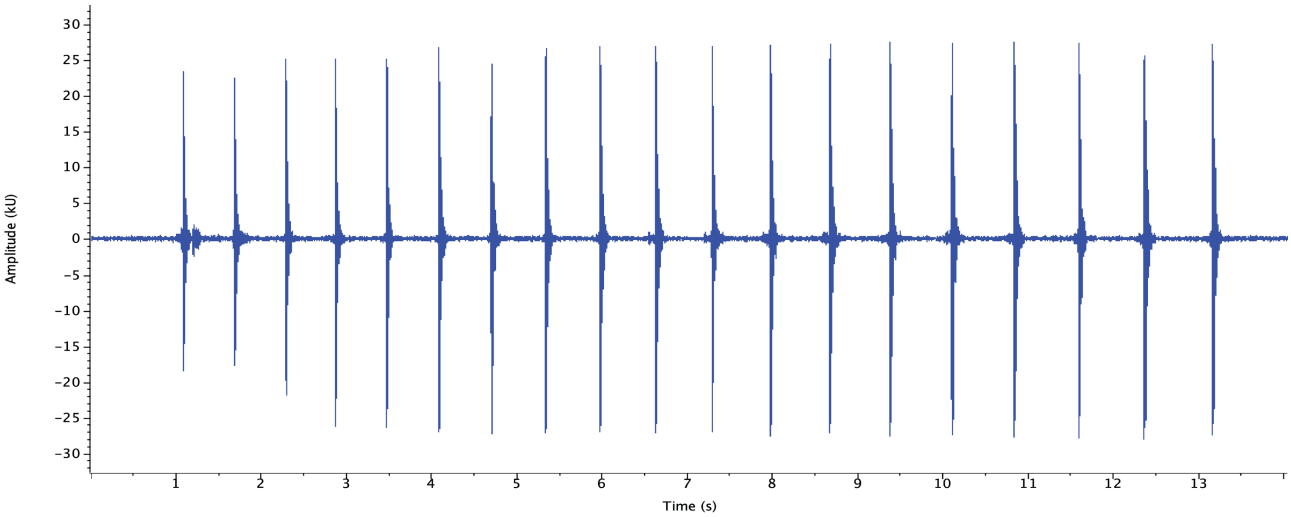


FIGURE 631. Calling drum (R05-3) holotype adult male *A. tehachapi.*

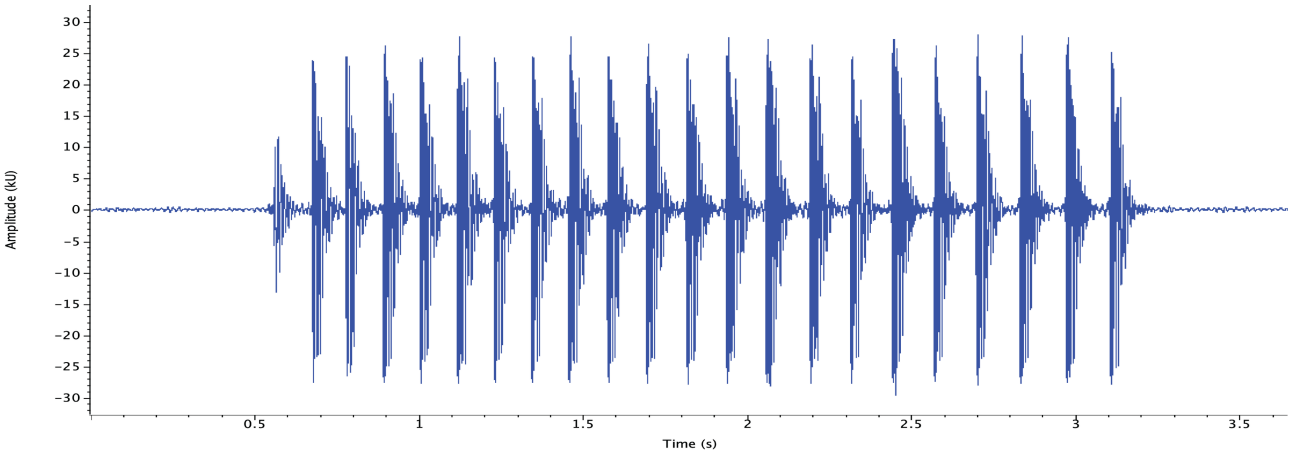


FIGURE 632. Sex clarification drum (R05-3) holotype adult male *A. tehachapi.*

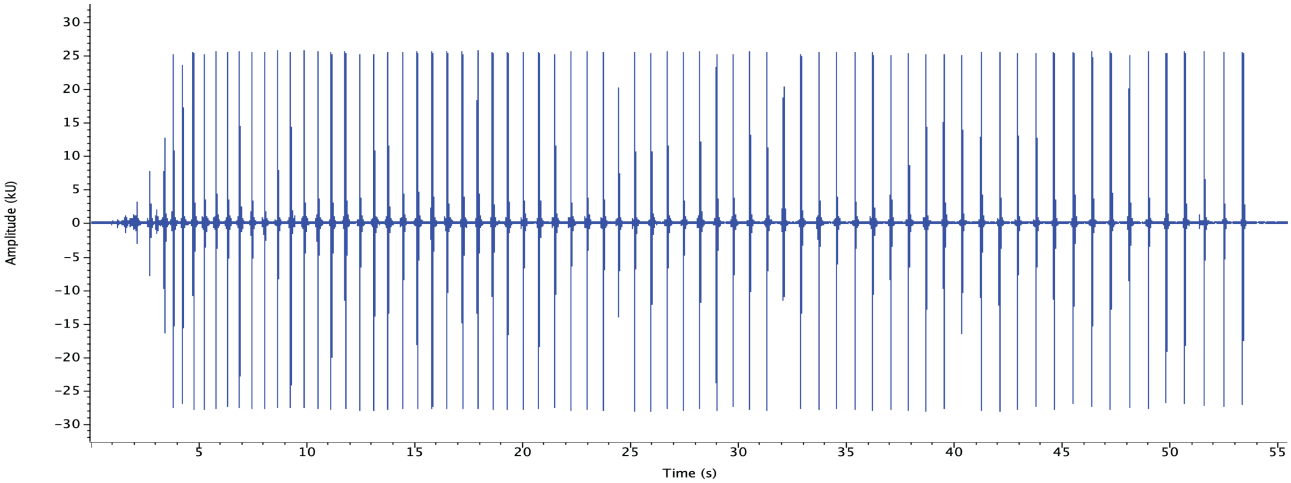


FIGURE 633. Calling drum (R05-140) allotype adult female *A. tehachapi.*

Derivation of name. Named for its restricted distribution within the northern foothills and mountains of the Tehachapi Mountains.

Habitat. Type locality is a dry ravine bed (between steep, grazed grassland hillsides) where JCs were under rocks. Tehachapi Mt Park area is open grassland with deciduous oaks. Grapevine locality along I-5 is open hillside grasslands with few shrubs and lots of rocks.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle. At holotype locality (S05-7), we collected 2 adult males and 3 adult females, 2 late instars, 5 mid instars and 1 small individual.

Variation. Of 20 individuals, all **fore** leg tibia with 3 ventral spurs; **middle** leg tibia in 3 adults with 7 calcars, 16 adults with 8 calcars, and 1 adult with 9 calcars, and all 20 with 2 ventral spurs; **hind** leg tibia in 2 adults with 4, 17 with 5, and 1 with 6 inner spines; 18 with 3 and 2 with 4 outer spines, all with 2 ventral spurs. Field collected adult females from Tehachapi Mt Park can be very small, but their identity was confirmed, since they didn't drum, by sequencing F0223 (S96-9).

DNA. Fig. 597, p. 353. F0223 & F0317 (both S96-9, Tehachapi Mt Park); F1324 (S01-13, Grapevine); and F1576 (type locality S05-7) recovered in Group 9 Smithi, and closest to *A. smithi*.

Karyotype. 2n♂=25. Two males (both with 3 fore leg tibial spurs) checked with slightly different results: T01-14 (Fig. 634, S01-13, Grapevine); T05-7 (Figs 635 & 636, type locality S05-7, Arvin) with either 5 (T01-14) or 6 (T05-7) metacentric or submetacentric autosomal pairs; 6 (T05-7) or 7 (T01-14) acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. The significance of these minor differences is unknown.



FIGURE 634. Idiogram T01-14 *A. tehachapi* (S01-13). From meiotic cell division.

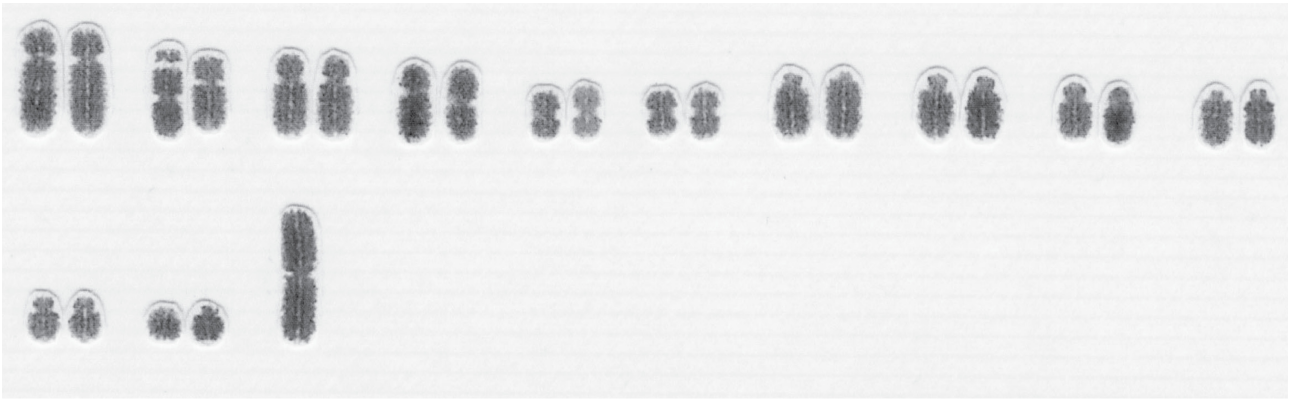


FIGURE 635. Idiogram T05-7 *A. tehachapi* (S05-7). From mitotic cell division.



FIGURE 636. Mitotic metaphase cell from T05-7 (S05-7). Single X chromosome is labeled.

Discussion. At the type locality, slow drumming (1.5 drums/s) *A. tehachapi*, with 3 fore leg ventral tibial spurs, is the only JC species present. Along the Grapevine, it occurs sympatric with the more common, fast drumming (10 drum/s) *A. grapevine*, which usually has 2 fore leg ventral tibial spurs (rarely 1 or 3). In Tehachapi Mt Park, it again occurs sympatric with *A. grapevine*; and with the rare, intermediate drumming rate (3 drums/s) *A. crypticus,* which has 3 fore leg tibial spurs.

Several other Southern California mountain areas also have high elevation, slow drumming JC species: *A. ashleighi* in the San Bernardino Mts; *A. sangabriel* in the San Gabriel Mts; *A. pinyonpines* in the San Jacinto-Santa Rosa Mts; and *A. anzaborrego* in the San Ysidro Mts west of Borrego Springs. These latter 4 taxa are recovered in Groups 11 & 12, Southern California #1 and #2, and different than Group 9 *A. tehachapi.*

(CLADE 8) Group 10, Grayi Group (Fig. 637)

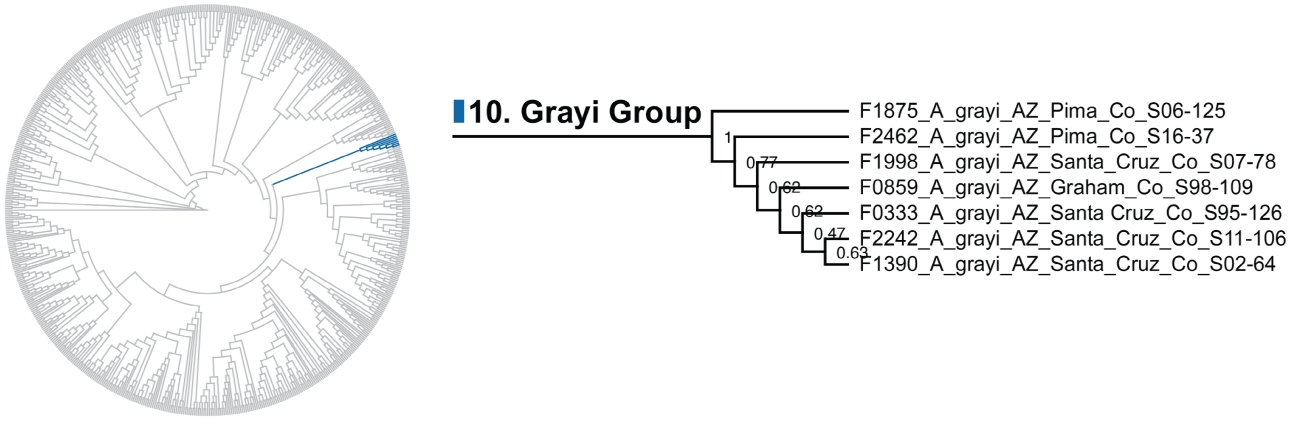


FIGURE 637. ASTRAL tree for Grayi Group.

This Group contains the only known JC species found in southern Arizona.

SPECIES WRITE UP: *A. grayi* (p. 373).

***Ammopelmatus grayi* Weissman, sp. nov.**
Southern Arizona Jerusalem Cricket
Figs 638–649, Table 25

Species #14, Weissman 2001b.

Distribution. (Fig. 638). Only known from southeastern Arizona.

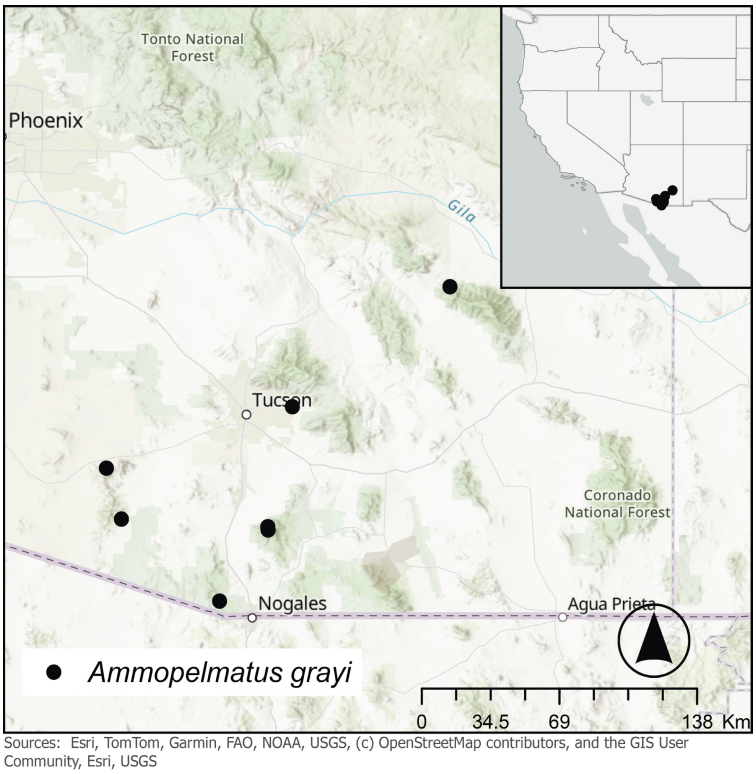


FIGURE 638. Distribution of *A. grayi.*

Recognition characters. Only member of the Grayi Group. Medium size, mid elevation JC with wide, black abdominal bands that drums around 4 drums/s. 2n♂=25. Fore leg tibia with 3 spurs; rear leg inner tibia with 4 spines, outer tibia with 3 spines, inner spine #2 usually longer than spine #1. Separated from only other southern Arizona JC species, *A. portal*, by drum, chromosome number, and DNA.

Holotype. Male (in alcohol, Fig. 639). **Arizona, *Santa Cruz Co.,*** Santa Rita Mts, Coronado National Forest, Madera Canyon, 31.712794° -110.873753°, 1654m, 26-vii-1990 (S90-79). DBW & DC Lightfoot. R90-32. Molt to adult 2-ix-1990. Deposited CAS, Entomology type #20137. Measurements in mm: Body length 30.72, hind femur length 10.18, hind femur width 3.81. Fore leg tibia with 3 ventral spurs; middle leg tibia with 6 or 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 640) with 4 inner and 2 or 4 outer spines, 2 ventral spurs.

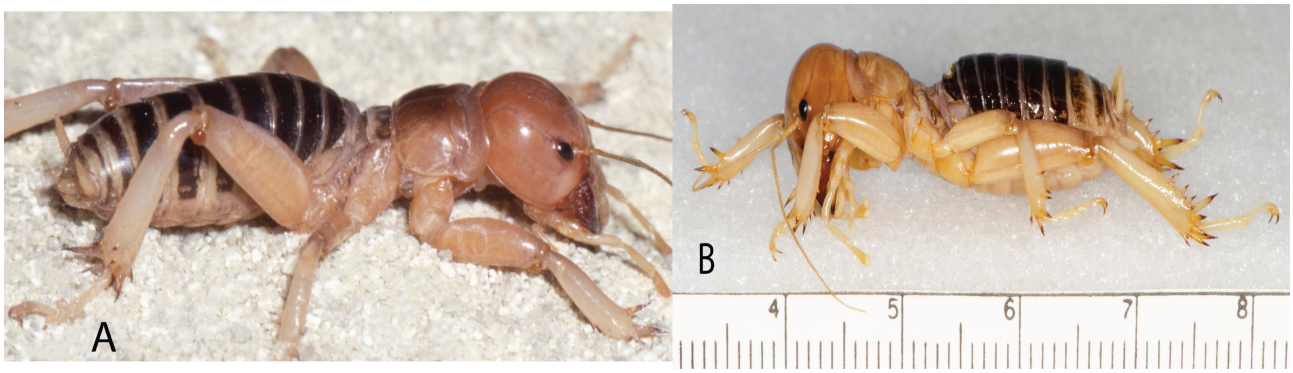


FIGURE 639. Adult male holotype *A. grayi.* A. When alive. B. When preserved.



FIGURE 640. Left hind leg tibia of male holotype *A. grayi.* A. Showing 4 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 641). **Arizona, *Santa Cruz Co.,*** Santa Rita Mts, Madera Canyon, 31.726667° -110.875000°, 1546m, 29-viii-2018 (S18-58) Alice Abela. R18-39, F2547. Molt to adult 3-x-2018. Deposited CAS, CASENT #9086347. Measurements in mm: Body length 32.33, hind femur length 10.07, hind femur width 3.64. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 642) with 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 643.

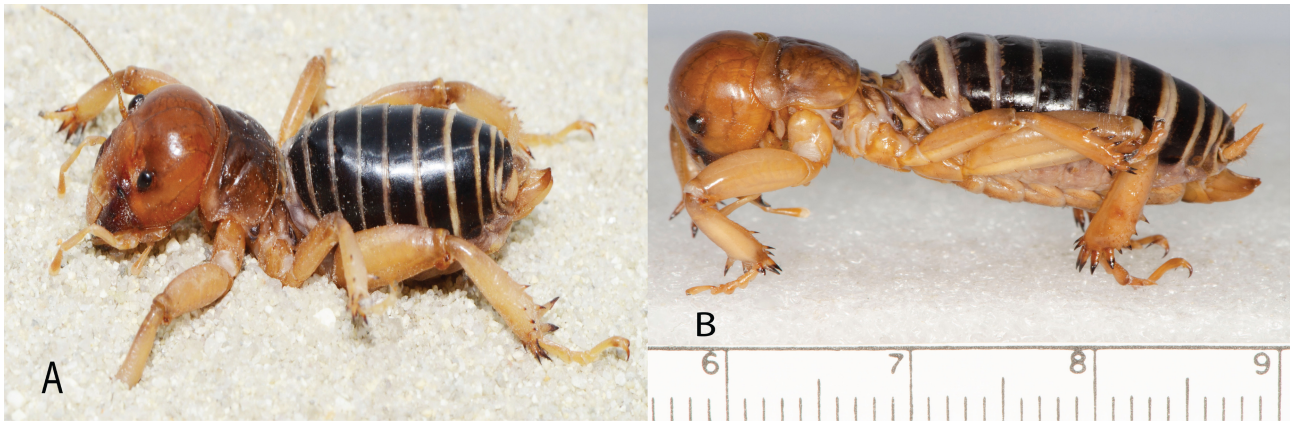


FIGURE 641. Adult female allotype *A. grayi.* A. When alive. B. When preserved.



FIGURE 642. Rear leg tibia allotype *A. grayi.* A. Right leg showing 4 inner and 3 outer spines. B. Left leg showing shape of calcars.



FIGURE 643. Ovipositor allotype *A. grayi*.

Paratypes. ♂32 ♀24. **ARIZONA**, ***Gila Co.,*** Pinal Mts 6.9 m S Globe, ~33.333571° -110.837949°, 1427m, 29-iv-1990 (S90-36), S. Woodward, ♂1. ***Graham Co.,*** Pinaleño Mts, Tripp Canyon, ~32.785346° -110.054711°, 1493m, 6-xi-1998 (S98-109), B. Tomberlin, ♂2 ♀2. ***Pima Co.,*** Baboquivari Mts., Brown Canyon, 21 m S Robles Junction, 5 m W Hwy 286, 31.76067° -111.53409°, 1158m, 29-vii-2015 (S15-105) ♀1; 14-x-2016 (S16-37) DA Gray ♂2. Quinlan Mts, Kitt Peak, ~31.985262° -111.601711°, 1371-1520m, 30-ix-1992 (S92-129) S. Woodward ♂2. Tucson, 10661 E. Sundance Circle, 32.256050° -110.764280°, 801m, 16-x-2006 (S06-125) J. West ♂1. ***Santa Cruz Co.,*** type locality of Madera Canyon: 5-vii-1994 (S94-57) ♂1; 31-viii-2002 (S02-64) KJ Ribardo ♂1; 31.72659° -110.87494°, 1548m, 22-viii-2005 (S05-124) A. Abela ♂1; 31.72667° -110.87500°, 1553m, 29-viii-2018 (S18-58) A. Abela ♀1. 10 m W Nogales, 3500’ 29-xi-1995 (S95-126) S. Beightol ♂21 ♀19. Peña Blanca Lake, 31.398983° -111.092006°, 1189m, 4-viii-2007 (S07-78) DC Lightfoot ♀1.

Drum. Calling drum similar in both sexes except longer in female; males with a sex clarification drum (SCD). **Male:** Holotype R90-32 (Fig. 644) with 28 drums over 6.0s (4.7 drums/s) at 21.5°C. SCD (Fig. 645, R98-209, S98-109) of 8 drums over 0.7s (11.4 drums/s) followed by 35 drums over 8.0s (4.4 drums/s) both at 16°C. **Female:** Allotype R18-39 (Fig. 646) with 80 drums over 19.8s (4.2 drums/s) at 21.2°C.

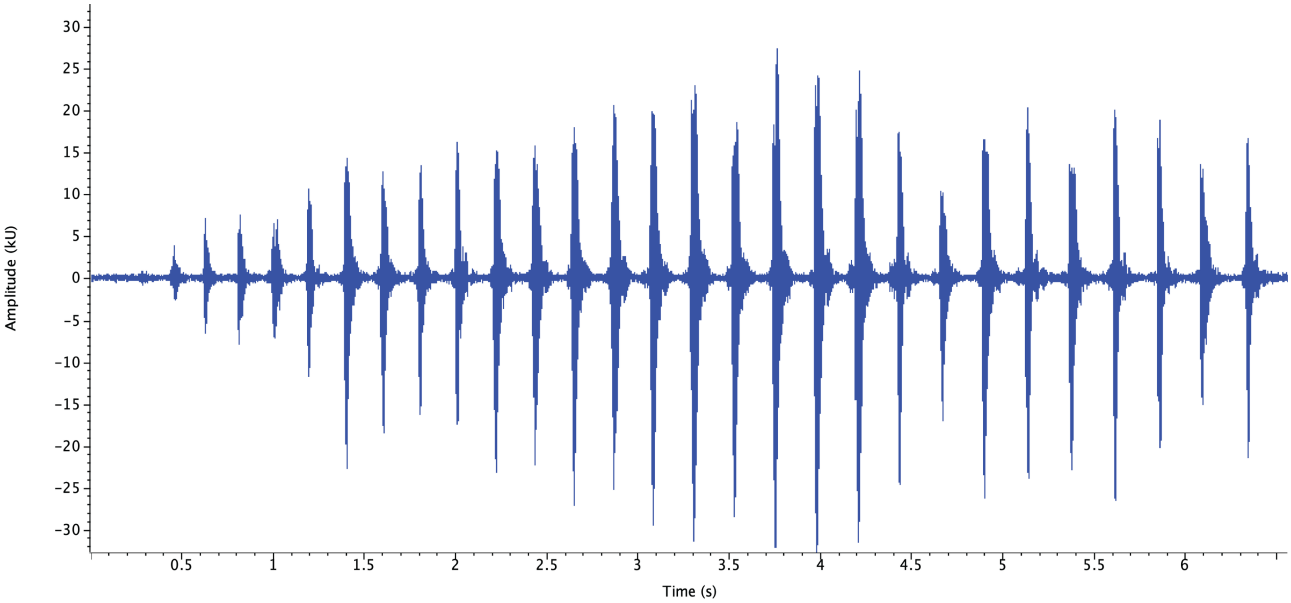


FIGURE 644. Calling drum (R90-32) in adult male holotype *A. grayi.*

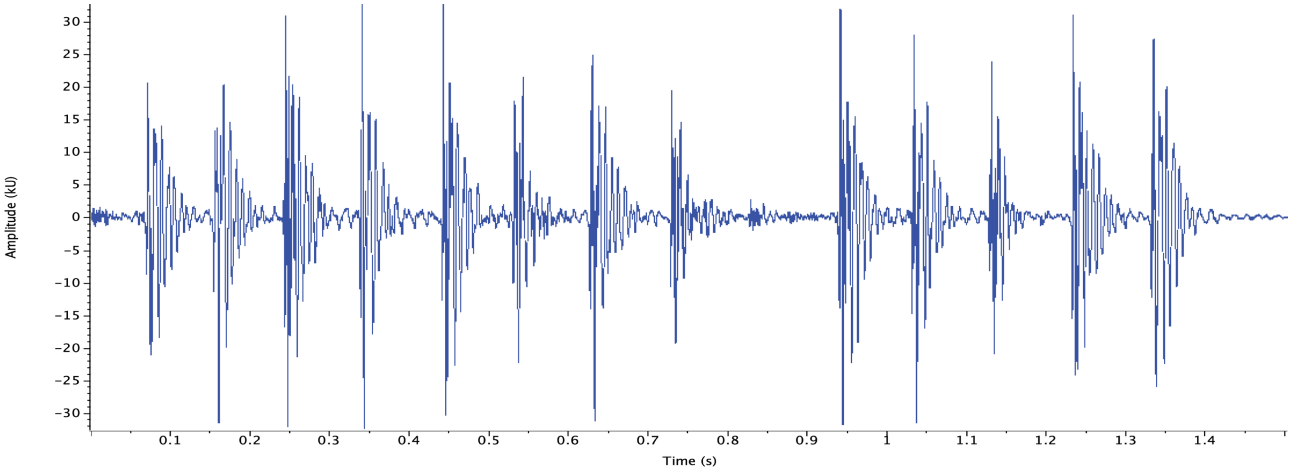


FIGURE 645. Sex clarification drum (R98-209) in Tripp Canyon adult paratype male *A. grayi*.

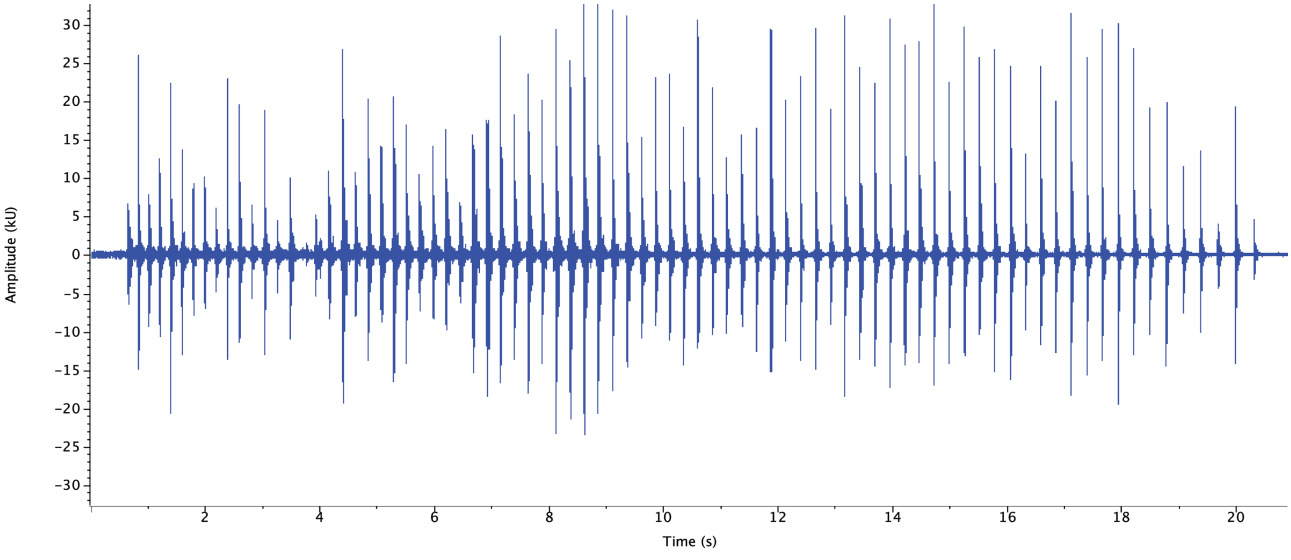


FIGURE 646. Calling drum (R18-39) in adult allotype female *A. grayi.*

Derivation of name. Named after our colleague David A. Gray, who collected this species at Brown Canyon (S16-37).

Habitat. Type locality is mid elevation canyon area with oaks, Ponderosa pines, and junipers. Tucson locality (S06-125) more interior chaparral. At S95-126, scrub oak and mesquite predominated.

Life cycle and seasonal occurrence. Apparent 2-year life cycle. At S95-126, in late November, S. Beightol collected 2 late instar females, 25 mid instar males, 17 mid instar females, and 2 early instar females.

Variation. Of 15 individuals from sites other than S95-126, all had 3 ventral **fore** leg tibial spurs; 2 had 6 and 12 had 7 **middle** leg tibial calcars, and 9 had 2 and 5 had 3 ventral spurs; all 15 had 4 inner **rear** leg tibial spines, while 12 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Of 26 individuals from **site S95-126**, 1 had 2 and 25 had 3 ventral **fore** leg tibial spurs; 1 had 6, 24 had 7, and 1 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; all had 4 inner **rear** leg tibial spines, while 25 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. From S95-126, rear tibial inner spine #1 was longest in 3 adults while spine #2 was longest in 23 adults. **Color:** Individuals from Brown Canyon (Fig. 647, S16-37, R16-8, F2462) with darker head, pronotum and legs than those from elsewhere.



FIGURE 647. Darker adult male *A. grayi*, from Brown Canyon (S16-37).

DNA. Fig. 637, p. 372. F0333 (S95-126, Nogales); F0859 (S98-109, Tripp Canyon); F1390 (type locality S02-64); F1875 (S06-125, Tucson); F1998 (S07-78, Pena Blanca Lake); F2242 (S11-106, Madera Canyon); and F2462 (S16-37, Brown Canyon) are all recovered in Group 10 Grayi, and most closely related to several Southern California Groups.

Karyotype. 2n♂=25. 3 males from W of Nogales (S95-126) examined: T96-9 (Fig. 648), T96-10 (Fig. 649), and T96-11 all agree: 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome

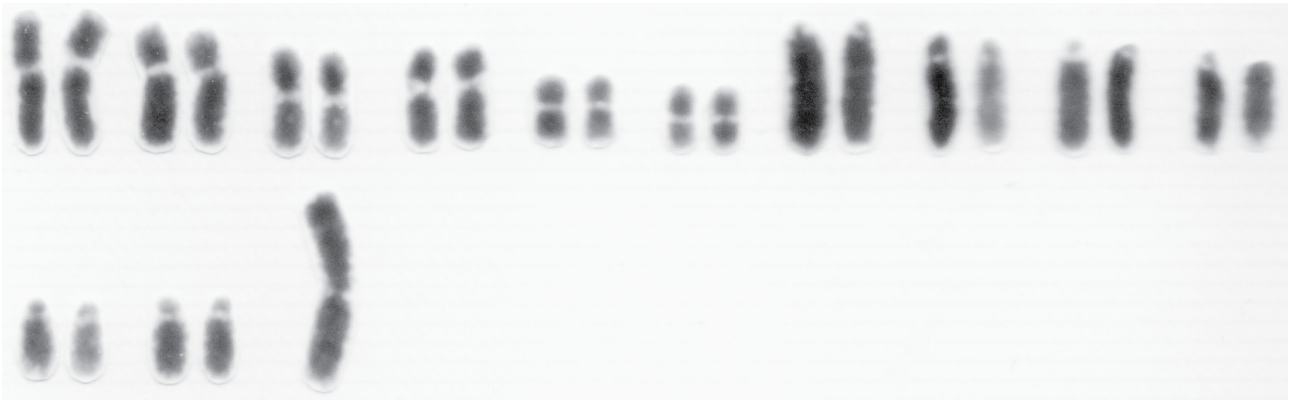


FIGURE 648. Idiogram T96-9 *A. grayi* (S95-126).

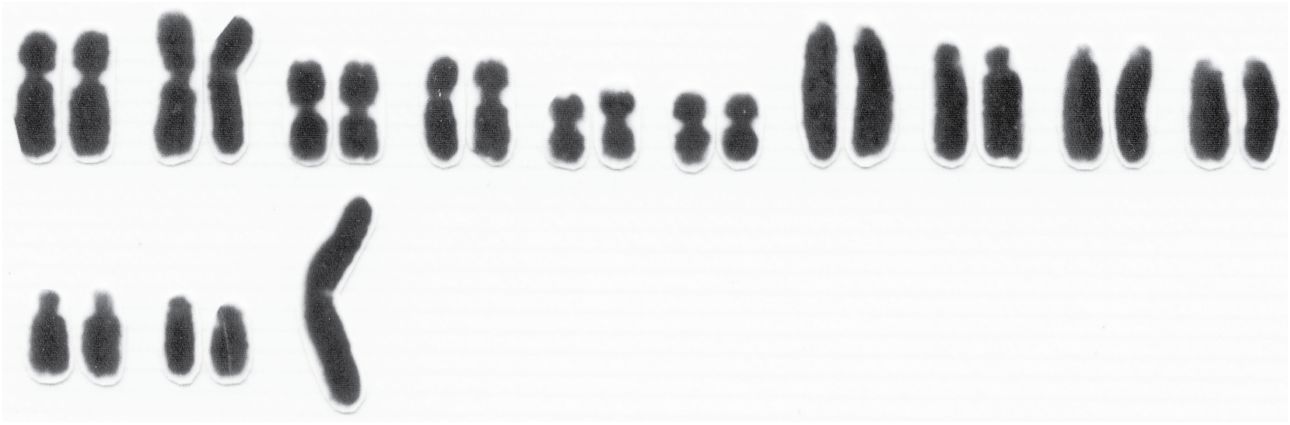


FIGURE 649. Idiogram T96-10 *A. grayi* (S95-126).

Discussion. A. grayi (S98-109) is probably sympatric with *A. portal* (S97-134) at Tripp Canyon, where their collection sites were separated, based on GPS data, by only some 400m linear distance.

Despite our largest series (S95-126) coming from west of Nogales, we made Madera Canyon the type locality because of some unfortunate uncertainty as to exactly where the Nogales specimens were collected.

Found at Brown Canyon with the rare Arizona Cricket *Gryllita arizonae* Hebard.

(CLADE 9) Composed of three Southern California and Baja California Groups. Group 11, Southern California Group #1 (Fig. 650)

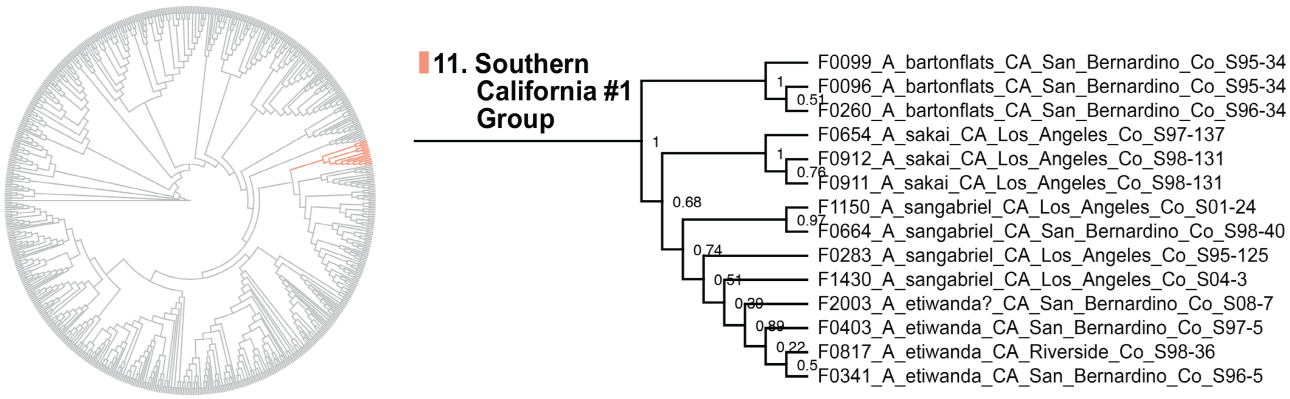


FIGURE 650. ASTRAL tree for Southern California #1 Group.

This Group is composed of 4 slow drumming species with either 2n♂=23 or 25 chromosomes; and habitats that range from coastal sand dunes to mountain forests.

SPECIES WRITE UPS: *A. bartonflats* (p. 378); *A. etiwanda* (p. 384); *A. sakai* (p. 390); and *A. sangabriel* (p. 394).

***Ammopelmatus bartonflats* Weissman, sp. nov.**
Barton Flats Jerusalem Cricket
Figs 651–662, Table 18

Distribution. (Fig. 651). Barton Flats area of San Bernardino Mts, California.

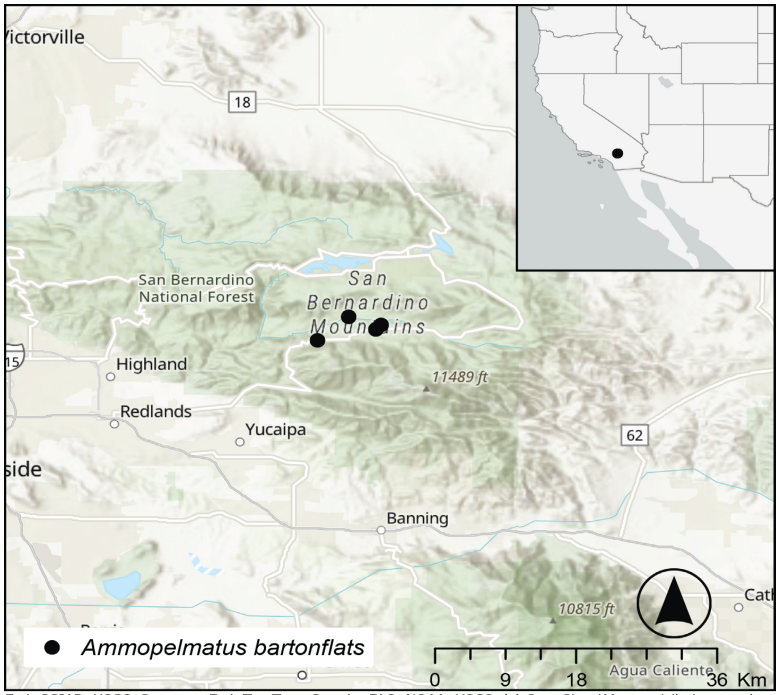


FIGURE 651. Known distribution of *A. bartonflats.*

Recognition characters. A small-medium, slow drumming (1.4–1.7 drums/s) JC with sex clarification drum (SCD), 2n♂=25, with calcar #1 darkened and broadened in males. Separated from San Bernardino Mts *A. ashleighi,* also with 2n♂=25, but which is larger in size with a slower calling drum (0.7–1.1 drums/s), longer drum series in females, male calcar #1 not darkened or modified, different DNA, and having 14 metacentric autosomes vs the 10 metacentric autosomes seen in *A. bartonflats.* Distinguished from third stripped San Bernardino Mt taxon *A. angelusoaks* by faster drum rate in latter species and lack of modified calcar #1.

Holotype. Male (in alcohol, Fig. 652). **California, *San Bernardino Co.,*** San Bernardino Mts, area near Barton Flats 34.176912° -116.876639°, 1904m, 18-iv-1995 (S95-34) T. Prentice. R95-11. Molt to adult 8-vii-1995. Deposited CAS, Entomology type #20172. Measurements in mm: Body length 27.9, hind femur length 10.02, hind femur width 3.68. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 or 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 653) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 652. Adult male holotype *A. bartonflats.* A. When alive. B. When preserved.

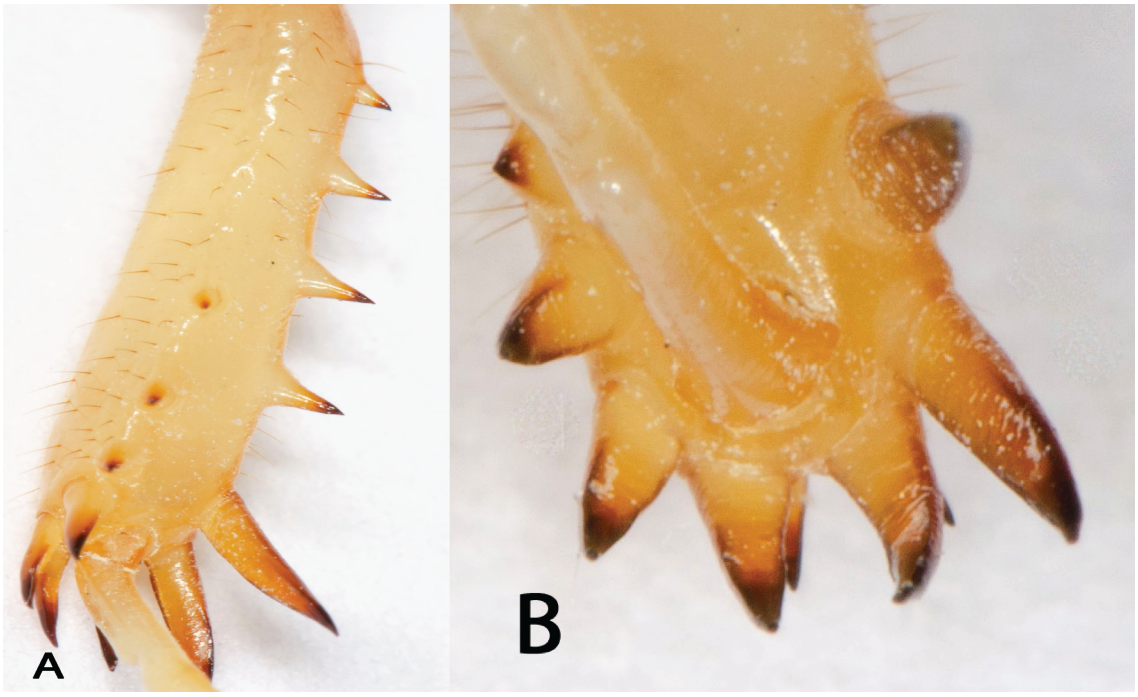


FIGURE 653. Left rear leg tibia adult male holotype *A. bartonflats.* A Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 654). Same data as holotype except R95-15. Molt to adult 21-vii-1995. Deposited CAS, CASENT #9081899. Measurements in mm: Body length 29.39, hind femur length 9.30, hind femur width 3.65. Fore leg tibia with 3 or 4 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 655) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 656.



FIGURE 654. Adult female allotype *A. bartonflats.* A. When alive. B. When preserved.

Paratypes. ♂8 ♀17. **CALIFORNIA, *San Bernardino Co.,*** San Bernardino Mts: Type locality, T. Prentice, 18-iv-1995 (S95-34) ♂4 ♀8; 29-iii-1997 (S97-29) ♂2 ♀7. Santa Ana Creek N Barton Flats off Hwy 38, 4.3 m W Glass Rd, 34.157967° -116.949639°, 1823m, 30-iii-1995 (S95-29) T. Prentice ♂1. Barton Flats, Rio Monte Area and Visitor's Center, 34.171295° -116.882757°, 1929m, 5-v-2013 (S13-9) ♀2. Seven Oaks, 34.186804° -116.913862°, 1626m, 18-v-1996 (S96-34) R. Vetter ♂1.

Possible placement. **CALIFORNIA, *San Bernardino Co.,*** San Bernardino Mts, Wildhorse Meadows, 34.197635° -116.777882°, 2599m, 2-v-1965 G. Ballmer. The lack of adults and drums makes this determination impossible.

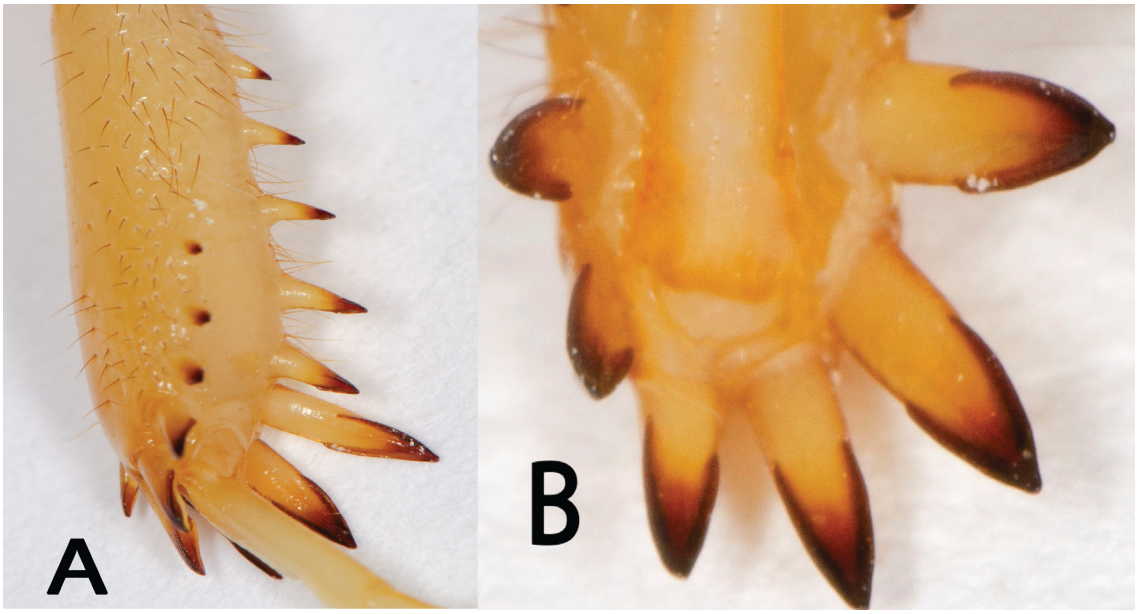


FIGURE 655. Left rear leg tibia adult allotype female *A. bartonflats*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 656. Ovipositor allotype *A. bartonflats.*

Drum. Calling drums similar in both sexes with female's series not much longer than males. Males with sex clarification drum (SCD). **Male:** Holotype R95-11 with 2 or 3 initial fast drums (Fig. 657) and a total of 33 drums over 19.8s (1.7 drums/s) at 20.5°C. Paratype male R95-9 (Fig. 658), S95-29, with SCD of 3 or 4 drums over 0.38s and 0.63s, respectively (7.9 and 6.3 drums/s) at 20°C. There was a drumming, paratype female (R95-8) on the recording bench with this male when he was making these SCDs. **Female:** Allotype R95-15 with (Fig. 659) 41 drums over 28.7s (1.4 drums/s) at 21°C.

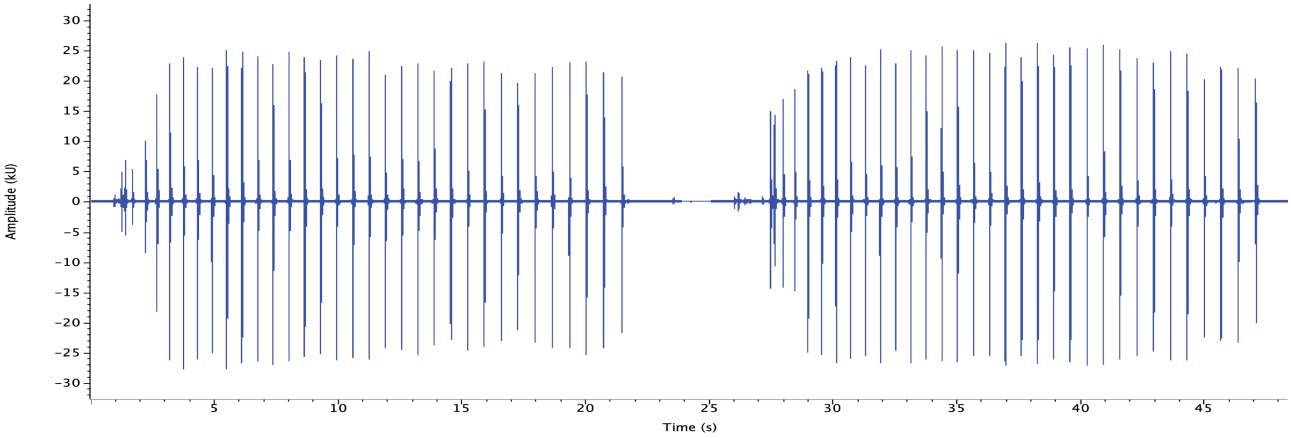


FIGURE 657. Two series of calling drums (R95-11) in holotype *A. bartonflats.*

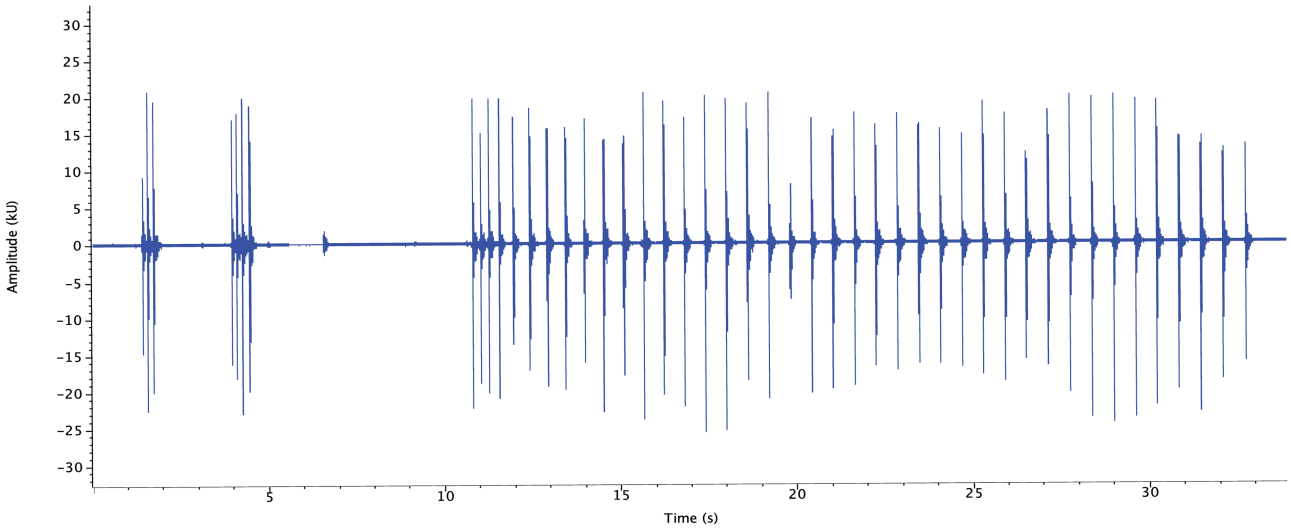


FIGURE 658. Calling drum (R95-9) in topotypic adult male *A. bartonflats*, with 2 SCD made before 1 calling drum series.

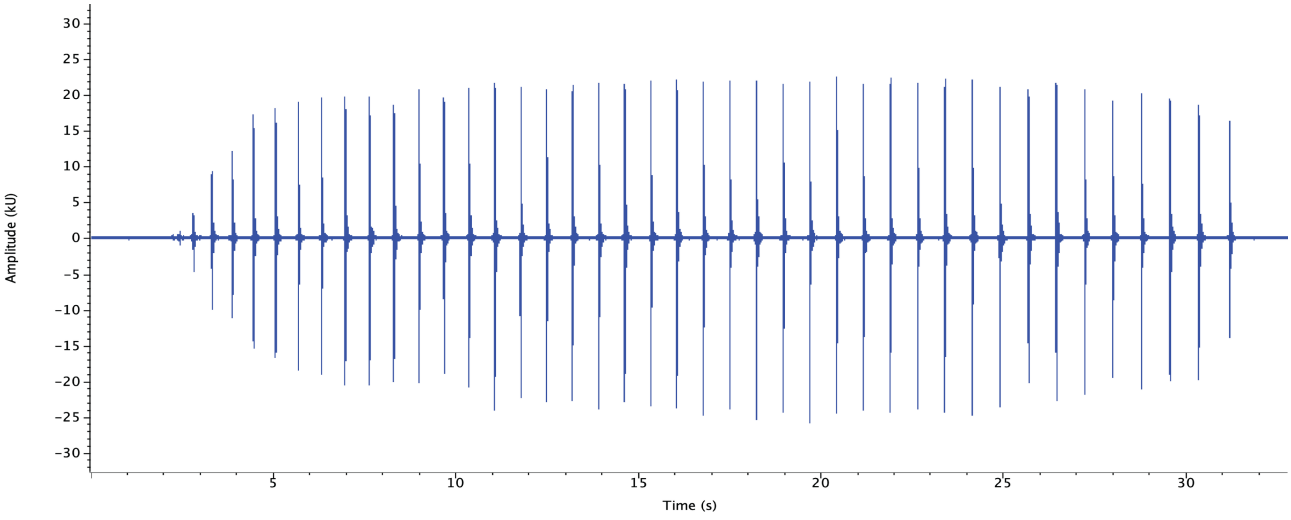


FIGURE 659. Calling drum (R95-15) allotype female.

Derivation of name. Named in reference to the campground near the type locality.

Habitat. Mostly under rocks and debris in Ponderosa pine forest, between 1770 and 2620m elevation.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. Of 27 individuals, 1 had 2, 25 had 3, and 1 had 4 ventral **fore** leg tibial spurs; 1 had 7 and 26 had 8 **middle** leg tibial calcars, 1 with 1 and 24 with 2 ventral spurs; 25 had 5 and 1 had 6 inner **rear** leg tibial spines, and 20 had 3 and 7 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Fig. 660A (S95-34, R95-18) shows the maximum rear leg tibial calcar development seen in any male *A. bartonflats*. This same male also had 6 and 8 (Fig. 660B) rear leg inner tibial spines, the most seen in any adult in the type series. Such an anomalous condition of increased spines was documented (Weissman *et al.* 2021, p. 12) in *Stenopelmatus sartorianus* Saussure, where a damaged and partially regenerated rear leg also had 8 inner tibial spines. In contrast, both rear legs of male R95-18 appear normal. The 2 adult females from S13-9 (Visitor's Center) are the largest specimens known for this species.



FIGURE 660. Unusual development of left rear leg tibial calcars and spines in type locality male (S95-34, R95-18). A. Calcars appear long. B. Inner spines 8 in number.

DNA. Fig. 650, p. 378. F0096 and F0099 (S95-34, Barton Flats), and F0260 (S96-34, Seven Oaks) recovered in own subclade in Group 11 Southern California #1, adjacent to a subclade with three other, slow drumming species: *A. etiwanda, A. sakai,* and *A. sangabriel*; but these latter three taxa all with 2n♂=23.

Karyotype. 2n♂=25. Two type locality males examined and both consistent: T95-1 (Fig. 661, type locality S95-34) and T97-9 (Fig. 662, type locality S97-29) both with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

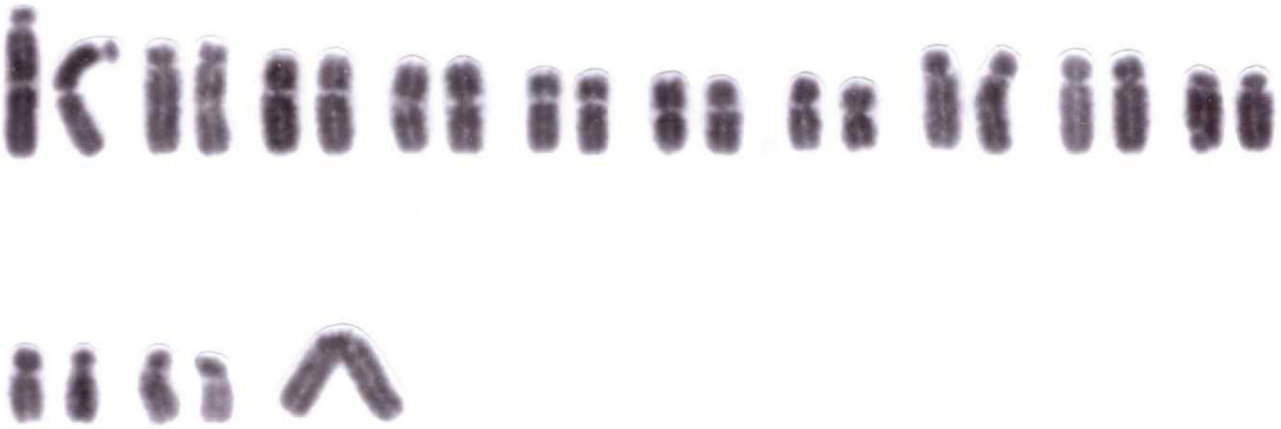


FIGURE 661. Idiogram T95-1 *A. bartonflats*, type locality (S95-34).

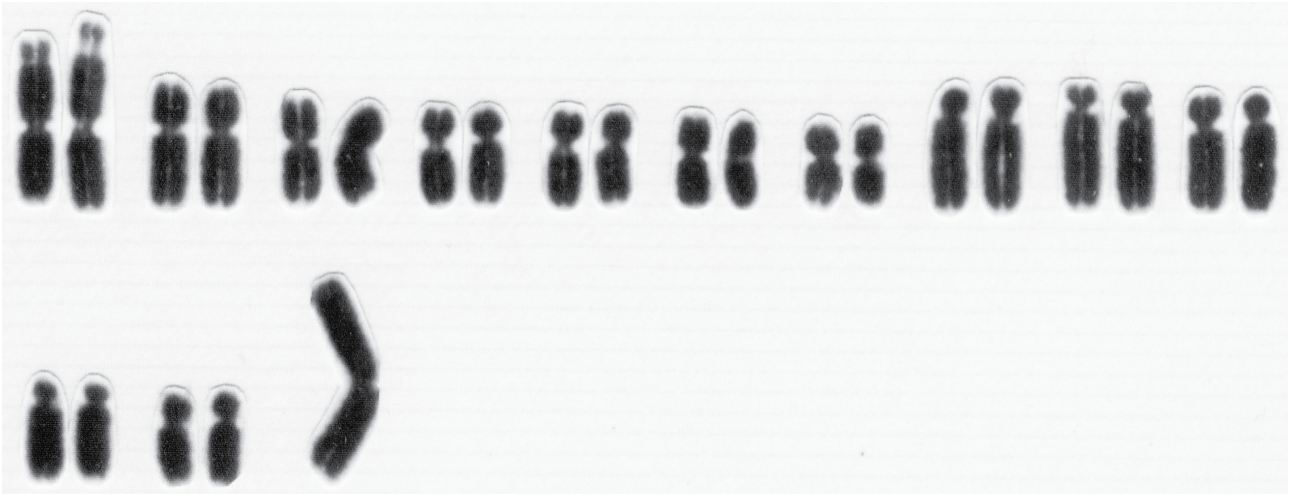


FIGURE 662. Idiogram T97-9 *A. bartonflats*, type locality (S97-29).

Discussion. We suspect that the size differences seen between the smaller, higher elevation (1770–2620m) San Bernardino Mts *A. bartonflats*, when compared with the lower elevation (1580m), larger *A. ashleighi*, cannot be totally explained by elevation differences, since the highest elevation females of *A. bartonflats* (S13-9), were the largest females of that species seen. In any case, the two taxa are recovered with different DNA and drum rates.

***Ammopelmatus etiwanda* Weissman, sp. nov.**
Etiwanda Wash Jerusalem Cricket
Figs 663–675, Table 6

Distribution. (Fig. 663). Only known from Riverside and San Bernardino Counties, California, along a stretch of the Etiwanda Wash.



FIGURE 663. Distribution of *A. etiwanda.*

Recognition characters. Small to medium-large JC with dark head, pronotum, and abdomen with wide black abdominal stripes, and long rear leg tibial calcar #1. 2n♂=23. Calling drum from 0.8–1.2 drums/s, no sex clarification drum. Can be separated from microsympatric *A. ballmeri* (at S96-5, S97-5, and S97-142) by differences in color (Fig. 664), drum rate, and DNA. Can be separated from nearest DNA neighbor *A. sangabriel* by habitat and inner rear leg tibial spine #3 being longest spine in latter.



FIGURE 664. Recently killed adult males (with right middle leg harvested for DNA studies), microsympatric *A. ballmeri* (on left side, S96-5, R96-148) and *A. etiwanda* (on right side, S96-5, R96-113).

Holotype. Male (in alcohol, Fig. 665). **California, *San Bernardino Co.,*** Rancho Cucamonga, along east side Etiwanda Ave, in wash, 34.157028° -117.523333°, 560m, 12-ii-1996 (S96-5) K. Stockwell. R96-113, F0322. Molt to adult 26-ix-1996. Deposited CAS, Entomology type #20120. Measurements in mm: Body length 31.01, hind femur length 10.02, hind femur width 3.61. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 666) with 5 inner and 3 outer spines, 2 ventral spurs.

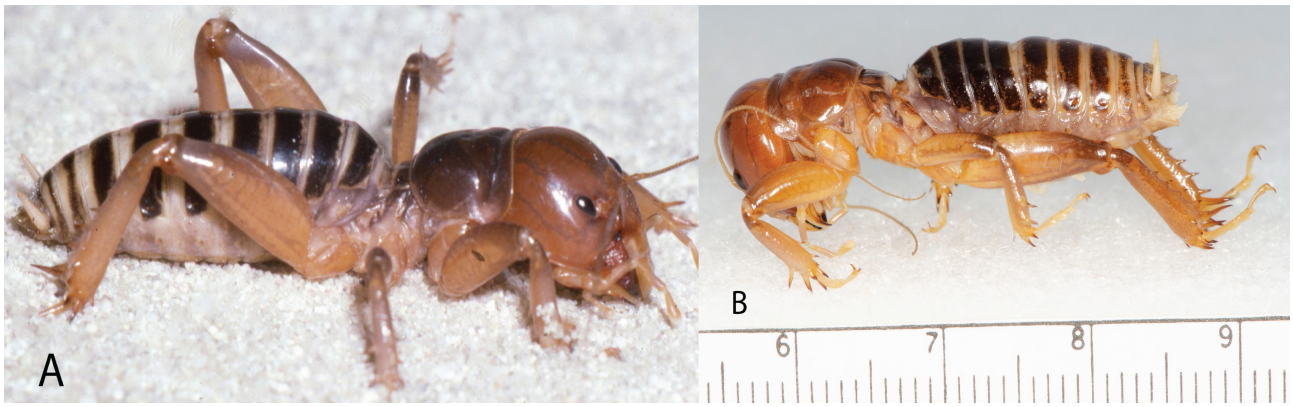


FIGURE 665. Holotype adult male *A. etiwanda.* A. When alive. B. When preserved.



FIGURE 666. Left rear leg tibia holotype male *A. etiwanda*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 667). Same collection data as holotype except R97-105, F0497. Molt to adult 20-viii-1997. Deposited CAS, CASENT #9080779. Measurements in mm: Body length 37.96, hind femur length 10.69, hind femur width 4.21. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 668) with 5 or 0 inner and 3 or 1 outer spines, 2 ventral spurs. Despite this discrepancy in spine count between left and right hind tibias, the hind legs otherwise look normal. Ovipositor Fig. 669.

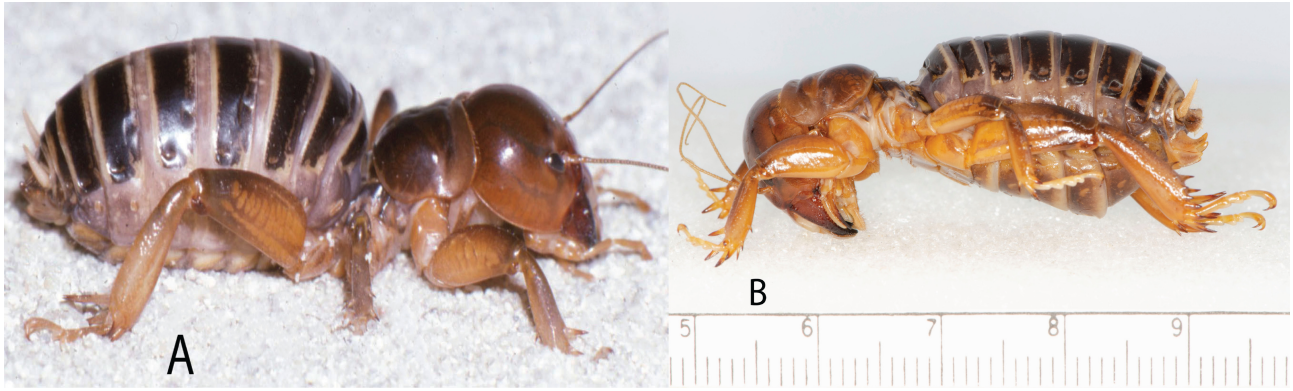


FIGURE 667. Allotype adult female *A. etiwanda.* A. When alive. B. When preserved.

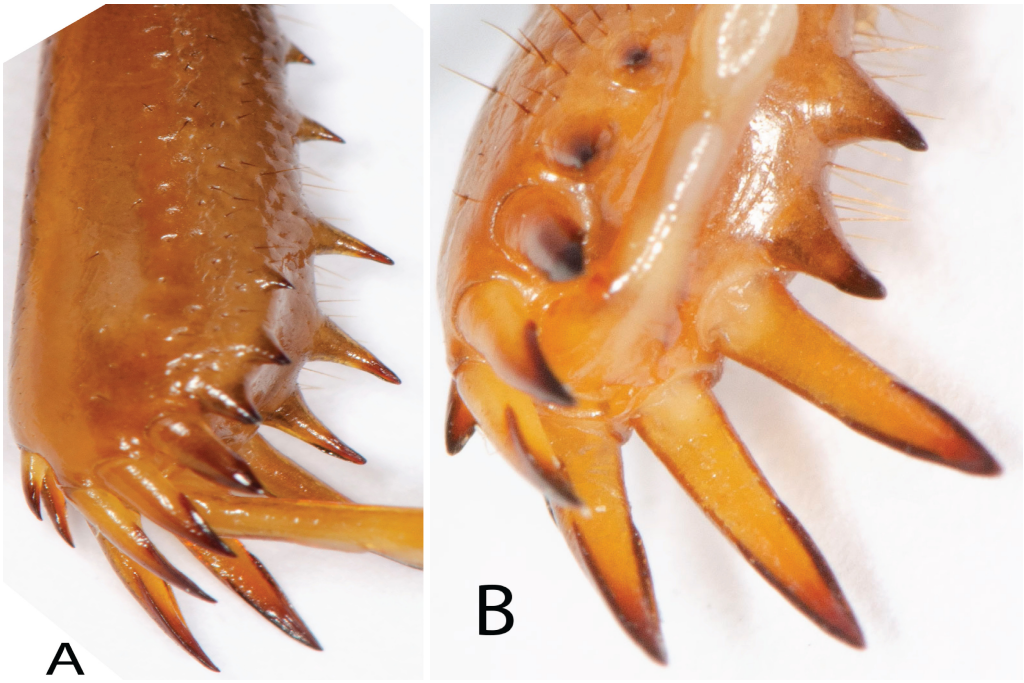


FIGURE 668. Left rear leg tibia allotype *A. etiwanda.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 669. Ovipositor allotype *A. etiwanda*.

Paratypes. ♂4 ♀21. **CALIFORNIA, *Riverside Co.,*** Rancho Cucamonga, N end Haven Ave, 34.163° -117.575°, 678m, 9-iv-1998 (S98-36) KT Stockwell ♀1. ***San Bernardino Co.,*** Same data as type locality ♀4. Etiwanda, Alluvial fan and Etiwanda Ave, 34.166667° -117.523056°, 636m, 7-xii-1997 (S97-141), GR Ballmer & KT Stockwell, ♀2. Etiwanda, Day Canyon, 600m, 15-ii-1995 (S95-20) ♂1. Etiwanda, alluvial fan and Etiwanda Ave, 34.157146° -117.523126°, 560m, 7-xii-1997 (S97-142) GR Ballmer & KT Stockwell, ♂1 ♀7. Fontana, Etiwanda Wash adjacent to Etiwanda Ave, 1.6 km S Arrow Hwy, 34.089647° -117.521151°, 340m, 5-i-1997 (S97-5), GR Ballmer & KT Stockwell, ♀1. Upland, 1657 Maywood Ave, 34.123640° -117.674972°, 486m, all KT Stockwell, 7-vi-1996 (S96-73) ♂1 ♀1; 25-xi-1997 (S97-140) ♀1; 12-xi-2000 (S00-72) ♀1; 14 & 18-x-2009 (S09-163) ♂1 ♀1; 24-i-2010 (S10-5) ♀2.

Possible placement. **CALIFORNIA, *San Bernardino Co.***, I-15 at Cleghorn Exit, 0.1 m E I-15, 34.299724° -117.456281°, 919m, 4-ii-2008 (S08-7) DBW ♀2. These 2 females were collected as very small adults, and never drummed. One was recovered (F2003) in a clade closest to *A. etiwanda*, but without a drum and adult male, we only tentatively place them here. Their site (S08-7) is some 17 km N of the type locality of *A. etiwanda.*

Drum. Similar in both sexes. **Male:** Holotype (R96-113, Fig. 670), with 12 drums in 11.8s (1.0 drums/s) at 19.5°C. **Female:** Allotype (R97-105), with 2 series, both at 19.5°C. In first series (Fig. 671), 47 drums (not counting first 2 drums) in 55.1s (0.85 drums/s). In second series (Fig. 672), 16 drums (not counting first drum) in 13.2s (1.2 drums/s), showing how different series can have different initial drumming rates. As an example of the extreme, the lone adult female from Upland (S97-140, R98-167) drummed 962 times in 1030s (0.93 drums/s), after being stimulated by finger drumming.

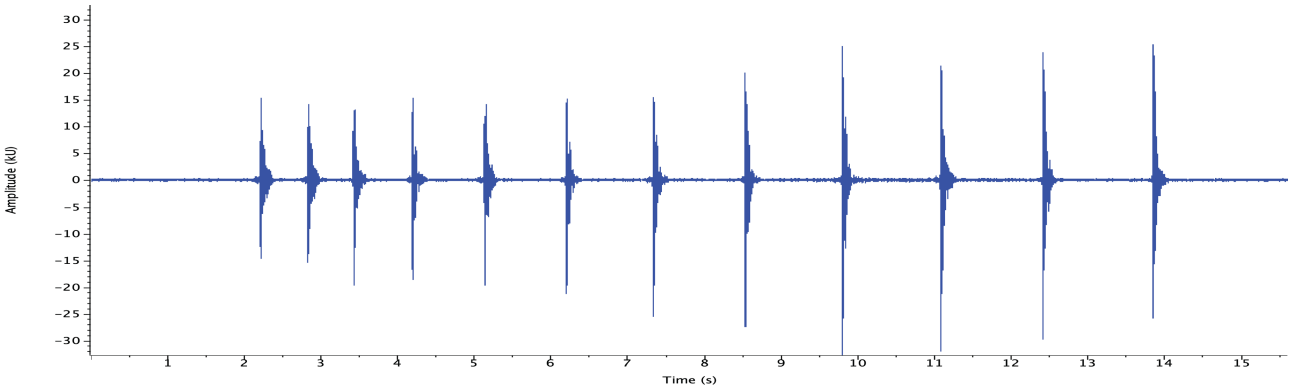


FIGURE 670. Calling drum (R96-113) in holotype adult male *A. etiwanda.*

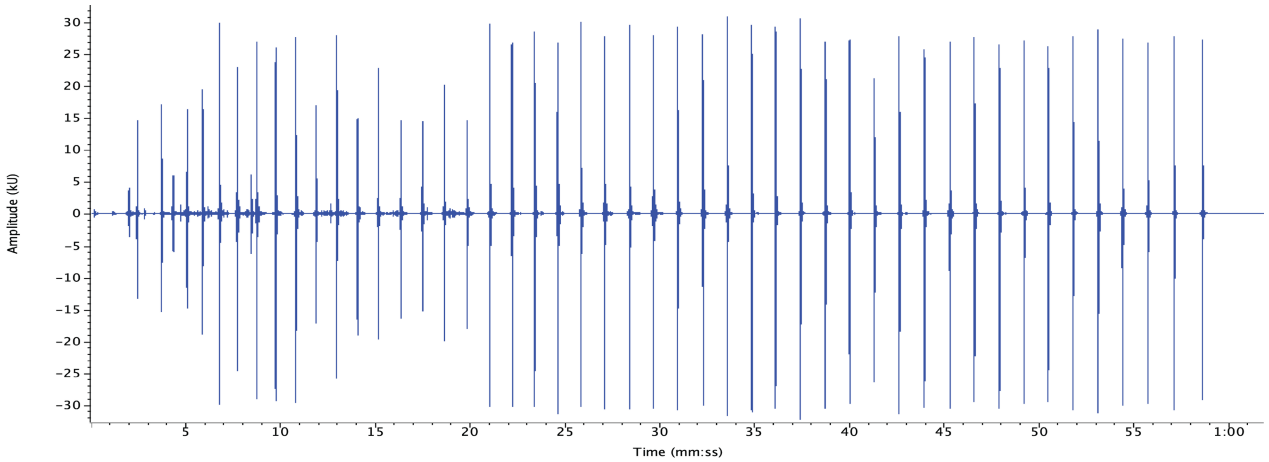


FIGURE 671. Calling drum (R97-105A) in allotype adult female *A. etiwanda.*

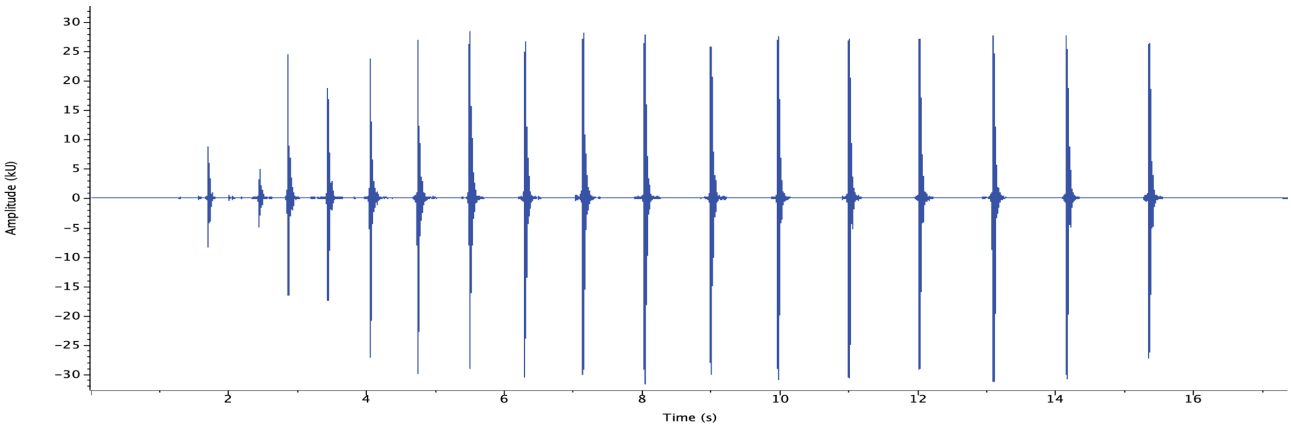


FIGURE 672. Calling drum (R97-105B) in allotype female *A. etiwanda.*

Derivation of name. Named after the large alluvial area where the type series was collected.

Habitat. Under rocks in loose dark brown soil at base and top edge of dry wash. Alluvial fan sage scrub habitat just south of San Gabriel Mts. In residential backyard in Upland.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For some 24 individuals, 1 had 2 and 23 had 3 ventral **fore** leg tibial spurs; 1 had 7 and 22 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 23 had 5 and 1 had 6 inner **rear** leg tibial spines, and 24 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color:** Adult female from Rancho Cucamonga (S98-36, R98-176), drums like typical *A. etiwanda* at 1.2 drums/s, but not dark (Fig. 673) like typical specimens, with head and legs orange, abdominal stripes not that broad. Nevertheless, her DNA (F0817) was recovered in a subclade with other *A. etiwanda.*



FIGURE 673. Adult female Rancho Cucamonga (S98-36) *A. etiwanda*, showing color variation.

DNA. Fig. 650, p. 378. F0341 (type locality, S96-5); F0403 (type locality, S97-5); and F0817 (S98-36, Riverside Co.) recovered in a mixed Group 11 Southern California #1 clade of several similar slow drumming, but either (1) high elevation *A. bartonflats* (2n♂=25) or *A. sangabriel (*2n♂=23); or (2) low elevation, coastal *A. sakai* (2n♂=23).



FIGURE 674. Idiogram from 2 cells T97-1 *A. etiwanda* (S96-5). Top cell during mitosis. Bottom cell during meiosis.

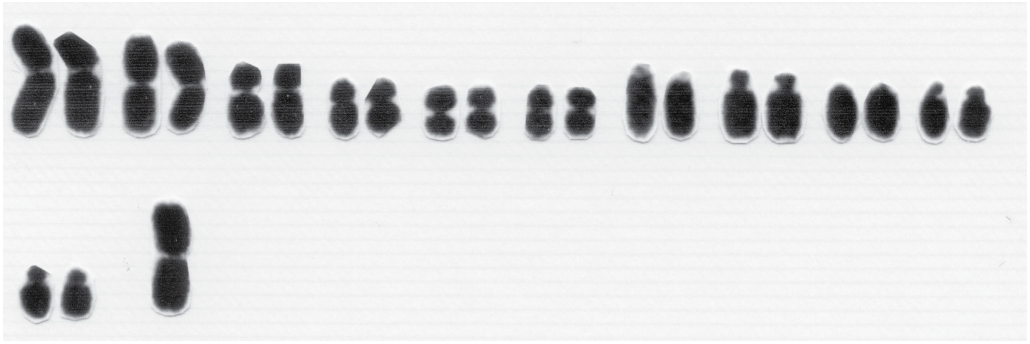


FIGURE 675. Idiogram T98-3 *A. etiwanda* (S97-142).

Karyotype. 2n♂=23. Two males examined: T97-1 (Fig. 674, S96-5, type locality) and T98-3 (Fig. 675, S97-142, Etiwanda), and both with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

Discussion. This taxon should be considered a species of conservation concern. The main collectors, Kathleen Stockwell and Greg Ballmer, write (pers comm to DBW, October, 2020): "Our earliest collections were on or near the alignment of Highland Avenue, which at that time was being converted to the I-210 freeway. Some very nice old growth alluvial fan sage scrub habitat along the north side of Highland Ave had been an informal dumping ground with plenty of old boards, roofing material, etc. scattered about—good for JC collecting. That area is now a suburban neighborhood. Other collection sites a bit higher elevation along Etiwanda Ave may still exist, but surrounded by new housing."

***Ammopelmatus sakai* Weissman, sp. nov.**

Light Ballona Dunes Jerusalem Cricket

Figs 676–685, Table 3

Distribution. (Fig. 676). Only known from coastal sandy areas at Ballona Dunes, by Playa del Rey; and the El Segundo Dunes, by Los Angeles International Airport (LAX).

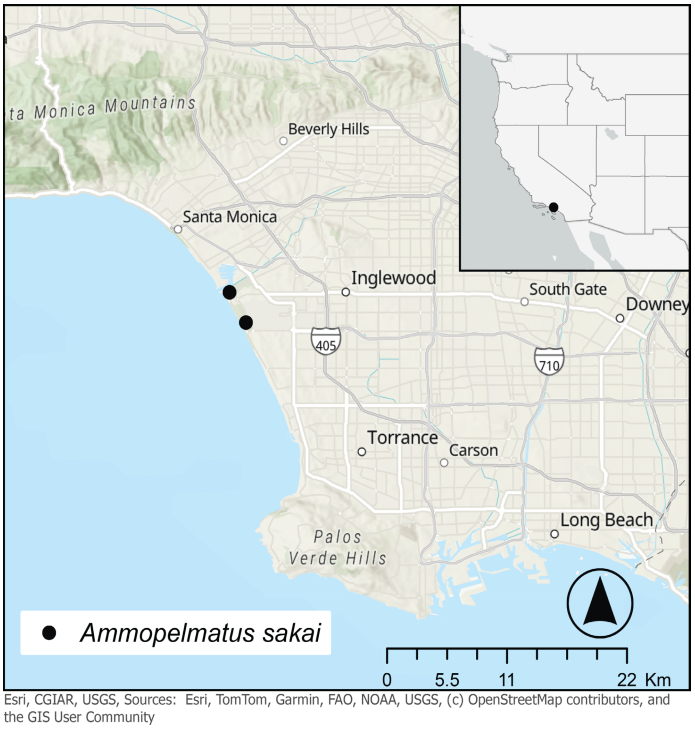


FIGURE 676. Distribution of *A. sakai.*

Recognition characters. A small to medium-large, light colored, slow drumming (0.5 drums/s) JC only known from the coastal dunes at Ballona and the adjacent LAX El Segundo Dunes. 2n♂=23. Rear leg tibial calcar #2 is generally longer than calcar #1. These rear leg calcars can be a little spatulate. Easily separated from darker, sympatric *A. ballonadark* by color, drum rate, rear leg calcars, and DNA.

Holotype. Male (in alcohol, Fig. 677). **California, *Los Angeles Co.,*** Playa del Rey, Ballona Wetlands, 33.961457° -118.449110°, 3m, 20-xii-1992 (S92-143) DBW & DW Weissman. R93-93. Molted to adult 9-x-1993. Deposited CAS, Entomology type #20121. Measurements in mm: Body length 29.93, hind femur length 10.25, hind femur width 3.77. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 and 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 678) with 3 and 4 inner and 3 and 4 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 679). Same collection information as holotype except 29-xi-1997 (S97-137). R98-183, F809. Molted to adult 11-x-1998. Deposited CAS, CASENT #9080606. Measurements in mm: Body length 37.27, hind femur length 10.75, hind femur width 4.20. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 680) with 4 inner (although the 4th spine in different locations on the tibias) and 3 & 4 outer spines, 2 ventral spurs. Ovipositor Fig. 681.



FIGURE 677. Adult male type locality *A. sakai.* A. Paratopotype (S87-129, R88-72) when alive. B. Holotype adult male when preserved.

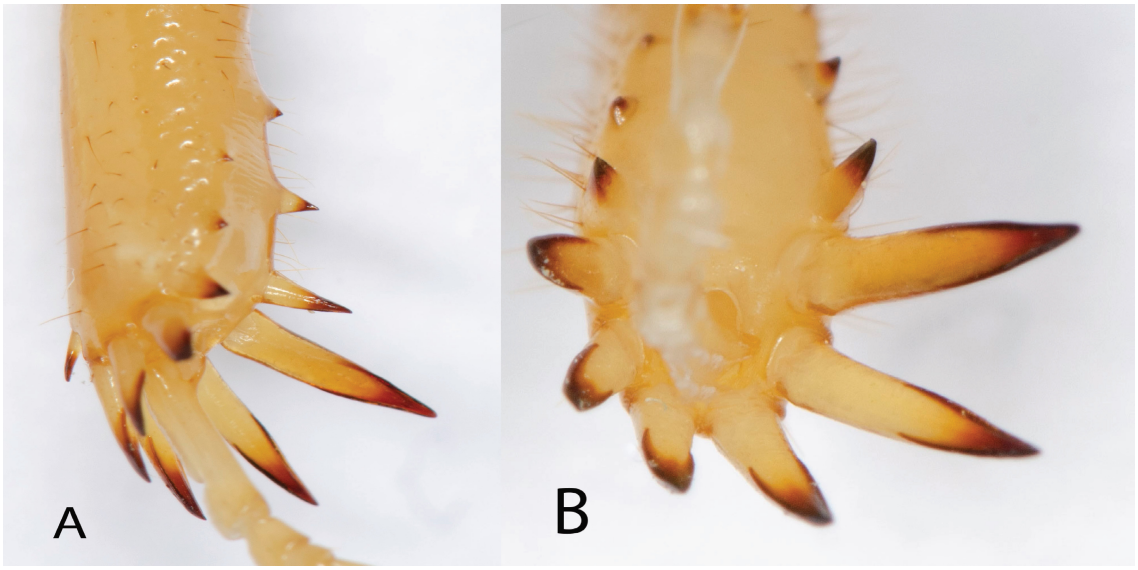


FIGURE 678. Left rear leg tibia adult male holotype *A. sakai.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

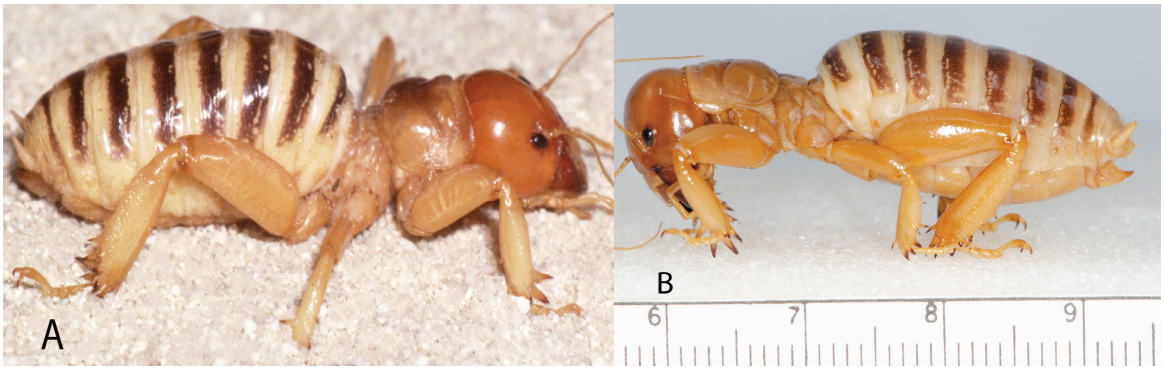


FIGURE 679. Adult female type locality *A. sakai.* A. Paratopotype (S87-129, R89-116) when alive. B. Allotype when preserved.



FIGURE 680. Left rear leg tibia allotype adult female *A. sakai.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 681. Ovipositor allotype *A. sakai.*

Paratypes. ♂6 ♀25. **CALIFORNIA, *Los Angeles Co.,*** type locality except 23-ii-1985 (S85-18) WH Sakai ♀1; 21-ii-1986 (S86-10) W. Sakai ♀1; 23-xii-1986 (S86-172) ♀2; 21-xii-1987 (S87-129) ♂1 ♀3; 9-ii-1988 (S88-4) ♀1; late February, 1989 (S89-5) W. Sakai ♂1; 28-ii-1990 (S90-20) W. Sakai ♀2; 2-ii-9-iii-1991 (S91-5) W. Sakai ♂1 ♀2; 14-ii-1992 (S92-2) W. Sakai ♂1; 13-vi-1992 (S92-54) W. Sakai ♀1; 25-xii-1992 (S92-143) ♂1 ♀3; early December, 1994 W. Sakai ♀1; 29-xi-1997 (S97-137) ♀1; 20-xii-1998 (S98-131) ♀3. El Segundo Dunes adjacent to LAX, 33.937751° -118.435586°, 40m, all R. Matoni, mid-December, 1989 (S89-96) ♀1; March-1993 (S93-19) ♀2; early November, 1993 (S93-85) ♂1 ♀1.

Drum. Calling drum similar in both sexes except series longer in females. **Male:** Holotype R93-93 (Fig. 682) 16 drums over 28.5s (0.56 drums/s) at 16.5°C. Topotypic male R88-72, S87-129, with calling drum rate between 0.52–0.54 drums/s at 20°C. **Female:** Allotype R98-183 (Fig. 683) 34 drums over 60.8s (0.56 drums/s) at 17.5°C.

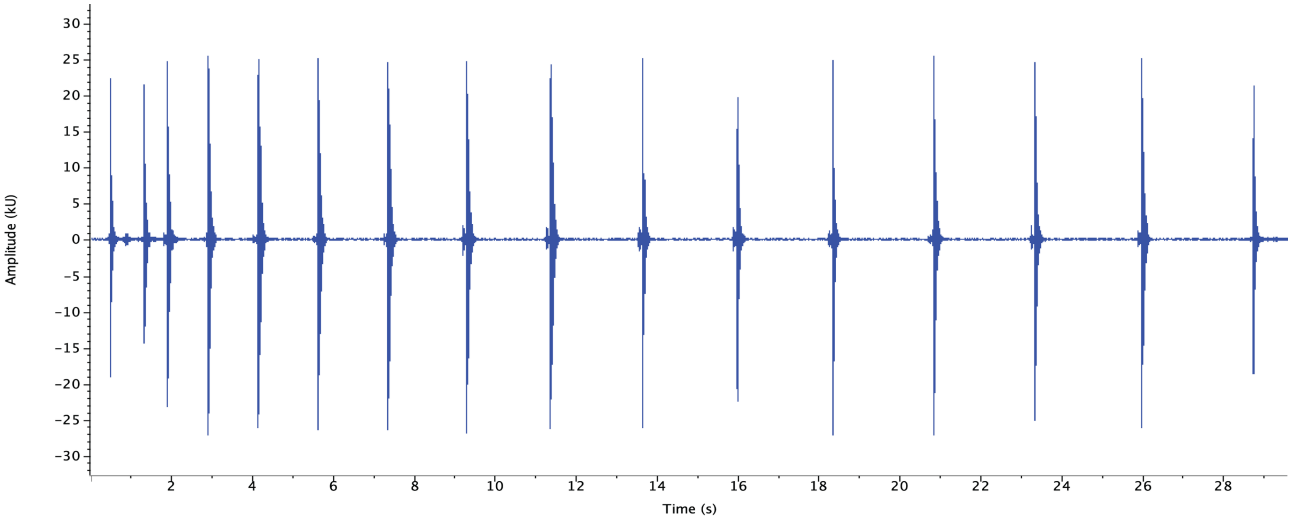


FIGURE 682. Calling drum (R93-93) adult male holotype *A. sakai.*

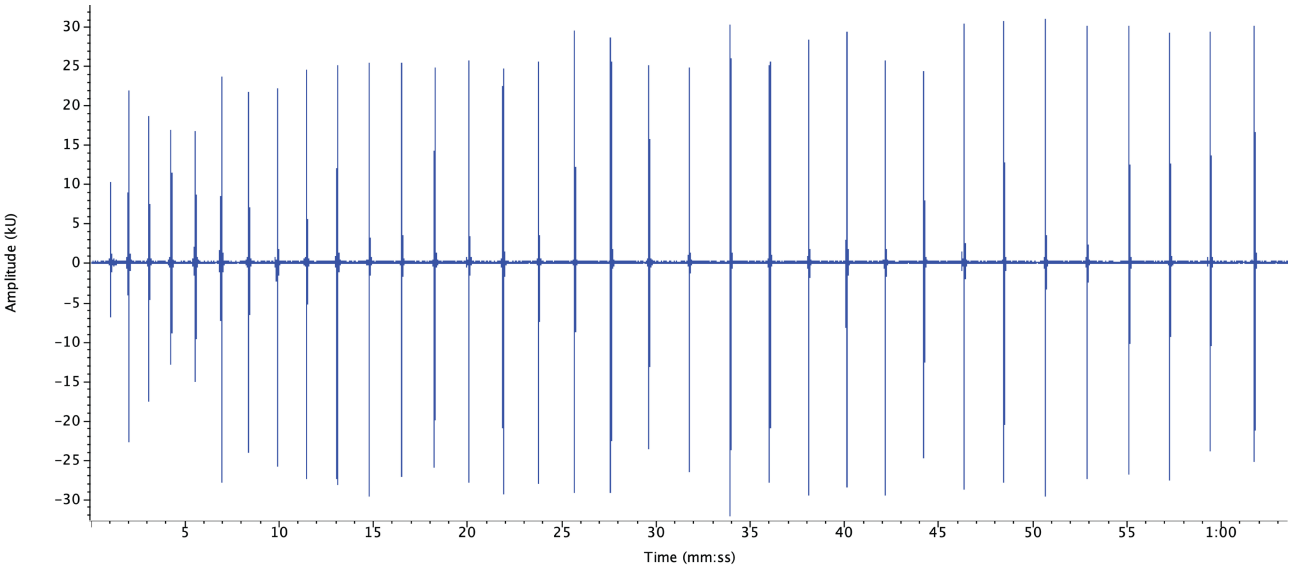


FIGURE 683. Calling drum (R98-183) adult female allotype *A. sakai.*

Derivation of name. Named after Walter H. Sakai, who first discovered this restricted species, and who has collected many other JCs for the senior author.

Habitat. Low coastal sand dunes, where most easily found under debris during the cold, wet winter months.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. Of 20 individuals, all had 3 ventral **fore** leg tibial spurs; 4 had 7 and 16 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 4 had 3, 10 had 4, 5 had 5, and 1 had 6 inner **rear** leg tibial spines, while 1 had 2, 17 had 3, and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 650, p. 378. F0654 (type locality S97-137, one of karyotyped [T98-8] males); F0911 and F0912 (both type locality S98-131) all recovered in Group 11 Southern California #1, and closest to *A. etiwanda* and *A. sangabriel.*

Karyotype. 2n♂=23. Two males from the type locality examined, with similar results: T89-29 (Fig. 684, S87-129) & T98-8 (Fig. 685, S97-137) both show 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 684. Idiogram T89-29 *A. sakai* (S87-129).

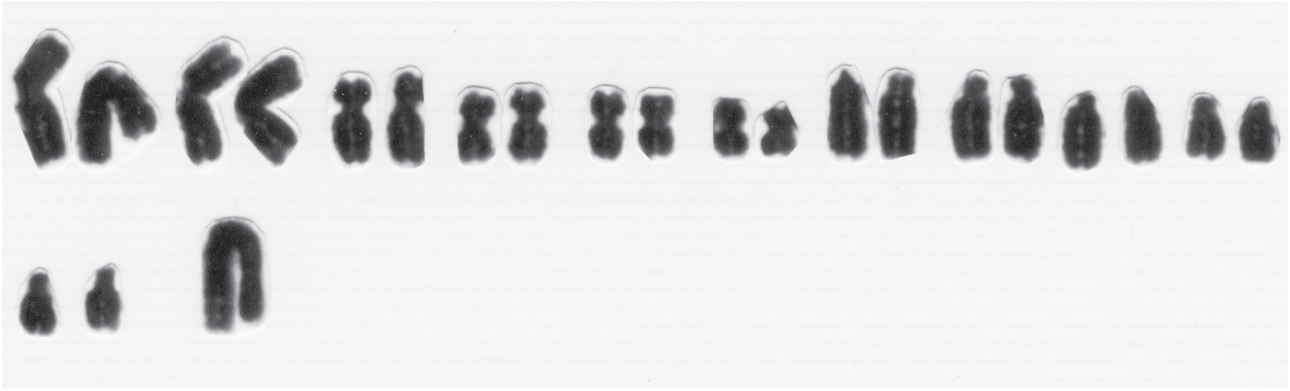


FIGURE 685. Idiogram T98-08 *A. sakai* (S97-137).

Discussion. For every individual of *A. sakai* collected at the type locality, probably 2 or 3 individuals of *A. ballonadark* were seen. Both taxa were also collected in pitfall traps at nearby Los Angeles International Airport (LAX). Those 2 localities, separated by some 3 km, currently appear protected, but we chose Ballona as the type locality because we have more individuals, with karyotype and DNA information, than from LAX. On the other hand, the total area of these two sites is small, even for a JC species. And the easiest way to collect individuals is by turning over man-made debris, such as slabs of asphalt and cement, such that "cleaning up" these localities could make the study of *A. sakai* difficult. The technique perfected by Prentice *et al.* (2011) might be a good, alternative methodology to employ. The LAX dunes are part of the once larger El Segundo Dunes, and are one of only 3 remnants for the El Segundo blue butterfly (https://xerces.org/endangered-species/species-profiles/at-risk-butterflies-moths/el-segundo-blue), one of the first insects listed under the 1973 Endangered Species Act.

***Ammopelmatus sangabriel* Weissman, sp. nov.**
San Gabriel Mountain Jerusalem Cricket
Figs 686–696, Tables 3, 19

Distribution. (Fig. 686). Known from above 660m elevation in the San Gabriel Mts. Rare in the adjacent Sierra Pelona Mts and represented by one specimen (S04-3, F1430, R04-5 at 0.86 drums/s at 21.5°C).

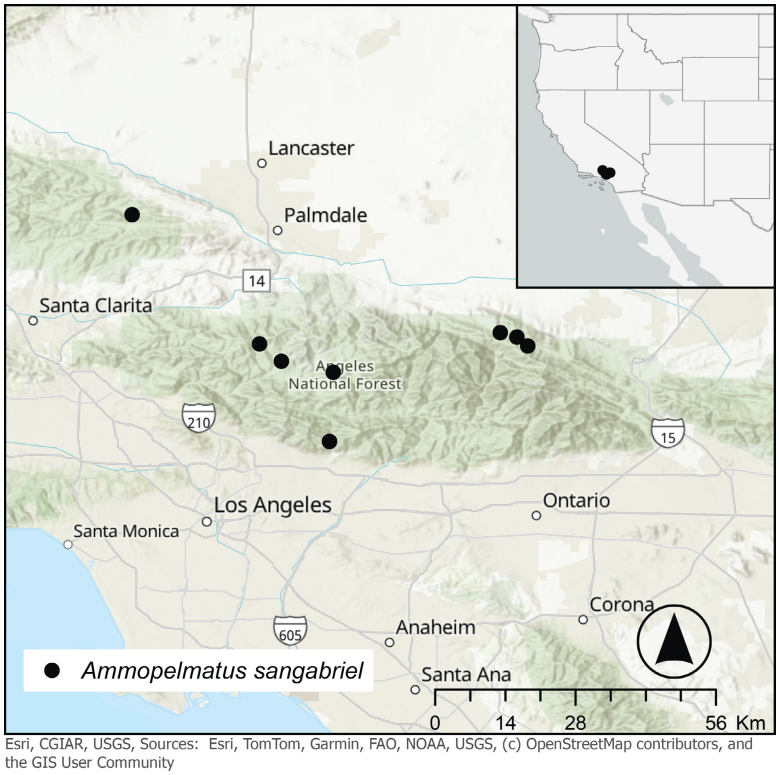


FIGURE 686. Distribution of *A. sangabriel.*

Recognition characters. Small-medium sized, slow drumming (0.6–1.0 drums/s) JC, 2n♂=23, generally orange colored head, pronotum, and legs, that is characterized, especially in females, by the rear leg inner tibial spine #3 being the longest of the typically 5 inner spines. But not in the Winchester Group, whose species also have inner rear leg tibial spine #3 the longest. Separated from latter Group by DNA and with the calling drum delivered at the same rate in both sexes. Separated from nearest DNA neighbor *A. etiwanda*, by habitat and inner rear tibial spine #3 not being longest spine in latter.

Holotype. Male (in alcohol, Fig. 687). **California, *Los Angeles Co.,*** San Gabriel Mts, Chilao Campground, 34.321144° -118.016722°, 1625m, 29-iv-2001 (S01-26) DBW. R01-71, F1226. Molt to adult 11-viii-2001. Deposited CAS, Entomology type #20171. Measurements in mm: Body length 30.28, hind femur length 10.04, hind femur width 3.68. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 688) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 687. Holotype adult male *A. sangabriel.* A. When alive. B. When preserved.

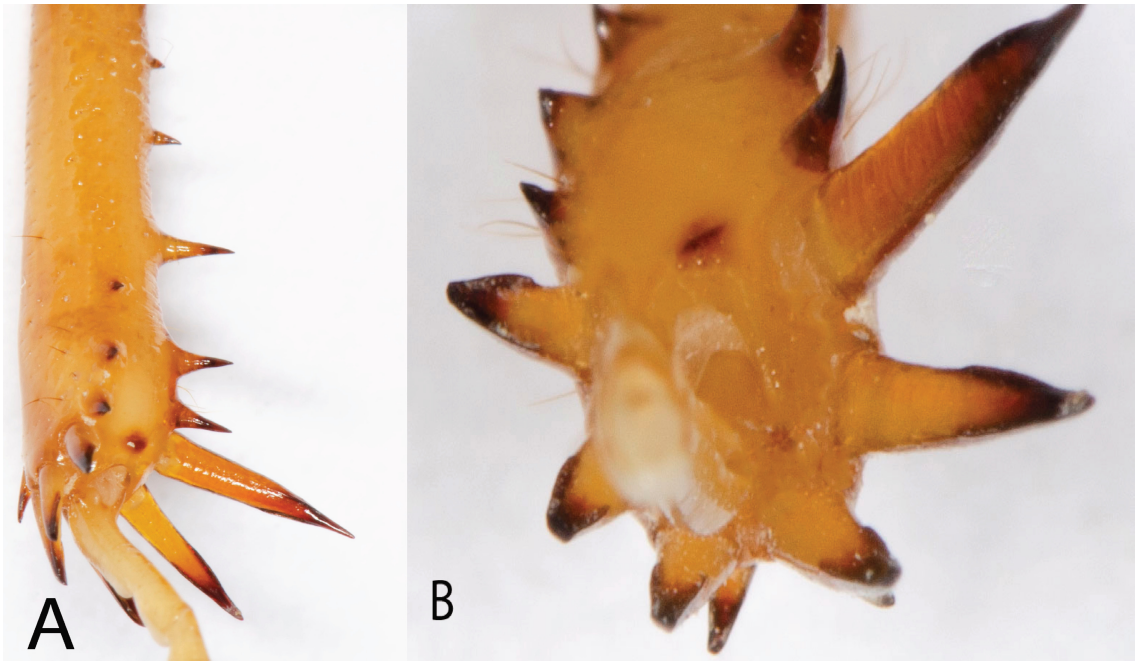


FIGURE 688. Left rear leg tibia adult male holotype *A. sangabriel.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 689). Same data as holotype except R01-29, F1153. Molt to adult 11-viii-2001. Deposited CAS, CASENT #9078814. Measurements in mm: Body length 37.39, hind femur length 11.29, hind femur width 4.03. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 690) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 691.

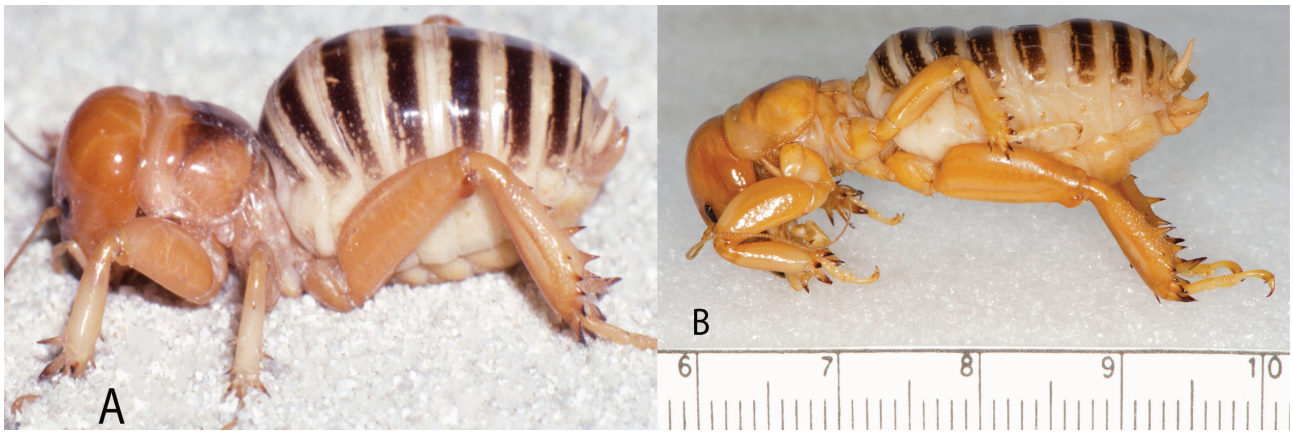


FIGURE 689. Adult female allotype *A. sangabriel.* A. When alive. B. When preserved

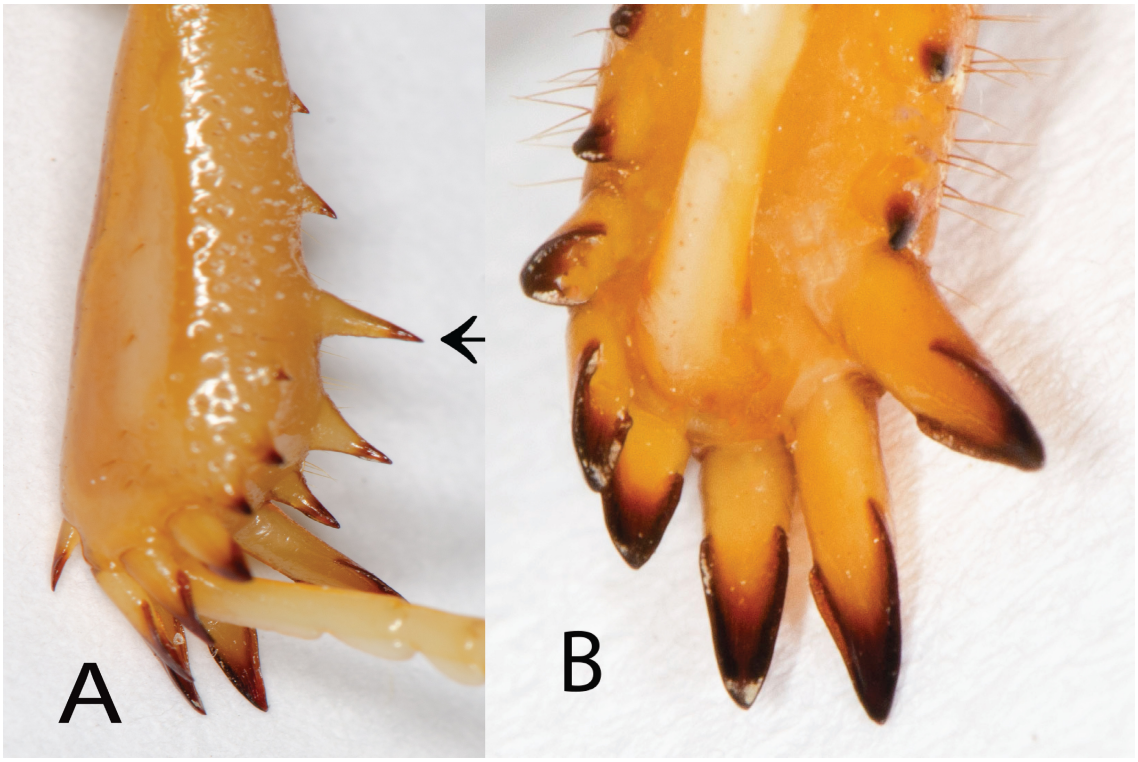


FIGURE 690. Left rear leg tibia adult female allotype *A. sangabriel.* A. Showing 3 outer and 5 inner spines. Note longest inner spine #3 (arrow). B. Showing shape of calcars.



FIGURE 691. Ovipositor allotype *A. sangabriel.*

Paratypes. ♂12 ♀11. **CALIFORNIA, *Los Angeles Co.,*** San Gabriel Mts, type locality, Chilao Campground, 1-viii-1982 (S82-122) R. Bervin ♀1. Camp Teresita Pines Campground, 34.392569° -117.717394°, 1790m, 8-vi-1983 (S83-66) ♂2. Mt Wilson, Chantry Flat area, Upper Winter Creek, 34.196558° -118.023354°, 663m, all W. Sakai: 31-x-1987 (S87-113) ♂1; 4-vi-1988 (S88-24) ♀1; 15-x-1988 (S88-112) ♂2; 2-ii-1989 (S89-4) ♀2; 14-x-1989 (S89-88) ♀3; 18-xi-1995 (S95-124) ♂1 ♀1. Near Mt Gleason, 34.372322° -118.148767°, 1674m, 29-iv-2001 (S01-24) ♂2 ♀2. Monte Cristo Campground, 34.340987° -118.109529°, 1086m, 29-iv-2001 (S01-25) ♂2. Table Mt Ski area, 34.384635° -117.687633°, 2244m, 22-viii-2006 (S06-85) ♂1. 3 km W Wrightwood, 34.368681° -117.668167°, 1975m, 10-v-1998 (S98-40) I. Swift ♀1. Sierra Pelona Mts, Spunky Canyon, Spunky Edison Rd, 34.6050° -118.3770°, 1100m, 16-ii-2004, M. Caterino (S04-3) ♂1.

Drum. Calling drum similar in both sexes except longer in females. **Male:** Holotype R01-71 (Fig. 692) with 9 drums over 12.0s (0.75 drums/s) at 20.5°C. Paratype male R01-11 (S01-24) (Fig. 693) with 20 drums over 25.4s (0.8 drums/s) at 21°C. **Female:** Allotype R01-29 (Fig. 694) with 203 drums over 206s (0.99 drums/s) at 21°C.

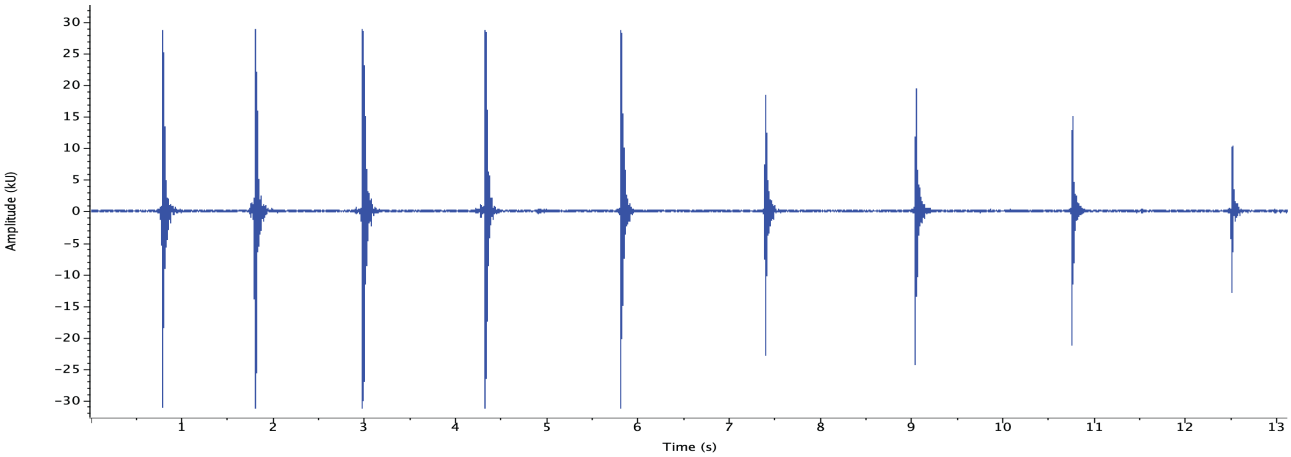


FIGURE 692. Calling drum (R01-71) adult male holotype *A. sangabriel.*

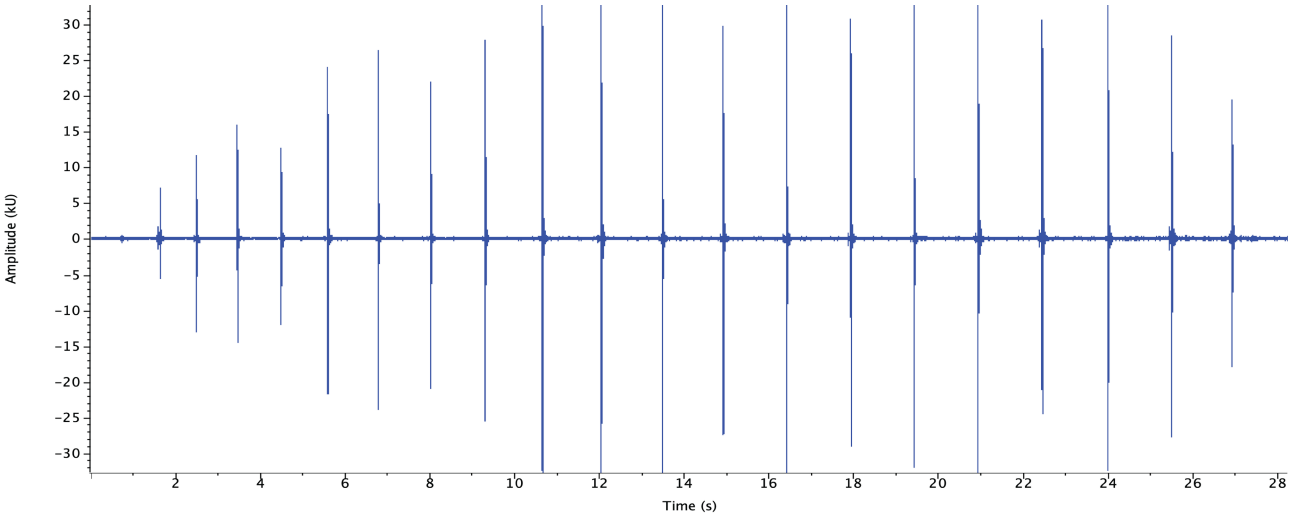


FIGURE 693. Calling drum (R01-11) adult male paratype *A. sangabriel.*

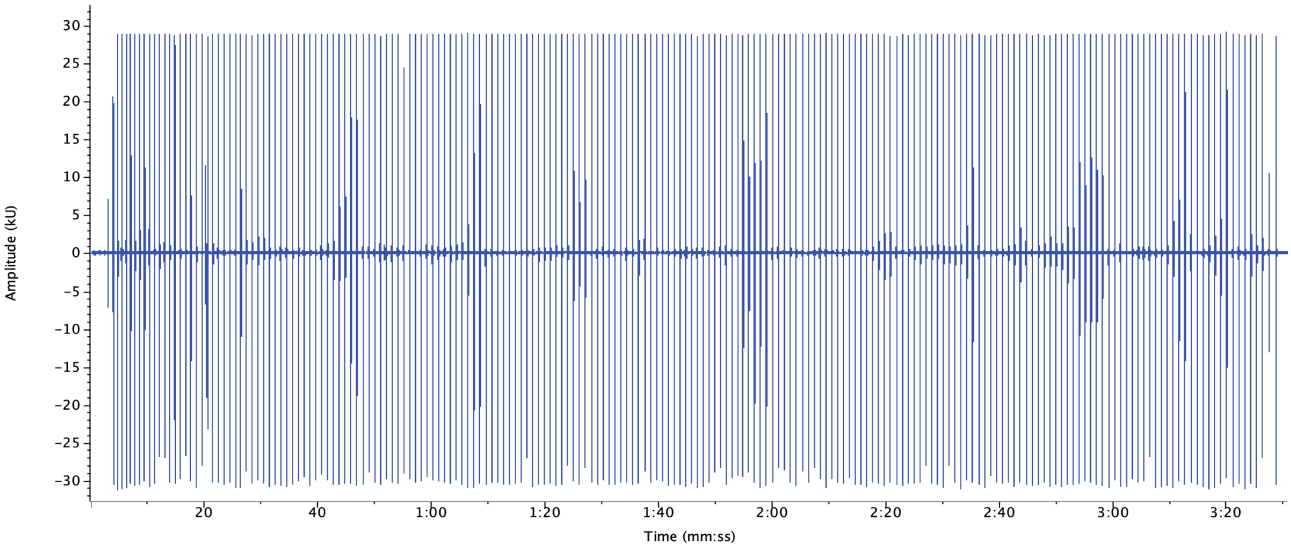


FIGURE 694. Calling drum (R01-29) adult female allotype *A. sangabriel.*

Derivation of name. Named with reference to the main mountain range where they occur.

Habitat. Mixed open habitat with pines, oaks, chaparral, always above 660m.

Life cycle and seasonal occurrence. Apparent 2-year life cycle. Good numbers of nymphs are difficult to collect during the spring since there is a balance between too early and too much snow, vs too late and too warm and dry.

Variation. Of 22 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 21 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 21 had 5 inner **rear** leg tibial spines, all with 3 outer **rear** leg tibial spines, and all with 2 ventral spurs. In 4 of 13 adult males, rear leg inner tibial spine #1 was longer or as long as spine #3. Some adult males (S01-25, R02-22) with calcar #1 darker and wider when compared with holotype.

DNA. Fig. 650, p. 378. F0283 (S95-124, Mt Wilson); F0664 (S98-40, Wrightwood); F1150 (near type locality S01-24); F1430 (S04-3, Spunky Canyon, Sierra Pelona Mts) all recovered together in Group 11 Southern California #1, and nearest to *A. etiwanda* (which also has 2n♂=23).

Karyotype. 2n♂=23. 2 males examined and both consistent: T90-3 (Fig. 695, S89-88, Upper Winter Creek); T02-5 (Fig. 696, type locality S01-26) both with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

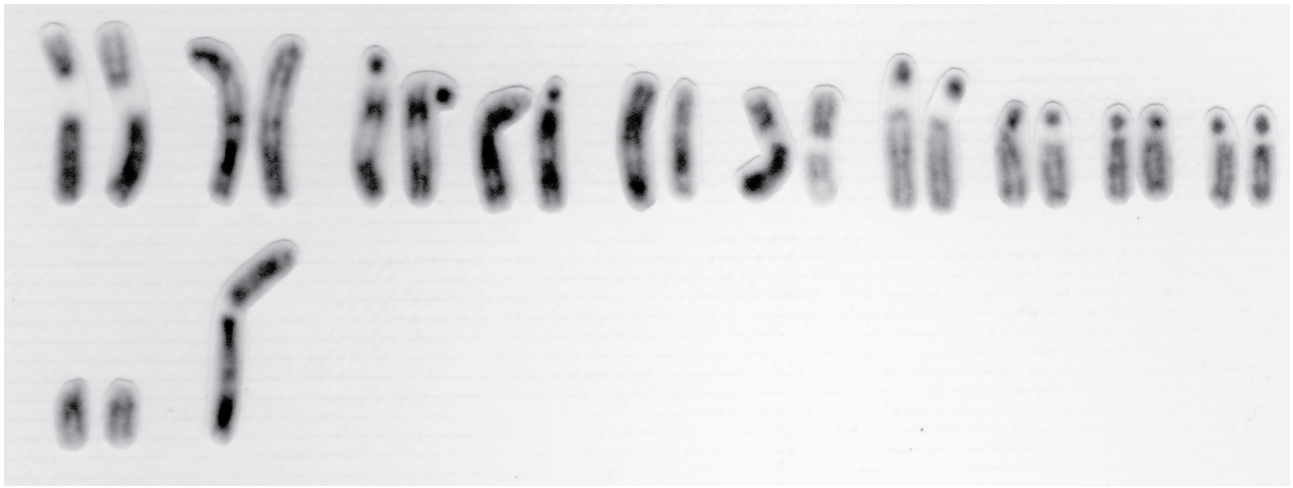


FIGURE 695. Idiogram T90-3 *A. sangabriel* (S89-88).

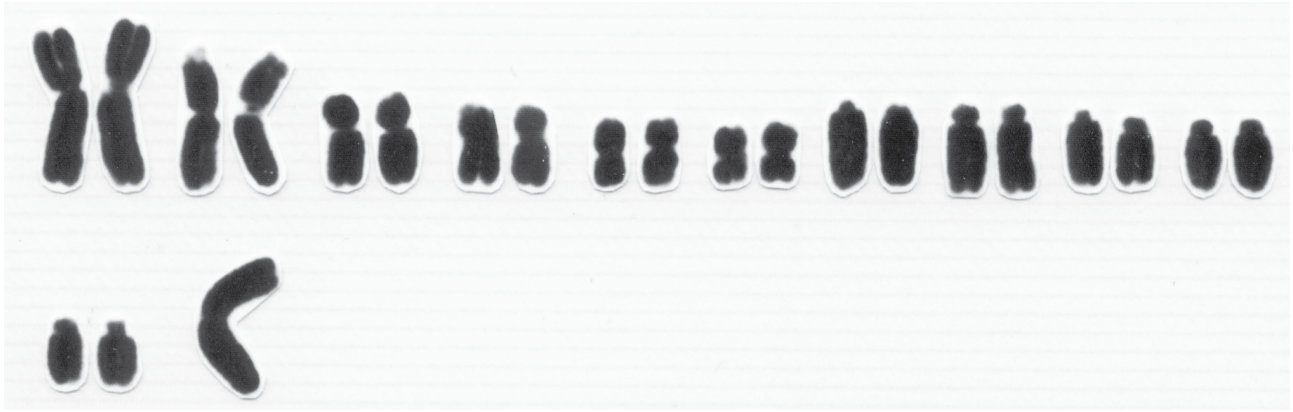


FIGURE 696. Idiogram T02-5 *A. sangabriel* (S01-26).

Discussion. At S88-112 & S89-88 (Upper Winter Creek) and S01-25 (Monte Cristo Campground), *A. sangabriel* collected with *A. mahogani.* At Wrightwood (S98-40), *A. sangabriel* occurs with 4.5 drums/s *A. wrightwoodi*, but their collected proximity unknown. In Spunky Canyon, broadly sympatric (S24-21) with *A. sierrapelona*, but not known microsympatric anywhere.

Group 12, Southern California Group #2 (Fig. 697)

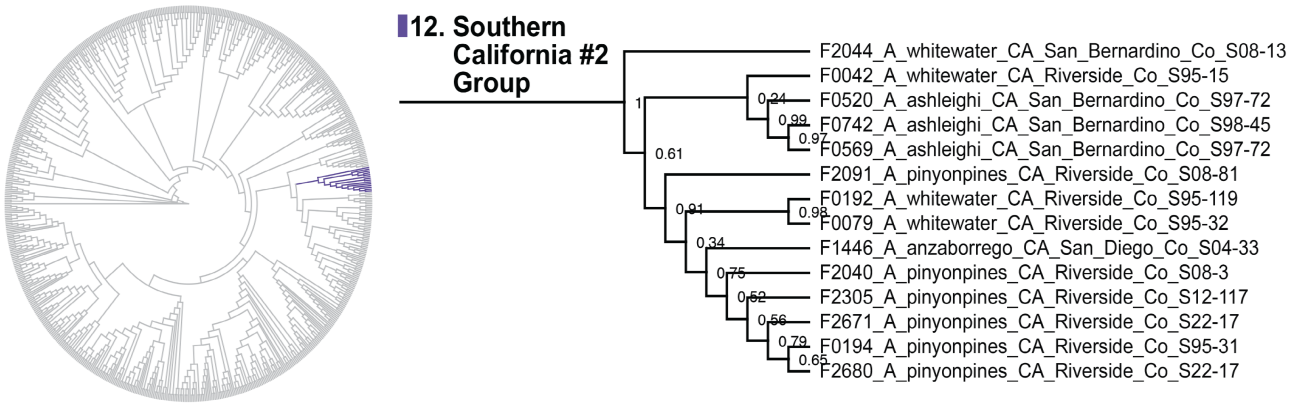


FIGURE 697. ASTRAL tree for Southern California #2 Group.

This Group is composed of 4 slow drumming species, with 2n♂=25 (*A. anzaborrego* unknown).

SPECIES WRITE UPS: *A. anzaborrego* (p. 400); *A. ashleighi* (p. 402); *A. pinyonpines* (p. 407); and *A. whitewater* (p. 412).

***Ammopelmatus anzaborrego* Weissman, sp. nov.**
Anza-Borrego Jerusalem Cricket
Figs 698–701, Table 7

Distribution. (Fig. 698). Known only from one moderate elevation site near the western boundary of Anza-Borrego Desert State Park, San Diego Co., California.

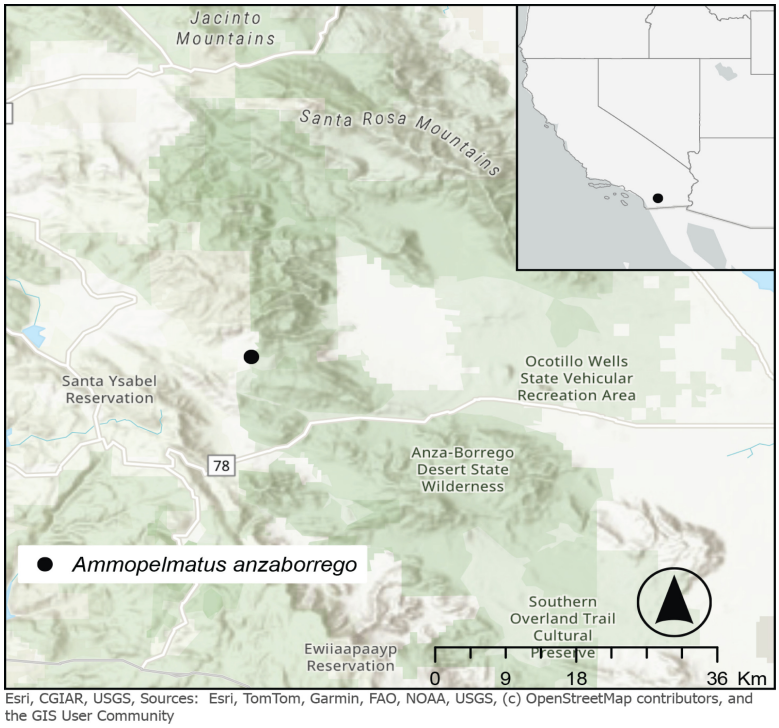


FIGURE 698. Known distribution of *A. anzaborrego.*

Recognition characters. A large, megacephalic, light colored species whose calling drum rate is 1 drum/s. Type locality is 3.7 road km due E of S05-34, a paratype locality of *A. kirai*, where the latter drums around 6.5–8 drums/s at 20°C. One of few megacephalic taxon that is not in the Fuscus Group (along with *A. danieli* from Monterey Co; *A. pinyonpines* from the San Jacinto Mts; and *A. acton* from Los Angeles Co)

Holotype. Male (in alcohol, Fig. 699). **California, *San Diego Co.,*** County Hwy S22 just inside entrance to Anza-Borrego Desert State Park, 33.210760° -116.499642°, 1294m, 13-v-2004 (S04-33) N. Crawford. R04-28, F1446. Molt to adult 23-viii-2004. Deposited CAS, Entomology type #20190. Measurements in mm: Body length 45.08, hind femur length 14.69, hind femur width 5.65. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 700) with 5 or 6 inner and 3 outer spines, 2 ventral spurs.

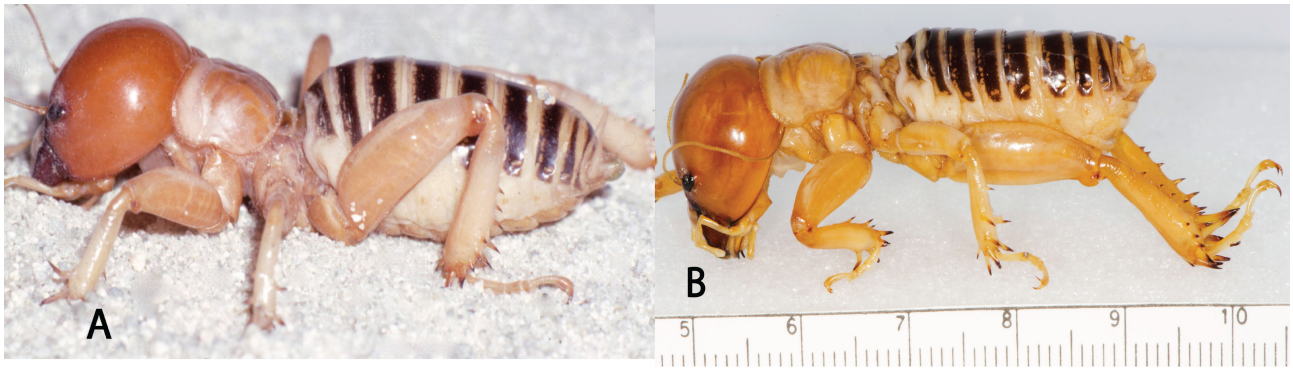


FIGURE 699. Holotype adult male *A. anzaborrego.* A. When alive. B. When preserved.



FIGURE 700. Left rear leg tibia holotype adult male *A. anzaborrego.* A. Showing 3 outer and 6 inner spines. B. Showing shape of calcars.

Female. Unknown.

Paratypes. None

Drum. **Male:** Holotype R04-28 (Fig. 701) with 16 drums over 15.6s (1.0 drum/s) at 20°C. **Female:** Unknown

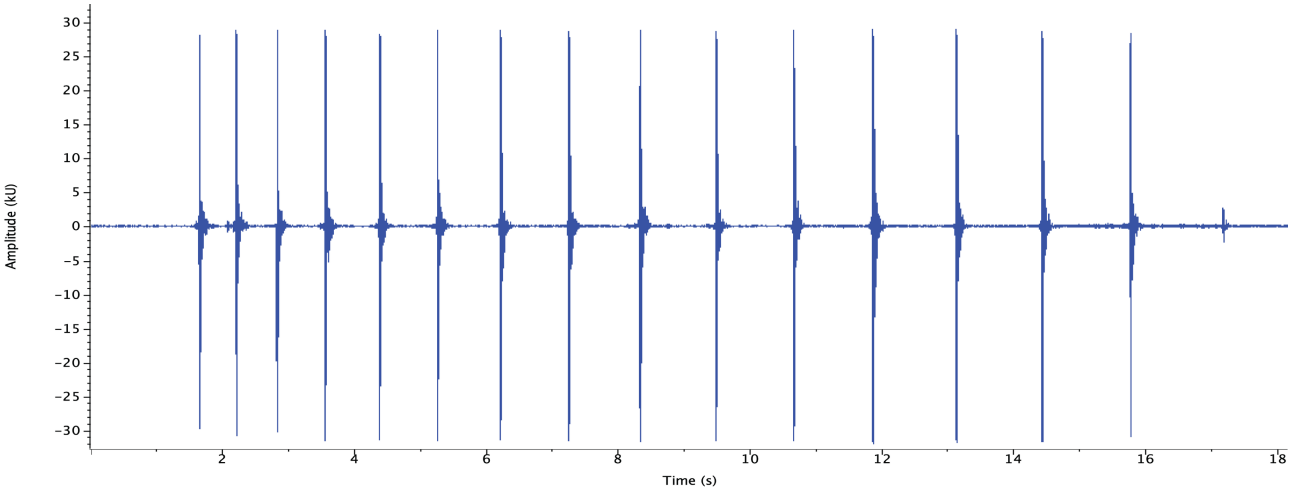


FIGURE 701. Calling drum (R04-28) holotype adult male *A. anzaborrego*

Derivation of name. Named after Anza-Borrego Desert State Park, and the only JC species known to occur in Anza-Borrego Park.

Habitat. Collected under rock in open juniper woodland-grassland just west before starting to descend into main Park area. Area was very dry at time of collection.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. Only known from holotype.

DNA. Fig. 697, p. 400. Holotype F1446 recovered in Group 12 Southern California #2, along with slow drumming *A. pinyonpines* (restricted to the San Jacinto Mountains); *A. whitewater* (restricted to the Mojave Desert); and *A. ashleighi* (restricted to the San Bernardino Mountains).

Karyotype. Unknown

Discussion. This unique adult male is recovered in the same clade as *A. pinyonpines.* The Anza-Borrego type locality is some 42 km due south of the type locality of *A. pinyonpines*, and is mid-elevation Colorado Desert, in contrast to the high elevation pine-oak woodland of the latter taxon. Although we cannot separate the two taxa on the basis of morphology, drum, or DNA, their habitats are so different that we name *A. anzaborrego* to call attention to the need for further collecting. *A. anzaborrego* is lighter colored with narrower black abdominal bands than *A. pinyonpines*, but it is unclear as to the taxonomic significance of these differences. Both species display megacephalism.

There are a number of other mid-elevation, mountainous Southern California JC populations where individuals drum around 1 drum/s. Recovered together in their own clade, along with *A. anzaborrego*, are *A. whitewater*, *A. pinyonpines*, and *A. ashleighi*. *A. sangabriel* (F1150, from high elevations in the San Gabriel Mts, 2n♂=23) drums similarly but recovered in a different clade. *A. joshuatree* (F0141, from Joshua Tree National Park, Little San Bernardino Mts, 2n♂=25) drums slightly slower at 0.7–0.8 drums/s and is recovered in a different clade. *A. tehachapi* (F0317, from the Tehachapi Mts, 2n♂=25) drums slightly faster at 1.5 drums/s, and is also recovered in a different clade.

***Ammopelmatus ashleighi* Weissman, sp. nov.**

UCLA Jerusalem Cricket

Figs 702–711, Table18

Species #5, Weissman 2001a.

Distribution. (Fig. 702). Only known from western San Bernardino Mts between Lake Arrowhead and Running Springs.



FIGURE 702. Known distribution of *A. ashleighi.*

Recognition characters. A medium-large, slow drumming, 2n♂=25 JC whose rear leg inner tibial spines #1–3 all of similar length. Separated from eastern San Bernardino Mts stripped abdomen *A. bartonflats,* which is smaller in size with a faster calling drum, male sex clarification drum, male calcar #1 darkened, different DNA, and having 14 metacentric autosomes vs 10 metacentric autosomes in *A. ashleighi.* Separated from nearest genetic relative, *A. whitewater*, by habitat and apparent absence of a sex clarification drum in *A. ashleighi*, and presence of more rear leg inner tibial spines (5–6) than the 3–5 seen in *A. whitewater*. Otherwise, similar for drum rate and karyotype. Separated from second eastern San Bernardino Mts species, *A. angelusoaks*, by faster drumming rate in latter.

Holotype. Male (in alcohol, Fig. 703). **California, *San Bernardino Co.,*** Lake Arrowhead, UCLA Bruin Woods, 34.266705° -117.188330°, 1604m, 14-20-vii-1990 (S90-64) DBW. R90-41. Molt to adult 5-ix-1990. Deposited CAS, Entomology type #20183. Measurements in mm: Body length 37.13, hind femur length 12.78, hind femur width 4.61. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 704) with 5 inner and 3 outer spines, 2 ventral spurs.

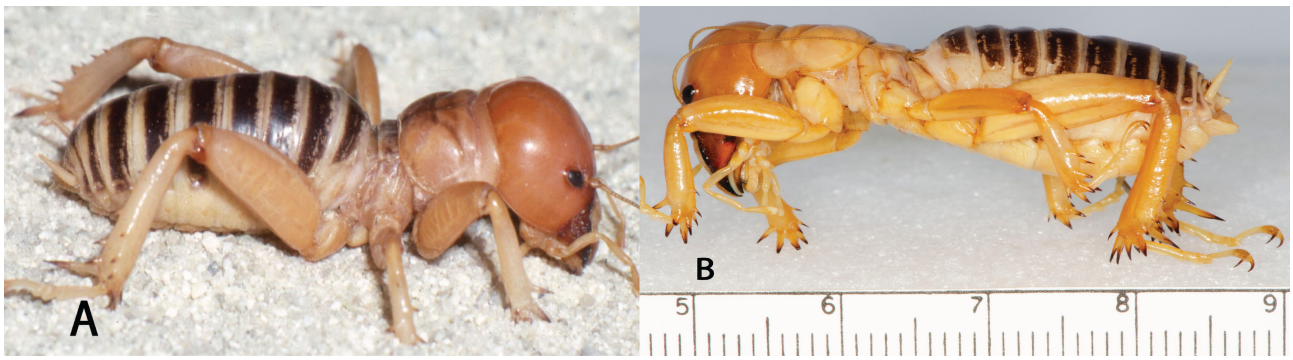


FIGURE 703. Holotype adult male *A. ashleighi.* A. When alive. B. When preserved.



FIGURE 704. Left rear leg tibia holotype adult male *A. ashleighi.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 705). Same data as holotype except R90-18. Molt to adult 1-ix-1990. Deposited CAS, CASENT #9083371. Measurements in mm: Body length 37.63, hind femur length 10.59, hind femur width 3.76 Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 706) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 707.

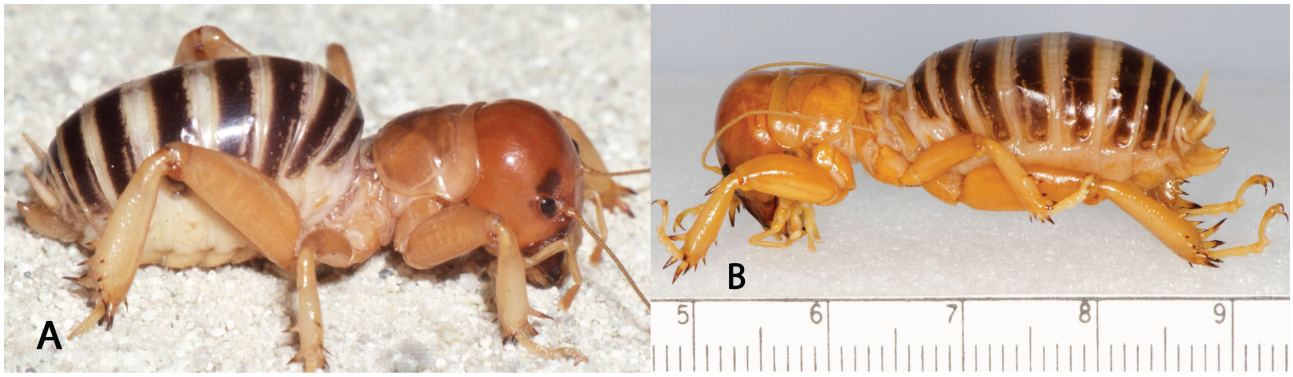


FIGURE 705. Allotype adult female *A. ashleighi.* A. When alive. B. When preserved.

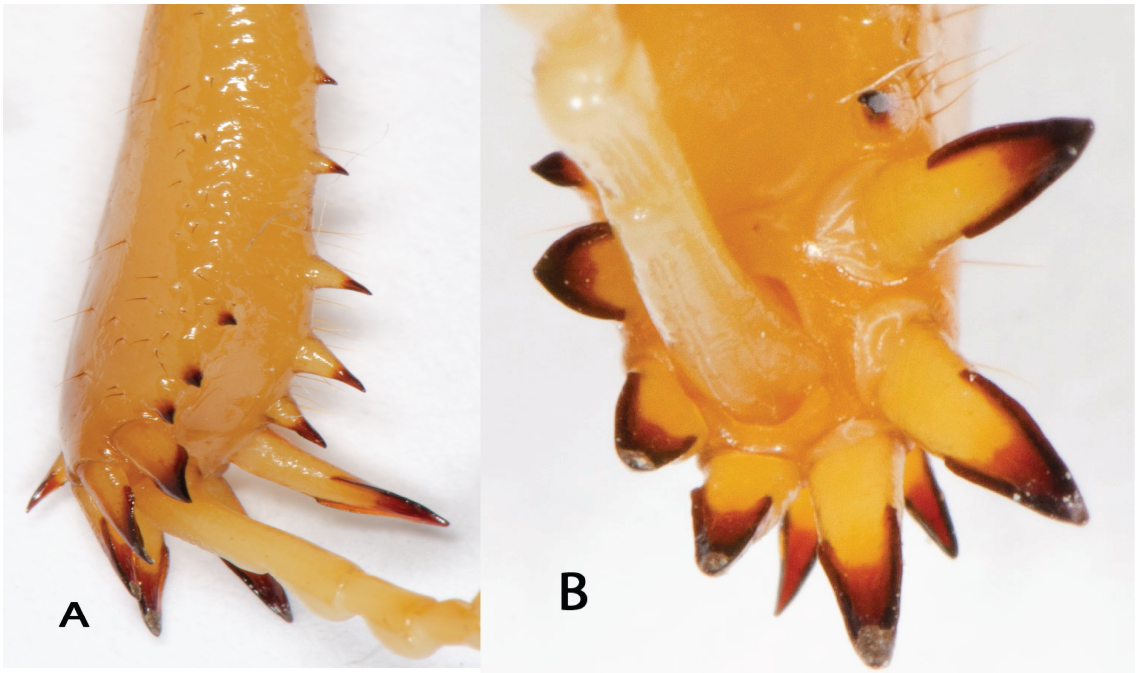


FIGURE 706. Left rear leg tibia allotype *A. ashleighi.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 707. Ovipositor allotype *A. ashleighi.*

Paratypes. ♂16 ♀31. **CALIFORNIA, *San Bernardino Co.,*** all from type locality: 12-xi-1983 (S83-152) ♀1; 23-25-vii-1989 (S89-55) ♂1 ♀3; 14-20-vii-1990 (S90-64) ♂2 ♀7; 14-20-vii-1991 (S91-57) ♂6 ♀4; 14-20-vii-1995 (S95-57) ♀9; 17-vii-1996 (S96-74) ♀1; 12-13-vii-1997 (S97-72) ♂2 ♀2. San Bernardino Mts, Lake Arrowhead, near Little Bear Creek, 1520m, 6-viii-1988 (S88-96) W. Sakai ♀1. Running Springs, 34.210505° -117.110802°, 1888m, 12-vii-1987 (S87-87) W. Sakai ♀1; Running Springs, 1646m, 6-vi-1998 (S98-45) M. Wilcox ♂1 ♀1. Switzer Park Picnic Ground, Hwy 18 0.4 m W Sky Forest, 34.232886° -117.186449°, 1733m, 20-vii-1992 (S92-76) ♂2; 20-vii-1994 (S94-64) ♂1 ♀1. Camp O'Ongo 2.6 m NW Running Springs, 34.225729° -117.133159°, 1917m, 27-xviii-1988 (S88-101), CL Hogue ♂1.

Drum. Similar calling drum in both sexes. **Male:** Holotype R90-41 (Fig. 708) with 35 drums over 47.3s (0.74 drums/s) at 20°C. **Female:** Allotype R90-18 (Fig. 709) with 52 drums over 48.6s (1.1 drums/s) at 21°C. Sex clarification drum apparently absent.

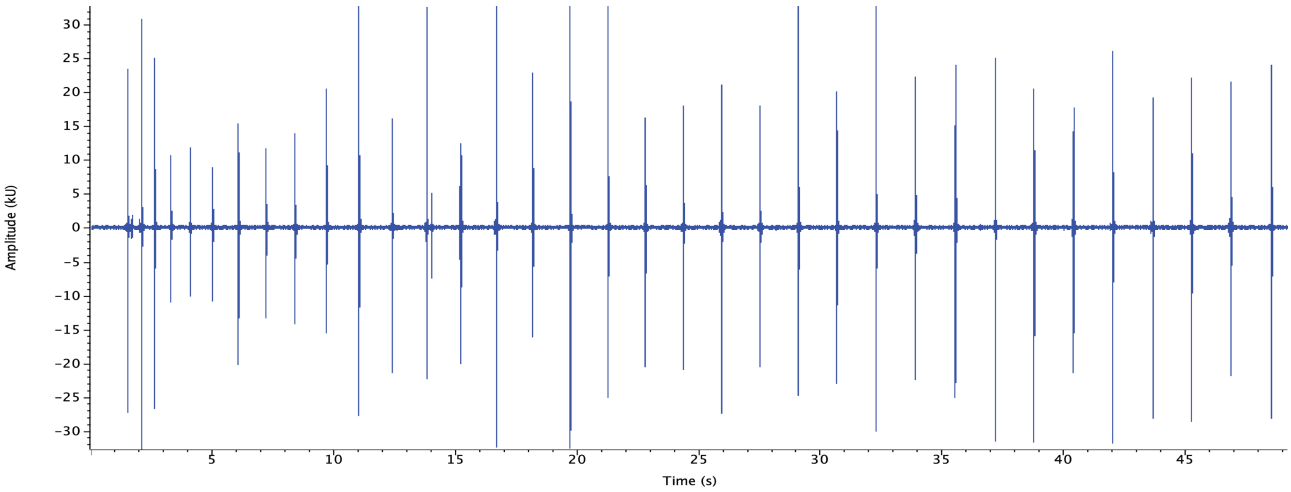


FIGURE 708. Calling drum (R90-41) holotype *A. ashleighi.*

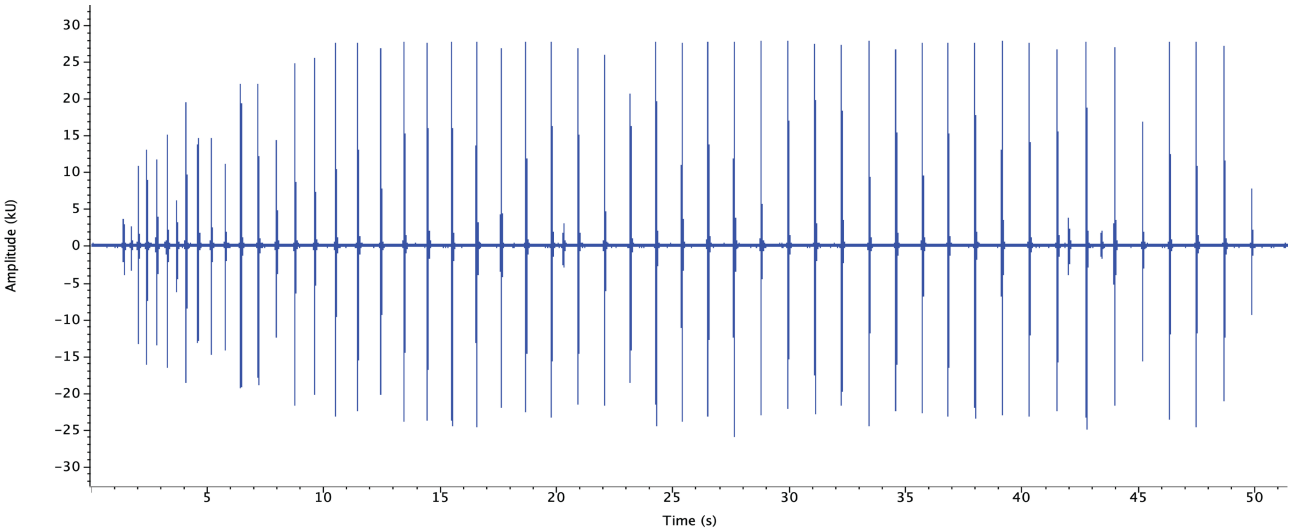


FIGURE 709. Calling drum (R90-18) allotype *A. ashleighi.*

Derivation of name. Named after Ashleigh Weissman Wood who had many pleasurable summers at UCLA's Bruin Woods family summer camp.

Habitat. To oatmeal trails, at type locality, in sandy, chaparral (mainly *Manzanita*) habitat with oak-pine woodland elements.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. Of 41 individuals, 40 had 3 and 1 had 4 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 38 had 5 and 3 had 6 inner **rear** leg tibial spines, and all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. In most individuals, inner rear leg tibial spines #1-3 of similar lengths such that any of them could be the longest.

DNA. Fig. 697, p. 400. F0520 & F0569 (both type locality S97-72), and F0742 (S98-45 Running Springs) all recovered together in Group 12 Southern California #2, along with *A. whitewater, A. pinyonpines,* and *A. anzaborrego.*

Karyotype. 2n♂=25. Two type locality males with similar results. T91-7 (Fig. 710, S91-57) and T96-15 (Fig. 711, S95-57) both with 5 or 6 metacentric or submetacentric autosomal pairs; 6 or 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

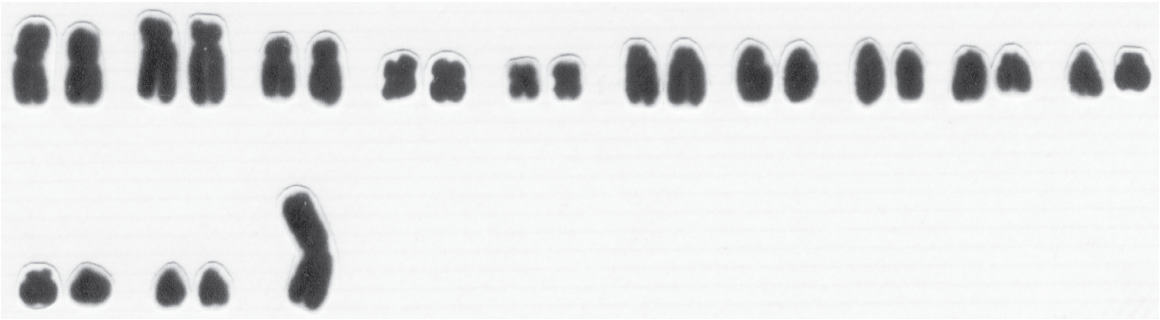


FIGURE 710. Idiogram T91-7 *A. ashleighi* (S91-57).

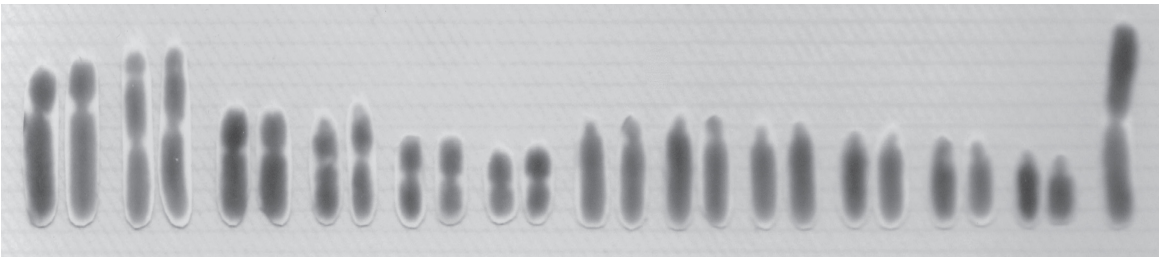


FIGURE 711. Idiogram T96-15 *A. ashleighi* (S95-57).

Discussion. In the San Bernardino Mts, at Switzer Park (S92-76) and Running Springs (S98-45), *A. ashleighi* was microsympatric with *A. mahogani.*

Ammopelmatus pinyonpines **Weissman, sp. nov.**

Pinyon Pines Jerusalem Cricket
Figs 712–722, Table 20

Distribution. (Fig. 712). Only known from the San Jacinto and Santa Rosa Mts, California, from 804–1650m elevation.

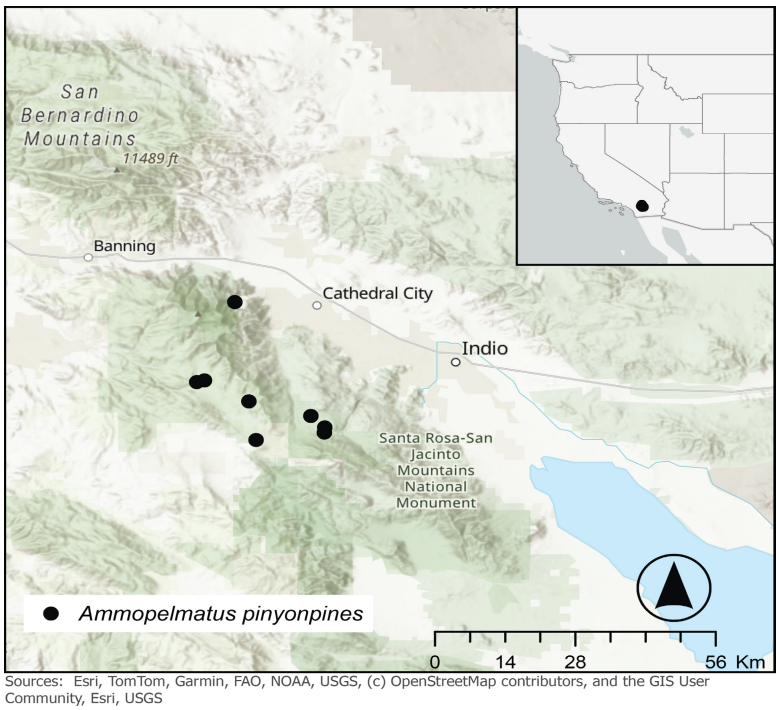


FIGURE 712. Distribution of *A. pinyonpines.*

Recognition characters. Medium-large, slow drumming JC (1.0–1.3 drums/s), 2n♂=25. Separated from near sympatric *A. sanjacinto* by larger size, slower drumming rate (4–6.5 drums/s in latter), DNA, karyotype (2n♂=23 in latter), and possibly habitat preference.

Holotype. Male (in alcohol, Fig. 713). **California, *Riverside Co.,*** Santa Rosa Mts, Pinyon Pines, near Fire Station, 33.590088° -116.452937°, 1247m, 26-vii-2015 (S15-115), W. Icenogle. R15-29. Adult when collected, crawling around at night. Deposited CAS, Entomology type #20185. Measurements in mm: Body length 34.13, hind femur length 10.82, hind femur width 4.02. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars bilaterally, although where an 8th calcar would normally be located, there are just stubs, 2 ventral spurs; hind leg tibia (Fig. 714) with 5 inner and 4 outer spines, 2 ventral spurs (missing right rear leg).



FIGURE 713. Adult male holotype *A. pinyonpines.* A. When alive. B. When preser



FIGURE 714. Left rear leg tibia adult male holotype *A. pinyonpines.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Figs 715A & 715B: A. live adult female paratype S08-3, R08-18); B. allotype. **California, *Riverside Co.,*** Santa Rosa Mts, Pinyon Pines, north Hwy 74 on Palm Canyon Dr 1.4 m N Pinon Drive, 33.612695° -116.477857°, 1227m, 12-vii-2913 (S13-75) W. Icenogle. R13-33. Molt to adult 16-ix-2013. Deposited CAS, CASENT #8413514. Measurements in mm: Body length 39.04, hind femur length 11.94, hind femur width 4.41. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 716) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 717.



FIGURE 715. Adult female *A. pinyonpines.* A. Paratype when alive. B. Allotype when preserved.



FIGURE 716. Left rear leg tibia adult female allotype *A. pinyonpines.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 717. Ovipositor allotype *A. pinyonpine*

Paratypes. ♂17 ♀18. **CALIFORNIA, *Riverside Co.,*** all San Jacinto Mts: Apple Canyon Rd, 33.682821° -116.668531°, 1368m, 13-iv-1992 (S92-40) J. Gannon ♂1 ♀1; 2-ii-2008 (S08-3) ♀2. Chino Canyon, Palm Springs Aerial Tramway (Valley Station), 33.837221° -116.614096°, 804m, 18-x-2008 (S08-81) W. Icenogle, ♂1. Garner Valley, Morris Ranch Rd, 33.641389° -116.588889°, 1651m, 4-iv-1995 (S95-31) J. Gannon ♂1 ♀2. Hurkey Creek Campground, 33.679466° -116.682396°, 1353m, 20-v-2022 (S22-15) A. Abela ♀1. Area around Pinyon Pines, various sites, usually on road at night, all W. Icenogle: 6-xi-2010 (S10-80) ♀2; 13-19-ix-2012 (S12-117) ♂7; 28-ix-2015 (S15-123) ♀1; 5-18-ix-2020 (S20-10) ♂1. Pinyon Flat, 33.579896° -116.453619°, 1233m, 18-v-2022 (S22-16) A. Abela ♀1. Pinyon Flat Campground, 33.583746° -116.457585°, 1222m, 25-27-ix-2023 (S23-100) A. Abela ♂1 ♀1. Pacific Crest Trail on both sides of Hwy 74, 33.565220° -116.576044°, 1509m, 19-v-2022 (S22-17) A. Abela ♂5 ♀7.

Drum. Calling drum similar in both sexes but series longer in females. One in 15 males (F2882) with a sex clarification drum (SCD). **Male:** Holotype R15-29 (Fig. 718) with SCD of 3 drums over 0.34s (8.8 drums/s) immediately followed by calling drum of 12 drums over 9.3s (1.3 drums/s) at 20°C. **Female:** Allotype R08-18 (Fig. 719) with 127 drums over 102.7s (1.2 drums/s) at 20.5°C.

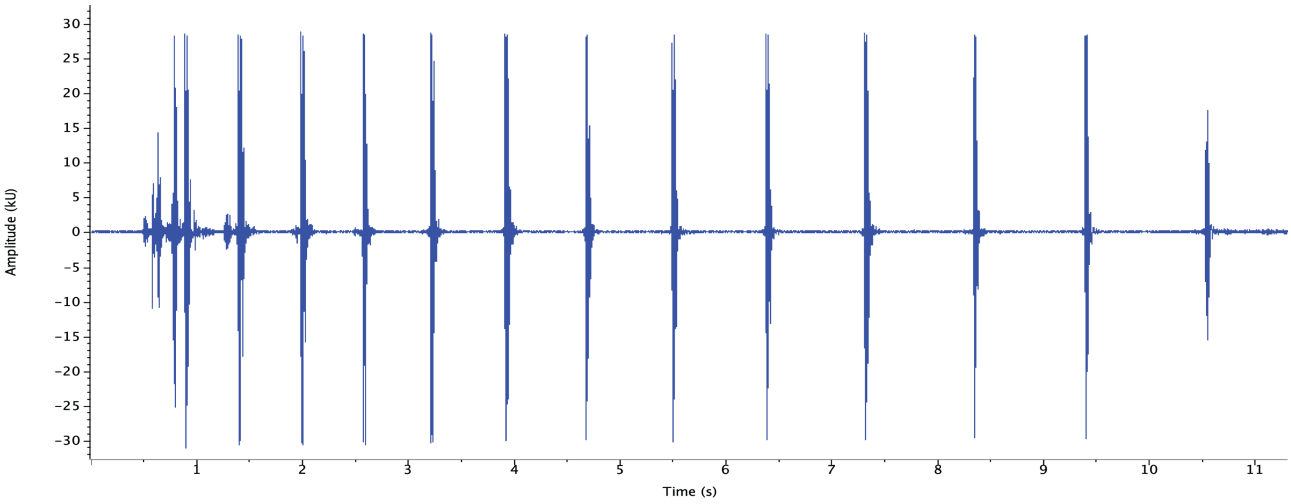


FIGURE 718. Calling drum (R15-29) male holotype *A. pinyonpines.*

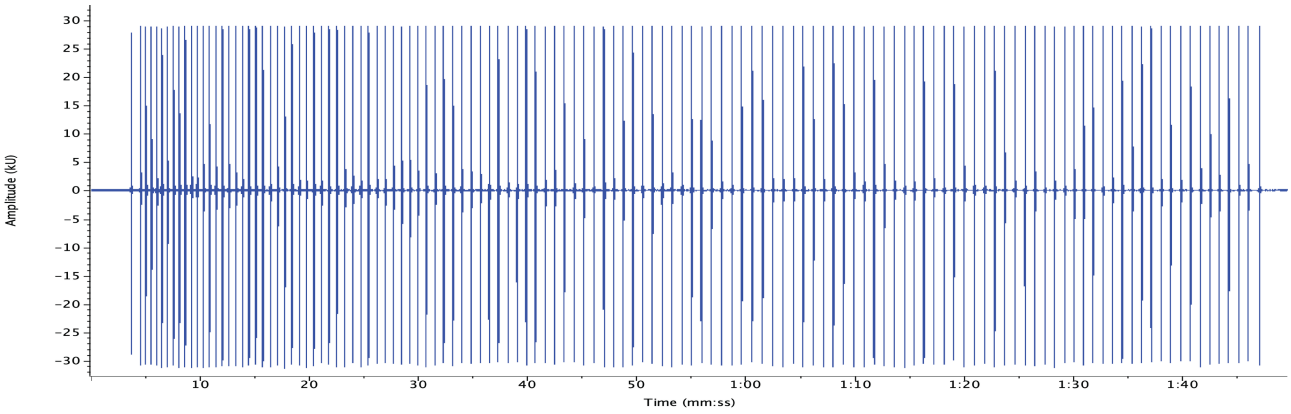


FIGURE 719. Calling drum (R08-18) female allotype *A. pinyonpines.*

Derivation of name. Named for the general area where the type locality is located.

Habitat. Type locality is pinyon pine-juniper woodlands. At Apple Canyon, all individuals reportedly collected under rocks in chaparral. None collected at oatmeal in adjacent open pine forests (S06-84) where *A. sanjacinto* occurs. At Garner Valley, in chaparral-oak woodland habitat.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle. At Pacific Crest Trail (S22-17), all individuals collected at the oatmeal trail on 19-v-2022, were juveniles.

Variation. Of 28 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 26 had 5 and 2 had 6 inner **rear** leg tibial spines, and 25 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Type locality individuals usually megacephalic (partly just the result of their larger body size?) and with brown heads vs less megacephalic and orange heads seen in those from Apple Valley (Fig. 720), Garner Valley, and around the Pacific Coast Trail.



FIGURE 720. Adult male *A. pinyonpines*, from Apple Canyon (S92-40, R92-86), showing more orange head than browner head seen in holotype.

DNA. Fig. 697, p. 400. F0194 (S95-31, Garner Valley); F2040 (S08-3, Apple Canyon); F2091 (S08-81, Palm Springs Tram); F2305 (S12-117, type locality); F2671 & F2680 (S22-17, Pacific Crest Trail) recovered in Group 12 Southern California #2, with *A. ashleighi* and *A. whitewater*. The single adult, megacephalic male (F1446) of *A. anzaborrego*, collected from near the entrance to Anza Borrego Desert State Park (S04-33), is recovered in the same clade with *A. pinyonpines.* This locality is some 42 km due south of the type locality of *A. pinyonpines*, and is high elevation desert in contrast to the high elevation pine-oak woodlands of the latter.

Karyotype. 2n♂=25. Three males (T22-8, Fig. 721; T22-11 & T22-12, both Fig. 722) all from Pacific Crest Trail (S22-17) examined, and all similar with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. This site, still in the San Jacinto Mts, is some 11 km from the type locality, but in similar habitat and elevation.

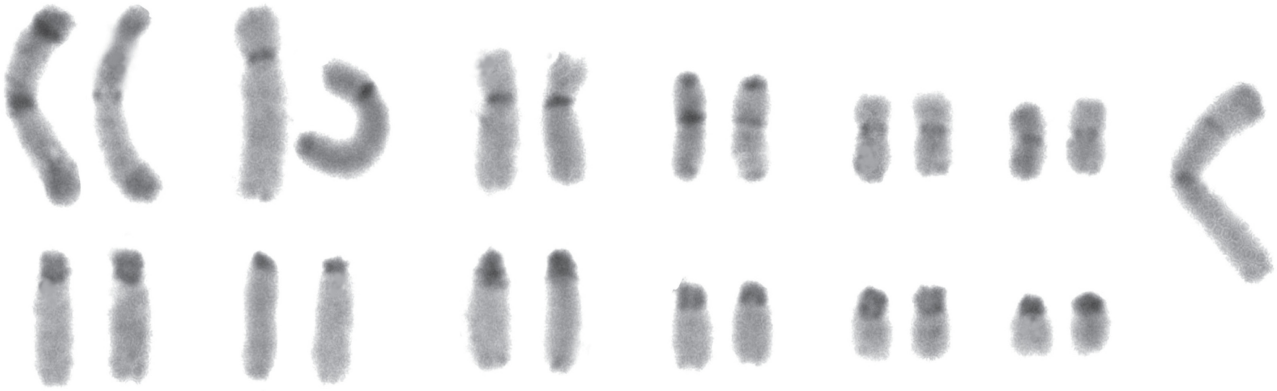


FIGURE 721. Idiogram T22-8 *A. pinyonpines* (S22-17), using C-banding.

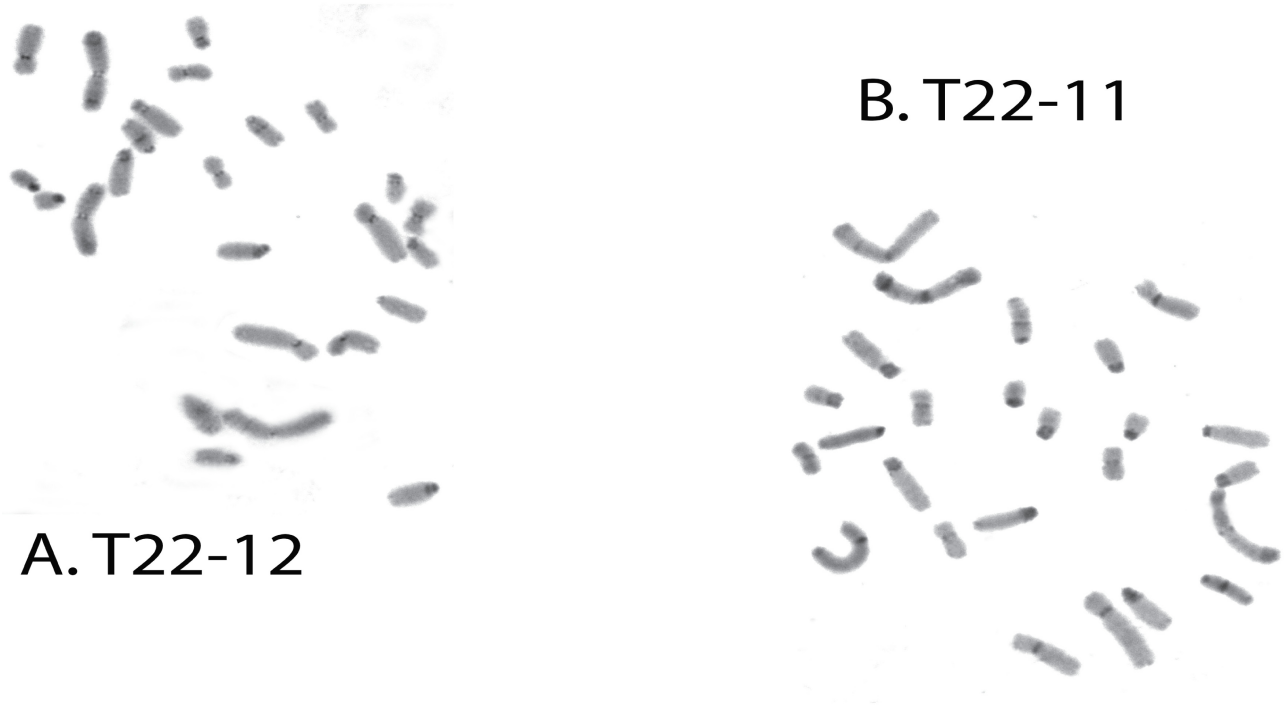


FIGURE 722. Anaphase cells from T22-11 & T22-12 *A. pinyonpines* (S22-17), each demonstrating 2n♂=25 chromosomes, using C-banding.

Discussion. The San Jacinto and Santa Rosa Mountain Ranges are technically separated by Palm Canyon, but this Canyon essentially disappears at higher elevations which, biologically, functionally "combines" the two named mountain ranges.

Microsympatric with *A. mahogani* at Garner Valley site (S95-31).

***Ammopelmatus whitewater* Weissman, sp. nov.**
Whitewater Canyon Jerusalem Cricket
Figs 723–733, Tables 6, 16

Species #1, Weissman 2001b.

Distribution. (Fig. 723). Sandy, desert areas of Riverside and San Bernardino Counties, California: Whitewater Canyon, Joshua Tree National Park, Yucca Valley, and Yucaipa.

Recognition characters. A large, slow drumming JC with a sex clarification drum (SCD), 2n♂=25. Separated from near sympatric, Coachella Valley *A. cahuilaensis*, by *A. whitewater's* wider, darker black abdominal stripes, habitat not sand dunes, slower calling drum rate, and DNA. Separated from more western and faster drumming *A. calimesa* by karyotype (2n♂=23) and DNA. In Joshua Tree Natural Park, separated from *A. joshuatree* by latter's smaller size, slower drum, 1 vs 3 fore leg tibial spines, DNA, and spatulate rear leg tibial calcars in latter.

Holotype. Male (in alcohol, Fig. 724). **California, *Riverside Co.,*** Whitewater Canyon ~2.2 m N frontage road, on east side of Whitewater Canyon stream bed, 33.952078° -116.641211°, 514m, 4-iii-1992 (S92-21) DBW, VF Lee. R92-126. Molt to adult 20-x-1992. Deposited CAS, Entomology type #20113. Measurements in mm: Body length 36.22, hind femur length 10.86, hind femur width 3.92. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 725) with 5 (1 small) inner and 3 outer spines, 2 ventral spurs.

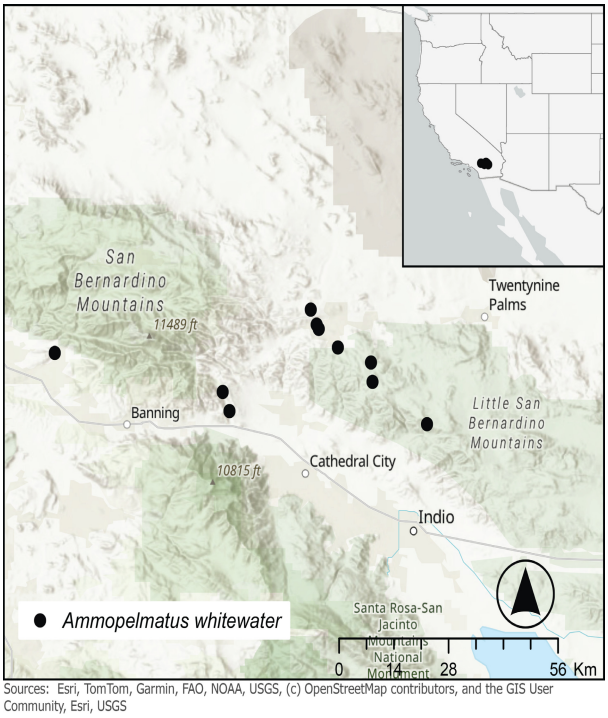


FIGURE 723. Distribution of *A. whitewater*.

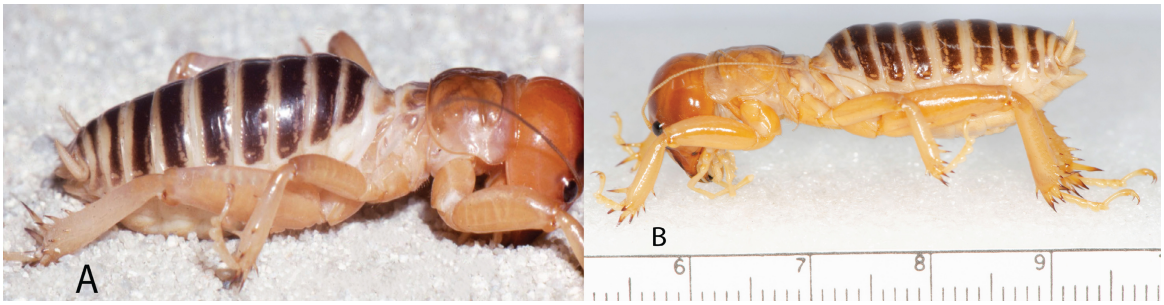


FIGURE 724. Adult male holotype *A. whitewater*. A. When alive. B. When preserved.



FIGURE 725. Left rear leg tibia male holotype *A. whitewater*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 726). Same data as holotype except R92-125. Molt to adult 27-ix-1992. Deposited CAS, CALENT #9082016. Measurements in mm: Body length 33.75, hind femur length 9.09, hind femur width 3.54. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 727) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 728.

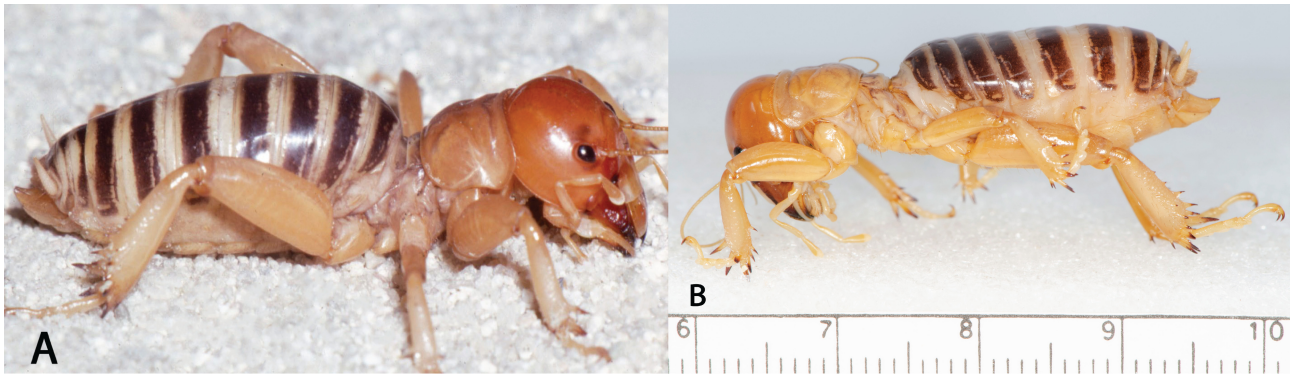


FIGURE 726. Adult female allotype *A. whitewater.* A. When alive. B. When preserved.

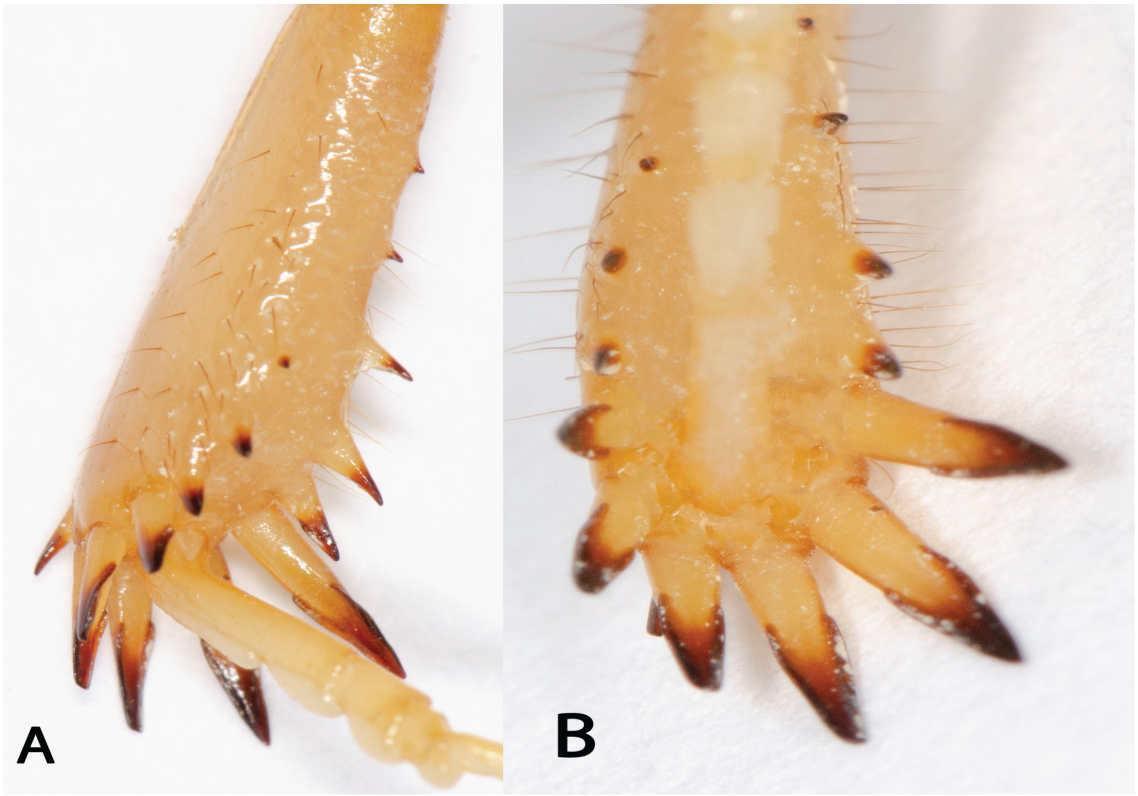


FIGURE 727. Left rear leg tibia adult female allotype *A. whitewater.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Paratypes. ♂16 ♀18. **CALIFORNIA, *Riverside Co.,*** Joshua Tree National Park: 16-iii-1996 (S96-21) J. Freilich ♀1; Horse Valley, 1290m, 26-iv-1994 (S94-16) R. Pepito, T Bertrand ♀1; Key's Ranch, 19-i-1994 (S94-1) ♀2. Lower Covington Flat, 34.046633° -116.315955°, 1414m, 25-iii-2000 (S00-01) GF Pratt ♀3. Upper Covington Flat, 34.008898° -116.312509°, 1485m, 17-vi-1988 (S88-51) J. Cornett ♀1; Black Rock Visitor Center, 9800 Black Rock Canyon Rd, 34.075890° -116.392094°, 1217m, 30-vi-1992 (S92-75) J. Freilich ♀1; Keys View Lookout, 33.926576° -116.187216°, 1580m, 5-vii-1993 (S93-61) J. Freilich ♂1; Key's Ranch Zone 11 37-67-000N 5-77-000E, 1250m, 13-iv-1995 (S95-32) J. Freilich, 1 late instar male for testes; Whitewater Canyon, type locality, 19-xii-1987 (S87-124) ♂1 ♀1; 16-v-1994 (S94-24) on road at night, SI Weissman ♂1; Near Trout hatchery, 33.989294° -116.656748°, 674m, 16-ii-1995 (S95-13), J. Gannon, ♂1; Near hatchery, 12-ii-1995 (S95-15), G. Ballmer & G.

Pratt ♂1 ♀2; 23-xi-1996 (S96-99) G. Ballmer ♂1 ♀1; 16-i-1998 (S98-3) G. Ballmer ♀1. ***San Bernardino Co.,*** Yucaipa, Grape Ave 0.5m W Bryant St, 34.065247° -117.042612°, 856m, W. Icenogle, 20-xi-2007 (S08-13) ♂1; 12-x-2008 (S08-80) ♂1. Yucca Valley, Burns Pinyon Ridge Reserve, 34.149503° -116.454402°, 1264m, all W. Sakai: 23-iv-1988 (S88-11) W. Sakai ♂1; 3-x-1992 (S92-131) ♂1; 10-17-iv-1993 (93-22) ♂1 ♀1; 28-iv-1996 (S96-28) ♂1; 16-x-1999 (S99-158) ♀1; 29-x-2005 (S05-162) ♀1. Yucca Valley: 56089 29 Palms Hwy, 34.120278° -116.440833°, 1009m, M. Perez, 26-ix-1993 (S93-79) ♀1; 21-xii-1993 (S93-94) ♂1. Yucca Valley, corner of Onaga Trail and Church St, 34.112104° -116.435979°, 1038m, 23-x-1995 (S95-119) A. Milligan, ♂1. Skyland Ranch Rd, ~2 km W Burns Pinyon Ridge Reserve, both J. Freilich, 4-ii-1995 (S95-10) ♂1; 12-x-1995 (S95-117) ♂1.



FIGURE 728. Ovipositor allotype *A. whitewater.*

Possible placement. **CALIFORNIA, *Riverside Co.,*** Cherry Valley, 33.976105° -116.969591°, 886m, J. Gannon, mid-March, 1990 (S90-26) ♂1; late iii-1990 (S90-28) ♂1 ♀1. These slow drumming (~1 drum/s) individuals could be *A. whitewater*, but without DNA we can't make a reliable determination.

Drum. Calling drums similar in both sexes except males have a SCD, and females have much longer series than males. **Male:** Holotype R92-126 (Fig. 729) with 15 drums in 15.0s (1 drum/s) at 20°C. **Female:** Allotype R92-125 with some 562 drums (Fig. 730) over 530s (1.1 drums/s) with the first 52 drums, in 46.3s (1.1 drums/s) at 20°C, shown in Fig. 731.

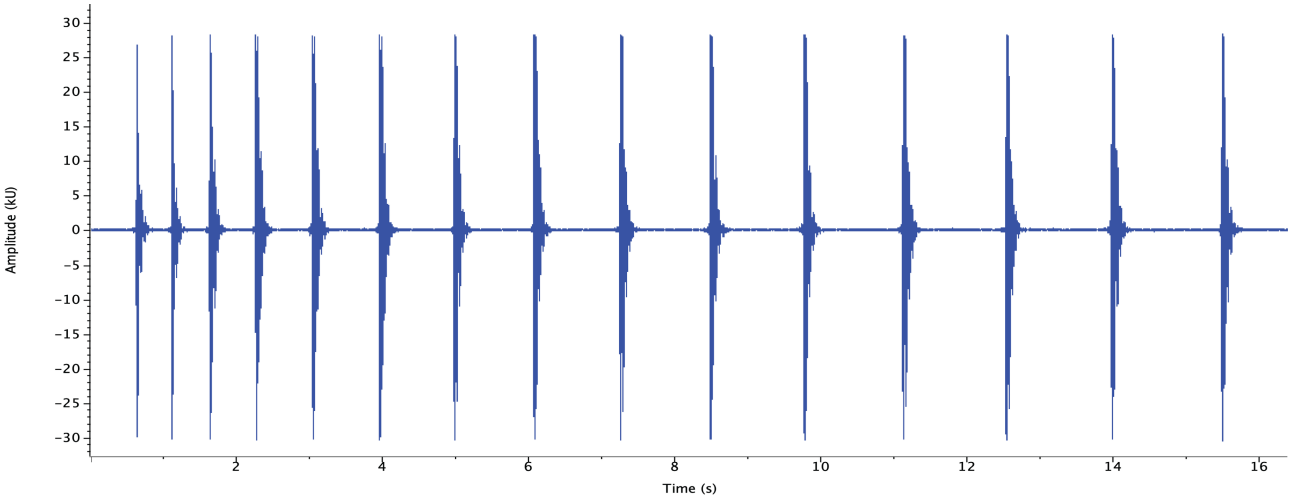


FIGURE 729. Calling drum (R92-126) adult male holotype *A. whitewater.*

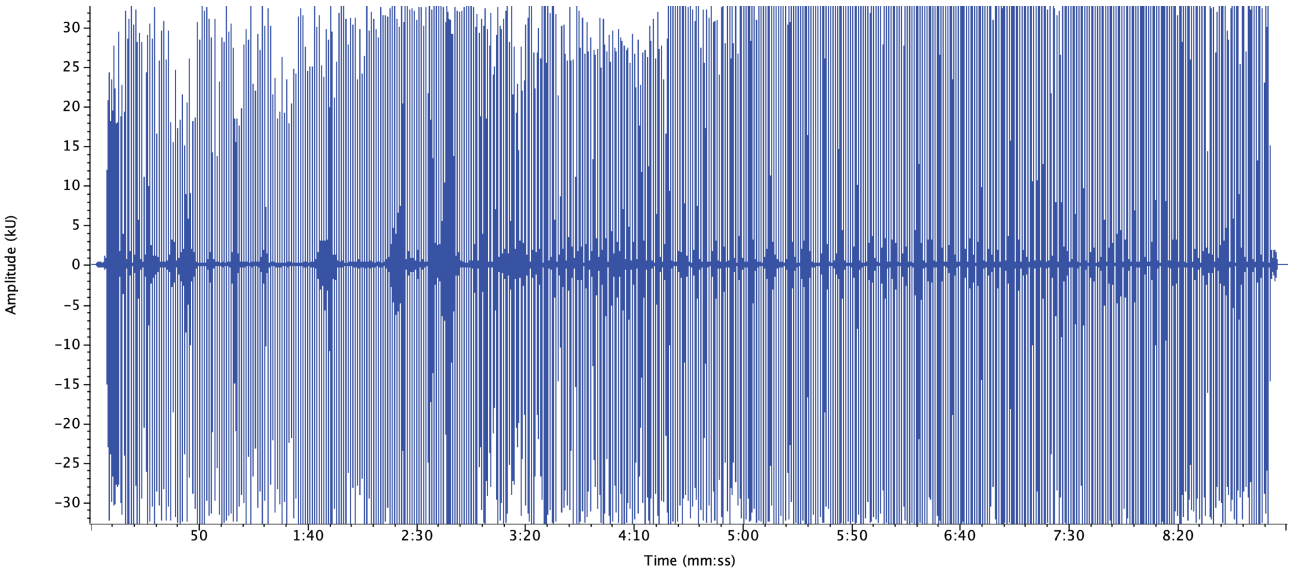


FIGURE 730. Calling drum (R92-125) adult female allotype *A. whitewater.*

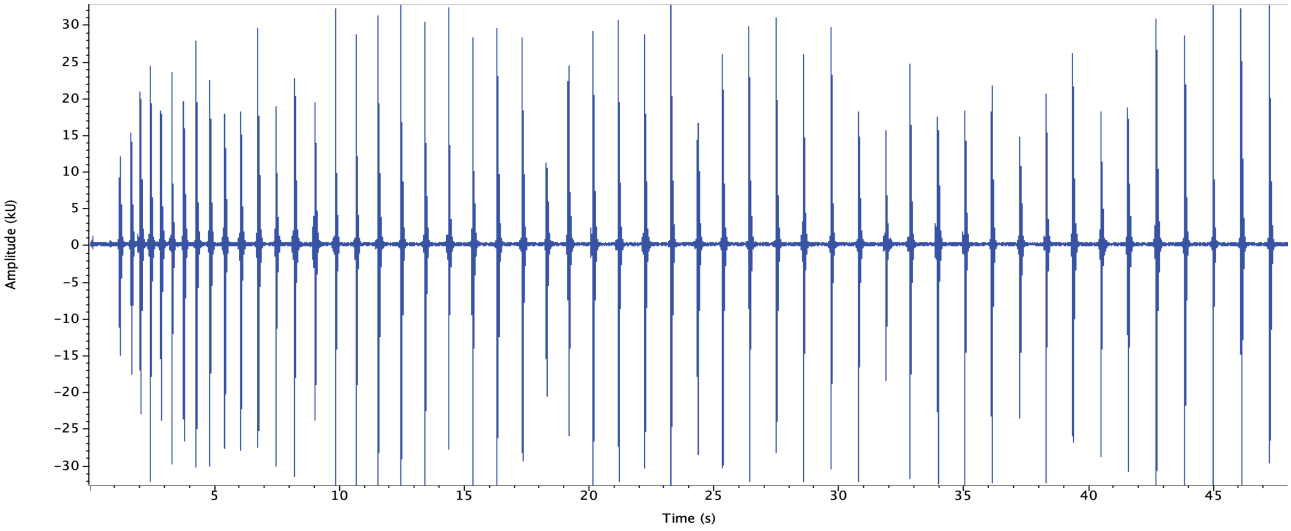


FIGURE 731. Expanded, initial part of calling drum (R92-125) adult female allotype *A. whitewater.*

Derivation of name. Named after the type locality.

Habitat. At type locality, under rocks on the sandy and gravely side banks of the Whitewater Canyon stream, in areas of winter-spring green grass.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. From 24 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 23 had 8 **middle** leg tibial calcars, and 1 had 1 and 23 had 2 ventral spurs; 1 had 4, and 23 had 5 inner **rear** leg tibial spines, while all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 697, p. 400. F0042 (type locality S95-15, Whitewater Canyon); F0079 (S95-32, Joshua Tree National Park); F0192 (S95-119, Burns Pinyon Ridge Reserve); F2044 (S08-13, Yucaipa) recovered together in Group 12 Southern California #2, and closest to *A. ashleighi* and *A. pinyonpines.* Yucaipa is some 29-air km, and 730 m lower, in the foothills of the San Bernardino Mts, and SE of Lake Arrowhead, which is the type locality of *A. ashleighi.*

Karyotype. 2n♂=25. T92-54 (Fig. 732, type locality S92-21); T95-13 (Fig. 733, S95-32, Joshua Tree) similar with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 732. Idiogram T92-54 *A. whitewater* (S92-21), meiotic cell.

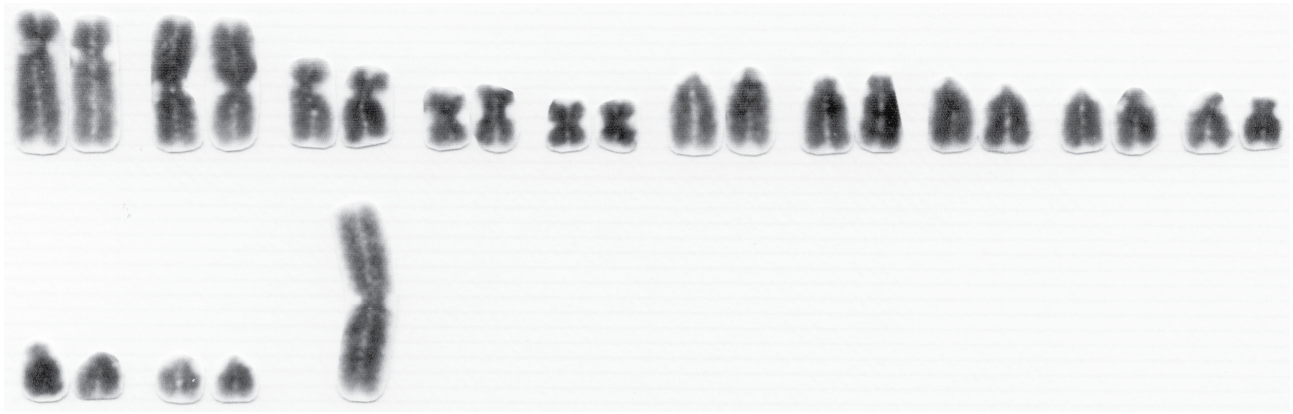


FIGURE 733. Idiogram T95-13 *A. whitewater* (S95-32), mitotic cell.

Discussion. At Cherry Valley, Riverside Co., may occur with both *A. calimesa* and *A. mahogani*, but identification needs further confirmation.

Group 13, Southern California and Baja California Group #3 (Fig. 734)

This Group is composed of 9 described species, and possibly 5 undescribed species, that have variable drum rates and either 2n♂=23 or 25 chromosomes.

SPECIES WRITE UPS: *A. ballmeri* (p. 418); *A. cahuilaensis* (p. 425); *A. calimesa* (p. 431); *A. fisheri* (p. 437); *A. kirai* (p. 445); *A. lagunahanson* (p. 449); *A. sanjacinto* (p. 454); *A. sanpedromartir* (p. 461); and *A. santarosaplateau* (p. 466); in addition to *A.* sp. #1, *A.* sp. #2., *A.* sp. #3, *A.* sp. #4, and *A.* sp. #6.

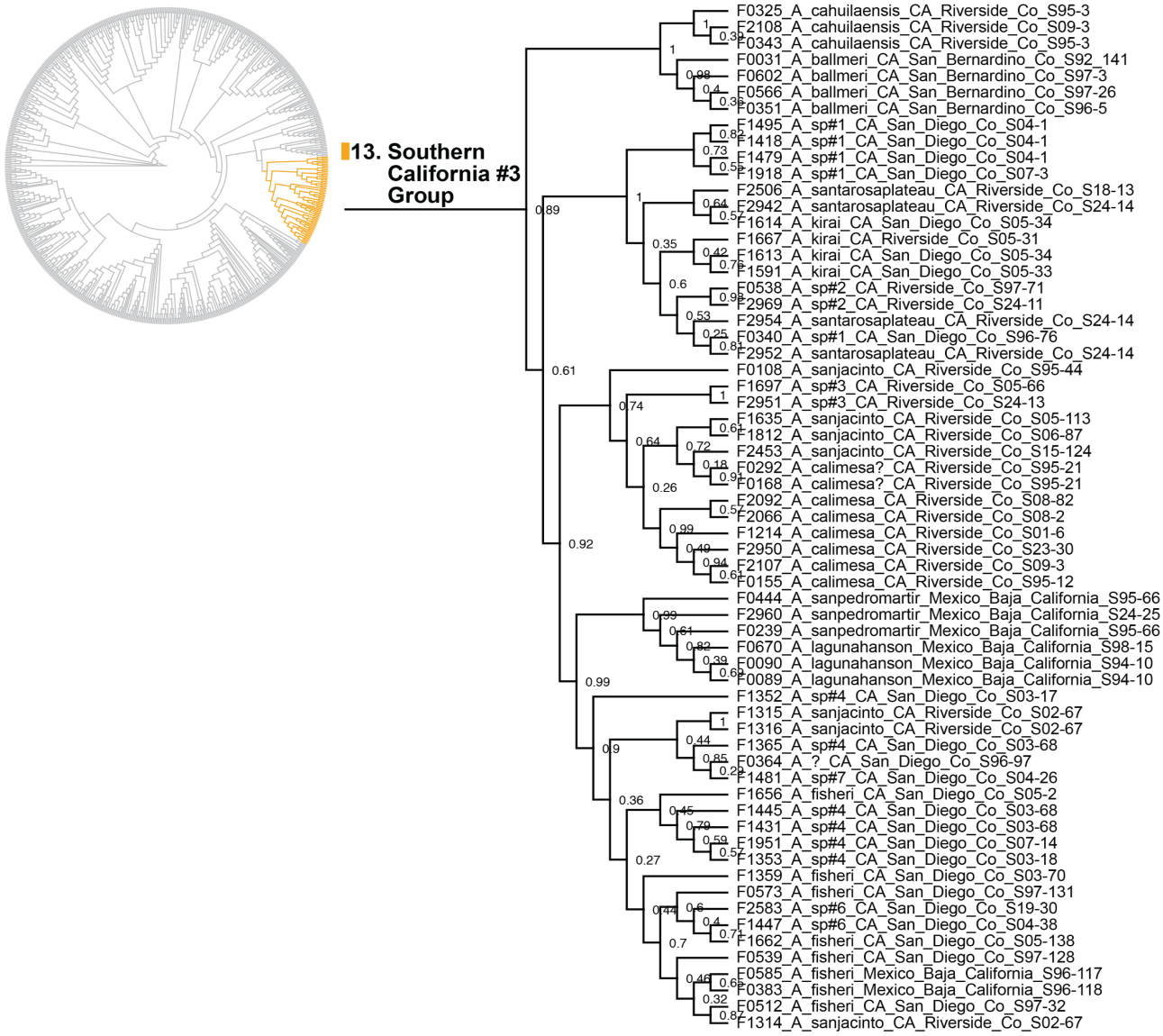


FIGURE 734. ASTRAL tree for Southern California #3 Group.

Ammopelmatus ballmeri Weissman, sp. nov.

Colton Dunes Jerusalem Cricket

Figs 735–747, Table 6

Distribution. (Fig. 735). Known only from the type locality Colton Sand Dunes, and nearby sandy areas, between the cities of Colton and Ontario, San Bernardino Co., California.

Recognition characters. A small to large, light colored, obligate sandy substrate species with a calling drum of 4.4–4.9 drums/s, apparent absence of sex clarification drum (SCD), and 2n♂=23. Can be separated from microsympatric *A. etiwanda* (at S96-5, S97-5, S97-142, S97-143) by differences in color (Fig. 736), drum rate, and DNA. Can be separated from nearest relative *A. cahuilaensis* by chromosome count (2n♂=23 in *A. ballmeri* vs 2n♂=25 in latter); and usually 5 inner rear leg tibial spines in *A. ballmeri* vs 3 spines in *A. cahuilaensis*. Both inner and outer rear leg tibial spines #1 flattened and rotated.

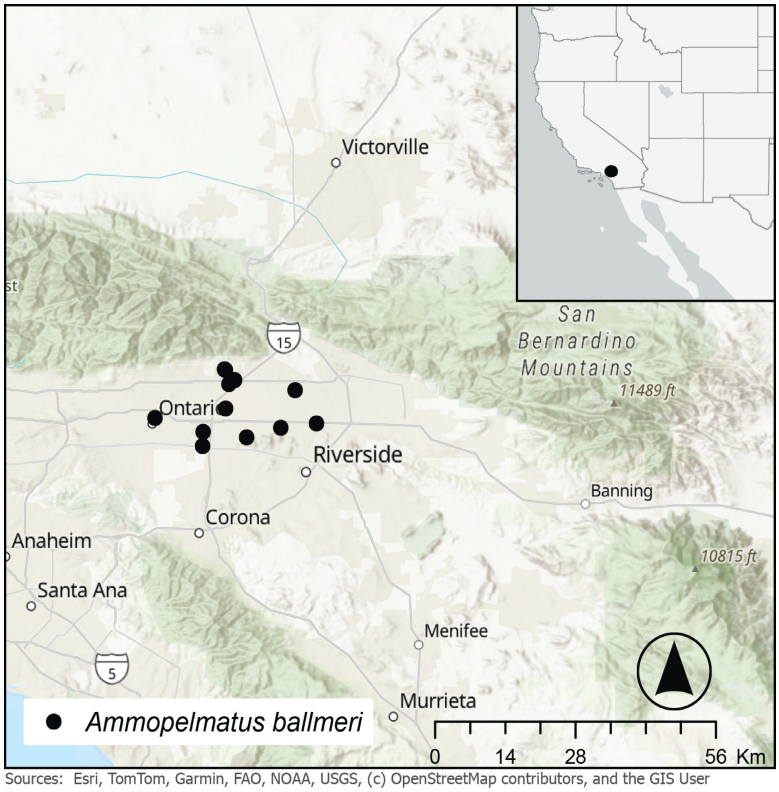


FIGURE 735. Known distribution of *A. ballmeri.*



FIGURE 736. Sympatric adult males *A. ballmeri,* on left, S96-5, R96-148; compared to *A. etiwanda*, on right, S96-5, R96-113.

Holotype. Male (in alcohol, Fig. 737). **California, *San Bernardino Co.,*** Colton, Colton Dunes, Slover Ave. ~0.4 m W intersection with Pepper Ave, 34.063986° -117.358386°, 312m, 2-iii-1991 (S91-9) GR Ballmer. R91-80 & R91-82. Molt to adult 21-x-1991. Deposited CAS, Entomology type #20119. Measurements in mm: Body length

31.92, hind femur length 9.37, hind femur width 3.29. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 738) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 737. Holotype adult male of *A. ballmeri.* A. When alive. B. When preserved.

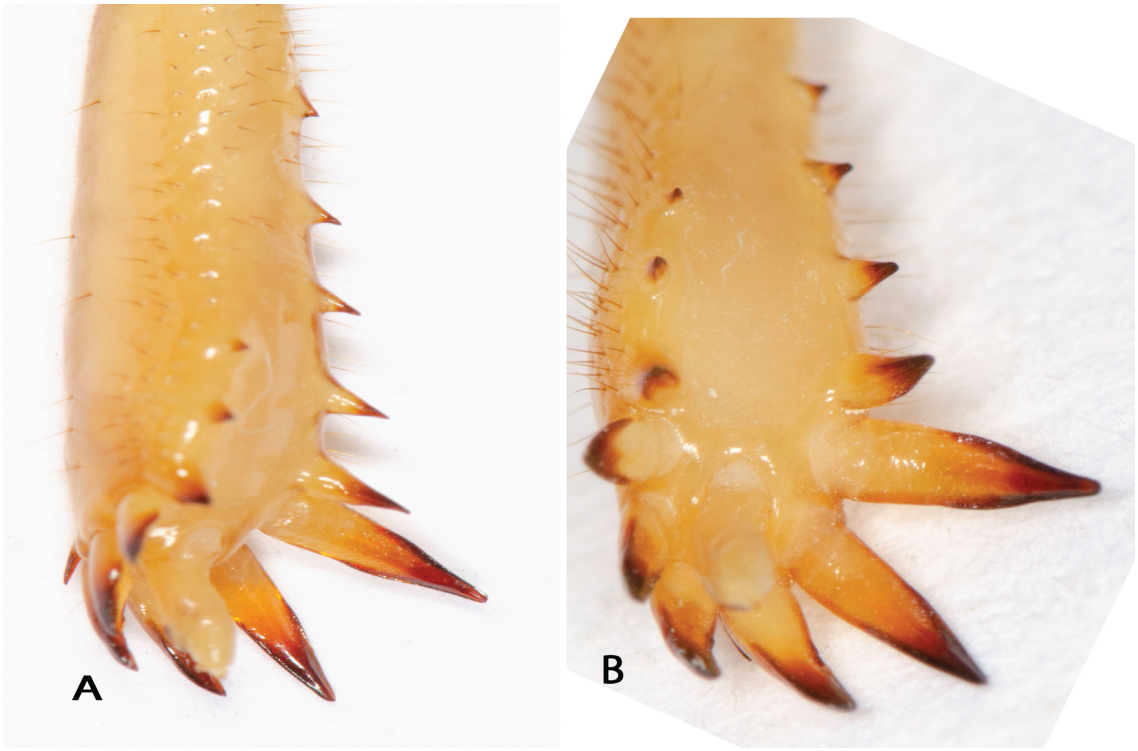


FIGURE 738. Left rear leg tibia in adult male holotype *A. ballmeri.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 739). Same locality data as holotype except 29-v-1990 (S90-63). R90-53. Molt to adult 8-x-1990. Deposited CAS, CALENT #9083372. Measurements in mm: Body length 35.81, hind femur length 8.98, hind femur width 3.39. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 740) with 5 or 6 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 741.

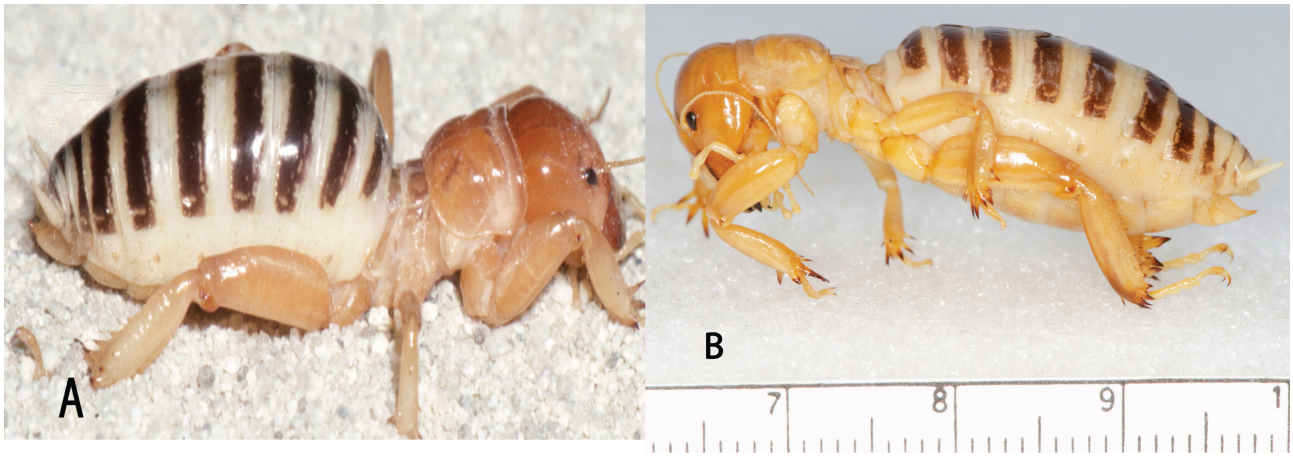


FIGURE 739. Allotype adult female *A. ballmeri.* A. When alive. B. When preserved.



FIGURE 740. Left rear tibia in allotype female. A. Showing 4 outer and 6 inner spines. B. Showing shape of calcars. Note how marked #1 inner and outer spines have their posteriorly facing sides flattened.

Paratypes. ♂15 ♀27. **CALIFORNIA, *San Bernardino Co.,*** type locality, 12-i-1991 (S91-3) GR Ballmer ♀2; 2-iii-1991 (S91-9) GR Ballmer ♂1 ♀1; 4-iv-1991 (S91-11) ♀2; 1-xi-1992 (S92-135) GR Ballmer ♂3 ♀1; 20-xii-1992 (S92-141) ♂5 ♀7. Etiwanda, alluvial fan and Etiwanda Ave, 34.157146° -117.523126°, 560m, 7-xii-1997 (S97-142) GR Ballmer & KT Stockwell ♀2. Fontana, Etiwanda Wash adjacent to Etiwanda Ave 1 m S Arrow Hwy, 34.089647° -117.521151°, 340m, 5-i-1997 (S97-5) GR Ballmer & KT Stockwell ♀2. Fontana, abandoned vineyard near intersection Santa Ana and Tamarind Ave, 34.056513° -117.422276°, 322m, 29-i-1997 (S97-27) KT Stockwell ♂1. Fontana, adjacent Southridge housing development, at base of Jurupa Hills, 34.040053° -117.483582°, 277m, 16-xii-1994 (S94-117) G. Ballmer ♀2. Ontario, abandoned vineyard, N side Greystone Dr. near Stanford Ave, 34.025071° -117.562475°, 246m, 27-ii-1997 (S97-26) KT Stockwell ♀1. Ontario, 307 E Granada Ave, 34.073346° -117.647617°, 321m, 18-xi-1999 (S99-162) M. Wilcox & B. Pemberton ♀1. North Rancho Cucamonga, along E side Etiwanda Ave, in wash, 34.156010° -117.521636°, 547m, 12-ii-1996 (S96-5) KT Stockwell ♂2. Rancho

Cucamonga, Highland Ave ½ m W I15, 34.138583° -117.505127°, 431m, 7-xii-1997 (S97-143) GR Ballmer & KT Stockwell ♂2 ♀2. Etiwanda, Highland Ave ½ m W I15, 34.131699° -117.515299°, 419m, 5-i-1997 (S97-4) GR Ballmer & KT Stockwell ♂1 ♀2. Rialto, near Cedar & Baseline, 34.121181° -117.396672°, 420m, late March, 1990 (S90-30) J. Gannon ♀1. 1 km E Ontario Airport, ~ ¼ m N Milliken Solid Waste Disposal site, nr intersection Jurupa Ave and Dupont, 34.049464° -117.561528°, 260m, 5-i-1997 (S97-3) GR Ballmer & KT Stockwell ♀1.



FIGURE 741. Ovipositor allotype *A. ballmeri.*

Drum. Similar in both sexes. **Male:** Holotype (Fig. 742, R91-82) with 48 drums in 9.7s (4.9 drums/s) at 20°C. **Female:** Allotype (Fig. 743, R90-53) with 83 drums in 17.0s (4.9 drums/s) at 20.5°C.

Derivation of name. Named after Greg R. Ballmer who collected the first specimens, and who has been a tireless advocate for the protection of the Colton Sand Dunes. His successful petitioning for Federal endangered species status of the Delhi Sands flower-loving fly (*Rhaphiomidas terminates abdominalis* Cazier) has also helped protect *A. ballmeri*'s type locality site, where this JC species reaches its highest density.

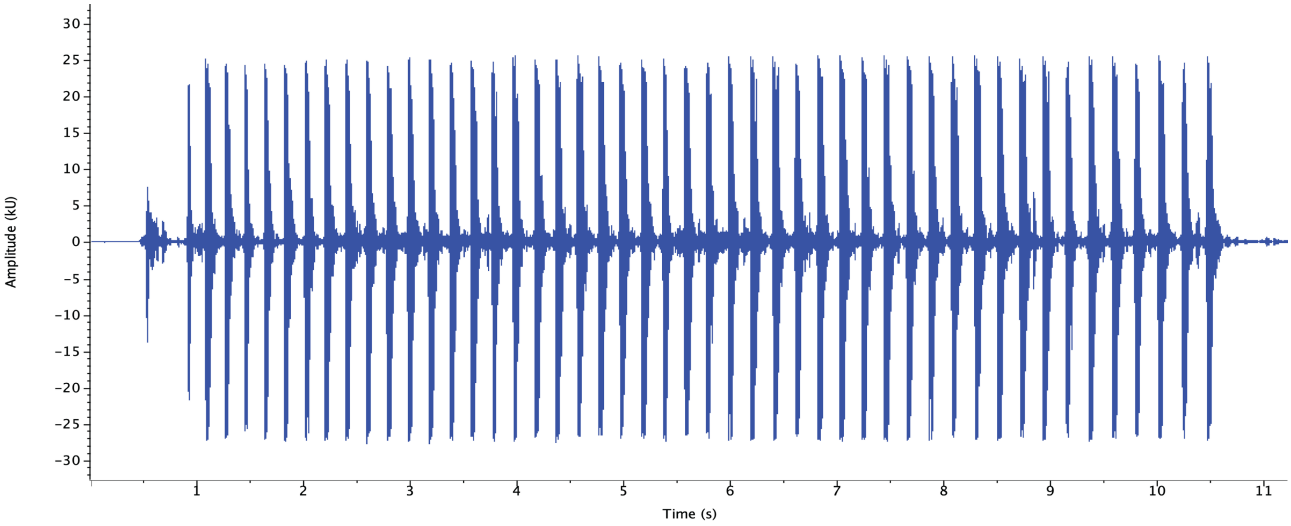


FIGURE 742. Calling drum (R91-82) adult male holotype *A. ballmeri*.

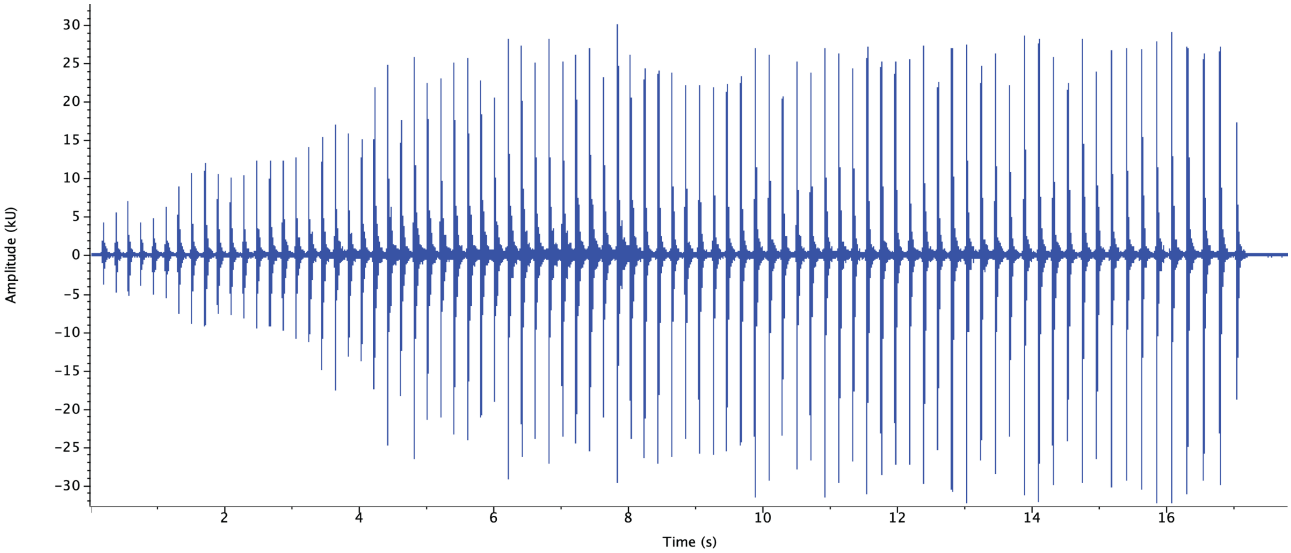


FIGURE 743. Calling drum (R90-53) adult female allotype *A. ballmeri*.

Habitat. Sandy type locality plants include California buckwheat (*Eriogonum fasciculatum*), California croton (*Croton californicus*), deerweed (*Acmispon glaber*), and California evening primrose (*Oenothera californica* sp. *californica*).

Life cycle and seasonal occurrence. Some individuals collected in 1992 did not molt to adult until 1995. We are unsure if this slow growth resulted from lack of adequate nutrition and/or moisture or whether *A. ballmeri* actually can have a 3-year life cycle. Such should be investigated using our current, better-diet regime (see p. 12).

Variation. From some 26 individuals, 15 had 2 and 11 had 3 ventral **fore** leg tibial spurs; 1 had 6, 2 had 7 and 21 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 3 had 4, 21 had 5 and 2 had 6 inner **rear** leg tibial spines, while 1 had 2, 23 had 3, and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color**: Some topotypic adult females (Fig. 744, S91-3, R91-3) are darker than the allotype.



FIGURE 744. Darker than usual adult female *A. ballmeri* (S91-3).

DNA. Fig. 734, p. 418. F0031 (S92-141, type locality), F0351 (S96-5, Etiwanda Wash), F0566 (S97-26, Ontario), and F0602 (S97-3, Ontario) recovered in Group 13 Southern California #3 closest to three individuals of *A. cahuilaensis*, despite the 2 taxa (Table 6, p. 33) having different (1) karyotype numbers; (2) absence of a SCD in *A. ballmeri* while present in *A. cahuilaensis*; and (3) 3 inner rear leg tibial spines in the latter while 5 inner spines typical in *A. ballmeri.*

Karyotype. 2n♂=23. Three males checked and all with similar results: T93-5 (Fig. 745) and T93-17 (Fig. 746) (both type locality S92-141) and T97-18 (Fig. 747, S97-5, Fontana) all with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

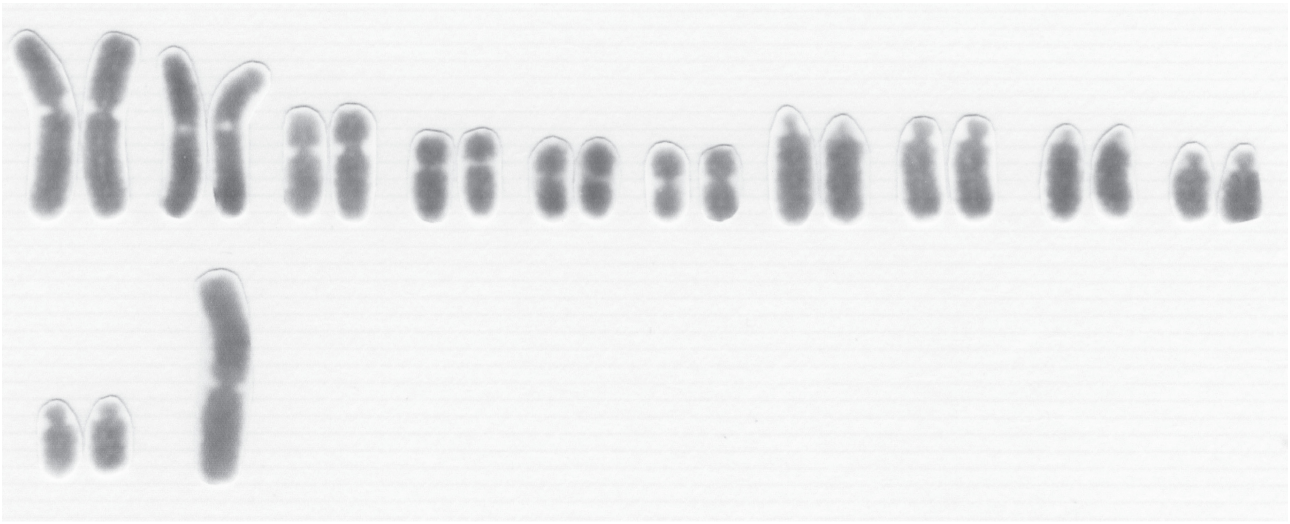


FIGURE 745. Idiogram T93-5 *A. ballmeri* (S92-141).

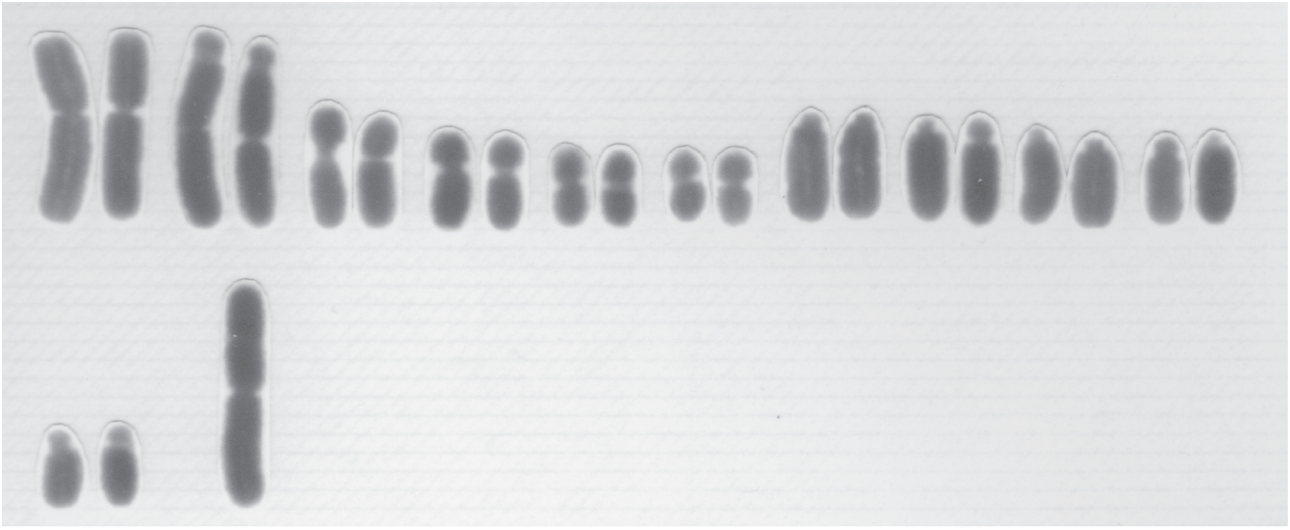


FIGURE 746. Idiogram T93-17 *A. ballmeri* (S92-141).

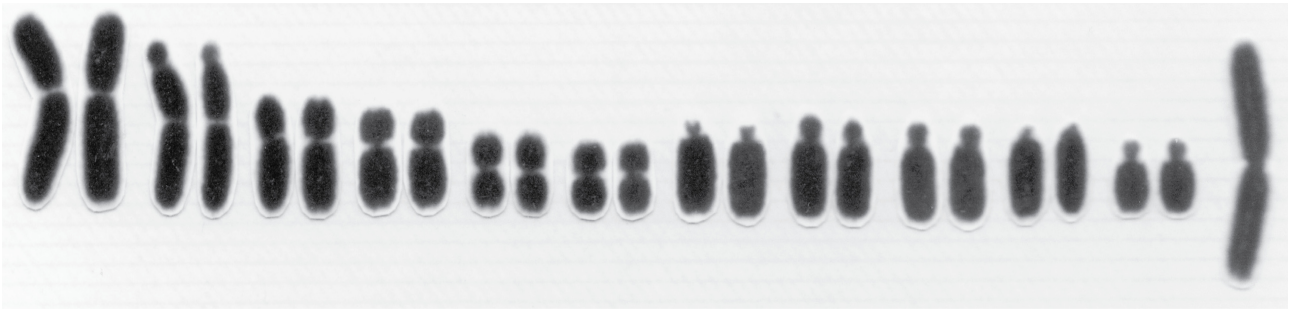


FIGURE 747. Idiogram T97-18 *A. ballmeri* (S97-5).

Discussion. The type locality Colton Dunes are ~1-mile square in area and home to the Delhi Sands flower-loving fly (*Rhaphiomidas terminates abdominalis*), which was the first US fly listed as endangered, in 1993, by the U.S. Fish and Wildlife Service, according to Wikipedia. This fly subspecies is also endemic to the sand dune formations of San Bernardino Valley, from Colton to Ontario. These sand dunes originally covered about 50

square miles, and have dwindled to 2 percent of their original area. The Colton Dunes are the largest inland sand dune formation in Southern California, exclusive of the desert. The vegetation of these dunes has been defined as the Desert Sand-verbena series in Sawyer and Keeler-Wolf (1995). Rivers and Land Conservancy holds title or conservation easement on seven properties totaling about 100 acres, which are preserved and managed as habitat for the Delhi Sands flower-loving fly.

***Ammopelmatus cahuilaensis* (Tinkham)**
Coachella Valley Jerusalem Cricket (CVJC)
Figs 748–759, Tables 6, 16

1968 *Stenopelmatus cahuilaensis* Great Basin Naturalist, 33, 124–131. Holotype adult male: California, Riverside Co., Palm Springs Depot. Deposited CAS, Entomology Type #16451. Specimen examined.

2021 *Ammopelmatus cahuilaensis* Weissman *et al.* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on hind tibial spines, geographical location, and DNA.

Distribution. (Fig. 748). Only known from active or stable aeolian dune systems in western Coachella Valley, Riverside Co., California, generally between (just west of) Cabazon and Thousand Palms.

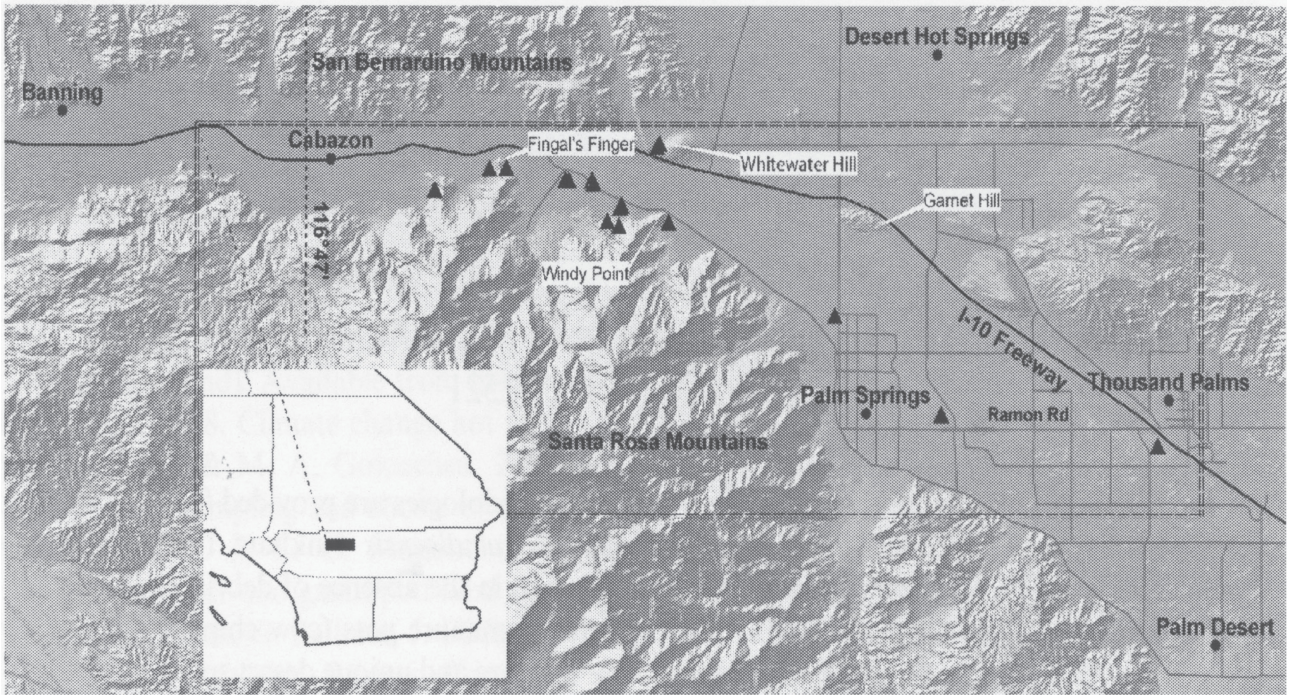


FIGURE 748. Past and present distribution (triangles) of *A. cahuilaensis* in Riverside Co., California (modified from Prentice *et al.* 2011). Not shown is western most locality, west of Cabazon, at 33.907818° -116.808817°, 551m, S09-3.

Recognition characters. A medium to large, generally orange colored head and pronotum (Figs 749 & 750) JC, with narrow light to medium brown (not black) abdominal bands. 2n♂=25. Rear leg tibial spines variable in number, but usually 3 inner and 3 outer; with both inner and outer #1 spines posteriorly flattened (Fig. 751). Calling drum around 5 single drums/s. Only known from areas of rolling sand dunes or very sandy substrate. Has to be distinguished from 2 rarely sympatric *Ammopelmatus* species: From *A. calimesa* (Fig. 752) to the west of *A. cahuilaensis*, which has wider, more black abdominal stripes, 3 fore leg tibial spurs, 5 inner rear leg tibial spines, and whose calling drum is composed of single drums delivered at 7 drums/s. Only *A. calimesa* is found west of longitude -116.813877°. From *A. whitewater* to the east of *A. cahuilaensis,* which also has wider, more black abdominal stripes, 3 fore leg tibial spurs, usually 5 rear leg inner spines, and whose calling drum is delivered at 1 drum/s.

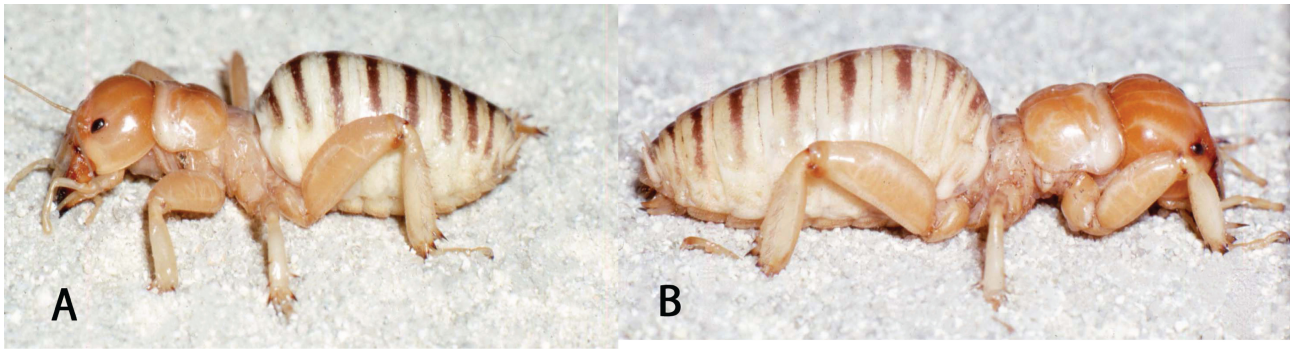


FIGURE 749. Live *A. cahuilaensis*. A. Adult male (S90-23, R90-48). B Adult female (S91-7, R92-118).



FIGURE 750. Preserved adult male (S90-23, R90-48), same as in previous Fig. 749.



FIGURE 751. Left rear leg tibia adult male (S90-19) *A. cahuilaensis,* showing 3 outer and 4 inner spines. Note posterior flattening of both inner and outer spine #1.

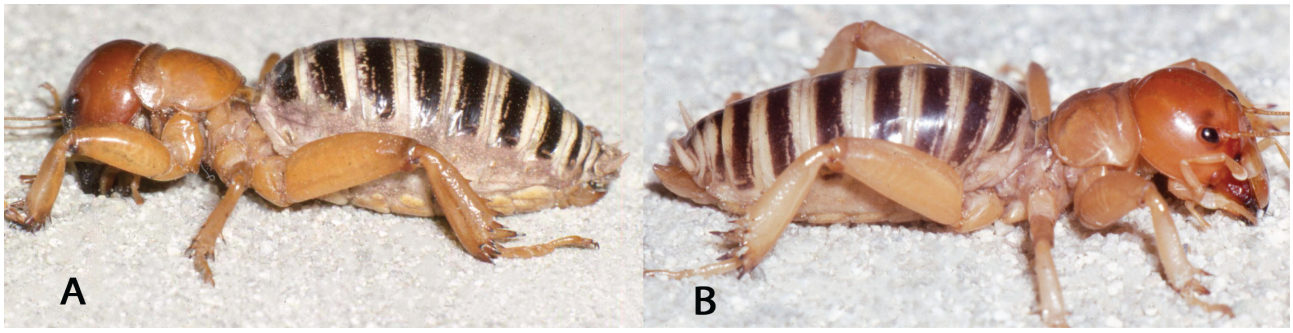


FIGURE 752. Two potentially sympatric species that must be distinguished from *A. cahuilaensis*: A. Live adult female of *A. calimesa* from S09-3 (F2107). B. Live allotype adult female *A. whitewater* from S92-21 (R92-125). Note black, wider abdominal bands in both, when compared with *A. cahuilaensis*.

Adult female. Since Tinkham (1968) did not discuss the female when he described this species, and it is unclear if his "a half-grown nymph" (on his p. 129) is an adult female when she was drumming, we now do so. Female (Fig. 753) similar to male although ringlet of 6 calcars (Fig. 754A) not as long as seen in males (Fig. 751 above). Ovipositor (Fig. 754B).



FIGURE 753. Preserved adult female *A. cahuilaensis* from S90-19.

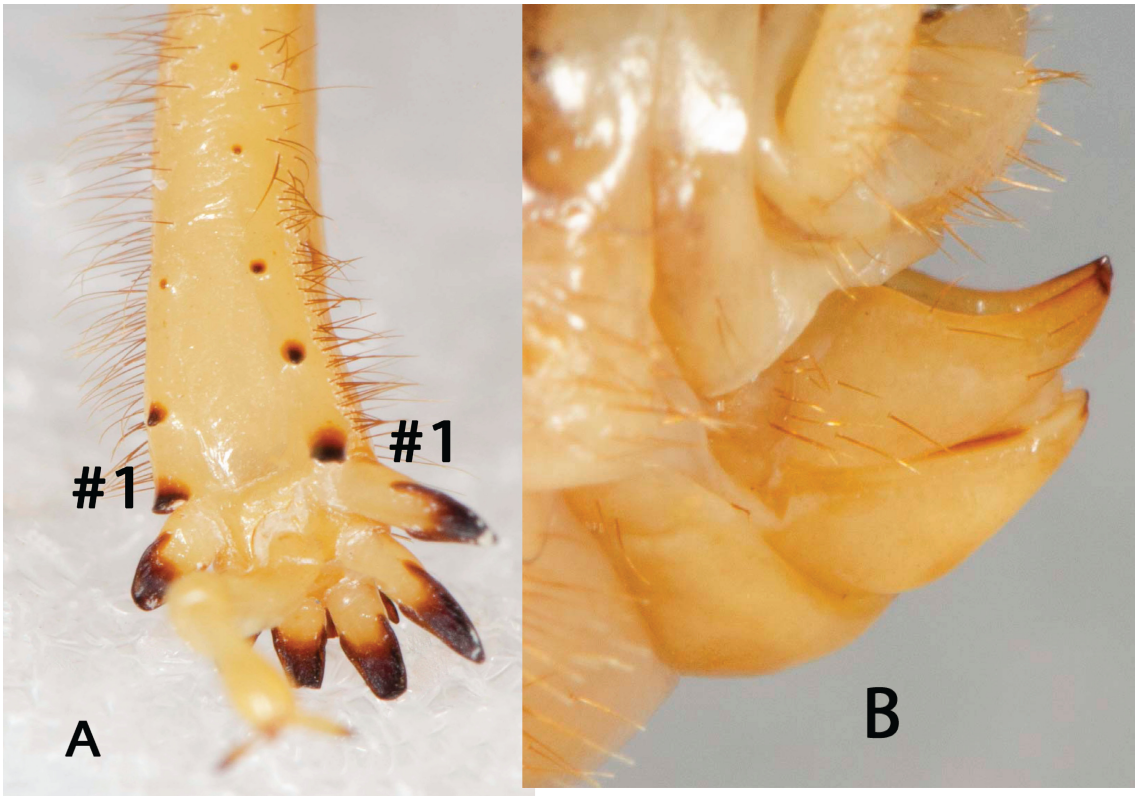


FIGURE 754. Same adult female as in Fig. 753, S90-19, showing (A) left rear leg tibia 3 outer and 5 inner spines, shape of calcars, and tibial hirsuteness. Also note flattening of posterior face of both inner and outer marked spines #1. (B) ovipositor.

Drum. Both sexes with similar calling drums, except longer in female, and males with a sex clarification drum (SCD). **Male** (Fig. 755): R19-60, S19-1, 40 drums in 8.3s at 20.7°C (4.8 drums/s). SCD (Fig. 756) in different adult male: R96-129, S95-3, 7 drums in 0.76s at 17°C (9.2 drums/s). **Female** (Fig. 757): R96-114, S95-3, 171 drums in 35.2s at 19.5°C (4.9 drums/s).

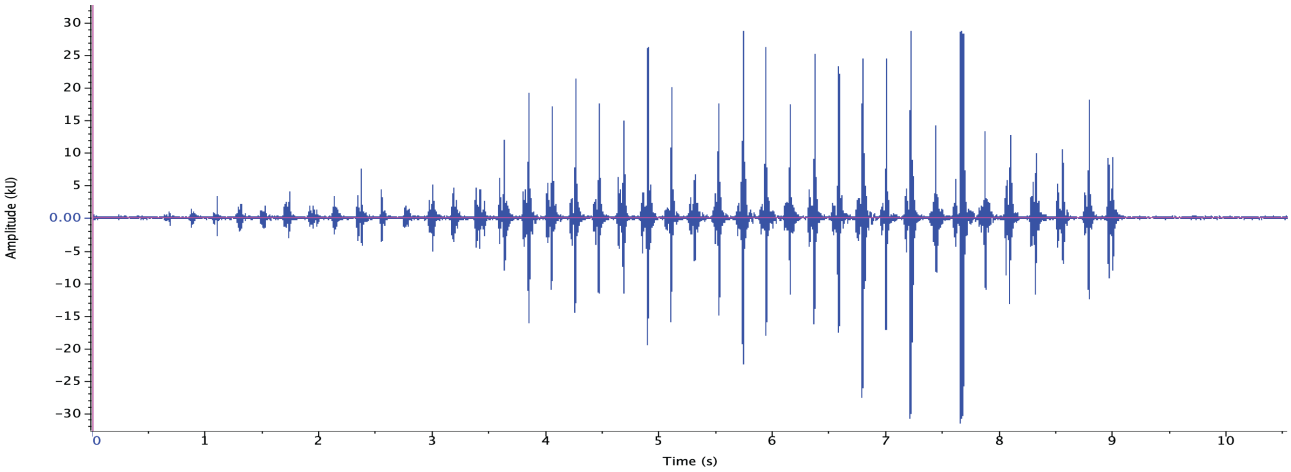


FIGURE 755. Calling drum (R19-60) in adult male *A. cahuilaensis*.

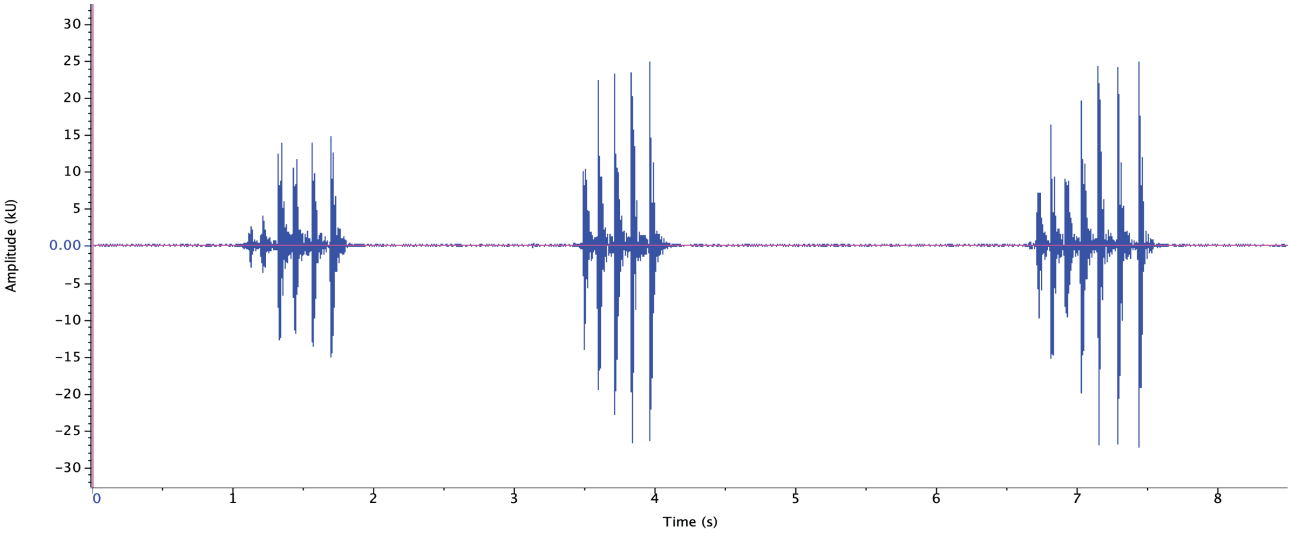


FIGURE 756. Three sex clarification drums (R96-129) in adult male *A. cahuilaensis* (S95-3).

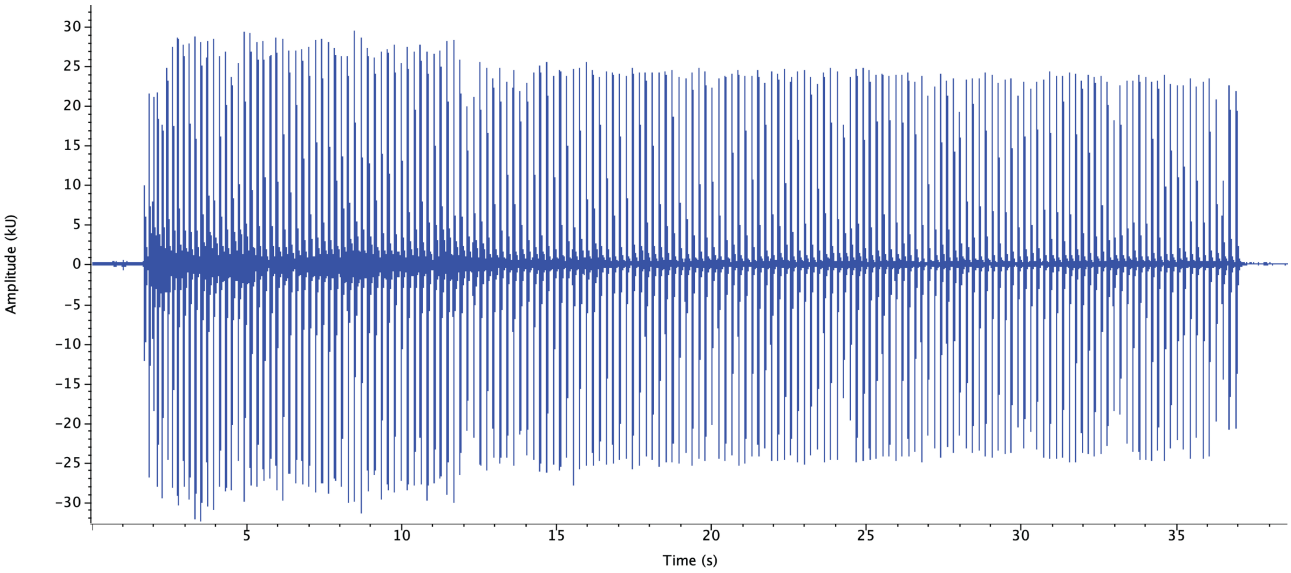


FIGURE 757. Calling drum (R96-114) in adult female *A. cahuilaensis.*

Derivation of name. According to Cameron Barrows (pers. comm. to DBW, April, 2020), Cahuilla (note spelling difference with two "l"s) is the name of the Native American tribe that did (and to a lesser extent still does) occupy the greater Coachella Valley region. Coachella is an artifact of the misspelling of Conchilla (Spanish for little shells) which was a description on one of the original Spanish maps of this region, referring to little shells littering the ground within the lake bed of what is now the Salton Sea, but what geologists have named Lake Cahuilla—the prehistoric lake that occupied the Salton Trough/Basin. "-ensis" is a Latin suffix denoting place or location.

Habitat. Known only from active or stable aeolian dune systems.

Life cycle and seasonal occurrence. All indications are that this species has the usually 2-year life cycle of Jerusalem crickets. But individuals most surface-active during wet and cooler weather.

Variation. **Abdominal stripes:** Can vary as shown in Fig. 749 above. Tinkham (1968) states that all 5 of his males had 2 fore leg spurs. From our larger sample, of over 35 adults of both sexes, 1 had 1, 33 had 2, and 2 had 3 **fore** tibial spurs; 22 had 7 and 15 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; and 26 had 3, 6 had 4 and 2 had 5 **rear** leg inner tibial spines, while 1 had 2 and 33 had 3 rear leg outer tibial spines, all with 2 ventral spurs. In some individuals the rear leg ringlet calcars approached those spatulate ones seen in other sand dune adapted species like *A. kelsoensis, A. muwu, A. davewerneri,* and *A. joshuatree.*

Specimens examined (we do not list those specimens from the San Gorgonio Wash, Snow Creek area (except for S90-109), of which we had many, because they were covered in Prentice *et al.* (2011). Over the years, G. Ballmer, T. Prentice, & S. Heacox have kindly sent us specimens for identification confirmation. **CALIFORNIA, *Riverside Co.,*** Palm Springs, San Rafael Rd near intersection with Puerta del Sol, 33.859439° -116.547567°, 182m, 18-2-1990 (S90-19) G. Ballmer. 1000 Palms Dunes, Ramon Rd between Bob Hope Dr. and I10, 33.815611° -116.409621°, 73m, 24-ii-1990 (S90-23) J. Gannon. Whitewater Canyon, Whitewater Hill, 33.926445° -116.622911°, 451m, 23-iv-2003 (S03-24) T. Prentice; 1-ii-2019 (S19-1) S. Heacox. 2 m NW Windy Point, near intersection of Tipton and Wendy Rds., 33.914125° -116.659092°, 354m, 21-i-1995, (S95-3) W. Icenogle. 1 to 3.5 m W Snow Creek Rd, 15-xii-1990 (S90-109), 2-ii-1991 (S91-7) G. Ballmer. Between Cabezon and Whitewater Canyon, 33.925488° -116.732419°, 473m, 11-ii-2009 (S09-3) T. Prentice ♀1. Cabazon, 33.917515° -116.787240°, 564m, 17-iii-1996 (S96-22) R. Meyer ♂2 ♀1. West Cabazon (most western known locality) 33.907732° -116.808825°, 551m, 11-ii-2009 (S09-3) T. Prentice ♀1.

DNA. Fig. 734, p. 418. F0325 and F0343 (both S95-3, Windy Point), and F2108 (S09-3, near Windy Point), all 3 from near the type locality, were recovered together in their own subclade, closest to *A. ballmeri*, and within the larger Group 13 Southern California #3.

Karyotype. 2n♂=25. Three testes all yielded same 2n count, but the two photographed individuals with somewhat variable results: T91-10 (Fig. 758, S90-109), shows 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T95-15 (Fig. 759, S93-3) shows 4 metacentric or submetacentric autosomal pairs; 8 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

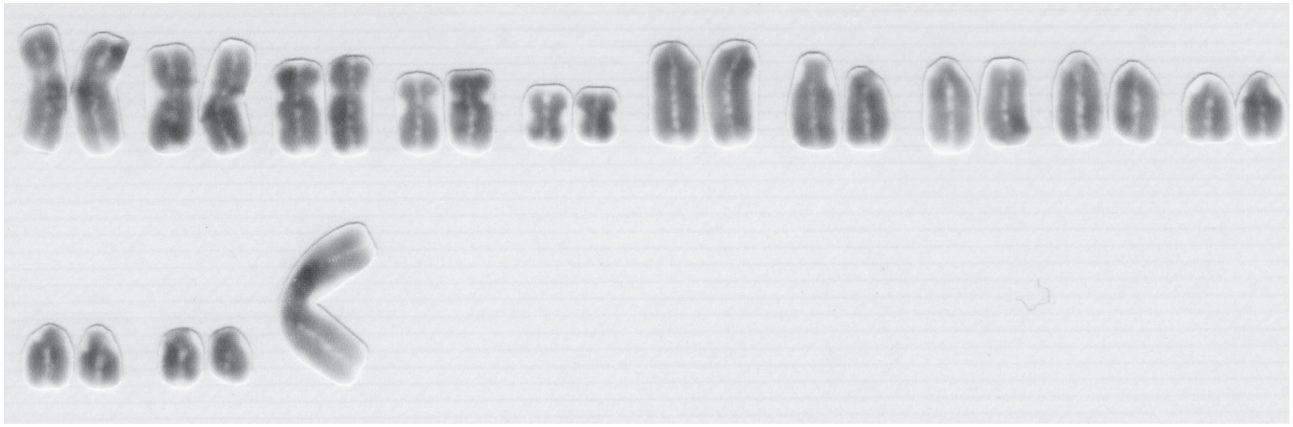


FIGURE 758. Idiogram T91-10 *A. cahuilaensis* (S90-109).



FIGURE 759. Idiogram T95-15 *A. cahuilaensis* (S93-3).

Discussion. According to Cameron Barrows (pers. comm to DBW, April 27, 2020), the CVJC is one of 27 species fully covered (and protected) under the Coachella Valley Multiple Species Habitat Conservation Plan: http://www.cvmshcp.org/ and http://www.cvmshcp.org/pdf%20files/Aeolian%20Sands%20Monitoring%20Protoc

ol%20Final.pdf. All covered species are monitored (Anon 2018) and protected with the same criteria as if they were listed, as endangered, under the California or Federal Endangered Species Acts. This Plan includes an active effort to purchase all occupied habitats currently in private ownership and have them owned and managed under a conservation authority. For those lands already in public ownership, they are managed to the extent feasible to reduce threats to all covered species. Barrows (2012) discusses the relationship between rainfall and arthropod abundance on a Coachella Valley sand dune system.

Polis (1979) discusses predation of *A. cahuilaensis* by the local scorpion *Paruroctonus mesaensis* Stahnke at the Windy Point site. Polis (pers. comm. to DBW, 1988) provided the following data points for predation episodes: 26-i-1976 (29mm length *A. cahuilaensis*), 26-ii-1976 (28mm), 17-iii-1976 (20mm), 2-iv-1976 (27mm), and 29-ix-1976 (2mm and 22mm), with no other records of predation from May, 1973–August, 1981.

Prentice *et al.* (2011) developed an ingenuous method for conducting field surveys and determining distributions in this taxon. Fortunately, such labor-intensive techniques are not needed for those taxa that reside in inland sand dunes in Washington, Oregon, Idaho, Wyoming, and some localities in Nevada, where oatmeal trails work well, since late instars and adults are more surface active, in those areas, during the summer months, than the CVJC is.

Ammopelmatus calimesa **Weissman, sp. nov.**

Calimesa Jerusalem Cricket
Figs 760–771, Table 6

Species #22, Weissman 2001b.

Distribution. (Fig. 760). Only known from Riverside Co., and a small area of neighboring San Bernardino Co., California, including several localities around the city of Calimesa; and almost as far east as Cabazon in the Coachella Valley.

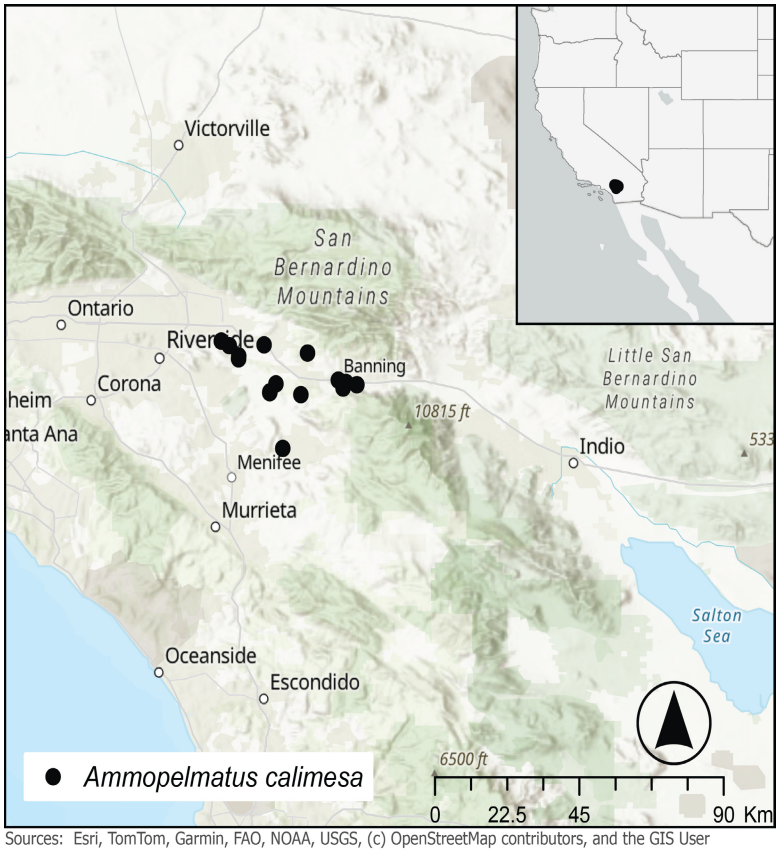


FIGURE 760. Known distribution of *A. calimesa.*

Recognition characters. Medium-large, moderately fast drumming (~7 drums/s) JC with 2n♂=23. Can be separated from nearby, similarly drumming *A. stringfellow* by 2n♂=25 in the latter and different DNA. Can be separated from more eastern *A. cahuilaensis* because the latter has a slower drum rate, narrower and lighter black abdominal bands, 2n♂=25, and different habitat and DNA. Separated from nearest DNA relative *A. sanjacinto* by slower drum rate in latter, and habitat.

Holotype. Male (in alcohol, Fig. 761). **California, *Riverside Co.,*** Calimesa, adjacent to I-10 eastbound between Live Oak Canyon Rd offramp and more eastern Rest Stop, 34.013683° -117.084258°, 653m, 24-ii-2001 (S01-6) DBW & VF Lee. R01-91, F1213. Molt to adult 8-ix-2001. Deposited CAS, Entomology type #20168. Measurements in mm: Body length 35.27, hind femur length 11.67, hind femur width 4.35. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 762) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

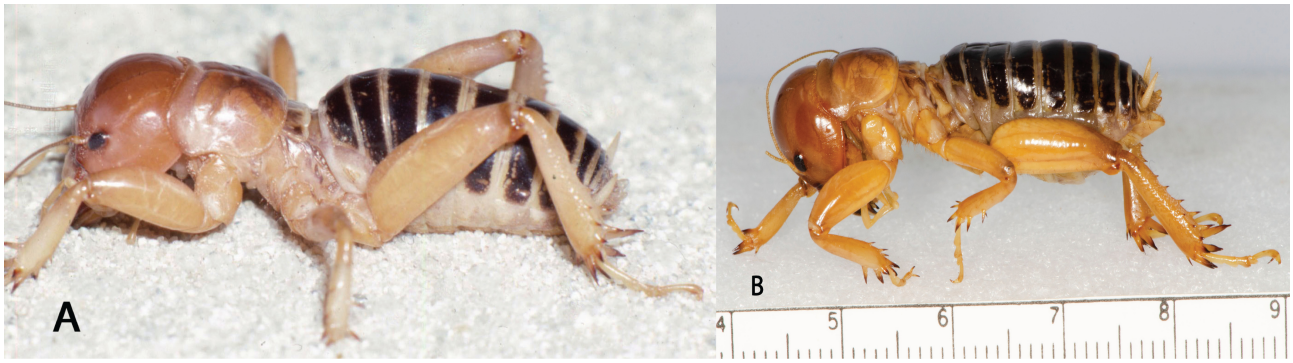


FIGURE 761. Holotype adult male *A. calimesa.* A. When alive. B. When preserved.



FIGURE 762. Left rear leg tibia holotype adult male *A. calimesa.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 763). Same collection data except 20-xii-1992 (S92-140), R94-59. Molt to adult 4-ix-1994. Deposited CAS, CASENT #9082084. Measurements in mm: Body length 34.46, hind femur length 10.16, hind femur width 3.89. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 or 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 764) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 765.

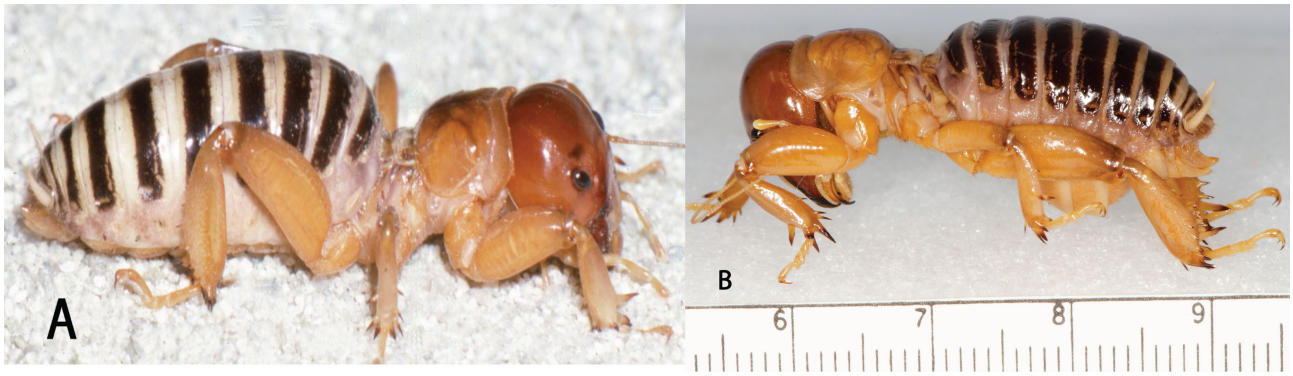


FIGURE 763. Allotype adult female *A. calimesa*. A. When alive. B. When preserved.



FIGURE 764. Left rear leg tibia allotype *A. calimesa.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 765. Ovipositor allotype *A. calimesa.*

Paratypes. ♂20 ♀38. **CALIFORNIA, *Riverside Co.*** Type locality 12-xii-1982 (S82-139) ♂1 ♀5; 21-xii-1986 (S86-169) ♂1 ♀3; 20-xii-1992 (S92-140) ♀2; 20-iv-1994 (S94-12) J. Gannon ♂1; 24-ii-2001 (S01-6) ♂2 ♀5. Badlands, Redlands Blvd ½ m S intersection with San Timoteo Canyon Rd, 33.986031° -117.155334°, 537m, 10-iv-1994 (S94-13) W. Icenogle ♂1 ♀1; Redlands Blvd 1 m S intersection with San Timoteo Canyon Rd, 33.978790° -117.155637°, 571m, W. Icenogle, 8-i-1995 (S95-5) ♀1; 29-i-1995 (S95-24) ♀2. Badlands, Jackrabbit Trail 2 m S Hwy 60, 33.916289° -117.051162°, 593m, 11-iv-1994 (S94-14) W. Icenogle ♂1 ♀1. Badlands, Jackrabbit Trail ½ m N Gilman Springs Rd, 33.896407° -117.068038°, 479m, 26-ii-1995 (S95-23) W. Icenogle ♂3 ♀1. Badlands, Jackrabbit Trail, 0.3 m NE Gilman Springs Rd, 33.894351° -117.068422°, 490m, 2-ii-2008 (S08-2) ♂3. San Timoteo Canyon, 34.023151° -117.204244°, 413m, mid-ii-1994 (S94-4) J. Gannon ♀2. Banning, 33.925571° -116.876410°, 710m, 8-iii-1990 (S90-25) J. Gannon ♀5. Hwy 243 2 m S Banning, 33.905789° -116.863116°, 763m, 16-ii-1995 (S95-12) J. Gannon ♂1. Banning, near Airport, 33.91978° -116.85497°, 661m, 24-i-2010 (S10-6) ♀2; 21-iii-2023 (S23-30) ♂1 ♀3. Hwy 79, Lamb Canyon, 4 m S Beaumont, 33.889386° -116.981269°, 746m, 1-x-2008 (S08-82) W. Icenogle ♂1 ♀1. Between Banning and Cabazon, 33.914154° -116.824526°, 590m, 11-ii-2009 (S09-3), 3-iii-2009 (S09-5) T. Prentice ♂1 ♀3. Cherry Valley, area around 8834 Apple Tree Lane, 33.993243° -116.962633°, 1026m, both J. Gannon, 5-iv-1990 (S90-28) ♂2; 11-xi-1993 (S93-87) ♀1. ***San Bernardino Co.,*** San Timoteo Canyon Rd near intersection with Alessandro Rd, 34.011832° -117.181875°, 447m, early March, 1991 (S91-10) J. Gannon ♂1.

Possible placement. **CALIFORNIA, *Riverside Co.*,** Hemet, NE of Warren Rd and Hwy 74, 33.755232° -117.031955°, 461m, 17-ii-1995 (S95-21) J. Gannon ♂1 ♀1. These 2 individuals (F0168 and F0292) were recovered near *A. calimesa* (type locality around 724m) and *A. sanjacinto* (type locality around 1747m), and some 33 km from the type locality of the former. But the western parts of the San Jacinto Mts are between Hemet and Calimesa, thus this assignment is considered tentative; although the drumming rates (male R95-101, 7.2 drums/s at 20°C; female R96-76, 7.0 drums/s at 20.5°C) for these 2 individuals are closer to those seen in *A. calimesa.*

Drum. Calling drum similar in both sexes except males with a sex clarification drum. **Male:** Holotype R01-91 (Fig. 766) shows 43 drums over 5.9s (7.3 drums/s) at 19.5°C. **Female:** Allotype R94-59 (Fig. 767) shows 33 drums over 4.5s (7.3 drums/s) at 21°C. This is one of few species where males and females have similar numbers of drums in their calling song: Of 5 type locality males, they had from 32–68 drums; of 8 type locality females, they had from 28–137 drums.

Derivation of name. Named in reference to the town of Calimesa around which the type series was collected.

Habitat. Open grassland areas to badlands coastal sage scrub.

Life cycle and seasonal occurrence. Apparently typical 2-year life history.

Variation. For 39 paratype individuals, 4 had 2 and 34 had 3 ventral **fore** leg tibial spurs; 1 had 7 and 37 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 37 had 5 and 1 had 6 inner **rear** leg tibial spines, while 37 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Some individuals (Fig. 768) can appear "lighter" in body color because their black bands are not as wide as those from the type locality.

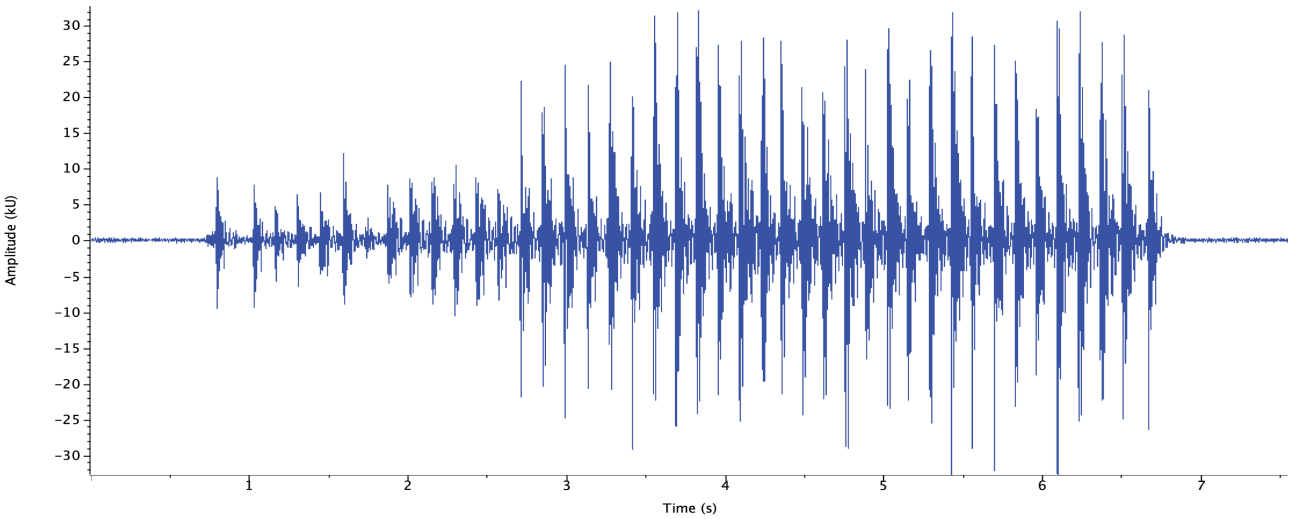


FIGURE 766. Calling drum (R01-91) holotype male *A. calimesa.*

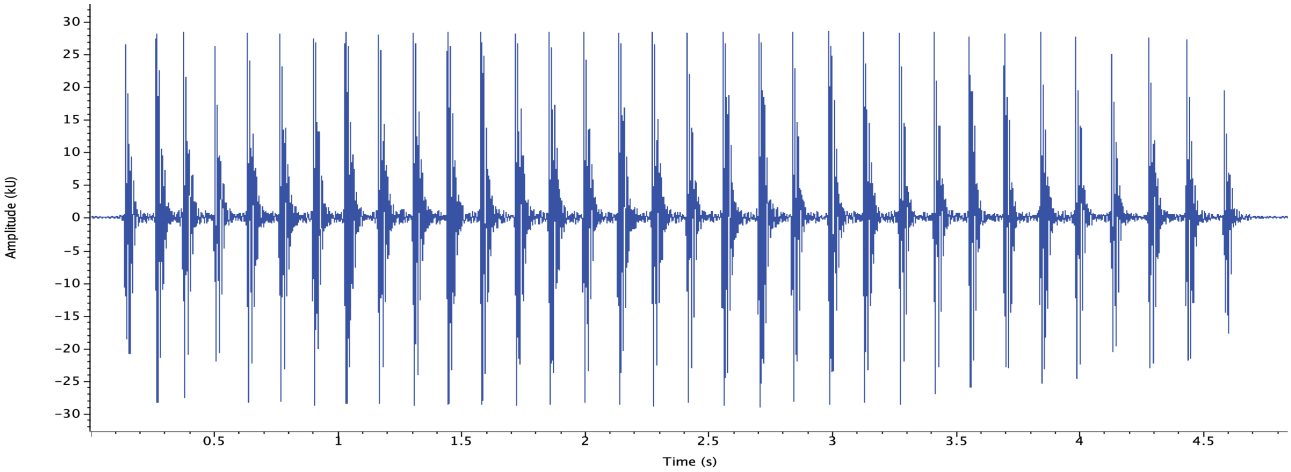


FIGURE 767. Calling drum (R94-59) allotype female *A. calimesa.*



FIGURE 768. Adult male *A. calimesa* (S86-169, R87-26 & 35) that appears "lighter in color" because of narrower black abdominal bands.

DNA. Fig. 734, p. 418. F0155 (S95-12, Banning), F1214 (type locality, S01-6), F2066 (S08-2, Badlands), F2092 (S08-82, 4 m S Beaumont), F2107 (S09-3, near Cabazon): F2950 (S23-30, near Banning Airport) all recovered together in Group 13 Southern California #3, and nearest to *A. sanjacinto.*

Karyotype. 2n♂=23. Three males examined and all consistent: T93-21 (Fig. 769, type locality S92-140); T95-12 (Fig. 770, S95-23, Badlands); and T02-2 (Fig. 771, type locality S01-6) and all with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 769. Idiogram T93-21 *A. calimesa* (S92-140).

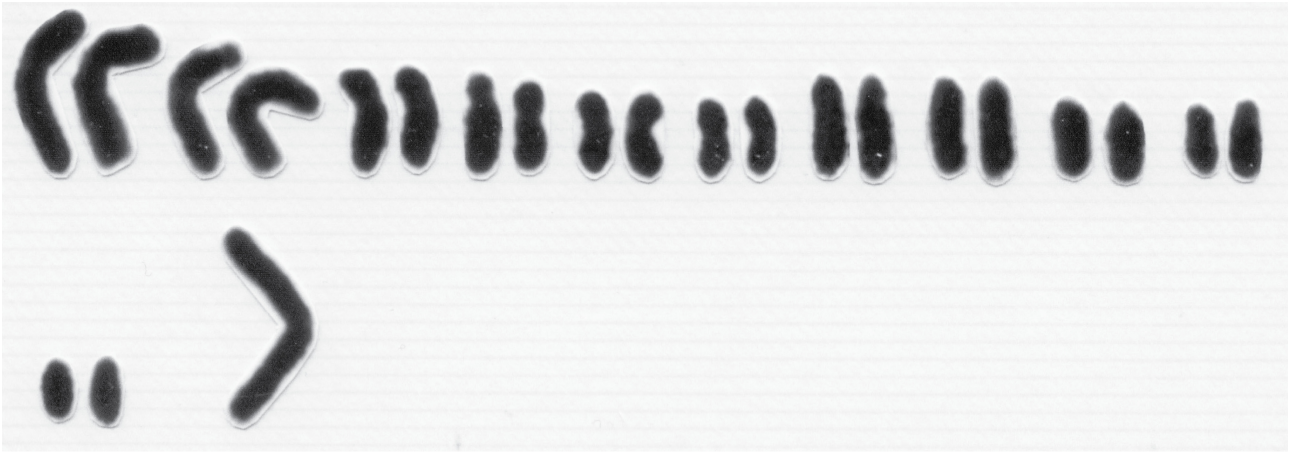


FIGURE 770. Idiogram T95-12 *A. calimesa* (S95-23).

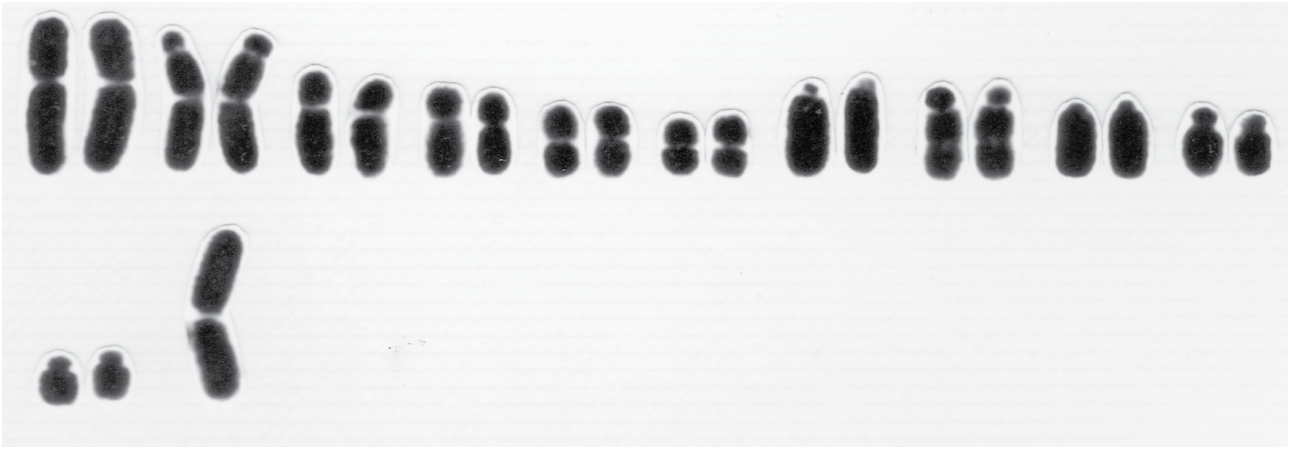


FIGURE 771. Idiogram T02-2 *A. calimesa* (S01-6).

Discussion. Found sympatric at type locality with less common *A. mahogani.* At Cherry Valley site (S90-28), found with *A. mahogani* and a slow drumming (~1 drum/s) JC, that could be one of several species, but in the absence of DNA information, is undetermined.

Over a 16 km linear stretch of the sandy Coachella Valley floor between Banning and Whitewater Canyon, 3 species of *Ammopelmatus* occur: *A. calimesa* that drums at 7 drums/s; *A. cahuilaensis* that drums around 5 drums/s; and *A. whitewater* that drums at 1 drum/s.

***Ammopelmatus fisheri* Weissman, sp. nov.**
San Diego County Jerusalem Cricket
Figs 772–787, Tables 7, 37

Species #15, Weissman 2001b.

Distribution. (Fig. 772). Widespread in lower elevations San Diego Co., California, and NW Baja California, Mexico.

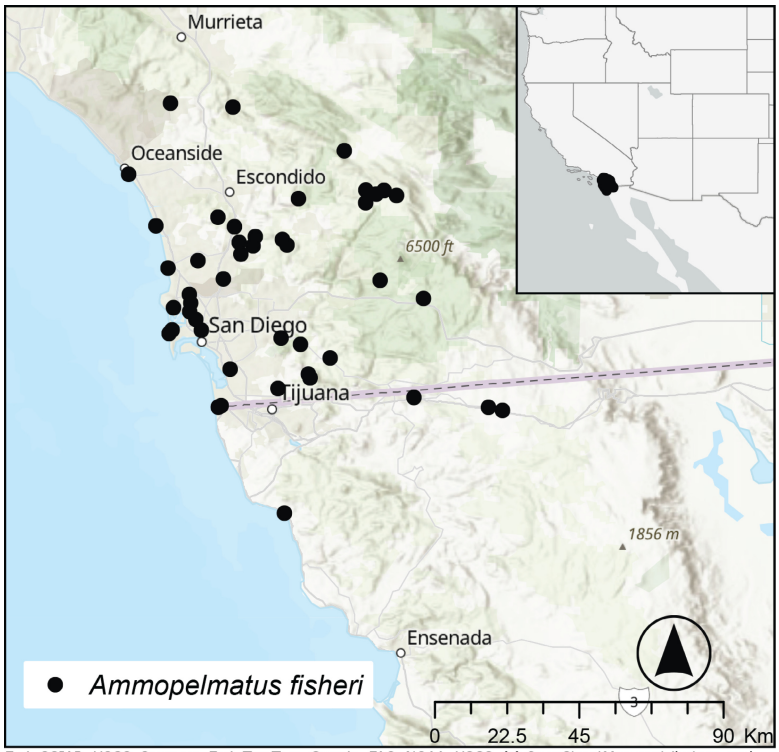


FIGURE 772. Distribution of *A. fisheri.*

Recognition characters. May be a multi-species complex, based on drum rate, elevation diversity, and DNA results. Small-medium, rarely large JC with wide, dark black abdominal stripes, rear leg calcar #1 broad and long in males, usually darkened, rear leg tibia frequently infused with reddish coloring. Calling drum 4–7 drums/s but variable between populations, and with male's drum rate similar to female's rate. Males with sex clarification drum, 2n♂=23. Sympatric with Winchester Group *A. sandiego*, from which it differs by slower male drum rate, DNA, and inner rear leg tibial spine #3 shorter than spines #1 and #2. Most closely related to a poorly supported complex of geographically neighboring species including *A. lagunahanson* (2n♂=23), *A. sanpedromartir* (2n♂=25), and *A.* sp. #4.

Holotype. Male (in alcohol, Fig. 773). **California, *San Diego Co.,*** Tijuana River Estuary, TJE-9, 32.5391° -117.10913°, 24m, 28-v-1997 (S97-38) RN Fisher. R97-124, F0534. Molt to adult 30-viii-1997. Deposited CAS, Entomology type #20189. Measurements in mm: Body length 34.01, hind femur length 11.6, hind femur width 4.29. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 774) with 5 inner and 3 outer spines, 2 ventral spurs. Inner rear leg tibia spine #1 always longest.

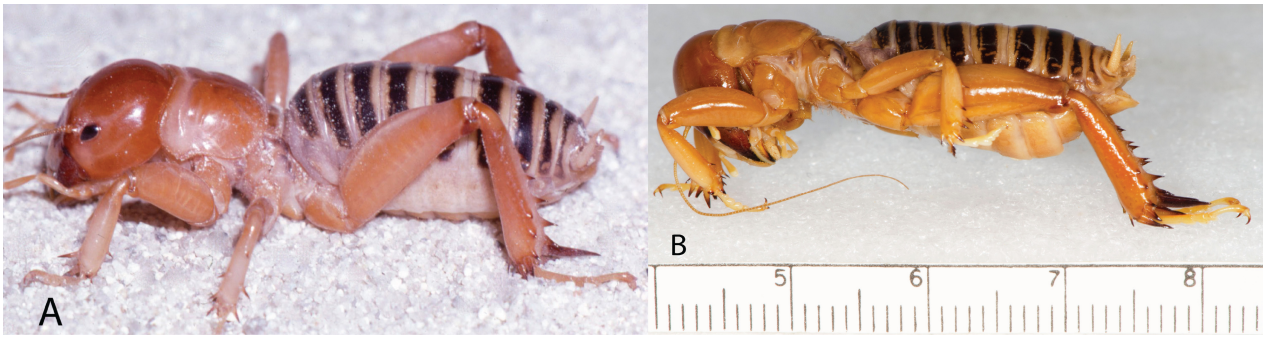


FIGURE 773. Holotype adult male *A. fisheri.* A. When alive. B. When preserved.

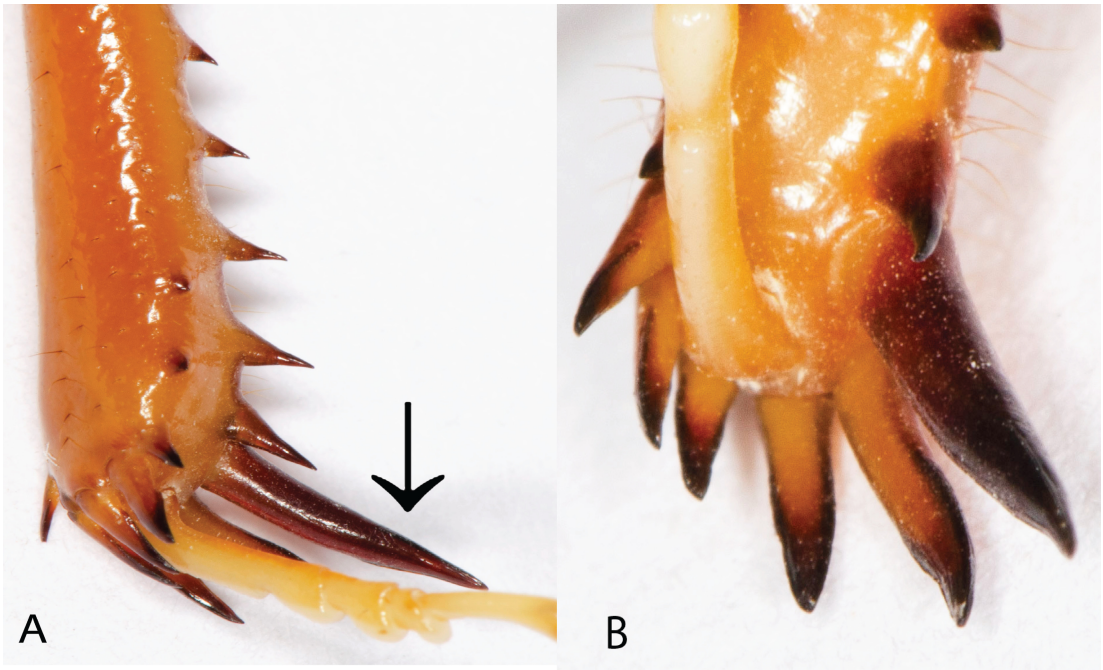


FIGURE 774. Left rear leg tibia holotype adult male *A. fisheri.* A. Showing 3 outer and 5 inner spines. Note development of calcar #1 (arrow). B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 775). **California, *San Diego Co.,*** Tijuana River Estuary, TJE-6, 32.53508° -117.1171°, 23m, 18-iii-1997 (S97-32) RN Fisher. R97-104, F0512. Molt to adult 27-viii-1997. Deposited CAS, CASENT #9080215. Measurements in mm: Body length 31.62, hind femur length 9.06, hind femur width 3.34. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 776) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 777.

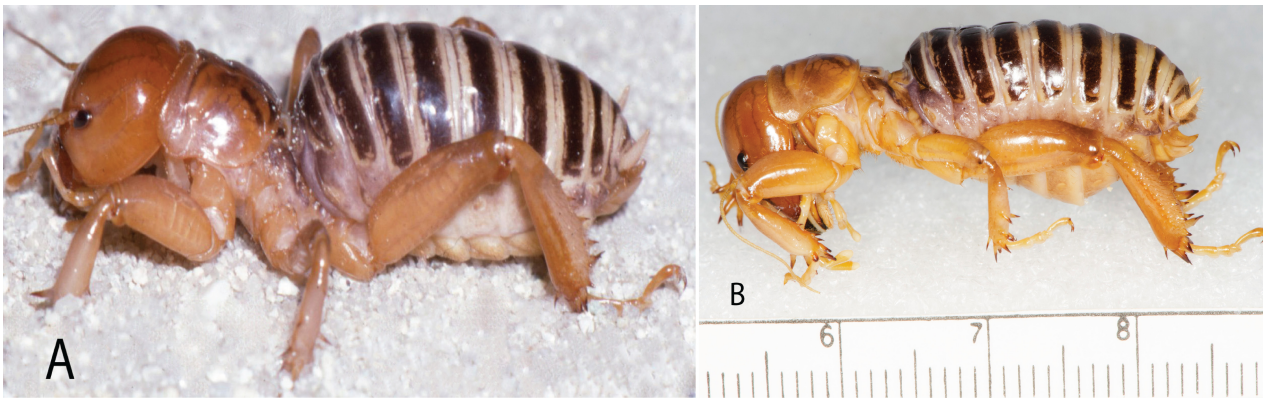


FIGURE 775. Allotype adult female *A. fisheri.* A. When alive. B. When preserved.



FIGURE 776. Left rear leg tibia allotype female *A. fisheri.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 777. Ovipositor allotype *A. fisheri*.

Paratypes. ♂64 ♀64. **MEXICO, *Baja California,*** Puerto Nuevo, Hwy 1 Libre at Km sign 44, 32.241420° -116.932014°, 27m, 19-xii-1996 (S96-117) ♀1. Hwy 2 libre ~5 km east Tecate at Km sign 126, 32.561900° -116.569361°, 575m, 19-xii-1982 (S82-143) ♂2; 3-iii-1992 (S92-18) ♂2 ♀2; 19-xii-1996 (S96-118) ♀1. Hwy 2 libre ~27 km east Tecate at Km sign 104, 32.534528°, -116.360569°, 945m, 19-xii-1982 (S82-142) ♂1; 20-xii-1987 (S87-126) ♂2 ♀6; 3-iii-1992 (S92-19) ♀6. Hwy 2 libre ~31 km east Tecate at Km 100.3, ~32.525888° -116.321328°, 974m, 19-xii-1982 (S82-141) ♂1 ♀2. Hwy 3, 16 km S intersection Hwy 2, 2300' 1-x-1979 (S79-220) DC Lightfoot ♂1 dead on road. **CALIFORNIA, *San Diego Co.,*** Boden Canyon, 33.11219° -116.89274°, 323m, 19-vi-2003 (S03-79) E. Erwin ♂1. Carmel Mesa, 24-x-2002 (S02-72) A. Vandergast ♀2. Clairemont, 32.823175° -117.194501°, 96m, 29-x-1985 (S85-125) M. Kessler ♀1; 8-xi-1988 (S88-118) DK Faulkner ♂1. Clairemont, Tecolote Canyon, 32.777638° -117.180096°, 62m, 22-ix-1985 (S85-111) S. Breisch ♂1; i-x-1986 (S86-132) DK Faulkner ♂1. Chula Vista, 32.640023° -117.084084°, 17m, 24-ix-1988 (S88-117) BG Kaya ♂1. Del Mar, 10-x-1986 (S86-138) DK Faulkner ♂1. Del Mar Mesa, 32.94047° -117.1742°, 105m, 24-x-2002 (S02-70) A. Vandergast ♂1. Elliot, 32.88998° -117.103°, 176m, 21-23-x-1997 (S97-135) R. Fisher ♂2. Encinitas, 33.036987° -117.291982°, 32m, 25-ix-1985 (S85-114) DK Faulkner ♂1. Fallbrook, 33.376395° -117.251150°, 210m, 4-xii-1985 (S85-136) RM Messner ♂1 ♀1. Hillcrest, 32.748062° -117.164757, 82m, 15-ix-1988 (S88-114) DK Faulkner ♂1. Hollenbeck

Canyon Wildlife Area, 32.67098° -116.804°, 308m, 21-iv-2003 (S03-44) D. Clark ♀1; 4-vi-22-vii-2003 (S03-70) D. Clark ♂3. Jamul, 32.708729° -116.887031°, 303m, 22-x-2006 (S06-123) V. Jones-Pittman ♀1. Johnson Canyon, north end Harvest Rd, 152m, W. Icenogle, 23-iv-1987 (S87-19) ♀1; 23-27-iii-1996 (S96-87) ♂1 ♀1. Johnson Canyon, 32.586635° -116.950022°, 110m, early May, 1995 (S95-40) T. Prentice, ♂2. Lake Henshaw, 33.24483° -116.76433°, 862m, 22-iii-2003 (S03-17) T. Reeder ♀1. Lake Hodges 33.060774° -117.118221°, 107m, 2-i-2005 (S05-2) ♂2 ♀3. Lake Poway Recreational Area, 33.007136° -117.013582°, 297m, 15-i-2005 (S05-11B) ♂2 ♀4. Linda Vista, 4659 Blackfoot Ave, 32.799662° -117.197492°, 92m, all A. Grennan, 4-xi-1982 (S82-126) ♂1; 1-vi-1983 (S83-77) ♂1 ♀1; 9-x-1986 (S86-135) ♂1. Mt. Soledad, 32.81026° -117.24266°, 93m, 22-iii-2003 (S03-15) J. Pitcairn ♂1 ♀1. Ocean Beach 17-x-1985 (S85-118) M. Schwartz ♀1. Ocean Beach, 32.73893° -117.25501°, 10m, 1-xi-2003 (S03-141) S. Hathaway ♀1. Ocean Beach, 32.748718° -117.246531°, 5m, 3-x-2006 (S06-122) D. Stokes ♂1. Oceanside, Paradise by the Sea RV Park, 33.179567° -117.368309°, 4m, 4-x-2005 (S05-147) D. & J. Humphrey ♂1. Otay Mt, Little Cedar, 32.61648° -116.86039°, 443m, 12-ix-1997 (S97-128) RN Fisher ♀1; 32.62632° -116.86501°, 351m, 12-ix-1997 (S97-128) RN Fisher ♂1; 32.6159° -116.86029°, 426m 7-ii-2007 (S07-2) ♀1. Pala, 33.365676° -117.076238°, 123m, 14-iv-1992 (S92-41) J. Gannon ♂1. Pine Valley, 32.83571° -116.54259°, 1127m, 23-v-2004 (S04-39) D. Palmer & P. Paquin ♂1. Poverty Gulch, 32.886° -116.664°, 832m, 4-iv-2002 (S02-3) E. Ervin ♂1 ♀1. Poway, 14382 Carnitas St., 32.981459° -117.019695°, 197m, 22-ix-2005 (S05-139) MB Bru ♂1. Poway, 13355 Carriage Rd, 32.958504° -117.054061°, 156m, 3-x-2006 C. Thomas ♂1. Ramona, Dos Picos County Rd, 32.999053° -116.93770°, 451m, 11-ix-2003 (S03-135) D. Palmer & D. Stokes ♂1. 4m SSW Ramona, Mussey Grade Rd. N Reservoir, 32.983700° -116.924725°, 402m, 15-xii-1996 (S97-6) M. Gates ♂1. Rancho Bernardo, Palmerado Rd., 32.991021° -117.058837°, 196m, 16-i-2005 (S05-12) ♀4. San Diego, NE intersection Genesee Ave & East Gate Mall, 1-ii-1984 (S84-3) CF Perrin ♀2. San Diego, 17629 Adena Ln, 33.034484° -117.071926°, 159m, 17-x-2005 (S05-152) SE Caldwell ♂1. San Diego Zoo Safari Park, 25-xi-1996 (S96-97) RN Fisher ♂2 ♀3. Santa Ysabel Ecological Reserve: Array 24, 33.12076° -116.618°, 1157m, 30-x-2002 (S02-71) S. Hayden ♂1 ♀1; Array 5, 33.13572° -116.704°, 1061m, 1-v-2003 (S03-45) A. Vandergast ♀1; Array 1, 33.10065° -116.70449°, 909-954m, 4-vi-9-vii-2003 (S03-67) D. Clark ♂1 ♀1; Array 15, 33.13470° -116.65308°, 1045m, 8-vi-2005 (S05-60) D. Wood ♀1; Array 9, 33.12490° -116.67471°, 926m, 10-vi-2005 (S05-60) D. Wood ♂1; Array 15, 33.1347° -116.65308°, 1045m, 18-viii-2005 (S05-138) D. Wood ♂1 ♀1. San Vicente Dam, 32.915° -116.932°, 238m, 12-xi-2001 (S01-113) DC Hawks ♀1. Sweetwater, 32.726267° -116.941445° 106m, 12-vi-1997 (S97-70) R. Fisher ♀1. Tijuana Estuary, 32.53522° -117.1171°, 16m, 18-iii-1997 (S97-32) ♀1; 28-v-1997 (S97-38) ♀1; 30-ix-1997 (S97-130) ♂6; 3-i-2003 (S03-2) ♀3; 3-iii-2003 (S03-11) A. Vandergast ♂1. Torrey Pines 32.919995° -117.25800°, 61m, 28-v-1997 (S97-39) R. Fisher ♂1 ♀1; 3-x-1997 (S97-131) ♂3. University City, 15-ii-1985 (S85-17) A. Grennan ♀1; 16-x-1986 (S86-143) E. Hittinger ♂1. University City, near San Clemente Canyon, 32.847061° -117.198273°, 68m, October, 2004 (S04-139) P. & K. Newman ♂1.

Drum. Calling drum similar in both sexes except males with a sex clarification drum (SCD) and female with longer series. **Male:** Holotype R97-124 (Fig. 778A) with 25 drums over 5.0s (5 drums/s) at 20°C. SCD holotype (Fig. 778B) with 26 drums over 1.9s (13.7 drums/s) at 20°C. **Female:** Allotype R97-104 (Fig. 779) with 32 drums over 8.1s (4.0 drums/s) at 19.5°C.

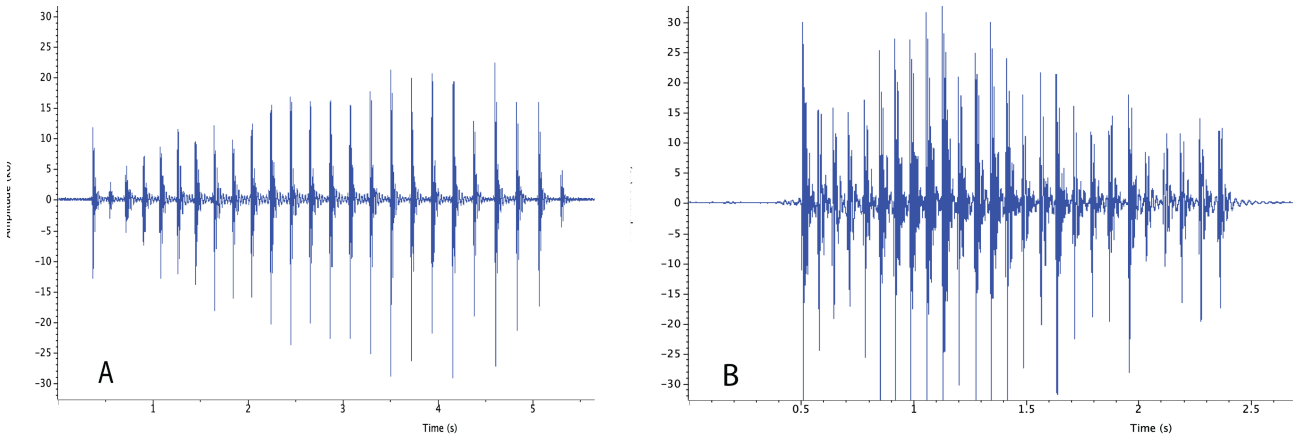


FIGURE 778. Drumming in adult male holotype *A. fisheri.* A. Calling drum R97-124. B. SCD in same male. Note difference in time scales.

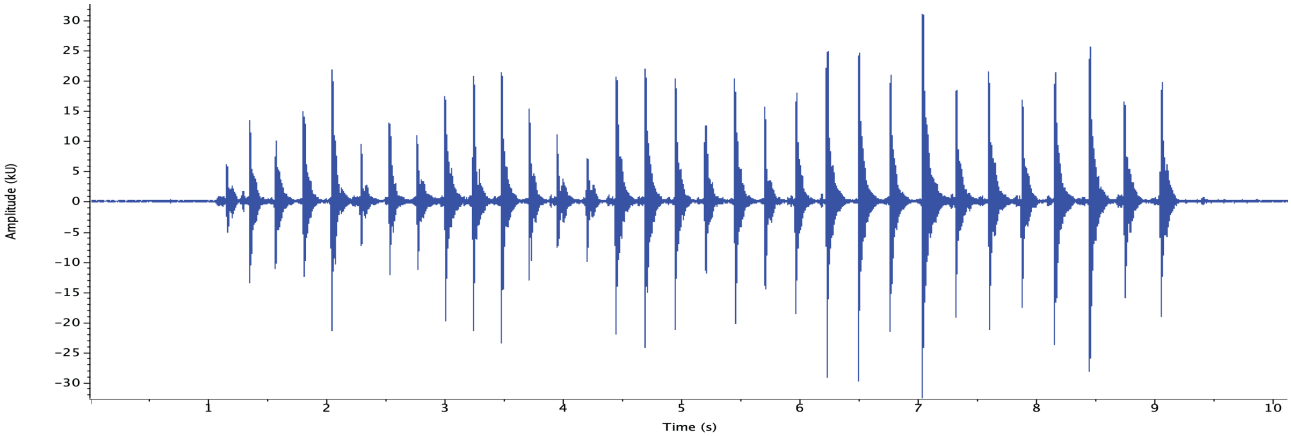


FIGURE 779. Calling drum (R97-104) in allotype adult female *A. fisheri.*

Because this species occurs across a variety of habitats and elevations, coupled with an apparent wide range of drumming rates when compared to drumming rates in other JC species (Weissman 2001b), we regressed temperature vs drumming rate in coastal populations in San Diego County vs inland populations around Tecate, Baja California, Mexico: Males vs females, and coastal vs inland. Males generally drum faster than females (Fig. 780) but with extensive overlap. Coastal individuals drum faster than inland ones (Figs 781 & 782) when sex taken into account, but again with overlap. We believe that further studies are warranted here, notably looking for possible cryptic taxa.

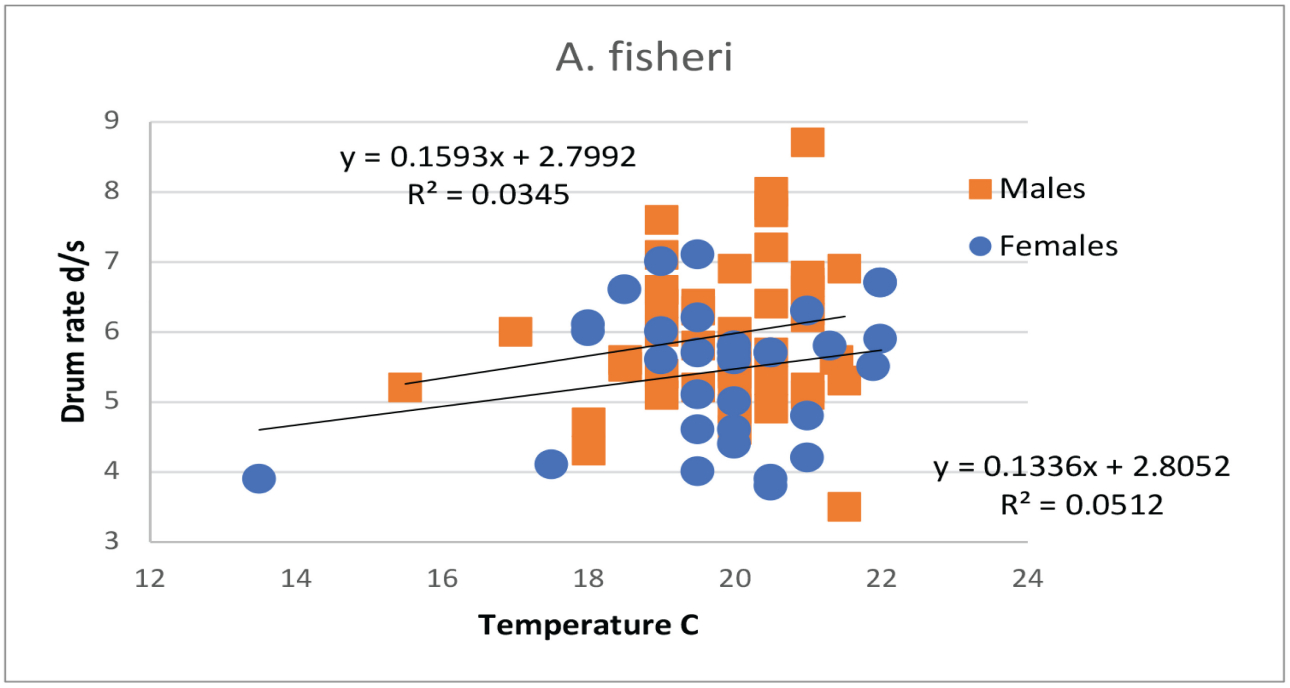


FIGURE 780. In combined populations of all *A. fisheri*, males may drum faster than females, but with so much overlap as to make any distinction useless.

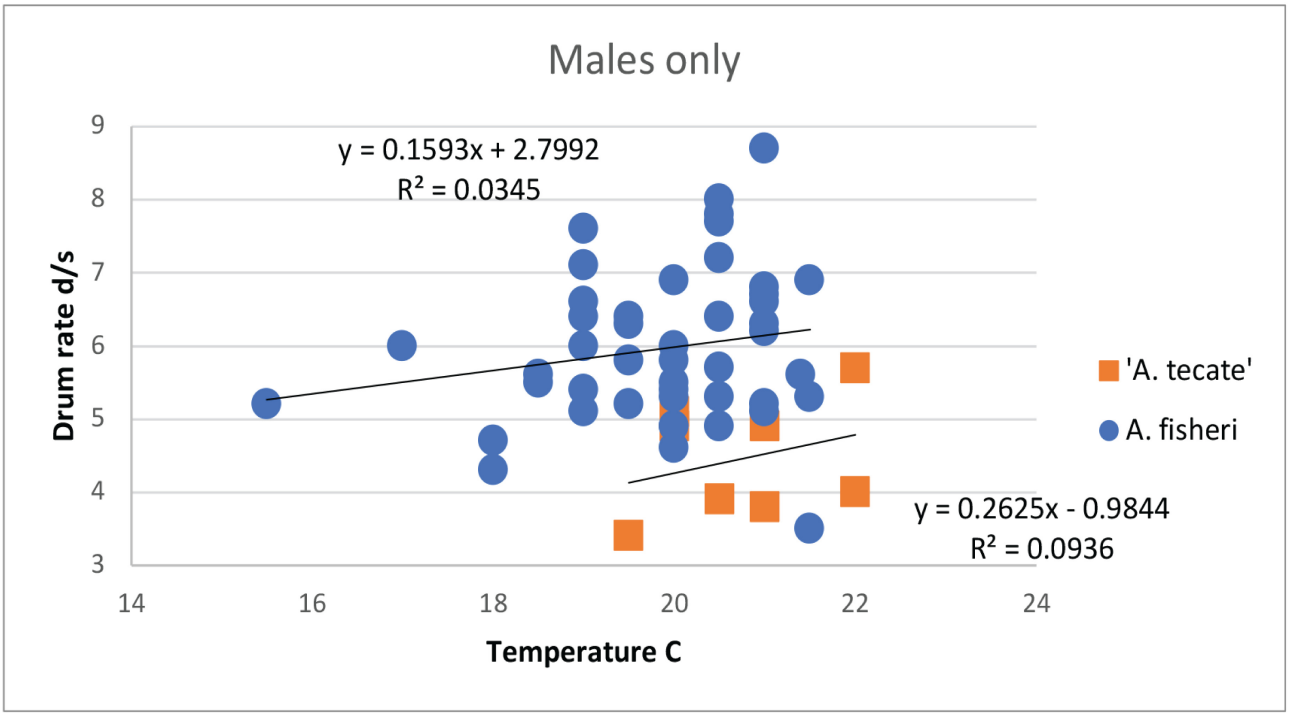


FIGURE 781. Comparing coastal populations of adult male *A. fisheri* with inland populations (here labeled 'A. tecate'), shows overlap but apparent separation.

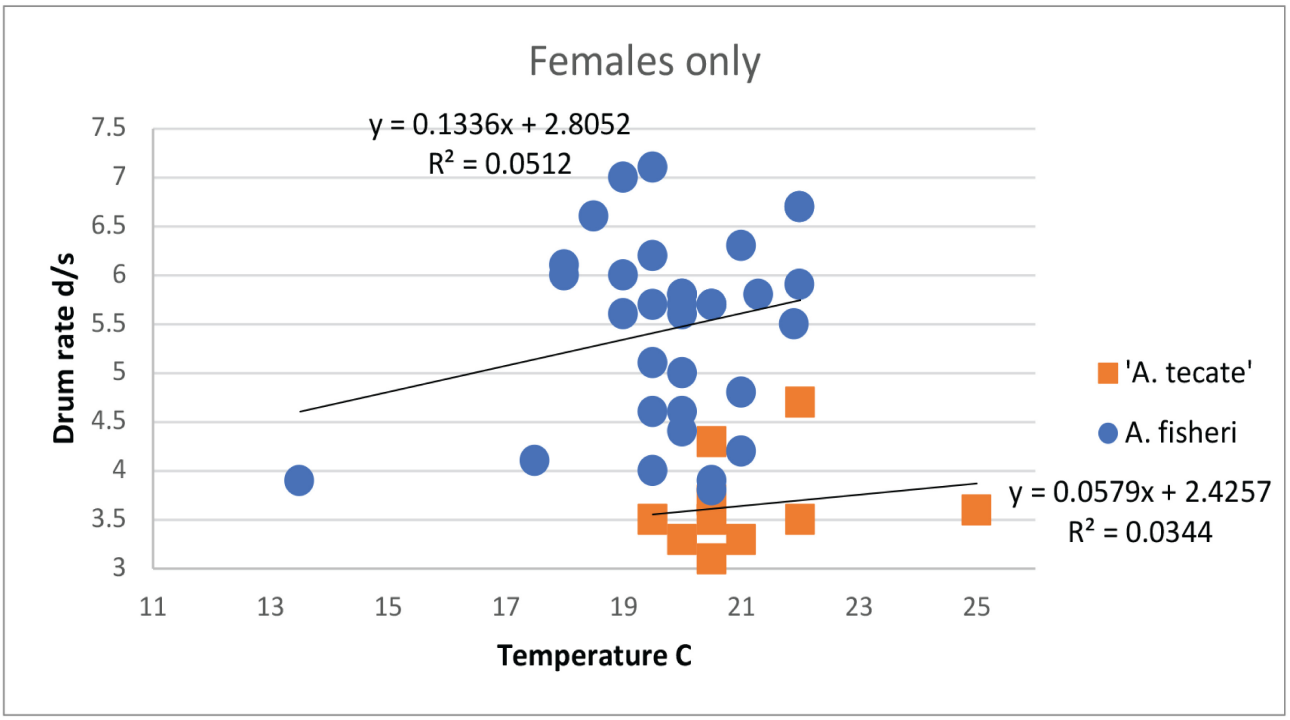


FIGURE 782. Comparing coastal populations of adult female *A. fisheri* with inland populations (here labeled 'A. tecate'), shows overlap but clear separation.

Derivation of name. Named for Robert N. Fisher, who has supported our research efforts on Southern California JCs for years by sending live individuals. Common name is in reference to its widespread occurrence in San Diego Co.

Habitat. Holotype from coastal sage habitat while allotype from nearby maritime scrub habitat. Other individuals from coastal oak woodland to riparian situations. At higher elevations >1000m, such as at Santa Ysabel Ecological Reserve, not into mixed conifer forests where *A.* sp. #4 might occur.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. From **San Diego Co**., CA, of 23 individuals, 1 had 2, 20 had 3, and 1 had 4 ventral **fore** leg tibial spurs; all 23 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4, 20 had 5 and 2 had 6 inner **rear** leg tibial spines, and 21 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. From **Baja California**, around Tecate, of 25 individuals, 1 had 2 and 24 had 3 ventral **fore** leg tibial spurs; 1 had 7, 23 had 8, and 1 had 9 **middle** leg tibial calcars, and all had 2 ventral spurs; 24 had 5 and 1 had 6 inner **rear** leg tibial spines, and 1 had 2 and 24 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 734, p. 418. F0383 (S96-118, Baja California, Km 126); F0512 (allotype, S97-32, Tijuana River Estuary); F0539 (S97-128, Little Cedar); F0573 (S97-131, Torrey Pines); F0585 (S96-117, Baja California, Puerto Nuevo); F1359 (S03-70, Hollenbeck Canyon); F1656 (S05-2, Lake Hodges); and F1662 (S05-138, Santa Ysabel) all recovered together in Group 13 Southern California #3, and closest to *A.* sp. #4.

Karyotype. 2n♂=23. Five males examined from 5 localities all show 6 (except for T97-30 with 7 pairs) metacentric or submetacentric autosomal pairs; 5 (except for T97-30 with 4 pairs) acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome: T92-7 (Fig. 783, S92-18, 5 km E Tecate); T96-1 (Fig. 784, S95-40, Johnson Canyon); T97-6 (Fig. 785, S97-38, Tijuana Estuary); T97-30 (Fig. 786, S97-39, Torrey Pines); and T03-19 (Fig. 787, S03-70, Hollenbeck Canyon).

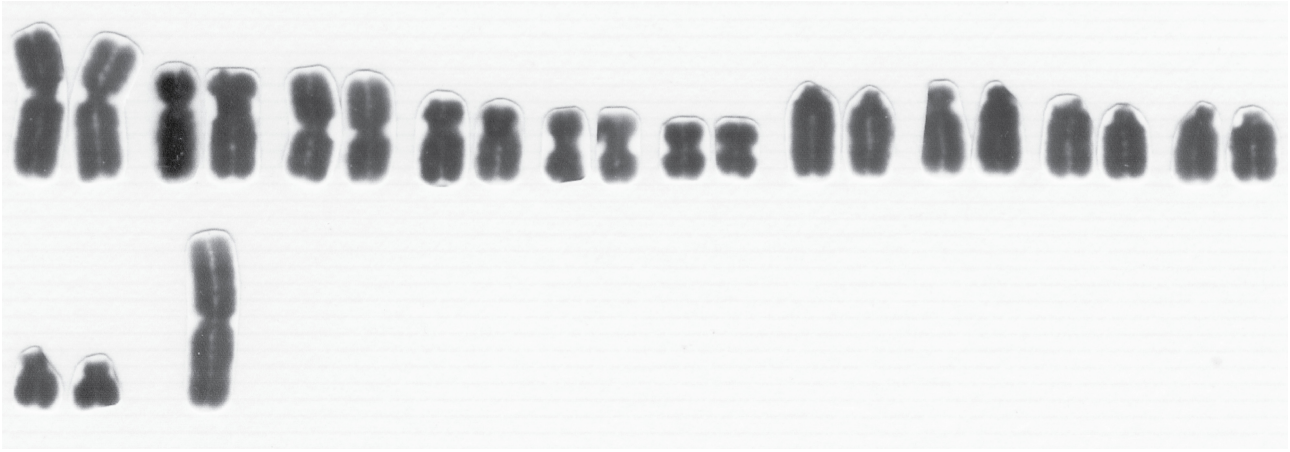


FIGURE 783. Idiogram T92-7 *A. fisheri* (S92-18).



FIGURE 784. Idiogram T96-1 *A. fisheri* (S95-40).



FIGURE 785. Idiogram T97-6 *A. fisheri* (S97-38).



FIGURE 786. Idiogram T97-30 *A. fisheri* (S97-39).



FIGURE 787. Idiogram T03-19 *A. fisheri* (S03-70).

Discussion. Given the wide geographic and habitat range, coupled with some calling drum rate variability, there may be more than one species involved. But because all sequenced legs are recovered together in this morphologically uniform series, we designate them as one species.

A. fisheri is found at several localities with *A. sandiego*: Lake Poway (S05-12); Lake Hodges (S05-2); Tijuana Estuary (S97-38 & S03-2); Rancho Bernardo (S05-12); and Santa Ysabel (S05-60). Collected with *A. mahogani* at Torrey Pines (S97-39) and Pala (S92-41).

***Ammopelmatus kirai* Weissman, sp. nov.**
Warner Springs Jerusalem Cricket
Figs 788–798, Tables 6, 7

Distribution. (Fig. 788). Northern San Diego Co. and adjacent Riverside Co., California.

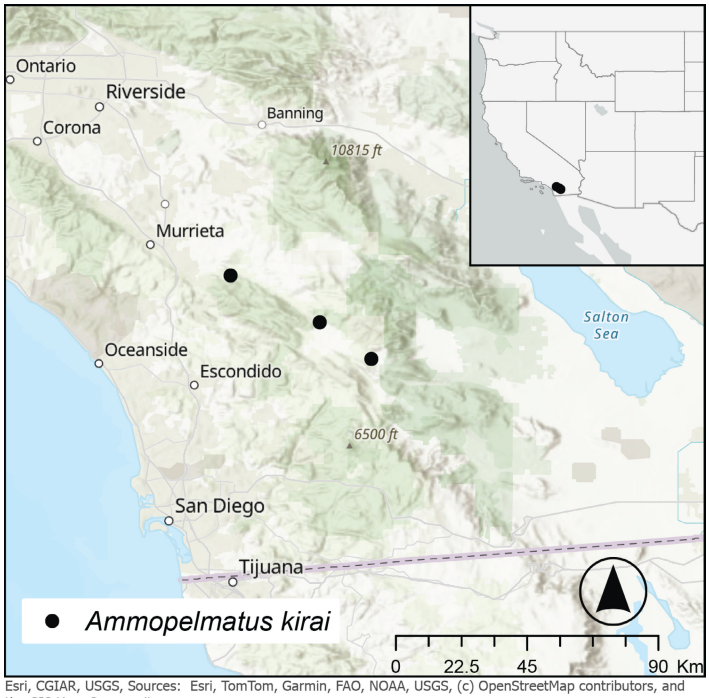


FIGURE 788. Distribution of *A. kirai.*

Recognition characters. Medium sized, medium fast drumming JC with a sex clarification drum and 2n♂=23. Distinguished from other nearby medium fast drumming JC species *A. calimesa* (2n♂=23) by habitat and DNA; from *A. fisheri* (2n♂=23) by less developed rear leg tibial calcars in *A. kirai*; from *A. santarosaplateau* (2n♂=23), its nearest DNA relative, by faster drum rate in latter; from *A. oneillpark* by karyotype (2n♂=25) and DNA; from *A. skinner* by karyotype (2n♂=25) and latter's slower drum rate and different DNA; and from *A. stringfellow* by karyotype (2n♂=25) and DNA.

Holotype. Male (in alcohol, Fig. 789). **California, *San Diego Co.,*** Hwy 79, 5.4 road m NW Warner Springs, 33.322103° -116.698839°, 905m, 17-iii-2005 (S05-33) DBW, KJ Weissman. R05-68, F1644. Molt to adult 20-viii-2005. Deposited CAS, Entomology type #20188. Measurements in mm: Body length 35.75, hind femur length 11.27, hind femur width 4.54. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 790) with 5 inner and 3 outer spines, 1 or 2 ventral spurs.

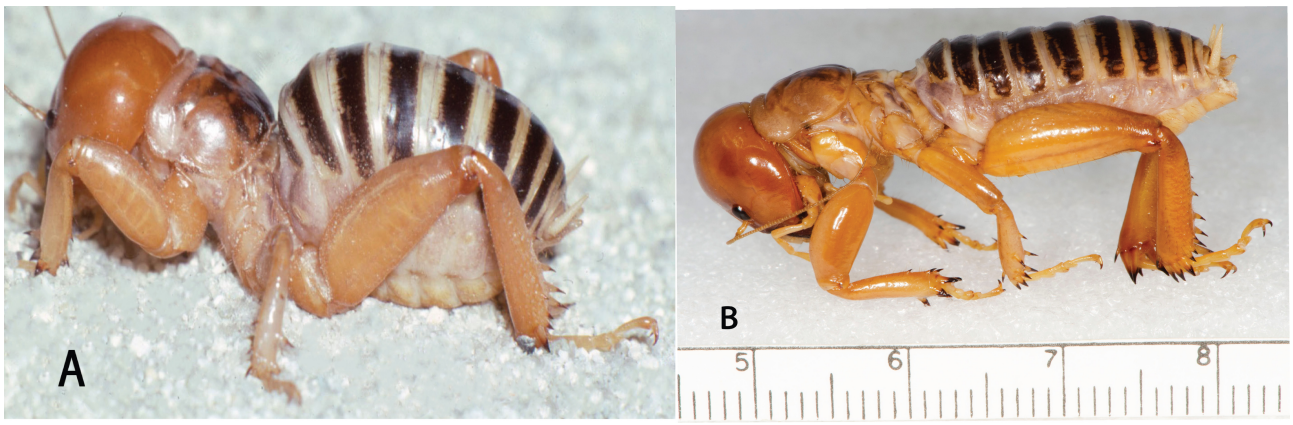


FIGURE 789. Adult male holotype *A. kirai.* A. When alive. B. When preserved.



FIGURE 790. Left rear leg tibia adult male holotype *A. kirai.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 791). Same data as holotype except R05-44, F1612. Molt to adult 25-viii-2005. Deposited CAS, CASENT #9079119. Measurements in mm: Body length 34.01, hind femur length 9.54, hind femur width 3.74. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 792) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 793.



FIGURE 791. Adult female allotype *A. kirai.* A. When alive. B. When preserved.

Paratypes. ♂6 ♀3. **CALIFORNIA, *Riverside Co.,*** Hwy 79 10.4 m E I-15, Dripping Springs Ranch, 33.465092° -116.973433°, 482m, 17-iii-2005 (S05-31) ♀1. ***San Diego Co.,*** same data as holotype ♂4 ♀2. County Hwy S22, 2.1 m W Anza Borrego State Park border, 33.210078° -116.539947°, 1192m, 17-iii-2005 (S05-34) ♂2.

Drum. Calling drum similar in both sexes although longer in females. Males with a sex clarification drum (SCD). **Male:** Holotype R05-68 (Fig. 794) with 41 drums over 5.2s (7.9 drums/s) at 20°C. SCD (Fig. 795, R05-68) shows 4 short series, while finger drumming to stimulate holotype male. First burst shows 9 drums over 0.625s (14.5 drums/s) while third burst shows 6 drums over 0.40s (15.0 drums/s) all at 20°C. **Female:** Allotype R05-44 (Fig. 796) with 56 drums over 8.6s (6.5 drums/s) at 20.5°C.



FIGURE 792. Left rear leg tibia adult female allotype *A. kirai.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 793. Ovipositor allotype *A. kirai*.

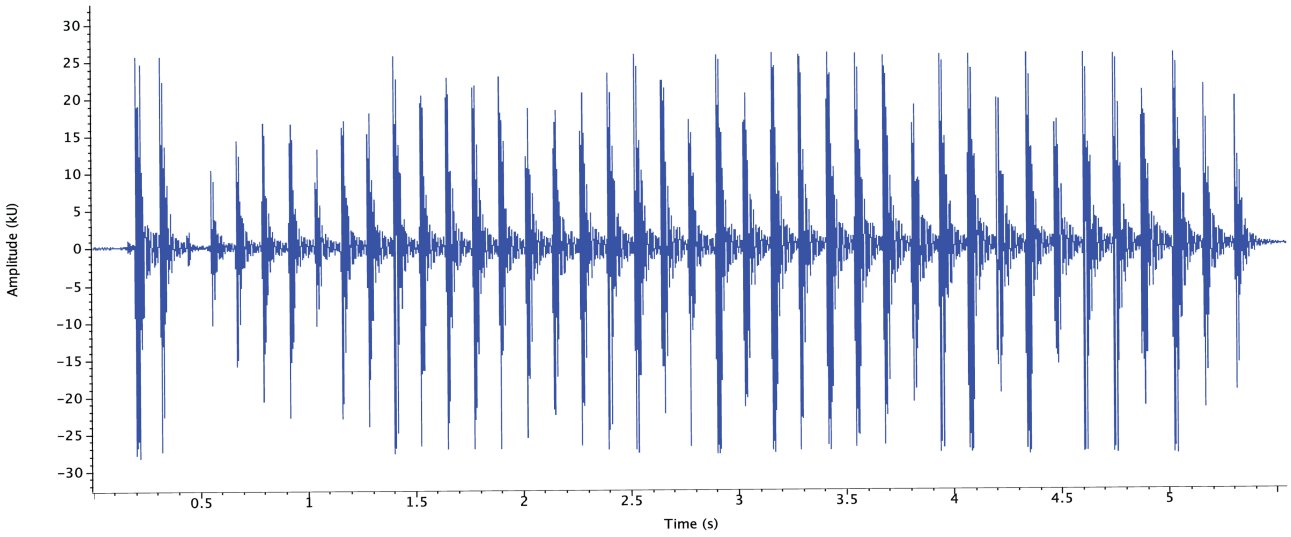


FIGURE 794. Calling drum (R05-68) adult male holotype *A. kirai.*

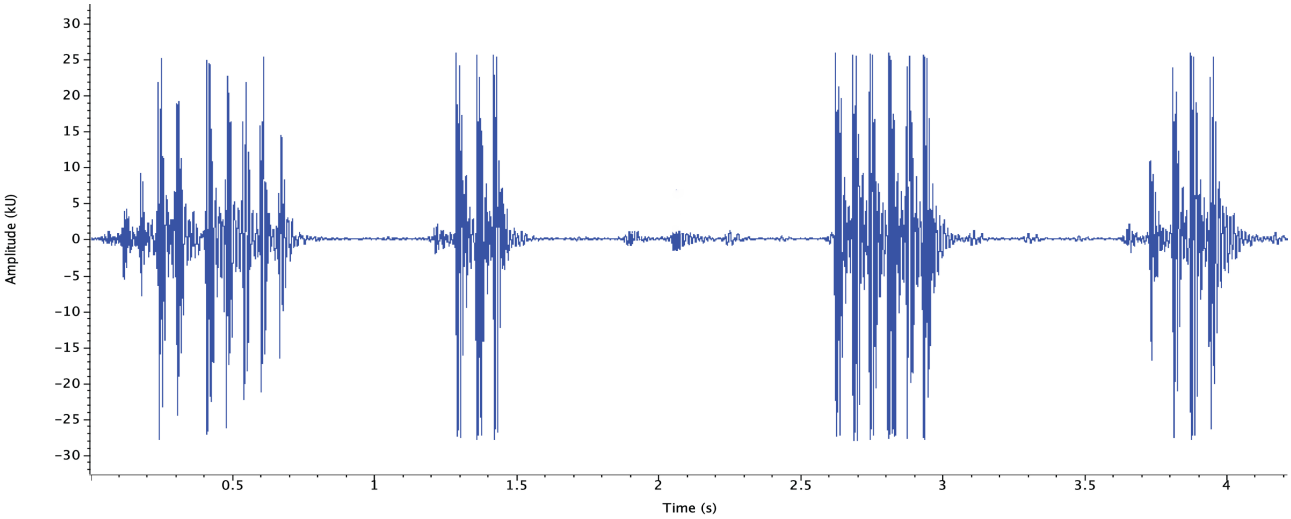


FIGURE 795. Sex clarification drums (R05-68) adult male holotype *A. kirai.*

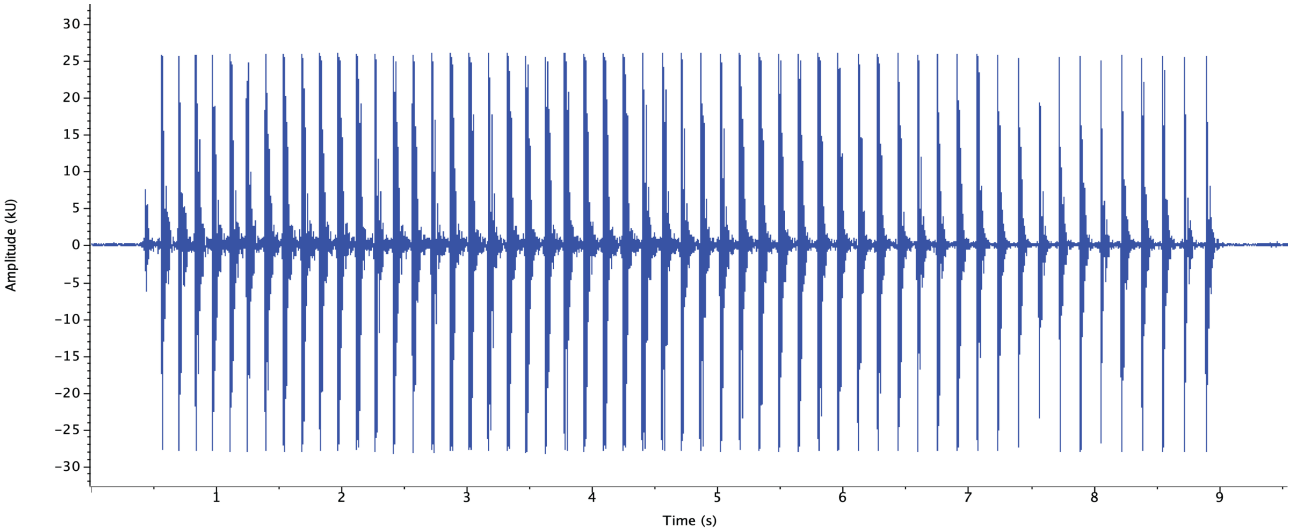


FIGURE 796. Calling drum (R05-44) adult female allotype *A. kirai.*

Derivation of name. Named for DBW's daughter, Kira, who enthusiastically helped collect the type series, even though she was extremely jet-lagged.

Habitat. At type locality, under rocks in oak woodland, with grasses. Site (S05-34) open scrub with some oaks and junipers. At latter site, dark male (Fig. 797A, R05-51, F1613) under rock under oaks with grasses; lighter male (Fig. 797B, R05-61, F1614) under rock in open chaparral.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. Of 11 individuals, 1 had 2 and 10 had 3 ventral **fore** leg tibial spurs; 4 had 7 and 7 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 10 had 5 inner **rear** leg tibial spines, 11 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color:** Adult males at both S05-33 and S05-34 mixed, some with darker colored head, pronotum, legs, and abdominal stripes (Fig. 797A, S05-34, R05-51, F1613) vs others with lighter head, pronotum, legs, and abdominal stripes (Fig. 797B, S05-34, R05-61, F1614), but otherwise the same for morphology, calling drumming rate, including a sex clarification drum, and with DNA recovered together in same poorly supported clade.

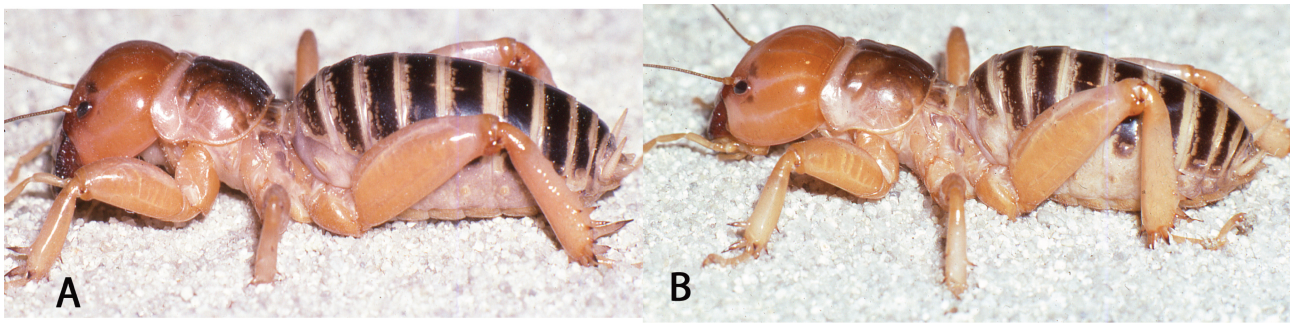


FIGURE 797. Color variation in adult, paratype males *A. kirai*, both S05-34. A. R05-51, F1613. B. R05-61, F1614.

DNA. Fig. 734, p. 418. F1591 (type locality); F1613 & F1614 (S05-34, 2.1 m W Anza Borrego); and F1667 (S05-31, Dripping Springs Ranch) all recovered together in Group 13 Southern California #3, and nearest to *A. santarosaplateau.*

Karyotype. 2n♂=23. T05-10 (Fig. 798) type locality (S05-33) examined: 6 metacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

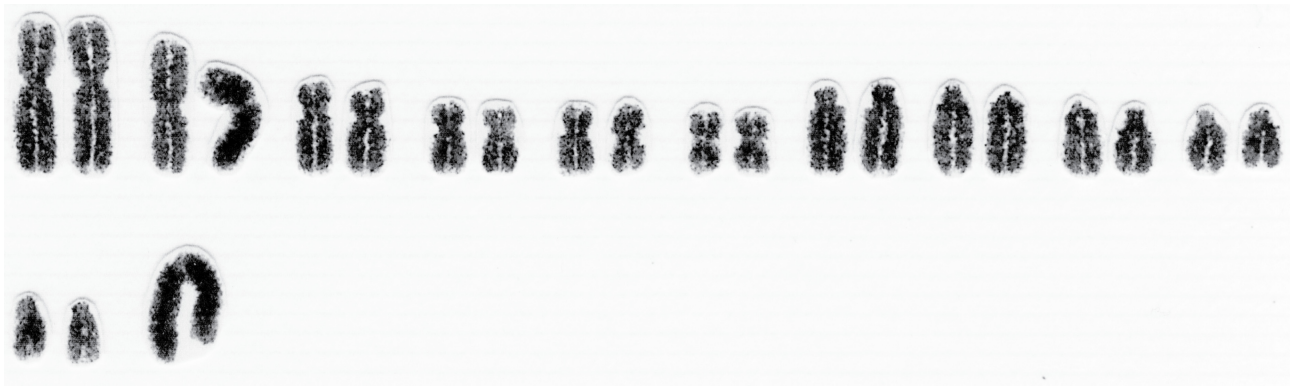


FIGURE 798. Idiogram T05-10 *A. kirai* (S05-33).

Discussion. The type locality is separated from paratype locality S05-31 by 37 km, and from paratype locality S05-34 by 19 km. Some 3.7 km almost due east of paratype locality, at S05-34, in drier, higher (1286m) open juniper-woodland-grassland, before dropping into Anza-Borrego Desert State Park, *A. anzaborrego* (S04-33, F1446), that drums at 1 drum/s, was collected.

***Ammopelmatus lagunahanson* Weissman, sp. nov.**
Laguna Hanson Jerusalem Cricket
Figs 799–809, Table 37

Distribution. (Fig. 799). Only known from the Sierra de Juarez, around Laguna Hanson (aka Laguna Juarez) and to the north about half the distance to La Rumorosa, Baja California, Mexico. Probably mostly within the boundaries of Parque Nacional Constitución de 1857.



FIGURE 799. Distribution of *A. lagunahanson.*

Recognition characters. A medium sized JC with broad, dark black abdominal stripes, a well-developed calcar #1, 2n♂=23, 3 fore leg tibial ventral spurs, calling drum rate around 4–5 drums/s, and males with a sex clarification drum. Can be distinguished from sometimes sympatric *A. larumorosa* by the lighter colored abdominal stripes (Fig. 800) in the latter, 2n♂=25, 2 fore leg tibial ventral spurs, male calling drum faster than females (but female *A. lagunahanson* drum rate does overlap with female *A. larumorosa* drum rate), and different DNA, since latter in the Winchester Group. Differs from *A. sanpedromartir*, known from ~120km due south in the Sierra San Pedro Martír, by 2n♂=25 in the latter despite DNA very similar to *A. lagunahanson.* Separated from morphologically similar *A. fisheri* (2n♂=23) by DNA, habitat, and inner rear leg spine #1 not as prominent as in *A. fisheri*.



FIGURE 800. Sympatric adult males: Left *A. lagunahanson* (S94-10, R95-25); Right *A. larumorosa* (S94-10, R95-36).

Holotype. Male (in alcohol, Fig. 801). **Mexico, *Baja California,*** 24.8 road miles S La Rumorosa (Hwy 1 libre) on road to Laguna Hanson, ~32.219395° -116.009731°, 1652m, 13-iii-1998 (S98-15) DBW, VF Lee. R98-6, F0670. Molt to adult 28-vii-1998. Deposited CAS, Entomology type #20154. Measurements in mm: Body length 28.46, hind femur length 10.54, hind femur width 4.04. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 802) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

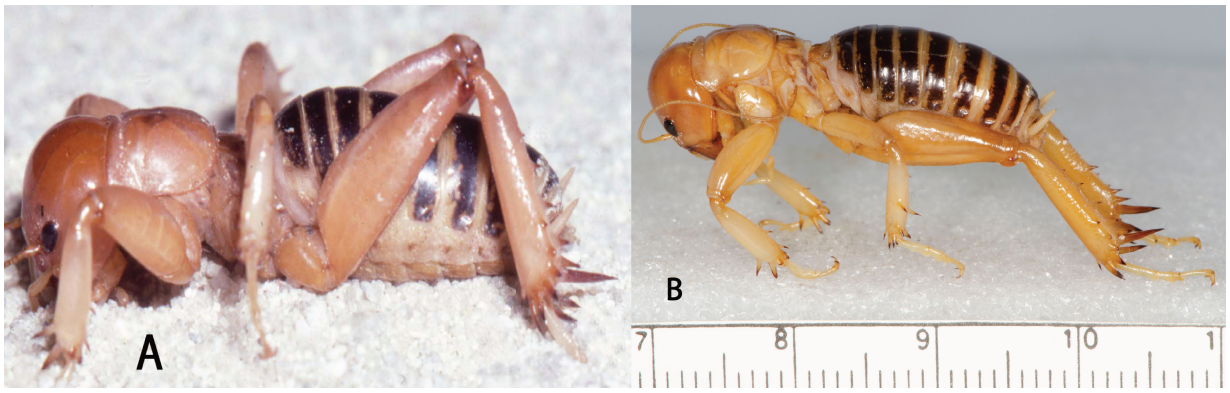


FIGURE 801. Adult male holotype *A. lagunahanson.* A. When alive. B. When preserved.

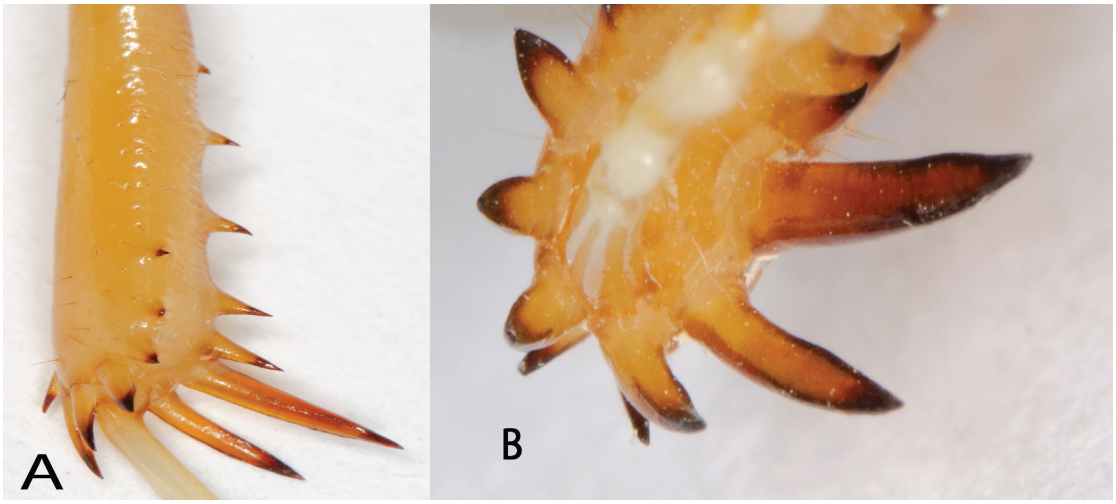


FIGURE 802. Left rear leg tibia adult male holotype *A. lagunahanson.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 803). Same data as holotype except R98-16, F0675. Molt to adult 27-viii-1998. Deposited CAS, CASENT #9080089. Measurements in mm: Body length 29.99, hind femur length 8.70, hind femur width 3.02. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 804) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 805.



FIGURE 803. Adult female allotype *A. lagunahanson.* A. When alive. B. When preserved.

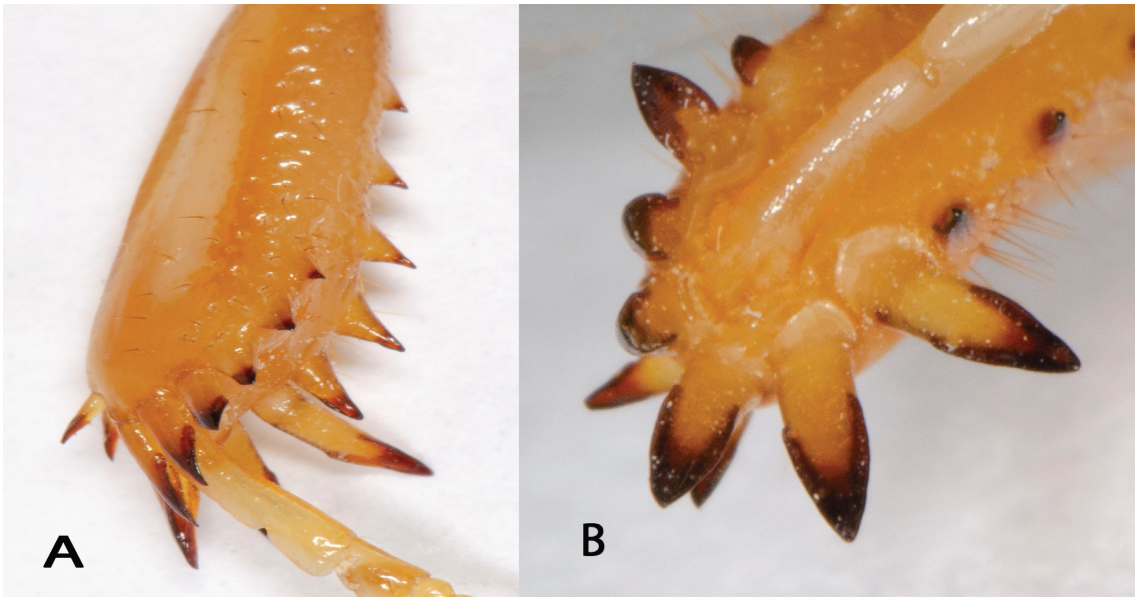


FIGURE 804. Left rear leg tibia adult female allotype *A. lagunahanson.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 805. Ovipositor allotype *A. lagunahanson*.

Paratypes. ♂8 ♀9 All **MEXICO, *Baja California,*** Laguna Hanson area, from around Lake and north for 3 m, 1676m, early April, 1994 (S94-10), J. Gannon, ♂4 ♀4. 18.2 m S La Rumorosa (Hwy 1 libre) on road to Laguna Hanson, 32.298170°, -116.018781°, 1509m, 13-iii-1998 (S98-12) ♂1. 18.7 road m S La Rumorosa (Hwy 1 libre) on road to Laguna Hanson, 32.293255° -116.024266°, 1509m, 13-iii-1998 (S98-13) ♂1 ♀2. 20.5 road m S La Rumorosa (Hwy 1 libre), at Rancho Las Margaritas, on road to Laguna Hanson, 32.269835° -116.021881°, 1503m, 13-iii-1998 (S98-14) ♂2 ♀1. 1-2 m S Laguna Hanson, 26-iv-1991 (S91-20) S. Woodward ♂1 ♀2.

Probable placement. **MEXICO, *Baja California***, 15.3 m E Ojos Negros on road to Laguna Hanson, 31.946114° -116.049583°, 1361m, 7-viii-2021 (S21-17) ♂1. This adult male escaped before he could be recorded but his dark color, medium size, and habitat all suggest *A. lagunahanson.* He was attracted to an oatmeal trail in a small riparian area with oak trees.

Drum. Calling drum rate similar in both sexes but longer in females, and males with a sex clarification drum (SCD). **Male:** Holotype R98-6, Fig. 806 with a SCD of 17 drums over 1.3s (13.1 drums/s) followed by a calling drum of 25 drums over 5.5s (4.5 drums/s) both at 20°C. **Female:** Allotype R98-16, Fig. 807 with 74 drums over 18.1s (4.1 drums/s) at 20°C.

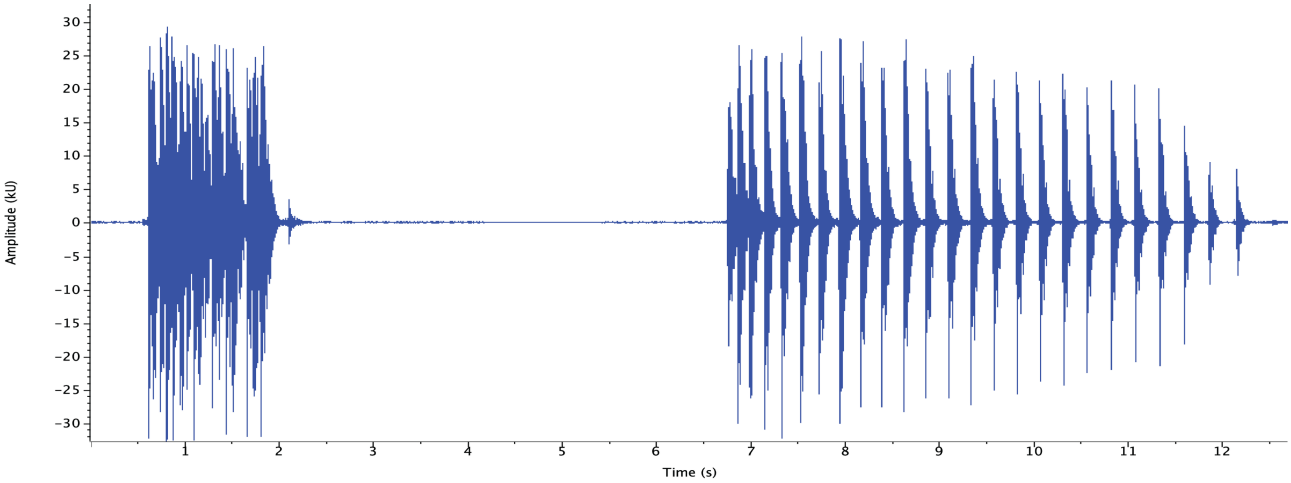


FIGURE 806. Sex clarification drum (R98-6) followed by calling drum in adult male holotype *A. lagunahanson.*

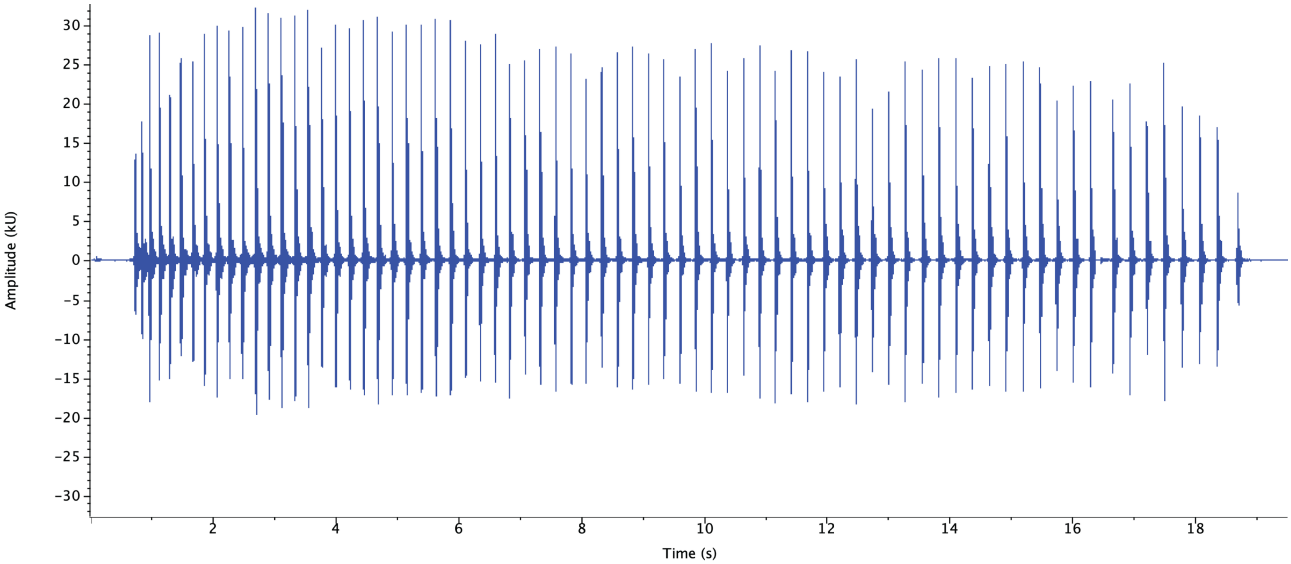


FIGURE 807. Calling drum (R98-16) in adult female allotype *A. lagunahanson.*

Derivation of name. Named after the locality from around which all specimens are known.

Habitat. Open Ponderosa pine forest, especially under rocks around outcrops, and under rocks elsewhere.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For 15 individuals, all had 3 ventral **fore** leg tibial spurs; 5 had 7 and 10 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 14 had 5 inner **rear** leg tibial spines, all with 3 outer **rear** leg tibial spines, and all with 2 ventral spurs.

DNA. Fig. 734, p. 418. F0089 and F0090 (both S94-10, Laguna Hanson); F0670 (holotype) recovered in Group 13 Southern California #3/Baja California, and closest to *A. sanpedromartir.*

Karyotype. 2n♂=23. 2 males karyotyped: T94-59 (Fig. 808, S94-10) and T99-9 (Fig. 809, S98-14) both with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1metacentric X chromosome.

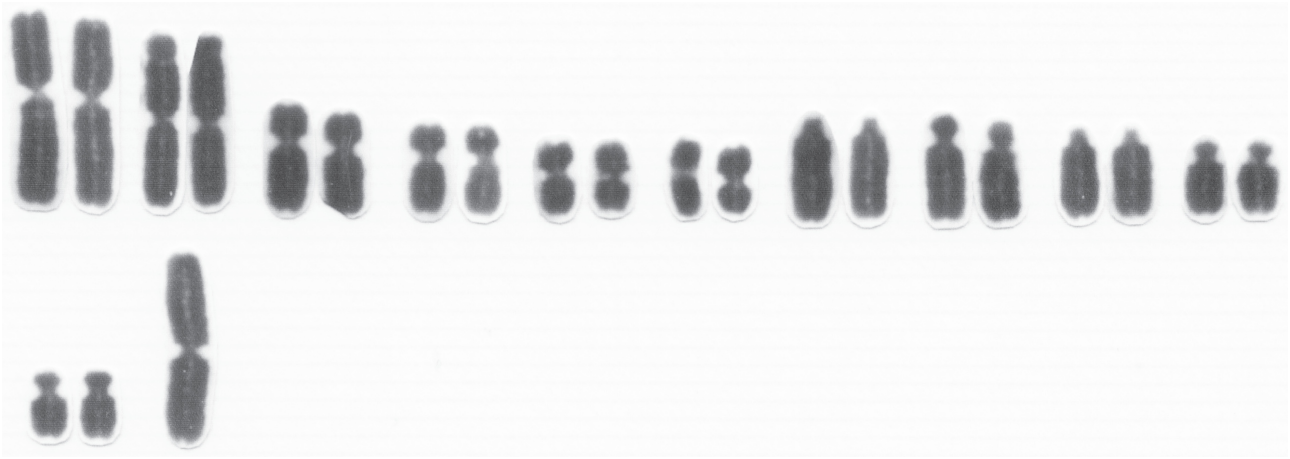


FIGURE 808. Idiogram T94-59 *A. lagunahanson* (S94-10).

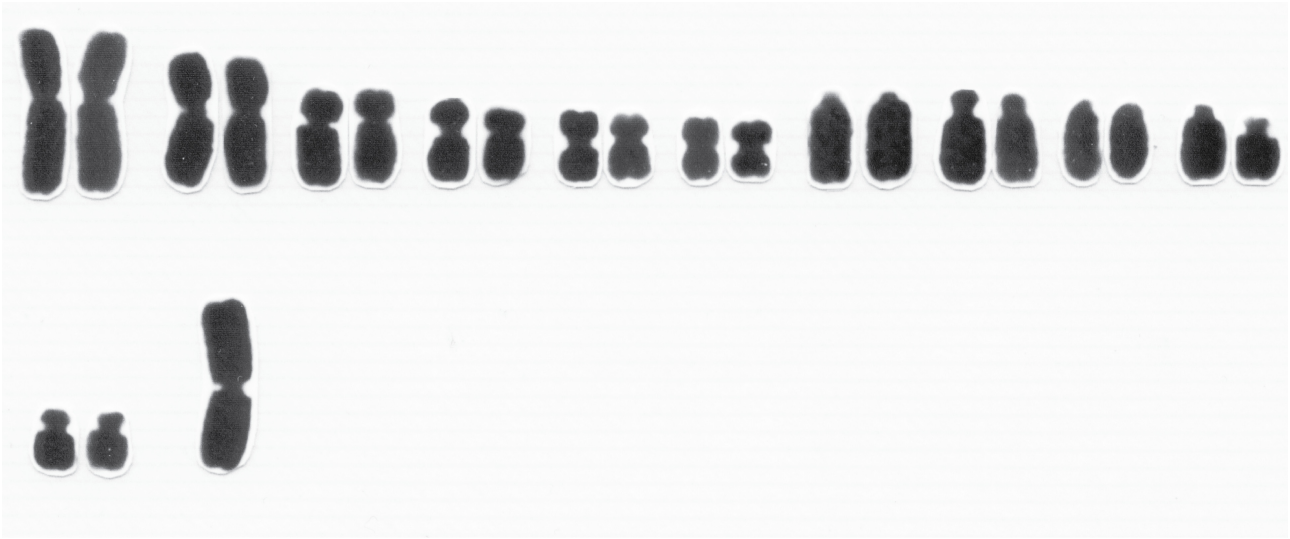


FIGURE 809. Idiogram T99-9 *A. lagunahanson* (S98-14).

Discussion. On the road to Laguna Hanson, traveling south from La Rumorosa, *A. lagunahanson* was found microsympatric with *A. larumorosa* at S98-13 and S94-10. It is of interest that the calling drum rate of females of both species is very similar, especially when compared to drumming rates in other sympatric pairs of JCs (see Appendix 2 on sympatric pairs, p. 771). In contrast, male *A. larumorosa* generally drum faster than male *A. lagunahanson.*

***Ammopelmatus sanjacinto* Weissman, sp. nov.**
San Jacinto Mountains Jerusalem Cricket
Figs 810–823, Table 20

Distribution. (Fig. 810). Only known from the San Jacinto Mts in Riverside County, California.

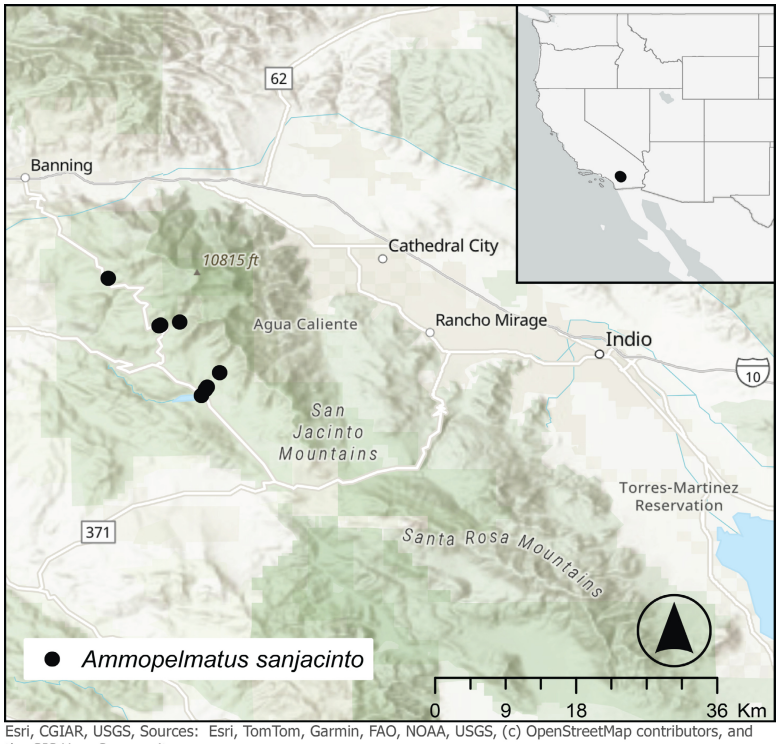


FIGURE 810. Distribution of *A. sanjacinto.*

Recognition characters. Medium to medium-large JC with an orange head, ~4–6.5 drums/s calling drum, with a male sex clarification drum (SCD), 2n♂=23. Distinguished from sympatric and morphologically similar *A. pinyonpines,* by drum rate, karyotype, and DNA. Separated from nearest DNA relative *A. calimesa* by faster drum rate in latter and habitat.

Holotype. Male (in alcohol, Fig. 811). **California, *Riverside Co.,*** UC James San Jacinto Mountain Reserve, 33.807481° -116.781608°, 1747m, 23-25-v-1992 (S92-52) W. Sakai. R92-6. Molt to adult 5-viii-1992. Deposited CAS, Entomology type #20170. Measurements in mm: Body length 34.89, hind femur length 10.88, hind femur width 3.78. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 or 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 812) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 811. Holotype adult male *A. sanjacinto.* A. When alive. B. When preserved.

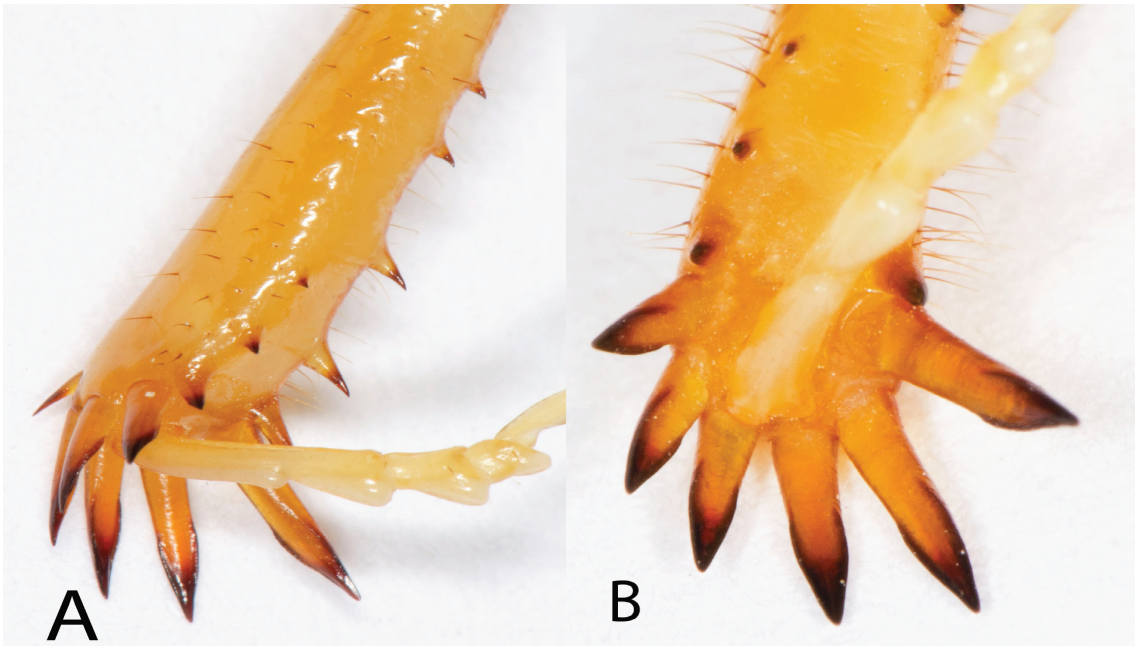


FIGURE 812. Left rear leg tibia adult male holotype *A. sanjacinto.* A. Showing 3 outer and 5 inner spines (inner spine #1 partially hidden behind tarsus). B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 813). Same data as holotype except 27-v-1995 (S95-44) W. Sakai. R95-31, F0108. Molt to adult 7-viii-1995. Deposited CAS, CASENT #9084003. Measurements in mm: Body length 34.36, hind femur length 9.92, hind femur width 3.61. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 814) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 815.



FIGURE 813. Adult female allotype *A. sanjacinto.* A. When alive. B. When preserved.

Paratypes. ♂15 ♀15. **CALIFORNIA, *Riverside Co.,*** San Jacinto Mts.: Type locality, all collected by W. Sakai: 30-v-1985 (S85-48) ♀1; 27-v-1985 (S85-67) ♀1; 30-v-1990 (S90-41) ♀2; 26-v-1991 (S91-49) ♂1; 23-25-v-1992 (S92-52) ♂1 ♀3; 30-v-1993 (S93-40) ♀1; 6-x-1996, ♀1; 23-26-v-1997 (S97-61) ♂1; 31-v-1999 (S99-65) ♀2;. Apple Canyon, 33.679890° -116.668099°, 1346m, 13-iv-1992 (S92-40) J. Gannon ♀1; 22-viii-2006 (S06-87) ♂6. Idyllwild, Deer Springs Trail 0.6 m NW Town Center, 33.752660° -116.721521°, 1713m, 31-viii-2005 (S05-113) ♂1; 22-viii-2006 (S06-86) ♂1. Idyllwild, 25180 Fern Valley Rd, 33.756184° -116.699671°, 1771m, 31-viii-2005 (S05-114) ♂1. Idyllwild, 33.751667° -116.723333°, 1698m, 1-ix-2021 (S21-48) A. Abelai, ♀1. Lake Hemet area, 33.669986° -116.674755°, 1328m, 26-29-ix-2002 (S02-67) W. Icenogle, ♂3; Apple Canyon Rd 0.8 m E Hwy 74, 33.677033° -116.670066°, 1340m, 8-xi-2015 (S15-124) ♀1; Apple Canyon Rd 2.6 m NE Hwy 74, 33.696807° -116.653838°, 1494m, 1-xi-2015 (S15-125) ♀1.



FIGURE 814. Left rear leg tibia adult female allotype *A. sanjacinto.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 815. Ovipositor allotype *A. sanjacinto.*

Doubtful placement. We have 1 individual from **Riverside Co**., vicinity of city of Riverside, that is morphologically inseparable from *A. sanjacinto* (except for having 2 fore leg ventral tibial spurs, which is a rare condition in *A. sanjacinto*), and drums similarly, but was collected in the flatlands and not in the San Jacinto Mts. In the absence of a DNA profile, we simply list it here based on its drumming similarity to *A. sanjacinto*: Roubidoux, 28-x-1983 (S83-145), S. Frommer, ♀1. This adult female was recorded several times (R83-461, R83-462, R83-464, R83-492), at temperatures between 17–22°C, with a measured drumming rate from 4.2–5.0 drums/s; which is probably too slow for *A. calimesa.*

Drum. Calling drum similar in both sexes except males with a sex clarification drum (SCD). **Male:** Holotype R92-6 (Fig. 816A) with 30 drums over 7.5s (4.0 drums/s) at 20°C. SCD Holotype R92-6 (Fig. 816B) of 4 drums over 0.30s (13.3 drums/s) at 20°C. **Female:** Allotype R95-31 (Fig. 817) with 22 drums over 4.6s (4.8 drums/s) at 20°C. Linear regression of temperature vs drum rate in the 14 males and 13 females of *A. sanjacinto* that we had

recorded showed two interesting properties: (1) The 6 males recorded from **Apple Canyon** (S06-87) appear to drum faster (Fig. 818) than the remaining 8 males from elsewhere in the San Jacinto Mts. Nevertheless, male F1812 from Apple Canyon was recovered in a clade with 3 other individuals from the San Jacinto Mt Range, seeming to indicate that one taxon is involved, but with a somewhat variable drumming rate. (2) The 13 recorded females of *A. sanjacinto* have an essentially flat response slope rate (-0.0663, Fig. 819) when regressing temperature vs drum rate, while the 14 males had a more typical positive slope rate (0.3393).

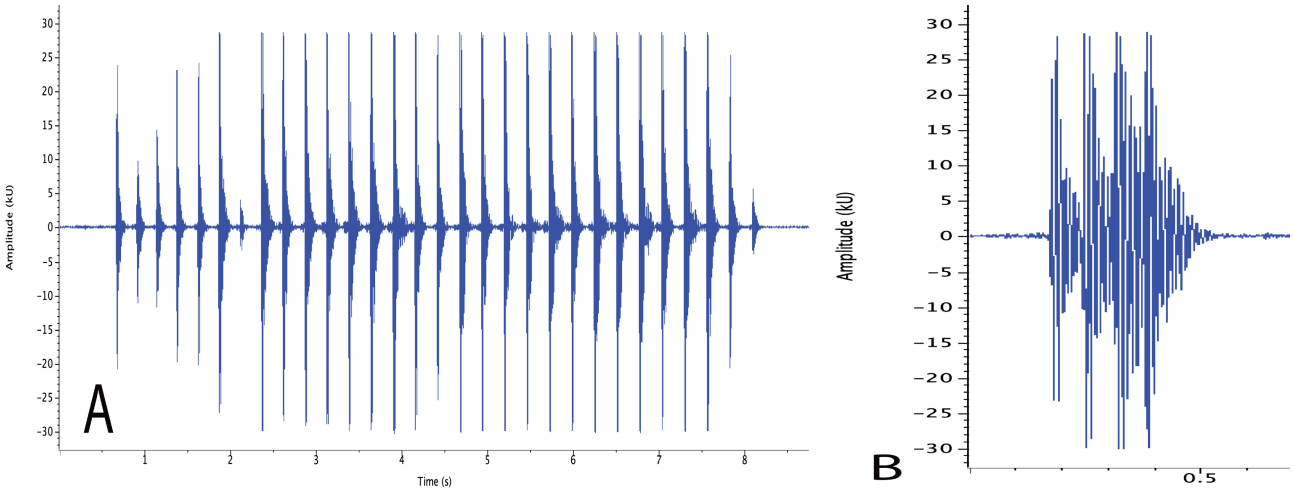


FIGURE 816. Calling drum (R92-6A) and SCD (R92-6B) in adult male holotype *A. sanjacinto.*

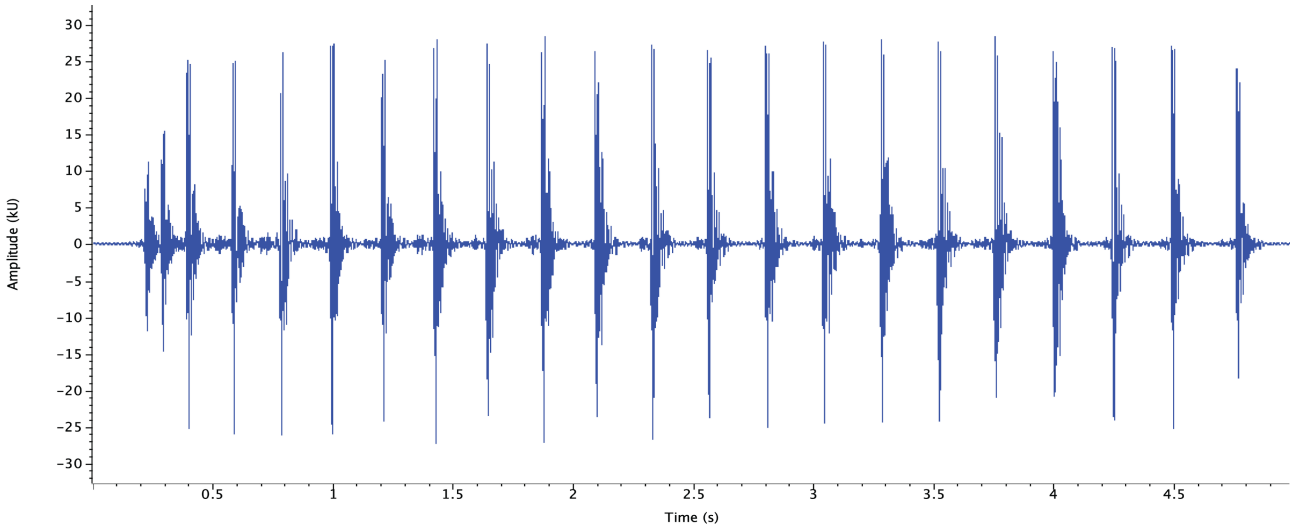


FIGURE 817. Calling drum (R95-31) adult female allotype *A. sanjacinto.*

Derivation of name. Named in reference to the only mountain range where it is known to occur.

Habitat. Pine-oak woodland.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 22 individuals, 1 had 2 and 20 had 3 ventral **fore** leg tibial spurs; 5 had 7 and 17 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and 1 had 2, 19 had 3, and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color pattern**: Fig. 820 shows color variation at the type locality (S92-52), with adult female (R92-15) on the left having broader black abdominal bands and more head patterning than holotype adult male (R92-6) on the right.

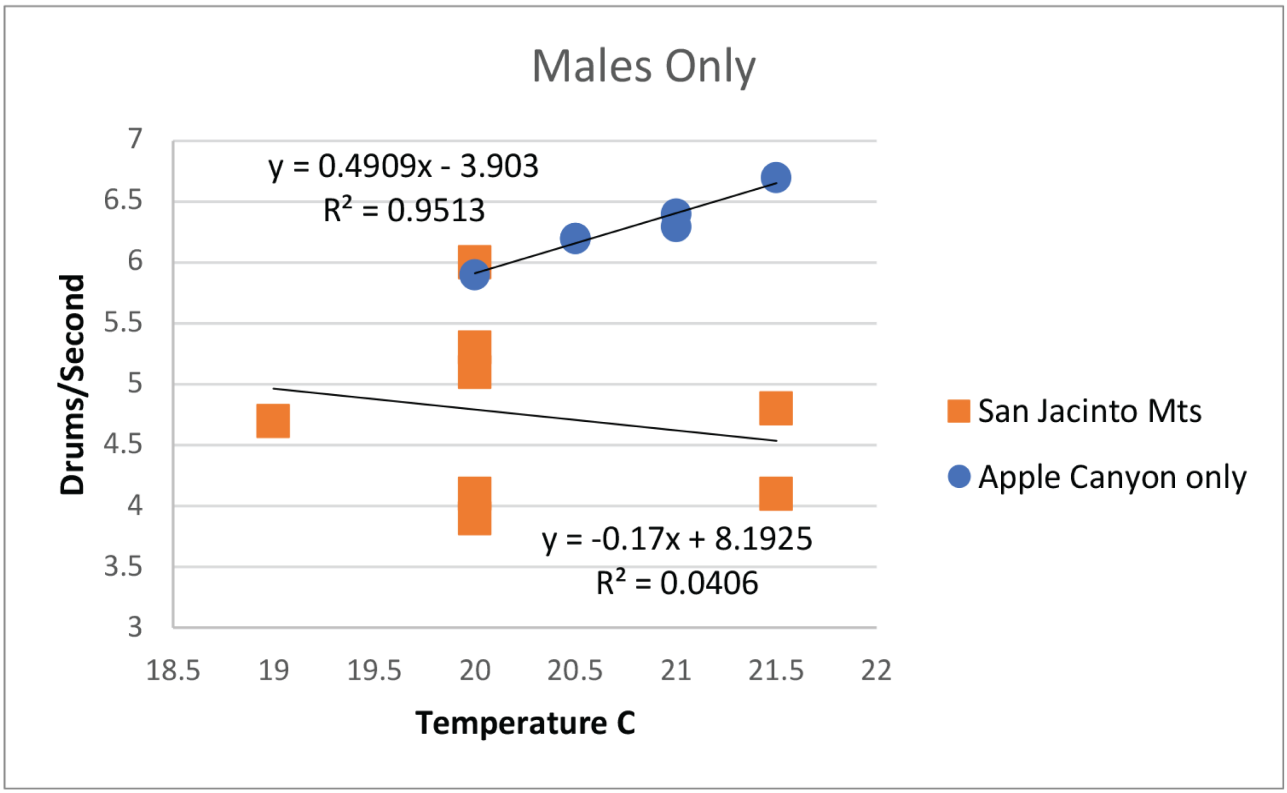


FIGURE 818. Calling drum rate for all male *A. sanjacinto*, appearing to show that those from Apple Canyon (S06-87) drum faster than those males from elsewhere.

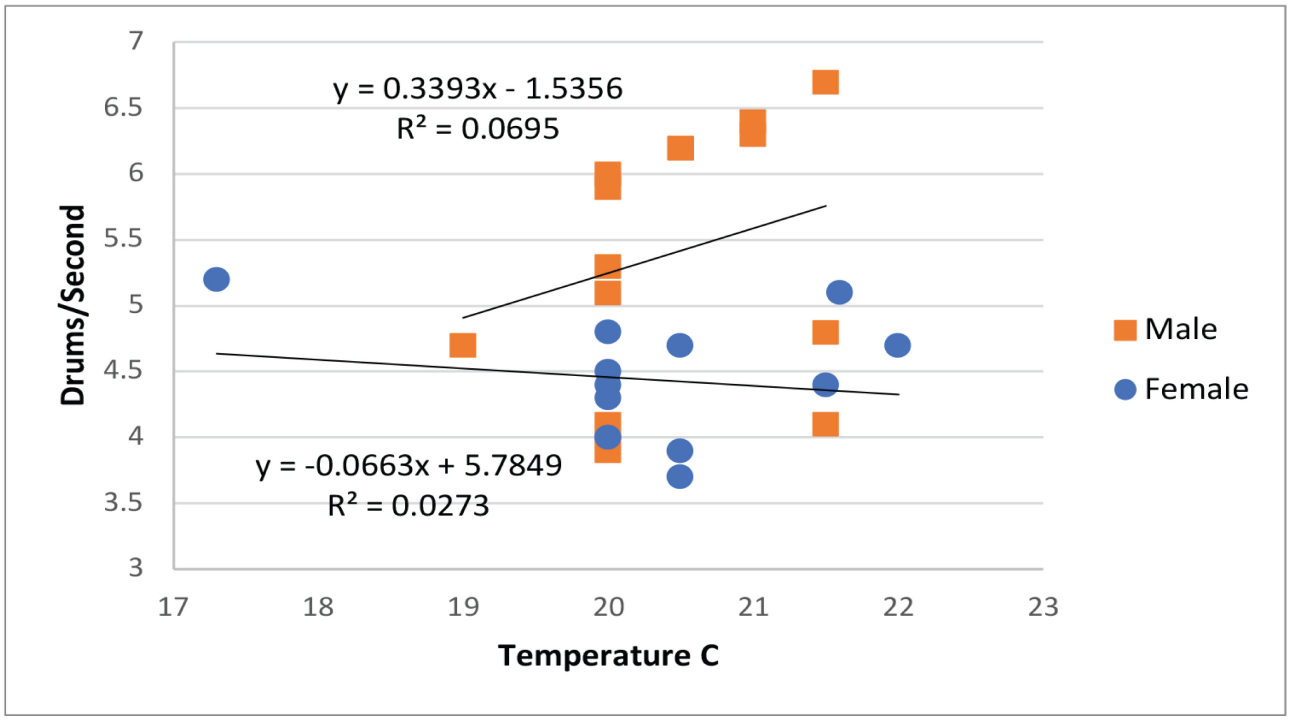


FIGURE 819. Calling drum rate in type series adults of *A. sanjacinto*, showing generally faster drumming rate in males and flat temperature response in females.



FIGURE 820. Individual pattern variation in type locality (S92-52) adult female (left, R92-15) vs adult male (right, R92-6) *A. sanjacinto.*

DNA. Fig. 734, p. 418. F0108 (allotype James Reserve, S95-44); F1314, F1315, & F1316 (all S02-67, east of Lake Hemet); F1635 (S05-113, Idyllwild); F1812 (S06-87, Apple Canyon); F2453 (S15-124, NE of Lake Hemet) all recovered in Group 13 Southern California #3, but with the impression of 2 subclades, one of which is composed of the 3 individuals from east of Lake Hemet (S02-67).

Karyotype. 2n♂=23. Three males examined and all consistent: T91-4 (Fig. 821, type locality S91-49); T97-28 (Fig. 822, type locality S97-61); T07-9 (Fig. 823, S06-87, Apple Canyon), and all demonstrate 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 821. Idiogram T91-4 *A. sanjacinto* (S91-49).



FIGURE 822. Idiogram T97-28 *A. sanjacinto* (S97-61).

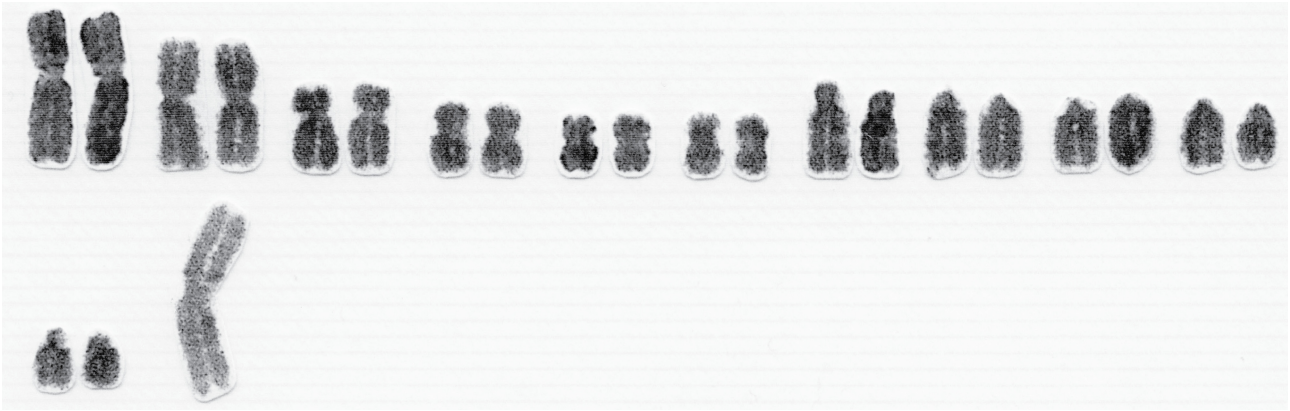


FIGURE 823. Idiogram T07-9 *A. sanjacinto* (S06-87).

Discussion. At Apple Canyon, *A. sanjacinto* was collected (S92-40) under rocks in chaparral areas, during the winter. *A. pinyonpines* was also collected (S92-40) under rocks during the winter; and at an oatmeal trail, in adjacent pine-oak woodland (S06-87), during the summer. At Idyllwild (S05-113), both *A. sanjacinto* and *A. mahogani* were collected at the same oatmeal trail.

***Ammopelmatus sanpedromartir* Weissman, sp. nov.**
San Pedro Mártir Jerusalem Cricket
Figs 824–832, Table 37

Distribution. (Fig. 824). Only known from Sierra de San Pedro Mártir Mts, from 641m, by Rancho Meling; to San Pedro Mártir National Park, Vallecitos Meadow area, at 2439m, all in Baja California, Mexico.

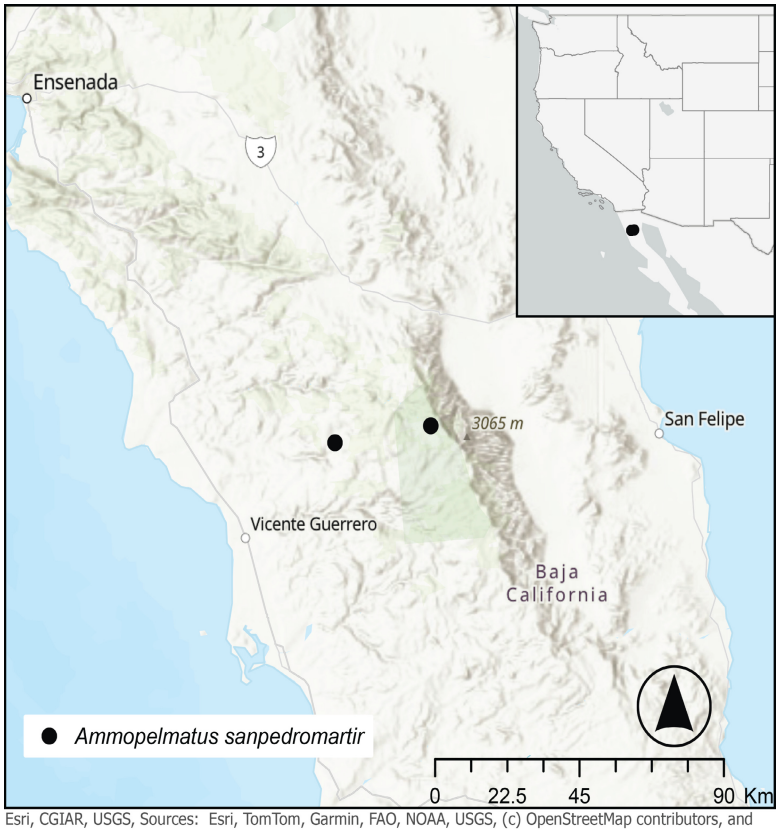


FIGURE 824. Distribution of *A. sanpedromartir.*

Recognition characters. A medium sized, generally light-colored JC where adult males have a dark, well developed rear leg tibial calcar #1 similar to that seen in the Lightfooti Group, 2n♂=25, calling drum around 3.0–3.7 drums/s with a sex clarification drum (SCD). Most closely related to more northern, allopatric but also montane Baja California *A. lagunahanson* that has a chromosome count of 2n♂=23 and faster drumming rate. The 2 taxa are separated by some 120km.

Holotype. Male (in alcohol, Fig. 825). **Mexico, *Baja California,*** Sierra de San Pedro Mártir National Park, Vallecitos Meadow area, 31.018269° -115.475475°, 2439m, 20-viii-1995 (S95-66) DBW, DC Lightfoot. R96-12, F0239. Molt to adult 2-vii-1996. Deposited CAS, Entomology type #20140. Measurements in mm: Body length 30.34, hind femur length 11.10, hind femur width 3.94. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 826) with 5 inner and 3 outer spines, 2 ventral spurs.

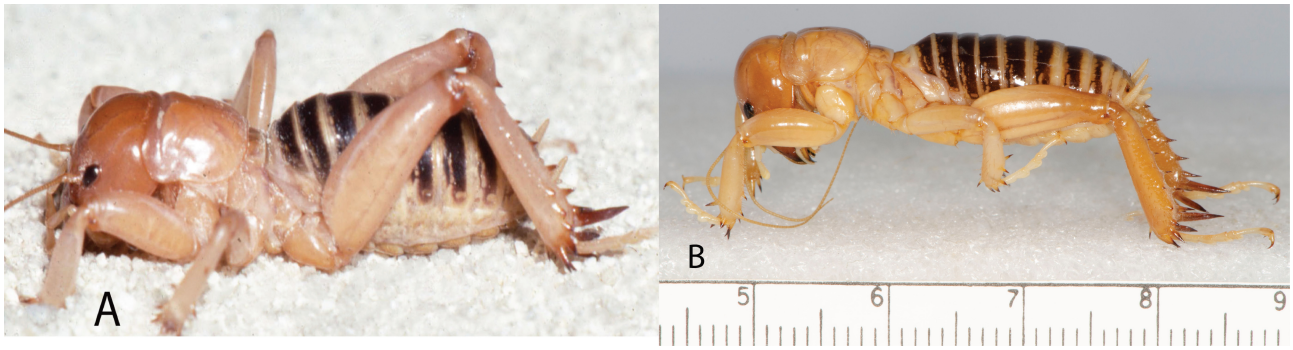


FIGURE 825. Holotype adult male *A. sanpedromartir.* A. When alive. B. When preserved.



FIGURE 826. Left rear leg tibia adult male holotype *A. sanpedromartir.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 827). Same data as holotype except R96-23, F0243. Molt to adult 11-vii-1996. Deposited CAS, CASENT #9081881. Measurements in mm: Body length 30.49, hind femur length 9.37, hind femur width 3.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 828) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 829.

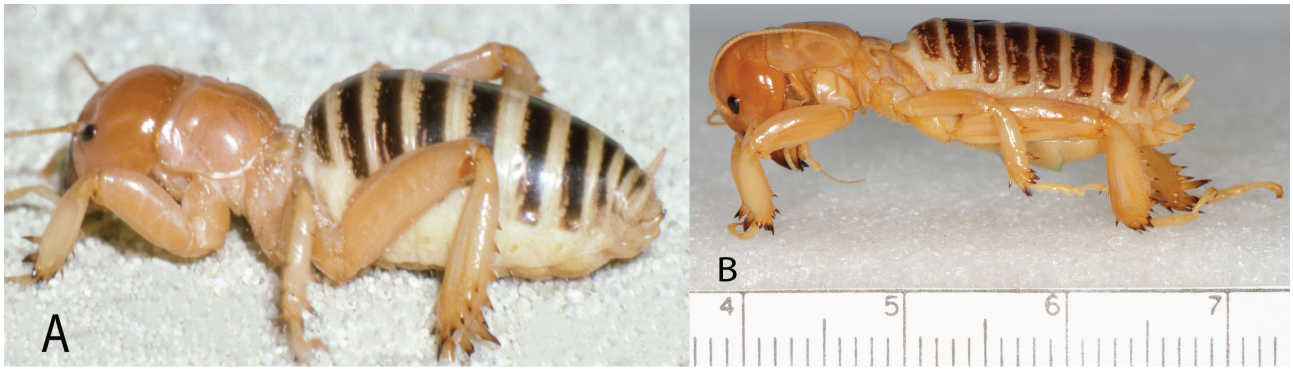


FIGURE 827. Adult female allotype *A. sanpedromartir.* A. When alive. B. When preserved.

Paratypes. ♂6 ♀13. **MEXICO, *Baja California***, all type locality, 6-vi-1984 (S84-22) ♂1 ♀4; 20-viii-1995 (S95-66) ♂2 ♀9. Road to San Pedro Mártir National Park, km post 76.7, 1981m, 20-ix-1979 (S79-179) DC Lightfoot ♂1. Rancho Meling, on road to San Pedro Mártir National Park, 30.974989° -115.743729°, 641m, 3-iv-2024 (S24-25) I. Parr ♂1. Km sign 76.7 on road to San Pedro Mártir National Park, 30.96511° -115.58597°, 2047m, 20-ix-1979, S79-179, DC Lightfoot ♂1.

Drum. Both sexes with similar calling drum except longer in females and males with a SCD. **Male:** Holotype R96-12 (Fig. 830) with SCD of 5 drums over 0.32s (15.6 drums/s) followed by a calling drum of 13 drums over 3.5s (3.7 drums/s) at 20°C. **Female:** Allotype R96-23 (Fig. 831) with 53 drums over 16.5s (3.2 drums/s) at 20°C.

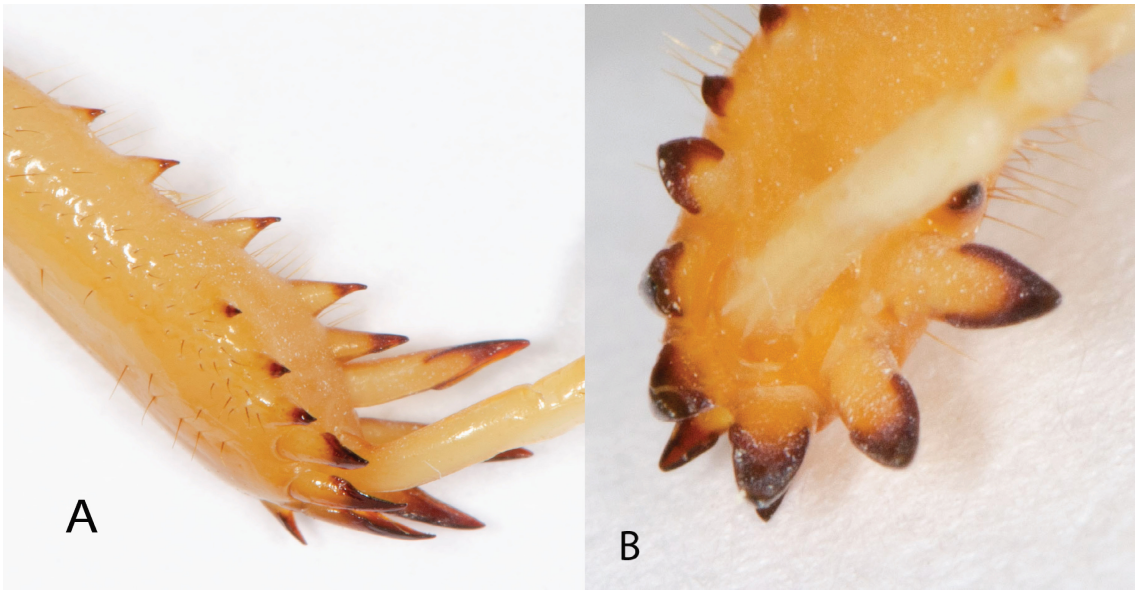


FIGURE 828. Left rear leg tibia adult female allotype *A. sanpedromartir.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 829. Ovipositor allotype *A. sanpedromartir.*

Derivation of name. Named after the type locality.

Habitat. Under rocks, logs, and cow pies along the edges of the Vallecitos meadow area, with surrounding Park area comprised of Californian mixed coniferous forest habitat.

Life cycle and seasonal occurrence. Apparent 2-year life cycle as tiny female (R97-6), collected in 1995, molted to adult on 7-vi-1997.

Variation. Of 18 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 3 and 17 had 5 inner **rear** leg tibial spines, 1 had 2, 16 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 734, p. 418. F0239 and F0444 (both type locality S95-66); F2960 (S24-25, Rancho Meling) all recovered in Group 13 Southern California #3/Baja California clade; with *A. lagunahanson* as nearest relative, despite their difference in chromosome count (2n♂=25 vs 2n♂=23 for the latter).

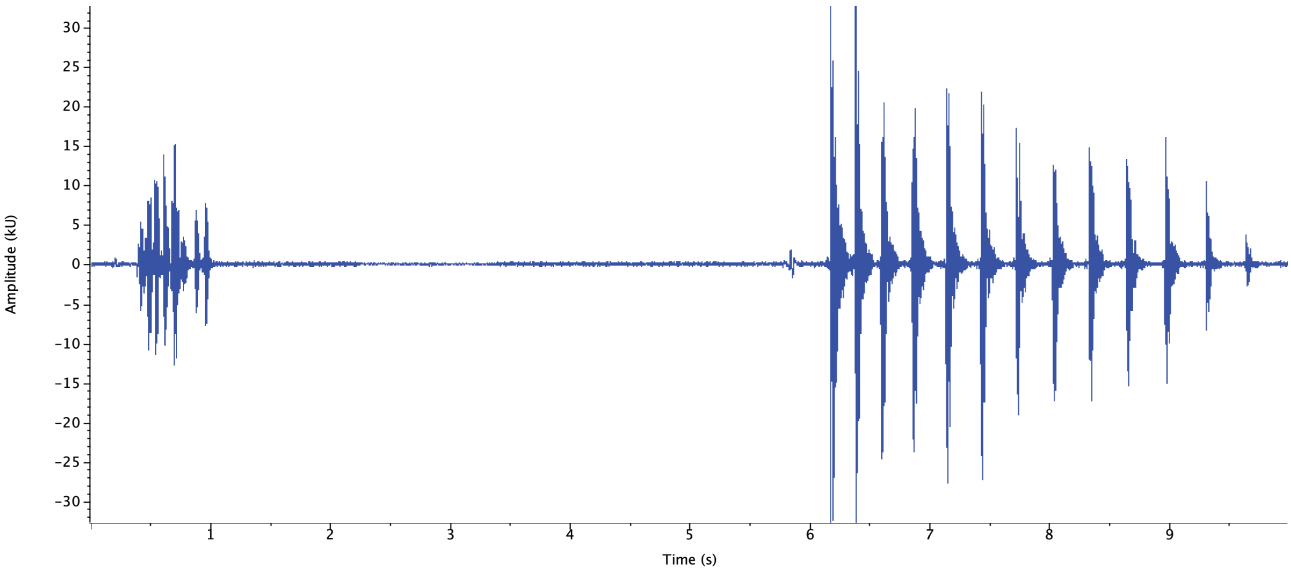


FIGURE 830. SCD and calling drum (R96-12) adult male holotype *A. sanpedromartir*.

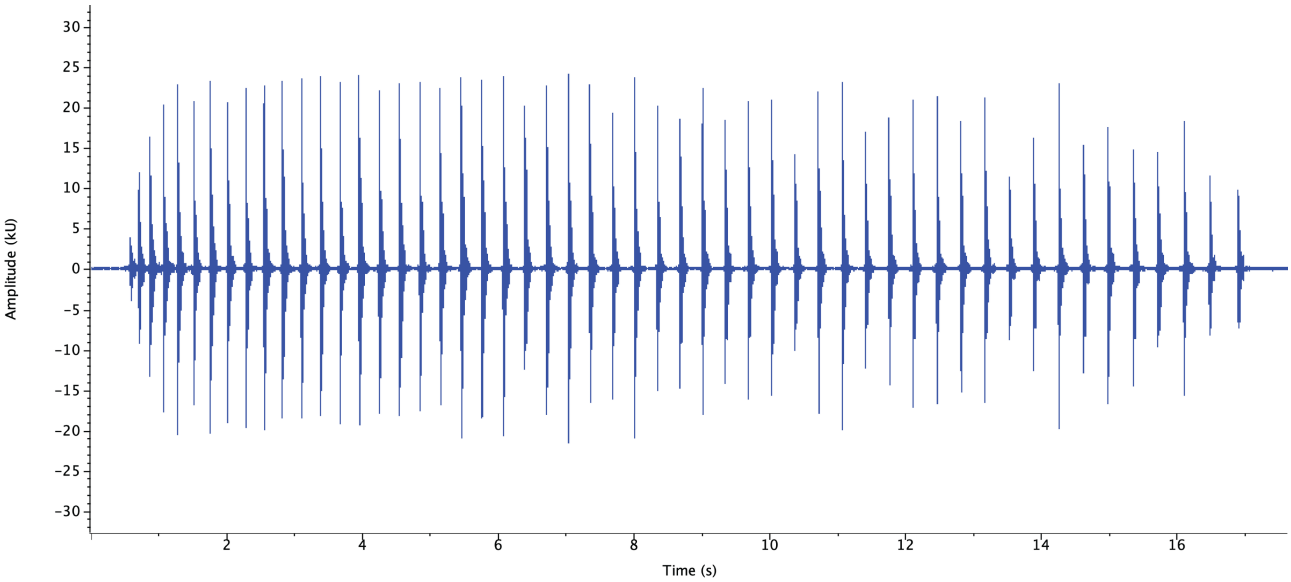


FIGURE 831. Calling drum (R96-23) adult female allotype *A. sanpedromartir*.

Karyotype. 2n♂=25. T95-23 (Fig. 832, type locality S95-66) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

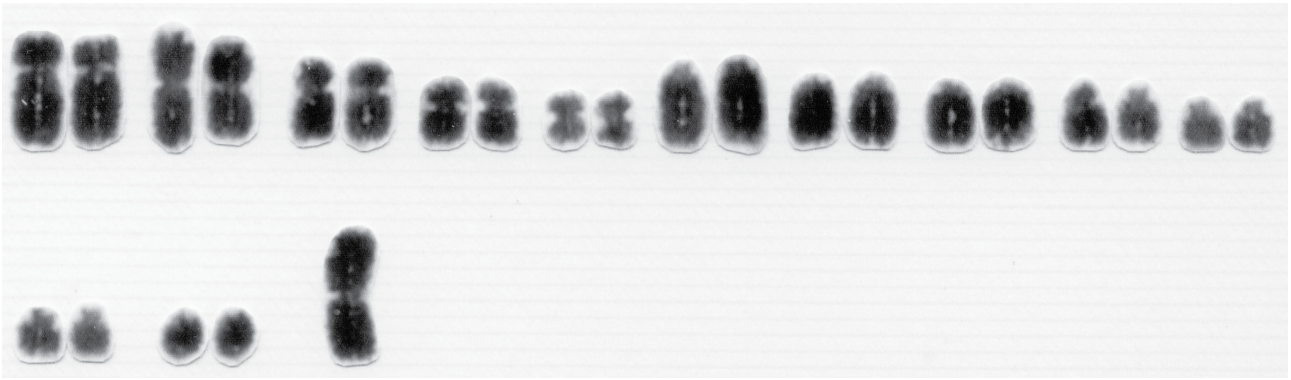


FIGURE 832. Idiogram T95-23 *A. sanpedromartir* (S95-66).

Discussion. Thorne *et al.* (2010) provides a good discussion on the natural history and flora of the type locality area.

***Ammopelmatus santarosaplateau* Weissman, sp. nov.**
Santa Rosa Plateau Jerusalem Cricket
Figs 833–842, Tables 6, 21

Distribution. (Fig. 833). Known only from the Santa Rosa Plateau area at the southern end of the Santa Ana Mts, Riverside Co., California.

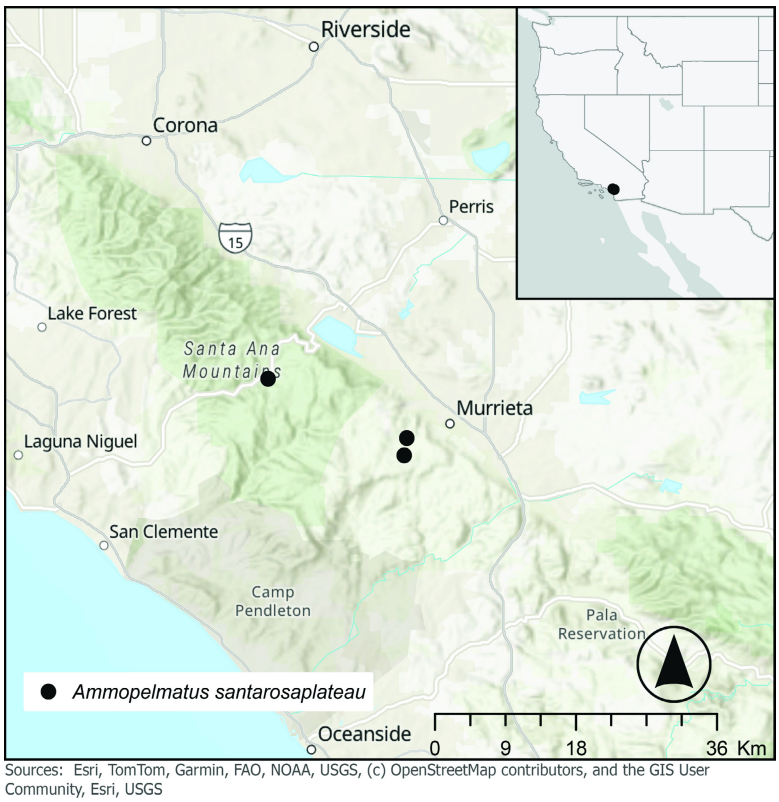


FIGURE 833. Distribution of *A. santarosaplateau.*

Recognition characters. Along with *A. coyflat,* the *Ammopelmatus* species with the fastest calling drum that is not in either the Longispinus or Fast Drumming Group of JCs. 2n♂= 23. Separated from nearby *A. oneillpark* (2n♂=25), *A. skinner* (2n♂= 25), and *A. stringfellow* (2n♂=25) by karyotype and slower drumming rate in all three taxa. From type locality Santa Rosa Plateau to *A. oneillpark*, at Caspers, is 26 km. Another fast drumming Riverside Co. taxon is *A. calimesa*, but it is separated by some physical distance and habitat. Female *A. icenoglei* also drum around 8 drums/s, but latter are easily distinguished by their 3rd rear leg tibial inner spine. Adjacent San Diego Co. *A. fisheri* and *A. kirai* also drum slower, and they can be distinguished from *A. santarosaplateau* by DNA. The drumming rate in *A. santarosaplateau* is obviously not 50% faster than that of *A. oneillpark* (both in Santa Ana Mts), as discussed on p. 22, but their DNA and karyotypes confirm their distinctiveness.

Holotype. Male (in alcohol, Fig. 834) **California, *Riverside Co.*,** Santa Ana Mts, Santa Rosa Plateau Ecological Preserve, Granite Loop Trail, 33.54360° -117.27015°, 544m, 26-ii-2024 (S24-15) DBW & DW Weissman. R24-8, F2956. Molt to adult 24-viii-2024. Deposited CAS, Entomology type #20385. Measurements in mm: Body length 35.08, hind femur length 10.84, hind femur width 4.15. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 835) with 5 inner and 3 outer spines, 2 ventral spurs.

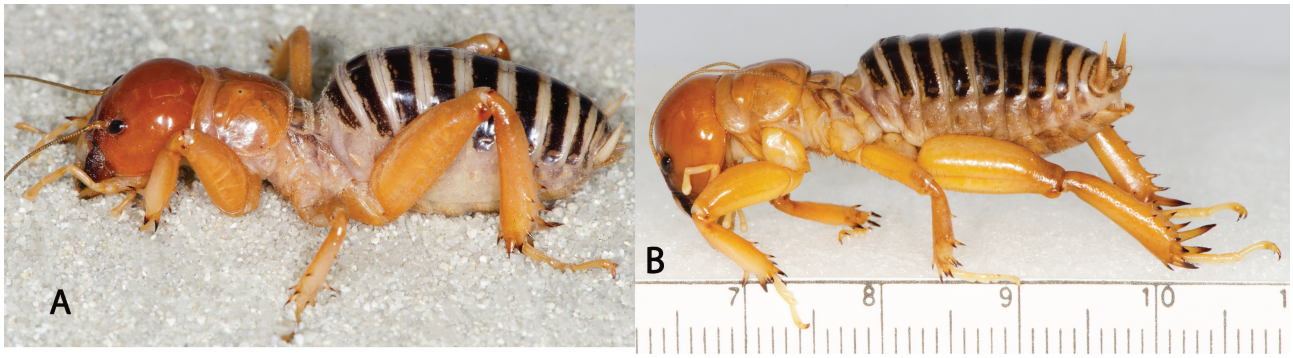


FIGURE 834. Adult male holotype *A. santarosaplateau.* A. When alive. B. When preserved.



FIGURE 835. Left rear leg tibia adult male holotype *A. santarosaplateau.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 836). Same data as holotype except R24-17, F2968. Molt to adult 6-ix-2024. Deposited CAS. Measurements in mm: Body length 35.23, hind femur length 9.57, hind femur width 3.44. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 837) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 838.

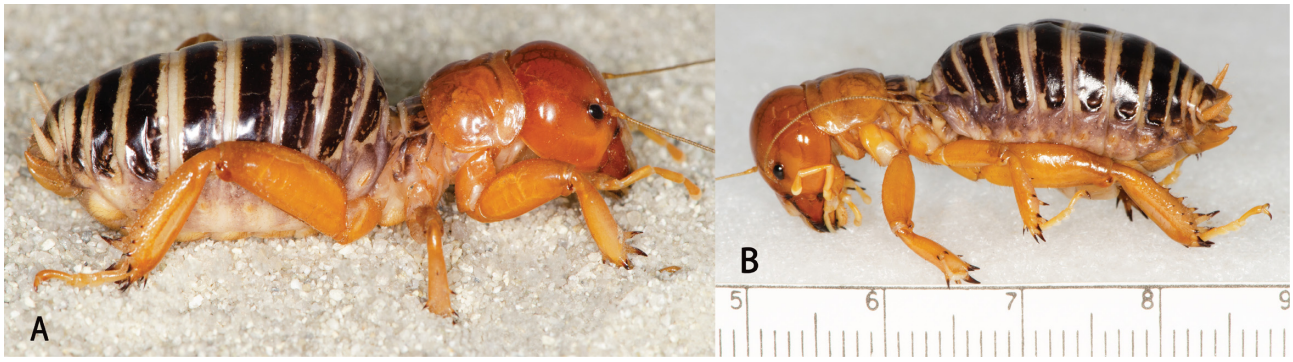


FIGURE 836. Adult female allotype *A. santarosaplateau.* A. When alive. B. When preserved.



FIGURE 837. Left rear leg tibia adult female allotype *A. santarosaplateau.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 838. Ovipositor allotype *A. santarosaplateau.*

Paratypes. ♂4 ♀13. **CALIFORNIA, *Riverside Co.,*** Same data as types, ♂3 ♀13. Santa Rosa Plateau, 33.524268° -117.273167°, 565m, 13-iii-1987 (S87-12) D. Goodward ♂1. Hwy 74, 33.609779° -117.429327°, 588m, 27-v-2018 (S18-13), J. Pavelek ♀1.

Drum. Both sexes drum similarly except males with a sex clarification drum (SCD) and females with longer series. Holotype **male**: R24-8 (Fig. 839) shows 40 drums over 4.2s (9.5 drums/s) at 21.9°C. Other topotypic males drummed as follows: R24-3, 9.6–10 drums/s at 22°C; R24-6, 9.3 drums/s at 22.8°C and 9.5 drums/s at 23.3°C; R24-10, 8.4 drums/s at 22°C. Allotype **female** R24-17 (Fig. 840) shows 46 drums over 5.4s (8.5 drums/s) at 21.9°C. Other topotypic female drumming rates as follows: R24-9, 8.1 drums/s at 21.3°C; R24-12, 8.3 drums/s at 22.2°C; R24-19, 8.5 drums/s at 21.5°C; R24-21, 8.7 drums/s at 21.7°C; and R24-22, 8.7 drums/s at 22°C.

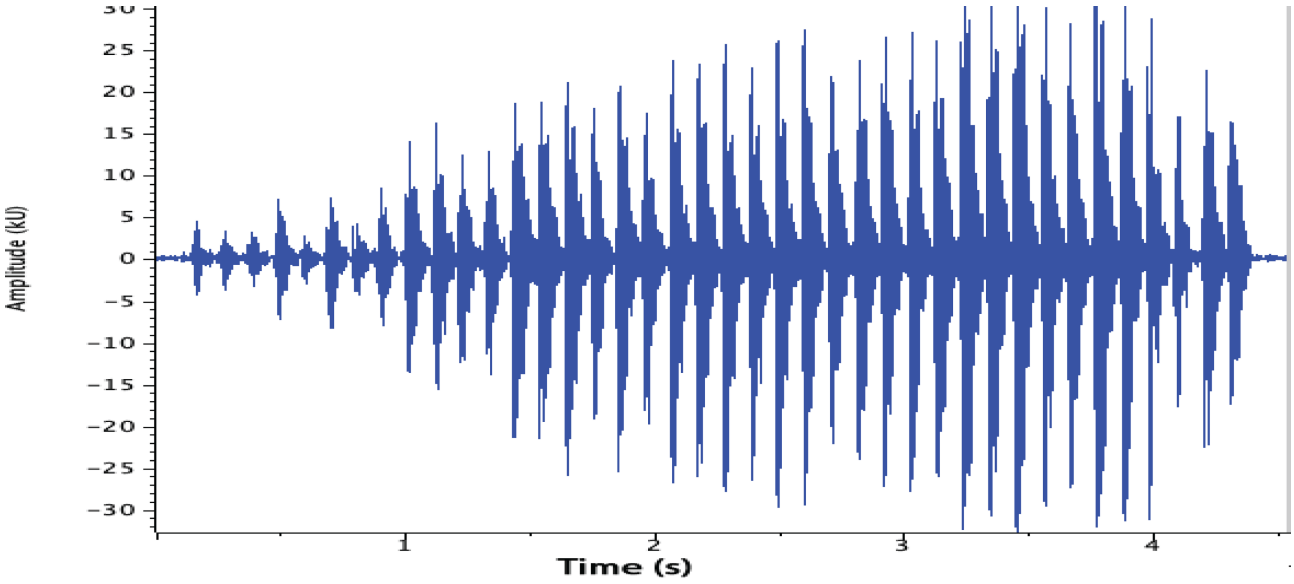


FIGURE 839. Calling drum (R24-8) holotype adult male *A. santarosaplateau.*

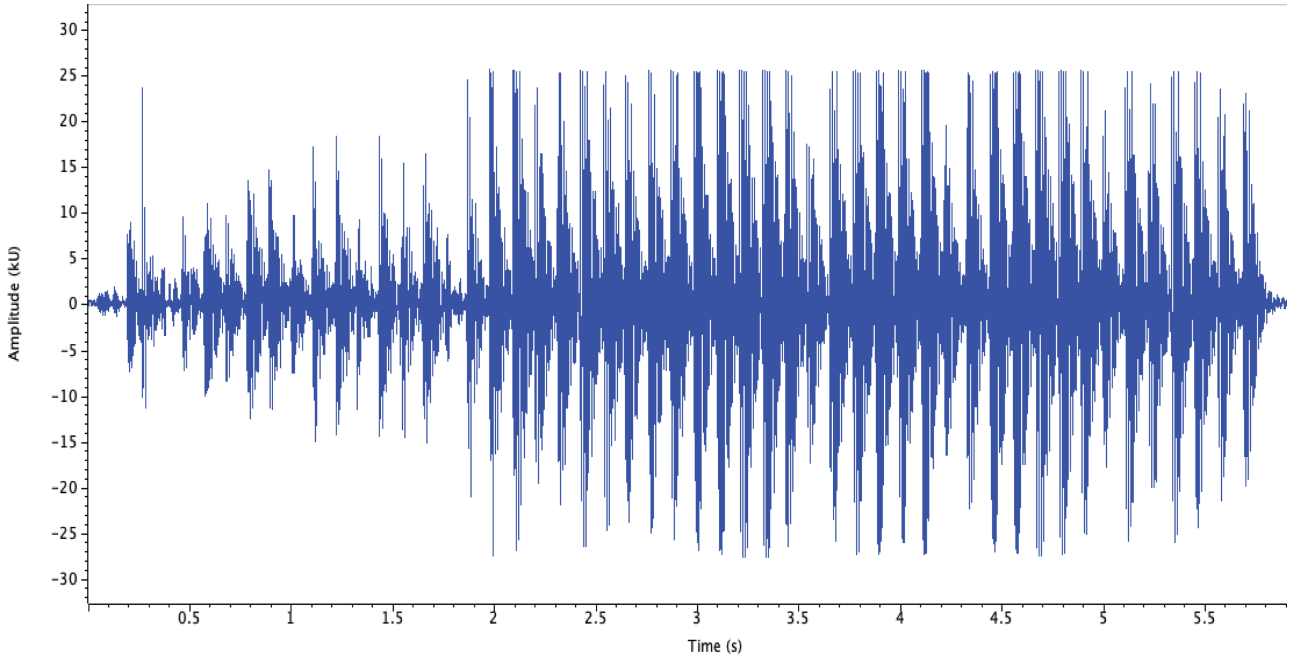


FIGURE 840. Calling drum (R24-17) adult female allotype *A. santarosaplateau.*

Derivation of name. Named after the type locality area.

Habitat. Chaparral with localized riparian areas. Mostly under stones bordering hiking trails.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle. *A. santarosaplateau* appears to have no adult reproductive dormancy period (compare with nearby *A. skinner*, see p. 865), because there is no significant delay between the molt to adult and when the first calling drums are heard or can be elicited with finger tapping. Representative 2024 intervals for both sexes are as follows. **Males:** R24-6, molt to adult 18-viii and recorded on 8-ix; R24-8, molt to adult 24-viii and recorded 11-ix; R24-10, molt to adult 26-viii and recorded 11-ix. **Females**: R24-12, molt to adult 24-viii and recorded 13-ix; R24-21, molt to adult 20-ix and recorded 30-ix; R24-22, molt to adult 13-ix and recorded 30-ix. Thus, *A. santarosaplateau* adults of both sexes start to drum 10 to 21 days after molting to adult. In contrast, *A. skinner*, with its apparent dormancy period, start drumming from 2.3 weeks to 2.5 months after the molt to adult.

Variation. Of 19 individuals, 2 had 2 and 17 had 3 ventral **fore** leg tibial spurs; 2 had 7 and 17 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and 15 had 3 and 4 had 4 outer **rear**

leg tibial spines, all with 2 ventral spurs. Smallest collected adult was a female, with a body length of 24.77mm, collected on 25-ii-2024. This seems to be a general pattern in many species, where the adults collected during the winter are usually females, and then some of them are the smallest adults seen.

DNA. Fig. 734, p. 418. F2506 (S18-13, Hwy 74); F2942, F2952, F2954 (all type locality S24-14) recovered in Group 13 Southern California #3, in a clade with *A. kirai* and *A.* sp. #2.

Karyotype. 2n♂=23. T24-15 (Fig. 841), T24-16 (Fig. 842), both type locality S24-14 with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 841. Idiogram T24-15 *A. santarosaplateau* (S24-14). Anaphase cell, on right, from which idiogram was made.



FIGURE 842. Idiogram T24-16 *A. santarosaplateau* (S24-14), using C-banding. Anaphase cell, on right, from which idiogram was made.

Discussion. According to Wikipedia, the type locality Santa Rosa Plateau Ecological Reserve is a protected area of some 34 km^2. The Ecological Reserve was assembled in several stages: two parcels, comprising 3,100 acres (13 km^2), were purchased by The Nature Conservancy in 1984. The intervening parcels were purchased in the 1990s by the State of California, the Riverside County Regional Park and Open-Space District, and the Metropolitan Water District of Southern California. Although the parcels remain under the ownership of separate agencies, they are managed cooperatively, with biological resource management, which includes prescribed fire and habitat restoration programs, managed by the Nature Conservancy. A non-profit organization, the Santa Rosa Plateau Nature Education Foundation, provides funding for field trips to the Reserve for all third-graders in the area.

A. santarosaplateau is found sympatric at type locality with the less common *A. mahogani.*

(CLADE 10) Four Groups, and 14 species, all east of the Sierra Nevada and Cascade Ranges, are recovered together. The individuals in this large Clade 10, with some undoubtedly unrecognized species given the diversity of habitats and geographic range, all (1) drum slowly (0.8–1.8 drums/s); (2) all have 2n♂=25; (3) generally light colored; (4) with many megacephalic individuals; (5) frequently associated with sandy substrates; and (6) adult male sex clarification drums rare, or unknown, except for *A. lincolncounty*. The geographical separation between the Fuscus, Mono Lake, and Yuba Lake Groups is somewhat arbitrary, mostly based on weakly supported branches, and used here for convenience. These Groups, and their further subdivisions into species, generally correlate with physical features (e.g., the Rocky Mts) and climatic zones (e.g., The Great Basin Desert), but these divisions are not always precise.

Group 14, Lincoln County Group (Fig. 843)

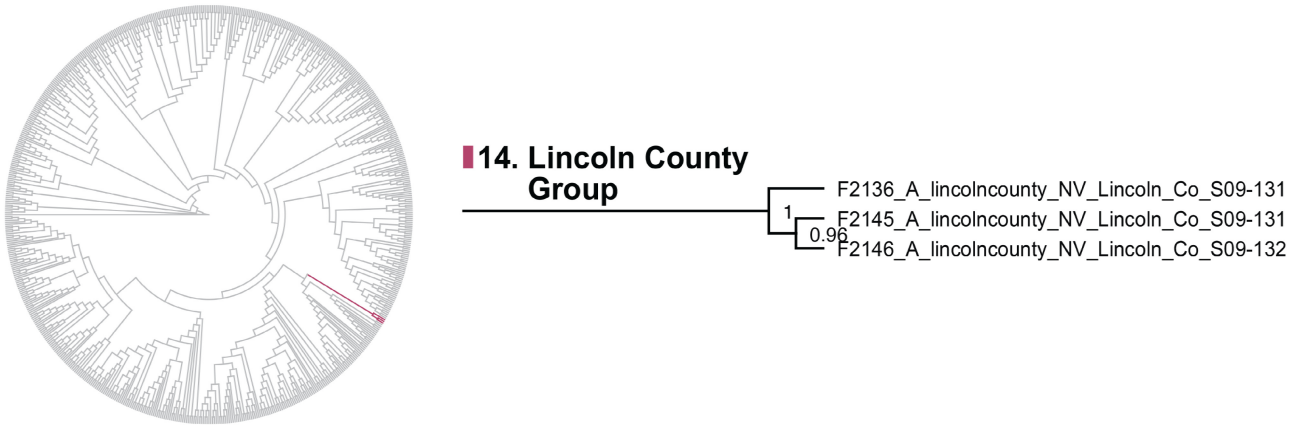


FIGURE 843. ASTRAL tree for Lincoln County Group.

This single species group is known from 3 adult males collected at night, at high elevation, on Hwy 319, Lincoln Co., Nevada, almost at the Utah border. These males are inseparable from *A. cathedralgorge*, except for their distinguishing DNA.

SPECIES WRITE UP: *A. lincolncounty* (p. 471).

***Ammopelmatus lincolncounty* Weissman, sp. nov.**
Lincoln County Jerusalem Cricket
Figs 844–849, Table 30

Distribution. (Fig. 844). High elevation in Lincoln Co., Nevada, close to the Utah border.

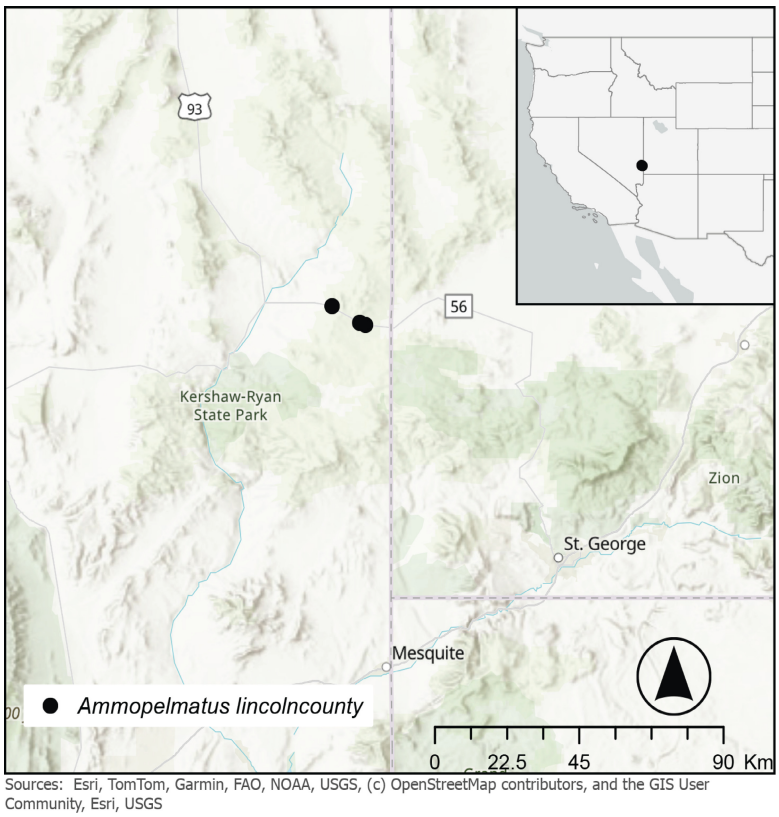


FIGURE 844. Distribution of *A. lincolncounty.*

Recognition characters. Morphologically similar to nearby, also high elevation *A. cathedralgorge*, but *A. lincolncounty* with a frequently heard sex clarification drum (SCD); and recovered DNA from all three adult males different than *A. cathedralgorge*. Calling drum of ~1 drum/s. SCD heard in only 1 (Panaca, S95-56, R95-113, F0171) of 14 males of *A. cathedralgorge*, while both collected live males of *A. lincolncounty* frequently employing a SCD. Cathedral Gorge is some 16 km due west of the closest known locality of *A. lincolncounty*. Rear leg outer tibial spine #1 attenuate, not truncate or flattened.

Holotype. Male (in alcohol, Fig. 845). **NEVADA, *Lincoln Co.,*** Hwy 319, 4.1 m W Utah state line, 37.731056° -114.123584°, 1857m, 18-viii-2009 (S09-131) DBW & DC Lightfoot. R09-33, F2145. Adult male collected on road at night. Deposited CAS, Entomology type #20220. Measurements in mm: Body length 36.67, hind femur length 10.86, hind femur width 3.78. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 846) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Inner rear leg tibial spines #1 and #2 about equal in length.



FIGURE 845. Adult male holotype *A. lincolncounty.* A. When alive. B. When preserved.



FIGURE 846. Left rear leg tibia holotype *A. lincolncounty.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Female. Unknown.

Paratypes. ♂3. **NEVADA, *Lincoln Co.,*** type locality, dead on road at night, ♂1. Hwy 319, 4.9 m W Utah state line or 16 m E Panaca, 37.7368° -114.1397°, 1840m, 11-viii-1988 (S88-92) ♂1. Hwy 319, 10.6 m W Utah state line, 37.781361° -114.217167°, 1902m, 18-viii-2009 (S09-132) ♂1.

Drum. One of only two species in the slow drumming, related Fuscus, Lincoln County, Utah, and Yuba Lake Groups, with a sex clarification drum (SCD). In the one other related species with a SCD, *A. cathedralgorge*, males rarely with a SCD. **Male:** Holotype R09-33 shows (Fig. 847) SCD of 18 drums over 3.2s (5.6 drums/s) at 20.5°C. A second series shows (Fig. 848) a SCD of 13 drums over 2.1s (6.2 drums/s), followed by 3 pairs, followed by 3 single drums over 2.9s (1.0 drums/s). Topotype male R09-30 (S09-132) shows (Fig. 849) SCD of 12 drums over 1.8s (6.7 drums/s) followed by 1 pair of drums and then a calling drum of 4 drums over 4.4s (0.9 drums/s) at 22°C. **Female:** Unknown.

Derivation of name. Named for the only county in which it is known to occur.

Habitat. High elevation, rocky mountain pass areas with pinyon/juniper, *Artemisia*. All four adult males collected on road pavement at night.

Life cycle and seasonal occurrence. We assume a typical 2-year life cycle.

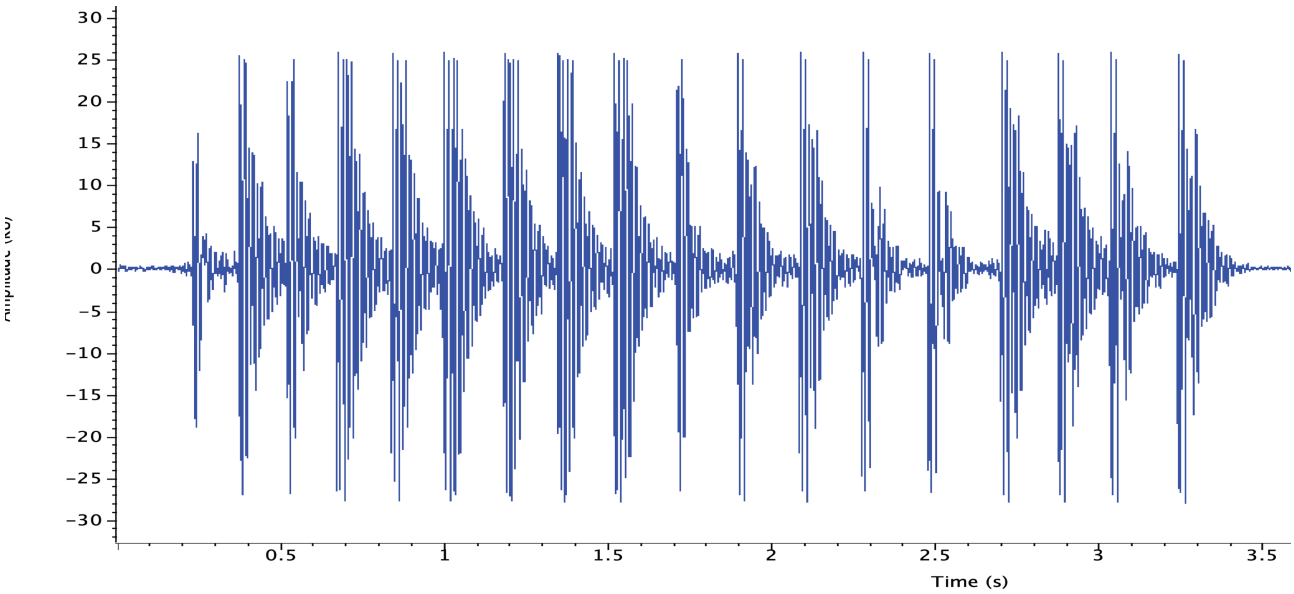


FIGURE 847. Long SCD (R09-33) in adult male holotype *A. lincolncounty.*

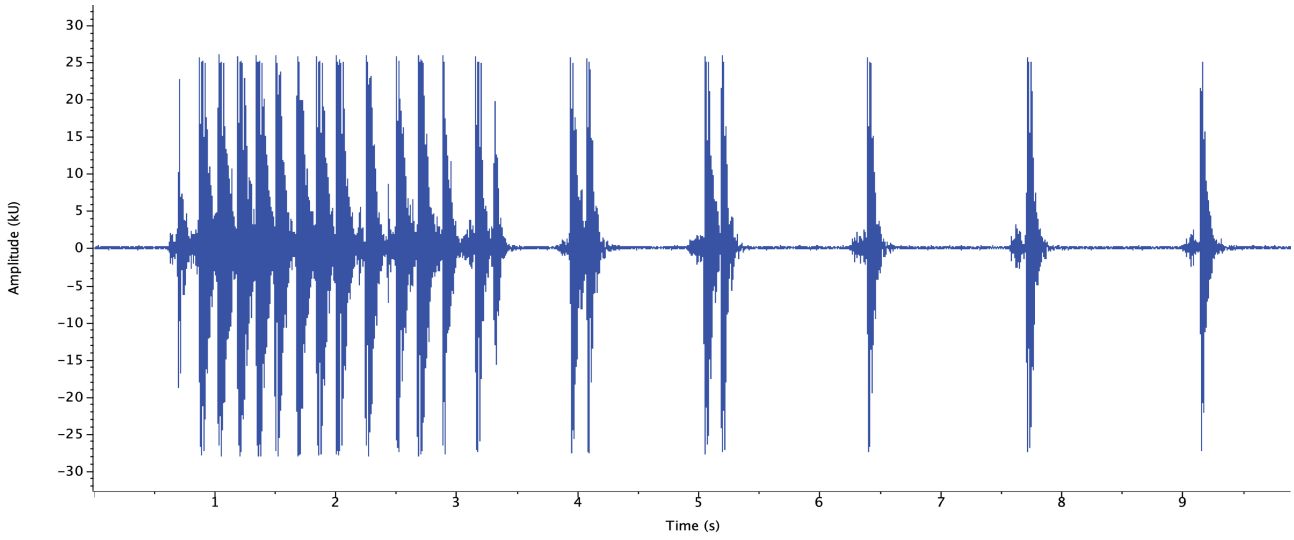


FIGURE 848. Second series (R09-33) in adult male holotype *A. lincolncounty.*

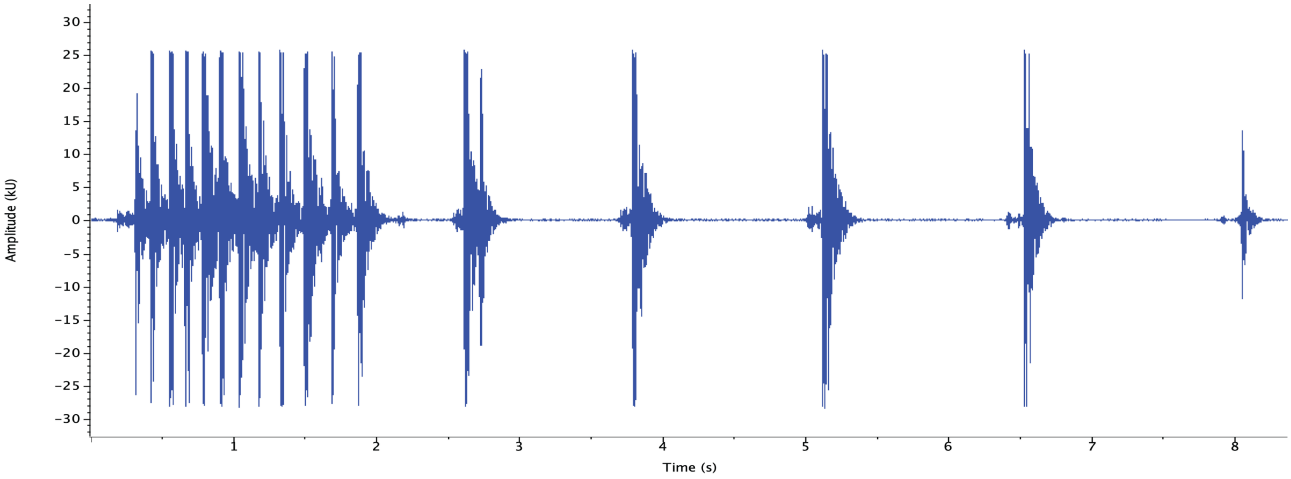


FIGURE 849. SCD and calling drum (R09-30) paratype adult male *A. lincolncounty.*

Variation. From 3 (including holotype) adult males, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; all had 5 **rear** leg inner tibial spines, and 2 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 844, p. 471. F2136 and F2145 (both type locality S09-131) and F2146 (S09-132) all recovered together in Group 14 Lincoln County, with a long, well supported branch, and closest to the Utah Group clade.

Karyotype. Unknown.

Discussion. SCDs were easily heard or elicited, by finger tapping, from both live collected adult males of *A. lincolncounty.* Their localities are separated by 10 km, along Hwy 319. In contrast, SCDs were heard in only 1 of 14 adult males of *A. cathedralgorge*. These 2 taxa were found within 14 east-west km of each other (S95-56 vs S09-132), but the former locality is at ~450m lower elevation. Because they are morphologically indistinguishable, and geographically close, had we not had significant DNA separation, we would have considered them conspecific. Unfortunately, elevation is not a reliable parameter for separating these 2 taxa since we also document *A. cathedralgorge* at 2070m in Great Basin National Park (S97-124, F0526).

Group 15, Utah Group (Fig. 850)

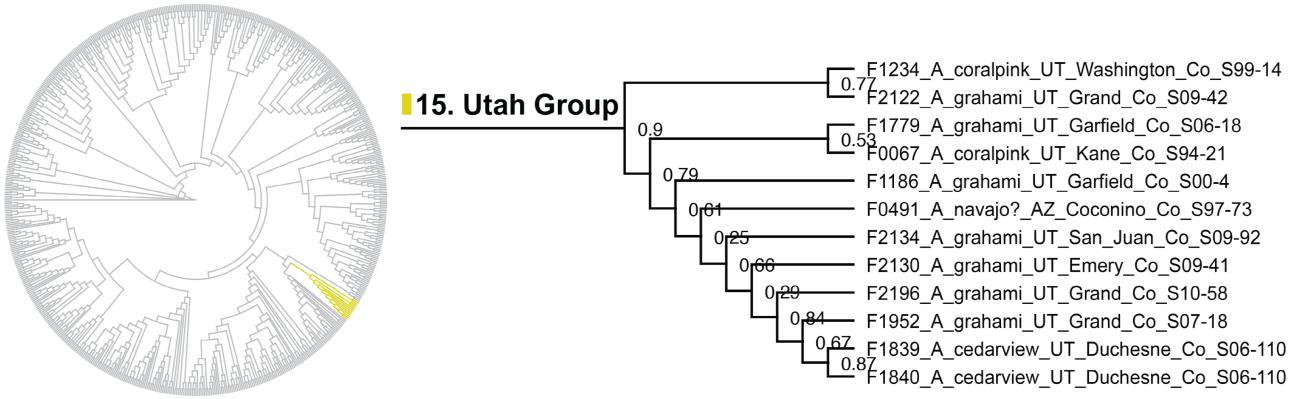


FIGURE 850. ASTRAL tree for Utah Group.

This Group of 3 species, all with varying habitats, is only known from Utah. All three taxa with 2n♂=25.

SPECIES WRITE UPS: *A. cedarview* (p. 475); *A. coralpink* (p. 479); and *A. grahami* (p. 484).

***Ammopelmatus cedarview* Weissman, sp. nov.**
Cedarview Jerusalem Cricket
Figs 851–860, Table 33

Distribution. (Fig. 851). Only known from area around Cedarview, Uintah Basin, Duchesne Co., Utah.



FIGURE 851. Known distribution of *A. cedarview.*

Recognition characters. Small to medium sized JC found east of the central mountain ranges in Utah. Morphologically similar to more widespread Utah *A. yubalake*, but, along with Utah Group members *A. coralpink* and *A. grahami,* the only Utah species with outer rear leg tibial spine #1 posteriorly flattened, with the face 15–75° rotated with reference to the long axis of the hind tibia; in contrast to 0–20° rotation seen in *A. yubalake.* Also differs from *A. yubalake* in DNA, being smaller with shorter rear leg tibial calcar #1, and lighter colored with less extensive abdominal stripes.

Holotype. Male (in alcohol, Fig. 852). **Utah, *Duchesne Co.,*** Cedarview, Cedar Ridge Academy 40.383474° -110.072959°, 1712m, 5-iv-2007 (S07-6) CF Hamblin. R07-19. Molt to adult 19-vii-2007. Deposited CAS, Entomology type #20196. Measurements in mm: Body length 36.09, hind femur length 11.64, hind femur width 4.03. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 853A) with 5 inner and 3 outer spines, 2 ventral spurs. Outer rear leg tibial spine posteriorly flattened, offset some 75° to long axis of tibia (Fig. 853B).

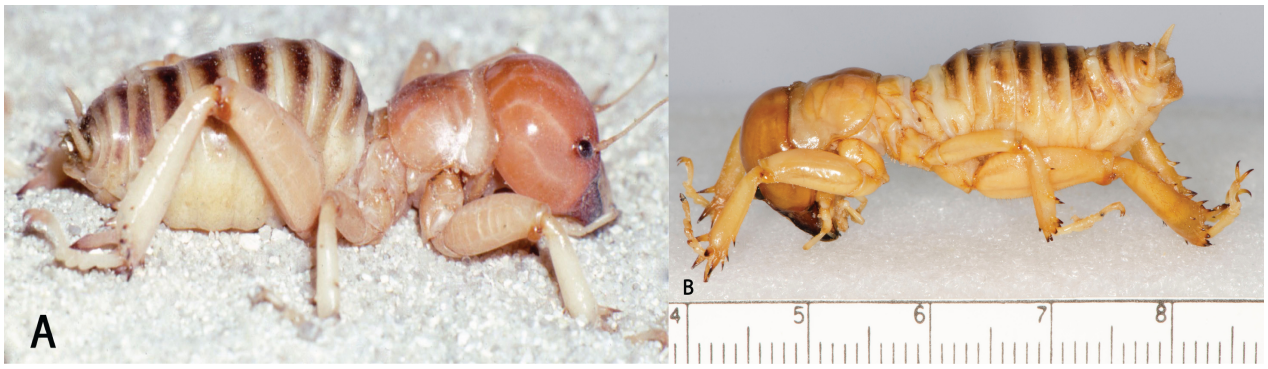


FIGURE 852. Holotype adult male *A. cedarview.* A. When alive. B. When preserved.

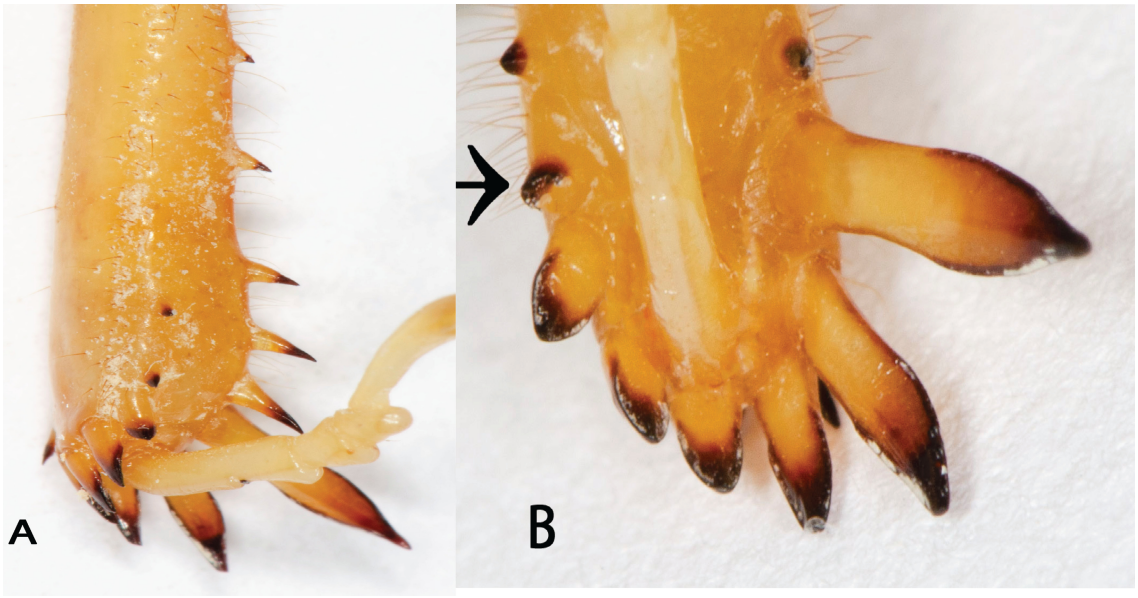


FIGURE 853. Left rear leg tibia in holotype adult male *A. cedarview.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars. Note how face of outer spine #1 (arrow) is offset some 75° to long axis of tibia.

Allotype. Female (in alcohol, Fig. 854A. live paratype female; Fig. 854B. preserved allotype). Same data as holotype except 10-vi-2008 (S08-48) CF Hamblin. R08-12. Molt to adult 16-viii-2008. Deposited CAS, CASENT #8413873. Measurements in mm: Body length 34.9, hind femur length 10.41, hind femur width 3.78. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 1 or 2 ventral spurs; hind leg tibia (Fig. 855) with 4 or 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 856.

Paratypes. ♂2 ♀8. **UTAH, *Duchesne Co.***, type locality, all CF Hamblin, 14-ix-27-x-2006 (S06-110) ♂1 ♀6; 4-vi-10-vii-2007 (S07-6) ♂1 ♀1. 8 m N Cedarview, west and north of Neola, 40.386289° -110.072763°, 1721m, 22-vii-2007, CF Hamblin ♀1.

Drum. Same in both sexes except series longer in females than males. **Male:** Holotype (Fig. 857, R07-19) with 35 drums over 25.7s at 21°C (1.4 d/s). **Female:** Allotype (Fig. 858, R08-12) with 129 drums over 97.9s (1.3 d/s) at 21°C.



FIGURE 854. Adult female *A. cedarview.* A. Live paratype (S06-110, F1839). B. Preserved allotype.

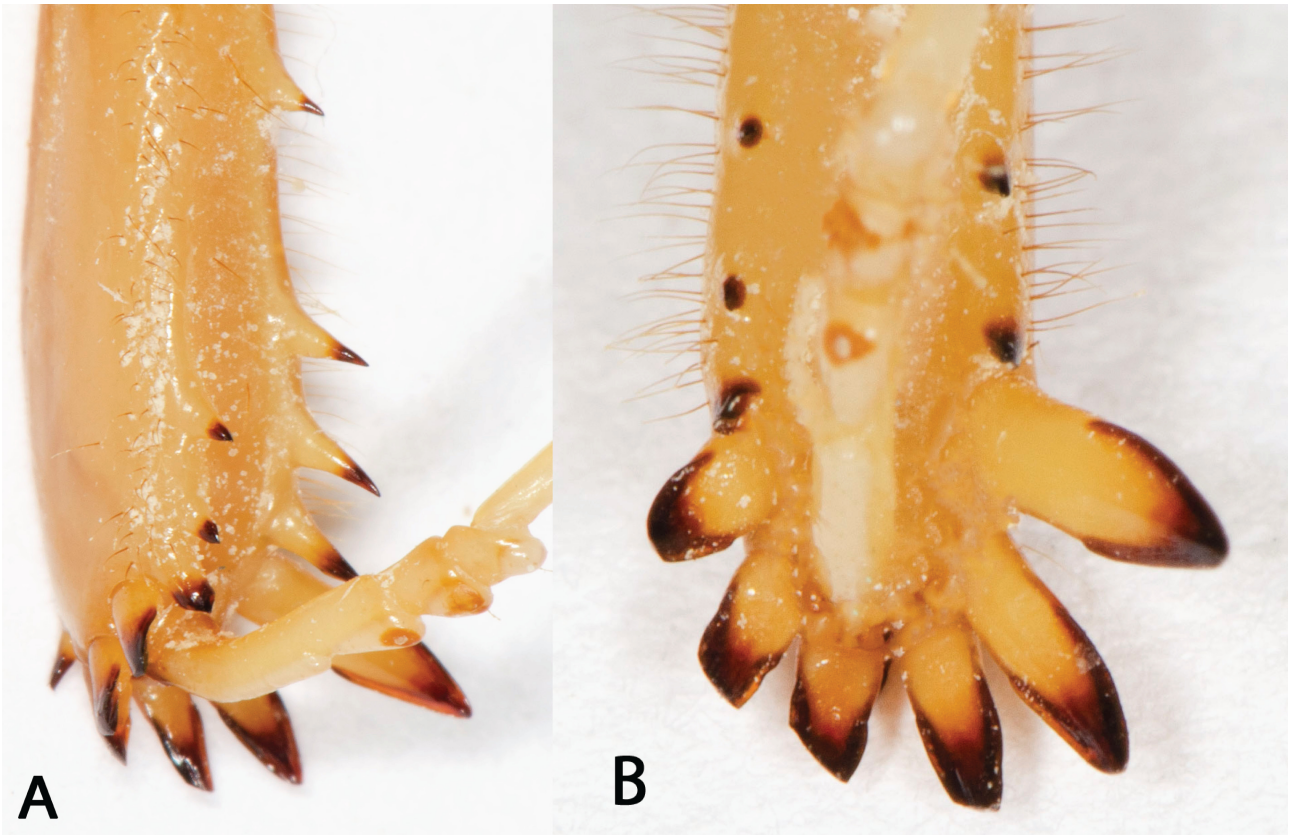


FIGURE 855. Left rear leg tibia allotype female *A. cedarview.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

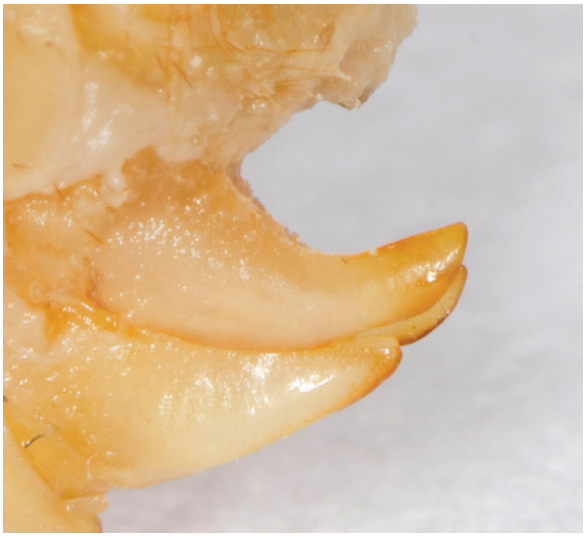


FIGURE 856. Ovipositor allotype *A. cedarview*.

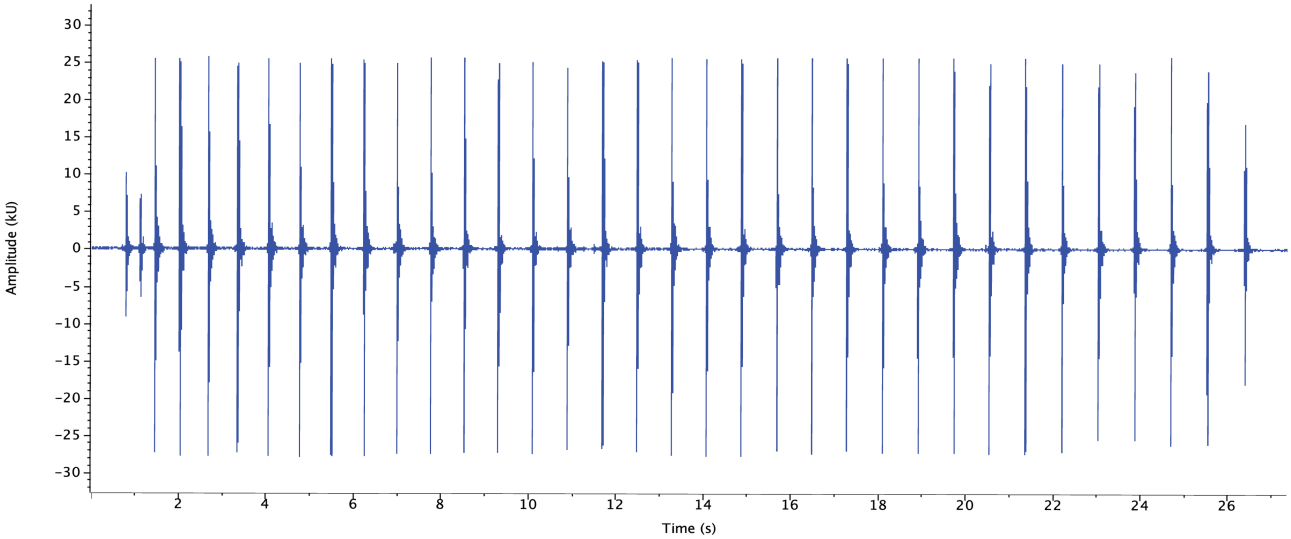


FIGURE 857. Calling drum (R07-19) holotype adult male.

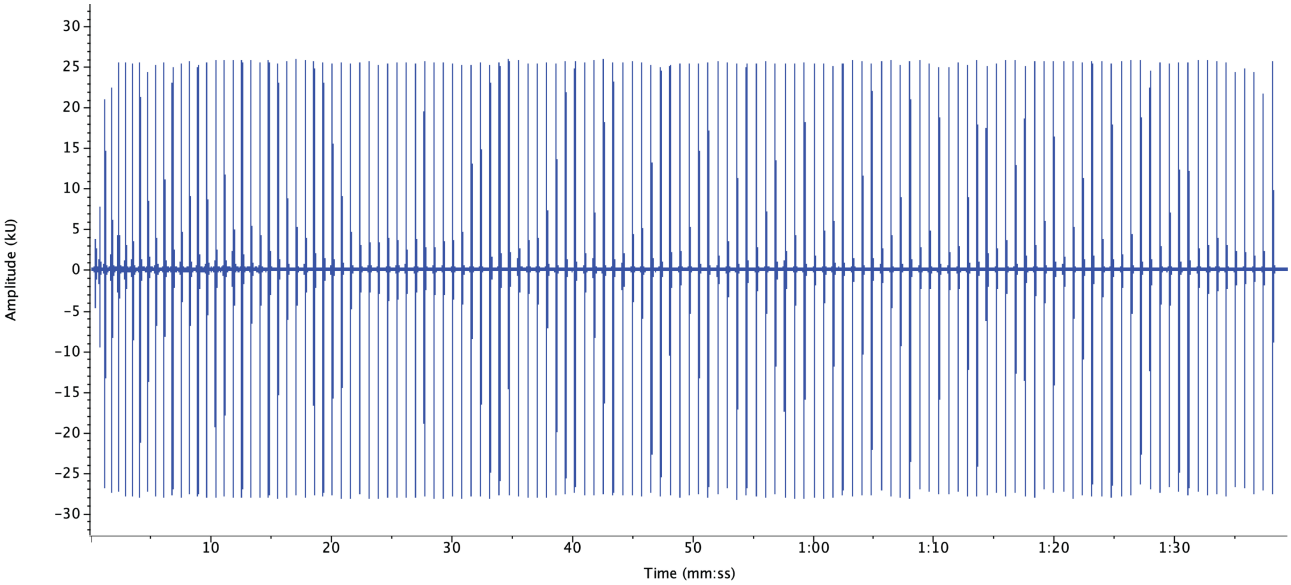


FIGURE 858. Calling drum (R08-12) allotype adult female.

Derivation of name. Named after the nearby, unincorporated community of Cedarview.

Habitat. Sandy substrate with juniper, bunch grasses, *Opuntia* cactus, sagebrush, rabbit brush, greasewood, and saltbush, according to Chad Hamblin.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. For 12 individuals, all had 3 ventral **fore** leg tibial spurs; all 12 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 3 had 4, 8 had 5 and 1 had 6 inner **rear** leg tibial spines, while 10 had 3 and 2 had 4 outer **rear** leg tibial spines, all 12 with 2 ventral spurs.

DNA. Fig. 850, p. 474. F1839 & F1840 (type locality S06-110) recovered in Group 15 Utah with *A. coralpink, A. grahami*, and an aberrant specimen of possibly *A. navajo.*

Karyotype. 2n♂=25. Two type locality males examined and both similar. T07-1 (Fig. 859, S06-110) and T07-8 (Fig. 860, S07-6) both show 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

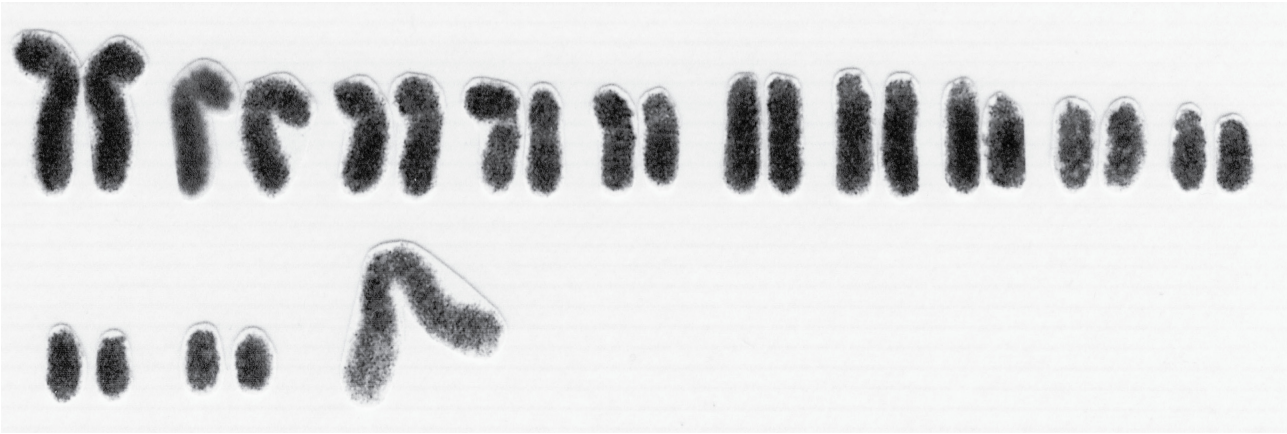


FIGURE 859. Idiogram T07-1 *A. cedarview* (S06-110).



FIGURE 860. Idiogram T07-8 *A. cedarview* (S07-6).

Discussion. The type locality, located on the 109-acre Cedar Ridge Academy campus in rural Utah, near Roosevelt, was subsequently renamed the Makana Outreach Leadership Academy, in 2020, after the Cedar Ridge Academy was closed for various child abuse infractions. Then the Makana Academy was closed and there is no longer any school operating at the site (pers. comm. C. Hamblin to DBW, August, 2025).

***Ammopelmatus coralpink* Weissman, sp. nov.**
Coral Pink Sand Dunes Jerusalem Cricket
Figs 861–870, Table 33

Distribution. (Fig. 861). Coral Pink Sand Dunes State Park and Zion National Park, both in southwestern Utah.

Recognition characters. Outer rear leg tibial spine #1 with flattened face rotated 75–90° from main linear axis of tibia, although face not as developed as in *A. mescaleroensis.* Separated from *A. grahami* by size and geography; with the abdominal stripes in *A. coralpink* darker, wider, and longer and extending closer to ventral surface.

Holotype. Male (in alcohol, Fig. 862). **Utah, *Kane Co.,*** Coral Pink Sand Dunes State Park, 37.037086° -112.730181°, 1814m, 5-v-1993 (S93-28) D. Richards. R94-33. Molt to adult 28-vii-1994. Deposited CAS, Entomology type #20193. Measurements in mm: Body length 35.91, hind femur length 11.89, hind femur width 4.42. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 863) with 5 or 6 inner and 4 outer spines, 2 ventral spurs.

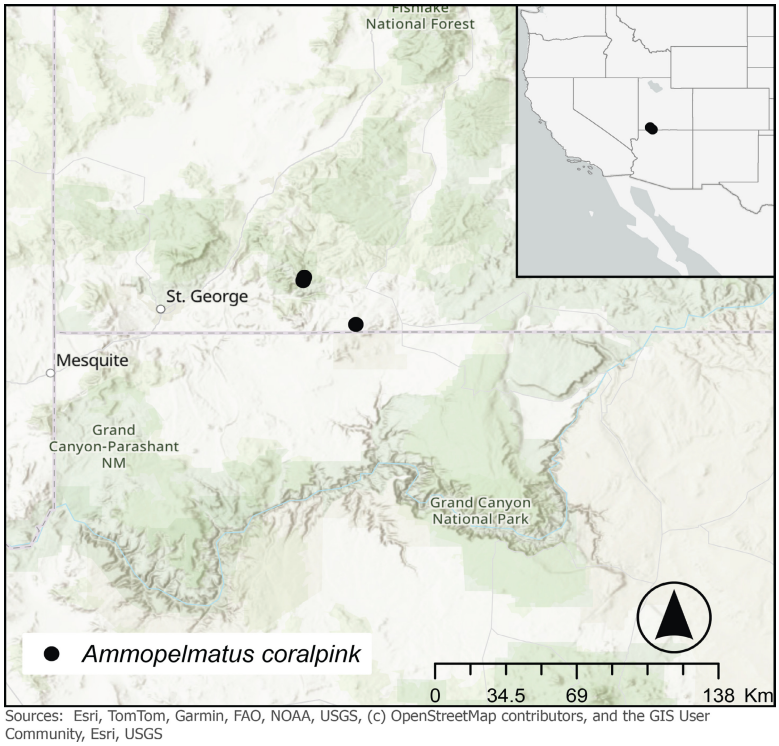


FIGURE 861. Known distribution of *A. coralpink.*



FIGURE 862. Holotype adult male *A. coralpink.* A. When alive. B. When preserved.

Allotype. Female (Photo of live paratype adult female, Fig. 864A, S99-13; in alcohol, Fig. 864B.). Same data as holotype except 21-iv-1999 (S99-15) DBW, VF Lee. R99-55, F0964. Molt to adult 29-viii-1999. Deposited CAS, CASENT #9080287. Measurements in mm: Body length 34.78, hind femur length 10.42, hind femur width 4.02. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 865) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 866.

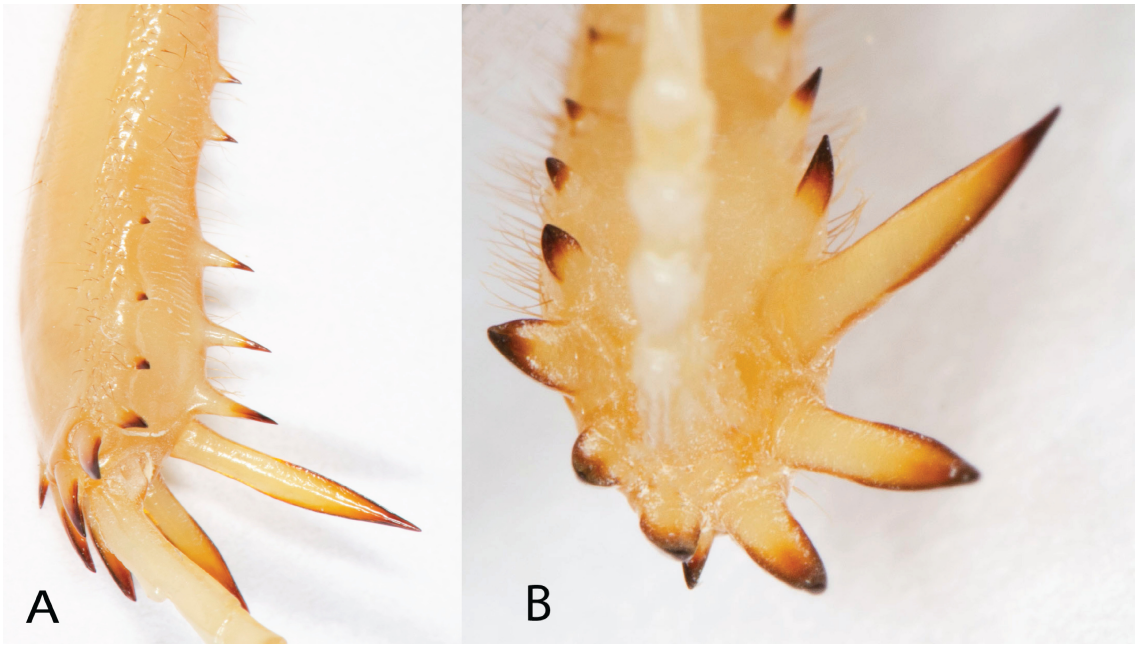


FIGURE 863. Left rear leg tibia holotype *A. coralpink*. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

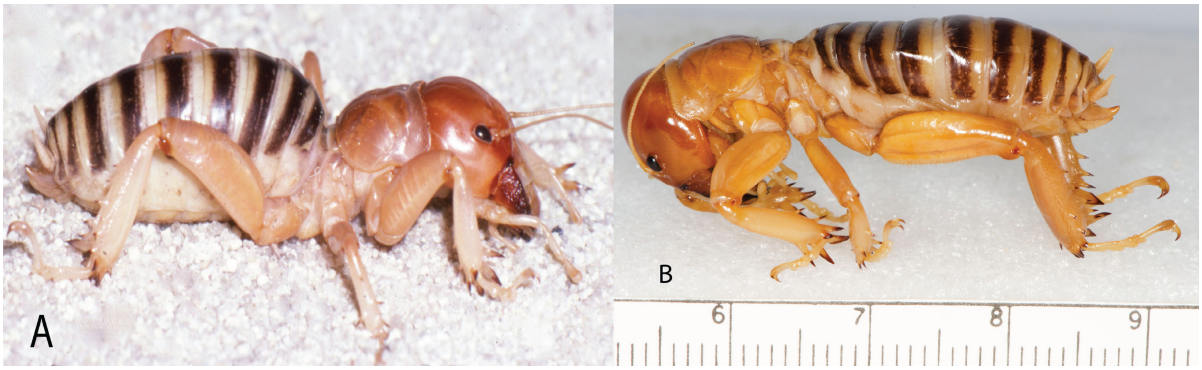


FIGURE 864. Female *A. coralpink.* A. Live paratype. B. Preserved allotype.

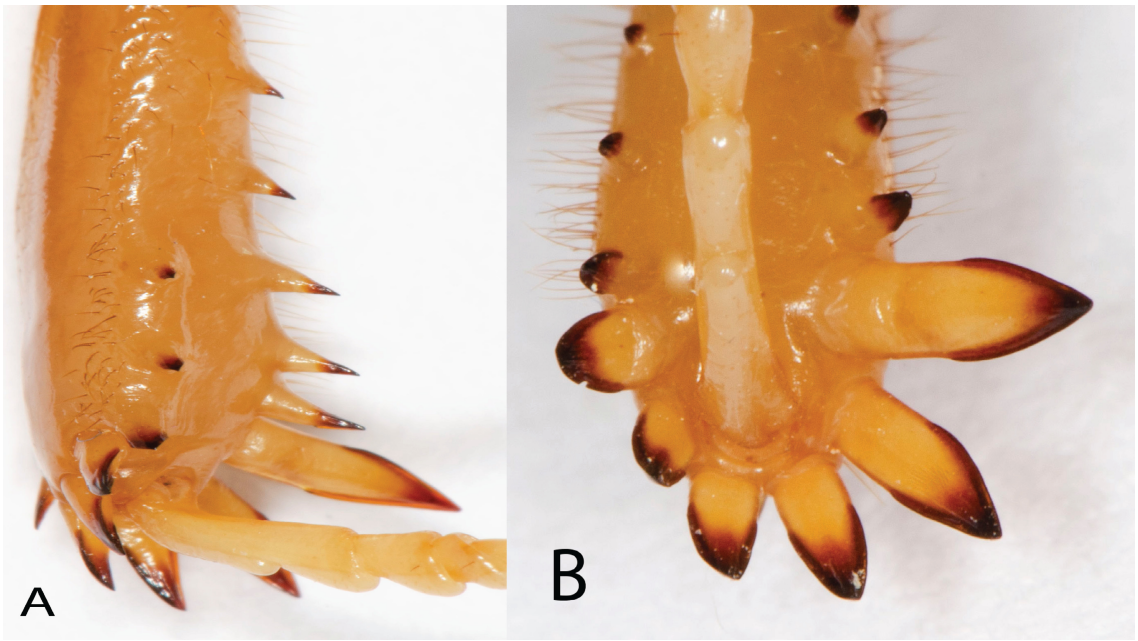


FIGURE 865. Left rear leg tibia allotype female *A. coralpink*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 866. Ovipositor allotype *A. coralpink*.

Paratypes. ♂9 ♀5. **UTAH. *Kane Co.,*** Type locality: 27-viii-1992 (S92-122) W. Icenogle ♂2; 8-vi-1993 (S93-38) D. Richards 1 male for testes; 13-v-1994 (S94-21) D. Richards ♂1 ♀1; 22-v-1998 (S98-42) RW Baumann & BA Huntsman ♀1; 21-iv-1999 (S99-15) ♂1 ♀1. ***Washington Co.,*** Zion National Park, Road to Zion Narrows 2.7 km from turnoff, 37.237030° -112.960701°, 1293m, 21-iv-1999 (S99-13) ♂1 ♀1; Zion Narrows parking lot area, 37.252873° -112.955523°, 1307m, 21-iv-1999 (S99-14) ♂4 ♀1.

Possible placement. **UTAH, *Kane Co.,*** ~13 m NE Kanab, ~37.1902° -112.3814°, 1720m, early June, 1993 (S93-39) D. Richards ♀1. Drum (R93-42) from this female is consistent with *A. coralpink* but no male or DNA available for confirmation.

Drum. Calling drum similar in both sexes but series longer in females. **Male:** Holotype R94-33 (Fig. 867) with 41 drums over 21.7s (1.9 drums/s) at 21°C. **Female:** Allotype R99-55 (Fig. 868) with 171 drums over 102.3s (1.7drums/s) at 20°C.

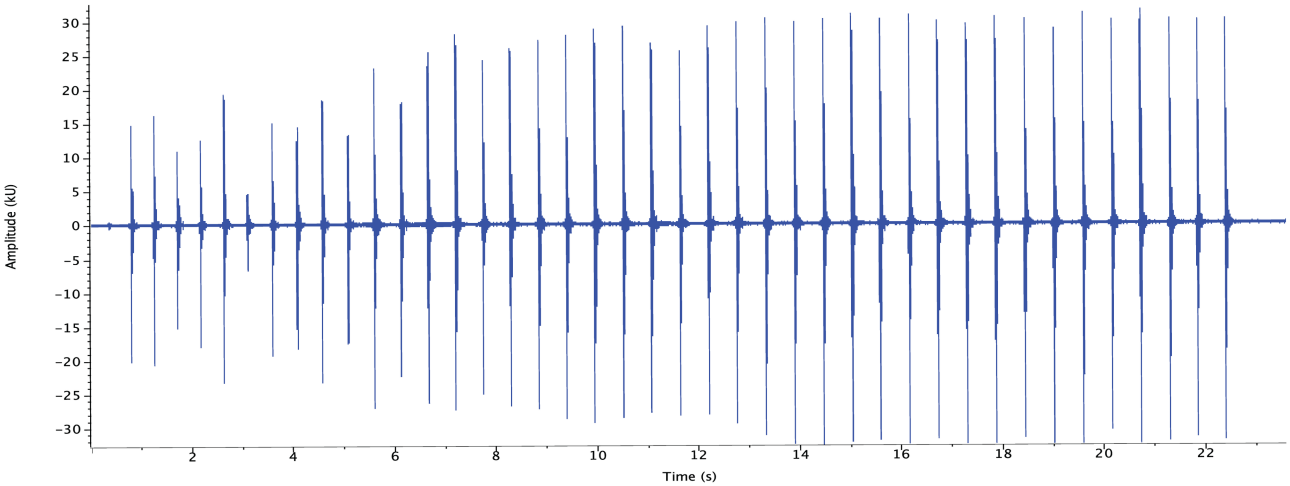


FIGURE 867. Calling drum (R94-33) adult male holotype.

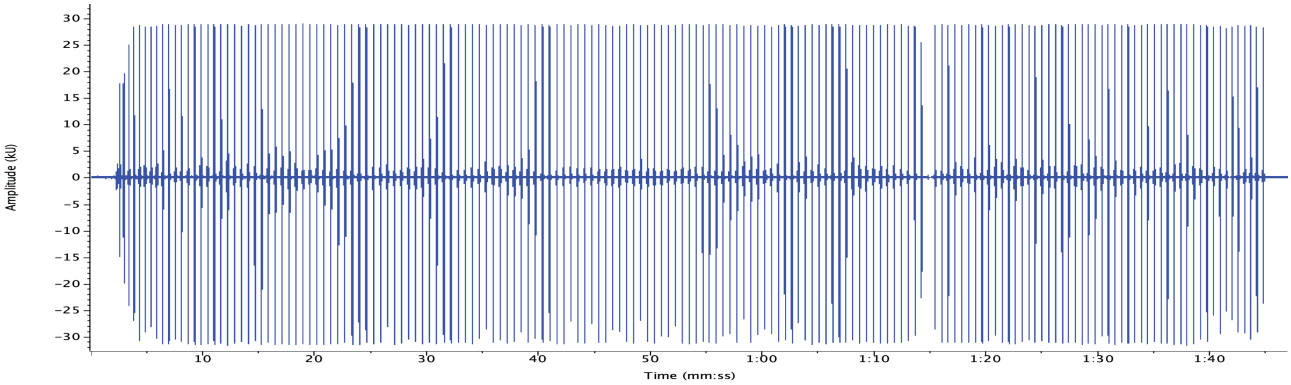


FIGURE 868. Calling drum (R99-55) adult female allotype.

Derivation of name. Named after the type locality.

Habitat. At type locality, under rocks in sandy habitat around Ranger residence; and from pinyon-juniper habitat ~1 km from dunes (S94-21). Under rocks in both Zion locations with riparian vegetation and sandy substrates.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 15 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and 1 had 1 and 14 had 2 ventral spurs; 14 had 5 and 1 had 6 inner **rear** leg tibial spines, and 8 had 3 and 7 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Instars from Zion are browner on head and pronotum than those from Coral Pink Sand Dunes.

DNA. Fig. 850, p. 474. F0067 (type locality S94-21); and F1234 (S99-14, Zion National Park) recovered in Group 15 Utah with individuals of *A. cedarview* and *A. grahami.*

Karyotype. 2n♂=25. Two males examined from type locality: T93-31 (Fig. 869, S93-38) and T99-33 (Fig. 870, S99-15) both with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 869. Idiogram T93-31 *A. coralpink* (S93-38).

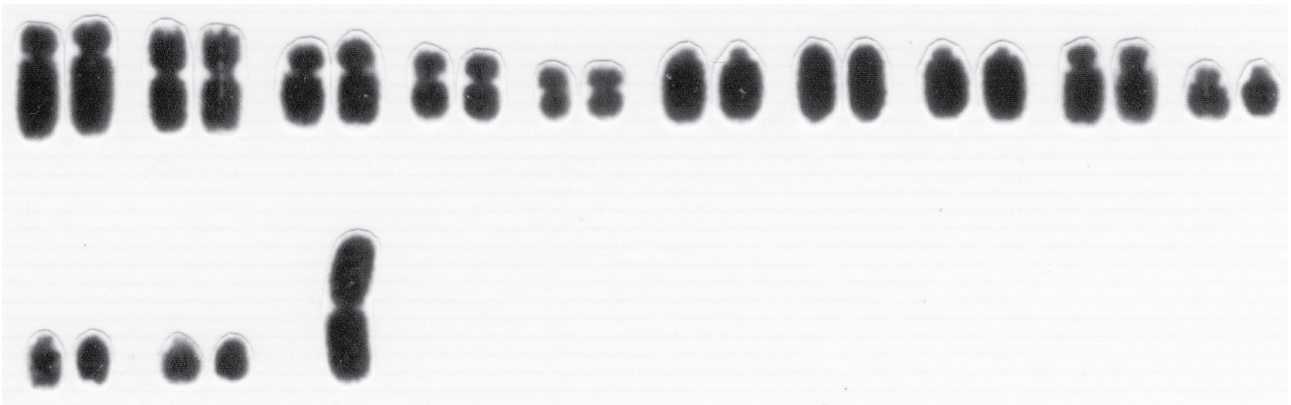


FIGURE 870. Idiogram T99-33 *A. coralpink* (S99-15).

Discussion. All three species (*A. coralpink* along with *A. cedarview* and *A. grahami*) in the Utah Group show an affinity for sandy substrates.

***Ammopelmatus grahami* Weissman, sp. nov.**

Colorado Plateau Jerusalem Cricket
Figs 871–884, Table 33

Distribution. (Fig. 871). Only known from several sandy habitats on the Colorado Plateau in Utah, all east of the mountain ranges of central Utah.

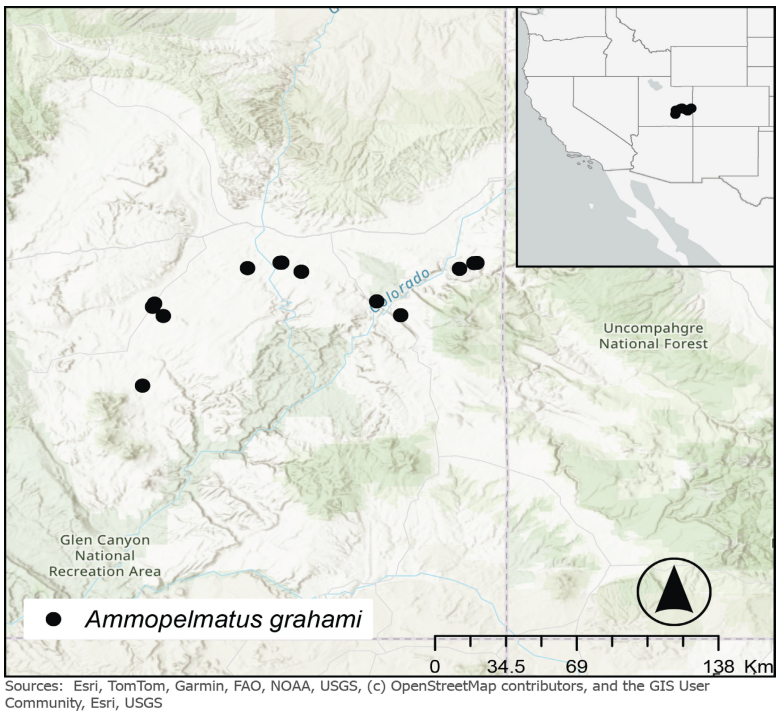


FIGURE 871. Distribution of *A. grahami.*

Recognition characters. Medium-large, light colored, with minimum black abdominal bands and whose stripes extend only half way down sides of abdomen. Rear leg tibia with 3 or 4 outer spines. Outer rear leg tibial spine #1 flattened, face rotated 0–45° from long axis of tibia. Calling drum ~1.5 drums/s. Separated from *A. coralpink* by geography (*A. coralpink* west of the mountain ranges of central Utah and with a more Great Basin climate), habitat, and greater rotation of rear leg tibial spine #1 in latter. Separated from *A. cedarview* by habitat.

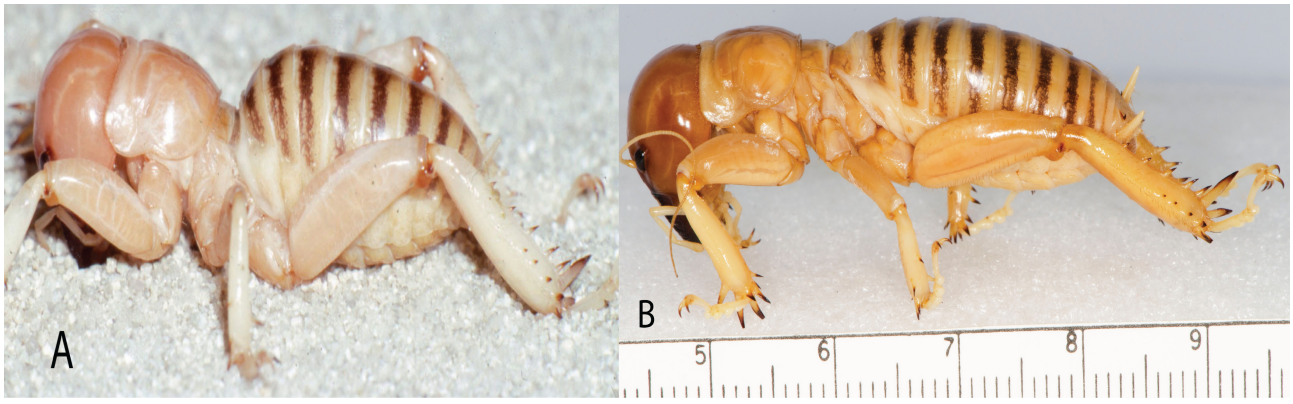


FIGURE 872. Holotype adult male *A. grahami.* A. When alive. B. When preserved.



FIGURE 873. Left rear leg tibia adult male holotype *A. grahami.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Holotype. Male (in alcohol, Fig. 872). **Utah, *Emery Co.,*** Gilson Butte Dunes, 38.5893° -110.5918°, 1560m, 30-v-2009 (S09-41) T. Graham. R09-4. Molt to adult 16-vii-2009. Deposited CAS, Entomology type #20194. Measurements in mm: Body length 42.13, hind femur length 12.76, hind femur width 4.54. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 873) with 5 inner and 3 or 4 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 874). Same data as holotype except R09-10, F2130. Molted to adult 16-vii-2009. Deposited CAS, CASENT #8413762. Measurements in mm: Body length 39.43, hind femur length 11.07, hind femur width 4.08. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 875) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 876.

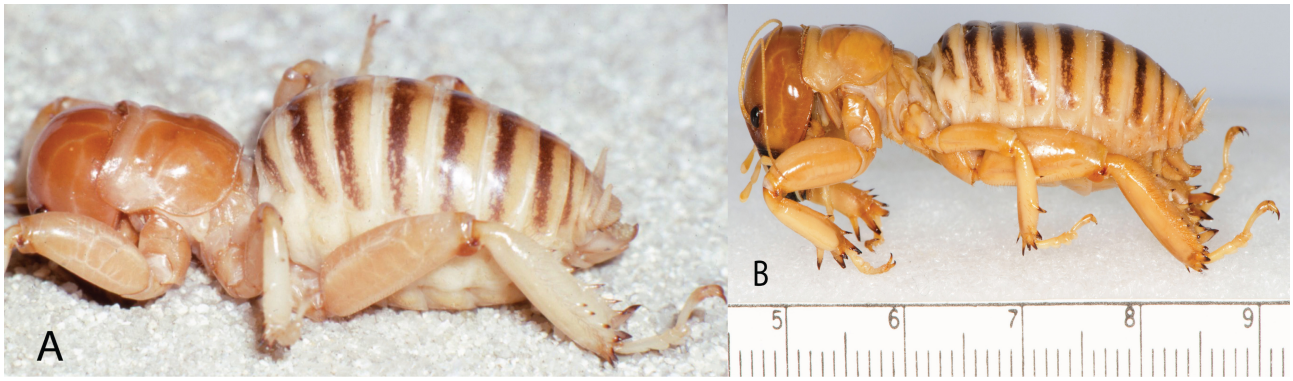


FIGURE 874. Adult female allotype *A. grahami.* A. When alive. B. When preserved.



FIGURE 875. Left rear leg tibia allotype *A. grahami.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 876. Ovipositor allotype *A. grahami*.

Paratypes. ♂18 ♀23. **UTAH, *Emery Co.,*** San Rafael Desert, 38.543738° -110.546455°, 1586m, 19-v-2001 (S01-36) ♀1; 38.772778° -110.177873°, 1341m, 17-v-2007 (S07-19) TB Graham, ♀1; 38.5893° -110.5918°, 1558m, 30-v-2009 (S09-41) TB Graham ♂1 ♀3; 38.21025° -110.63722°, 1465m, 20-ix-2013 (S13-82) TB Graham ♀2; 38.5877° -110.5934°, 1558m, 6-ix-2014 (S14-81) TB Graham ♀1; 38.60309° -110.58455°, 1552m, 2-3-iv-2017 (S17-2) TB Graham, ♂1, 1 late instar male for testes. San Rafael Swell, Secret Mesa, 1890m, 9-vi-1989 (S89-40) K. Lightfoot ♀1. 15 m NE Hanksville, 5-viii-1988 (S88-113) D. Guiliani ♀1. Gilson Dunes, 38.58707° -110.59317°, 1558m, 6-v-2019 (S19-4) T. Graham ♂1. ***Garfield Co.,*** Boulder, 37.913145° -111.423873°, 2057m, 24-iv-2006 (S06-18) ♂3 ♀4. Calf Creek Campground, 37.794862° -111.413106°, 1632m, 27-ix-1990 (S90-102) RW Baumann ♀1. Deer Creek Campground, 37.854170° -111.354805°, 1741m, 29-iii-2000 (S00-2) R. Baumann ♀1. Escalante River, Hwy 12, 37.776657° -111.419246°, 1590m, 30-iii-2000 (S00-4) R. Baumann ♂1. ***Grand Co.,*** north Arches sand hills, 38.613692° -109.612663°, 1239m, 1-vi-2009 (S09-42) ♂1, 1 late instar for testes. Moab,

1701 Murphy Lane, 38.547208° -109.507881°, 1323m, all T. Graham, 18-30-viii-2010 (S10-58) ♂2; 10-viii-2012 (S12-109) ♂1; 24-viii-2023 (S23-95) ♂1. 10 m N Moab, 38.755723° -109.943122°, 1341m, 15-viii-2013 (S13-77) T. Graham ♀1. 10 Mile Canyon, 38.755378° -109.941733°, 1371m, 28-v-2007 (S07-18) TB Graham ♂1; 21-viii-2012 (S12-110) TB Graham ♀1. Rio Mesa, Dolores River, T. Graham, 38.797944° -109.174811°, 1295m, 22-v-2013 (S13-11) ♀1; 38.769528° -109.250444°, 1547m, 22-v-2013 (S13-12) ♂1; 38.796518° -109.187522°, 1286m, 29-ix-2013 (S13-81B) 1 male nymph for testes. White Wash, 38.799058° -110.028671°, 1272m, 30-v-2009 (S09-40) T. Graham ♀1. White Wash Dunes, 38.798778° -110.034972°, 1258m, 1-vi-2007 (S07-69) TB Graham ♀1. 1.4m NW Moab, 38.57702° -109.52511°, 1426m, 9-vi-2018 (S18-17) TB Graham ♂1. ***San Juan Co.,*** Black Ridge 7-8 m SSE Moab, 38.489912° -109.462096°, 1469m, 28-iv-1995 (S95-35) S. Holmes ♂1. Canyonlands National Park, all T. Graham, Peekaboo Campsite, 38.114930° -109.754464°, 1530m, 10-vii-2009 (S09-92) ♂1; 38.157403° -109.722137°, 1560m, 24-vi-2010 (S10-18) ♂1 ♀1. Canyonlands National Park, Squaw Flat, 38.1645° -109.7899°, 1535m, 4-iii-1994 (S94-5) BC Kondratieff ♀1.

Drum. Calling drum similar in both sexes. **Male:** Holotype (Fig. 877, R09-4) with 40 drums over 25.1s (1.6 drums/s) at 21.5°C. **Female:** Allotype (Fig. 878, R09-10) with 60 drums over 41.6s (1.4 drums/s) at 21°C.

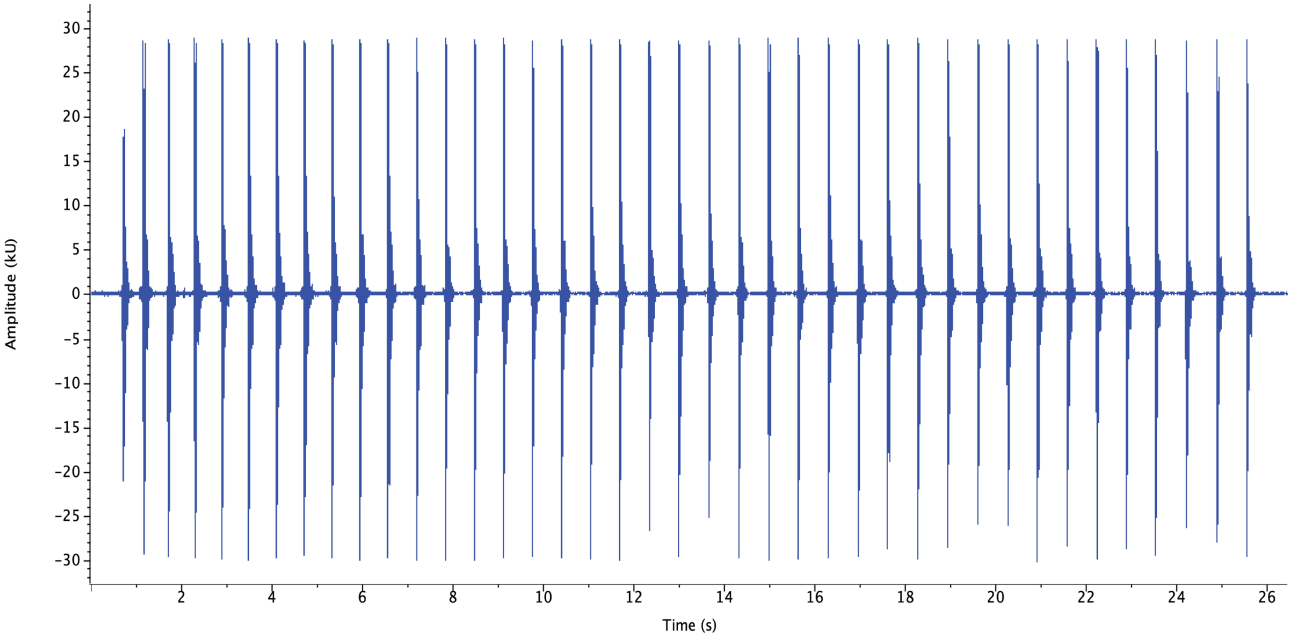


FIGURE 877. Calling drum (R09-4) holotype adult male *A. grahami.*

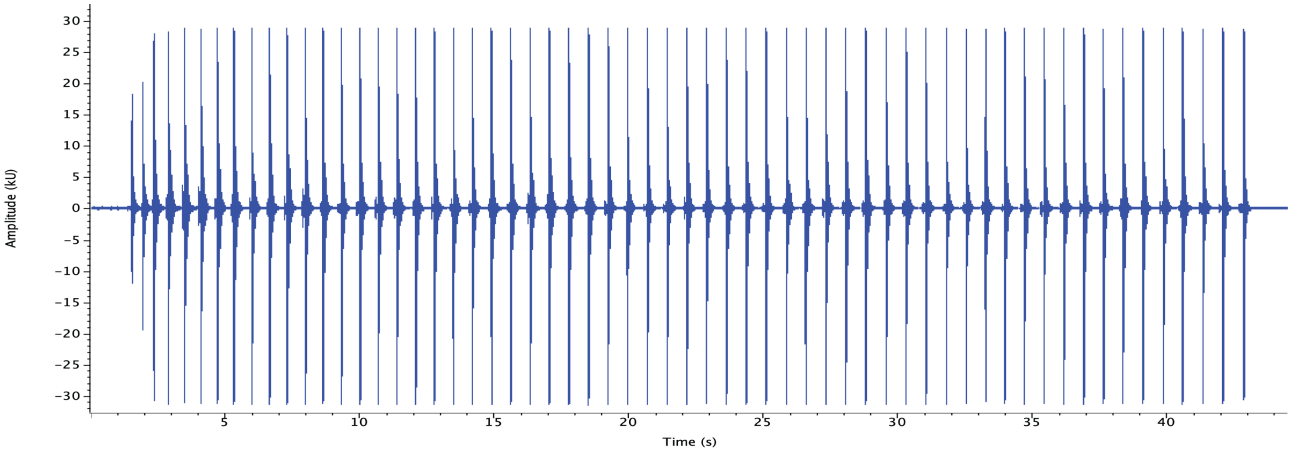


FIGURE 878. Calling drum (R09-10) allotype adult female *A. grahami.*

Derivation of name. Named for Tim B. Graham, who collected the majority of the type series.

Habitat. To oatmeal trails in open sandy and dune habitats.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 35 individuals, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 33 had 8 **middle** leg tibial calcars, while 2 had 1 and 33 had 2 ventral spurs; 1 had 3 and 35 had 5 inner **rear** leg tibial spines, while 22 had 3 and 14 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Amongst the paratype localities, the lightest are those from Gilson Butte, then Arches (S09-42), then Boulder (S06-18), with the darkest ones from 10 Mile Canyon (S07-18).

DNA. Fig. 850, p. 474. F1186 (S00-4, Escalante River); F1779 (S06-18, Boulder); F1952 (S07-18, Carbon Co.); F2122 (S09-42, north of Arches); F2130 (allotype S09-41); F2134 (S09-92, Canyonlands); F2196 (S10-58, Moab) all recovered in Group 15 Utah with *A. coralpink* and *A. cedarview.*

Karyotype. 2n♂=25. Five males examined with conflicting results: T06-2 (Fig. 879) & T06-9 (Fig. 880, both S06-18, Boulder); T14-5 (Fig. 881, S13-81B, Grand Co.); with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T18-1 (Fig. 882, type locality S17-2, Gilson Butte) with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. In contrast, T09-3 (Fig. 883, north of Arches, S09-42) with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. The unknown significance of these differences suggest further investigation is warranted.

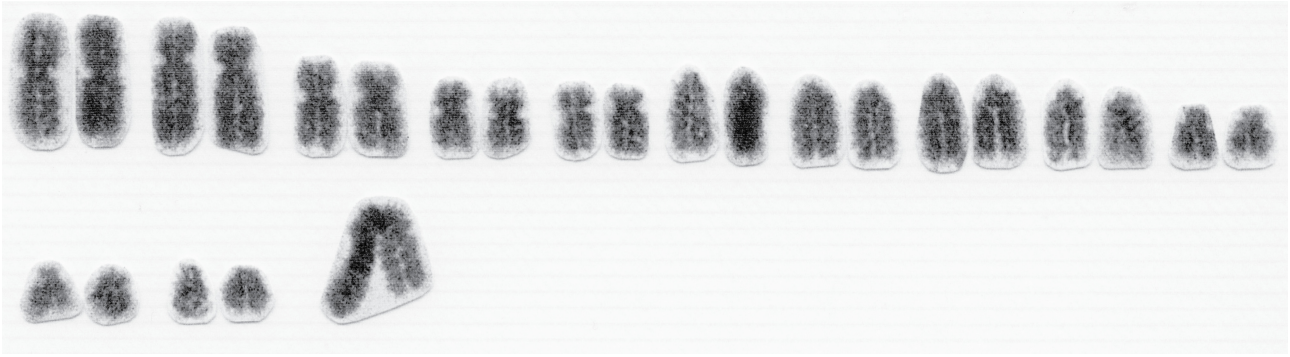


FIGURE 879. Idiogram T06-2 *A. grahami* (S06-18).

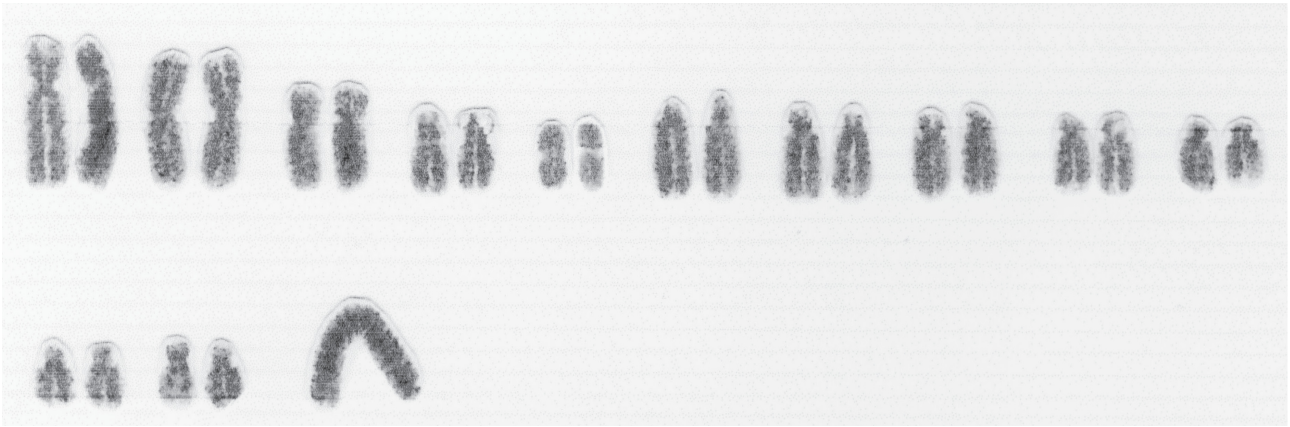


FIGURE 880. Idiogram T06-9 *A. grahami* (S06-18).



FIGURE 881. Idiogram T14-5 *A. grahami* (S13-81B).

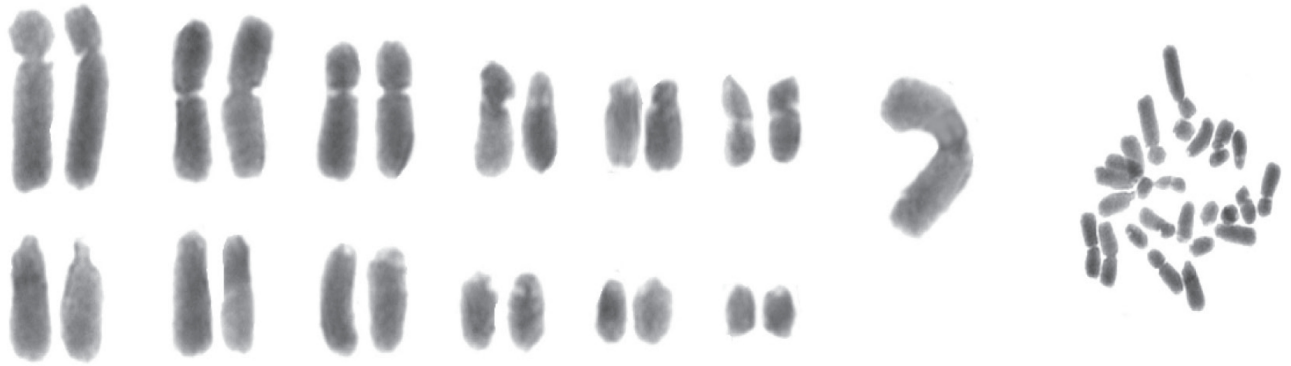


FIGURE 882. Idiogram T18-1 *A. grahami* (S17-2); and anaphase cell (on right) from which idiogram was produced.



FIGURE 883. Idiogram T09-3 *A. grahami* (S09-42).

Discussion. Fig. 884 shows a late instar female photographed on her Gilson Butte type locality sand; and demonstrating apparently poor crypsis, at least during daylight hours.

For unknown reasons, this has been a uniquely difficult species to raise to adult when individuals collected as early or mid-instars. Late instars collected in spring and early summer can be raised to adult more than 80% of the time. But early and mid-instars that have to overwinter once before maturing over 1 year later, have almost 0% chance of living that long.



FIGURE 884. Type locality late instar female *A. grahami* (S01-36), on natural substrate, showing apparent poor crypsis.

Group 16, Fuscus Group (Fig. 885)

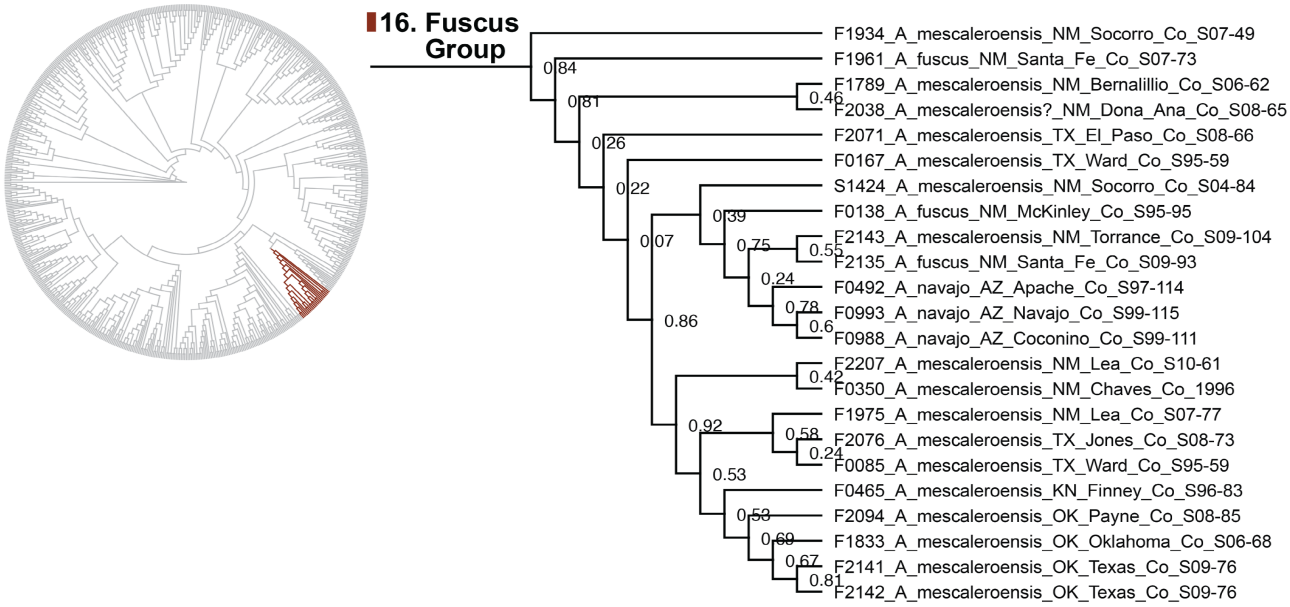


FIGURE 885. ASTRAL tree for Fuscus Group.

This Group is composed of 3 valid (and 2 tentative) species, after our designating *A. monahansensis* a junior synonym of *A. mescaleroensis*. The Fuscus Group is noteworthy for it includes the first named JC from the United States (*A. fuscus*); the most color variable JC species (*A. mescaleroensis*); and the JC with the most extreme megacephalic individuals known (those individuals of *A. mescaleroensis* from the Monahans Sand Dunes in Texas). Two known taxa with 2n♂=25.

SPECIES WRITE UPS: *A. comanchus* (tentatively placed here, p. 490); *A. fuscus* (p. 494); *A. mescaleroensis* (p. 500); *A. navajo* (p. 513); and *A. sonoraensis* (tentatively placed here, p. 521).

Ammopelmatus comanchus (Saussure & Pictet)

Villa Lerdo Jerusalem Cricket
Figs 886–891, Table 36

1897. *Stenopelmatus comanchus* Saussure & Pictet. Biologia Centrali-Americana 1:290. **Lectotype here designated** (specimen suggested by Hubbell 1960): Adult female (pinned, Fig. 886); labels (Fig. 887). Blue syntype label; Stenopelmatus comanchus; Villa Lerdo, Durango. Höge; Brit. Mus. 1899-235.; var.; green label Stenopelmatus hydrocephalus Brun.; on white label probably written by Pat Stock (aka Newman), before 1964 (pers. corr. to DBW from Judith Marshall, January, 2020): "It is undecided whether this specimen is the holotype or cotype of Stenopelmatus comanchus S. & P., Biol. Centr. Amer., 1897, I, p. 290, n. 9". Lectotype in NHMUK, as, supposedly, is rest of type series (Hollier 2011). But J. Marshall (pers. comm. to DBW January, 2020) says that this is the only specimen in NHMUK, and no others were noted in any European museum by Hubbell (1960). J. Marshall also had this to say regarding the green lectotype label: "I think the green ones were added when first received and registered here, by checking information in *Biologia Centrali Americana*; though this label is wrong and refers to the specimen listed above *S. comanchus* on p. 290. I assume a copying error; I've checked that we have no specimens of *S. hydrocephalus* mislabeled as *S. comanchus*." The original description mentions male and female, provides no drawings, and gives the following measurements in mm: Body length 39, hind femur length 13, (we measured hind femur width as 4.9 mm), pronotum 7.5, all of which agree fairly well with the lectotype except for our body length measurement of 30 mm, 32.5 mm counting the ovipositor (per J. Marshall). Lectotype megacephalic with protuberant eyes, uniform reddish-tan color, slight furrow on face (Fig. 888A), hind tibia 2 toned with dorsal aspect darker than ventral (Fig. 886). Ovipositor Fig. 888B. Beulah Garner confirmed (pers comm to DBW, August, 2025)

front tibia with 3 ventral spurs (Fig. 889); middle tibia with 8 calcars, 2 ventral spurs. Hind tibia with 3 outer and 5 inner spines (Fig. 890A), which agrees with original description. Given the poorly developed hind tibial spines, we transferred this species from *Stenopelmatus* to *Ammopelmatus* in 2021 (Weissman *et. al.* 2021). Photos (Fig. 890B) provided by J. Marshall clearly show the flat, posterior facing surface present on outer rear leg tibial spine #1, which is consistent with *A. mescaleroensis*, and consistent with the variation seen in all species in the Fuscus Group.

1916. *Stenopelmatus fuscus.* Hebard, Journal New York Entomological Society, 24, 75. **New status: herein removed from synonymy with *S. fuscus***, and reinstated to full species status.

The lectotype of *A. comanchus* resembles those topotypic specimens of *A. monahansensis* seen from the Monahans Sand Dunes of Texas, especially for the shape, and rear facing, outer rear leg tibial spine #1. Elsewhere in this paper (p. 739), we synonymize *A. monahansensis* under *A. mescaleroensis.* Nevertheless, at this time, we choose to leave *A. comanchus* as a valid species given the separation of some 670 km from the Samalayuca sand dunes, Mexico (the closest known locality of *A. mescaleroensis*), to Villa Lerdo, the type locality for *A. comanchus*. We are unaware of any *Ammopelmatus* specimens collected from between these Mexican localities.



FIGURE 886. Lectotype adult female *A. comanchus.*



FIGURE 887. Labels on lectotype *S. comanchus* (Courtesy of J. Marshall).

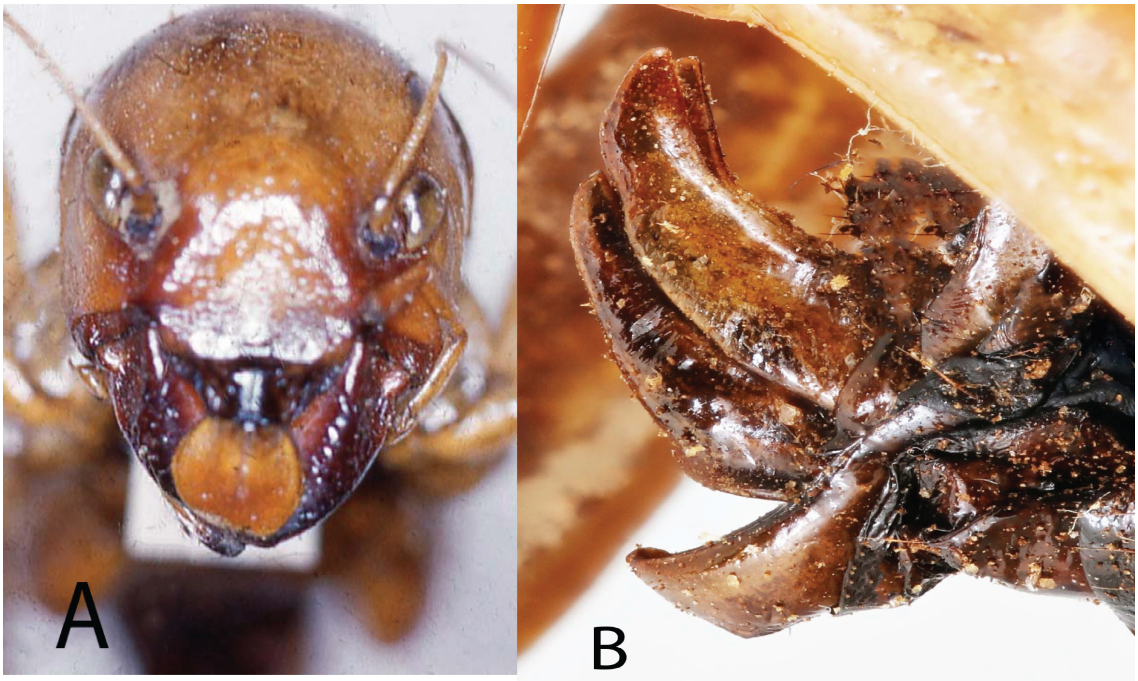


FIGURE 888. Lectotype adult female *A. comanchus.* A. Face showing furrow. B. Ovipositor.

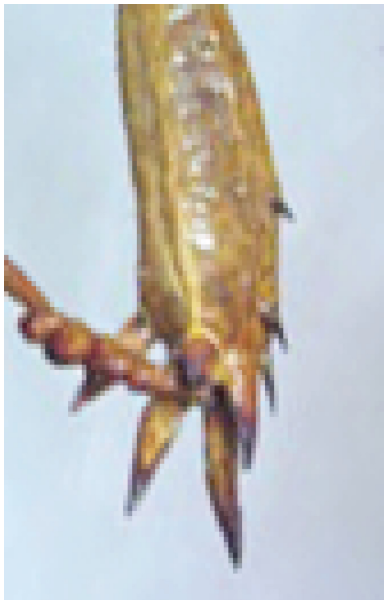


FIGURE 889. Front leg tibia holotype female *A. comanchus* showing 3 ventral spurs (Photo B. Garner).

Derivation of name. "co" or "com" are both Latin for together, with; while "anchusa" is Latin for bugloss, which could mean rough-hairy. In any case, we have no idea what this name implies since the lectotype is neither hairy nor rough. On the other hand, this name could be in reference to the Comanche Indians, even though they never inhabited Mexico as far south as the state of Durango. Additionally, Saussure gave a wasp the name of *Polistes comanchus* in 1857.

Discussion. From Google Earth, (Villa) Lerdo, Durango, is at 25.542497° -103.528991°, 1137m (Fig. 891). Nearby locations include Torreón and Gómez Palacio, although we recognize that the actual collection locality in the 1890s may have been at some distance from Lerdo. The surrounding habitat is Chihuahuan Desert, which is more typical for *Ammopelmatus* than *Stenopelmatus*. We have collected around Lerdo several times without finding any JCs. On the other hand, small black *Stenopelmatus* are known from slightly more southern, higher elevation

localities (see Weissman *et. al.* 2021): *S. saltillo* from S94-79 (open Chihuahuan Desert at 1865m); and *S. durango* from S14-41 (pine oak woodland at 2468m).

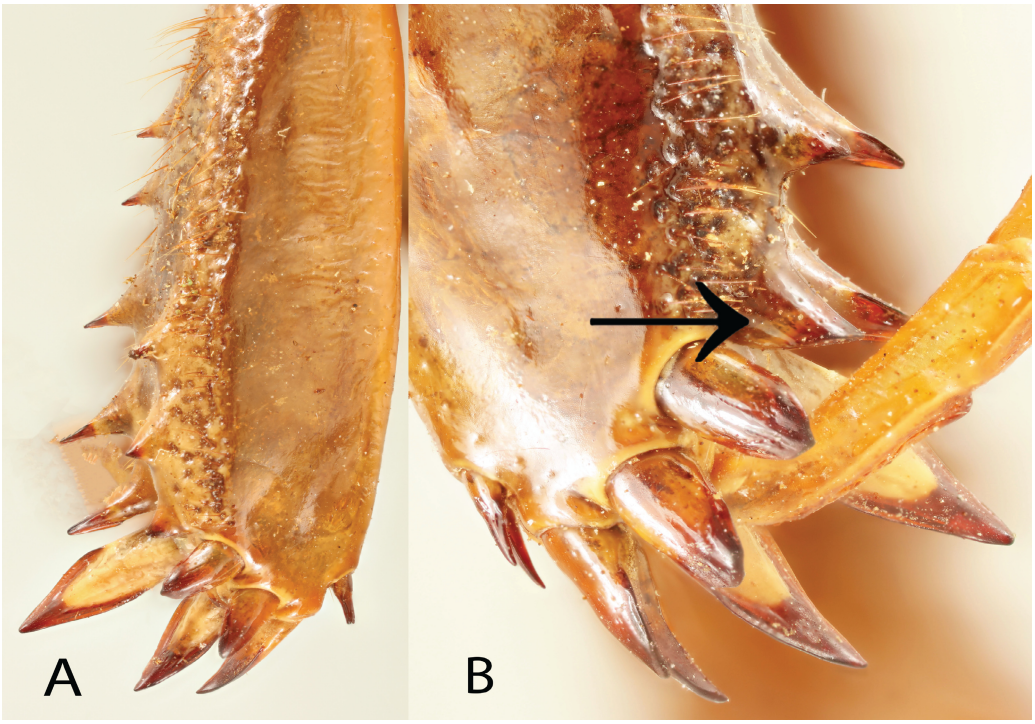


FIGURE 890. Lectotype adult female *A. comanchus.* A. Right rear leg tibia showing 5 inner and 3 outer spines. B. Showing shape of calcars (photos courtesy of Judith Marshall). Note flattened, posteriorly facing (arrow) outer rear leg tibial spine #1, whose surface is perpendicular to the long axis of the tibia.



FIGURE 891. Known distribution of *A. comanchus.*

As our discussion on p. 490 documents, *A. comanchus* is probably a member of the Fuscus Group, based upon the flat face of its rear leg outer tibial spine #1. Hebard (1916) comments that adult female JCs are rarely megacephalic. But members of the Fuscus Group, including the lectotype of *A. comanchus*, are frequently megacephalic, although this condition is more common in males than females. In contrast, megacephalism is very rare in *Stenopelmatus*, the holotype of *S. vicinus* being an exception, while several other taxa have borderline enlarged heads.

DC Lightfoot comments (pers comm to DBW, 7-iv-2020): "Lerdo, Mexico (Torreon-Saltillo area) is a long way from Monahans, but could be the same JC. I do not know of any dune fields in the Lerdo area, but that entire basin has silty/sandy soils. As I recall, there are silt dunes on the north side of that basin where highway 30 heads NE of San Pedro. The Nazas River flows through Lerdo to the basin floor clay salt flats north of Lerdo and Torreon, and those sandy silty areas north of San Pedro. Also, there are likely sandy soils all along the Nazas River, similar to the sandy soils along the Rio Grande that support the JC [=*A. mescaleroensis*] that occurs in deep sandy riparian soils along the Rio Grande in New Mexico. There are sand dunes at the Mapimi Biosphere Preserve just NW of Lerdo and Torreon. Those dunes are on the NE side of a salt flat basin, and they support an endemic fringe-toed lizard, I've seen them there along with the large bolson desert tortoise. And, there are a series of low desert basins with salt flats and silty/sandy soils extending north from the Lerdo area, to Big Bend, TX. So, a sand specialized JC could occur from Lerdo to Big Bend, and from there up to Monahans, El Paso, and even up the Rio Grande to Santa Fe."

Ammopelmatus fuscus (Haldeman)

Santa Fé Jerusalem Cricket
Figs 892–900, Table 31

1852 *Stenopelmatus fuscus*. Stansbury, H., Exploration and Survey of the Valley of the Great Salt Lake of Utah, Senate Executive paper No. 3, Philadelphia, Lippincott, Grambo & Co., Appendix C, p. 372. Syntype series from Santa Fé and Chihuahua, Mexico. As this reference is rather obscure, and since this was the first described USA Jerusalem cricket, which is now erroneously cited in most entomology field guides as being widespread across the western US, we present (see in Discussion below) two verbatim excerpts from this original publication, since these quotes clarify several confusing aspects with reference to the original description.

1916 Hebard, M., Journal New York Entomological Society, 24, 70–86. Original types destroyed (Hebard 1916). Type locality of Santa Fé, New Mexico, chosen by Hebard (1916), but no neotype selected. Hebard also lists prior synonymies as *S. cephalotes* Walker, *S. comanchus* Saussure & Pictet, *S. fasciatus* Thomas, *S. hydrocephalus* Brunner, and *S. oculatus* Scudder. All 5 synonym names were transferred to *Ammopelmatus* by Weissman *et al.* (2021). These taxa are discussed elsewhere in this paper, with 4 names declared nomen dubium, and *A. comanchus*, from state of Durango, Mexico, allowed to stand (see p. 490).

2021 *Ammopelmatus fuscus*, in Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on hind leg tibial spines, distribution, and DNA.

Distribution. (Fig. 892). New Mexico only, in a broad swath from type locality Santa Fé, north into the Jemez Mts, west to Gallup, and south to El Malpais National Monument, all sites higher than 1700m.

Neotype adult male (in alcohol, Fig. 893) here selected: **New Mexico, *Santa Fé Co*.,** Santa Fé, 6 Starfire Lane, 35.643764° -105.924158°, 2182m, 1-vii-2009 (S09-93) J. Patterson. R09-14, F2135. Collected as adult. Deposited CAS, Entomology type #20064. Measurements in mm: Body length 35.34, hind femur length 11.91, hind femur width 4.25. **Fore** leg tibia with 3 ventral spurs; **middle** leg tibia with 8 calcars, 2 ventral spurs; **hind** leg tibia (Fig. 894) with 5 inner and 3 outer spines, 2 ventral spurs. Rear leg outer tibia spine #1 attenuate (gradually tapering apically, Fig. 895A) and not truncate or rounded at the tip (as in *A. mescaleroensis*, see Figs 905 & 912, pp 502 & 506). The posterior facing part of this spine is flattened (Fig. 895A) and somewhat concave, creating a scoop-like surface. The flattened face of this spine is rotated 45° to the long axis of the tibia. Face (Fig. 895B) with slight furrow.

Recognition characters. Restricted to high elevations in New Mexico. Small to medium sized JC. Some type locality adults with a distinctive pink tone (Fig. 893A) to head and pronotum. Abdomen frequently with bold yellow band (Fig. 893A) between black and white bands. Calling drum slow (1.3–1.7 drums/s), sex clarification drum unknown. Hind tibia with 5 inner and 3 outer spines. Some individuals megacephalic. Rear leg outer tibial spine

#1 flattened on posterior facing surface, rotated between 0–45° from linear axis of tibia. Found sympatric with *A. portal* at Gallup, Bandelier, and El Malpais, from which it can be separated by orange colored head and pronotum in *A. fuscus* vs brown in *A. portal*; and presence of rear leg outer tibial spine with flattened face, vs no flattened face in *A. portal.* Can be separated from *A. mescaleroensis* in that the latter frequently has a truncate (cut off squarely at the tip) and 45–90° rotated outer rear leg tibial spine #1, whereas in *A. fuscus,* this spine is more attenuate (gradually tapering apically) and, if flattened, then face rotated <45° to the main tibial axis.

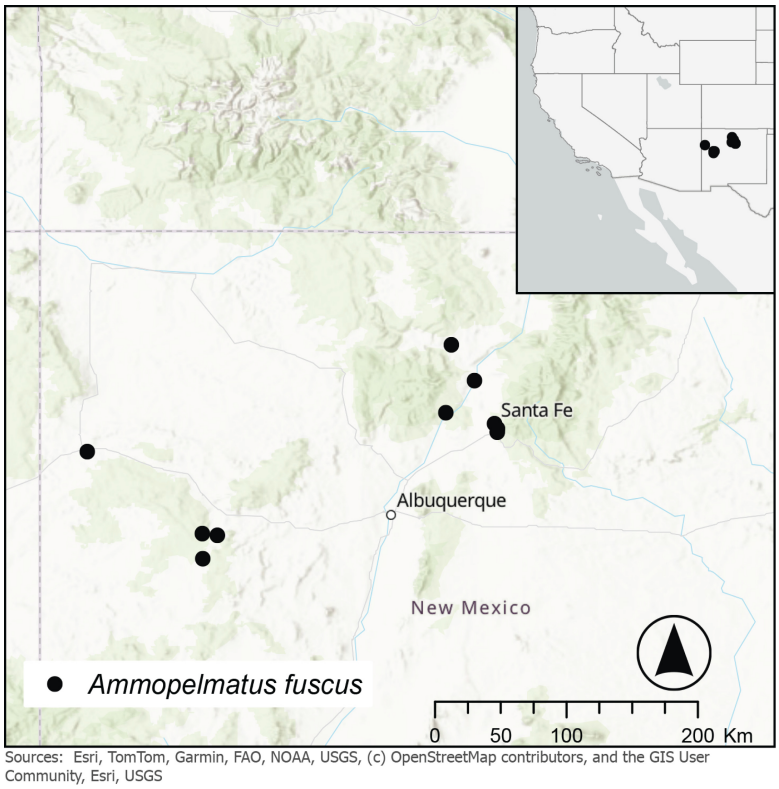


FIGURE 892. Distribution of *A. fuscus.*

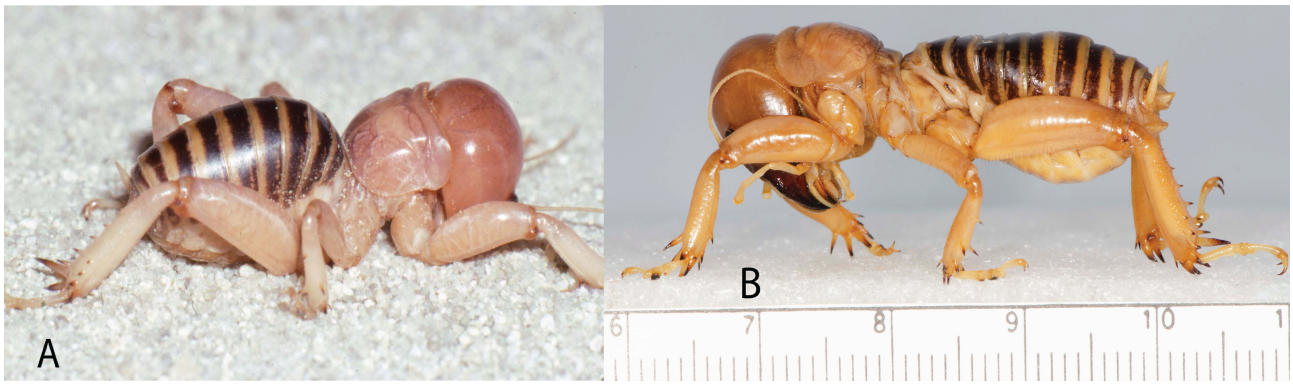


FIGURE 893. Neotype adult male *A. fuscus.* A. When alive, and note distinctive pink-toned head and pronotum. B. When preserved.



FIGURE 894. Neotype adult male *A. fuscus* left rear leg tibia. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

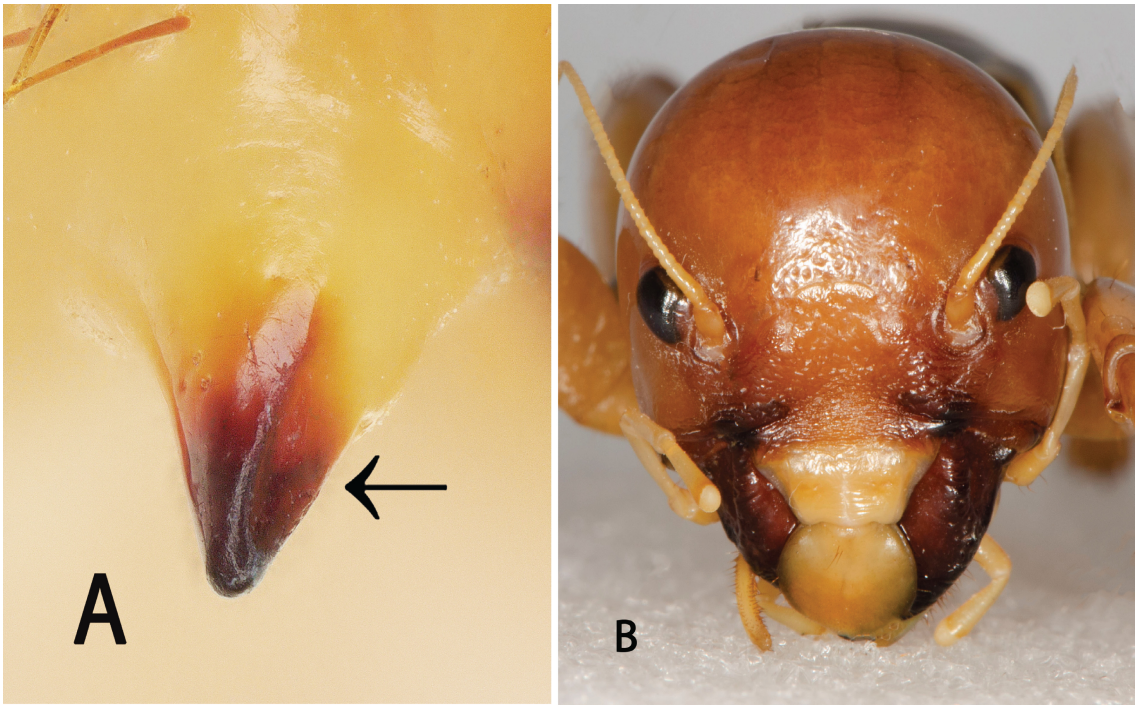


FIGURE 895. Adult male neotype *A. fuscus.* A. Showing attenuate shape of outer rear leg tibial spine #1, with flattened (arrow) posterior facing side (Photo C. Grinter). B. Face showing minor indications of furrow.

Topotype female. Similar to neotype male (Fig. 896). Rear leg tibia Fig. 897. Ovipositor Fig. 898.

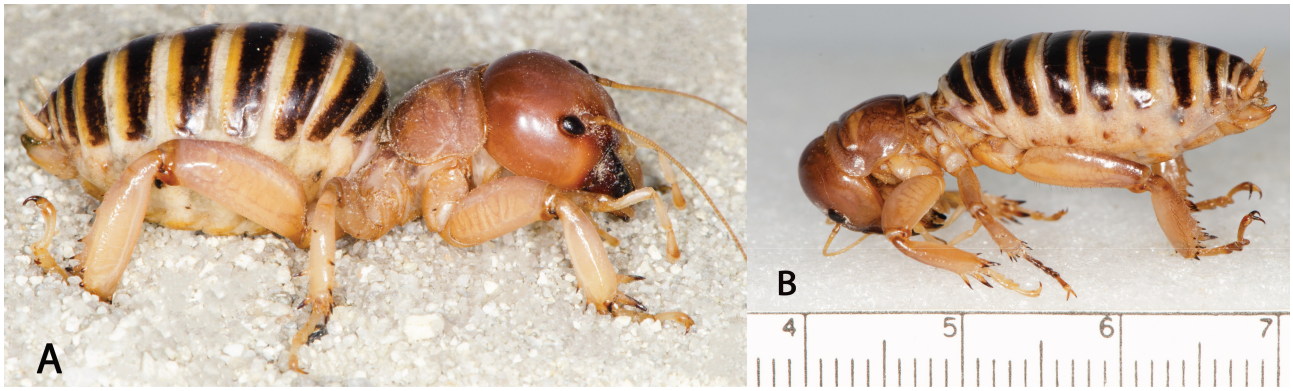


FIGURE 896. Topotypic adult female *A. fuscus.* A. When alive (S22-42). B. When preserved (S22-42, R22-6, F2673).

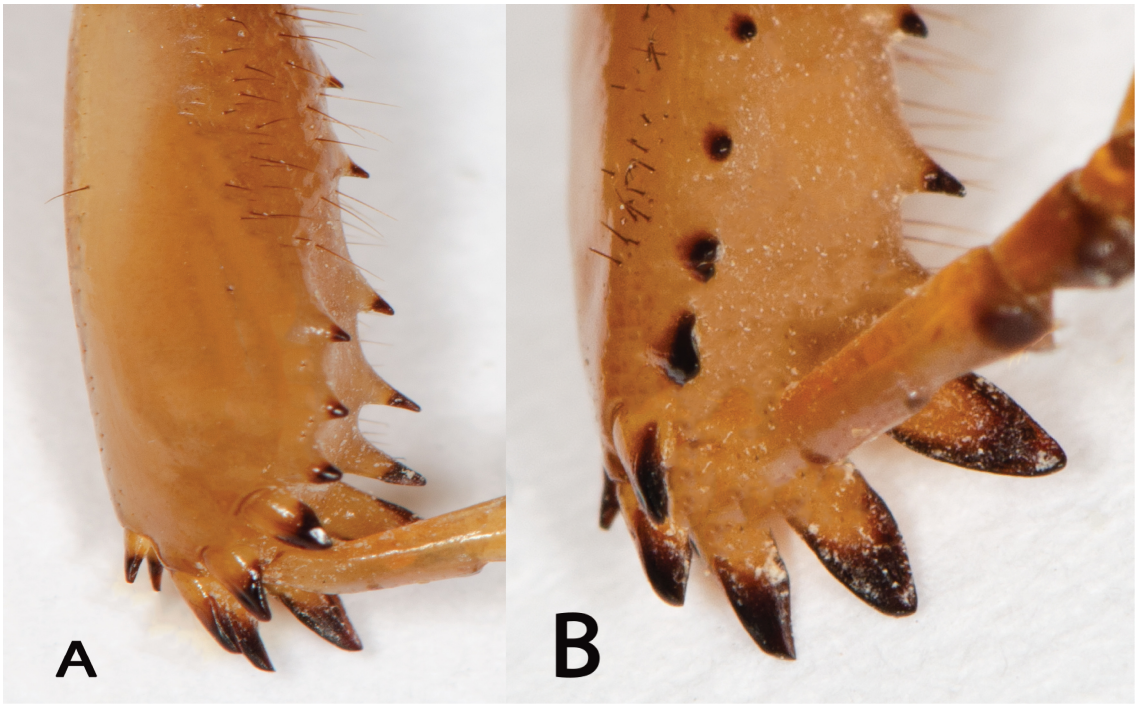


FIGURE 897. Left hind leg tibia topotypic adult female *A. fuscus* (S22-42, R22-6, F2673). A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 898. Ovipositor same topotype female *A. fuscus* as in Fig. 896.

Drum. Adult male and female calling drums similar. **Male:** Topotypic adult male (S07-73, R07-31) produced (Fig. 899) 34 drums in 22.9s (1.5 drums/s) at 20°C. **Female:** Topotypic R22-6, S22-42 (Fig. 900) showing 92 drums over 65s (1.4 drums/s) at 22.3°.

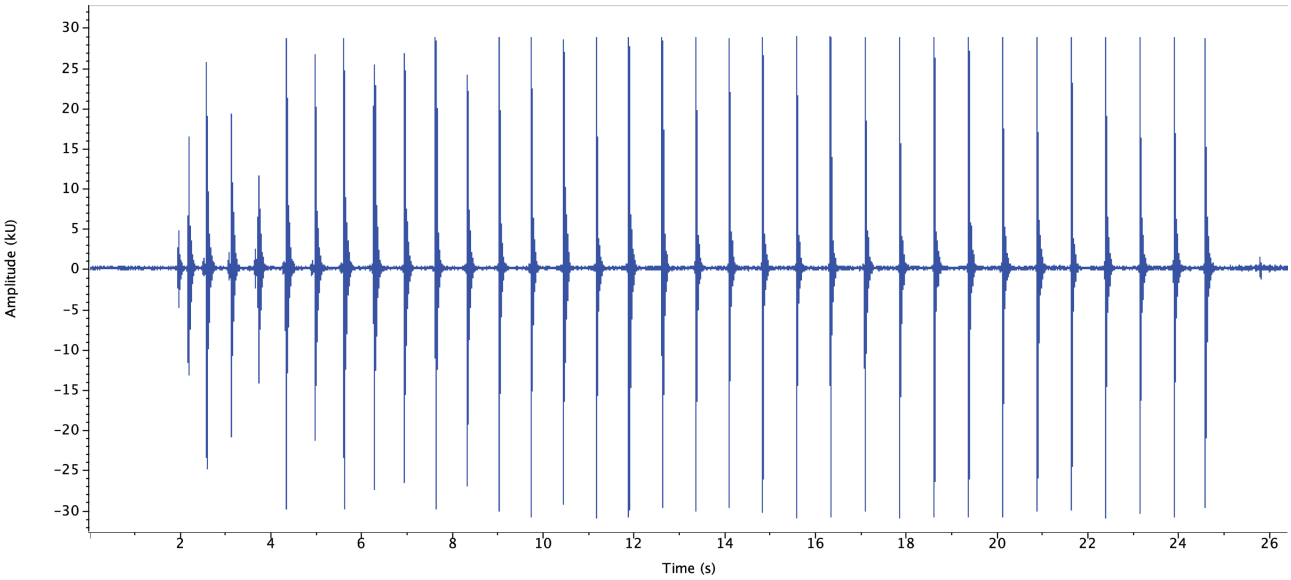


FIGURE 899. Calling drum (R07-31) topotypic adult male *A. fuscus*.

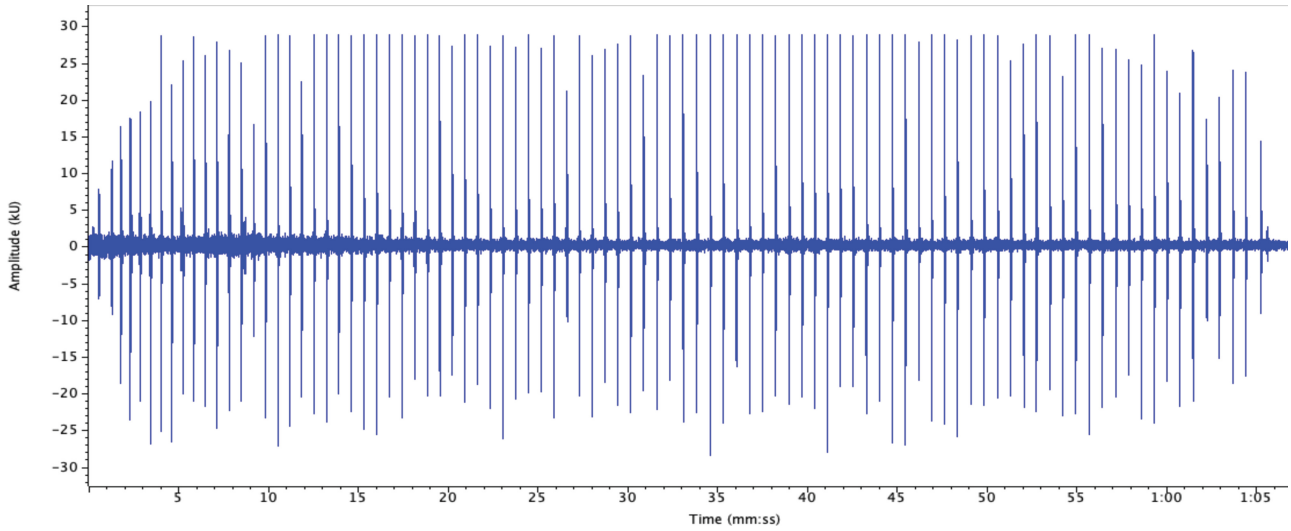


FIGURE 900. Calling drum (R22-6) topotypic adult female *A. fuscus.*

Derivation of name. "fuscus" is Latin for dusky, dark, swarthy. See Discussion below.

Habitat. All sites above 1700m elevation. According to DC Lightfoot: "... the neotype locality is oak woodlands, in a transition area between lowland juniper savanna on alluvial slopes, with the upper portions of lowland dry washes that drain into the Santa Fé River, and hill-slope pinyon-juniper woodlands on fine gravely soils. El Malpais National Monument is pinyon-juniper woodland adjacent to heavily vegetated lava flows. In the Jemez Mts. *A. fuscus* occurs in loose, pumice soils and rocky volcanic soils. Overall, seems like *A. fuscus* occurs in loose, well drained sandy or fine gravelly or volcanic soils; while *A. portal* prefers loams or clay-loam soils in pinyon-juniper woodlands."

Life cycle and seasonal occurrence. Apparently typical 2 years. DC Lightfoot laid oatmeal trails at the Santa Fé National Park Service Office, with the following variable results: 14-viii-2022 (S22-42) ♀5; 19-vi-2023 with no success; l 3-viii-2023 ♀3; 12-vi-2024 with no success; 6-vii-2024 with no success.

Variation. **Color:** Intensity of yellow abdominal band varies between adults. For 22 individuals, all had 3

ventral **fore** leg tibial spurs; all with 8 **middle** leg tibial calcars, while 1 had 1 and 21 had 2 ventral spurs; all 22 had 5 inner **rear** leg tibial spines, while 20 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

Specimens examined. **NEW MEXICO, *Cibola Co.,*** El Malpais National Monument, Sandstone Bluff's Overlook, 34.946031° -107.837660°, 2100m, 21-viii-1991 (S91-102), DC Lightfoot ♂1. Near McCarty's lava flow off Hwy 117, 34.788100° -107.937200°, 2161m, 18-viii-1993 (S93-71) ♀3. 34.957655° -107.940367°, 2115m, 12-vii-25-viii-1993, DC Lightfoot ♂1. ***McKinley Co.,*** Gallup, 1607 Red Rock Dr and elsewhere in town, 35.511783° -108.726900°, 2068m, all D. Kennell, 9-20-ix-1995 (S95-95) ♀1; 28-ix-1995 (S95-102) ♀1; viii-1996 (S96-29) ♂3 ♀1. ***Rio Arriba Co.,*** Espanola, 35.992° -106.080°, 1705m, 11-vi-2003 (S03-69) AR Alared ♀1. Base of Sierra Negra, ~36.234° -106.238°, 1981m, 2-viii-2006 (S06-57) J. Beddo ♀2. ***Sandoval Co.***, Bandelier National Monument, 0.5m SW Visitor Center, 35.775° -106.276°, 1965m, pitfall trap, 22-iv–20-vi-2005; 19-iv–15-vi-2006; 7-viii–8-ix-2015 DC Lightfoot, 1 juvenile male each time. ***Santa Fé Co.,*** Edgewood, 35.061438° -106.191426°, 2029m, 8-viii-2007 (S07-80) J. Underwood ♂2. Santa Fé, National Park Service Office, 1100 Old Santa Fé Trail, 35.667243° -105.922618°, 2216m, 29-vii-1985 (S85-98) M. Fletcher ♂1; 26-viii-1985 (S85-102) M. Fletcher ♀1; 16-v-1986 (S86-23) M. Fletcher ♂1; early July, 1986, M. Fletcher ♂1; 9-vii-2005 (S05-65) L. Wagner ♂1; DC Lightfoot 14-viii-2022 (S22-42) ♀5; 3-viii-2023, ♀3. Santa Fé, 804 Los Arboles Dr, 35.700566° -105.943242°, 2158m, 10-25-vii-2007 (S07-73) B. Erwin ♂1 ♀1; 6 Starfire Ln, 35.643737° -105.924160°, 2185m, J. Patterson, ♂1. 12 m S Santa Fé, 2072m, 5-vi-1988 (S88-48) M. Fletcher ♀1.

DNA. Fig. 885, p. 490. F0138 (S95-95, Gallup); type locality F1961 (S07-73); F2135 (neotype S09-93); all recovered together in Group 16 Fuscus with *A. mescaleroensis* and *A. navajo.*

Karyotype. Unknown.

Discussion. Because of the obscurity of the original 1852 Stansbury publication, we present 2 verbatim quotes, from the 1960 notes of TH Hubbell (pers. comm. to DBW, 1980):

From Stansbury's p. 366: "There were but few facilities for collecting, preserving, and transporting insects upon the journey, and those which were brought home are few in number and in bad condition. Under these circumstances, Captain Stansbury has allowed other species to be introduced, which have been collected by Lieutenant Horace Haldeman, U.S.A., chiefly at Fredericksburg and Fort Gates, on the western frontier of Texas; and by Mr. Richard Kern, in a journey across the plains to Santa Fé. In the latter case, the specimens were thrown into bottles of spirits as collected, so that there is nothing to distinguish those which were found upon the route from those of Santa Fé; but as the greater part probably appertain to the latter locality, this has been used to Mr. Kern's species."

From Stansbury's p. 372: "Stenopelmatus fuscus, Hald. Shining dark brown, abdomen darker. One specimen, seven lines long [1 line = 1/12 inch], is from Santa Fé; another is eight lines long, and from Chihuahua; the latter has the labrum and tibiae darker than the general colour. It is possible that these small specimens may be immature, and they would not have been characterized but for the fact that in the allied genera the color remains remarkedly uniform during the various transformations, which renders it probable that they are not larvae of the rufo-testaceus Mexican S. talpa, which my brother has brought from Jalapa. The tibial springs of S. fuscus are well developed, a character by which the adult of Phalangopsis can be distinguished from the pupae of the same size and general appearance."

First off, Hubbell's transcription helps us understand why a report, with the title of an expedition in Utah, included the description of a new species from New Mexico and Chihuahua, Mexico. Second, a specimen 7 or 8 lines in length (~15 mm) would be a juvenile of *A. fuscus*. Third, throwing almost any light-colored *Ammopelmatus* into a bottle of spirits, undoubtedly along with other specimens that could all contribute to diluting the spirits, would surely result in the rotting and darkening of such a JC. Hence, we can now understand the origin (see Derivation of name) of the name "fuscus."

On the other hand, an alternative explanation exists that could explain the dark colored specimen from Santa Fé: in fact, the specimen is not *A. fuscus* but *A. portal.* The latter is a smaller species that could be found in the higher elevation pinyon-juniper community around Santa Fé, and individuals are naturally much darker (see p. 224) than *A. fuscus.* Since the original types are lost, this discussion becomes moot with our designation of a neotype.

While Hebard (1916) apparently didn't have a specimen of *A. fuscus* from Santa Fé to designate as a neotype, he did have JCs from two nearby New Mexico sites of Albuquerque (actually *A. mescaleroensis*) and Jemez Hot Springs, so he apparently felt more comfortable in designating Santa Fé, and not Chihuahua, as the type locality. We have a nice series of light phase *A. mescaleroensis* from Albuquerque (p. 509); and DC Lightfoot has provided several specimens of *A. fuscus* from Bandelier in the Jemez Mts. While Hebard's designating just the type locality without a type specimen is unusual, it is not prohibited under International Commission on Zoological Nomenclature codes, according to Philip K. Tubbs (pers. comm to DBW, November, 2001).

Since there could be 2 species (*A. fuscus* and *A. portal*) of *Ammopelmatus* from the Santa Fé area, designation of a neotype is an "exceptional need" under ICZN Article 75.3, for the express purpose of clarifying the taxonomic status of the nominal taxon. In any case, the morphological differences between higher elevation *A. fuscus* and lower elevation *A. mescaleroensis* are limited to a subtle distinction in rear leg outer tibial spine #1. Such a difference would be most apparent in adults, and Hebard (1916) lists no adults from either Albuquerque or Jemez Hot Springs. Our three multilocus sequenced specimens of *A. fuscus* are recovered in a mixed clade with both *A. mescaleroensis* and *A. navajo*. The latter two taxa also having a flattened posterior face, on rear leg outer tibial spine #1, but that is rotated between 45–90° from the main tibial axis. In fact, multiple *Ammopelmatus* species that live in sandy substrates also have a flat posterior face on outer rear leg tibial spine #1.

A. fuscus is about 60% less common in Gallup, NM, than is *A. portal*, according to the numerous specimens that Dan Kennell collected from his swimming pool. *A. fuscus* also occurs sympatric with *A. portal* at Bandelier (Sandoval Co, NM).

***Ammopelmatus mescaleroensis* (Tinkham)**

Southwest Sand Dune Jerusalem Cricket
Figs 901–922, Tables 28, 31, 34, 36

1979. *Stenopelmatus mescaleroensis.* Great Basin Naturalist, 39, 226–230. Holotype adult male Mescalero Sands 45 m E Roswell, New Mexico. DBW saw the holotype in the Tinkham Eremological Museum when he visited Indio, California, in late 1982, but not located after Tinkham's death in 1987 (Weissman 1988); nor after that when the remainder of Tinkham's collection was moved to CAS.

Species #23, Weissman 2001b.

2021. *Ammopelmatus mescaleroensis.* Weissman *et al.,* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* on the basis of rear leg tibial spines, geographic distribution, and DNA.

2025. *Ammopelmatus monahansensis* Stidham & Stidham, **new status,** junior synonym, see p. 739.

In 1897, Saussure & Pictet described *Stenopelmatus comanchus* from an adult female from Villa Lerdo, state of Durango, Mexico, some 900 km due S of Mescalero Dunes. Weissman *et al.* (2021) transferred this latter taxon to *Ammopelmatus.* We are aware of no further specimens from Villa Lerdo and discuss, on p. 491, why we think that *A. mescaleroensis* could be a junior synonym of *A. comanchus,* although given the physical separation involved, we choose not to take any action at this time.

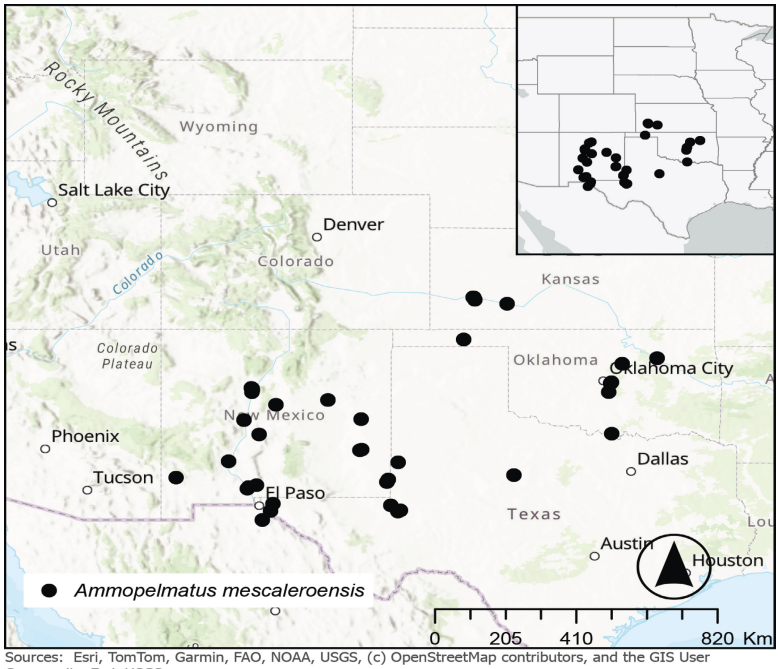


FIGURE 901. Distribution of *A. mescaleroensis.*

Distribution (Fig. 901). Known from a broad swath of generally interconnected sand dunes and sandy habitats across New Mexico, starting in Albuquerque, south to El Paso, Texas, and adjacent Chihuahua, Mexico, east to Monahans Sandhills State Park in Texas, and as far east as the Dallas area, and from there, north to Sand Springs, Oklahoma (S05-148), and as far north as Garden City, Kansas. In large part, where the Dunes Sagebrush Lizard occurs (Chan *et al.* 2020), one finds *A. mescaleroensis.*

Neotype adult male (in alcohol, Figs 902 & 903) **here selected: New Mexico, *Chaves Co.,*** Mescalero Sands, 4500', 19-vi-1991 (S91-53) D. Stricker. Molt to adult 19-viii-1991. Deposited CAS, Entomology Type #20065. Measurements in mm: Body length 37.44, hind femur length 12.17, hind femur width 4.5. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 904) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Face with furrow (Fig. 905A). Rear leg tibial outer spine #1 attenuate, posteriorly flattened with a slightly concave face (Fig. 905B) that is rotated 90° to the long axis of the tibia. Given the possible confusion, as discussed below, with newly assigned (see p. 739) junior synonym *A. monahansensis*, a neotype designation is an exceptional need, per ICZN Code 75.3, to clarify the taxonomic status of the nominal taxon.



FIGURE 902. Live neotype adult male *A. mescaleroensis* (S91-53). Many individuals at the type locality have this purple tinting, as opposed to an actual black color.



FIGURE 903. Neotype adult male *A. mescaleroensis,* showing loss of purple tinting with preservation.



FIGURE 904. Left rear leg tibia neotype adult male *A. mescaleroensis.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

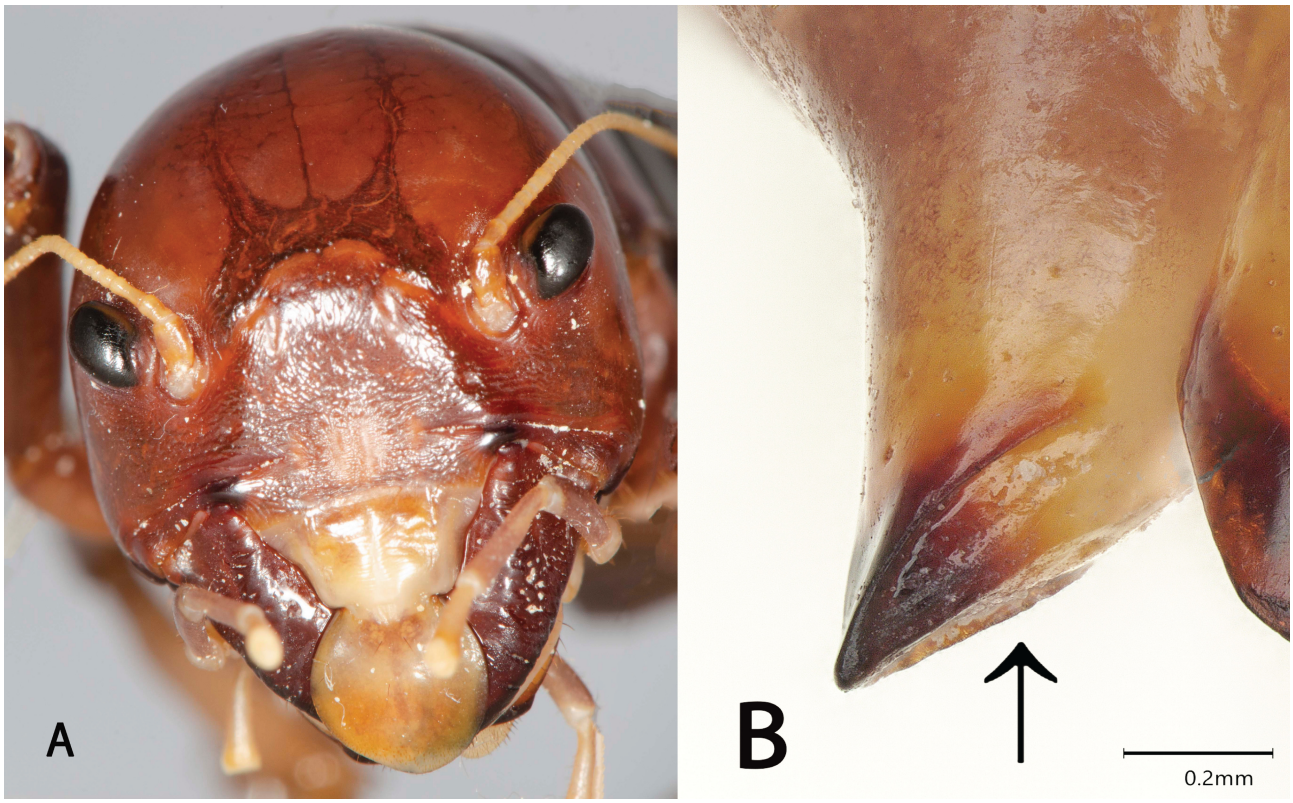


FIGURE 905. Neotype adult male *A. mescaleroensis.* A. Face. B. Outer rear leg tibial spine #1. Note flat, rear facing surface (arrow). Head is toward the top of photo (Photo by Chris Grinter).

Female. Unknown to Tinkham (1979): Topotypic adult female similar to male (Fig. 906), megacephalic, rear leg tibia with (Fig. 907) 4 outer and 5 inner spines. Ovipositor Fig. 908.



FIGURE 906. Megacephalic adult female *A. mescaleroensis* (S85-54, R85-34) showing black color with a purple tinge, from type locality Mescalero Dunes.

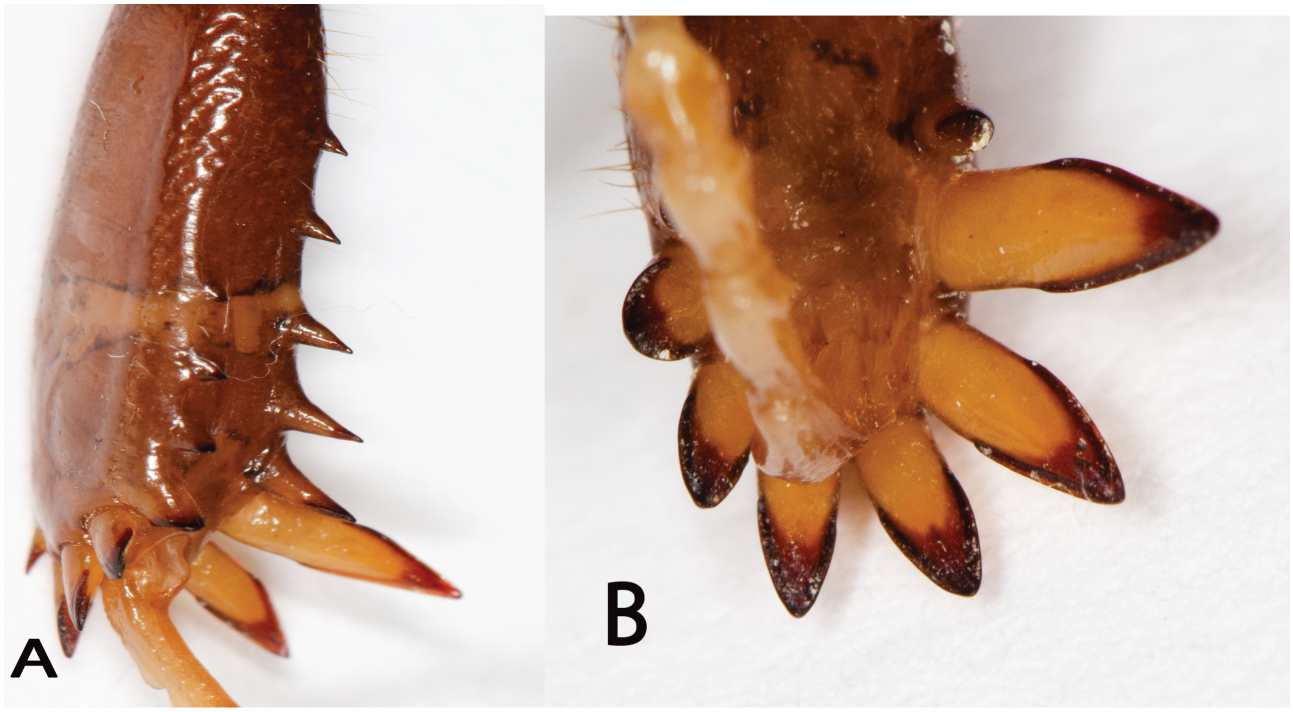


FIGURE 907. Left rear leg tibia same topotypic adult female as in Fig. 906. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 908. Ovipositor topotype *A. mescaleroensis.*

This widespread species is one of the most color variable *Ammopelmatus* species known. As such, it took years for us to be convinced that one species was involved, and only after documenting uniform morphology, karyotype, drumming, and DNA. We make our arguments below, and correlate general body color with the amount of surface vegetational cover at each locality. The extreme population colors range from almost pure dark individuals at Mescalero Dunes (see Figs 902 & 906 above); to almost pure light-colored individuals (see Fig. 911) found at Monahans Sand Dunes, some 220 km to the southeast. Rare, intermediate-colored individuals are known (Figs 909 & 910). We also discuss each species separately, to minimize confusion, even though we designate (p. 739) *A. monahansensis* as a junior synonym of *A. mescaleroensis.*



FIGURE 909. Adult male Plains, Texas (S10-70), showing body and leg colors intermediate between *A. mescaleroensis* and "*A. monahansensis*".



FIGURE 910. Adult female from near Eunice, New Mexico (S07-77, R07-58), showing intermediate colors.



FIGURE 911. Adult male (S94-97, R94-73) light color morph *A. mescaleroensis* from type locality of Mescalero Sands.

Recognition characters. A geographically widespread taxon. Small (only at most western locality of dunes N Lordsburg, S25-7), generally medium to large, sandy habitat, rear leg outer tibial spine #1 is posteriorly flattened and rotated from 45–90° from the main long axis of the tibia. Rear leg tibia frequently with 4 outer spines. A variable-colored JC depending on amount of ground cover: from almost pure purple-black, to black with dark yellow abdominal stripes, to light colored head, pronotum and legs except for striped abdomen. Both color morphs occur at Mescalero Sands, and elsewhere (see below), with dark morphs in natural or untreated herbicide areas with dense ground cover; and light morphs from open dunes or from herbicide treated areas with resultant open ground cover. At Monahans Sands State Park, Texas, type locality of *A. monahansensis,* which is ~220 km SE of Mescalero Dunes, and which is more open than Mescalero, 96% of our specimens (24 out of 25 individuals) were light colored and most of those individuals were megacephalic. Some individuals were huge (Fig. 1393, p. 739). Of the 7 light colored morphs from Mescalero Dunes, none were megacephalic. Both light and dark-colored individuals megacephalic around Eunice, New Mexico (S07-77 & S10-61).

In large individuals, including the neotype, outer rear leg tibial spine #1 has a flat, posterior facing surface (Fig. 905B above), an adaptation that may help these JCs swim through the sand. This condition is more easily appreciated in light colored morphs than in dark colored morphs. This 45–90° rotated spine #1 also helps separate *A. mescaleroensis* from its smaller, higher elevation relative *A. fuscus*, whose spine is more attenuate (gradually tapering apically) than truncate (cut off squarely at the tip), and only rotated between 0–45°. Similar, smaller modifications are sometimes seen in inner rear leg tibial spine #1 of some individuals (Fig. 912), but not to the extent seen in outer spine #1. Calling drum rate is around 1 drum/s at 20°C. Separated from morphologically (also with a flat rear leg tibial outer #1 spine rotated between 45–90°) and ecologically (living in sand) similar *A. navajo*, from Arizona, by differences in color morphs (see Fig. 924, p. 514), drum rate (Fig. 928, p. 516), and possibly DNA.

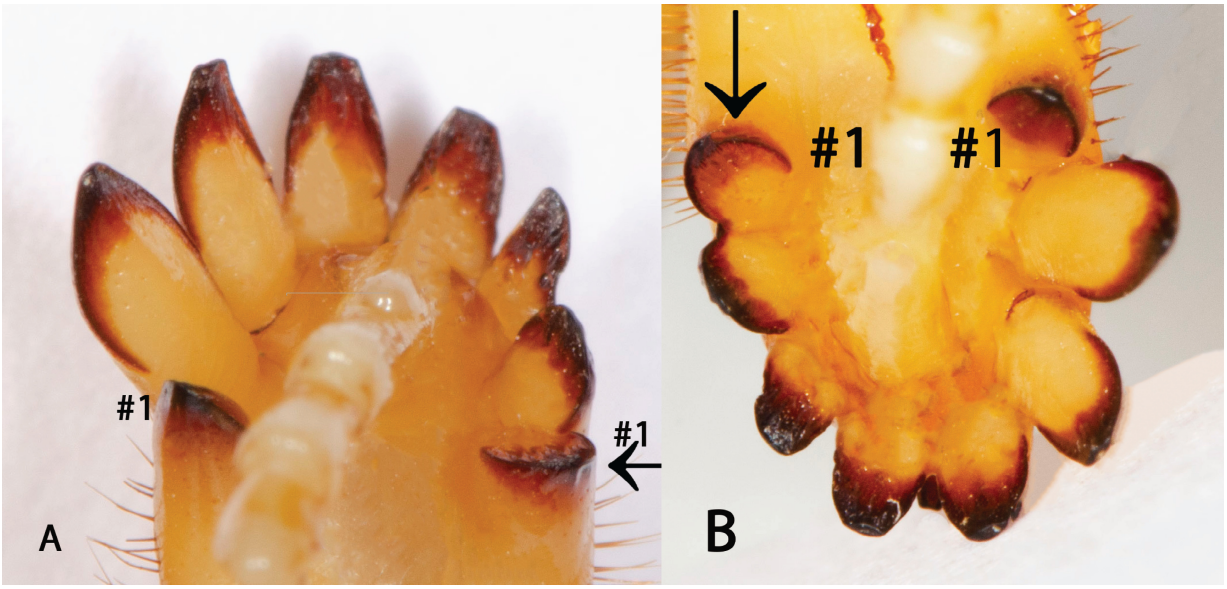


FIGURE 912. Two perspectives of left rear leg tibial spines, adult female *A. mescaleroensis* from Monahans Sand Dunes (S95-59, R95-90). A. Showing flat posterior-facing outer spine #1 (arrow) on right side of photo. B. Showing flat posterior-facing outer tibial spine #1 (arrow) on left side of photo. Also note flat face of inner tibial spine #1 on left side of photo in A; and on right side of photo in B.

Drum. Calling drum similar in both sexes although series longer in females. **Topotype male:** Calling drum (Fig. 913, R91-38) adult male from S91-53, showing 10 drums in 9.4s (0.9 drums/s) at 20°C. **Topotype female:** Calling drum (Fig. 914, R92-42) in adult female from S91-53, showing 108 drums in 94.4s (1.1 drums/s) at 21°C (first 3 spaced drums not counted).

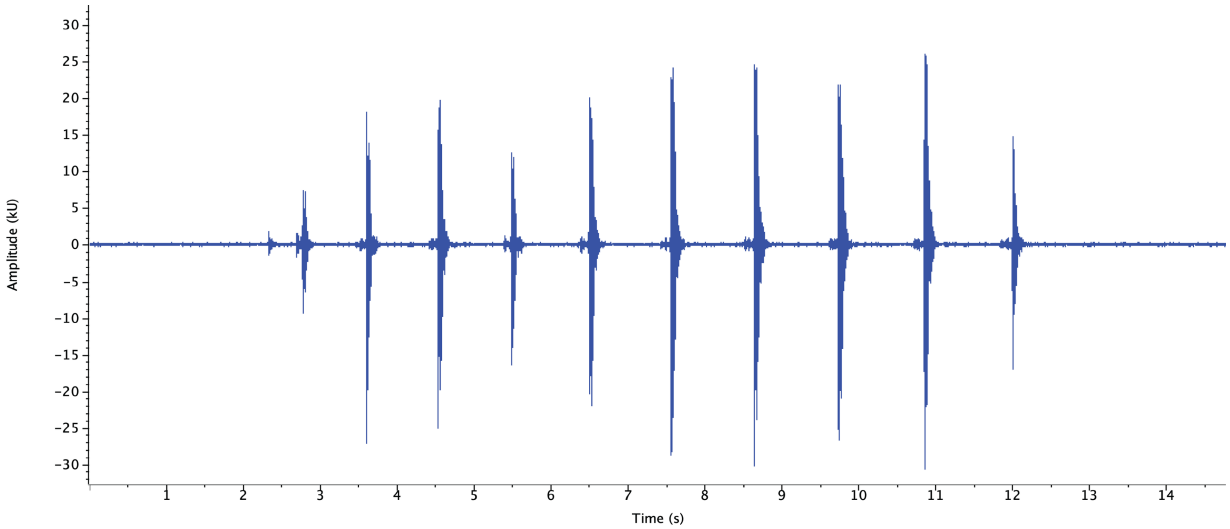


FIGURE 913. Calling drum (R91-38) adult male from type locality (S91-53), showing 10 drums in 9.4s (0.9 drums/s) at 20°C.

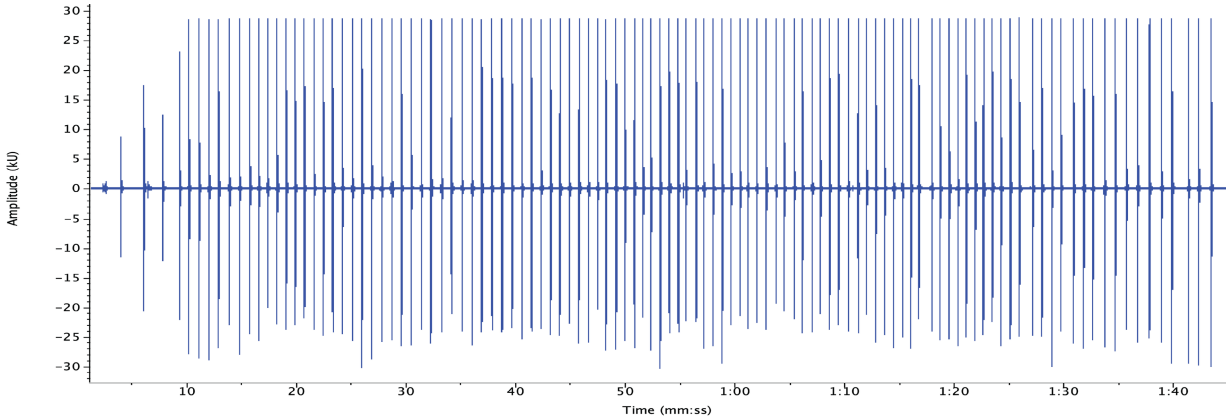


FIGURE 914. Calling drum (R92-42) in adult female from type locality (S91-53), showing 108 drums in 94.4s (1.1 drums/s) at 21°C.

Derivation of name. Named after the Mescalero Sand Dunes, the type locality.

Habitat. Mescalero Sands is ~1700 square kilometers in area and ~220 km NW of Monahans Sands. The type locality is rolling sand dunes with or without much surface cover. Natural dominant plant is shinnery oak, *Quercus havardii.* https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238194. Elsewhere, habitats variable but always sandy. Areas around Garden City, Kansas, are sandhills-sage prairie. Clint Dunes east of El Paso (Fig. 915, S08-66) with nice plant cover.



FIGURE 915. Clint Dunes east of El Paso (S08-66). (Photo Greg Ballmer).

Life cycle and seasonal occurrence. Like most arenicolous JCs, this species is best collected using oatmeal trails and pitfall traps. T.J. Cohn collected 7 adult females, 3 male and 2 female nymphs at a Mescalero Sands oatmeal trail on 3-x-1974. Weissman & Lightfoot (S85-54) collected 14 late instar males, 7 late instar females, and 6 smaller nymphs to oatmeal on 7-vi-1985. Researchers out of the Department of Biology, University of New Mexico, Albuquerque, between 1989 and 1993, had good success with 5-gallon pitfall buckets while doing survey work on Dunes Sagebrush Lizards. If one only walks the dunes at night looking for JCs, then success will be variable—mostly wandering adult males late in the season, as discussed in Tinkham (1979), or nothing. Where there is good vegetation cover, the JCs apparently stay under cover of that vegetation, probably to avoid nocturnal predators.

Our collecting on the Rio Salado Dunes (Socorro Co., NM) along I-25 in central New Mexico, demonstrates the differences in collecting one can see during different dates in different years at the same site. On 15-viii-1993 (S93-68), an oatmeal laid on the dunes in late afternoon was almost completely cleaned up, by kangaroo rats, when we arrived back at the dunes at 01:30, with 1 adult female at the trail. The following afternoon, we placed 30 pit fall traps on the dunes, baited with dry oats, and covered with cardboard attempting to exclude kangaroo rats. When we returned at 00:30 that evening, there were 4 mid instars JCs in the pit fall traps. We then put out 2 long oatmeal trails which we first walked at 02:00 and collected 2 adult females. A subsequent walk at 03:30 yielded 3 adult females and 1 mid instar male. Our last walk, at 04:30, yielded 3 mid instar females and 3 mid instar males. This late-placed trail was almost untouched by kangaroo rats, who were apparently down for the night. On 10-vi-1994 (S94-32), 7 adult males were collected by DC Lightfoot walking in the parking lot while none were seen in the dunes, although no oatmeal was laid there. Returning 18-vi-1994 (S94-32), he collected another 3 adult males in the parking lot while 4 adult males and 1 adult female came to an oatmeal trail laid in the dunes. Finally, a single adult male was captured in the parking lot on 8-vii-2004 (S04-84).

Aaron Chambers (pers comm to DBW October, 2025) saw some 60 individuals, at a long trail, on the stabilized dunes NW Lordsburg (S25-7) on 9-x-2025. His somewhat random collection included all adults except for 1 mid-instar female. All adult males were megacephalic while none of the adult females were.

Variation. See Discussion below re **color morphs**. See p. 744 for discussion on variation in **megacephalism**, especially for those individuals from Monahans Sands. For 32 dark morph adults from ***Mescalero Sands***, 1 had 2 and 31 had 3 ventral **fore** leg tibial spurs; all 32 had 8 **middle** leg tibial calcars, and all had 2 ventral spurs; 2 had 4 and 30 had 5 inner **rear** leg tibial spines, and 1 had 2, 20 had 3 and 11 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 7 dark morph adults from around ***Eunice, NM***, 1 had 2 and 6 had 3 ventral **fore** leg tibial spurs; all 7 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 6 had 5 inner **rear** leg tibial spines, and 1 had 2, 5 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 9 light morph adults examined from ***Mescalero Sands***, all had 3 ventral **fore** leg tibial spurs; all 7 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 6 had 5 and 1 had 6 inner **rear** leg tibial spines, and 5 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 26 light colored adults from ***Monahans Sands***, 1 had 2 and 25 had 3 ventral **fore** leg tibial spurs; all 26 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 3, 8 had 4, and 16 had 5 inner **rear** leg tibial spines, and 21 had 3 and 5 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 16 light morph adults examined from ***NW Lordsburg***, **NM** (S25-7), all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, 1 with 1 and 15 with 2 ventral spurs; 4 had 4, and 12 had 5 inner **rear** leg tibial spines, and 1 had 2 and 15 had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. **Size:** Individuals from most western locality, stabilized dunes NW Lordsburg (S25-7), are the smallest seen, and around 1/2 the length of those largest ones from Monahans Sand Dunes in Texas.

Specimens from the Museum of Texas Tech University, Lubbock, kindly sent, in 2006, by Fay Mayer and Matt Renide, are from the following Texas Counties and Cities: Cochran Co (no city listed); Fremont Co (Cole?); Gaines Co (Seagraves); Lubbock Co (Lubbock); Lynn Co (Wilson); Terry Co (Brownfield); and Yoakum Co (Beasley Ranch). These specimens include both light and dark morphs, with those from Lubbock comprising both color morphs.

Specimens examined. Dark Colored Morphs (Figs 902 & 906): **NEW MEXICO, *Chaves Co.,*** Mescalero Sand Dunes, 33.426972° -103.819472°, 1273m, 7-vi-1985 (S85-54) ♂9 ♀7; 2-viii-1989 (S89-59) GS Forbes ♂1 ♀3; 19-vi-1991 (S91-53) D. Stricker ♂7 ♀2; 24-26-vi-1992 (S92-73) ♀2; mid-August, 1994 (S94-97) B. Gorum ♂3; 19-vi-1995 (S95-51) B. Gorum ♂2; 33.40733° -103.86661°, 1246m, 26-27-viii-2015 (S15-119) JA Cole & LA Gonzales ♂1. ***Lea Co.,*** Hwy 18, 7.6 m N Eunice 32.538367° -103.125529°, 1085m, 6-ix-2010 (S10-61) ♂4 ♀1. Intermediate Colored Morphs (Figs 909 & 910): **NEW MEXICO, *Lea Co.,*** 1 m N Eunice, 32.464924° -103.162144°, 1047m,

21-vii-2007 (S07-77, R07-58) H. Lease ♀1. **OKLAHOMA, *Tulsa Co.***, Sand Springs, 311 N. Franklin Ave., 36.140352° -96.117373°, 220m, 1-x-2005 (S05-148) M. Rucker ♂1. **TEXAS, *Yoakum Co.,*** Plains, 33.04888° -102.86863°, 1107m, 17-ix-2010 (S10-70) B. Anderson ♂1. Light Colored Morphs (Fig. 911): **KANSAS, *Finney Co.,*** Dodge City, 37.758° -100.028°, 767m, 26-ix-1996 (S96-84) K. Sexson ♀1, male nymph for testes (T98-9). Garden City, 740 Yucca Path, 37.949380° -100.913490°, 878m; and Buffalo Dunes Golf Course, 37.876603° -100.868512°, 888m, all K. Sexson, 13-x-1994 (S94-108) ♂1; 20-x-10-xi-1995 (S95-120) ♀1 and male for testes (T96-19); 28-v-1996 (S96-32) ♀1; 20-ix-4-xi-1996 (S96-83) ♀3; 10-iii-17-vii (S97-25) ♂1 ♀1; 25-viii-13-ix-1997 (S97-63) ♂1 ♀1; 8-v-1999 (S99-24) ♀1; 4-x-1999 (S99-151) ♀1; 15-x-2000 (S00-64) ♀2; 4-vi-30-viii-2001 (S01-55) 2 males for testes (T01-13, T02-6); 20-ix-2001 (S01-103) ♂2. Southwind Golf Course 37.9461° -100.8962°, 880m, 7-10-xi-1999 (S99-156) K. Sexson ♀3. **NEW MEXICO, *Bernalillo Co.,*** Albuquerque, 2-viii-1984 (S84-49) D. Ferguson ♂1 ♀2; 3-iii-1985 (S85-21) ♂2. Albuquerque, 9304 Clearwater St NW, 35.187648° -106.671300°, 1569m, J. Ward, 1-8-vii-2006 (S06-62) ♀2, 26-ix-29-xi-2007 (S07-93) ♂2 ♀2; 16-18-iv-2009 (S09-12) ♂2 ♀1. Albuquerque, Rio Grande Nature Center, 35.130571° -106.682793°, 1516m, 8-v-12-vi-1993 (S93-41); 30-vi-16-vii-1993 (S93-62) H. Pratt ♂2 for testes, ♂1 ♀2. Rio Rancho, 32 Unser Blvd, 35.2583732° -106.697493°, 1683m, 2-iv-2009 (S09-11) S. Madrid ♂1. ***Chaves Co.,*** Mescalero Sand Dunes, 19-vi-1991 (S91-53) D. Stricker ♂1; 24-26-vi-1992 (S92-73) ♀2; mid-August, 1994 (S94-97) B. Gorum ♂3; 19-vi-1995 (S95-51) B. Gorum ♀1. ***Dona Ana Co.,*** Las Cruces, 32.317° -106.764°, 1217m, all DC Lightfoot, 10-ix-1984 (S84-54) ♂1; 18-xi-1986 (S86-153) ♀1; 22-viii-1988 (S88-97) ♂1; 11-viii-1990 (S90-91) ♀1; 19-ix-1990 (S90-100) ♂1 ♀1. Mesilla, 32.267° -106.801°, 1185m, 14-iv-1990 (S90-34) DC Lightfoot ♂1. Organ Mts, Aguirre Spring Campground, 32.370164° -106.562544°, 1743m, 30-vii-1989 (S89-58) DC Lightfoot ♂1; 13-x-1989 (S90-33) DC Lightfoot ♂1; 17-viii-1993 (S93-70) ♂1. 4 m N Aguirre Spring, 1520m, 21-ix-1983 (S83-139) DC Lightfoot ♂1. ***Guadalupe Co.,*** Santa Rosa, 4000-5000', 12-viii-1993 (S93-64), T. Thompson ♂2. Santa Rosa, 34.9° -104.7°, 1440m, 9-xi-2004 (S04-160) P. Cain ♀1. ***Hidalgo Co.,*** dunes 21 km NW Lordsburg, 32.501136° -108.829836°, 1309m, 9-x-2025 (S25-7) A. Chambers ♂5 ♀11. ***Lea Co.,*** 1 m N Eunice, 32.465127° -103.162165°, 1047m, 21-vii-2007 (S07-77) H. Lease ♂1. ***Roosevelt Co.,*** 8 m S, 5.5 m E Tolar, 34.3316° -103.8343° 1317m, 2-x-1993 (S93-82) J. Stuart ♀1. ***Sandoval Co.,*** Rio Rancho, 3201 Jane Cir SE, 35.239761° -106.673572°, 1640m, 24-iii-2006 (S06-6) L. Shiver ♀1. ***Sierra Co.,*** 1.5 m N Las Palomas, 33.08° -107.29°, 1285m, 28-ix-1993 (S93-81) JN Stuart ♂1. ***Socorro Co.,*** Hwy 380 ~42 m W Carrizozo, 33.876471° -106.493678°, 1549m, 13-vi-2007 (S07-49) ♂1. Rio Salado Dunes, I-25 6 km S La Joya, Walking Sands Rest Area, 34.303162° -106.889264°, 1471m, 16-viii-1993 (S93-68) ♂3 ♀9; 10-18-vi-1994 (S94-32) DC Lightfoot ♂13 ♀1; 8-vii-2004 (S04-84) ♂1. ***Torrance Co.,*** Estancia, 34.758729° -106.055694°, 1864m, 13-viii-2009 (S09-104) C. Lancaster ♀1. **OKLAHOMA, *Cleveland Co.,*** 12 m E Noble, 35.1341° -97.3785°, 356m, 25-vi-2008 (S08-52) C. Grant ♂1. ***Love Co.,*** Burneyville, 33.9° -97.3°, 232m, 20-ix-2010 (S10-75) C. Starsick ♂1. ***Oklahoma Co.,*** Choctaw, 12537 SE 38th St, 35.426972° -97.307109°, 366m, 22-x-2007 (S07-97) JJ Prachyl ♀1. Oklahoma City, 11221 E I-240 Service Rd, 35.395° -97.330°, 389m, 27-vii-2006 (S06-68) J. Kouri ♀2. ***Payne Co.,*** Perkins, 19-ix-1983 (S83-130) B. McNelly ♂1. Perkins, 18-x-1983 (S83-144) DC Arnold ♀1. Perkins, 622 E. Chantry, 35.977067° -97.026957°, 272m, 15-xi-2008 (S08-85) JA Squire ♀1. ***Texas Co.,*** Optima Wildlife Refuge ~15 m E Guymon, 36.697363° -101.160066°, 845m, 1-vii-2009 (S09-76) ♂2. ***Tulsa Co.,*** Sand Springs, 311 N Franklin Ave, 36.140387° -96.117390°, 220m, 1-x-2005 (S05-148) M. Rucker ♂1. **TEXAS, *El Paso Co.,*** near Clint just E I-10, 31.605746° -106.195896°, 1170m, 13-ix-2008 (S08-66) G. Ballmer ♂5, wandering on dunes at night. Hwy 62, 31.820912° -106.133293°, 1244m, 12-ix-2008 MV Dam ♂3 ♀1. ***Jones Co.,*** between towns of Anson and Hawley, 32.67° -99.85°, 533m, 4-x-2008 (S08-73) R. & D. Esparza ♀1. ***Ward Co.,*** Monahans Sandhills State Park, 31.621865° -102.810412°, 830m, 31-viii-1986 (S86-110) E. Gonzales ♂1; 22-ix-1986 (S86-121) E. Gonzales ♂1; 13-x-1986 (S86-136) E. Gonzales ♀1; 31-vii-1991 (S91-98) ♀1; 10-15-ix-1991 (S91-106) K. Benad ♂2; 28-ix-1991 (S91-111) ♂3 ♀1; 18-x-1991 (S91-117) ♂2 ♀5; 25-x-1991 ♀1; 10-23-xii-1991 (S91-124) ♂1 ♀2; 25-ii-1992 (S92-6) K. Benad ♀1; 22-24-iii-1992 (S92-37) K. Benad ♂1; 21-vii to 26-ix-1995 (S95-59) ♂2 ♀1. Monahans, Nelson Ave, 31.5878° -102.8749°, 800m, 9-x-1991 (S91-113) ♂1. ***Winkler Co.,*** 6 m S Kermit on Hwy 18, 31.7714° -103.0600°, 850m, 11-x-1991 (S91-114) K. Benad ♀1. **MEXICO, *Chihuahua*,** Samalayuca sand dunes 30 m S El Paso, 31.337225° -106.410475°, 1322m, 2-xi-2008 L. Saenz adult 1. Samalayuca sand dunes 48 km S Juarez, 28-iv-1974, D. Giuliani, mid instar female.

Possible placement. **NEW MEXICO**, ***Dona Ana Co.,*** White Sands Missile Range, Frontier Club, 32.376169° -106.496387°, 1326m, 12-ix-2008 (S08-65) J. & M. Diven ♂1. This adult male (F2038) was recovered in a clade with both *A. fuscus* and *A. mescaleroensis.* While his outer rear leg tibial spine #1 was posteriorly flattened, it was

only rotated 10–15° from the main long axis of the tibia. Plus, the sands at White Sands are composed of gypsum crystals, as opposed to typical quartz crystals which make up most desert sands. ChatGPT notes that White Sands is the world's largest gypsum dune field (around 712 square kilometers).

Unknown placement. **TEXAS,** probably ***Brooks Co.,*** A.C. Jones Ranch, Lovidas water hole in Borregas Section, between Encino & Agua Nueva near Jim Hoggs Co. line, ~26.92° 98.40°, 77m, R. Hamilton, 1938, 1 mid-late instar female light-colored morph, University of Minnesota, Department of Entomology, examined through curtesy of Curator Robin Thomson. If this locality is legitimate, then this specimen is most likely *A. mescaleroensis.* But given its disjunct distribution, we don't know what to make of this record.

DNA. Fig. 885, p. 490. F0085 (S95-59, Monahans Dunes, TX); F0167 (light morph, S95-59, Monahans State Park, TX); F0350 (dark morph, Mescalero Dunes, NM); F0465 (S96-83, Garden City, KN); F1424 (S04-84, Rio Salado, NM); F1789 (S06-62, Albuquerque); F1833 (S06-68, Oklahoma City, OK); F1934 (S07-49, 42 m W Carrizozo, NM); F1975 (light morph, S07-77, Eunice Dunes, NM); F2038 (S08-65, White Sands, NM); F2071 (S08-66, Clint Dunes, TX); F2076 (S08-73, Jones Co., TX); F2094 (S08-85, Perkins, OK); F2141 & F2142 (S09-76, Texas Co., OK); F2143 (S09-104, Estancia); F2207 (dark morph, S10-61, Eunice Dunes, NM) all recovered together in Group 16 Fuscus, with individuals of *A. fuscus* and *A. navajo.*

Karyotype. 2n♂=25. T91-1 (Mescalero Dunes, dark morph, Fig. 916, S91-53); T91-43 (Mescalero Dunes, dark morph, Fig. 917, S91-53); T92-25 (Monahans Dunes, light morph, Fig. 918, S91-111); T93-24 (light morph, Fig. 919, S93-68, Socorro Co., New Mexico); T93-26 (Fig. 920, S93-62, Albuquerque); T98-10 (Fig. 921, S97-25, Kansas); T01-13 (Fig. 922, S01-55, Kansas) all with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. These are the same karyotypes as were seen in the following testes (without photos): T92-3 (Monahans Dunes, light morph, S91-117); T92-50 (Mescalero Dunes, light morph, S92-73); T93-25 (S93-68, Rio Salado, NM); T93-26, T93-27 (S93-62, Albuquerque, New Mexico); T02-6 (S01-55, Kansas).

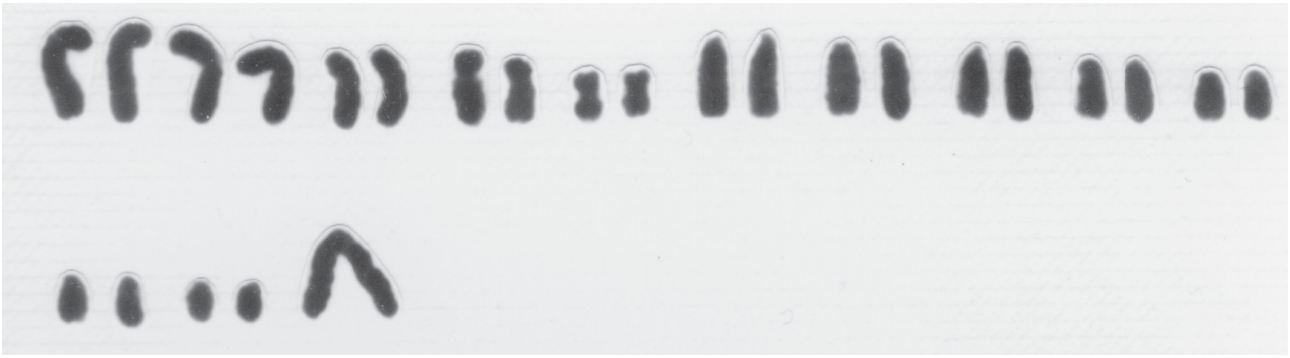


FIGURE 916. Idiogram T91-1 *A. mescaleroensis* (S91-53).

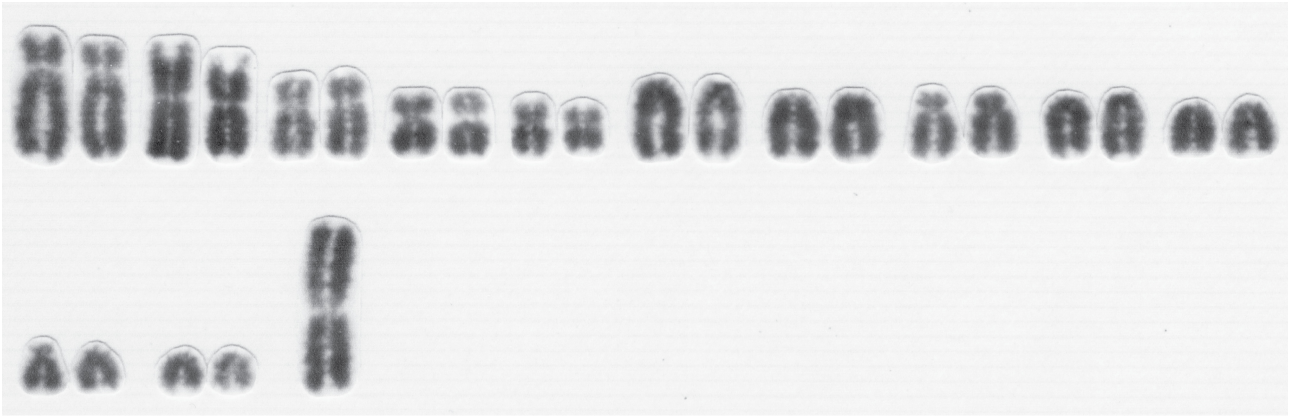


FIGURE 917. Idiogram T91-43 *A. mescaleroensis* (S91-53).

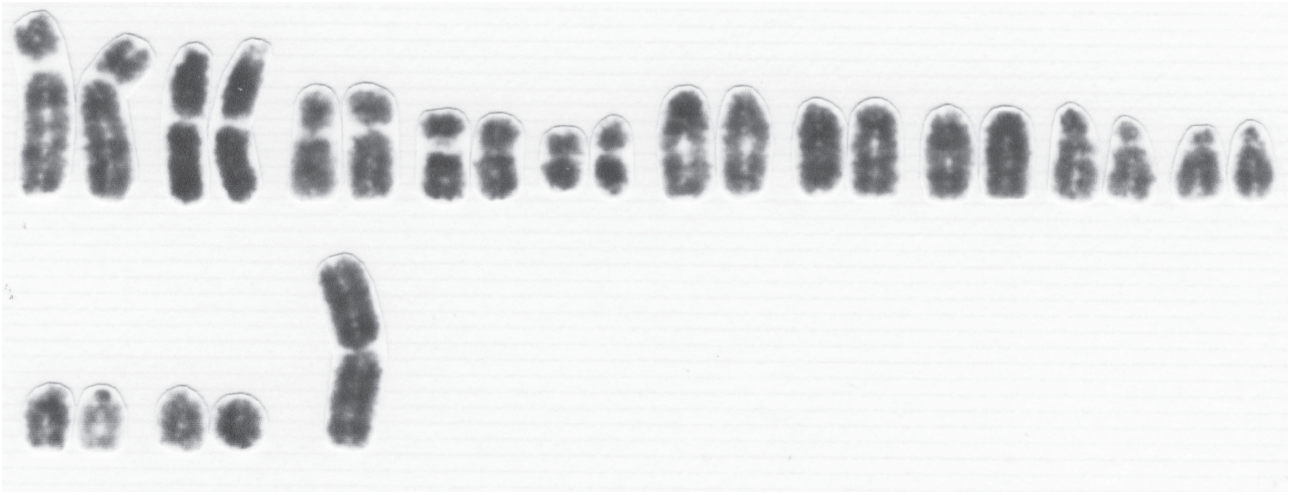


FIGURE 918. Idiogram T92-25 *A. mescaleroensis* (S93-68).

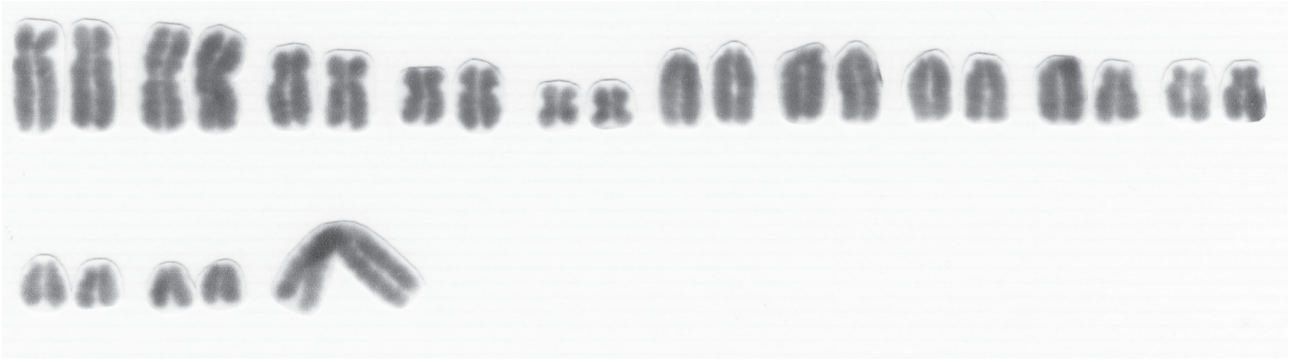


FIGURE 919. Idiogram T93-24 *A. mescaleroensis* (S93-68).

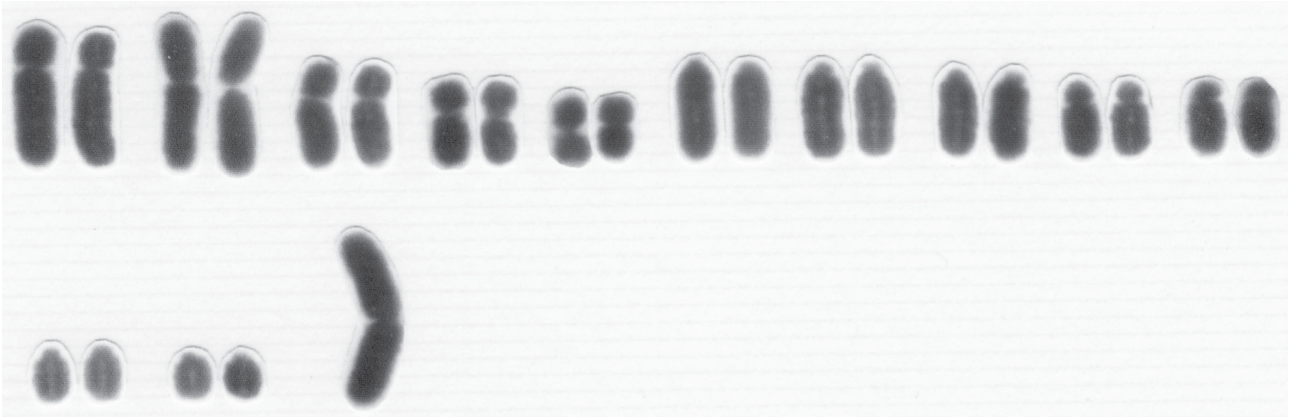


FIGURE 920. Idiogram T93-26 *A. mescaleroensis* (S93-62).

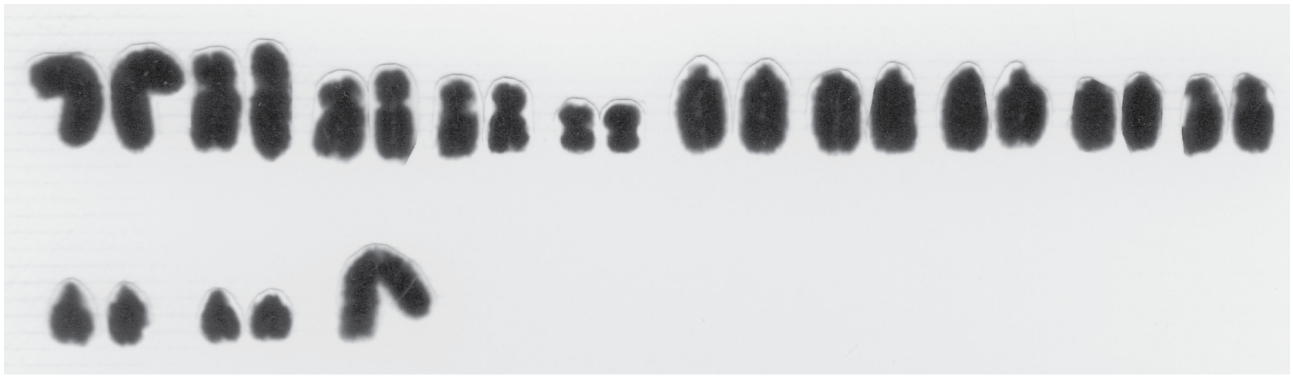


FIGURE 921. Idiogram T98-10 *A. mescaleroensis* (S97-25).

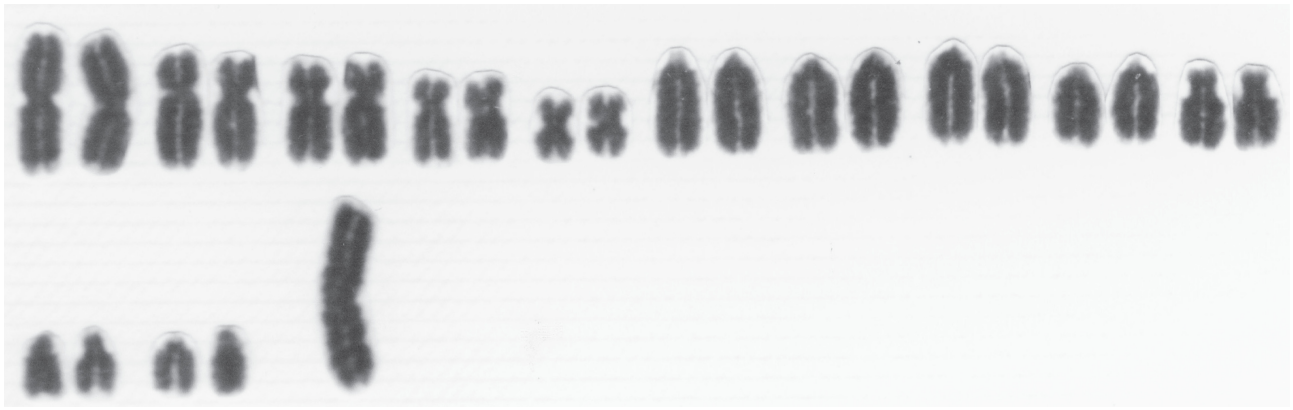


FIGURE 922. Idiogram T01-3 *A. mescaleroensis* (S01-55).

Discussion. For years, we were bothered because two named taxa (*A. mescaleroensis* and *A. monahansensis*), both with the same karyotype, drum, and morphology, were microsympatric in the southeastern New Mexico—west Texas area. Bothered because this situation was occurring in the generally accepted context that sympatric orthopteran taxa always sing (or in our case, drum) differently. In the end, identical DNA, the presence of intermediate-colored specimens, and the association of color morphs with the amount of vegetation cover, helped us accept the proposition that *A. mescaleroensis* was just a color-variable species. Additional evidence supporting this synonymy is supplied by the analysis of the data in Appendix 2 (p. 771). In those 42 populations where two species of *Ammopelmatus* are sympatric, those two species always differ by either drum rate or chromosome number, or both.

While several species of JCs are known to have two basic color morphs (see p. 24), none (with the exception of *A. abelai*) approach the diversity seen in *A. mescaleroensis.* These color differences resulted in Stidham & Stidham (2001) describing the light-colored morph of *A. mescaleroensis,* from the Monahans Sand Dunes, as a distinct taxon, *A. monahansensis*; a situation that we discuss elsewhere in this paper (see p. 739). Based on unpublished data collected by Chris Anderson (pers comm to DBW, January, 1993) and colleagues, under the direction of PI Howard Snell at University of New Mexico, during bucket capture studies, at Mescalero Sands, on Dune Sagebrush Lizard population impacts from BLM sponsored spraying of native vegetation, we see the following: Of 264 total JCs collected, 81 dark (81%) and 19 light (19%) individuals were collected from herbicide untreated areas; while 38 dark (23%) and 126 light (77%) individuals were collected from herbicide treated areas. These data support the hypothesis that dark individuals were most common in areas where dense, although short (<1 meter tall), native vegetation afforded them visual coverage from predators; while light colored individuals were most common in open dunes, where being light colored was advantageous. It would be of interest to sample subadults through the season and see if color morph percentages change since shinnery oaks are deciduous and *A. mescaleroensis* has a 2-year life cycle. Do individual JCs change color during their lifetime, most likely when they molt?

What triggers the color morph variability? Probably not substrate color, as seen in many diurnal Orthoptera,

since herbicide treated and untreated sand is probably the same color. Could there be some chemical in the sand that is produced/leached from the shinnery oaks that triggers this process? Or from some chemical ingested during direct consumption of endemic plants? Or simply differential color morph survivorship via density dependent selection (Bond 1998, Winter *et al.* 2021, Ramírez-Delgado *et al.* 2025, Michaeli *et al.* 2025)?

While mostly nocturnal, *A. mescaleroensis* is also crepuscular. Intermediate color morphs were rare, perhaps because they may be poorly adapted to either vegetated or non-vegetated habitats. Selective predation pressure, if high enough, could be responsible, as is seen in the Industrial Melanism in the Peppered Moth, *Biston betularia* (Majerus 2009). In any case, herbicidal treatment has long term, irreversible environmental consequences to this unique community (Leavitt & Fitzgerald 2013). With the 2023 addition of the Dunes Sagebrush Lizard to the Endangered Specieslist(https://biologicaldiversity.org/w/news/press-releases/dunes-sagebrush-lizard-proposed-for-endangered-species-protection-2023-06-29/?utm_source=eeo&utm_medium=email&utm_campaign=eeo1200&utm_term=EndangeredSpecies&emci=71458a02-711b-ee11-a9bb-00224832eb73&emdi=5e73b94a-331c-ee11-a9bb-00224832eb73&ceid=786514), herbicide application (mainly with tebuthiuron) is no longer authorized for use on BLM lands in lizard habitat, although, according to ChatGPT, it continues to be used on State Lands and private lands.

The individuals at Monahans Sandhills State Park have a high percentage of individuals megacephalic (see p. 739). Perhaps there is higher selection pressure from an unknown predator on the open dunes at Monahans, where a big head could facilitate both defense and quick burial. Then once below the surface, their flattened spines and spatulate calcars could help propel individuals forward. Additionally, it may be advantageous for adult males to be able to dig readily to drumming females. Since both sexes are megacephalic at Monahans, we wonder if our hypothesis that males usually dig to buried females, is correct at this locality?

Dark morph, late instar JCs collected 7-vi-1985 (S85-54) on the Mescalero Dunes at a nighttime oatmeal trail were very aggressive, with one male inflicting a near fatal bite to the hand of Dave Lightfoot. By the subsequent morning, those same collected individuals were more mellow, with Lightfoot ultimately making a complete recovery, although with a small residual scar and minor, lingering PTSD symptoms.

Ammopelmatus navajo **(Rentz)**

Navajo Jerusalem Cricket
Figs 923–937, Table 25

1978. *Stenopelmatus navajo.* Pan Pacific Entomologist, 54, 81–97. Holotype adult male (in alcohol): **Arizona, *Coconino Co*.,** Hwy 264, 3.1 m SE Moenkopi (Rentz [1978] cites 3.1 m SW of Moenkopi but label says SE and data confirmed by collector A. Hardy to DBW), 36.091799° -111.193139°, 1497m, 17-vii-1975. Deposited CAS, Entomology type #12775. Specimen examined. Measurements in mm: Body length 45.3, hind femur length 13.5. Type series, from 3-vii-1972 & 17-vii-1975, from 2.4 to 7.6 m E and SE Moenkopi, includes 6 adult males, 1 late instar female, and 4 early instars, 3 that are probably too large to be first instars, as cited by Rentz (1978).

2021. *Ammopelmatus navajo.* Weissman *et al.,* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* on basis of rear leg tibial spines, distribution, and DNA.

Distribution. (Fig. 923). Widely distributed in dispersed sandy habitats in north-central Arizona, generally north of I-40 and east of Hwy 89, including areas of the Moenkopi Plateau (a western subdivision of the Colorado Plateau), Painted Desert, Petrified Forest (on the southern edge of the Colorado Plateau), and Black Mesa.

Recognition characters. Generally medium, rarely large sized JCs, frequently megacephalic, that are variable for color and intensity of abdominal stripes (Fig. 924, and below). 2n♂=25. Fore leg tibia with 3 ventral spurs. In **males,** rear leg calcar #1 ~50% longer than calcar #2. Rear leg outer tibial spine #1 (Fig. 925) with a flattened, generally posteriorly directed face, with the face rotated 45–90° from the long axis of the tibia. Rear leg inner tibial spine #1 always longer than outer spine #1, attenuate (gradually tapering apically) in shape, and frequently with a somewhat flattened face; but if flattened, then usually rotated only 15–45° from the main long axis of the tibia. In **females,** rear leg tibia (Fig. 926) with 3 outer and 5 inner spines. Ovipositor as in Fig. 927, since adult females not seen by Rentz (1978).

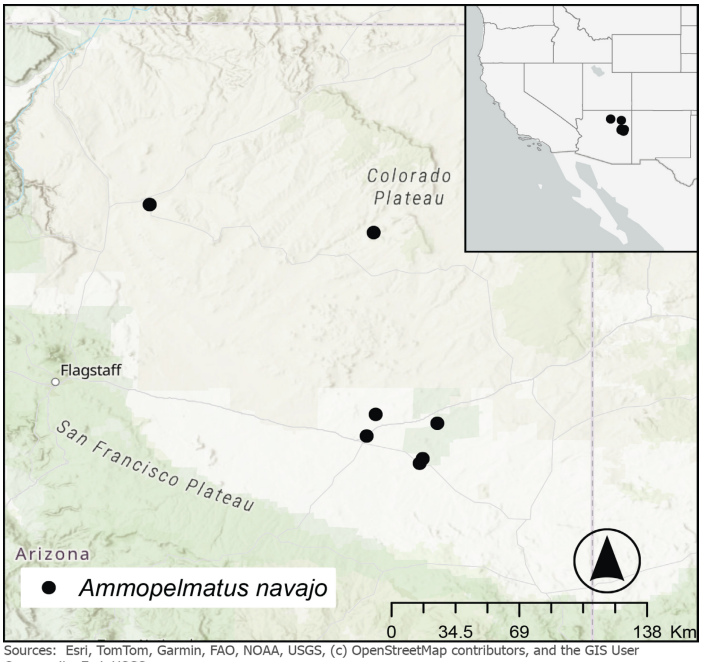


FIGURE 923. Distribution of *A. navajo.*

This taxon is morphologically, chromosomally, and genetically very similar to another Fuscus Group member, Chihuahuan Desert *A. mescaleroensis*, but differs as follows: 1. While body color ranges from almost solid black to light tan with dark black abdominal stripes in *A. mescaleroensis*; the body ranges from almost solid light colored, with minimal abdominal stripes, to light tan with (rarely) solid black abdominal stripes in *A. navajo*. 2. Base of outer rear leg tibial spine #1 is smaller in *A. navajo* than base of same spine #1 in *A. mescaleroensis*, although latter species larger. Outer rear leg tibial spine #1 more attenuate (gradually tapering) in *A. navajo,* than truncate (cut off squarely at the tip), even if still flattened. 3. Drumming rate slightly faster (Fig. 928) in *A. navajo* vs *A. mescaleroensis*, but not diagnostic. 4. Both rear leg inner and outer tibial spines #1, in *A. navajo*, are not as uniformly 90 degrees to the main axis of the tibia as is seen in *A. mescaleroensis.* 5. *A. navajo* adults are smaller.



FIGURE 924. Color variation in *A. navajo.* Two adult males: Left from S91-86 (R91-5, Hwy 77); Right from S91-88 (R91-19, Petrified Forest).

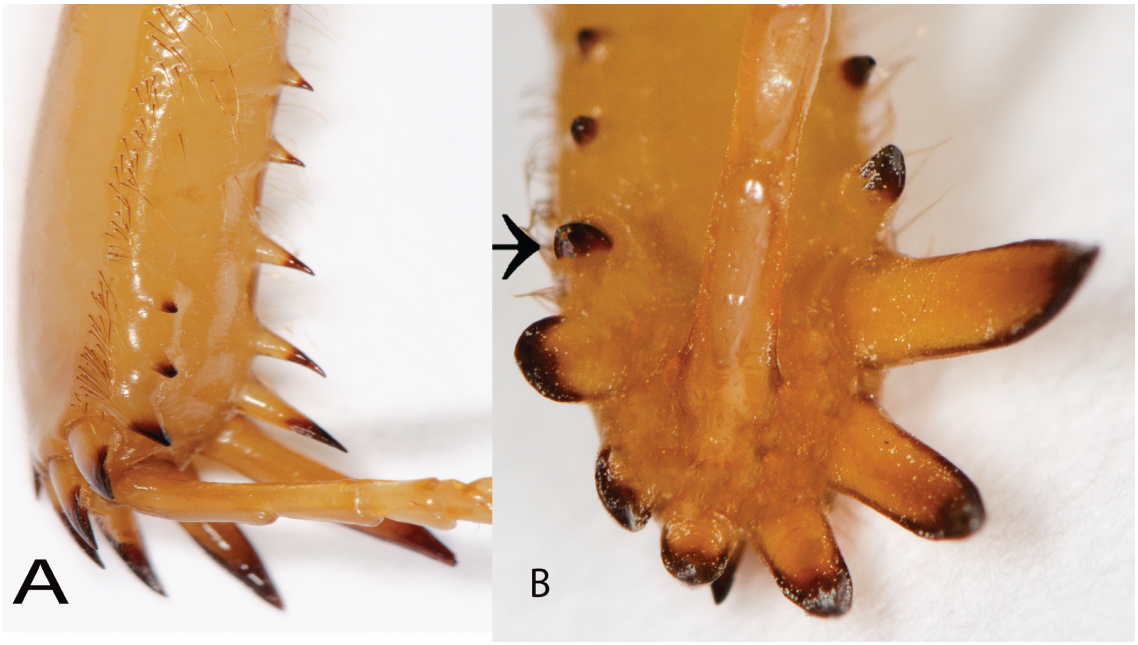


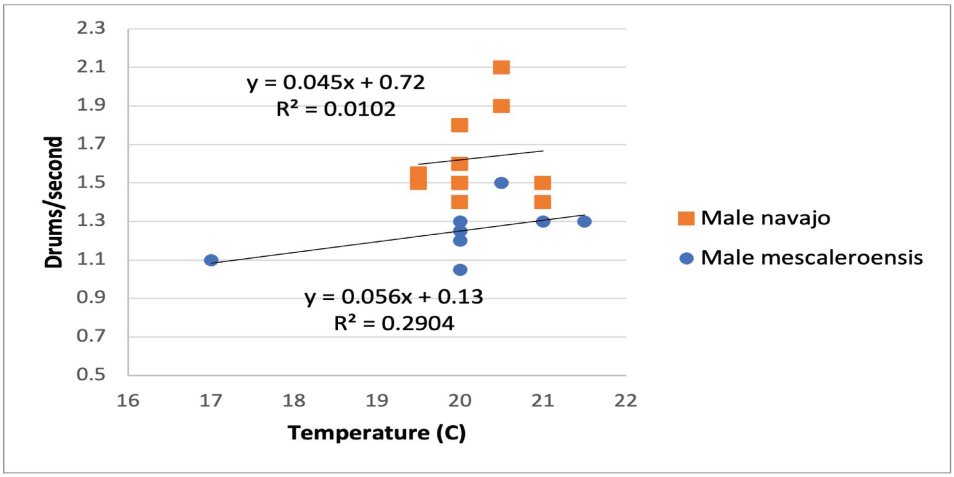
FIGURE 925. Left rear leg tibia adult paratype male *A. navajo.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars. Note flattened face (arrow) of outer spine #1, which is perpendicular (90°) to the long axis of tibia.



FIGURE 926. Left rear leg adult female *A. navajo* (S99-115, F0994). A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 927. Ovipositor adult female *A. navajo* from S99-115 (F0994), Hwy 77.



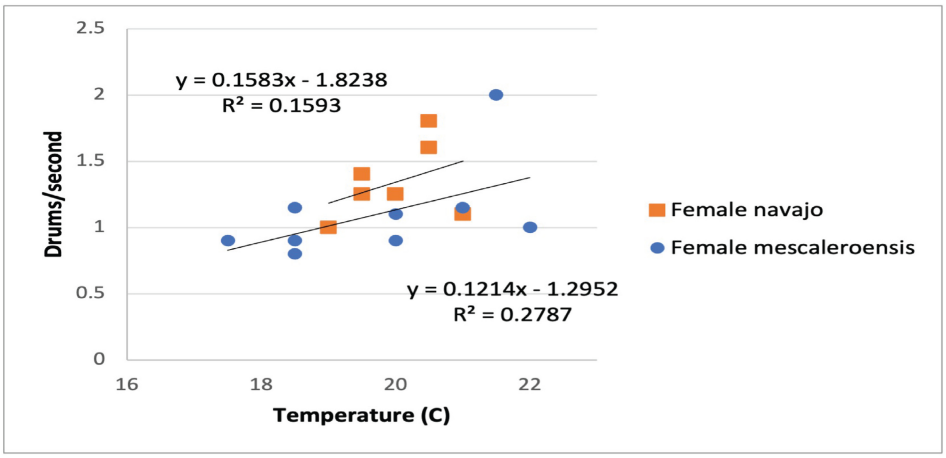


FIGURE 928. Drumming rate in both sexes of *A. navajo* vs *A. mescaleroensis.* (Top) Males; (Lower) Females. Sexes were analyzed separately because calling drum series in males were much shorter (many <10 drums) than in females (many >30 drums). Since the first few drums in most series were delivered slightly faster than subsequent drums, combining the sexes would distort the results.

Drum. Calling drum similar in both sexes. **Male**: no drum from type locality Moenkopi Dunes but from Hwy 77 off US I-40 (some 160 km SE of type locality), S91-86, R91-5 (Fig. 929), at 20°C: 17 drums in 9.6s (1.8 drums/s). **Female:** from type locality of Moenkopi Dunes, S91-82, R91-8 (Fig. 930), at 20.5°C: 22 drums in 11.6s (1.9 drums/s).

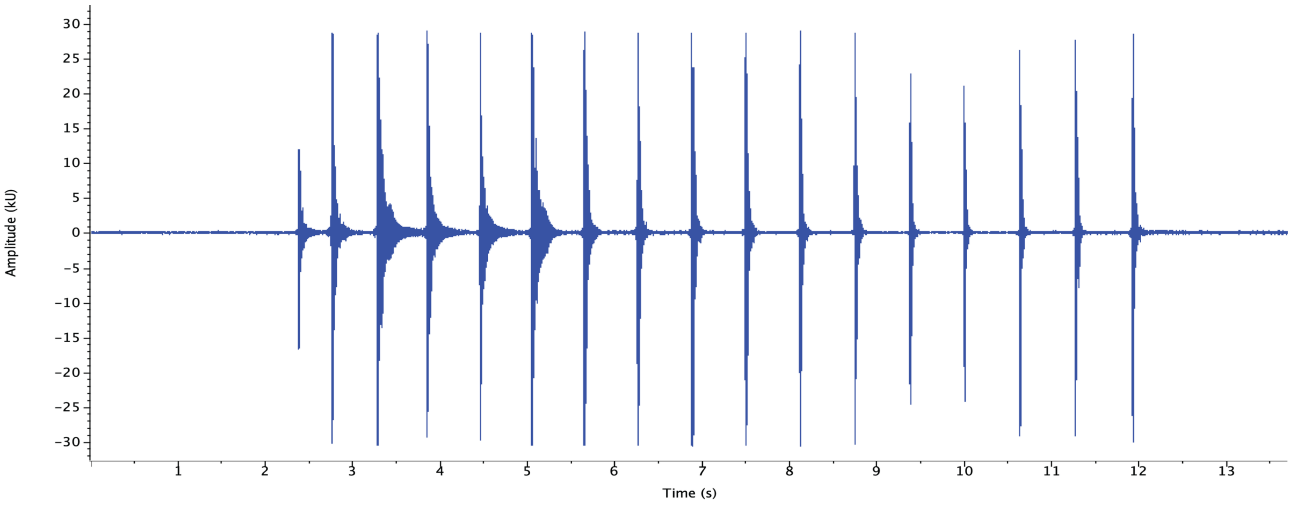


FIGURE 929. Calling drum (R91-5) adult male *A. navajo* (Hwy 77, S91-86, 20°C).

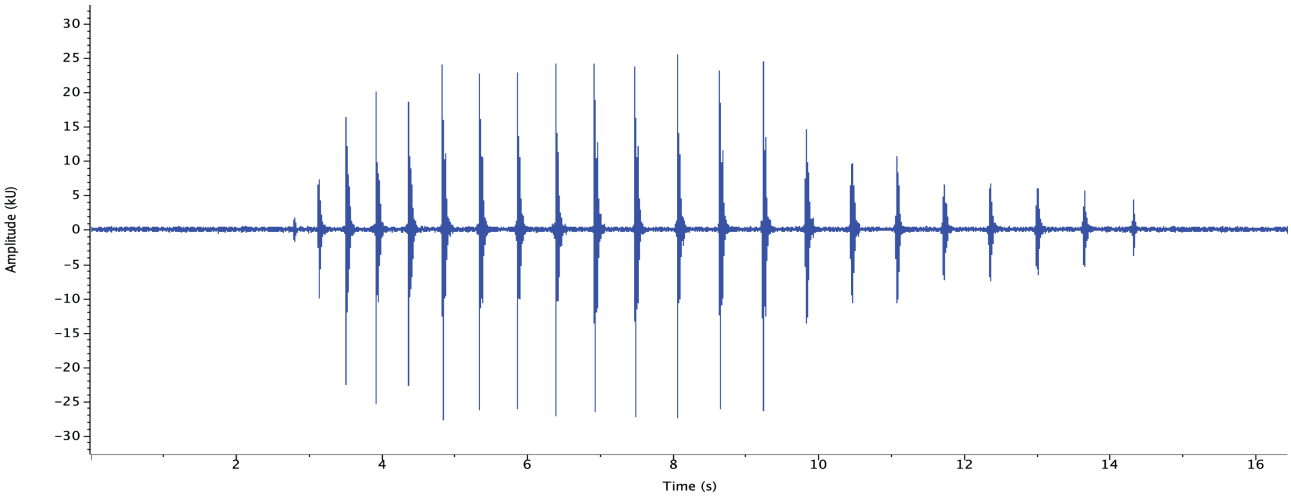


FIGURE 930. Calling drum (R91-8) adult female *A. navajo* (type locality S91-82, 20.5°C).

Derivation of name. The type locality is on the Navajo Indian Reservation.

Habitat. Type locality is low rolling sand dunes with varying degrees of damage from cattle grazing. The sand there has a distinct reddish quality, which the JCs generally match (Fig. 933), except for the abdomen. This dune area might be more open, because of disturbance, than other areas where individuals have distinctive black striped abdomens. On the other hand, it might be difficult to correlate substrate cover with degree of stripes since several of our specimens were collected wandering on the paved roads at night and we have little idea of what their habitat was like when they were developing, and how such coloration is determined by edaphic and floristic factors.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle. The material studied by Rentz was comprised of 6 adult males, collected in July, and no adult females. During our three August and September visits, we collected 14 adult females and no adult males, all at long oatmeal trails. Kangaroo rats were a definite problem.

Variation. Color most obvious variable, as discussed above and illustrated below. For 49 individuals, all had 3 ventral **fore** leg tibial spurs; all 49 had 8 **middle** leg tibial calcars, and 1 had 1 and 48 had 2 ventral spurs; 6 had 4 and 43 had 5 inner **rear** leg tibial spines, while 46 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

Specimens examined. **ARIZONA, *Apache Co.,*** Petrified Forest National Park, between Rainbow Forest Museum and south entrance, 34.812474° -109.868167°, 1672m, 7-viii-1991 (S91-85) ♂1. Petrified Forest National Park, Old Route 66, N I-40, 1750m, 23-vii-1997 (S97-114) C. Drost ♂1. Petrified Forest National Park along main road N Puerco Wash, 34.990621° -109.797366°, 1670m, 23-vii-1997 (S97-115) C. Drost ♂1. ***Coconino Co.,*** Type locality, Moenkopi Dunes, Hwy 264 3.1 m SE Tuba City, 36.091799° -111.193139°, 1497m, 6-viii-1991 (S91-82) ♀7, 1 late male and 1 late instar female; 2-viii-1992 (S92-112) ♀4, 2 early nymphs; 7-ix-1999 (S99-111) ♀3. ***Navajo Co.,*** Cottonwood Wash 0.5-1.0 m E of S entrance to Petrified Forest National Park, 34.789158° -109.882930°, 1642m, 8-viii-1991 (S91-88) ♂10. Holbrook, 213 Anita Dr., 34.926508° -110.140204°, 1602m, all M. Wischmann, 21-v-1993 (S93-32) ♂2; 2-iv-1995 (S95-27) ♀1; 5-ix-1996 (S96-81) ♂1 ♀1. Low Mountain, 35.950900° -110.106194°, 1884m, all S. Redsteer, 26-v-1992 (S92-51) ♂1; 25-v-1993 (S93-33) ♂1 ♀6. Hwy 77 from 0 to 12 m N of US I-40, 7-viii-1991 (S91-86, wandering on road and at oatmeal trail at dune area by mile post 406.8, 35.035433° -110.096454°, 1609m) ♂2 ♀7; Hwy 180, from 0.5 to 3.4 miles SE of S entrance to Petrified Forest National Park, 8-ix-1999 (S99-114) ♂1 ♀3. Hwy 77 11.3 m N I-40, mile post 406.8, 35.035433° -110.096454°, 1609m, 8-ix-1999 (S99-115) ♀3.

Possible placement. **ARIZONA, *Coconino Co.,*** Inscription House Canyon, Navajo Creek drainage, 36.659998° -110.789011°, 1900m, 15-vii-1997 (S97-73) C. Drost ♂1. This adult male was captured in a heavily eroded gully, under cottonwoods, and his DNA (F0491) was recovered closest to *A. grahami.* He drummed (R97-30) at 1.5 drums/s at 20°C; his rear leg outer tibial spine #1 is rotated 45° from the main long axis of the tibia; and he is tentatively placed here given his proximity to the type locality of *A. navajo.*

DNA. Fig. 885, p. 490. F0492 (S97-114, Petrified Forest); F0988 (type locality S99-111); F0993 (S99-115, Hwy 77) all recovered together in Group 16 Fuscus, and closest to *A. fuscus* and *A. mescaleroensis*.

Karyotype. 2n♂=25. T92-10 (Fig. 931, type locality S91-82); T93-8 (Fig. 932, Low Mountain, S93-33) both with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

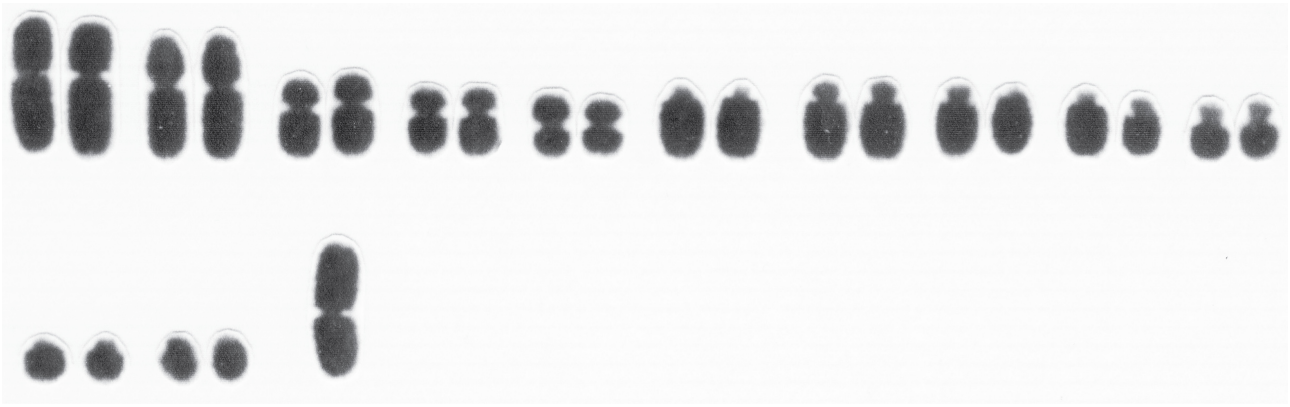


FIGURE 931. Idiogram T92-10 *A. navajo* (S91-82).

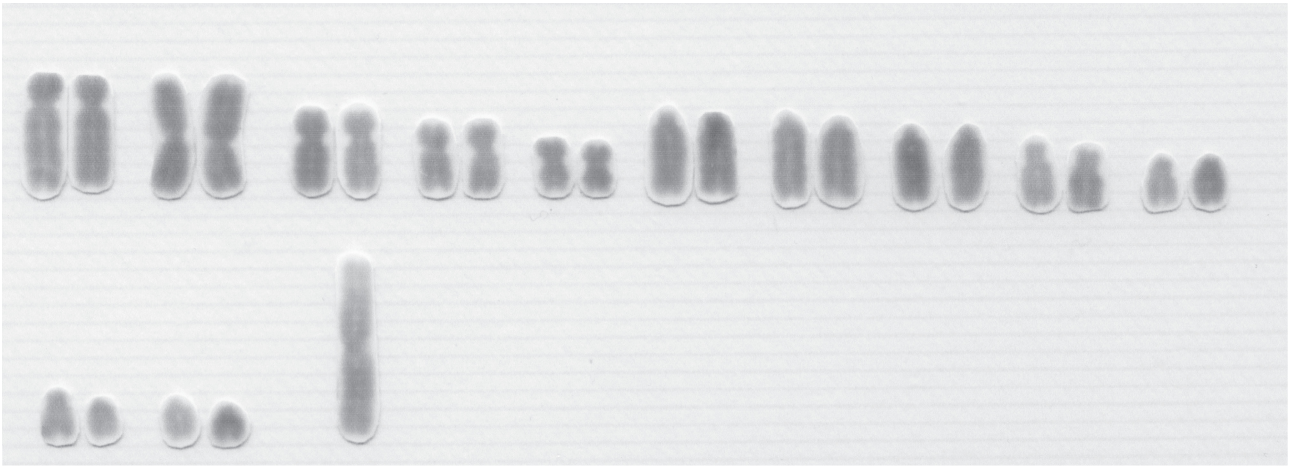


FIGURE 932. Idiogram T93-8 *A. navajo* (S93-33).

Discussion. The Moenkopi Dune field is some 1250 square kilometers in area (Ellwein *et al.* 2018). While it is unknown how the individual color patterns are related to the color of the substrate, at the type locality (S91-82), where reddish colored sand predominates, the JCs are fairly uniformly colored (Fig. 933) and match the sand well, except for their abdomens.



FIGURE 933. Adult female *A. navajo* from type locality (S91-82, R91-8) on native sand.

There is little color variation seen in the 14 adult females that we collected at the type locality, with Fig. 934 representing the extremes seen.



FIGURE 934. Two adult females from type locality (S91-82), on non-native sand, showing color range seen in the 11 adult females collected there.

But elsewhere within its range, the presence of color variation in *A. navajo* is more typical than not. At the Hwy 77 site (S91-86), from 0 to 18 km north US I-40, and some 140 km from the type locality, the sand was more tan-brown colored. Collecting JCs on the road and at an oatmeal trail laid near sandy-substrate mile post 406.8, yielded a variety of color patterns (Fig. 935).

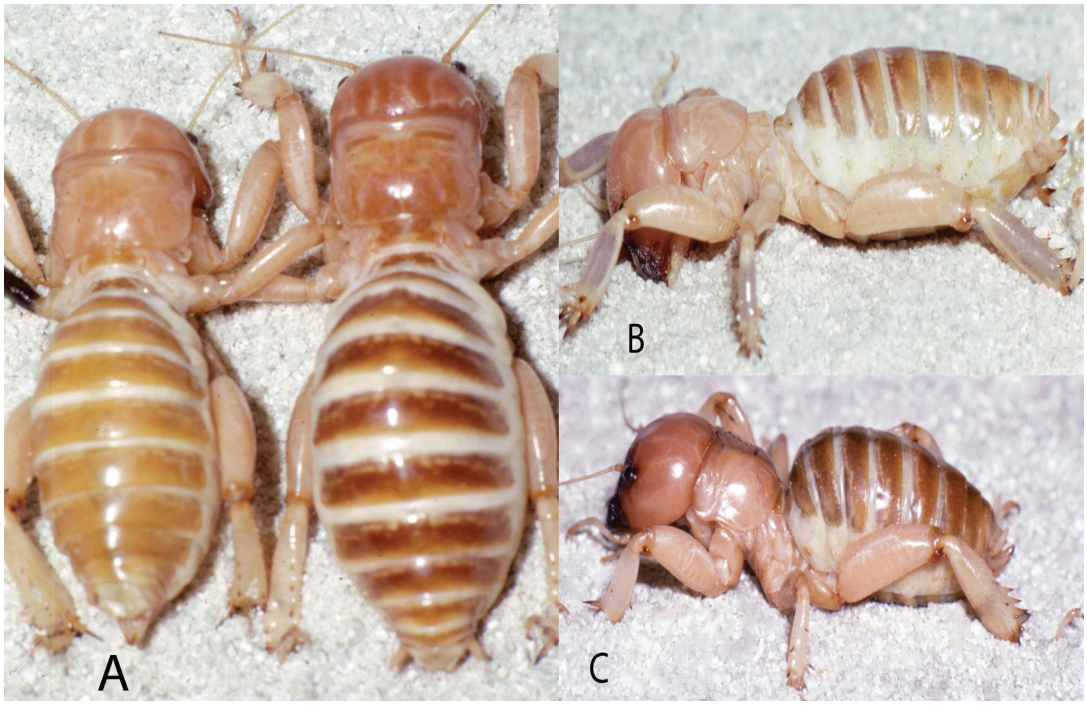


FIGURE 935. Four adult females, all from along Hwy 77 (S91-86), showing range of color variation in *A. navajo.* A. These two individuals were collected on the highway within about 1.5 km of each other. B. Note light purple markings on all tibias, and even some purple on anterior section of abdominal tergites. Such purple coloration was not seen in any other specimen of *A. navajo* but is common at type locality *A. mescaleroensis.* C. Female from sandy area (S99-115, F0993) was collected on dunes near Hwy 77-mile post 406.8, some 18 km north of I-40.

Petrified Forest National Park is ~30 km east of Hwy 77, and some 180 km from the type locality. The area is generally clay soil with open grassland and areas of sand. JCs there were crepuscular, as adult males were easily seen wandering the road at 19:15 on 7-viii-1991 (S91-85); it was not dark until 20:15. All 17 individuals seen were striped (Fig. 936). Rear leg outer tibial spine #1 is still attenuate and posterior flattened, as at the type locality Moenkopi Dunes. Specimens at Petrified Forest were generally larger than type locality *A. navajo*.



FIGURE 936. Adult female *A. navajo* from sandy habitat (S99-114) near Petrified Forest National Park.

Holbrook is some 30 km west of Petrified Forest. Two late instar males were collected on 21-v-1993 (S93-32) within 5 m of each other. Their color patterns were so different that we initially suspected they were different species. They maintained these color differences when they both molted to adult (Fig. 937), confirming the natural color variability of *A. navajo* at several sites across its range.



FIGURE 937. Adult males *A. navajo* from Holbrook, Arizona (S93-32). Male on left R93-6. Male on right R93-16.

***Ammopelmatus sonoraensis* Weissman, sp. nov.**
Sonoran Jerusalem Cricket
Figs 938–941, Table 36

Distribution. (Fig. 938). Only known from the holotype locality in the state of Sonora, Mexico.

Recognition characters. Medium sized, megacephalic JC with small adult male hooks, and representing the only species, and specimen, known from the Mexican state of Sonora. Rear leg with 4 inner and 2 outer tibial spines. Possible member of Fuscus Group, but probably not *A. comanchus*, which has 5 inner and 3 outer rear leg tibial spines; nor *A. mescaleroensis* since outer rear leg tibial spine #1, while flattened, is almost parallel to the long tibial axis, as opposed to the 45–90° rotation seen in *A. mescaleroensis*. Doubt similar to *A. bajasur* (p. 59), in the state of Baja California Sur, because *A. sonoraensis* has 2 instead of the 3 outer rear leg tibial spines of *A. bajasur*, and the two taxa are separated by the Gulf of California.

Holotype. Male (pinned, Fig. 939). **MEXICO, *Sonora,*** 10 m S Obregon (Ciudad Obregón), 0–100m elevation, 1-ix-1957, Cohn & Tinkham (Fig. 940A). Locality probably around 27.383880° -109.805637°, 66m, along what is now Hwy 15, since their next notebook stop is at 3 m NW Navojoa, which would also be along current day Hwy 15. Deposited CAS, Entomology type #20222. Measurements in mm: Body length 26.55, hind femur length 11.31, hind femur width 4.11. Fore leg tibia with 3 ventral spurs, the most proximal one almost to mid tibial shaft; right hind leg tibia (Fig. 940B) with 4 inner and 2 outer spines, 2 ventral spurs. Rear leg calcars (Fig. 940B) not spatulate. Holotype with pest damage and missing both middle legs and left rear leg.



FIGURE 938. Distribution of *A. sonoraensis*.



FIGURE 939. Adult male holotype *A. sonoraensis*.

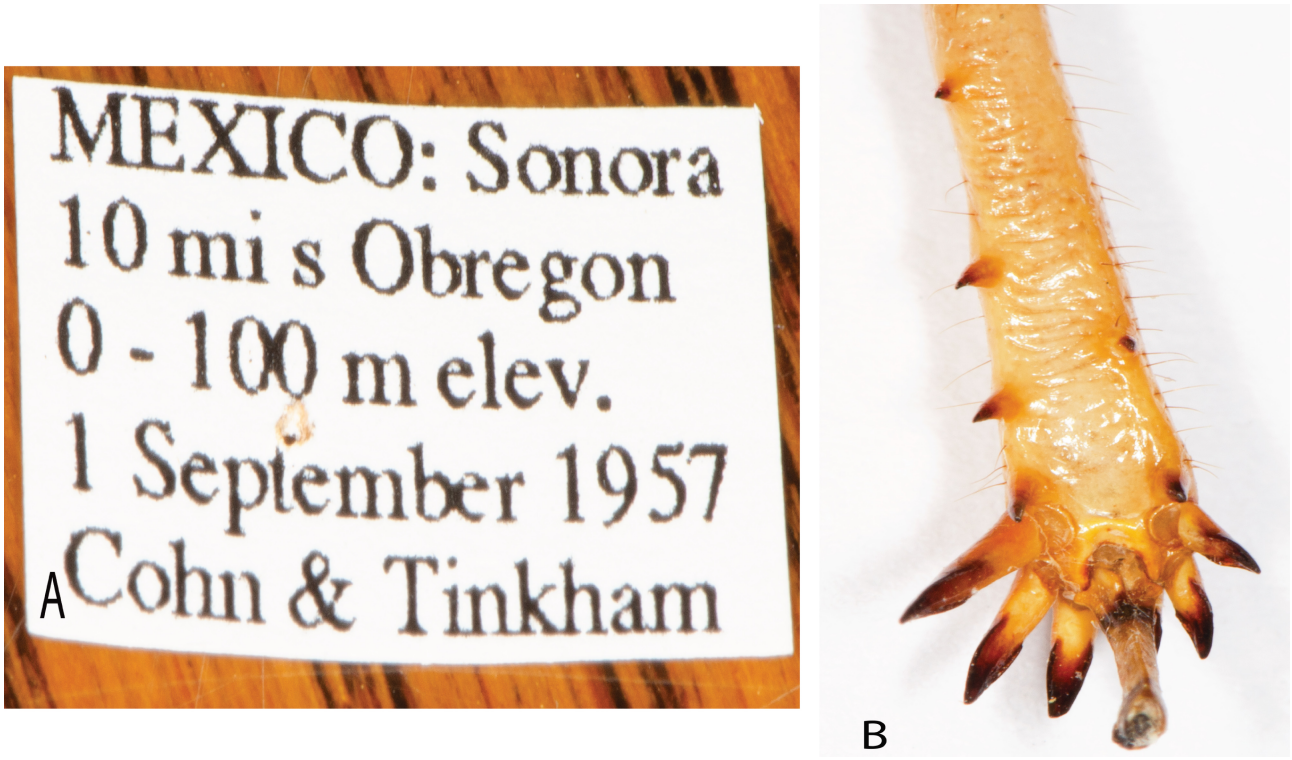


FIGURE 940. A. Original specimen label, holotype *A. sonoraensis*. B. Right rear leg tibia holotype *A. sonoraensis,* showing 4 inner and 2 outer tibial spines, and shape of calcars.

Female. Unknown.
Paratypes. None.
Drum. Unknown.
Derivation of name. Named after the Mexico state wherein the type locality is located.
Habitat. Sonoran Desert.
Life cycle and seasonal occurrence. Collected as adult.
Variation. Unknown.
DNA. Unknown.
Karyotype. Unknown.
Discussion. Theodore J. Cohn's field notebooks are available on the UMMZ web site showing (Fig. 941) that Cohn and ER Tinkham were at this locality on the date cited on the label, even if this specimen wasn't noted by Cohn. We also know that Tinkham kept the specimen because it was transferred to the CAS, from the Tinkham Eremological collection, sometime after his death in 1987. Had Cohn kept the specimen, it would have been in the UMMZ's collection. This ownership is also consistent with Tinkham's interest in JCs, as demonstrated by his describing several new species in subsequent years, while Cohn published nothing on that group.

Our describing a new JC in the absence of drumming, DNA, and karyotype data is against those principles advocated by Weissman *et al.* (2021). We do so because we have good locality data and this specimen represents the only JC (adult or otherwise) that we have seen from anywhere in the Mexican state of Sonora. We have no doubt that it represents a new species and naming it will alert others to be aware of its existence. Interestingly, the syntype series of *A. irregularis* (see p. 750) includes 3 apparent adult female specimens from Mazatlán, and they are the only JC records from that neighboring Mexican state of Sinaloa that we know of.

The geographically closest JC population, in the Fuscus Group, is at Villa Lerdo, in the state of Durango, and the type locality of *A. comanchus*. This site is some 640 km SE of Ciudad Obregón. While Ciudad Obregón is Sonoran Desert, Villa Lerdo is Chihuahuan Desert. The locality of *A. gomezfarias* is closer (~295 km NE of Ciudad Obregón), but the latter taxon is in the Portal Group.

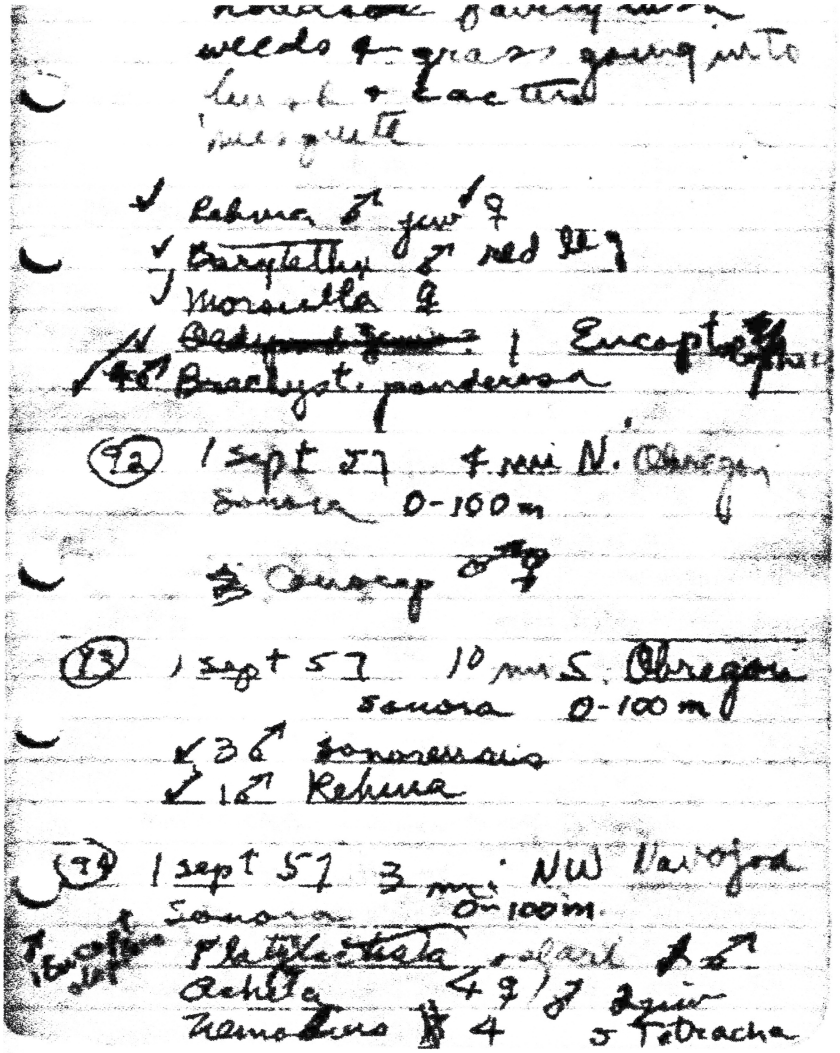


FIGURE 941. Copy of Cohn's field notebook showing when he visited holotype locality [#93] in 1957.

There are 4 species of *Ammopelmatus* known to occur in Mexico (see Table 36, p. 48), exclusive of the Baja California Peninsula with its 11 taxa. *A. gomezfarias* is known from NE of Gómez Farías, in the state of Chihuahua; light phase *A. mescaleroensis* is known from the Samalayuca sand dunes south of Ciudad Juárez, in the state of Chihuahua; *A. comanchus* is known from the unique holotype female described, in 1897, from Villa Lerdo, in the state of Durango; and *A. sonoraensis* is discussed here.

Group 17, Mono Lake Group (Fig. 942)

Five of seven species in this Group with limited distributions, in contrast to the widely distributed *A. monolake* and *A. yubalake.* Four known taxa with 2n♂=25.

SPECIES WRITE UPS: *A. cathedralgorge* (p. 525); *A. dogtown* (p. 530); *A. kokoweef* (p. 535); *A. monolake* (p. 537); *A. reno* (p. 544); *A. westgardpass* (p. 550); and *A. yubalake* (p. 554).

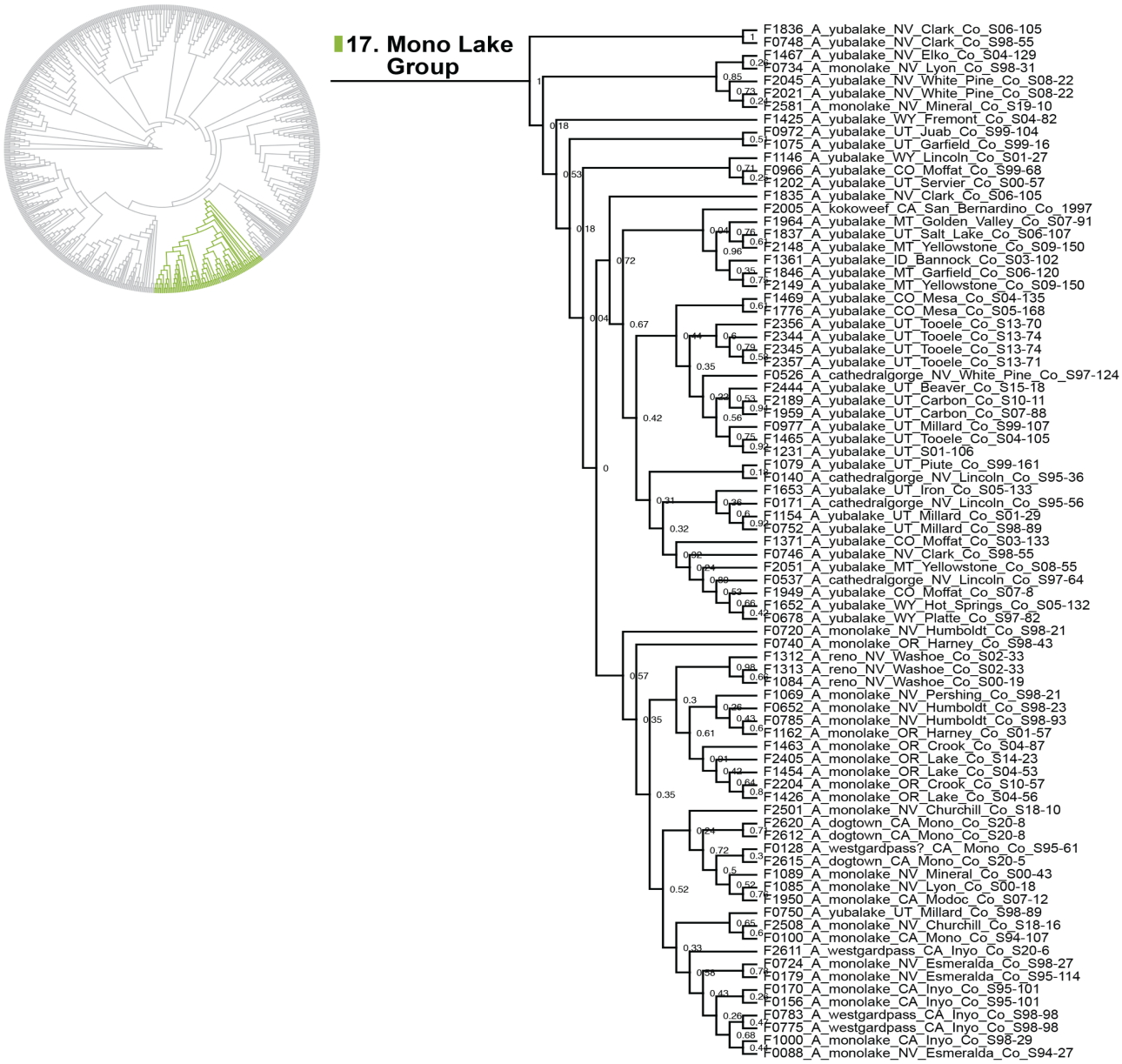


FIGURE 942. ASTRAL tree for Mono Lake Group.

***Ammopelmatus cathedralgorge* Weissman, sp. nov.**
Cathedral Gorge Jerusalem Cricket
Figs 943–952, Table 30

Distribution. (Fig. 943). Known from several high elevation localities in Nevada, along the Nevada-Utah border. May get across Utah into western Colorado.

Recognition characters. Medium-large, generally light-colored, megacephalic JC with a calling drum of 1–1.2 drums/s, males rarely with a sex clarification drum (SCD), and rear leg outer distal spine #1 not posteriorly flattened. 2n♂=25. Morphologically indistinguishable from nearby *A. lincolncounty*, with DNA the only known means for separation of the 2 species. Rear leg outer tibial spine #1 attenuate, not truncate or flattened. In tree, *A. lincolncounty* F2136, F2145, and F2146 recovered distinct from adults of *A. cathedralgorge.* Both live adult males of *A. lincolncounty* readily produced, or could be stimulated to produce (with finger drumming), a SCD. It is possible that the presence or absence of a SCD could be useful to separate the taxa: of 14 adult males of *A. cathedralgorge*, only the single male (S95-56, R 95-113, F0171) from Panaca, NV, had a SCD; the DNA in this Panaca male was recovered with *A. cathedralgorge*, and not with *A. lincolncounty.*

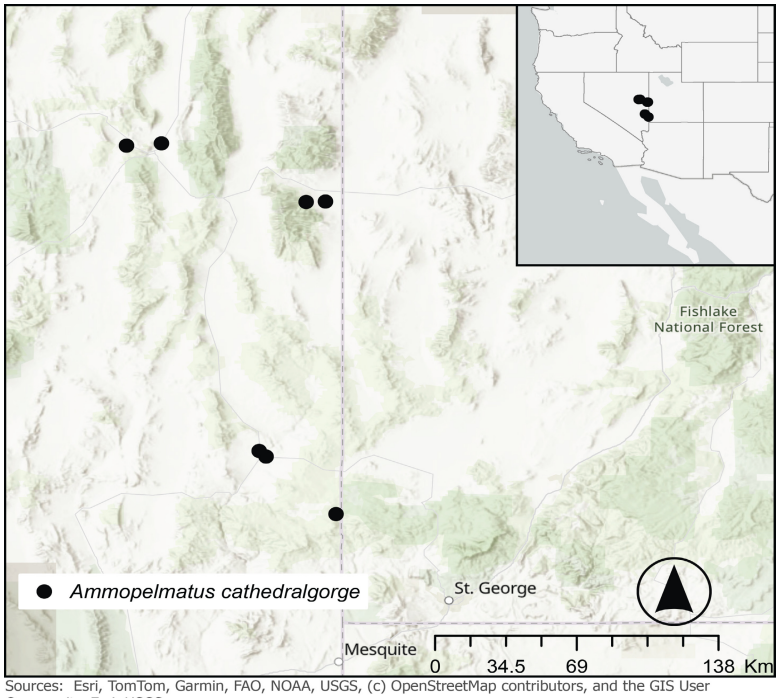


FIGURE 943. Known distribution of *A. cathedralgorge.*

Holotype. Male (in alcohol, Fig. 944). **Nevada, *Lincoln Co.,*** Cathedral Gorge State Park Campground, 37.820922°, -114.413603°, 1417m, 18-vi-1997 (S97-64) J. Wilkinson. R97-133, F0537. Molt to adult 30-viii-1997. Deposited CAS, Entomology type #20195. Megacephalic. Measurements in mm: Body length 41.66, hind femur length 13.95, hind femur width 5.12. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 945) with 5 inner and 3 outer spines, 2 ventral spurs.

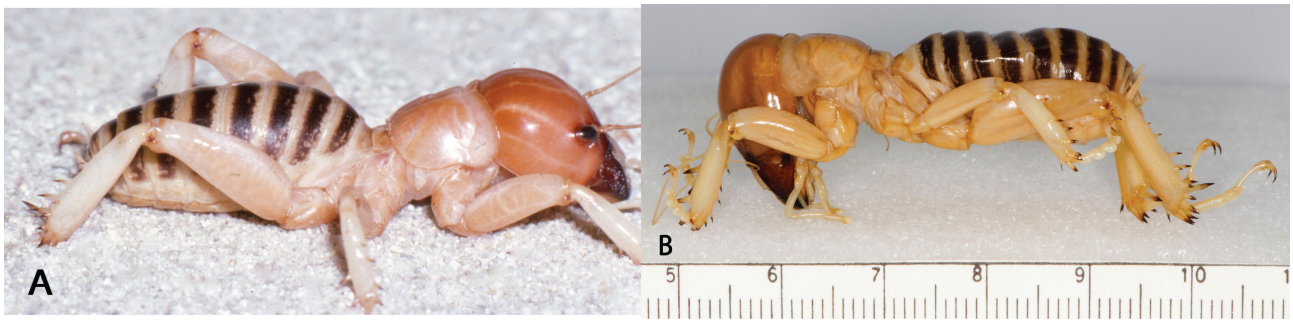


FIGURE 944. Holotype adult male *A. cathedralgorge.* A. When alive. B. When preserved.

Allotype. Female (in alcohol, Fig. 946). Same data as holotype except 31-x-1997 (S97-64). F0601. Collected as adult. Deposited CAS, CASENT #9080509. Megacephalic. Measurements in mm: Body length 35.37, hind femur length 11.81, hind femur width 4.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 947) with 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 948.



FIGURE 945. Left rear leg tibia holotype adult male *A. cathedralgorge*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

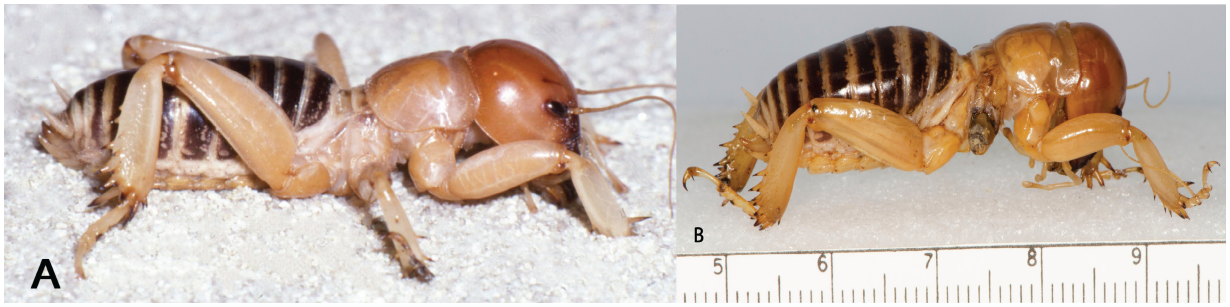


FIGURE 946. Allotype adult female *A. cathedralgorge.* A. When alive. B. When preserved.



FIGURE 947. Right rear hind leg tibia adult female allotype *A. cathedralgorge*. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 948. Ovipositor allotype *A. cathedralgorge.*

Paratypes. ♂15 ♀5. **NEVADA, *Lincoln Co.,*** type locality, 2-ix-1988 (S88-105) SC Williams, RC Bechtel, VF Lee, ♂2; 9-ix-1995 (S95-96) B. Rohde ♂1; 25-iv-1997 (S97-34) J. Wilkinson ♂1; 18-vi-4-xi-1997 (S97-64) J. Wilkinson ♂1 ♀1; 10-x-1998 J. Wilkinson ♂1; 20-ix-2001 (S01-104) B. Rohde ♂1. Beaver Dam State Park, 37.519677° -114.077363°, 1556m, 3-v-1995 (S95-36) J. Wilkinson ♀1. Panaca, 37.793958° -114.383292°, 1456m, 19-vii-1995 (S95-56) A. Newberry ♂1. ***White Pine Co.,*** Baker 39.011125° -114.123475°, 1627m, 23-v-2015 (S15-16) ♂1. Ely, 39.288784° -114.841083°, 1973m, 11-vii-1999 (S99-70) B. Rohde ♂1. Great Basin National Park, 4.7-5.5 m W Baker, 39.008894° -114.208030°, 2072m, 8-ix-1997 (S97-124) R. Wood & M. Renfro ♂3. Ruth, 9 Cedar St, 39.277838° -114.993858°, 2101m, 4-11-v-2008 (S08-22) J. Legate ♂3 ♀3.

Probable placement. **COLORADO, *Mesa Co.,*** Grand Junction, 1879 Broadway, 39.113994° -108.707274°, 1415m, 21-ix-2004 (S04-135, F1469), C. Tabor ♂1. Glade Park, 15720 B. South Rd, 39.012200° -108.758662°, 2073m, 11-xi-2005 (S05-168, F1776) D. & A. Brach ♀1. Glade Park, 310 N Trail Canyon Dr, 39.023454° -108.778242°, 2092m, 23-ix-2004 (S04-130) L. Branscom ♀1; 7-vii-2006 & 12-vii-2006 (S06-63, F1791, F1806) L. Branscom ♂1 ♀1; 26-vii-2006 (S06-28, F1938) L. Branscom ♀1. ***Moffat Co.,*** Craig, 855 Ranney St, 40.514489° -107.550642°, 1888m, 24-ix-2003 (S03-133, F1371) S. Burns ♂1. Craig, 1552 E 10th St, 40.522815° -107.529794°, 1955m, 4-ix-2006 (S06-108, F1824) M. Daszkiewicz ♂1. Craig, 1255 Lecuyer Dr, 40.521952° -107.532643°, 1947m, 5-iv-2007 (S07-8, F1949) G. Rohrich ♂1.

Possible placement. **COLORADO, *Mesa Co.,*** Colorado National Monument, 39.100833° -108.734687°, 1749m, 6-iv-17-v-1989 (S89-17) MW Weissmann ♂1 ♀1; 10-xiii-1989 (S89-61) MW Weissmann, L. Clement ♂1 ♀1; 19-ix-1989 (S89-85) MW Weissmann, L. Clement ♀2. Separated from Glade Park, with its known DNA, by 13 air miles. **NEVADA, *Lincoln Co.,*** Pioche, 37.931609° -114.451180°, 1845m, 15-x-1998 (S98-102) M. Mayer ♀1. Collected as megacephalic adult. As this locality of close to populations of both *A. cathedralgorge* and *A. lincolncounty,* and because we have no confirmatory DNA, we list this specimen's placement here.

Drum. Calling drum similar in both sexes except longer in females, and 1 in 14 males with a sex clarification drum: **Male:** Holotype R97-133 (Fig. 949) with 2 series of drums, the second of 10 drums over 8.2s (1.2 drums/s) at 20°C. **Female:** Paratype R95-64 (Fig. 950, S95-36, Beaver Dam State Park) with 53 drums over 44.4s (1.2 drums/s) at 19°C.

Derivation of name. Named after the type locality

Habitat. Native vegetation at the type locality includes narrowleafyucca,junipertrees, barberrysagebrush,greasewood,shadscale,four-winged saltbush, rabbitbrush, and white sage. Soils variable and include sandy areas. At Beaver Dam Stata Park (S95-36), area riparian-desert habitat.

Life cycle and seasonal occurrence. Apparently, typical 2-year life cycle.

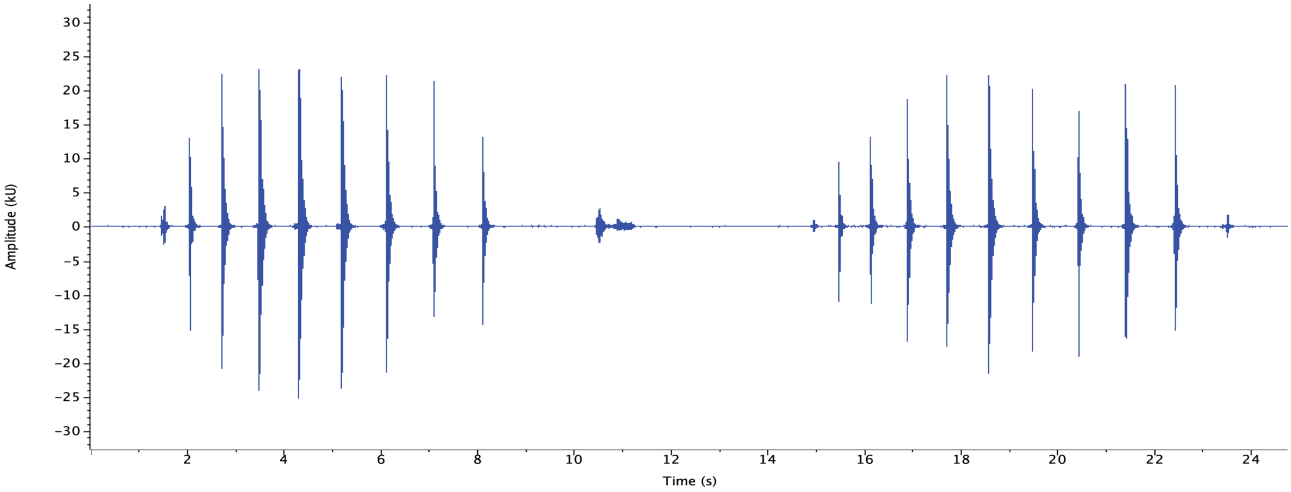


FIGURE 949. Calling drum (R97-133) in holotype adult male *A. cathedralgorge.*

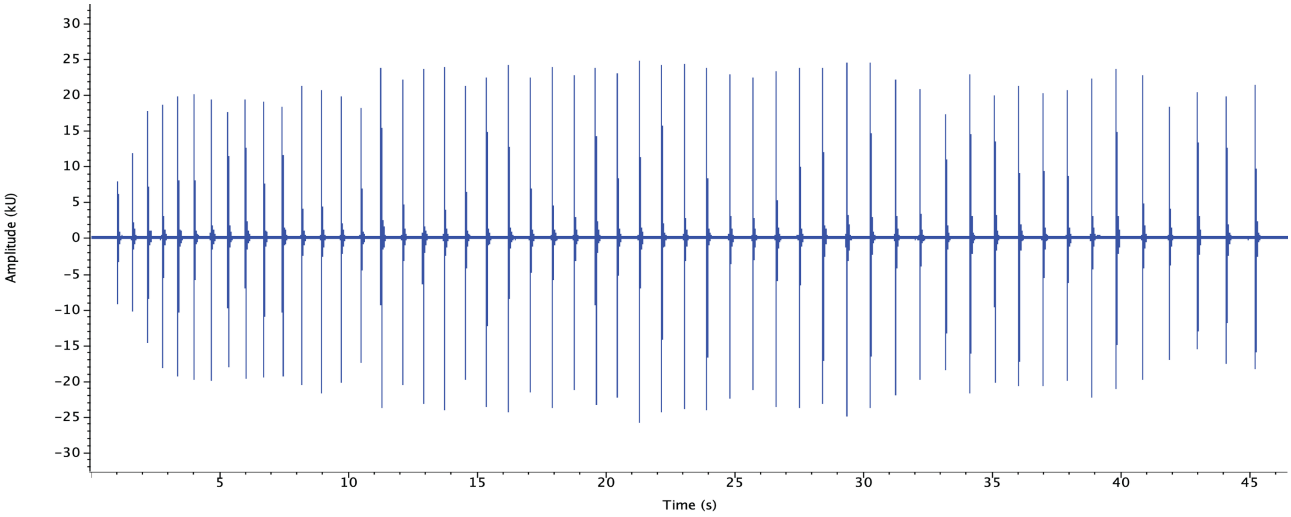


FIGURE 950. Calling drum (R95-64) in paratype adult female *A. cathedralgorge.*

Variation. Of 14 individuals, all had 3 ventral **fore** leg tibial spurs; all 14 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 14 had 5 inner **rear** leg tibial spines, 10 with 3 and 4 with 4 outer **rear** leg tibial spines, and all with 2 ventral spurs. In all individuals, inner rear leg tibial spine #1 was the longest.

DNA. Fig. 942, p. 525. F0140 (S95-36, at 1554m, Beaver Dam State Park); F0171 (S95-56, at 1456m, Panaca); F0526 (S97-124, at 2070m, Great Basin National Park); and F0537 (S97-64, at 1432m, type locality of Cathedral Gorge State Park) all recovered in two poorly supported, neighboring subclades of Group 17 Mono Lake. Recovered separate from morphologically indistinguishable *A. lincolncounty* F2136 and F2145 (both S09-131) and F2146 (S09-132).

Karyotype. 2n♂=25. Two males examined, with different results: T99-22 (Fig. 951, type locality S97-64) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; a 1 metacentric X chromosome. T08-7 (Fig. 952, S08-22, Ruth) with 7 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; a 1 metacentric X chromosome. We are unsure of the significance of these differences.

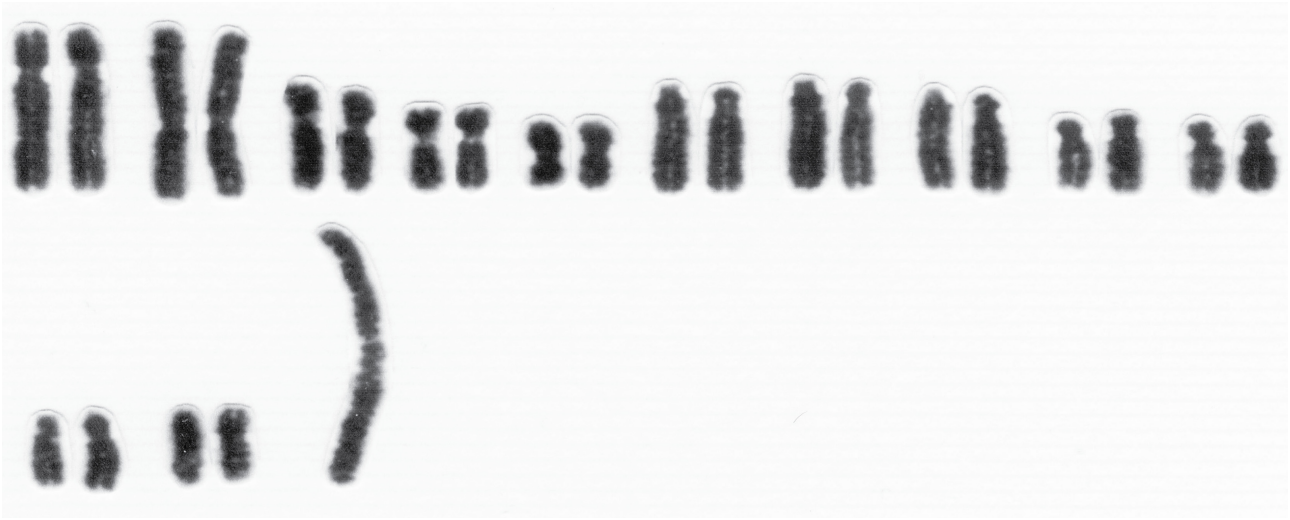


FIGURE 951. Idiogram T99-22 *A. cathedralgorge* (S97-64).

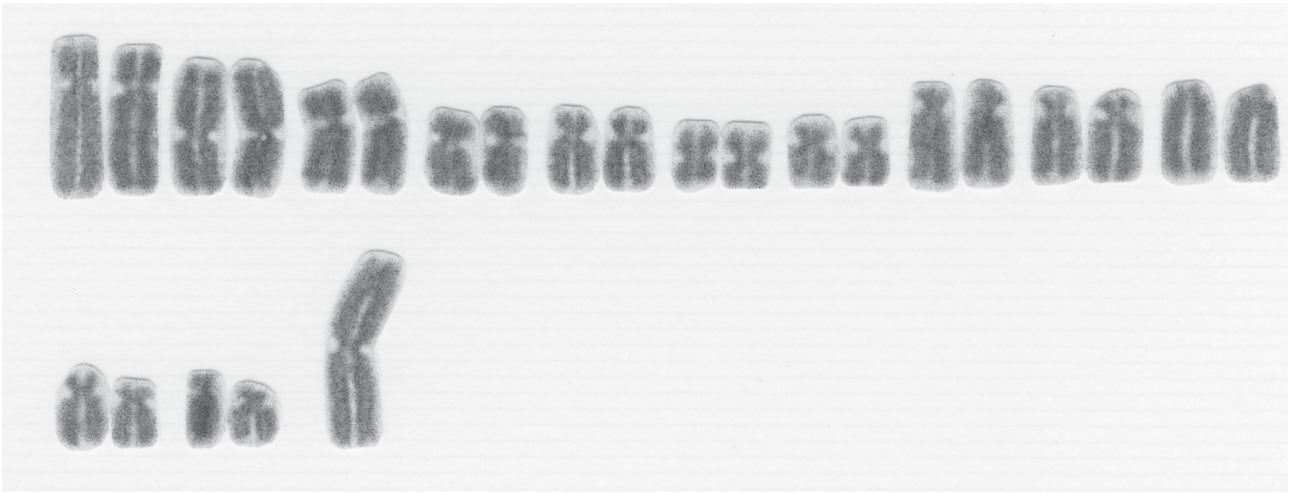


FIGURE 952. Idiogram T08-7 *A. cathedralgorge* (S08-22).

Discussion. We were surprised to see that a documented SCD in *A. lincolncounty* was the second-best way to separate that taxon from *A. cathedralgorge*, with DNA recovery being the best way.

***Ammopelmatus dogtown* Weissman, sp. nov.**
Dogtown Jerusalem Cricket
Figs 953–961, Table 15

Distribution. (Fig. 953). Known from three high elevation sites, across some 55 km, in Mono Co., California, all east of the Sierra Nevada crest.

Recognition characters. Medium sized, dark red head, orange colored pronotum, orange-beige colored legs, abdomen with wide, black bands. Calling drum 1.3–1.9 drums/s, apparently without a sex clarification drum. Other slow drumming JCs in the vicinity are *A. monolake* from Mono Lake (18 km SE); *A. tomsplace* from near Toms Place (69 km SE); and *A. westgardpass* from Westgard Pass in the White Mts (123 km SE). They can be separated by usually dark red head in *A. dogtown*, presence of SCD and faster calling drum in *A. tomsplace*, and by habitat and isolation in *A. westgardpass.*

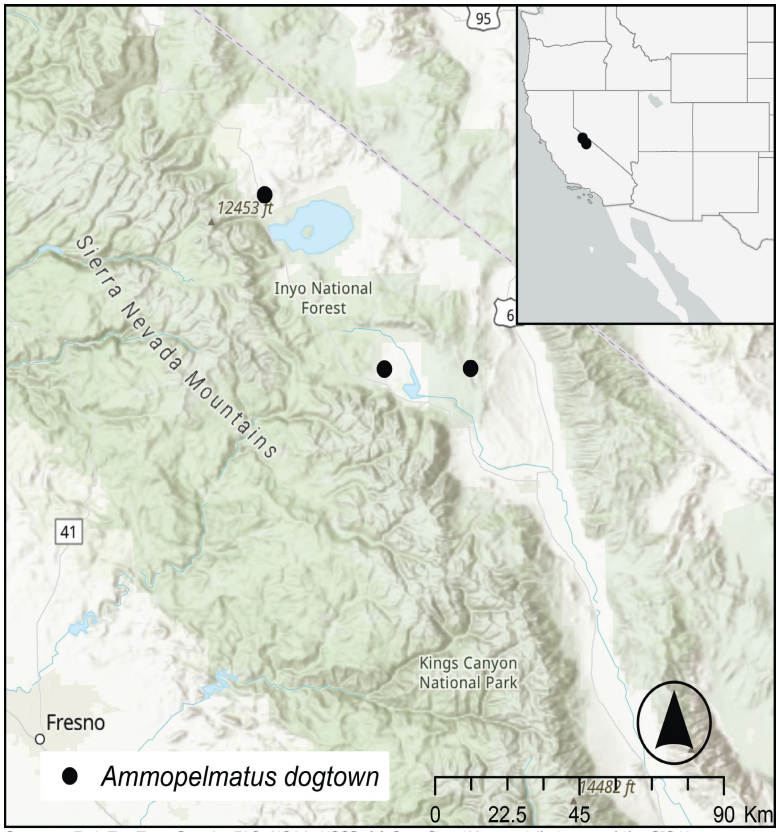


FIGURE 953. Known distribution of *A. dogtown.*

Holotype. Male (in alcohol, Fig. 954). **California, *Mono Co.,*** Near Conway Summit, 38.090278° -119.156944°, 2281m, 6-ix-2020 (S20-8) A. Abela. R20-17, F2620. Collected as adult. Deposited CAS, Entomology type #20156. Measurements in mm: Body length 32.88, hind femur length 10.84, hind femur width 3.97. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 955) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

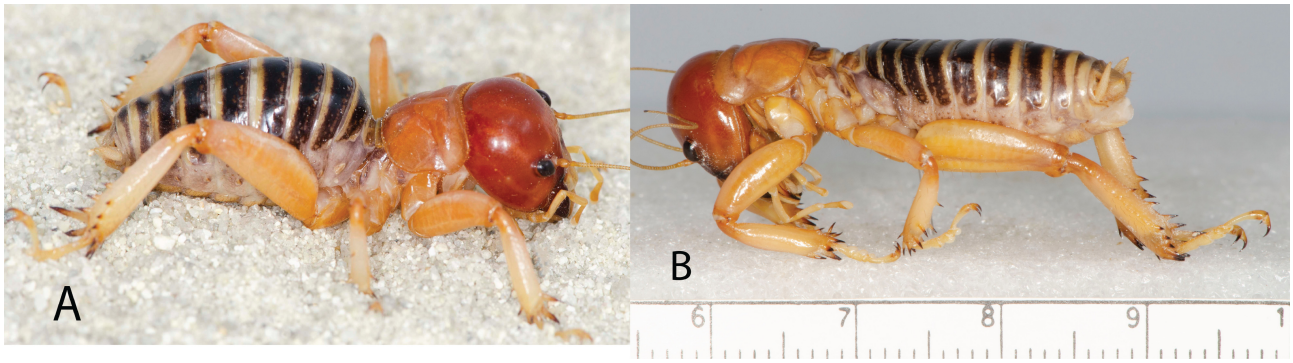


FIGURE 954. Adult male holotype *A. dogtown.* A. When alive. B. When preserved.



FIGURE 955. Left hind leg tibia holotype *A. dogtown.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 956). Same data as holotype except R20-11, F2614. Collected as adult. Deposited CAS. Measurements in mm: Body length 36.14, hind femur length 10.59, hind femur width 3.98. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 957) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 958.

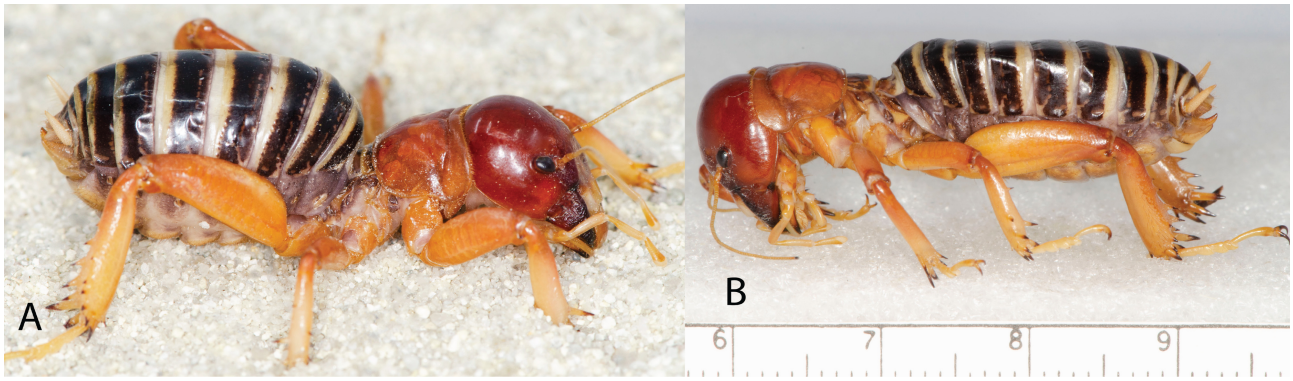


FIGURE 956. Adult female allotype *A. dogtown.* A. When alive. B. When preserved.



FIGURE 957. Left hind leg tibia allotype female *A. dogtown.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 958. Ovipositor allotype *A. dogtown*.

Paratypes. ♂2 ♀3. **CALIFORNIA, *Mono Co.,*** Type locality: ♂2, ♀3. Near Hot Creek (Fig. 959), 37.655333° -118.821722°, 2184m, 30-viii-2020 (S20-5) A. Abela ♂3 ♀1.

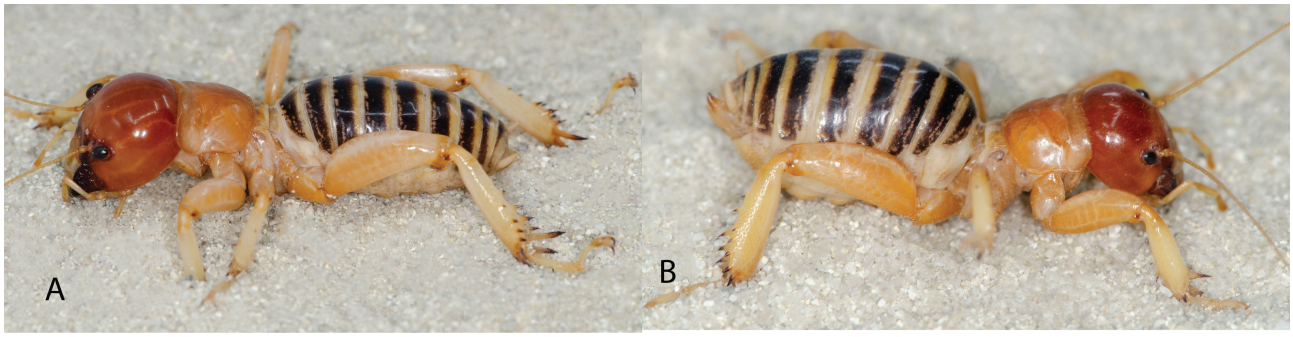


FIGURE 959. Adults *A. dogtown*, both S20-5, Hot Creek. A. Male (R20-14, F2616). B. Female (R20-7, F2615).

Drum. Calling drum similar in both sexes except longer in females. **Male:** Holotype R20-17 (Fig. 960) with 13 drums over 7.9s (1.6 drums/s) at 21.4°C. **Female:** Allotype R20-11 (Fig. 961) with 71 drums over 47.2s (1.5 drums/s) at 21.1°C.

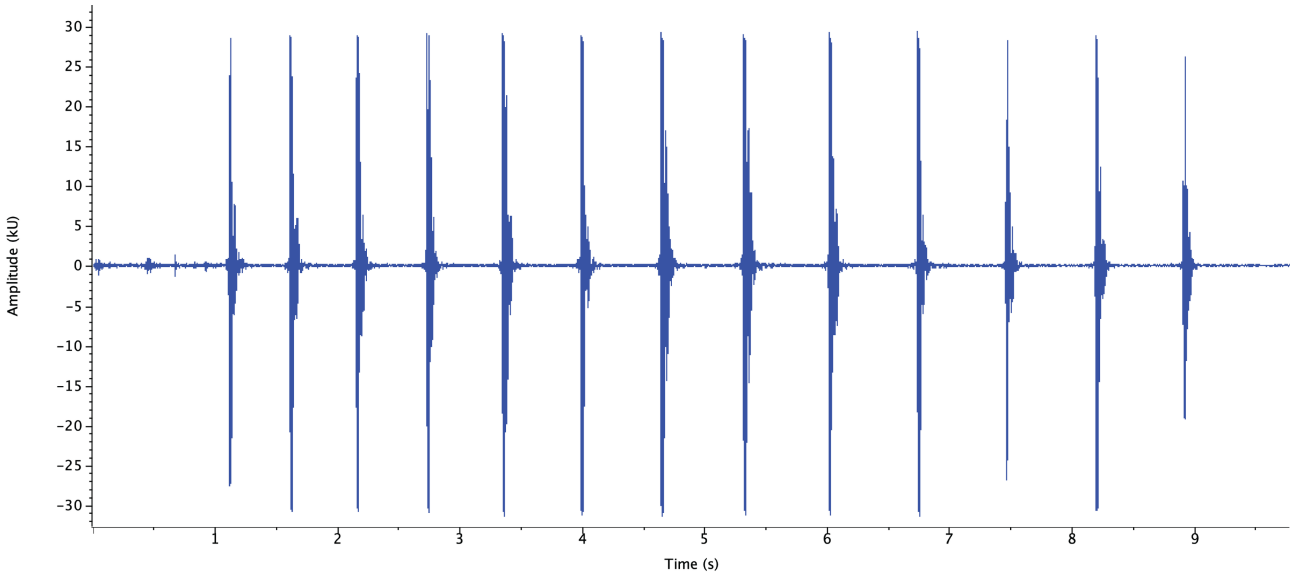


FIGURE 960. Calling drum (R20-17) holotype *A. dogtown.*

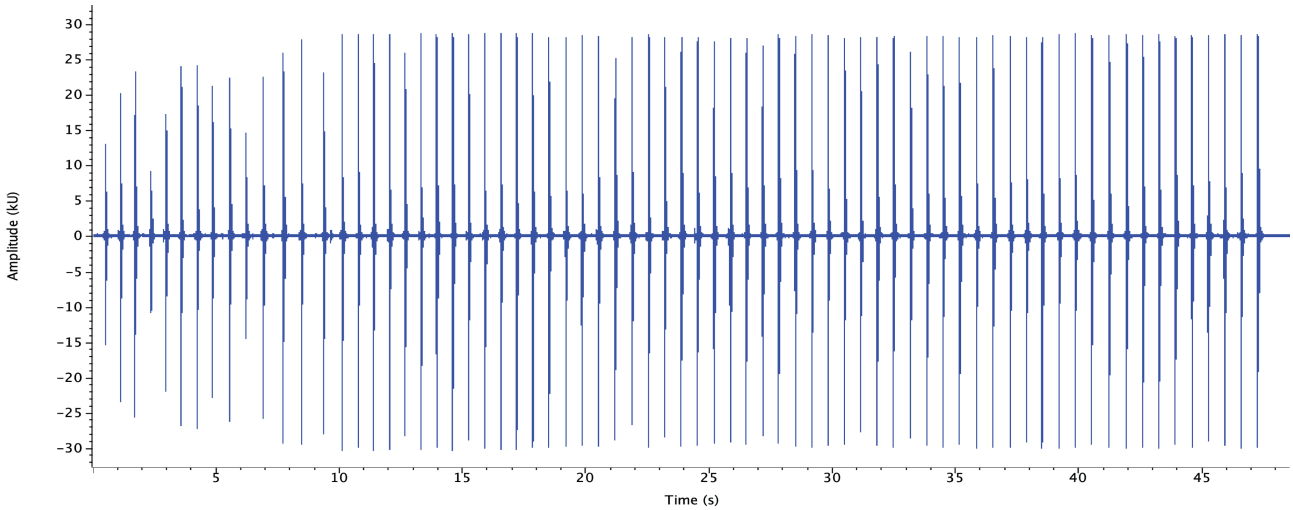


FIGURE 961. Calling drum (R20-11) allotype *A. dogtown.*

Derivation of name. Named with reference to Dogtown, a long-abandoned mining town, near the type locality, that was established around 1857, and was the site of the first gold rush on the eastern slopes of the Sierra Nevada.

Habitat. According to Alice Abela, the type locality is waist to head-high *Purshia* scrub on one side with riparian corridor with dense willow and wild rose understory on other side. Substrate was coarse gravely granite. JCs to oatmeal trails.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For 12 individuals, all had 3 ventral **fore** leg tibial spurs; all 12 had 8 **middle** leg tibial calcars, 1 had 1 and 11 had 2 ventral spurs; 1 had 4 and 11 had 5 inner **rear** leg tibial spines, and 7 had 3 and 5 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 942, p. 525. F2612 & F2620 (type locality, S20-8, near Dogtown); F2615 (S20-5, Hot Creek) recovered in Group 17 Mono Lake, with *A. monolake, A. reno,* and *A. westgardpass.*

Karyotype. Unknown.

Discussion. Given the habitat differences seen between *A. dogtown* and *A. monolake*, we believe them to be distinct.

Ammopelmatus kokoweef **Weissman, sp. nov.**

Kokoweef Jerusalem Cricket

Figs 962–964, Tables 6, 16

Distribution. (Fig. 962). Only known from the southwest slope of Kokoweef Peak, Mescal Range, San Bernardino Co, California.

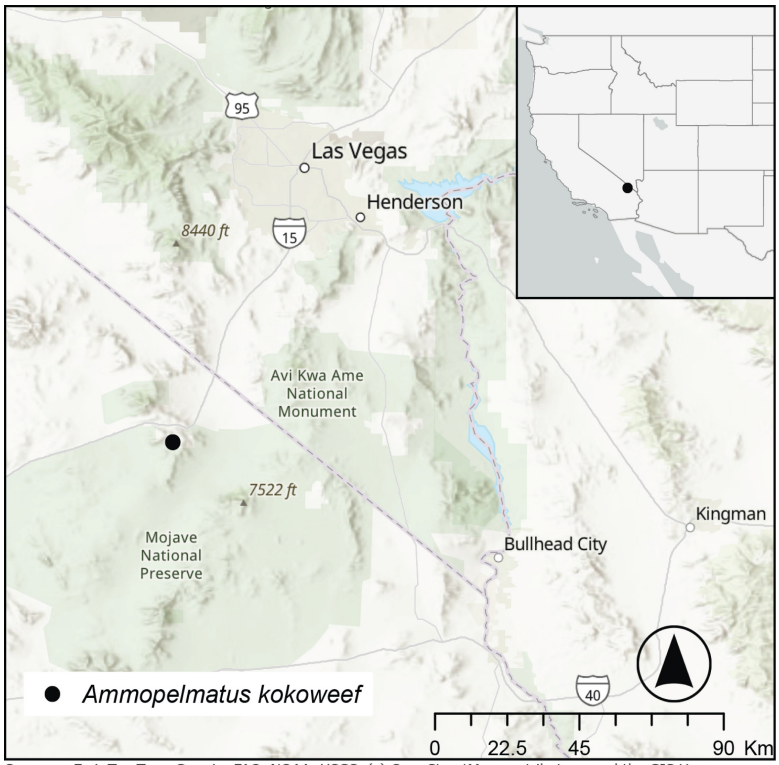


FIGURE 962. Distribution of *A. kokoweef.*

Recognition characters. A large, striped, megacephalic, geographically isolated JC.

Holotype. Late instar male (in alcohol, Fig. 963). ***California,*** **San Bernardino Co,** Mescal Range, near SW base Kokoweef Peak. [~35.417500° -115.500833°, 1586m], 2-viii-1997, under rock beneath *Juniperus*, GR Ballmer. Deposited CAS, Entomology type #20387. Megacephalic. Measurements in mm: Body length 42.92, hind femur

length 11.29, hind femur width 4.57. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 964) with 5 inner and 2 or 3 outer spines, 2 ventral spurs.



FIGURE 963. Preserved late instar male holotype *A. kokoweef.*



FIGURE 964. Right rear leg tibia late instar male holotype *A. kokoweef.* A. Showing 5 inner and 2 outer spines. B. Showing shape of calcars.

Female and adults unknown.
Paratypes. None.

Drum. Unknown.

Derivation of name. Named after the isolated Kokoweef Peak area.

Habitat. Eastern Mojave Desert.

Life cycle and seasonal occurrence. We have returned to this area on several occasions searching for more specimens, including rock rolling during the early spring and laying several oatmeal trails during the summer, the latter in the dry river bed area and along the trail toward the summit. All efforts were without success.

Variation. Only one individual known.

DNA. Fig. 942, p. 525. F2005 recovered in a subclade with several individuals of *A. yubalake.*

Karyotype. Unknown.

Discussion. Kokoweef Peak is a long hogback ridge formed by a massive north-south-trending, vertically dipping limestone bed. According to A. Powers (https://www.latimes.com/archives/la-xpm-2006-sep-11-me-kokoweef11-story.html), the name "Kokoweef " is believed to be derived from the Southern Paiute language, meaning "gopher snake canyon." According to Bob Spirko (https://bobspirko.ca/USTrips/California/Kokoweef/Kokoweef.htm), Kokoweef Peak area is best known for its fabled River of Gold. In the 1930s, despite geological evidence to the contrary, prospectors not only believed there was a vast quantity of gold under the mountain, one even reported finding it. The source of the gold was an underground river where gold nuggets lay in the black sands lining the shore. The River of Gold was said to be 300 feet wide in a cavern so large that one stalactite was "27 feet in diameter and hangs 1,510 feet down, taller than the Eiffel Tower!" From 1940 to 1946 zinc was mined in Kokoweef Peak and the proceeds were used to help finance the search for the River of Gold caverns. But neither river nor gold were ever found.

Ammopelmatus monolake **Weissman, sp. nov.**

Mono Lake Jerusalem Cricket

Figs 965–977, Tables 15, 30, 32

Distribution. (Fig. 965). Widespread in the Great Basin areas of eastern California, southeastern Oregon, and northern 2/3 of Nevada. Surprisingly, unknown from eastern Washington, despite appropriate appearing habitat of extensive dune systems, where only *A. juniperdunes* has been found.

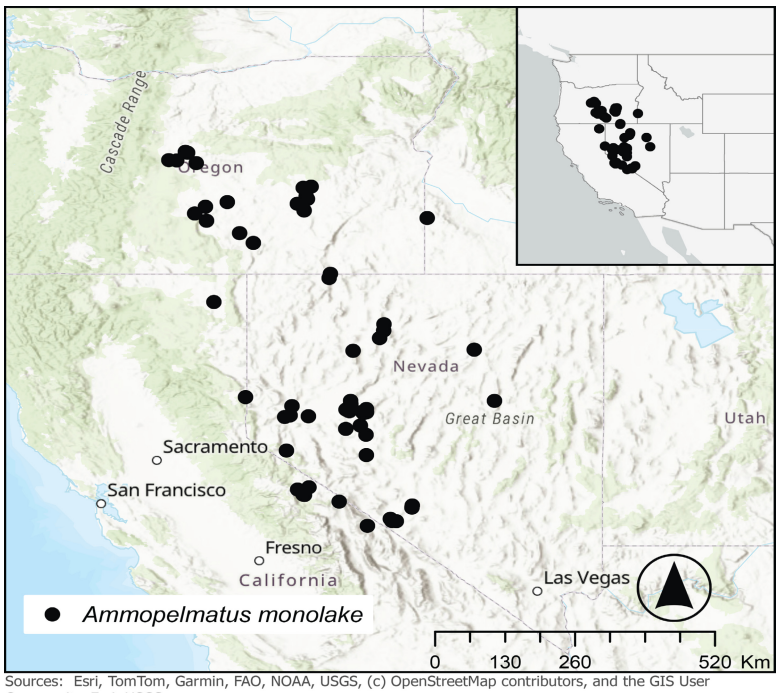


FIGURE 965. Distribution of *A. monolake.*

Recognition characters. Medium-large, generally brown headed JC with a slow calling drum of <2 drums/s. A member of the Mono Lake Group, and the only California representative, along with *A. dogtown* and *A. kokoweef*, of a large, more eastern, but widespread, slow drumming, 2n♂=25 assemblage, which also includes the Fuscus and Utah Groups. Outer rear leg tibial spine #1 barely flattened, and only rotated posteriorly between 0–45° from the main tibial axis. Adults rarely megacephalic, with black abdominal stripes more solid than in *A. fuscus, A. mescaleroensis*, and *A. yubalake.* Separated from closest relatives *A. reno* by DNA and color; from high elevation, isolated *A. westgardpass* by habitat; and from *A. dogtown* by head color.

Holotype. Male (in alcohol, Fig. 966). **California, *Mono Co.,*** South Shore Mono Lake 37.947184° -119.053515°, 1990m, 27-viii-2005 (S05-96) DBW & DC Lightfoot. R05-22, F1625. Collected as adult. Deposited CAS, Entomology type #20157. Measurements in mm: Body length 41.05, hind femur length 12.81, hind femur width 4.61. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 967) with 4 inner and 3 outer spines, 2 ventral spurs.

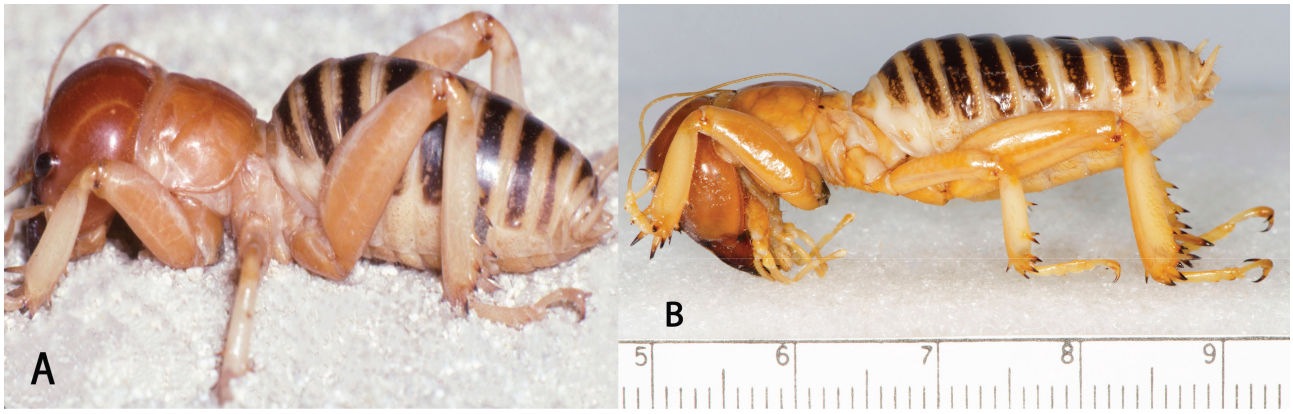


FIGURE 966. Holotype adult male *A. monolake.* A. When alive. B. When preserved.

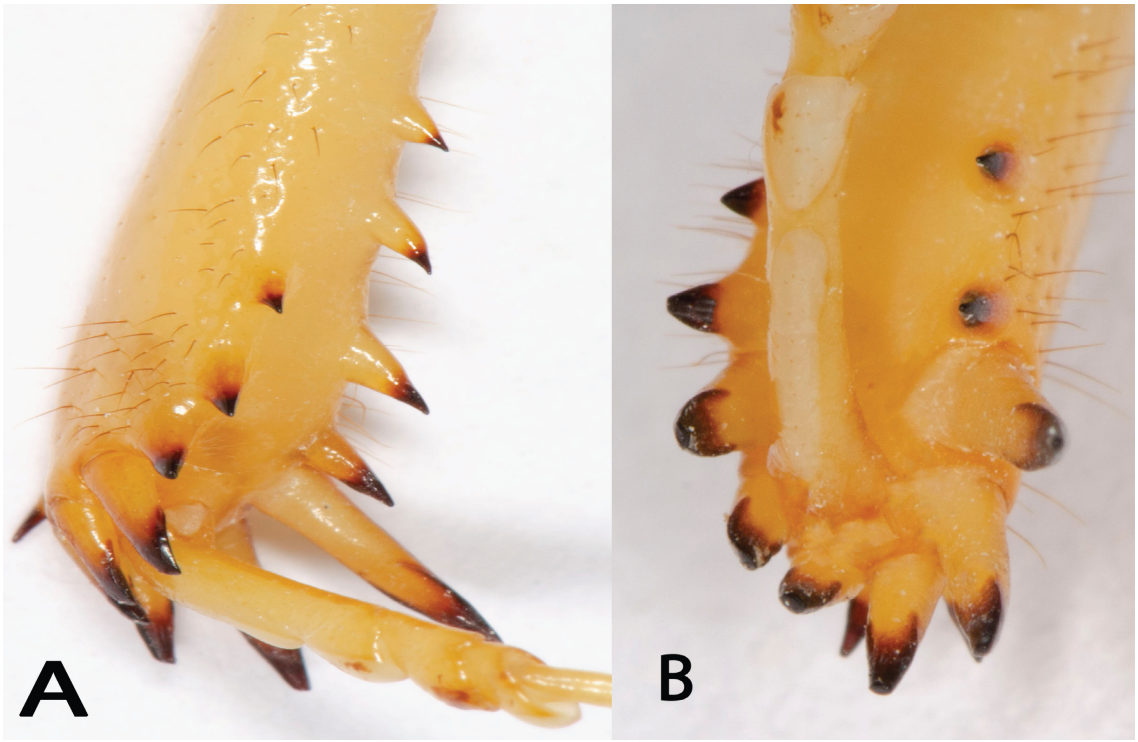


FIGURE 967. Left rear leg tibia adult male holotype *A. monolake.* A. Showing 3 outer and 4 inner spines.

Allotype. Female (in alcohol, Fig. 968). Same data as holotype except R05-20, F1621. Collected as adult. Deposited CAS, CASENT #9079097. Measurements in mm: Body length 36.72, hind femur length 11.52, hind

femur width 4.18. Fore leg tibia with ventral 3 spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 969) with 4 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 970.

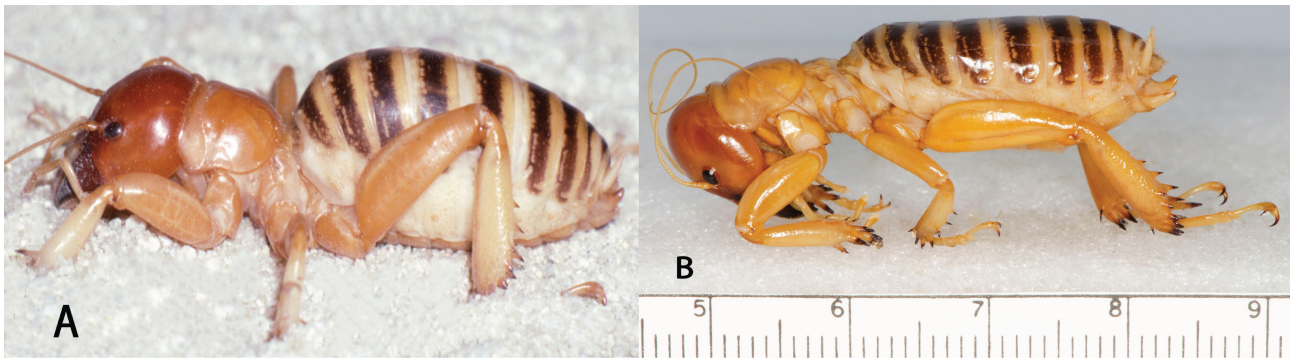


FIGURE 968. Adult female allotype *A. monolake.* A. When alive. B. When preserved.



FIGURE 969. Left rear leg tibia adult female *A. monolake.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 970. Ovipositor allotype *A. monolake*.

Paratypes. ♂186 ♀128. **CALIFORNIA, *Inyo Co.,*** Deep Springs Valley, Deep Springs College, 37.373417° -117.980201°, 1592m, 28-ix-21-x-1994 (S94-102) J. Sgewczak ♂1 ♀1; 29-ix-10-x-1995 (S95-101) J. Sgewczak ♂1 ♀1; 18-iv-1998 (S98-29) ♀1. ***Lassen Co.,*** 1.6 m E Hwy 395 and 2.5 m S Hallelujah Junction, 39.73842° -120.01470° 1615m, 26-vi-1985 (S85-73) D. Ubick ♀1. ***Modoc Co.,*** Alturas, 41.4873° -120.5424°, 1333m, 18-iv-2007 (S07-12) G. Kuld ♀1. ***Mono Co.,*** type locality, 27-viii-2005 (S05-96) ♀3. Mono Lake, south dune area, 37.939389° -119.031028°, 1956m, 13-ix-2012 (S12-112) ♂1. Mono Lake, north dune area 2.6 to 3.9 m E Hwy 167, 38.081278° -118.956506°, 1962m, E. Miller, 24-ix-1994 (S94-103) ♀3; 22-ix-1995 (S95-100) ♂1. Mono Lake, east dune area, 2042m, 13-26-X-1994 (S94-107) D. Hennek ♀3. Mono City, 38.040756° -119.144595°, 2070m, 2-27-vii-1994 (S94-62) D. & J. Carle ♂1 ♀2. 1.5 m E Benton, 37.818405° -118.451814°, 1766m, 9-vi-1983 (S83-78) A. Evans ♀1. **NEVADA, *Churchill Co.,*** Fallon Range Training Complex Expansion, all A. Abela: 39.670592° -118.260515°, 1655m, 20-v-2018 (S18-10) ♂1 ♀1; 39.614322° -118.257125°, 1799m, 16-vi-2018 (S18-15) ♂1; 39.215894° -118.098328°, 1854m, 16-vi-2018 (S18-16) ♂2 ♀1; 39.155500° -118.341317°, 1516m, 17-vii-2018 (S18-32) ♂1; 39.387231° -118.965359°, 1441m, 18-vii-2018 (S18-33) ♂2; 39.444553° -118.046063°, 1827m, 20-vii-2018 (S18-36) ♂1 ♀2; 39.4605340° -117.995570°, 1830m, 14-viii-2018 (S18-45) ♂2 ♀1; 39.52143° -117.997957°, 1674m, 20-iv-2019 (S19-5) A. Abela ♂1 ♀2; 39.486132° -118.295452°, 1863m, 1-vi-2019 (S19-11) A. Abela ♀1; 39.469858° -118.066489°, 1581m, 3-vi-2019 (S19-13) A. Abela ♂1; 39.509628° -118.337032°, 2024m, 27-vi-2019 (S19-40) E. Howe ♂1. Dixie Valley, 39.479351° -118.281511° 1825m, 1-vi-2019 (S19-12) A. Abela ♂1 for testes. Dixie Valley, 39.447067° -118.049211°, 1820m, 3-vi-2019 (S19-14) A. Abela ♀1. Dixie Valley, 39.610902° -118.260980°, 1733m, 5-vi-2019 (S19-15) A. Abela, ♀2. Fernley, 1397 Red Bluffs Way, 39.574271° -119.239481°, 1294m, 13-iii-2008 (S08-12) S. Murphy ♂1. Silver Springs, 3095 Opal Ave, 39.403164° -119.269711°, 1308m, 17-x-2008 (S08-78) M. Watts ♀1. ***Esmeralda Co.,*** Lida, 37.458269° -117.498136°, 1889m, 18-iv-1998 (S98-28) ♂2 ♀4. 3 m NNW Palmetto Mt, 37.501865° -117.597540°, 2726m, 5-vi-1994 (S94-27) D. Giuliani ♀1. Palmetto Mt, 37.461837° -117.572479°, 2720m, 4-vi-1994 (S94-28) D. Giuliani ♂1. Goldfield, nr intersection Main St and Meyers Ave, 37.70815° -117.23779°, 1749m, 18-iv-1998 (S98-27) ♂3 ♀4; 28-ii-2005 (S05-19) ♂2 ♀8. Dunes 3 m N Goldfield, 37.74695° -117.23216°, 1676m, 10-x-1995 (S95-114) ♀1; 16-iii-1996 (S96-12) ♀1. ***Eureka Co.,*** Diamond Valley, Black Point 11.75 m NE Eureka, 39.669957° -115.860577°, 2031m, 31-vii-2007 (S07-76) RJ Little & JE Yelle ♂1. Palisade 40.610596° -116.198151°, 1477m, 21-iv-2004 (S04-28) R. Baumann ♀1. ***Humboldt Co.,*** Hwy 80 7 m NW Battle Mt at Exit 222, 14-v-2005 (S05-49) DL Metzger ♂1. Winnemucca, 40.963° -117.709° 1379m, 14-ix-1999 (S99-146) G. Wegren ♂1. Hwy 95 7 m N Winnemucca, 41.078699° -117.704735°, 1323m, 17-iv-1998 (S98-23) ♂5 ♀5. Hwy 140 2-7 m S Denio, 41.927849° -118.619407°, 1306m, 15-ix-1998 (S98-93) ♂85 ♀5. ***Lyon Co.,*** Stagecoach, 5060 Abilene, 39.373888° -119.359705°, 1338m, 29-vi-2000 (S00-18) J. Knight ♂1. 2.7 m S Smith, 38.756481° -119.331317°, 1494m, 19-iv-1998 (S98-31) ♂5 ♀4. 6 m E Smith, 28-iii-1983 (S83-22) A. Evans & K. Smith ♂1. ***Mineral Co.,*** Dixie Valley, 39.047420° -118.004244°, 1604m, 31-v-2019 (S19-10) A. Abela ♂1. 5.2m SE of State Route 361, Fingerrock Wash Rd, Elsnors Rawhide Ranch, 38.673465° -117.998277°, 1547m, 29-viii-2000 (S00-43) VF Lee & HI Scudder ♂1. ***Pershing Co.,*** Auburn Canyon, 40.823206° -117.776815°, 1327m, 7-iv-1993 (S93-23) JB Knight ♂1 for testes. Humboldt Canyon, 40.590198° -118.219639°, 1526m, 19-iii-1993 (S93-8) ♂5 ♀3; 17-iv-1998 (S98-21) ♂3 ♀2. **OREGON, *Crook Co.,*** Powell Butte, 44.247621° -121.017914°, 950m, early June, 2003 (S03-81) V. Trampush ♀1; late July, 2004 (S04-87) V. Trampush ♂1; October, 2004 (S04-138) V. Trampush ♂1 ♀1; 8081 S Pokegama Dr, 44.230220° -120.980646°, 1047m, 20-v-2005 (S05-52); 27-ix-2006 (S06-112) ♂1. 12 m S Powell Butte, 23-x-2005 (S05-164) V. Trampush, ♀1. Prineville, 750 SW Redwood Lane, 44.040313° -120.837287°, 1149m, 15-viii-2010 (S10-57) R. Hynes-Kissler ♂1. ***Deschutes Co.,*** Bend, 63007 Terry Dr, 44.089409° -121.162396°, 1020m, 3-vii-2002 (S02-32) W. Fowler ♂1. Bend, 63217 Logan Ave, 44.095339° -121.293452°, 1067m, 7-vi-2014 (S14-14) D. Neilsen ♂1. Redmond, 1022 NW 51st St, 44.286232° -121.228609°, 911m, 22-ix-2004 (S04-137) G. & L. Ollerenshaw ♂1. ***Harney Co.,*** Alvord Lake Basin type locality, 27-ix-1981, DC Lightfoot, ♂2; 10-viii-1983 (S83-110) D. Lightfoot ♀1; 14-ix-1998 (S98-91B) ♂1. Burns, 288 E Madison Ave, 43.586633° -119.051559°, 1267m, 15-x-2001 (S01-110) S. Backowski ♀2. 8m E Burns, 43.607905° -118.919999°, 1260m, all T. Downs, 4-vi-1998 (S98-43) ♂1 ♀1; 1-xi-2001 (S01-112) ♀1; 27-vi-2002 (S02-30) ♂1 ♀1. 11.3m S Burns, Hwy 205 @ Sunset Valley Lane, 43.426835° -119.002905°, 1254m, 14-vi-2004 (S04-50) ♀1. 15m S Burns, 43.380892° -118.981617°, 1252m, all C. Larson, 21-vii-2001 (S01-94) ♂1; 25-ix-2001 (S01-105) ♂3 ♀2. 20m S Burns, 52021 Double-O Ranch Rd, 43.293505° -119.149220°, 1250m, 25-vi-2002 (S02-29) M. McCanna ♂1. Crescent Dunes, 42.006167° -118.597865°, 1271m, 14-ix-1998 (S98-92) ♂4 ♀2; 15-vi-2001 (S01-57) ♀3. Harney Lake Dunes, 43.16808° -119.03641°, 1270m, 14-vi2004 (S04-49) ♂1 ♀2. Guano Slough N of Beatty's Butte and W

Guano Reservoir, 12-vii-2001 (S01-62) K. Janette ♀1. ***Lake Co.,*** Alkali Lake, 43.028012° -119.984881°, 1323m, 15-vi-2004 (S04-52) ♀2. Christmas Valley 43.238446° -120.683773°, 1317m, 22-vi-2014 (S14-23) ♂4 ♀2. Christmas Valley Dunes 43.323967° -120.318500°, 1366m, 16-vi-2001 (S01-58) ♂1 ♀2; 18-vi-2004 (S04-59) ♀1. Christmas Valley Dunes 43.114211° -120.862132° 1314m, 17-vi-2004 (S04-58) ♀1. Lake Abert, 42.753422° -120.113136°, 1327m, 15-vi-2004 (S04-53) ♂5 ♀5. Summer Lake Dunes, 42.980953° -120.665873°, 1284m, 17-vi-2004 (S04-56) ♂4 ♀6. Warner Valley, 42.573333° -119.884250°, 1374m, 24-vi-2014 (S14-26) ♂11 ♀15. Hwy 31 intersection Old Lake Rd, 43.113994° -120.862199°, 1314m, 17-vi-2004 (S04-58) ♀1.

Possible placement. **CALIFORNIA, *Mono Co.,*** White Mts, 8 m N White Mt Peak, Indian Creek, 37.7519° -118.2556°, 2641m, 19-vii-1995 (S95-61) D. Giuliani ♂1. While his DNA (F0128) recovered in large clade with other individuals of *A. monolake*; and his drum rate (R95-44) of 1.7–1.8 drums/s (at 19.5°C) is also consistent with *A. monolake*, the collected elevation and habitat are more consistent with sister taxon *A. dogtown* in this orange headed, adult male specimen.

Drum. Calling drum rate similar in both sexes but series longer in females. **Male:** Holotype R05-22 (Fig. 971) with 22 drums over 12.5s (1.8 drums/s) at 20.5°C. **Female:** Allotype R05-20 (Fig. 972) with 160 drums over 103.6s (1.5 drums/s) at 20°C.

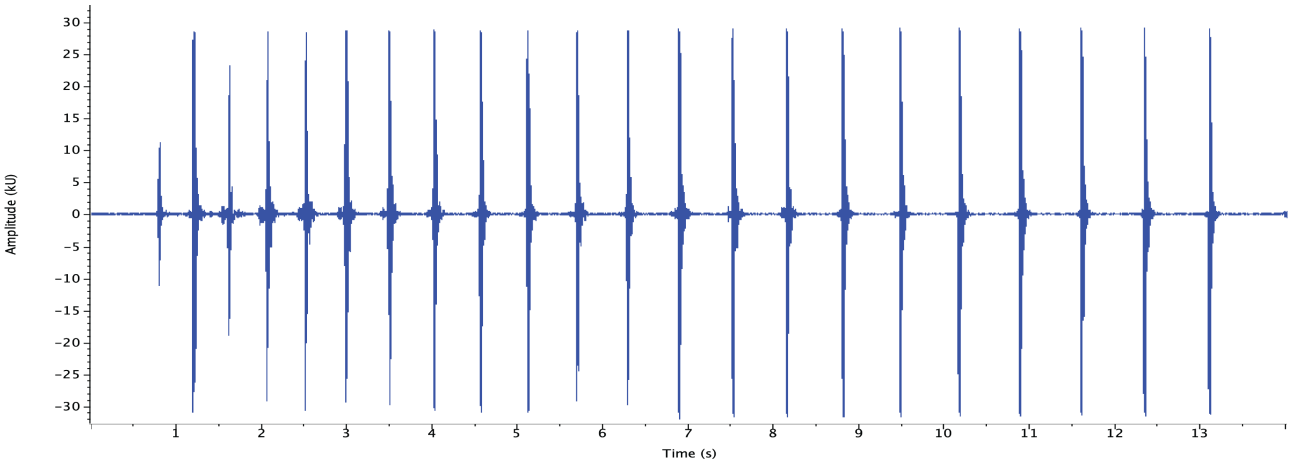


FIGURE 971. Calling drum (R05-22) adult male holotype *A. monolake.*

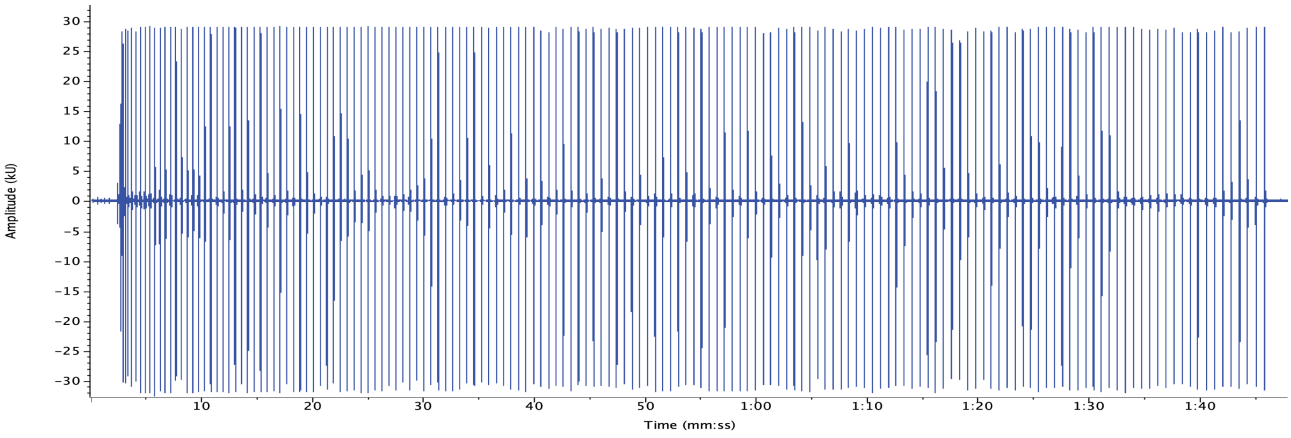


FIGURE 972. Calling drum (R05-20) adult female allotype *A. monolake.*

Derivation of name. Named after the type locality.

Habitat. At Mono Lake, individuals collected, under objects, from low, rolling sand dunes on North Shore; while to oatmeal trails in sloping sandy habitats on South Shore. At Mono City, habitat is sandy soil with sagebrush and bitterbrush. Hwy 140 S Denio (S98-93, Humboldt Co., NV) is *Sarcobatus* flats with sagebrush on rocky substrate. Warner Valley, OR (S14-26) is ridgetop basalt and sagebrush with sandy substrate and little vegetation; late instars to oatmeal trail.

Life cycle and seasonal occurrence. All 5 individuals collected at type locality were adults. Apparently typical 2-year life cycle. On 14-ix-1998, we started driving south of Denio, Nevada, on Hwy 140 (S98-93), at 00:30, and found the road covered with dead JCs but in the following 3 hours of driving back and forth, during which time we saw no cars, we collected only 10 live adult males. Clearly, the road must have been covered with many wandering JCs earlier in the evening such that each of the few cars that passed through killed many. We returned there the next evening and saw the first adult male on the road at 19:28, while still fairly light. Over the next 2 hours, we made 3 slow passes over that 5-mile stretch of highway, between 2 to 7 miles S Denio, and collected a total of 85 adult males, 5 adult females, and 1 last instar male nymph. The best habitats were flat areas of sagebrush. We have only seen so many JCs, of any species, on 2 other occasions: (1) *A. yubalake* at an oatmeal trail at Split Rock, WY (S04-82); and (2) *A. davewerneri* when dug from dunes in the Vizcaíno Desert (S90-11).

Variation. For 21 **California** adults, 2 had 2 and 19 had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 5 had 4 and 15 had 5 inner **rear** leg tibial spines, and 10 had 3 and 11 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 153 **Nevada** adults, 1 had 2, 151 had 3, and 1 had 4 ventral **fore** leg tibial spurs; 10 had 7 and 137 had 8 **middle** leg tibial calcars, 149 had 2 and 4 had 3 ventral spurs; 2 had 3, 19 had 4, 127 had 5 and 4 had 6 inner **rear** leg tibial spines, while 86 had 3 and 67 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 89 **Oregon** adults, 8 had 2 and 79 had 3 ventral **fore** leg tibial spurs; 3 had 7 and 84 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 6 had 4, 78 had 5 and 2 had 6 inner **rear** leg tibial spines, and 67 had 3 and 20 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

Deep Springs College is 113 air km southeast of the type locality South Shore of Mono Lake, where individuals are indistinguishable from those individuals at Mono Lake except, possibly, for number of outer rear leg tibial spines: At **Deep Springs**, 4 adults (80%) had 3 and 1 adult had 4 outer spines; while at **Mono Lake**, 6 adults (38%) had 3 and 10 adults (62%) had 4 outer spines. Small, early nymphs from **Summer Lake Dunes**, OR (S04-56) are darker brown than larger instars and adults.

DNA. Fig. 942, p. 525. F0088 (S94-27, Esmeralda Co, NV); F0100 (S94-107, Mono Co, CA); F0156 & F0170 (both S95-101, Inyo Co, CA); F0179 (S95-114, Esmeralda Co, NV); F0652 (S98-23, Humboldt Co, NV); F0720 (S98-21, Pershing Co, NV); F0724 (S98-27, Esmeralda Co, NV); F0734 (S98-31, Lyon Co, NV); F0740 (S98-43, Harney Co, OR); F0785 (S98-93, Humboldt Co, NV); F1000 (S98-29, Inyo Co, CA); F1069 (S98-21, Pershing Co, NV); F1085 (S00-18, Lyon Co., NV); F1089 (S00-43, Mineral Co., NV); F1162 (S01-57, Harney Co, OR); F1426 (S04-56, Lake Co, OR); F1454 (S04-53, Lake Co, OR); F1463 (S04-87, Crook Co, OR); F1950 (S07-12, Modoc Co., CA); F2204 (S10-57, Crook Co, OR); F2405 (S14-23, Lake Co, OR); F2501 (S18-10, Churchill Co., NV); F2508 (S18-16, Churchill Co., NV); F2581 (S19-10, Mineral Co., NV) all recovered in Group 17 Mono Lake, along with *A. dogtown*, *A. reno*, *A. westgardpass*, and *A. yubalake.*

Karyotype. 2n♂=25. One type locality male checked: T95-17 (Fig. 973, S94-107) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Also have many confirmatory results and/or photos from other sites: T93-15 (S93-8, Pershing Co, NV); T93-19 (S93-23, Pershing Co, NV); T98-1, T98-2 (both S98-31, Lyon Co, NV); T98-5 (S98-43, Harney Co, OR); T98-6 & T98-7 (both S98-23, off dunes, Humboldt Co, NV); T98-32 (S98-93, Humboldt Co, NV); T01-6 (Fig. 974, S01-57, Harney Co, OR); T04-3 (Fig. 975, S04-59, Lake Co, OR); T04-17 (S04-53, Lake Co, OR); T04-19 (Fig. 976, S04-56, Lake Co, OR); T05-33 (Fig. 977, S05-19, Esmeralda Co, NV; T14-10 (S14-23, Lake Co, OR); T14-15 & T14-16 (both S14-26, Lake Co, OR); T18-4 (S18-16, Churchill Co, NV); T19-1 (S19-15, Churchill Co, NV); T19-12 (S19-12, Churchill Co, NV).

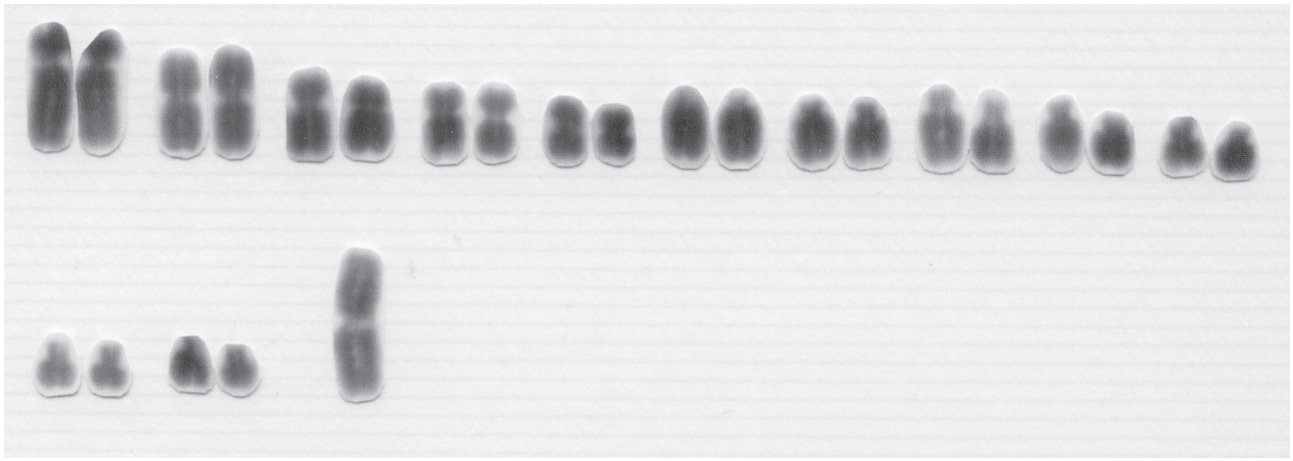


FIGURE 973. Idiogram T95-17 *A. monolake* (S94-107).



FIGURE 974. Idiogram T01-6 *A. monolake* (S01-6).



FIGURE 975. Idiogram T04-3 *A. monolake* (S04-59).

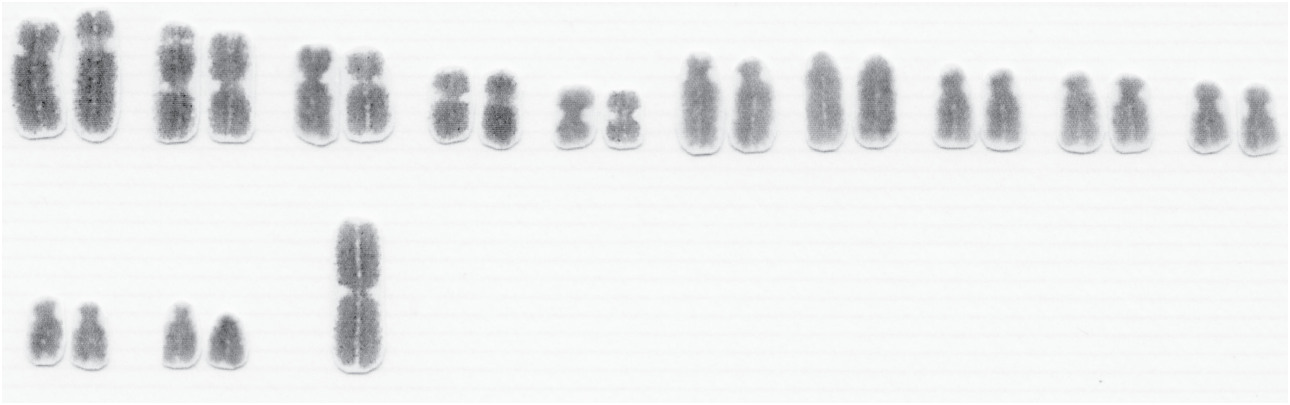


FIGURE 976. Idiogram T04-19 *A. monolake* (S04-56).

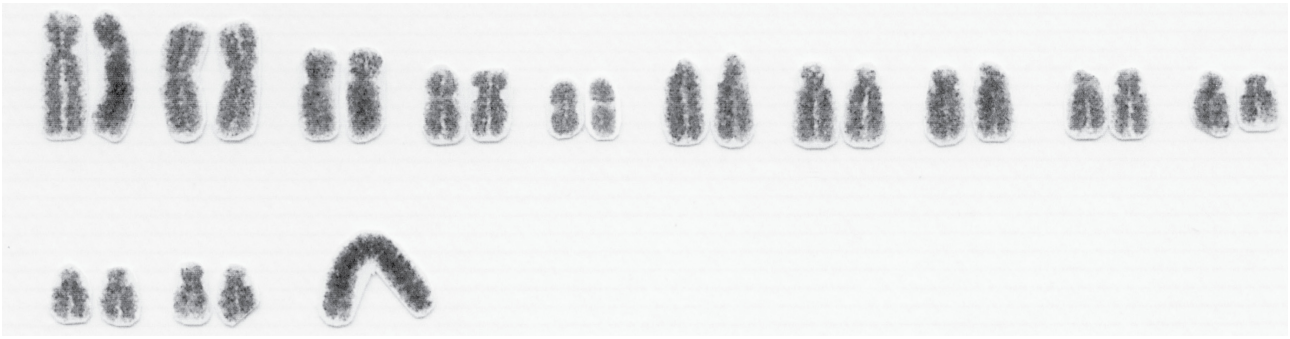


FIGURE 977. Idiogram T05-33 *A. monolake* (S05-19).

Discussion. Conveniently, all 4 type locality adult females drummed once back in the laboratory. While we suspect that they were mated anyway, such a condition could have been confirmed as described in Weissman (1979).

North of Winnemucca (S98-23), *A. monolake* occurs in flat sandy areas but near *A. winnemucca.* At Christmas Valley Dunes, OR (S01-58 & S04-59), *A. monolake* occurs sympatric with *A. christmasvalleydunes.* At Alvord Lake Dunes, OR (S01-56, S04-58), *A. monolake* occurs in less sandy areas, but near *A. lightfooti.* At Fallon Range Training Complex (S18-11), sympatric with *A. knighti.*

***Ammopelmatus reno* Weissman, sp. nov.**
Reno slow drumming Jerusalem Cricket
Figs 978–988, Table 30

Distribution. (Fig. 978). Restricted to Carson City and Washoe Counties of western Nevada, from Carson City north to Sparks and almost to Pyramid Lake.

Recognition characters. Occurs around Reno in west-central Nevada and frequently sympatric with Lightfooti Group *A. carsoncity*, from which it can be separated by: *A. reno* has (1) wider, darker black abdominal bands (Fig. 979A) frequently with a dark reddish coloration to head, pronotum, and legs and purple coloration to sides of abdomen; (2) drums at 1.2–1.7 drums/s vs 4–5 drums/s; (3) lacks a male sex clarification drum; (4) adult males lack developed rear leg tibial calcars # 1 & 2, because they are not in the Lightfooti Group, (5) both sexes invariably megacephalic, to some degree, as adults, (6) 2n♂=25 vs 2n♂=23 in *A. carsoncity*; and (7) DNA.

Separated from *A. monolake*, its closest DNA relative, by color and width of black abdominal bands (Fig. 979B). Unfortunately, these 2 sympatric individuals in Fig. 980 arrived dead, so we have no drumming or DNA. But the adult male on the left is most consistent with *A. monolake* given his narrow abdominal bands. The adult male on the right is most consistent with *A. reno* given his large head, reddish color, and wider abdominal bands. We can definitely say that neither specimen is *A. carsoncity* because rear leg calcars #1 and #2 are not developed as in the

latter species. But because these two species are almost morphologically indistinguishable with the same karyotype and drum, and recovered as each other's nearest DNA relative, consideration should be given to the possibility that *A. reno* and *A. monolake* are conspecific.

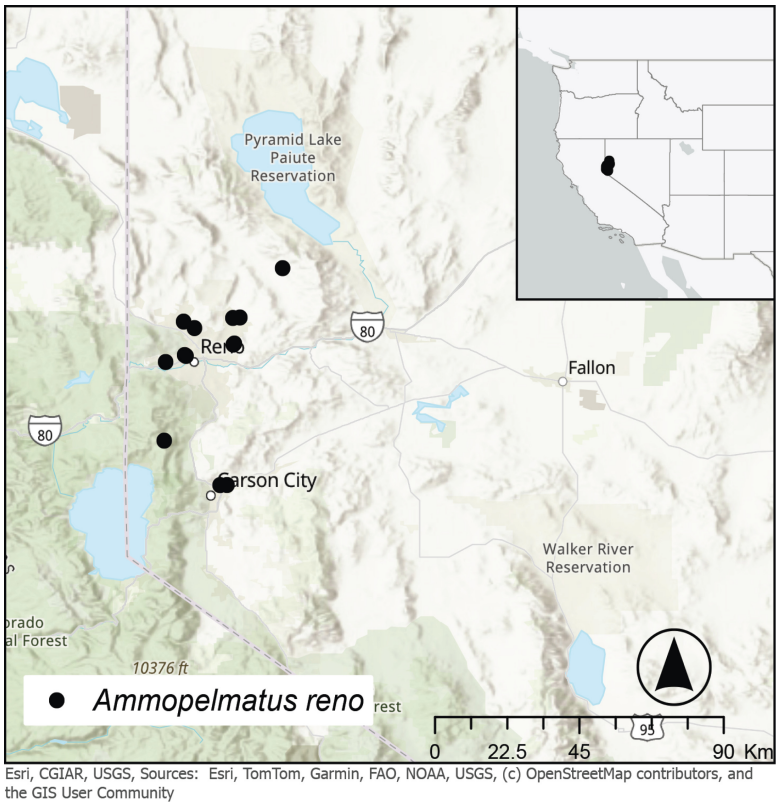


FIGURE 978. Distribution of *A. reno.*

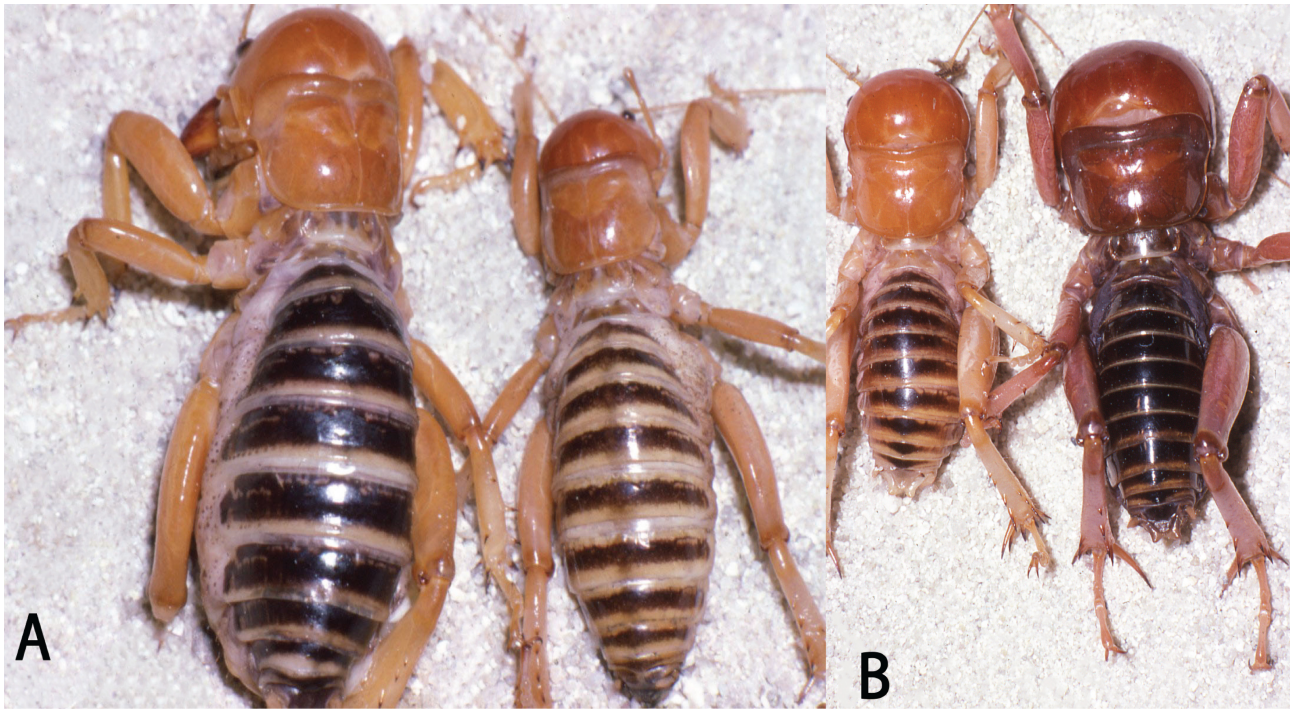


FIGURE 979. Comparison of *Ammopelmatus* species sympatric with *A. carsoncity.* A. Adult females from Carson City, NV. Left side *A. reno* (S87-77, R87-13) vs right side *A. carsoncity* (S87-44, R87-23). B. Comparison of sympatric adult males from Golden Valley, NV (both S00-46). Adult male on left probably *A. monolake;* adult male on right *A. reno.*

Holotype. Male (in alcohol, Fig. 980): **Nevada, *Washoe Co.,*** Reno, Ellendale Rd, 39.543030° -119.836428°, 1454m, 27-vi–3-vii-2002 (S02-33) J. Knight. R02-13, F1313. Molt to adult 11-ix-2002. Deposited CAS, Entomology type #20091. Megacephalic. Measurements in mm: Body length 42.4, hind femur length 13.79, hind femur width 4.73. Megacephalic. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 981) with 5 inner and 3 and 4 outer spines, 2 ventral spurs.

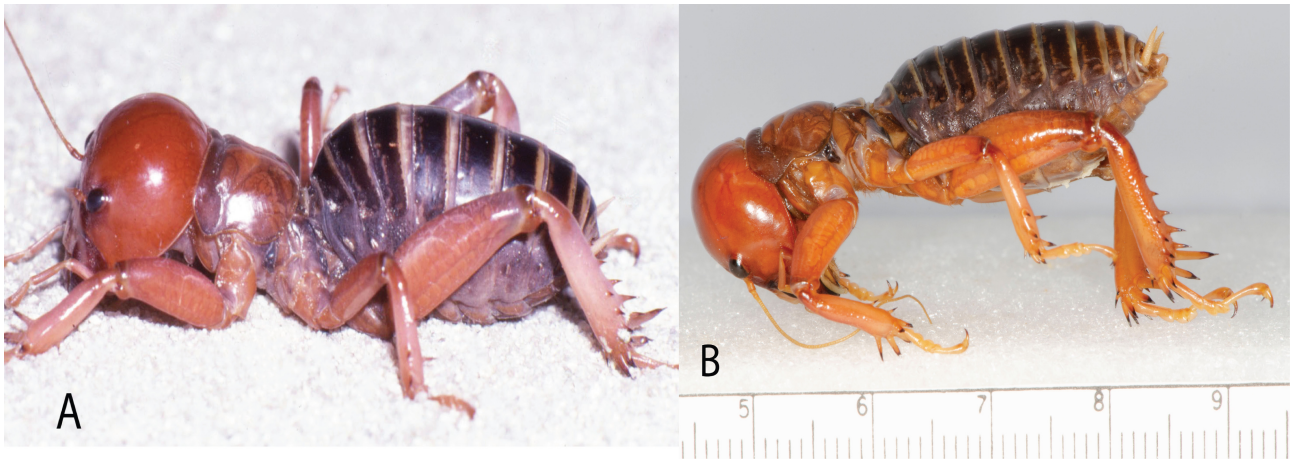


FIGURE 980. Adult male holotype *A. reno.* A. When alive. B. When preserved.

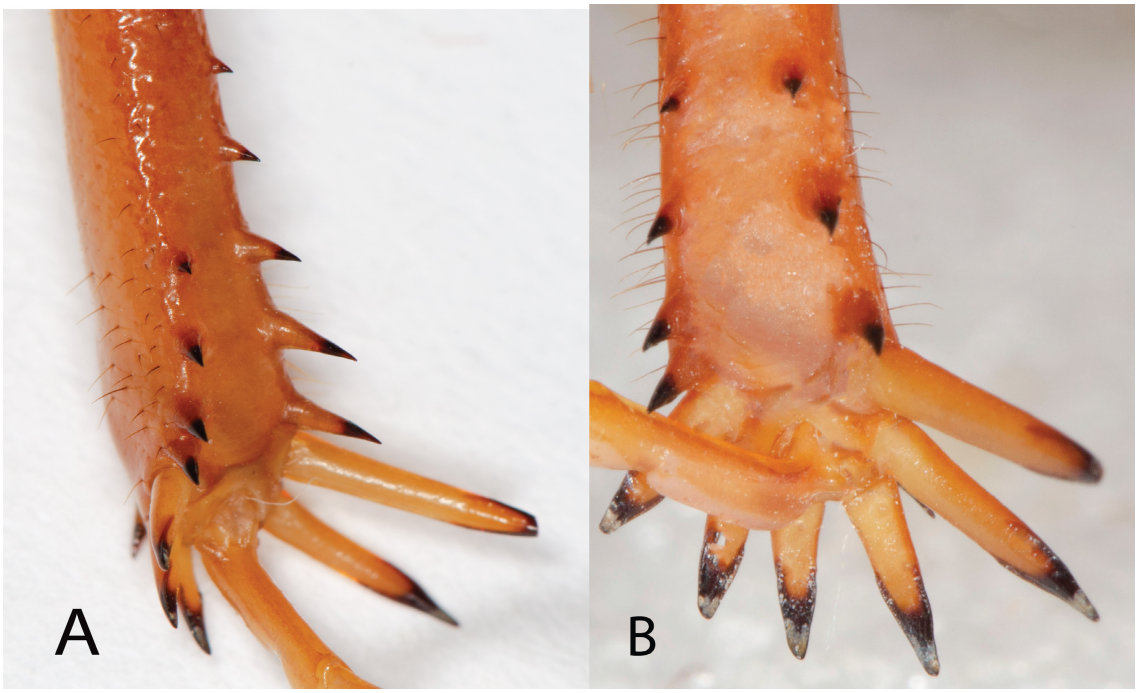


FIGURE 981. Left rear leg tibia adult male holotype *A. reno.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 982): same data as holotype except R02-26, F1312. Molt to adult 11-ix-2002. Deposited CAS, Entomology #9078803. Measurements in mm: Body length 47.98, hind femur length 13.77, hind femur width 5.12. Megacephalic. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 983) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 984.

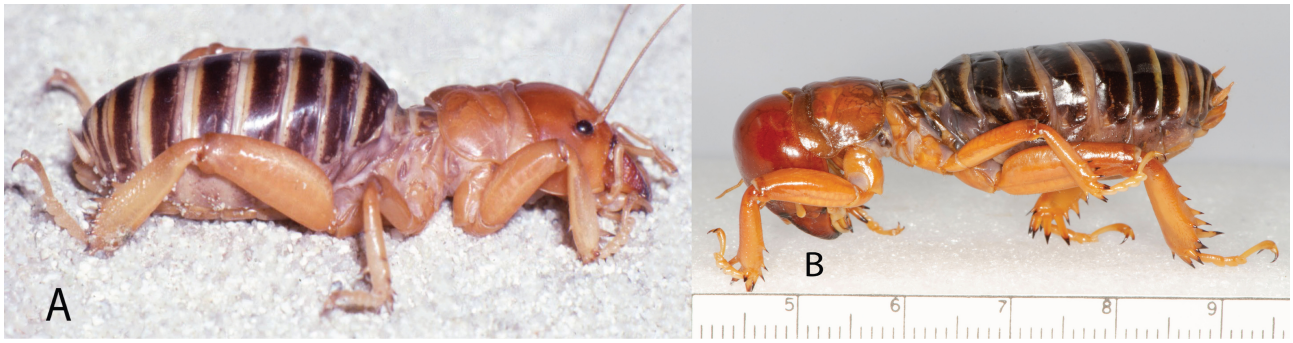


FIGURE 982. Adult female *A. reno.* A. Topotype (S02-33, R02-40, F1325) when alive. B. Adult female allotype *A. reno* when preserved.



FIGURE 983. Left rear leg tibia adult female allotype *A. reno.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 984. Ovipositor allotype *A. reno.*

Paratypes. ♂16 ♀11. **NEVADA.** ***Carson City Co.***: Carson City, northern part of town, 39.193068° -119.741096°, 1432m, 10-ix-1986 (S86-112) R. Arkell ♂1; 2-vii-1987 (S87-77) R. Arkell ♀1; 5-vii-1987 (S87-83) R. Arkell ♂1; 5-ix-1988 (S88-103) R. Arkell ♂1; 11-ix-1988 (S88-106) R. Arkell ♂1; 21-vi-1989 (S89-45) R. Arkell ♂1; 4-viii-1989 (S89-57) R. Arkell ♂1; 6-ix-1991 (S91-105) R. Arkell ♂1; 19-ix-1991 (S91-107) R. Arkell ♂1; 3-x-1991 (S91-110) R. Arkell ♂1; 17-x-1991 (S91-116) R. Arkell ♀1. Carson City Airport, 39.193337° -119.721786°, 1428m, 16-x-1986 (S86-142a) R. Arkell ♀1. ***Washoe Co.***: Type locality (S02-33) ♀1. Dry Valley 6 m SE Pyramid, 40.040046° -119.609546°, 1158m, 6-15-vii-1997 (S97-129) S. Bateman ♀1. Reno, Lemmon Valley, 39.636020° -119.843245°, 1511m, 27-vii-1998 (S98-51) R. Mooney ♀1. Reno, near Westgard Elementary School, 39.526655° -119.893508°, 1521m, 3-ix-2000 (S00-47) T. Hajec ♂1. Reno, 3485 Running Bear Lane, 39.618577° -119.812780°, 1595m, C. Pendill, 29-vi-2000 (S00-19) ♀1; 11-ix-2000 (S00-46) ♂1. Reno, 4700' 24-ix-2003 (S03-134) J. Crandell ♂1. Reno, 2275 Ellendale Rd, 39.545579° -119.840362°, 1466m, (S05-127) K. Gutierrez ♂1. Spanish Springs, Bridle Path Development, 39.645885° -119.705274°, 1374m, 10-ix-1998 (S98-104) W. Stone ♂1. Warm Springs Valley, 39.780817° -119.566050°, 1487m, 21-vi-1998 (S98-50) M. Schoendeider ♀1. Cold Springs, ~10 m N Reno, 14-iii-2007 (S07-4) B. Rivera ♀1. Sparks, 4566 Goodwin Rd, 39.573885° -119.704120°, 1434m, 11-ix-1999 (S99-145) D. Smith ♂1. Sparks, 70 Stags Leap Circle, 39.647134° -119.685680°, 1396m, 20-ix-1999 (S99-147) J. Hooper ♂1. Sparks, 4692 Goodwin Rd, 39.576715° -119.701133°, 1436m, 10-x-1999 (S99-159) K. Dach ♀1. Near Mt Rose, Hwy 431, Trailhead parking lot, 39.313518° -119.897496°, 2719m, (S05-151) J. Farrar ♀1.

Drum. Both sexes, and male nymph (T92-2), with similar calling drums **Male:** Holotype R02-13 (Fig. 985, S02-33, 20.5°C) with 22 drums in 13.1s (1.7 drums/s). **Male**: nymph (Fig. 986, R91-60, S91-118, 19°C) with 101 drums in 94.2s (1.1 drums/s). **Female:** Allotype R02-26 (Fig. 987, S02-33, 20°C) with 64 drums in 40.9s (1.6 drums/s).

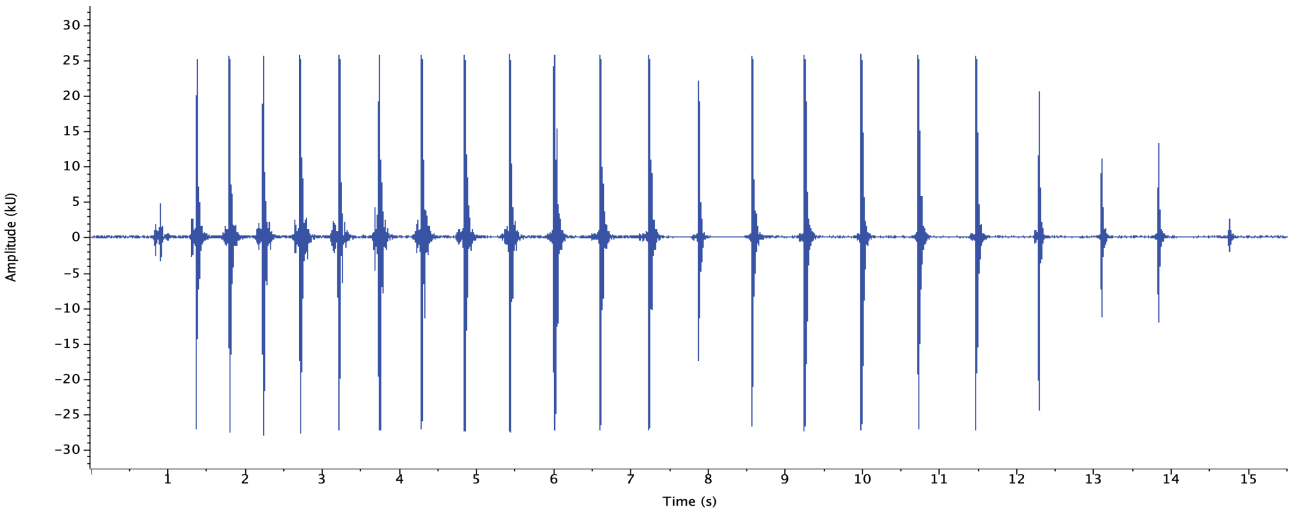


FIGURE 985. Calling drum (R02-13) adult male holotype *A. reno.*

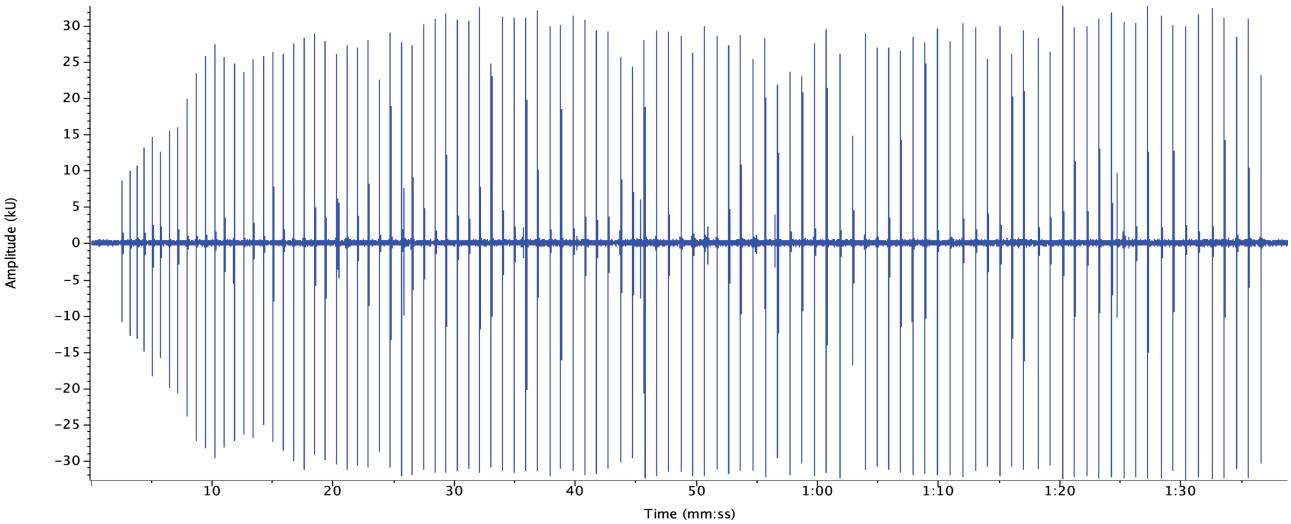


FIGURE 986. Calling drum (R91-60) last instar male nymph *A. reno.* Testes (T92-2) subsequently harvested for karyotype (see below under "Karyotype").

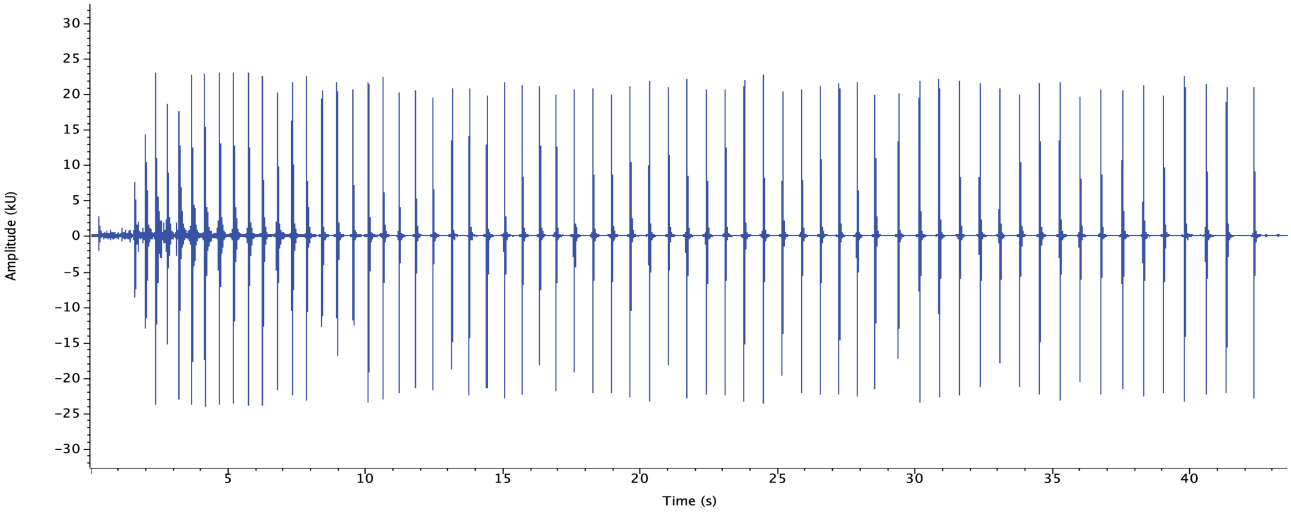


FIGURE 987. Calling drum (R02-26) adult female allotype *A. reno.*

Derivation of name. Named after the type locality.

Habitat. Sagebrush and rabbitbrush habitat, but also seem to do well in some developed areas around Reno.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. **Color** can vary from holotype (Fig. 980) red head and legs and purple tinge to sides of abdomen; to topotype (Fig. 982A, R02-40, F1325) orange head and legs with little infused purple coloration. Of some 26 tabulated individuals, 2 had 2 and 23 had 3 **fore** leg ventral tibial spurs; 25 individuals had **middle** leg tibia with 8 calcars and 2 ventral spurs; and 3 individuals had 4 and 23 had 5 **rear** leg inner tibia spines, while 10 had 3, 15 had 4 and 1 individual had 5 **rear** leg outer spines, all with 2 ventral spurs.

DNA. Fig. 942, p. 525. F1084 ((S00-19, Washoe Co); F1312 (allotype) and F1313 (holotype), both S02-33, all recovered in Group 17 Mono Lake, and closest to *A. monolake.*

Karyotype. 2n♂=25. T92-2 (Fig. 988, S91-118, Carson City, R91-60) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

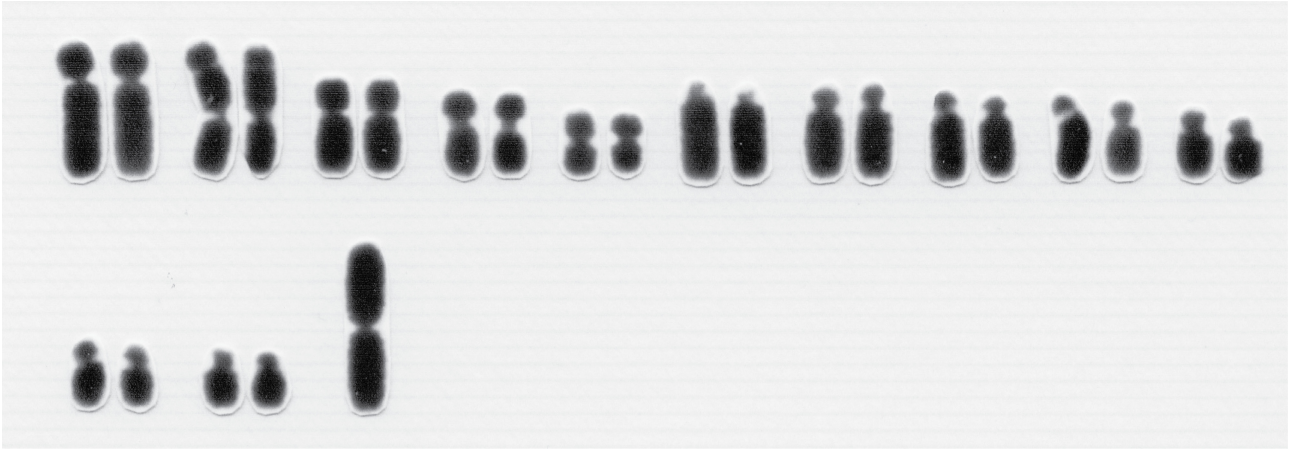


FIGURE 988. Idiogram T92-2 *A. reno* (S91-118).

Discussion. A. reno occurs sympatric with the generally more common *A. carsoncity* in a narrow geographical area. Once one goes farther east into drier, more sandy habitats, these 2 taxa drop out and a new assemblage of Lightfooti Group taxa appear: *A. rusti, A. knighti,* and *A. winnemucca*. At Reno (S00-46) it appears (Fig. 979B) that *A. reno* occurs sympatric with *A. monolake*, but no drum or DNA exists for confirmation (but see discussion above under "Recognition characters").

***Ammopelmatus westgardpass* Weissman, sp. nov.**
Westgard Pass Jerusalem Cricket
Figs 989–996, Table 15

Distribution. (Fig. 989). White Mts of California, probably up to 3078 m elevation.

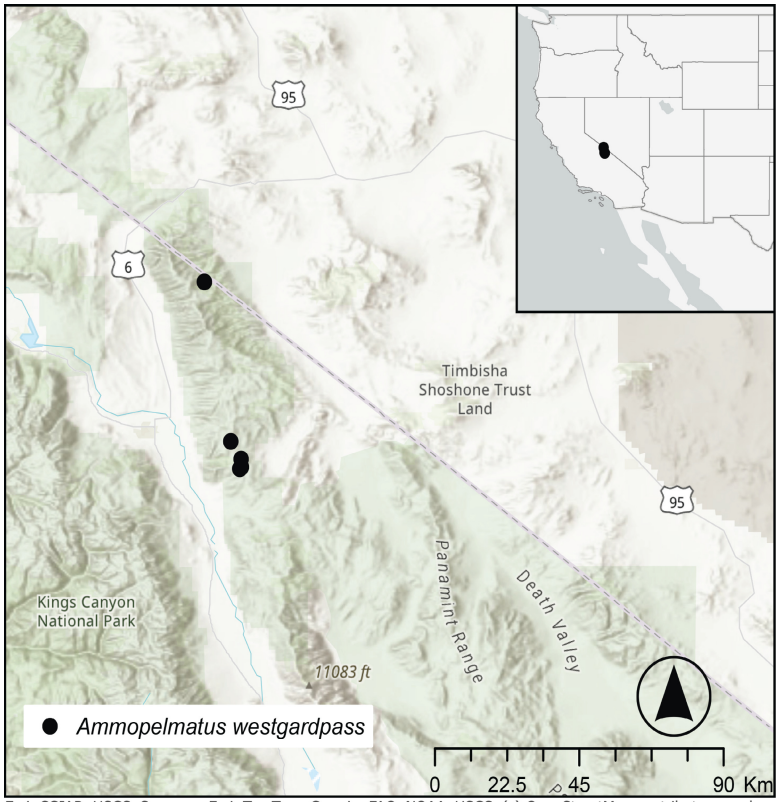


FIGURE 989. Distribution of *A. westgardpass.*

Recognition characters. Medium-large, orange headed, generally megacephalic, slow drumming (1.2–1.5 drums/s) species that is indistinguishable from *A. monolake* (drum range 1.5–1.8 drums/s), but given differences in habitat (pinyon pine sagebrush forests vs open, sandy, Great Basin Desert), elevation (exceeding 3000m vs <2100m), and a separation of 110 air km, especially with known high JC biodiversity in California, we are confident that this is a distinct taxon. Separated from sister species *A. dogtown* (drum range 1.3–1.9 drums/s) by red head in latter and the Owens Valley; and from *A. tomsplace* by the Owens Valley, faster drum rate (2.0–2.7 drums/s), DNA, and darker rear leg tibial calcars #1 and #2.

Holotype. Male (in alcohol, Fig. 990). **California, *Inyo Co.,*** White Mts, Hwy 168 from 1.1 km (37.292690° -118.152731°, 2231m) to 3.9 km (37.267789° -118.156466°, 2218m) S of Westgard Pass sign, 17-ix-1998 (S98-98) DBW, VF Lee. R98-90, F0776. Collected as adult. Deposited CAS, Entomology type #20158. Megacephalic. Measurements in mm: Body length 38.53, hind femur length 13.3, hind femur width 4.67. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 991) with 5 inner and 3 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 992). Same data as holotype except R98-72. Collected as adult. Deposited CAS, CASENT #9080135. Megacephalic. Measurements in mm: Body length 36.03, hind femur length 10.91, hind femur width 4.25. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 993) with 5 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 994.

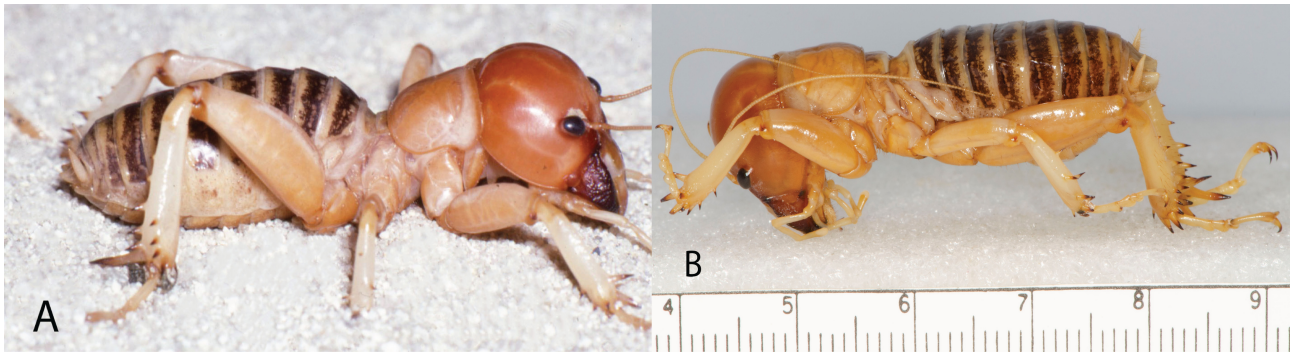


FIGURE 990. Holotype adult male *A. westgardpass.* A. When alive. B. When preserved.



FIGURE 991. Left rear leg tibia adult male holotype *A. westgardpass.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

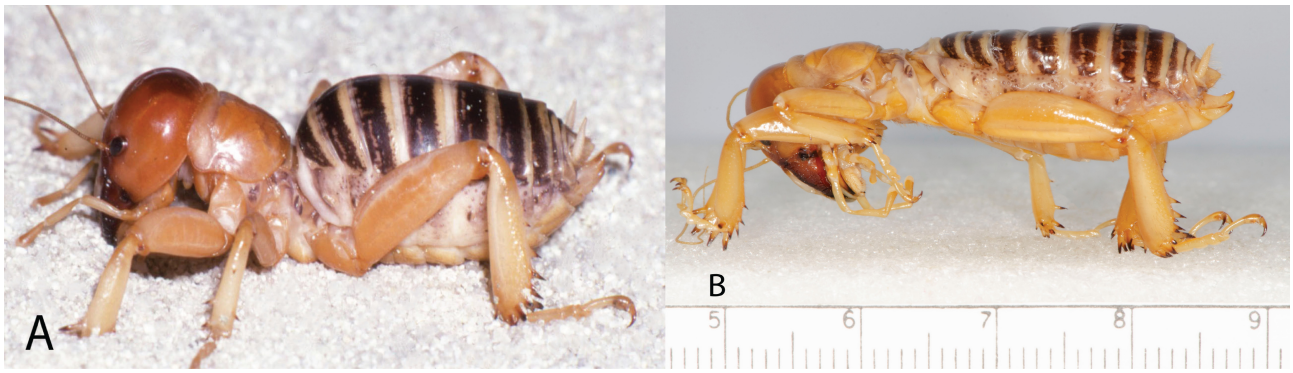


FIGURE 992. Allotype adult female *A. westgardpass.*

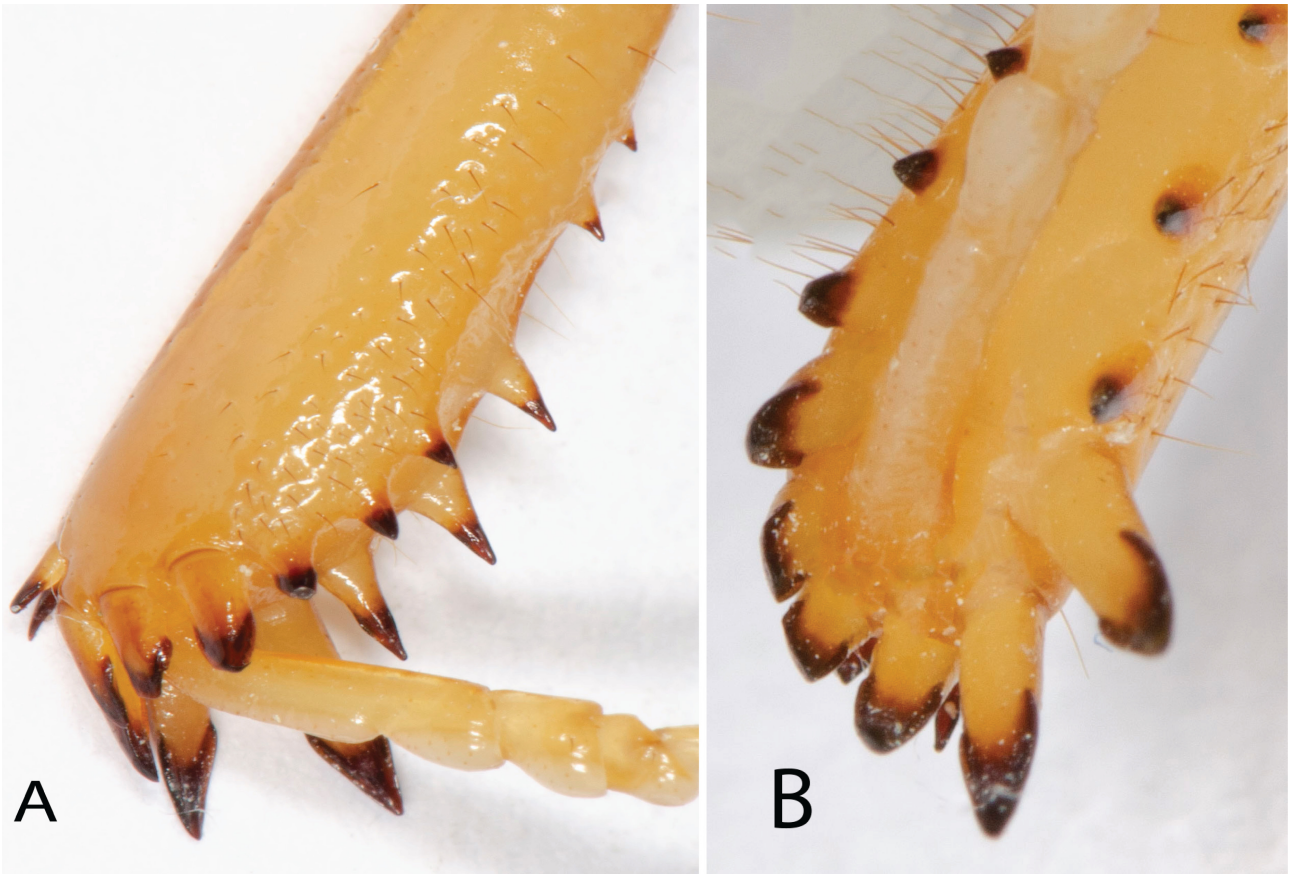


FIGURE 993. Left rear leg tibia adult female allotype *A. westgardpass.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 994. Ovipositor allotype *A. westgardpass.*

Paratypes. ♂18 ♀4. **CALIFORNIA, *Inyo Co.,*** type locality, 17-ix-1998 (S98-98) ♂17 ♀2. 37.27224927° -118.151818°, 2223m, 26-vi-2016 (S16-17) ♀1. Westgard Pass Rd, 10 m NE Big Pine, 2042m 12-x-1984 (S84-67)

D. Guiliani ♀1. White Mts., off White Mt Road, 37.338611° -118.181667°, 2587m, 1-ix-2020 (S20-6, F2611) A. Abela ♂1. This last site is 11.5 km NW type locality Westgard Pass. This adult male with more of an orange-brown head than a red head (probably ruling out *A. dogtown*); and without well-developed calcars #1 and #2, and a slower drum rate (R20-18, 1.3 drums/s at 21.4°C), which probably rules out *A. tomsplace*.

Probable placement. **CALIFORNIA, *Mono Co.,*** White Mts, 8 m N White Mt Peak, Indian Creek, 37.7519° -118.2556°, 2641m, 19-vii-1995 (S95-61) D. Giuliani ♂1. His recovered DNA (F0128) is in a large clade with other individuals of *A. westgardpass*; and his drum rate (R95-44) of 1.7–1.8 drums/s (at 19.5°C) and habitat are also consistent. The site is 53 km N of Westgard Pass.

Drum. Calling drum same in both sexes except series longer in female. **Male:** Holotype R98-90 (Fig. 995) with 15 drums over 10.2s (1.5 drums/s) at 19°C. **Female:** Allotype R98-72 (Fig. 996) with 32 drums over 22.3s (1.4 drums/s) at 18.5°C.

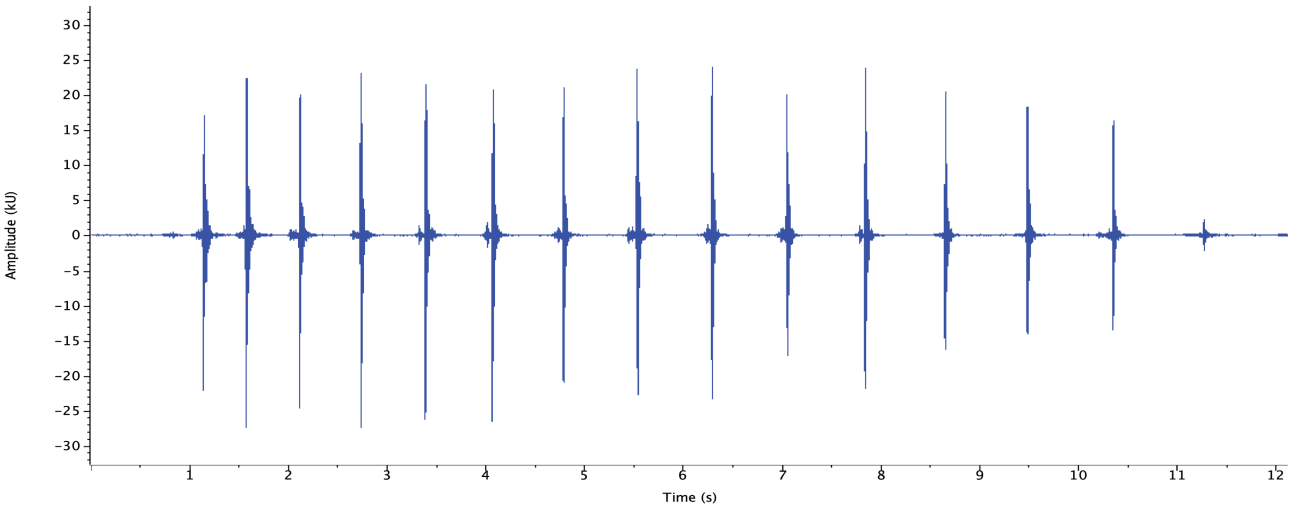


FIGURE 995. Calling drum (R98-90) adult male holotype *A. westgardpass.*

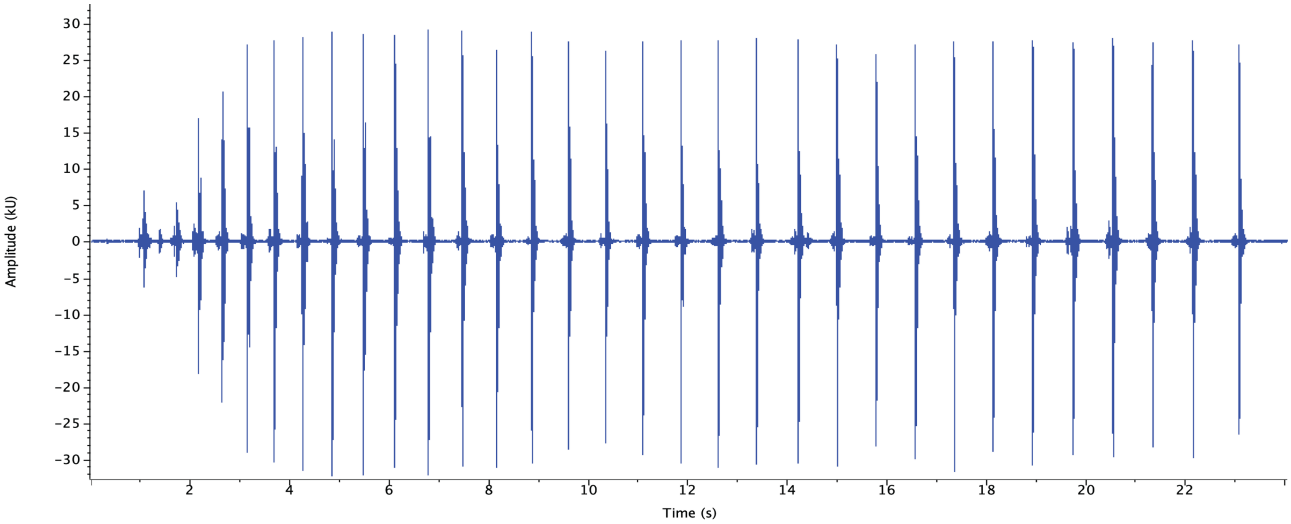


FIGURE 996. Calling drum (R98-72) adult female allotype *A. westgardpass.*

Derivation of name. Named after the type locality.

Habitat. Open pinyon pine sagebrush forests.

Life cycle and seasonal occurrence. Most of type series (S98-98) collected while cruising Hwy 168 at night, between 1.1–3.9 km S of Westgard Pass. We got 18 adults in 45 minutes starting at 19:45 and 3 more adult males on 22:00 pass. At S16-17, collected wandering late instar female.

Variation. Of 21 individuals, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4, 19 had 5 and 1 had 6 inner **rear** leg tibial spines, and 16 had 3 and 5 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 942, p. 525. F0128 (S95-61, Indian Creek); F0775 & F0783 (both type locality S98-98); F2611 (S20-6, White Mt Road) recovered in Group 17 Mono Lake, a poorly supported, Great Basin clade of other slow drumming species: *A. dogtown, A. monolake,* and *A. reno*.

Karyotype. Unknown.

Discussion. Derham Giuliani collected (with specimens at CAS) what we assume is this species, in long-running (16-vii-1983 to 3-xi-1983) antifreeze pitfall traps at 3078m, at 0.8 km S, 0.4 km W of Bristlecone Pine Schulman Grove in the White Mts (Giuliani site #480). These are the highest elevation collections of any *Ammopelmatus* JC species, which are still considerably lower than the highest elevations known for Mexican *Stenopelmatus* JC specimens, documented (Weissman *et al.* 2021, p. 116 & p. 117) above tree line, around 4265 m, on Mt Popocatépetl, in Mexico.

Ammopelmatus yubalake **Weissman, sp. nov.**

Yuba Lake Jerusalem Cricket

Figs 997–1022, Tables 26, 27, 29, 30, 33

Distribution. (Fig. 997). Eastern half of Nevada, from Elko south to Lee Canyon (in the Spring Mts), the western half of Utah, into southern Idaho, central Montana, and across Wyoming as far east as western North Dakota, and south into western Colorado. In Utah, all known localities west of the central, north-south running mountain ranges except for two localities in Carbon Co: Helper (S10-11) and Price (S07-88). These latter two localities east of the mountain crests, at high elevations, and on the northwestern edge of the Colorado Plateau, and may represent an unrecognized taxon.

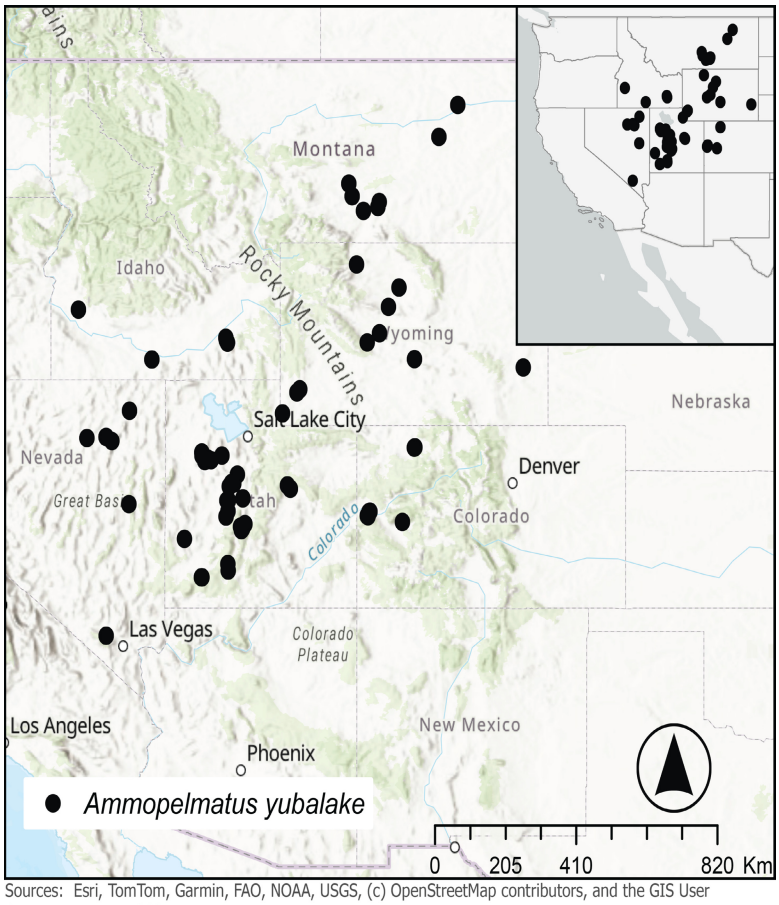


FIGURE 997. Distribution of *A. yubalake.*

Recognition characters. A widespread, small to large, slow drumming, 2n♂=25, color-variable, usually sand associated JC where males with very long rear leg calcar #1, and rear leg outer tibial spine #1 minimally, if at all, flattened on posterior face. When flattened, then face rotated for a variable amount, between 0–75°, from long axis

of tibia, but usually less than 50°. Out of 109 adults, 74 (68%) had 3 rear leg outer tibial spines while 35 (32%) had 4 spines. This is a very high % of 4 outer spines amongst all JC taxa not in the Lightfooti Group. There is large intrapopulation variation in abdominal stripe intensity from areas where good sample sizes are available: e.g., Hawbush Dunes (Fig. 998) and Dugway Proving Ground (Fig. 999). Separated from neighboring Fuscus Group members *A. coralpink, A. mescaleroensis*, and *A. navajo* by general lack of, or minimal posterior flattening in outer rear leg tibial spine #1 in Yuba Lake Group specimens, and DNA. Collected over some of its western range with various species of the Lightfooti Group. Adult male and female Lightfooti Group species are easily separated, from *A. yubalake*, by DNA, drum rate (>3 drums/s in the Lightfooti Group vs <2 drums/s in *A. yubalake*) and the morphological characters listed on p. 304.



FIGURE 998. Range of abdominal stripe variation seen in adult individuals of *A. yubalake* from Hawbush Dunes (all S98-89), Millard Co, Utah. From left to right: male (R98-127); female (R98-79); male (R98-94).



FIGURE 999. Range of abdominal stripe variation seen in adult individuals of *A. yubalake* from Dugway Proving Grounds, Tooele Co., Utah. From left to right: male (S13-70, R14-109); female (S13-74, R14-102); male (S14-15, R14-121).

Holotype. Male (in alcohol, Fig. 1000). **Utah, *Juab Co.,*** Yuba State Park and Recreational Area, North Beach, 39.404983° -112.021183°, 1537m, 23-iv-2006 (S06-15) DBW, P. Cook. R07-24. Molt to adult 29-vii-2007. Deposited CAS, Entomology type #20197. Measurements in mm: Body length 45.16, hind femur length 12.15, hind femur width 4.19. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1001) with 5 inner and 3 outer spines, 2 ventral spurs.

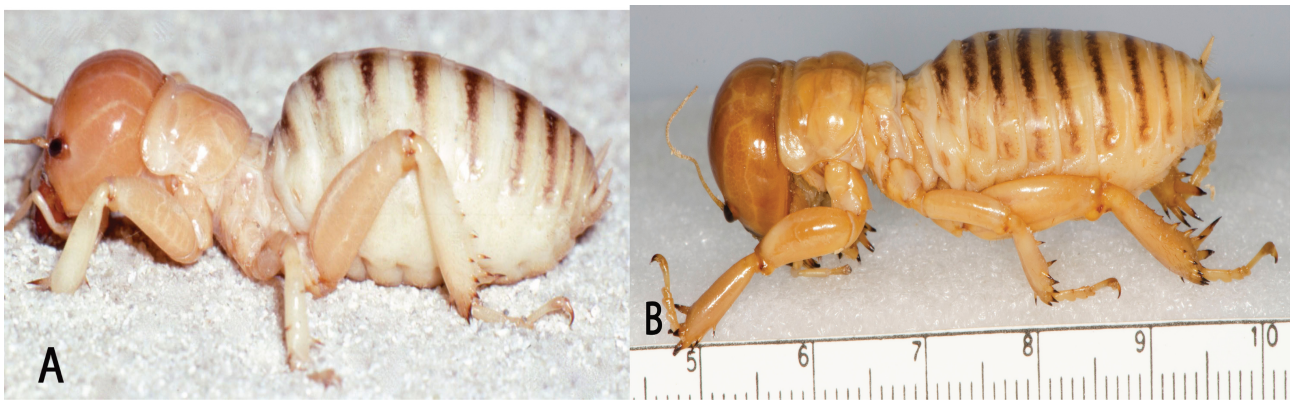


FIGURE 1000. Adult male holotype *A. yubalake.* A. When alive. B. When preserved.



FIGURE 1001. Left rear leg tibia adult male holotype *A. yubalake.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1002). Same data as holotype except R06-73, F1822. Molt to adult 16-viii-2006. Deposited CAS, CASENT #8414200. Measurements in mm: Body length 35.87, hind femur length 10.40, hind femur width 3.77. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1003) with 4 or 5 inner and 4 outer spines, 2 ventral spurs. Ovipositor Fig. 1004.

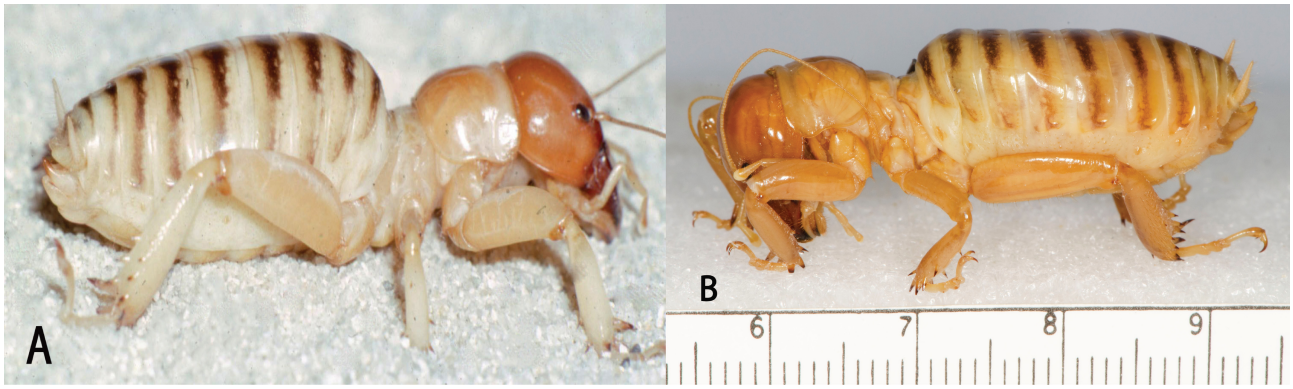


FIGURE 1002. Adult female allotype *A. yubalake.* A. When alive. B. When preserved.



FIGURE 1003. Left rear leg tibia adult female allotype *A. yubalake.* A. Showing 4 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 1004. Ovipositor allotype *A. yubalake.*

Paratypes. ♂134 ♀134. **COLORADO, *Delta Co.,*** Cedaredge, 26685 Cedar Mesa Rd, 38.888101° -107.861000°, 1960m, 2-x-2007 (S07-96) R. Toothaker ♂1. ***Mesa Co.,*** Colorado National Monument, near Visitor's Center, 39.101316° -108.734806°, 1766m, L. Clement & M. Weissmann, 6-iv-7-v-1989 (S89-17) ♂1 ♀1; 10-viii-1989 (S89-61) ♂1 ♀1; 19-ix-1989 (S89-85) ♀2. Glade Park, 310 N. Trail Canyon Dr., 39.023472° -108.778190°, 2091m, all L. Branscom, 23-ix-2004 (S04-130) ♀1; 5-v-2006 (S06-28) ♀1; 2-vii-2006 (S06-63) ♂1 ♀1; 3-iv-17-vi-2007 (S07-7) ♂2; 13-vi-2009 (S09-44) ♀1. Glade Park, 15720 B. South Rd., 39.012279° -108.758583°, 2073m, all D. & A. Brach, 11-xi-2005 (S05-168) ♀1. Grand Junction, 6797', early ix-2003 (S03-103) D. Brach ♂1. Grand Junction, 1879 Broadway, 39.113867° -108.707313°, 1415m, 21-ix-2004 (S04-135) C. Tabor ♂1. ***Moffat Co.,*** Craig, 40.514400° -107.550717°, 1888m, early ix-2003 (S03-133) S. Burns ♂1. Craig, 1255 Lecuyer Dr., 40.522499° -107.534373°, 1940m, 5-iv-2007 (S07-8) G. Rohrich ♂1. Rd 10 off Hwy 318, 14-vii-1999 (S99-68) B. Kondratieff ♂1. **IDAHO, *Ada Co.,*** 10260 Huntwoot Dr, 43.537730° -116.310109°, 837m, 11-v-2009 (S09-13) L. Turner ♀1. ***Bannock Co.,*** Pocatello, 340 S Arthur, 42.862014° -112.450373°, 1362m, early ix-2003 (S03-102) S. Christensen ♂1. Pocatello, 5140 Daisy Lane, 42.813905° -112.422234°, 1504m, S. Fullerton, 27-ix-2006 (S06-116) ♂1; 5-ix-2008 (S08-61) ♂1. Chubbuck, 42.920748° -112.466091°, 1363m, 19-x-2008 (S08-77), McDougal ♀1. ***Twin Falls Co.,*** Kimberly, 42.534222° -114364622°, 1197m, 9-ix-2006 (S06-109) J. Bryant ♂1. 7 m S of Kimberly, 42.445121° -114.395644°, 1253m, 4-ix-2007 (S07-89) D. Thornborrow ♂1. **MONTANA, *Dawson Co.,*** Glendive, 100m, 13-x-2004 (S04-156) L. Boese ♀1. ***Garfield Co.,*** Jordan, 47.321° -106.909°, 795m, October, 2006 (S06-120) C. McKeever ♀1. ***Golden Valley Co.,*** Ryegate, 46.297179° -109.258786°, 1112m, 19-ix-2007 (S07-91) T. Peterson ♂1. ***McCone Co.,*** Fort Peck Reservoir, 48.019198° -106.416924°, 666m, 20-30-vi-1988 (S88-57) J. Shennum ♀1. ***Stillwater Co.,*** Rapelje, Hailstone Wildlife Refuge, 46.02143° -109.17243°, 1221m, 20-ix-2008 (S08-69) J. Barron ♀1. ***Yellowstone Co.,*** Billings, 934 Falls Dr., 45.894459° -108.464819°, 1033m, 4-ix-2009 (S09-150) M. Webb ♂2. Billings, 45.785° -108.501°, 953m, 16-ix-2005 (S05-140) K. Goralczyk ♂1. Laurel, 2300 Indian Gulch Rd, 45.699649° -108.8777147°, 1112m, 7-vii to 24-ix-2008 (S08-55) L. Wolfe ♂2 ♀2. **NEVADA, *Clark Co.,*** Spring Mts, Lee Canyon, Hwy 156 ~8.85m SW Hwy 95, 36.396080° -115.586289°, 1855m, 30-viii-1986 (S86-104) ♂1; 8-vi-1989 (S89-36) ♂1; 21-vii-1990 (S90-65) ♀3; 2-viii-1991 (S91-60) ♀2; 15-viii-1998 (S98-55) ♀3; 5-ix-2006 (S06-105) ♀2. ***Elko Co.,*** Antelope Peak 15 m N Wells, 41.322892° -114.978106°, 2630m, 8-x-1991 (S91-115) N. Dailey-Phelps ♀1. Elko, 366 S. Spring Creek Parkway, 40.749270° -115.589825°, 1667m, all N. Dailey-Phelps, 17-v-1990 (S90-39) ♀1; 24-x-1990 (S90-103) ♀1; 7-x-1992 (S92-130) ♀1; 20-iv-1993 (S93-25) ♂1 ♀1; 26-vi-1993, 1 male for testes; late September, 1993 (S93-78) ♀1; 13-x-1993 (S93-83) ♂1 ♀2. Elko, 229 Brooklawn Dr., 40.749744° -115.586643°, 1661m, 13-ix-2004 (S04-129) C. Pierce ♀1. Spring Creek ~12 m SE Elko, 4-x-2001 (S01-109) J. Motheishead ♀1. 2m NE Carlin, 40.725685° -116.088577°, 1499m, 8-xi-1990 (S90-105) N. Dailey-Phelps ♀2. 16m S Elko, 20-x-1989 (S89-89) N. Dailey-Phelps ♀2. Humboldt National Forest, Lamoille Canyon, Camp Lamoille, 40.658916° -115.438722°, 2170m, 22-viii-1989 (S89-82) SC Williams, RC Bechtel, VF Lee ♀1. ***White Pine Co.,*** Ruth, 39.2779° -114.9938°, 2101m, 11-v-2008 (S08-22) J. Legate ♂3 ♀3. **UTAH, *Beaver Co.,*** Hwy 21 31.5m NW Milford, 38.517507° -113.545177°, 1971m, 24-v-2015 (S15-18) ♂1. ***Carbon Co.,*** Helper, 174 Unitah St, 39.688852° -110.859425°, 1804m, 20-iv-2010 (S10-11) B. Evans ♀1. Price, 39.613879° -110.783798°, 1737m, 4-ix-2007 (S07-88) J. Humes ♂1. ***Garfield Co.,*** Hwy 89 0.6 m S Panguitch, 37.823052° -112.404275°, 2012m, 21-iv-1999 (S99-16) ♂2 ♀1; 19-v-2001 (S01-35) ♀1; 23-iv-2006 (S06-17) ♂1 ♀2. Intersection Hwy 89 & Hwy 20 10 m N Panguitch, 37.965930° -112.413255°, 1976m, 23-iv-2006 (S06-16) ♂2 ♀2. ***Iron Co.,*** Cedar City, 2235 W. Sunnyside Dr., 37.678179° -113.091155°, 1763m, 8-ix-2005 (S05-133) T. Garman ♂1. Cedar City, 19-ix-2007 (S07-92) N. Berti ♂1. Cedar City, 103 S. Marble Canyon Dr., 37.675959° -113.103571°, 1734m, 30-iii-2009 (S09-7) D. & S. Larkin ♂1 ♀1. Cedar City, 2190 W Sunset Pointe Dr, 37.673440° -113.089914°, 1826m, 6-ix-2009 (S09-147) C. Allison ♂1. ***Juab Co.,*** Yuba State Park along Sevier Bridge Reservoir, 22-ix-2001 (S01-106) RW Baumann ♀3; type locality, 23-iv-2006 (S06-15) ♂1 ♀1. Eureka, 1 m E intersection Hwy 36 and Hwy 6, 39.923890° -112.165367°, 1787m, 23-v-2015 (S15-13) ♂1. Little Sahara Recreational Area, White Sands Campground, 39.739265° -112.319461°, 1621m, 6-ix-1999 (S99-104) ♂5. Road between Little Sahara Recreational Area Visitor Center and road to Hwy 6, 39.727461° -112.258569°, 1595m, 6-ix-1999 (S99-105) ♂1. White Sand Dunes ~5 m S, 30 m W Nephi, 39.666344° -112.376602°, 1511m, 4-ix-1985 (S85-103) D. Guiliani ♂1 ♀1. ***Millard Co.,*** Flowell, 39.005344° -112.461247°, 1415m, 18-v-2001 (S01-29) ♂3 ♀3. Hawbush Dunes, Hwy 100 9.6 m N Flowell, 39.126081° -112.409498°, 1424m, 31-vii-1992 (S92-100) ♀1; 12-ix-1998 (S98-89) ♂7 ♀2; 19-iv-1999 (S99-9) ♀2. Oak City Dunes 3 m W Oak City, 39.358108° -112.398430°, 1452m, 6-ix-1999 (S99-107) ♂4. Near Oak City Dunes, Hwy 125 between Hwy 50 and 3 m W Oak City, 39.355714° -112.439340°, 1453m, 6-ix-1999 (S99-106) ♂4. ***Piute Co.,*** Elbow Ranch, W Marysvale,

1889m, 2-x-1999 (S99-161) KL Waters ♀1. ***Salt Lake Co.,*** Riverton, 2827 Victorian Dr., 40.596° -110.074°, 2378m, 11-ix-2006 (S06-107) S. Summers ♀1. ***Sanpete Co.,*** Gunnison, 39-155239° -111.818259°, 1568m, 1-ix-2000 (S00-50) J. Jolley ♂1. ***Sevier Co.,*** Annabella, 38.708621° -112.059871°, 1616m, 12-ix-2000 (S00-52) K. Orten ♀1. Annabella, 25-29-ix-2000 (S00-57) RG Call ♂5 ♀3. Heppler's Ponds, near Glenwood, 38.739842° -112.031453°, 1608m, RG Call, 6-v-1999 (S99-27) ♀2; 10-12-v-1999 (S99-28, S99-29, S99-30) ♂2 ♀3; 20-25-ix-2000 (S00-56) ♂2 ♀2. Austin, 28-ix-2000 (S00-63) KC Cutler ♂1. Northern Richfield, 38.784649° -112.083906°, 1654m, 25-ix-2000 (S00-58) KE Dart ♀1. Richfield, September, 1999 (S99-150) RG Call ♂2 ♀1; 1-ix-2000 (S00-52) RG Call ♀1. Sigurd, 38.840484° -111.967767°, 1592m, 4-ix-2000 (S00-49) ML Madsen ♂1. ***Tooele Co.,*** Dugway Proving Ground, all R. Delph, 40.4102° -113.0921°, 1316m 4-vii-2013 (S13-69) ♂2 ♀4; 6-vii-2013 (S13-70) ♂2; 40.2204° -113.0144°, 1378m, 10-vii-2013 (S13-71) ♀1; 40.3368° -113.0879°, 1312m, 11-vii-2013 (S13-72) ♂2 ♀1; 40.2410° -112.8493°, 1490m, 11-vii-2013 (S13-73) ♂1 ♀4; 40.2738° -112.9359, 1488m, 11-vii-2013 (S13-74) ♂4 ♀8; various dune sites, 21-29-v-2014 (S14-15) ♂6 ♀2. Johnson Pass, Hwy 199 at mile post 15.2, 40.341361° -112.567258°, 1936m, 9-ix-2004 (S04-105) ♂1 ♀1. ***Utah Co.,*** near Utah Lake, 1220m, 18-ix-1989 (S89-84) RC Smith ♀1. Spanish Fork, 22-ix-1994, CM Acord ♀1. **WYOMING, *Fremont Co.,*** Split Rock Historic Area, off Hwy 287, 42.453600° -107.545750°, 1920m, 17-vii-2004 (S04-82) ♂17 ♀15. Lander, Squaw Creek Rd, 42.819° -108.779° 1699m, 20-ix-1999 (S99-148) J. Freilich ♂1. Riverton, 931 Deerfield Dr, 43.019681° -108.459055°, 1530m, 12-ix-2001 (S01-102) J. Sikkink ♀1. Riverton, 1-x-2001 (S01-108) F. Finch ♀1. ***Hot Springs Co.,*** Thermopolis, 410 Rimrock Dr, 43.598107° -108.224596°, 1412m, 2-ix-2005 (S05-132) E. Finch ♂1. Thermopolis, 30-ix-2010 (S10-74) J. Ginter ♂1. ***Lincoln Co.,*** Elkol, 41.723837° -110.612397°, 2110m, 19-viii-1986 (S86-106) M. Mesch ♂1 ♀2. Kemmerer, 41.792447° -110.537669°, 2117m, all R. Davis 23-x-2000 (S00-65) ♀2; 5-v-2001 (S01-27) ♂1; 16-v-2002 (S02-27) ♂4 ♀7. ***Park Co.,*** Cody, 44.5263° -109.0565°, 1527m, 17-x-2009 (S09-157) C. Freeman ♀1. ***Platte Co.,*** Guernsey, Rd 270 from intersection Hwy 26 to 4 m N Hwy 26, 42.270488° -104.708623°, 1358m, 31-viii-1989 (S89-78) ♂4 ♀1; 28-vii-1997 (S97-82) ♀1; 12-ix-1999 (S99-139) ♂1. ***Uinta Co.,*** Evanston, 136 Porter Rd, 41.265514° -110.987297°, 2076m, 3-ix-2007 (S07-84) C. Gillette ♂1. ***Washakie Co.,*** Worland, 1219 Crest Way, 44.021576° -107.950261°, 1240m, late August, 2009 (S09-146) D. Beckstead ♂1. Worland, both D. Hunter, 696 W River Rd, 44.080862° -107.958020°, 1244m, 11-ix-2006 (S06-115) ♂1; 2-ix-2007 (S07-87) ♂1.

Probable placement. **IDAHO, *Owyhee Co.,*** near E rim Big Jacks Creek, ~3 m N of confluence of Wickahoney Creek, 42.612688° -115.997260°, 1272m, 27-ix-1992 (S92-128) G. Stephens ♀2. 1 km N Bruneau, 42.889226° -115.789139°, 834m, 26-x-2000 (S00-69) W. & J. Peterson ♀2. **NEBRASKA,** specimens from ***Boxbutte and Sioux County*** listed in Hebard (1916). **NEVADA, *Clark Co.,*** Virgin Mts 2.2m NE Virgin Peak, 6960' 21-vi-1987 (S87-85) R. Macey ♀1. Virgin Mts SE ¼ NW ¼ Sec 19, T 15 S.R.17E, 6560' 20-vi-1987 (S87-86) R. Macey ♀1. Virgin Mts ~2.5 m NE Virgin Peak, 36.597612° -114.095691°, 2047m, 7-vi-1989 (S89-31) ♂3. No DNA available for further investigation. **NORTH DAKOTA, *McKenzie Co.,*** Cartwright, specimen at North Dakota State University, according to EU Balsbaugh (pers comm to DBW, December, 1987). ***Slope Co.,*** Marmarth [46.295° -103.920°, 825m], 12-ix-1920, Chas. A. Kinnie ♂1. Specimen originally at ANSP, and apparently loaned to E. R. Tinkham. This large adult male, currently at CAS, where Tinkham material deposited after his death. Hubbell identified this specimen (cited by Hebard 1936) as *A. fuscus*. **SOUTH DAKOTA,** from dot in Vickery & Kevan (1983) distribution map.

Drum. Calling drum rate similar in both sexes except series longer in females. **Male:** Holotype R07-24 (Fig. 1005) with 12 drums over 7.8s (1.5 drums/s) at 21.5°C. One male (Fig. 1006, R01-40), out of 5 recorded from Annabella (S00-57), with an apparent vibration just before his calling drum of 13 drums over 7.6s (1.7 drums/s) at 20.5°C. As this vibration was not witnessed, we do not know which body structure was being moved but the rate was too fast for a sex clarification drum, which always involves the abdomen striking the substrate and occurs at a rate of 8 to12 times/s. We wonder if these movements are similar to those described for *Stenopelmatus sartorianus* in Weissman *et al.* (2021, p. 93 and 94)? **Female:** Allotype R06-73 (Fig. 1007) with 63 drums over 49.4s (1.3 drums/s) at 21.5°C.

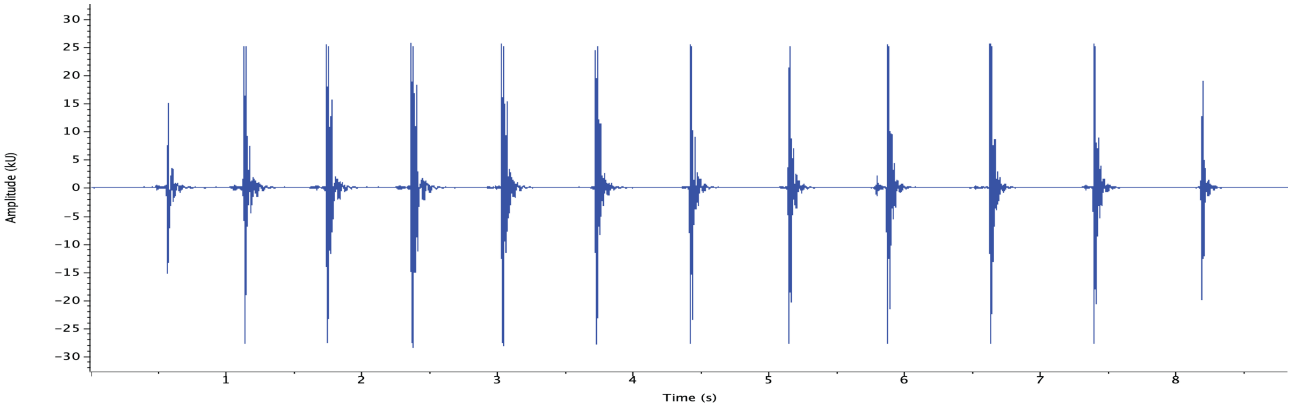


FIGURE 1005. Calling drum (R07-24) adult male holotype *A. yubalake.*

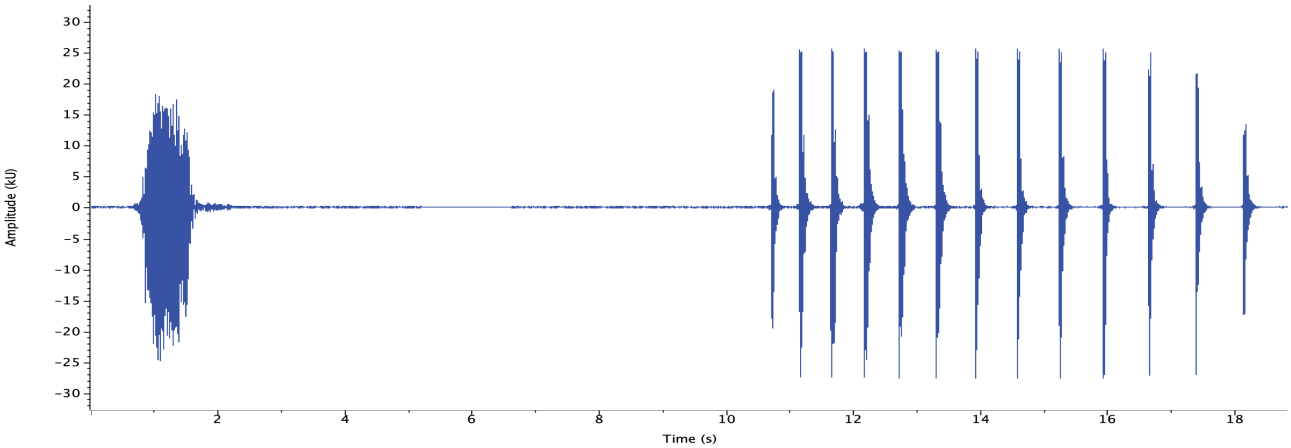


FIGURE 1006. Apparent vibration, on left side of oscillogram, followed by calling drum (R01-40) in adult male *A. yubalake* from Annabella (S00-57).

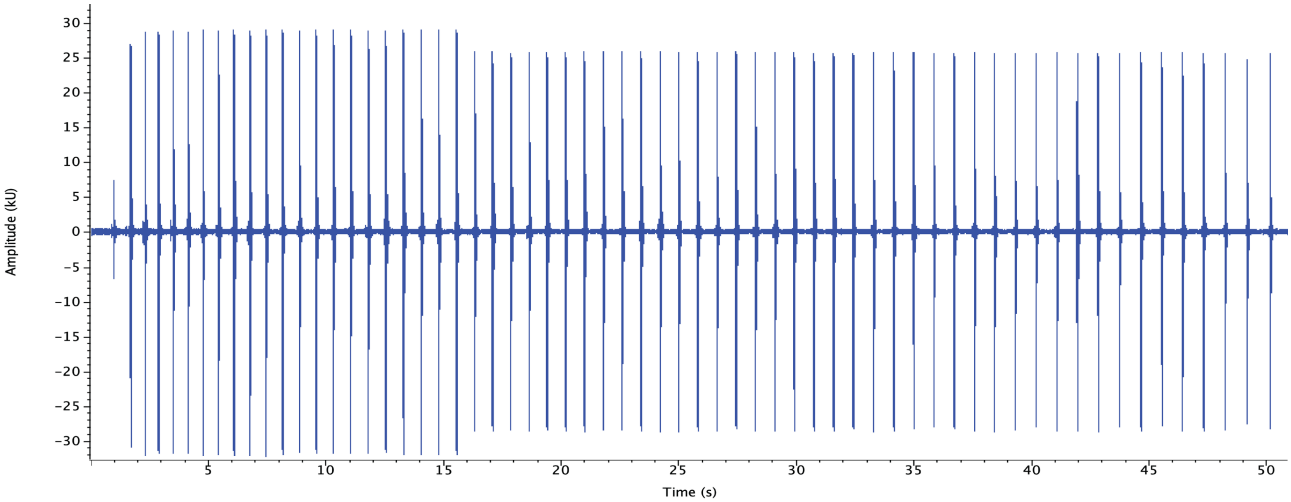


FIGURE 1007. Calling drum (R06-73) adult female allotype *A. yubalake.*

Derivation of name. Named after the type locality. According to Park information, the Yuba Dam was built from 1902 to 1917. Men working on the Dam called it the U. B. Dam: they were dammed if they worked and dammed if they didn't. The phonetic sound of the reservoir's name was eventually spelled Yuba. In 1969, the area became a Utah state park.

Habitat. At the type locality (S06-15), specimens collected from under large cow pies, on wet sand, on 23-iv-2006, 3–5 cm below the surface. A long oatmeal trail placed here on 10-ix-2004 (S04-114) attracted only 1 very small JC with the trail experiencing extensive damage from kangaroo rats by our second walk at 20:45. Surprisingly, 7 JCs (3 adult females and 4 nymphs) were found under cow pies on 22-ix-2001 (S01-106) despite warm daytime temperatures and dry sand. At Dugway Proving Ground, individuals collected alive in pitfall traps, on dunes, with sagebrush, cheatgrass, in native *Sporobolus cryptandrus* grassland. At Lee Canyon, habitat is mixed ponderosa pine, *Cercocarpus, Ribes*, sagebrush, rabbitbrush.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle. At Split Rock, WY (S04-82), 3 kg of oatmeal were placed, in late afternoon, on sandy areas and small dunes adjacent to the parking area. By 21:30, while still somewhat light, the oatmeal trail was populated with aggressive JCs. All 35 late instars individuals collected from Split Rock, on 17-vii-2004, molted to adult between 15–26-viii-2004, indicating synchronization and absence of protandry. Fortunately (for collecting purposes), we saw almost no kangaroo rat activity there.

Variation. Since we have a good sample size of adults from several localities, we present a summary of morphological variation from 7 localities. For 8 individuals from the type locality of Yuba Lake (***Juab Co., Utah***), all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 4 and 5 had 5 inner **rear** leg tibial spines, while 4 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 37 individuals from Dugway (***Tooele Co., Utah***), 1 had 2, 35 had 3, and 1 had 4 ventral **fore** leg tibial spurs; all 37 with 8 **middle** leg tibial calcars, and 1 had 1 while 36 had 2 ventral spurs; 4 had 4, 31 had 5 and 2 had 6 inner **rear** leg tibial spines; while 25 had 3 and 12 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 18 individuals from Flowell and nearby Hawbush Dunes (***Millard Co., Utah***), all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 18 had 5 inner **rear** leg tibial spines, and 14 had 3 and 4 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 11 individuals from Panguitch (***Garfield Co., Utah***), all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 9 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all 11 had 5 inner **rear** leg tibial spines, while 9 had 3 and 2 had 4 outer **rear** leg tibial spines, and all with 2 ventral spurs. For 16 individuals from ***Sevier Co., Utah***, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 14 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 16 had 5 inner **rear** leg tibial spines, while 7 had 3 and 9 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 32 individuals from Split Rock (***Fremont Co., Wyoming***), all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, while 19 had 3 and 13 had 4 outer **rear** leg tibial spines, and all 32 with 2 ventral spurs. For 13 individuals from Kemmerer (***Lincoln Co., Wyoming***), all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 11 had 5 inner **rear** leg tibial spines, and 5 had 3 while 7 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Adults from Dugway and Cedar City larger than those from elsewhere.

DNA. Fig. 942, p. 525. F0678 (S97-82, Platte Co., WY); F0746 & F0748 (S98-55, Lee Canyon, Clark Co, NV); F0750 & F0752 (both S98-89, Hawbush Dunes, Millard Co., UT); F0966 (S99-68, Moffat Co., CO); F0972 (S99-104, Little Sahara Dunes, Juab Co., UT); F0977 (S99-107, Oak City Dunes, Millard Co., UT); F1075 (S99-16, Panguitch, Garfield Co., UT); F1079 (S99-161, Piute Co., UT); F1146 (S01-27, Lincoln Co., WY); F1154 (S01-29, Flowell, Millard Co., UT); F1202 (S00-57, Annabella, Sevier Co., UT); F1231 (type locality S01-106, Yuba Lake, Juab Co., UT); F1361 (S03-102, Bannock Co., ID); F1371 (S03-133, Moffat Co., CO); F1425 (Split Rock, Fremont Co., WY); F1465 (S04-105, Johnson Pass, Tooele Co., UT); F1467 (S04-129, Elko, Elko Co, UT); F1469 (S04-135, Mesa Co., CO); F1652 (S05-132, Hot Springs Co., WY); F1653 (S05-133, Cedar City, Iron Co., UT); F1776 (S05-168, Mesa Co., CO); F1835 & F1836 (both S06-105, Lee Canyon, Clark Co, NV); F1837 (S06-107, Riverton, Salt Lake Co., UT); F1838 (S06-109, Twin Falls Co., ID); F1846 (S06-120, Garfield Co., MT); F1949 (S07-8, Moffat Co., CO); F1959 (S07-88, Price, Carbon Co., UT); F1964 (S07-91, Golden Valley Co., MT); F2021 & F2045 (S08-22, Ruth, White Pine Co, NV); F2051 (S08-55, Yellowstone Co., MT); F2148 & F2149 (S09-150, Yellowstone Co., MT); F2189 (S10-11, Helper, Carbon Co., UT); F2344 (S13-74, Dugway no stripes, Tooele Co., UT); F2345 (S13-73, Dugway striped, Tooele Co., UT), F2356 (S13-70, Dugway striped, Tooele Co., UT), and F2357 (S13-71, Dugway no stripes, Tooele Co., UT); F2444 (S15-18, Beaver Co., UT) all recovered together in Group 17 Mono Lake, a large, poorly supported clade that includes other slow drumming, 2n♂=25 taxa: *A. cathedralgorge*, *A. dogtown, A. kokoweef, A. monolake, A. piute*, *A. reno,* and *A. westgardpass.*

Karyotype. 2n♂=25. T90-5 (Fig. 1008, S89-85, Colorado National Monument, Mesa Co., CO); T90-18 (Fig. 1009, S90-65, Lee Canyon, Clark Co., NV); T92-63 (Fig. 1010, S92-130, Elko, Elko Co., NV); T99-21 (Fig. 1011, S99-9, Hawbush Dunes, Millard Co., UT); T01-8 (Fig. 1012, S00-57, Annabella, Sevier Co., UT); T01-10 (Fig.

1013), S00-56, Hepplers Ponds, Sevier Co., UT); T01-12 (Fig. 1014, S01-29, Flowell, Millard Co., UT); T02-3 (Fig. 1015) and T02-4 (Fig. 1016), both S02-27, Wyoming, Lincoln Co.; T04-22 (Fig. 1017, S04-82, Split Rock, Fremont Co., WY); T07-7 (Fig. 1018, S06-15, type locality Yuba Lake); T08-7 (no photo, S08-22, Ruth, White Pine Co., NV); T14-2 (Fig. 1019, S13-69, Dugway unstriped, Tooele Co., UT); T14-3 (Fig. 1020, S13-74, Dugway striped, Tooele Co., UT); T14-6 (Fig. 1021, S14-15, Dugway unstriped, Tooele Co., UT); T14-7 (Fig. 1022, S14-15, Dugway striped, Tooele Co., UT): 16 males checked and all with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

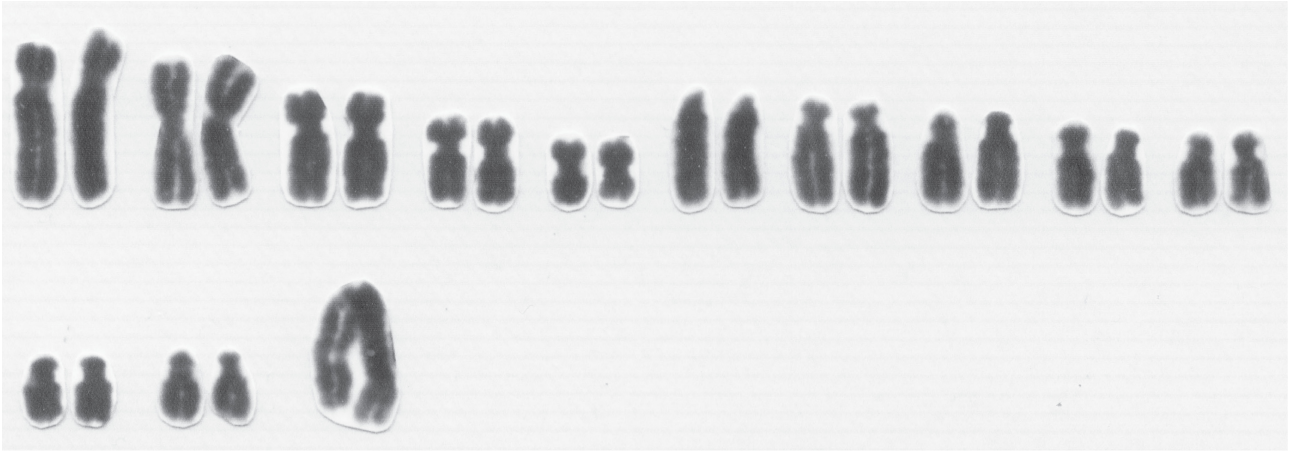


FIGURE 1008. Idiogram T90-5 *A. yubalake* (S89-85).

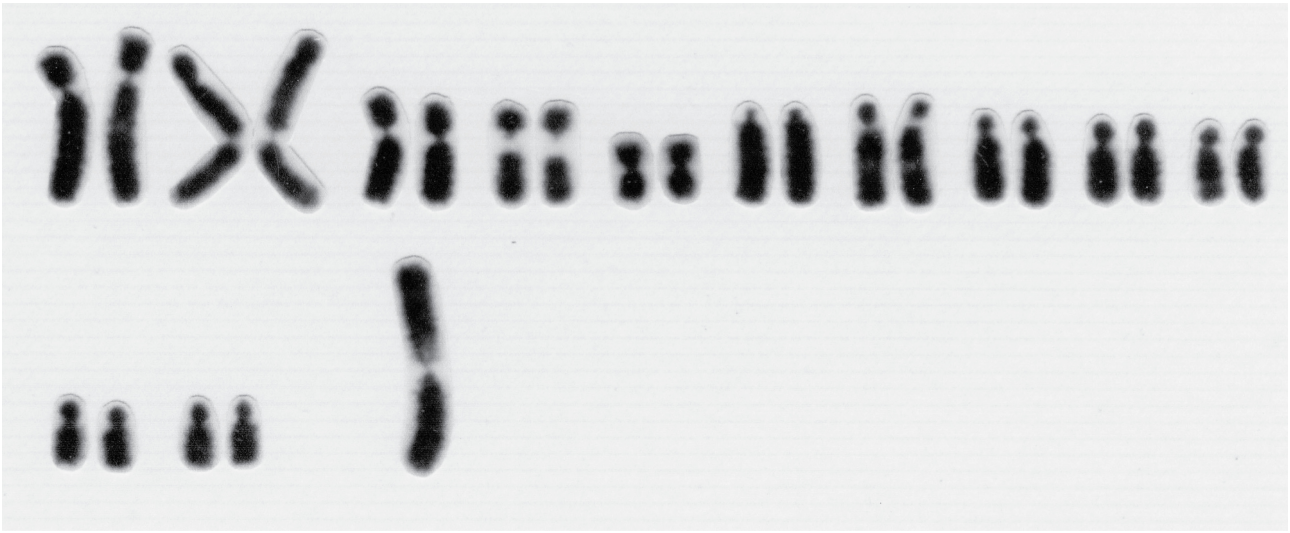


FIGURE 1009. Idiogram T90-18 *A. yubalake* (S90-65).

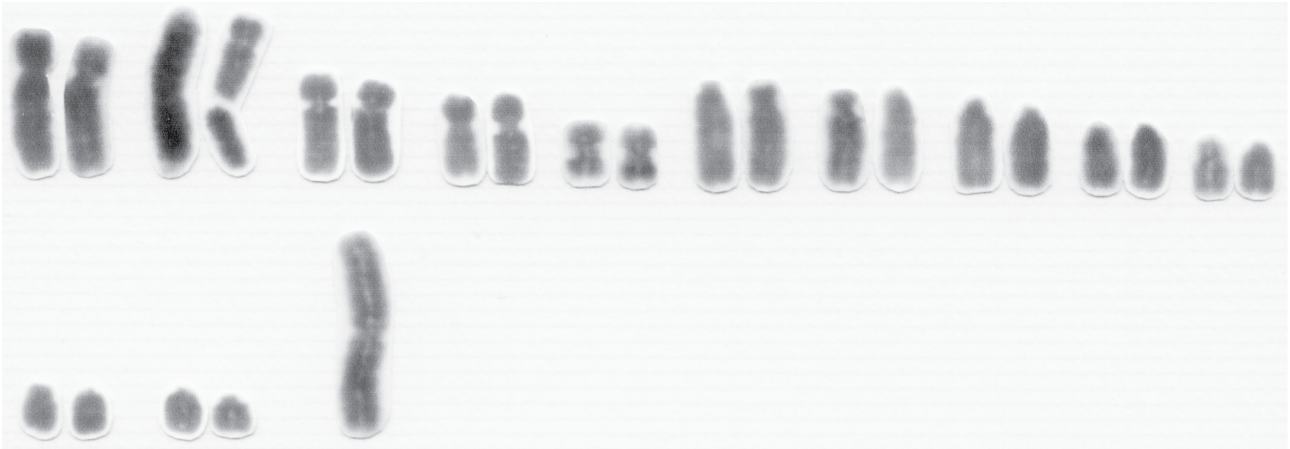


FIGURE 1010. Idiogram T92-63 *A. yubalake* (S92-130).

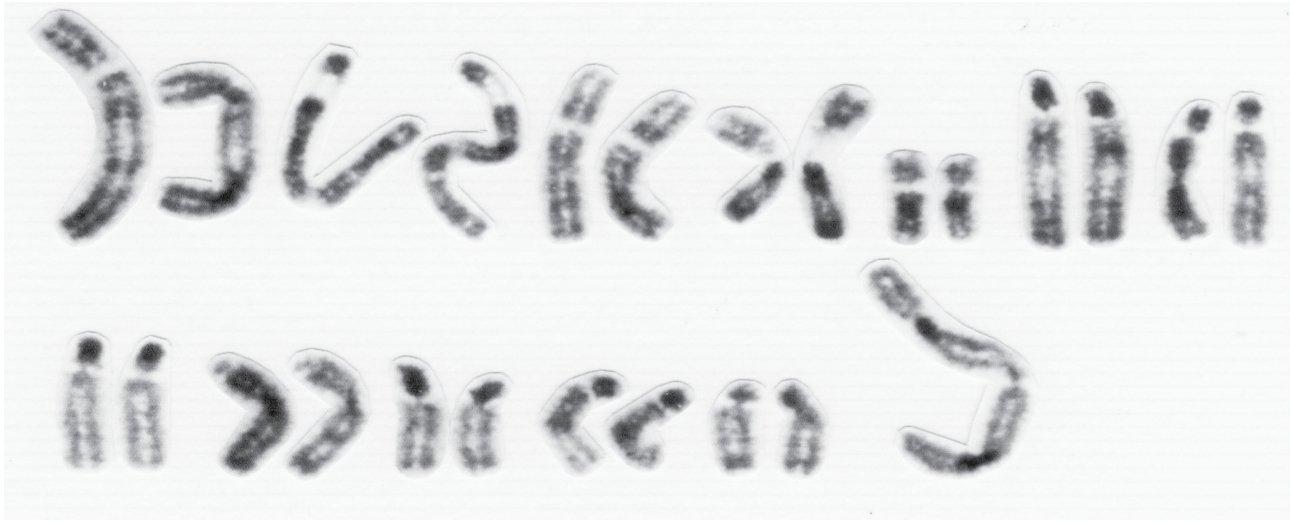


FIGURE 1011. Idiogram T99-21 *A. yubalake* (S99-9).

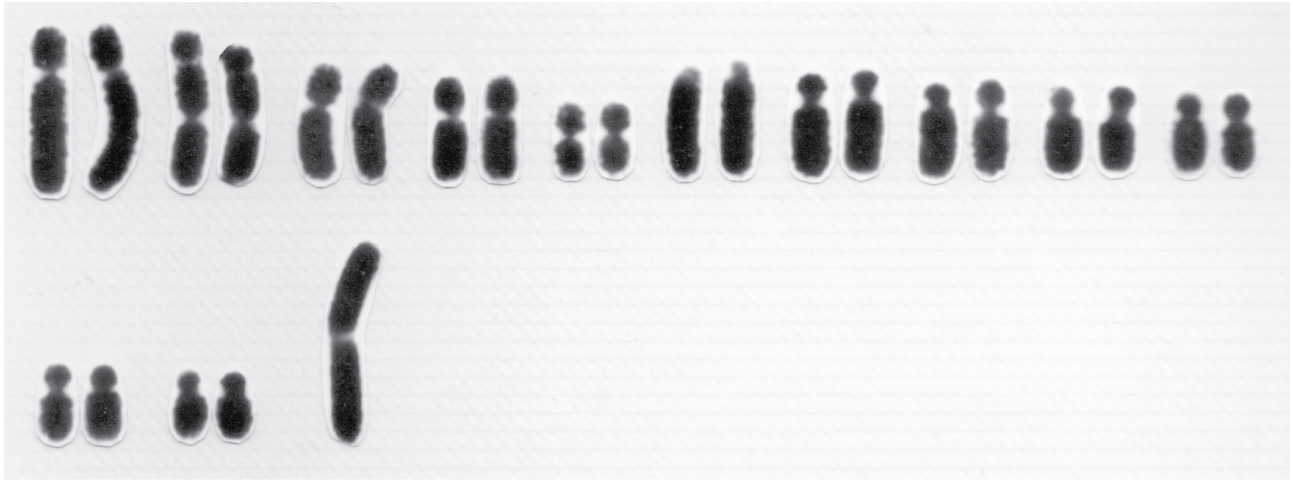


FIGURE 1012. Idiogram T01-8 *A. yubalake* (S00-57).



FIGURE 1013. Idiogram T01-10 *A. yubalake* (S00-57).

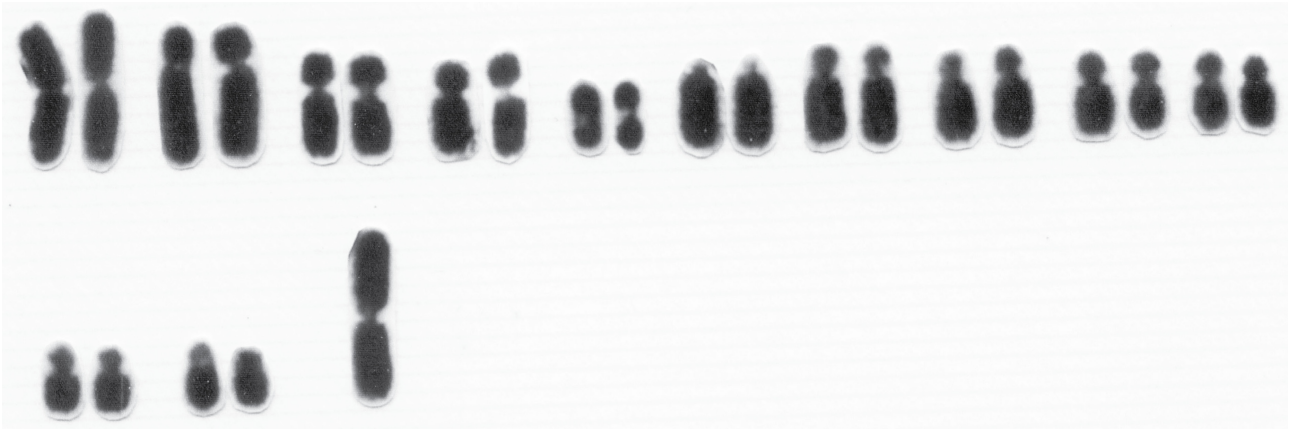


FIGURE 1014. Idiogram T01-12 *A. yubalake* (S01-29).

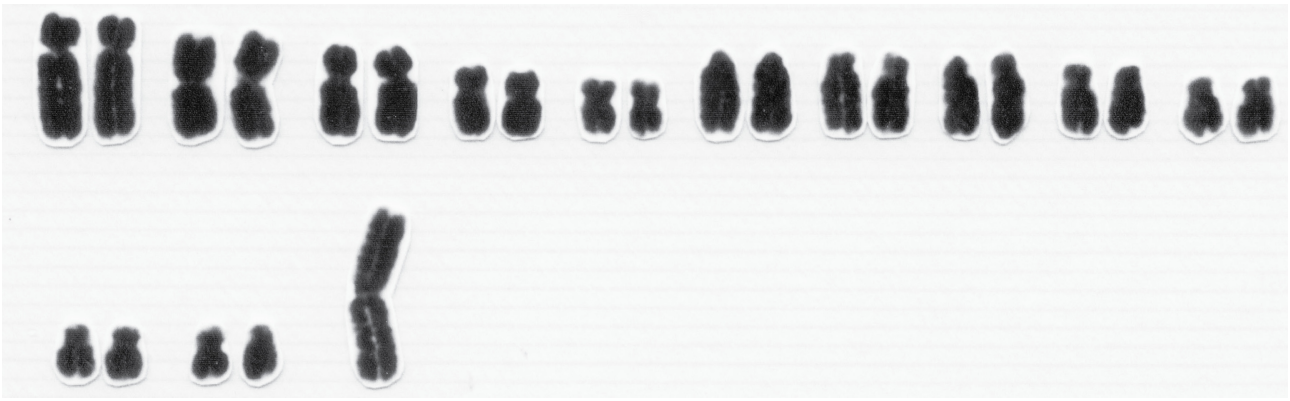


FIGURE 1015. Idiogram T02-3 *A. yubalake* (S02-27).



FIGURE 1016. Idiogram T02-4 *A. yubalake* (S02-27).

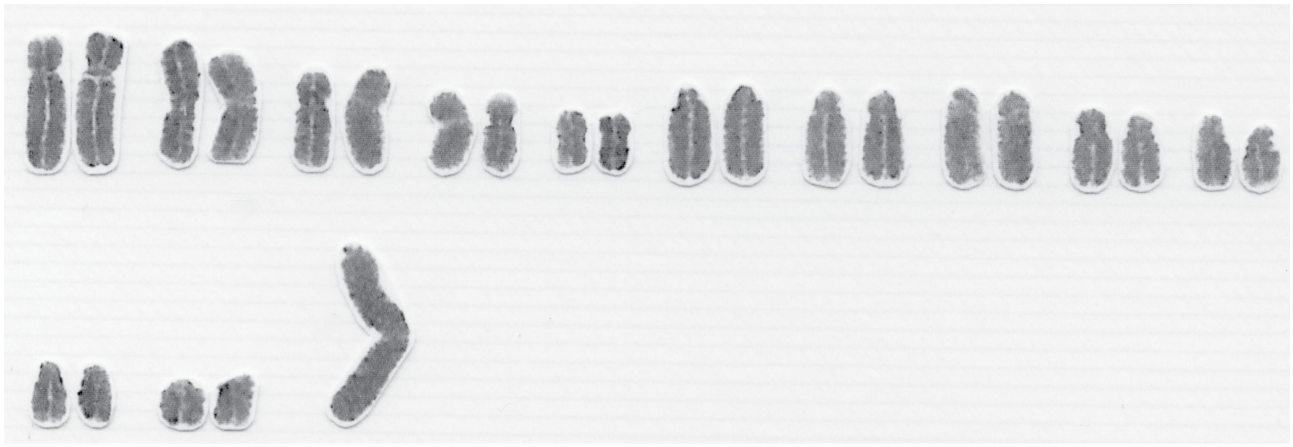


FIGURE 1017. Idiogram T04-22 *A. yubalake* (S04-82).

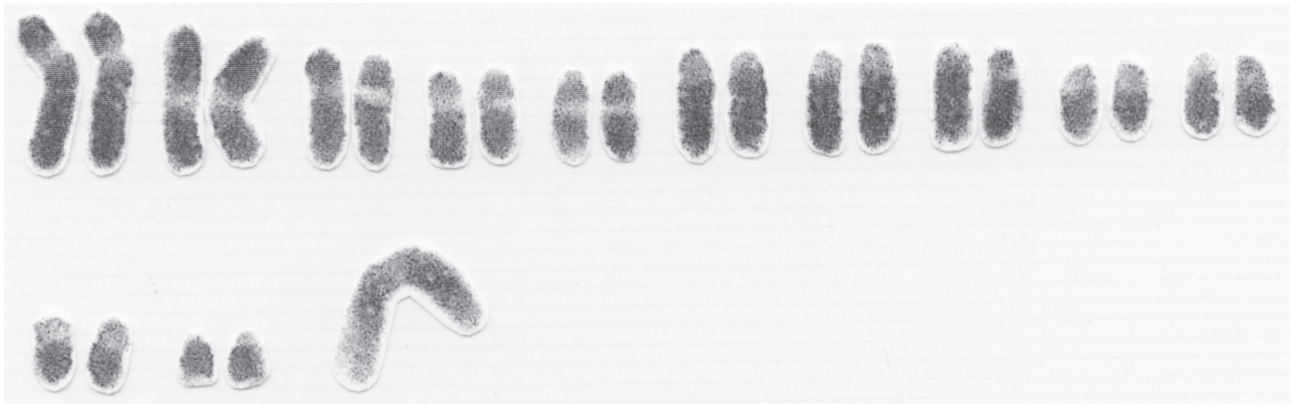


FIGURE 1018. Idiogram T07-7 *A. yubalake* (S06-15).

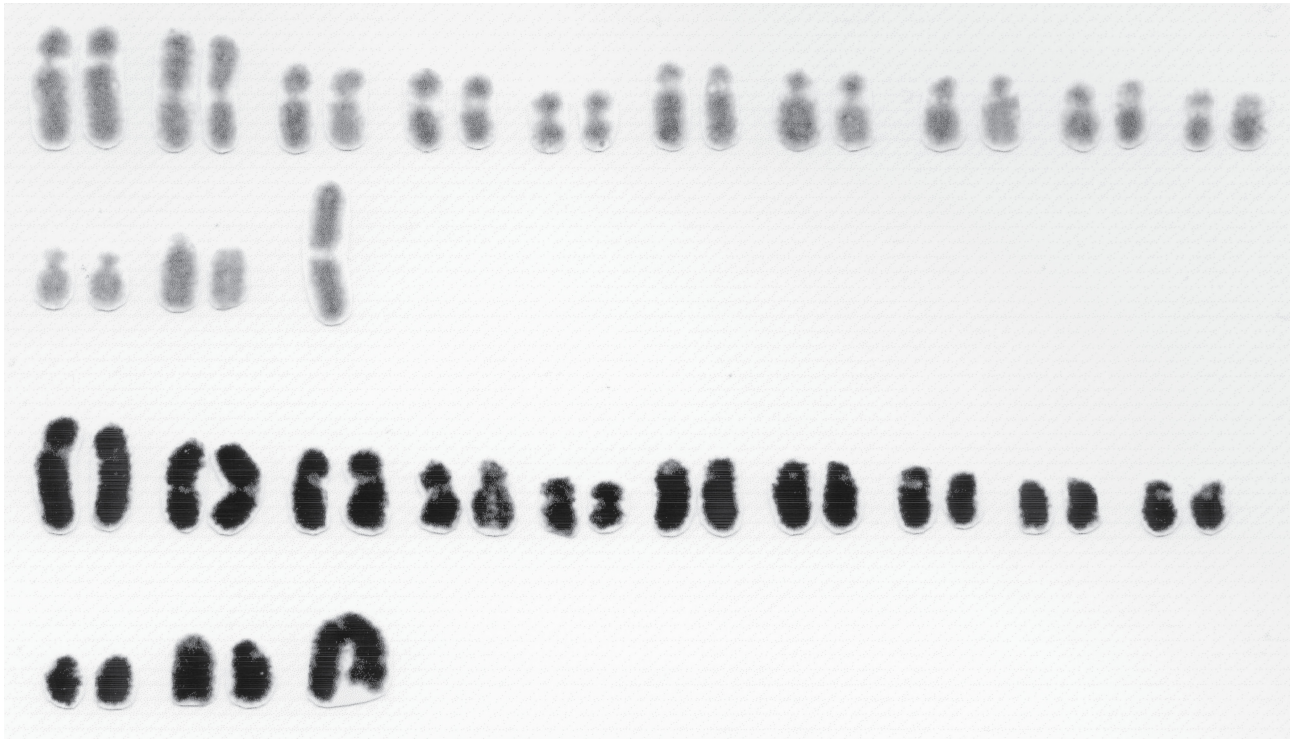


FIGURE 1019. Idiograms T14-2, unstriped *A. yubalake* (S13-69).

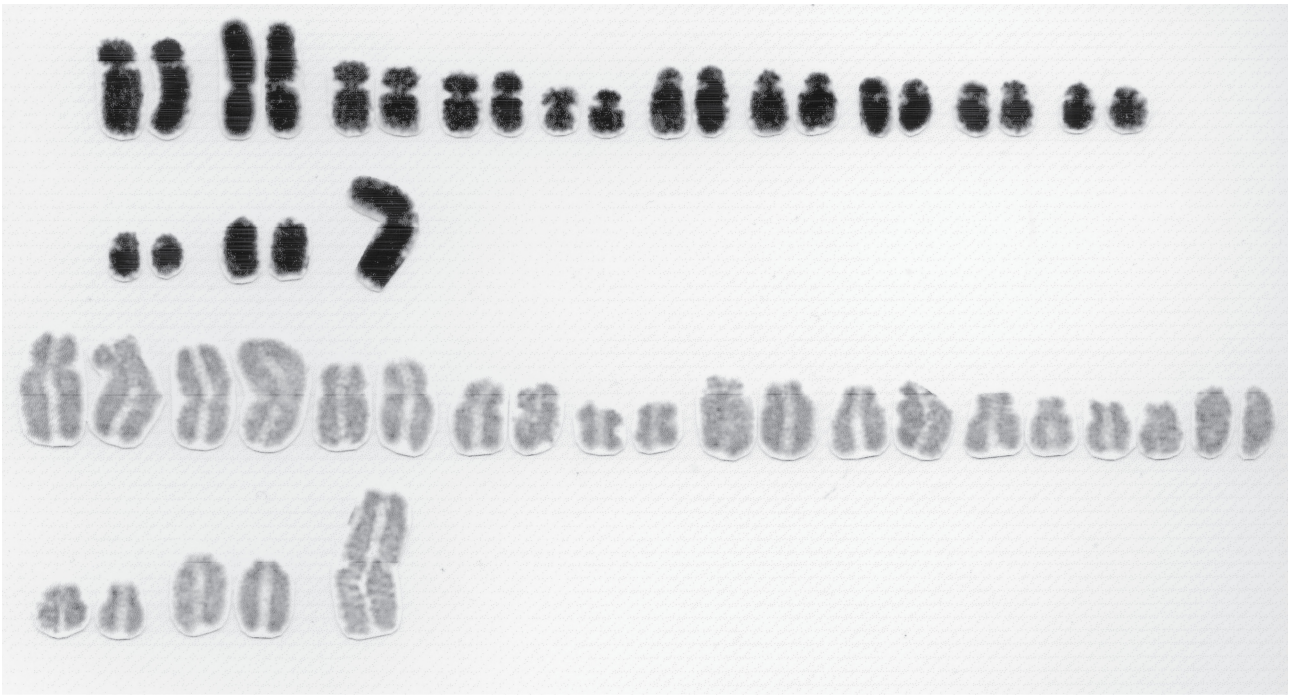


FIGURE 1020. Idiograms T14-3, striped *A. yubalake* (S13-74).



FIGURE 1021. Idiogram T14-6, unstriped *A. yubalake* (S14-15).

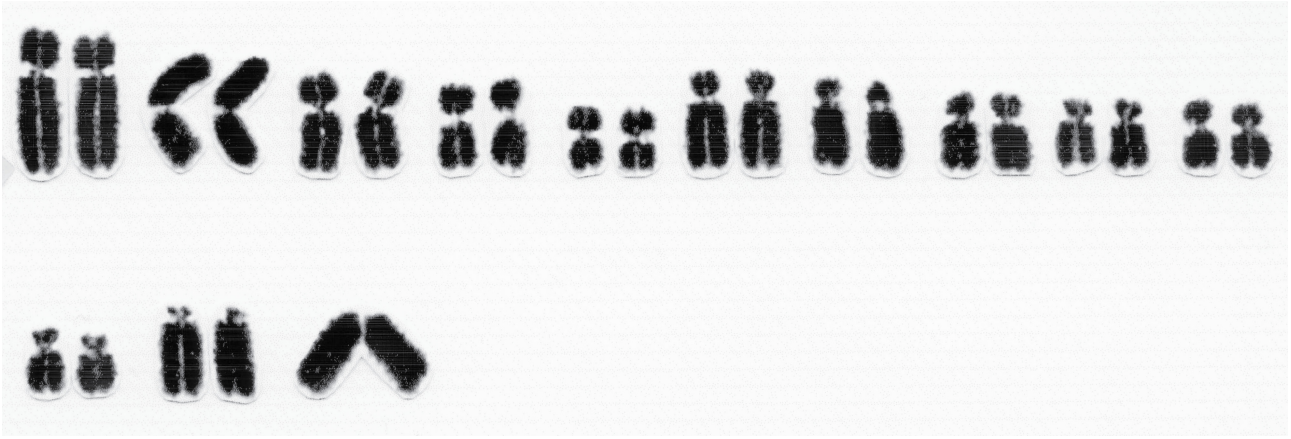


FIGURE 1022. Idiogram T14-7 striped *A. yubalake* (S14-15).

Discussion. Hebard (1916) recorded 3 JC localities for western Nebraska, which could be this species or *A. mescaleroensis*; but specimens not examined.

At Hawbush Dunes (Fig. 998, S98-89), Dugway Proving Ground (Fig. 999), Oak City Dunes, and Little Sahara Dunes, adults were variable for general abdominal color and intensity of black abdominal bands. The identical calling drums, karyotype, and DNA in these different morphs, convinces us that one color-variable species is involved. In fact, we were able to easily mate a striped and unstriped morph from Dugway (S14-15).

Although more adults were collected from Dugway Proving Ground and several other localities, the general public does not have access to Dugway, so we decided that Yuba Lake would be a better type locality.

At Dugway, Robert Delph found (pers comm to DBW, 29-ix-2023) a situation similar to what is found with *A. mescaleroensis* at Mescalero Dunes (see p. 512): At Mescalero Dunes, dark colored individuals were associated with dense vegetation cover; and light-colored individuals are associate with more open, poorly vegetated dunes. At Dugway, Delph reports that unstriped JCs occur more often in open dune areas, and that striped JCs are more common in vegetated areas with juniper and woody debris, but that both forms have been collected in the same habitat.

Clark & Tinkham (1977) report *A. yubalake* (called *A. fuscus*) living with the harvester ant *Pogonomyrmex salinus* Olsen [= *P. owyheei* Cole] in northern Nevada; similar to that reported (p. 327) for *A. idaho* from Circular Butte, Idaho.

(CLADE 11) Composed of 9 California groups all located west of the Sierras

Group 18, Muwu Group (Fig. 1023)

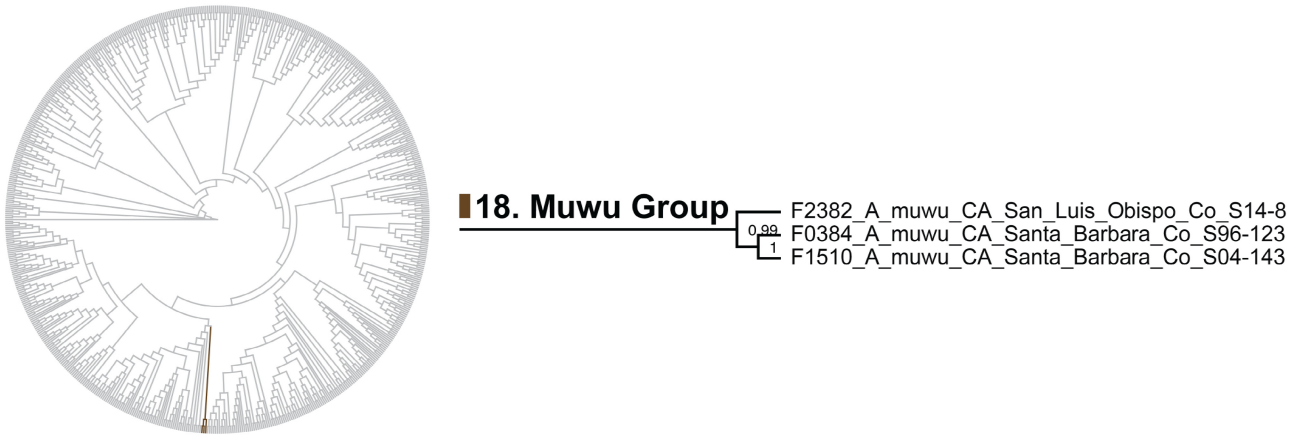


FIGURE 1023. ASTRAL tree for Muwu Group.

This Group contains one coastal, sand specialist species with 2n♂=23.

SPECIES WRITE UP: *A. muwu* (p. 567).

***Ammopelmatus muwu* Rentz & Weissman**
Point Conception Jerusalem Cricket.
Figs 1024–1036, Tables 8, 11, 17

1981. *Ammopelmatus muwu.* University of California Publications, Entomology, 94, 1–240. Holotype male (in alcohol): California, *Santa Barbara Co*., Point Conception, Bixby Ranch, dunes near lighthouse, 34.453306° -120.468022°, 38m. Deposited CAS, Entomology type #12428.

Distribution. (Fig. 1024). Coastal California sand dunes from Point Conception, Santa Barbara Co., north to Morro Strand State Park, San Luis Obispo Co. Farthest known inland location is S04-143, some 9.5 km from the ocean on Vandenberg Air Force Base.

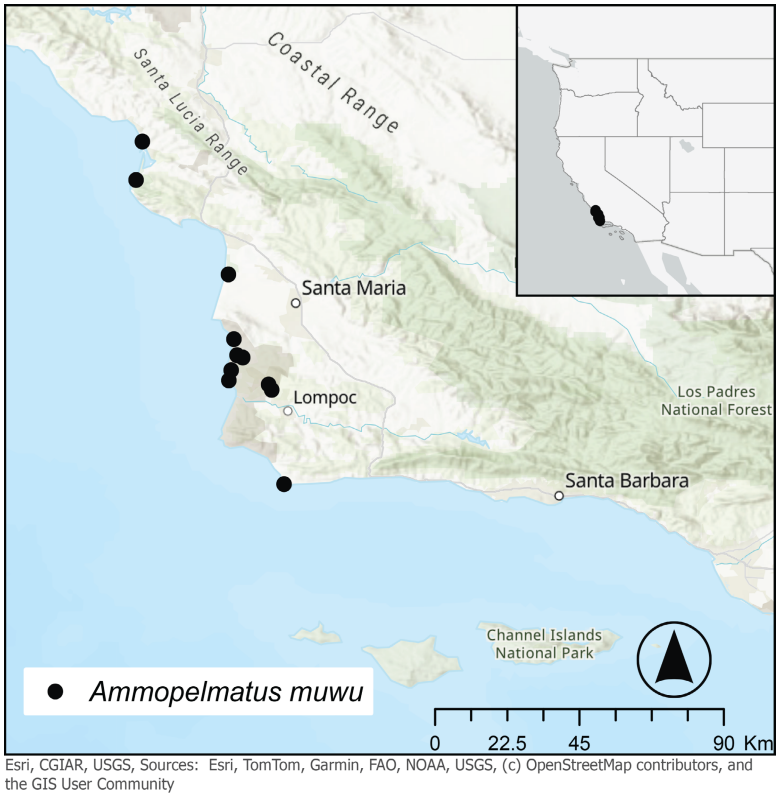


FIGURE 1024. Distribution of *A. muwu.*

Recognition characters. Color generally light, but somewhat variable (Fig. 1025). Small to large (Fig. 1026, coastal sand dune obligate with usually 1 fore leg tibial spur; 7 middle leg tibial calcars; and 1 inner and 2 or 3 outer rear leg tibial spines (Fig. 1027) combined with 1 rear leg tibial spur. Drum rate medium slow (2.8 to 3.3 drums/s), 2n♂=23. Originally described in *Ammopelmatus* because of scoop-like rear leg tibial calcars (Fig. 1027), in agreement with the type species *A. kelsoensis*. At type locality, sympatric with *A. abelai*, from which it can be separated by color, rear leg calcars and spines, drum, and DNA.

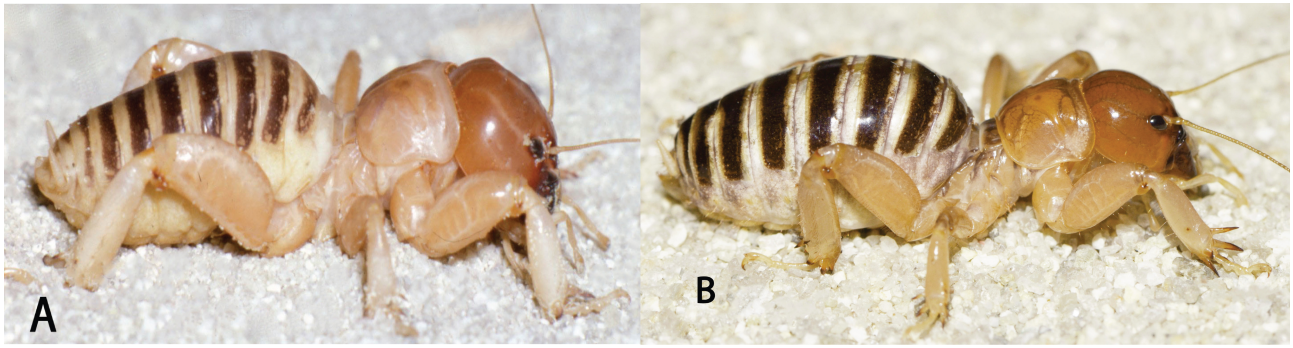


FIGURE 1025. Color variation in live *A. muwu.* A. Adult male from Oso Flaco Lake (S85-34, R85-41). B. Adult female from Montaña de Oro (S14-8, F2382).



FIGURE 1026. Preserved topotypic (S96-123, R98-77) adult male *A. muwu,* from Pt Conception.

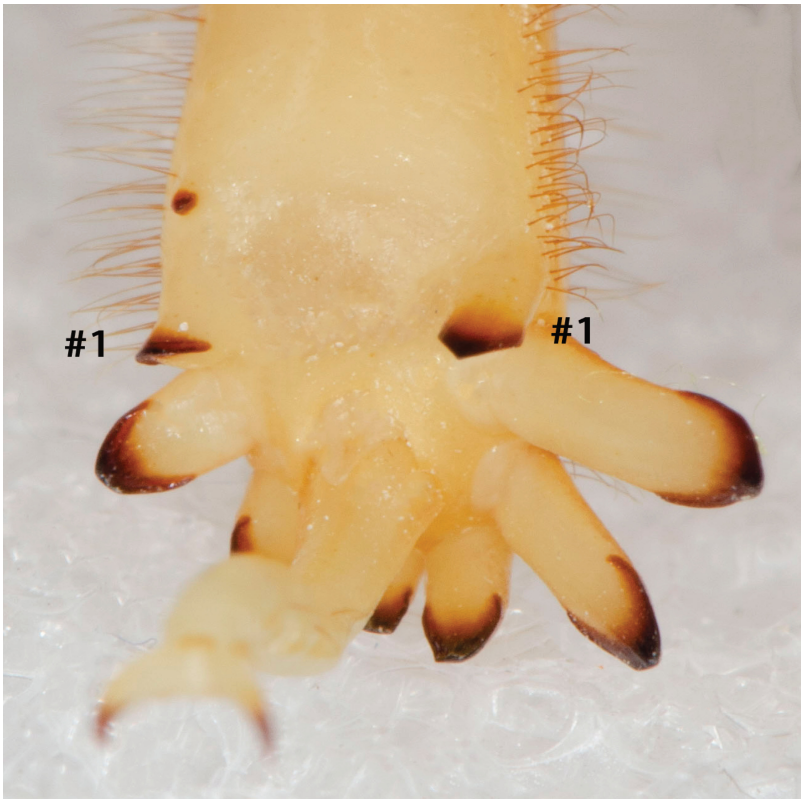


FIGURE 1027. Left leg hind tibial calcars, in topotypic (S96-123) male, showing scoop-shaped morphology. Also note how both labeled inner and outer tibial spines #1 are posteriorly flattened, as seen in other sand dune obligates like *A. mescaleroensis*, *A. clarki, A. kelsoensis,* and *A. joshuatree,* apparently to provide maximum propulsion through the sand.

Female. Overall similar to male (Fig. 1028). Hind leg tibia (Fig. 1029) with 2 outer and 1 inner spine; calcars scoop-like. Ovipositor Fig. 1030.

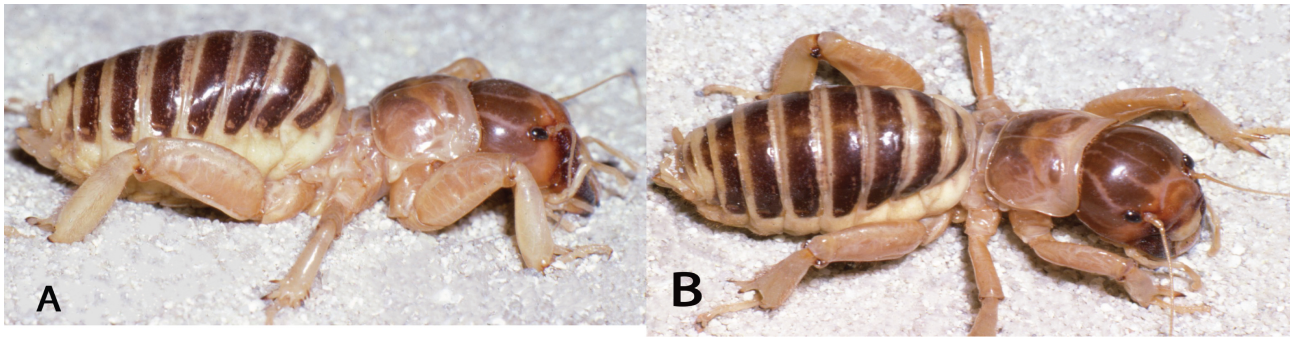


FIGURE 1028. Two views, live adult female *A. muwu* from Oso Flaco Lake (S85-34, R86-34).



FIGURE 1029. Left rear leg tibia adult female Oso Flaco Lake (S85-34, R86-34). A. Showing 2 outer and 1 inner spine. B. Showing shape of calcars.



FIGURE 1030. Ovipositor *A. muwu* from Oso Flaco Lake (S85-34, R86-34).

Drum. Calling drum similar in both adult sexes, but longer in females. Adult male (S05-3, R06-82) had 37 single drums (Fig. 1031) in 11.1s (3.3 drums/s) at 20.5°C. Adult female (S05-3, R06-96) had 115 single drums (Fig. 1032) in 41.3s (2.8 drums/s) at 19.5°C. One adult male (S85-34, R85-45) performed a sex clarification drum. Juveniles of *A. muwu* also drum, at the same rate as the adult calling drum, an occurrence discussed in Weissman (2001b), and whose function is unknown.

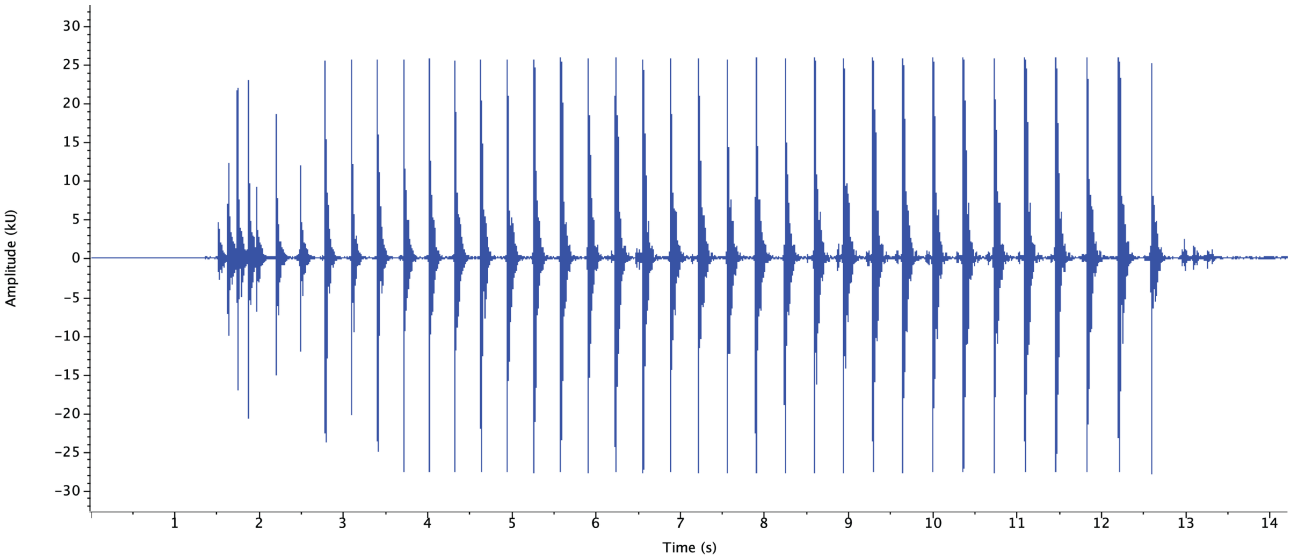


FIGURE 1031. Calling drum (R06-82) adult male *A. muwu* from Vandenberg Air Force Base (S05-3).

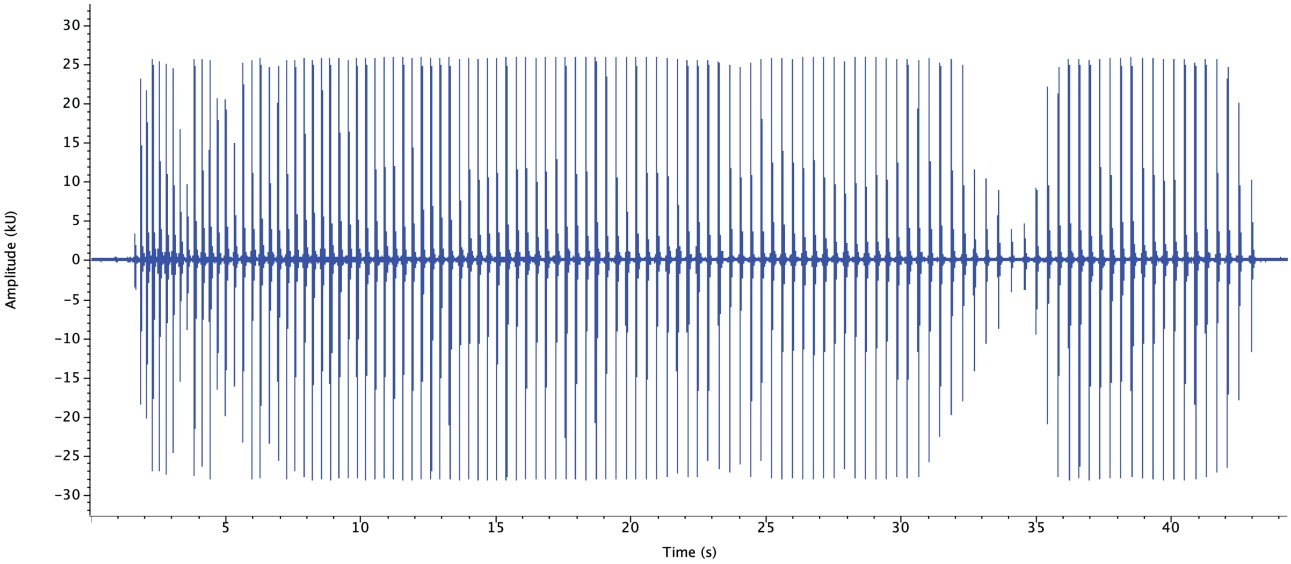


FIGURE 1032. Calling drum (R06-96) adult female *A. muwu* from Vandenberg Air Force Base (S05-3).

Derivation of name. "muwu" is derived from the name given to sand dunes by the Chumash Indians, who lived along coastal Southern California.

Habitat. On high dunes at Oso Flaco Lake, mostly under *Ambrosia chamissonis*, and rarely under *Lupinus* sp., usually on SW or S facing slopes of 10–45°. Sifting was not necessary as sand could be thrown down the face of the dunes with the JCs easily exposed. On 15-iii-1985, sand was wet just below surface and JCs were also found shallow. At Point Conception, in 1996, dunes to the east of lighthouse, where we collected the holotype in 1972, were overgrown with ice plant and few JCs found sifting under *Ambrosia*. We thus collected a little farther east where it was flatter and grassier and got *A. muwu* and *A. abelai* there, mostly under cow pies. At Pine Canyon Lakes (S04-143), Vandenberg Air Force Base, 1 adult male found ~9 km inland at a sandy location.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. **Color:** Basic head and pronotal color fairly constant except for darker adult female (Fig. 1025) collected from Montaña de Oro (S14-8), that is definitely *A. muwu* based on tibial calcars (Fig. 1033) and DNA (F2382). Also, width and darkness of abdominal bands can vary. In our sample of 21 adult males and 23 adult females, 40 had 1 and 2 had 2 ventral **fore** leg tibial spurs; 2 had 6, 35 had 7 and 6 had 8 **middle** leg tibial calcars, 17 had 1 and 26 had 2 ventral spurs; 42 had 1 and 3 had 2 inner **rear** leg tibial spines, while 1 had 1, 12 had 2 and 31 had 3 outer **rear** leg tibial spines, all with 1 ventral spur. Most of these fore tibia spurs were curved, as noted by Rentz & Weissman (1981). In some individuals of *A. muwu,* the rear leg tibial calcars are so closely adjacent that they form a solid "wall", apparently to maximize forward propulsion through the sand.



FIGURE 1033. Adult female *A. muwu,* Montaña de Oro State Park (S14-8), same individual as Fig. 1025B, showing scoop-shaped calcars.

Specimens examined. **CALIFORNIA, *San Luis Obispo Co*.**, Montaña de Oro State Park, 35.28572° -120.88227°, 39m, 27-ii-2014 (S14-8) A. Abela. Morro Strand State Beach, 15-x-1999 (S99-152) W. Icenogle ♂1. Morro Strand State Park, 35.390875° -120.864581°, 3m, 4-i-2019 (S19-9) A. Abela. Oso Flaco Lake, 35.027258° -120.623748°, 15m, 23-vi-1983 (S83-81), FT Hovore & PH Sullivan, 1 small instar; 15-iii-1985 (S85-34), 1 adult female, 4 late instars, 9 early instars; 1-iii-1992 (S92-11), 2 adult females, 6 late instars, 2 medium instars, 4 early instars, mostly under *Lupinus*. ***Santa Barbara Co.,*** Point Conception, type locality; 20-xii-1996 (S96-123), 1 adult female, 4 late instars, 5 mid instars. Vandenberg Air Force Base, 34.80627° -120.59966°, 48m, 17-xii-2004 (S04-167) A. Abela; 34.79977° -120.58361°, 62m, 23-xii-2004 (S04-168) A. Abela; 34.85008° -120.60841°, 5m, 3-i-2005 (S05-3) A. Abela; South Spur, 34.7372° -120.6225°, 13m, 2-v-2013 (S13-4), to oatmeal trail; TCRA, 34.7651° -120.6160°, 63m, Winter, 2013, A. Abela; Pine 1, 34.7113° -120.5025°, 52m, 12-v-2012, A. Abela. Pine Canyon Lakes, 34.7259° -120.5113°, 73m, 23-ix-2004 (S04-143) A. Abela.

DNA. Fig. 1023, p. 567. F0384 (type locality S96-123); F1510 (S04-143, Vandenberg Air Force Base); F2382 (S14-8, Montaña de Oro State Park) all recovered in Group 18 Muwu

Karyotype. 2n♂=23. Three males examined and all similar: T92-8 (Fig. 1034, S92-11, Oso Flaco Lake); T97-17 (Fig. 1035, type locality S96-123); T05-6 (Fig. 1036, S04-167, Vandenberg Air Force Base) all with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Karyotype also illustrated in John & Rentz (1987).

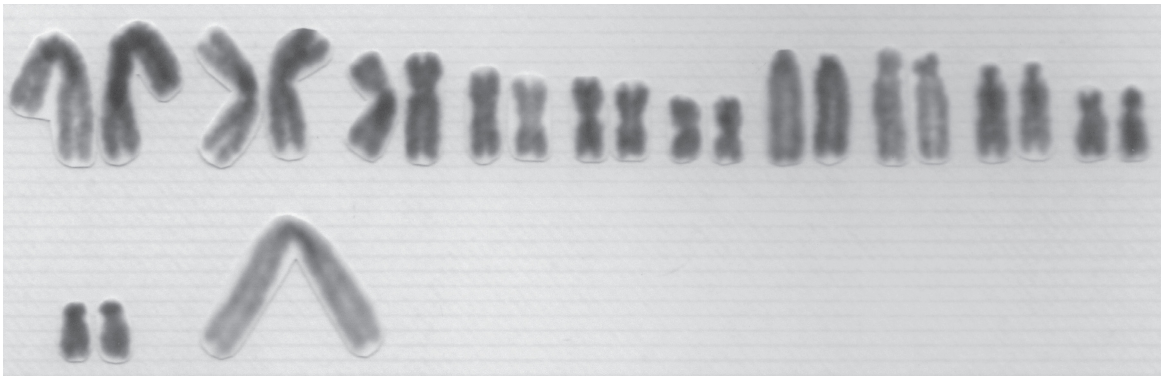


FIGURE 1034. Idiogram T92-8 *A. muwu* (S92-11).

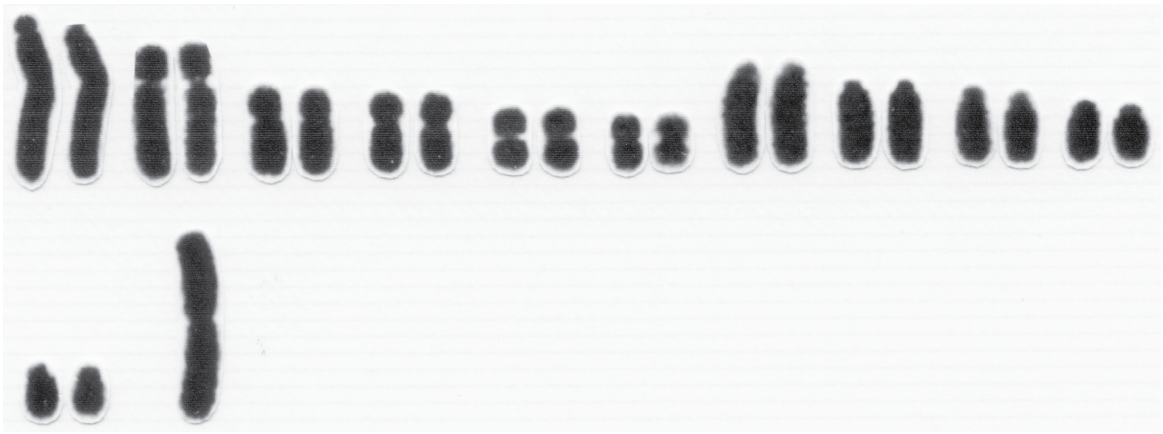


FIGURE 1035. Idiogram T97-17 *A. muwu* (S96-123).

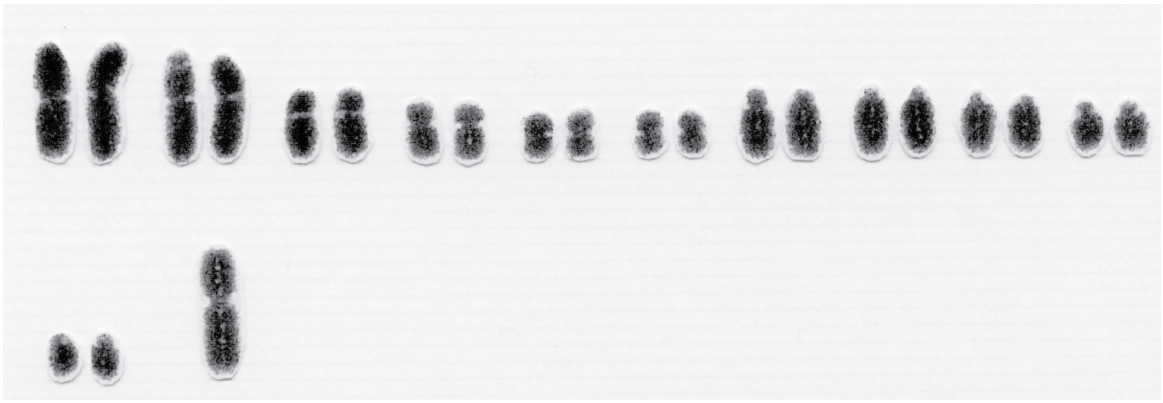


FIGURE 1036. Idiogram T05-6 *A. muwu* (S04-167).

Discussion. At 4 localities, *A. muwu* is sympatric with another species of *Ammopelmatus*, but only *A. muwu* has scooped-shaped calcars and is restricted to the dunes. These sympatric taxa include *A. castaneus* (Oso Flaco Sand Dunes, S83-81; Montaña de Oro, S06-97; Vandenberg Air Force Base, S04-143); and *A. abelai* (Pt Conception, S96-123).

The type locality Point Conception Bixby Ranch of some 25,000 acres was protected by the Nature Conservancy in 2017: https://www.nationalgeographic.com/news/2017/12/santa-barbara-california-nature-conservancy-dangermond-donation-cojo-jalama-bixby-ranch-spd/

Group 19, Pratti Group (Fig. 1037)

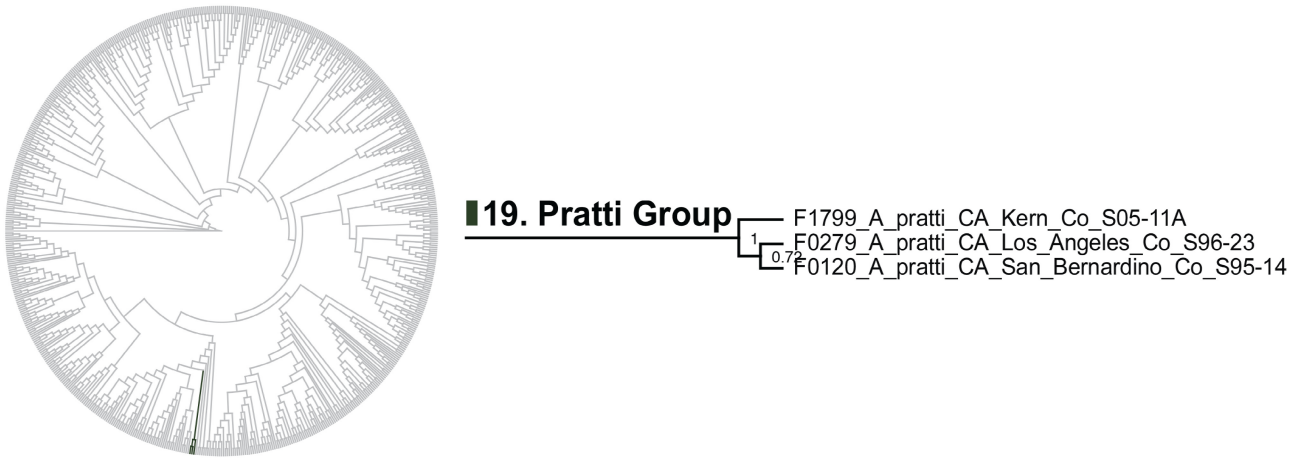


FIGURE 1037. ASTRAL tree for Pratti Group.

This Group contains one Mojave Desert species with 2n♂=25.

SPECIES WRITE UP: *A. pratti* (p. 574).

***Ammopelmatus pratti* Weissman, sp. nov.**
Antelope Valley Jerusalem Cricket
Figs 1038–1046, Tables 3, 6, 16

Distribution. (Fig. 1038). Only known from Mojave Desert areas of Los Angeles and San Bernardino Counties, California.



FIGURE 1038. Distribution of *A. pratti.*

Recognition characters. A Mojave Desert sand dune obligate, medium sized JC with a drum rate 4.5–5.4 drums/s, no sex clarification drum (SCD), 8 middle leg tibial calcars, and 3 or 4 inner and 3 outer rear leg tibial spines. Most similar to *A. brockovichi* in geographic distribution, and habitat, but nowhere sympatric. *A. brockovichi*'s drum rate is 1.1–1.4 drums/s, has a SCD, 7 middle leg tibial calcars, 1 or 2 inner and 2 outer rear leg tibial spines, and different DNA. Both taxa have 2n♂=25. There are 6 sand dune-obligate, Mojave Desert/Colorado Desert JCs taxa: *A. brockovichi, A. cahuilaensis, A. chinalake, A. joshuatree, A. kelsoensis,* and *A. pratti.* They can be separated by the characters listed in Table 16, p. 40.

Holotype. Male (in alcohol, Fig. 1039). **California, *San Bernardino Co.,*** El Mirage Dry Lake, 34.631417° -117.578183°, 866m, 10-ii-1995 (S95-14) GF Pratt. R96-77, F0291. Molt to adult 18-viii-1996. Deposited CAS, Entomology type #20111. Measurements in mm: Body length 37.9, hind femur length 11.42, hind femur width 4.11. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1040) with 3 inner and 3 outer spines, 1 ventral spur.

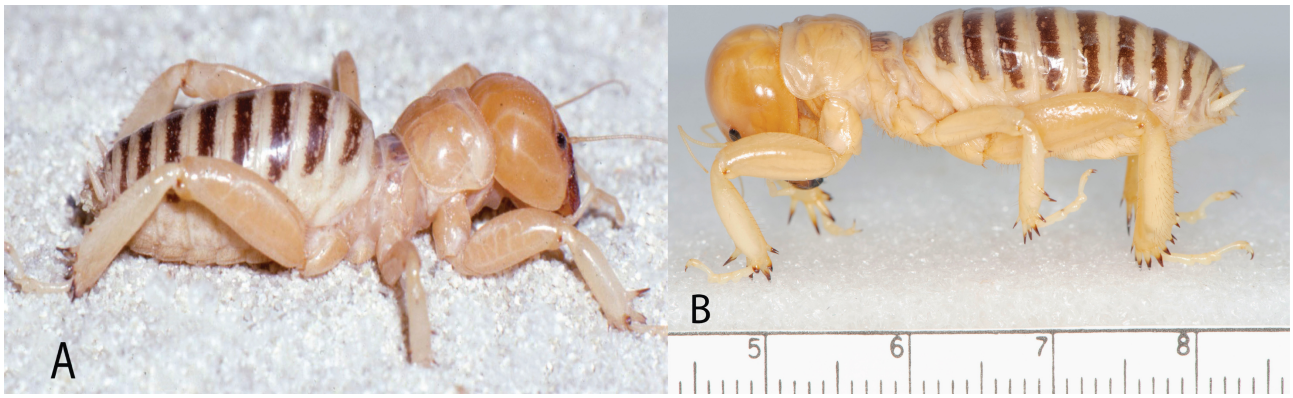


FIGURE 1039. Adult male holotype *A. pratti.* A. When alive. B. When preserved.

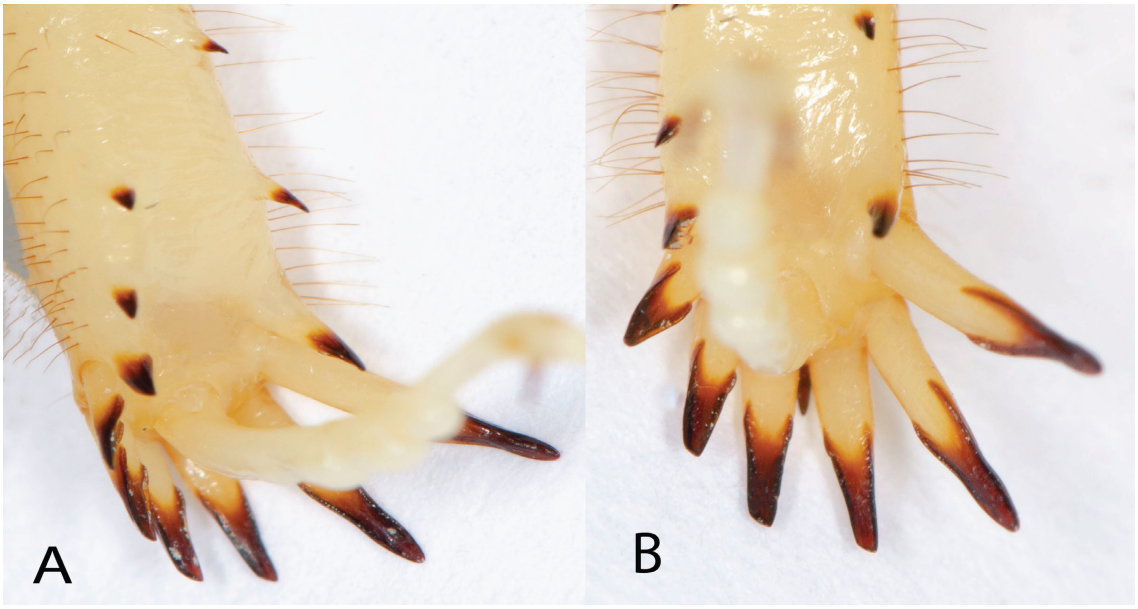


FIGURE 1040. Left rear leg tibia adult male holotype *A. pratti.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1041). Same collection data as holotype except R95-50, F0120. Molt to adult 4-ix-1995, Deposited CAS, CALENT #9081908. Measurements in mm: Body length 29.38, hind femur length 8.45, hind femur width 3.4. Fore leg tibia with 1 ventral spur; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1042) with 4 or 3 inner and 3 outer spines, 0 or 1ventral spur. Ovipositor Fig. 1043.

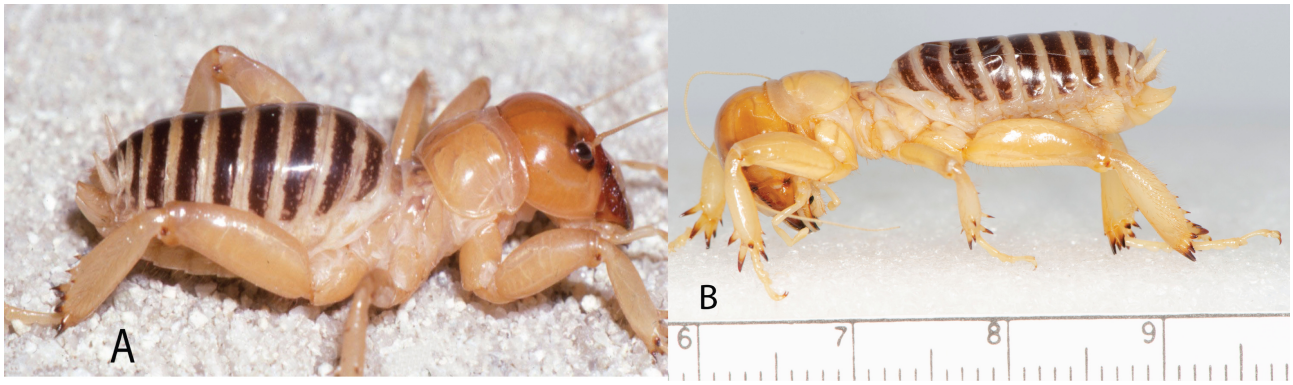


FIGURE 1041. Adult female allotype *A. pratti.* A. When alive. B. When preserved.

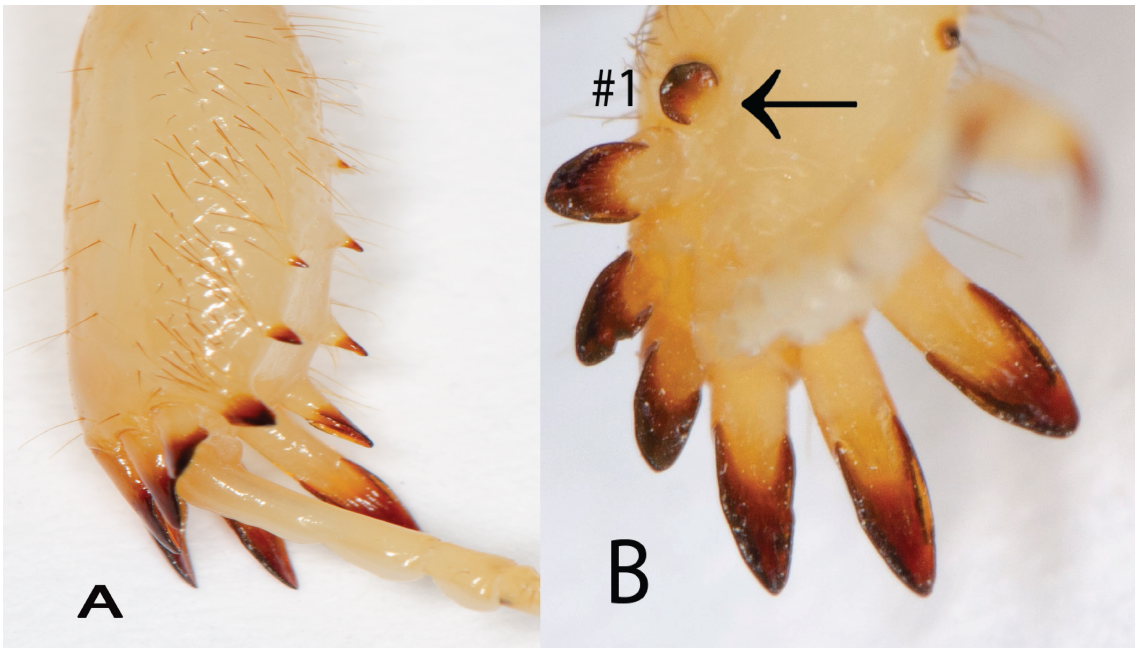


FIGURE 1042. Left rear leg tibia adult female allotype *A. pratti.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars. Note how outer tibial spine #1 (arrow) is somewhat concave and rotated some 25° from the linear axis of the tibia.



FIGURE 1043. Ovipositor allotype *A. pratti.*

Paratypes. ♂14 ♀9. **CALIFORNIA, *Los Angeles Co.,*** Alpine Butte Wildlife Sanctuary, 25-iii-1984 (S84-15) D. Reagan ♂1; 34.612585° -117.893313°, 833m, 18-xii-1987 (S87-123) ♀3; 17-ii-1988 (S88-5) FT Hovore & CR Carter ♂2; 30-iii-1988 (S88-13) FT Hovore & CR Carter ♀1; 18-xii-1988 (S88-125) ♂3 ♀2; 19-xii-1992 (S92-139) ♂3 ♀1. California City, near SW corner Conklin Blvd and Lindbergh Blvd, 35.148377° -117.950538°, 714m, 12-xi-1991 (S91-123) FT Hovore ♀1, under *Ambrosia dumosa*; 5-iii-1992 (S92-26) ♂1, under *Larrea*; 8-i-2005 (S05-11A) ♂1, under *Larrea.* Palmdale, corner of 62nd St E and Ave S-8, 35.541573° -118.019341°, 845m, 4-iv-1996 (S96-23) FT Hovore ♀1. Sierra Hwy 2 m N Palmdale and 0.5 m S Ave N, 34.623933° -118.124540°, 783m, 26-iv-1992 (S92-47) FT Hovore ♂1. Saddleback Butte State Park near 180th St and Ave K-8, 34.663664° -117.809790°, 824m, 29-iv-1998 (S98-37) L. LaPre ♂1. Saddleback Butte State Park, 1-v-1998 (S98-38) MD Wilcox & R. Norton ♂1.

Possible placement. **CALIFORNIA, *Los Angeles Co.,*** Devil's Punchbowl County Park, 0.5 m N Headquarters, 34.418572° -117.863198°, 1404m, 22-xii-1997, J. Farley ♀2. These 2 small adult females are morphologically similar, and geographically closest to *A. pratti*, except that both have 7 middle leg calcars, and 3 inner and 2 outer rear leg tibial spines; while the typical arrangement is 8 middle leg calcars and 3 or 4 inner and 3 (rarely 4) outer spines in *A. pratti.* The habitat is similar to that of the nearby Antelope Valley, where *A. pratti* is documented. Unfortunately, no DNA or drum were available. An alternative taxon for these Devil's Punchbowl specimens would be the more geographically distant *A. brockovichi*, with its normal 7 middle leg calcars, along with 1 or 2 inner and typically 2 outer rear leg tibial spines.

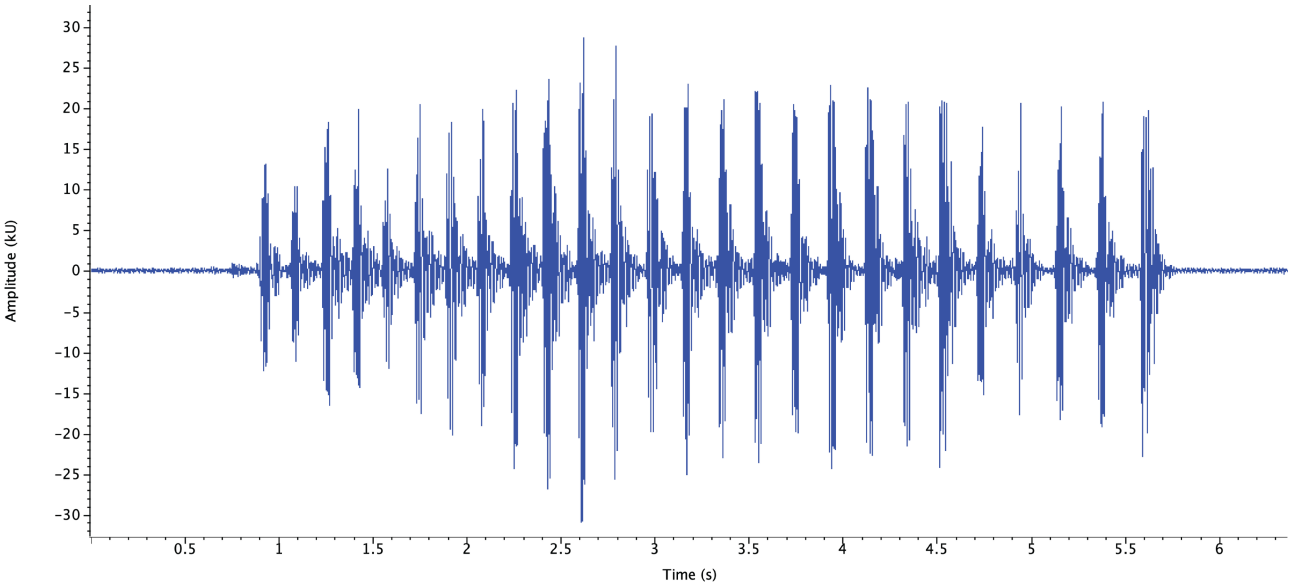


FIGURE 1044. Calling drum (R96-77) adult male holotype *A. pratti.*

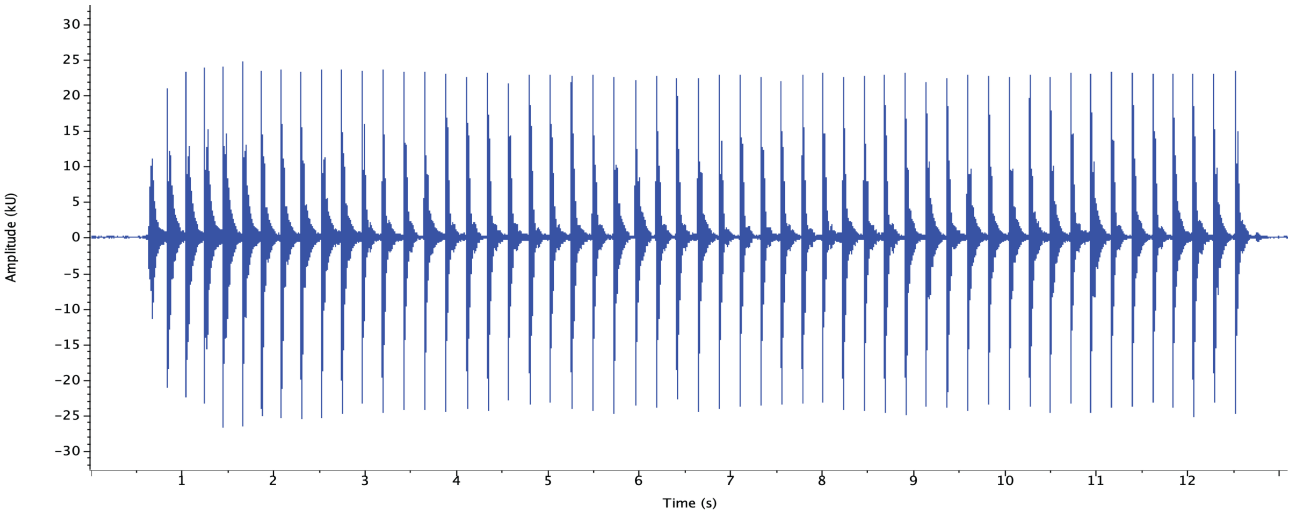


FIGURE 1045. Calling drum (R95-50) adult female allotype *A. pratti.*

Drum. Calling drum similar in both sexes; males apparently without a SCD. **Male:** Holotype R96-77 (Fig. 1044), 20°C, 26 drums over 4.8s (5.4 drums/s). **Female:** Allotype R95-50 (Fig. 1045), 21°C, 54 drums over 12s (4.5 drums/s).

Derivation of name. Named in appreciation of Gordon F. Pratt, who collected the holotype and allotype; and many other JCs over the years. Although the type locality is in the adjacent Victor Valley, most of the type series was collected in the Antelope Valley, hence the origin of the common name.

Habitat. The types were collected on sand dunes under fallen Joshua tree limbs. Habitat at both the Alpine Butte and Saddleback Butte localities is similar to the type locality. At the California City site, the area sifted was an open, flat sandy area, with scattered houses.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. From some 21 individuals, 2 had 1 and 19 had 2 ventral **fore** leg tibial spurs; 5 had 7, 14 had 8, and 1 had 9 **middle** leg tibial calcars, and 2 had 1 and 19 had 2 ventral spurs; 1 had 2, 12 had 3, and 8 had 4 inner **rear** leg tibial spines, and 18 had 3 and 3 had 4 outer **rear** leg tibial spines, and 3 had 1 and 19 had 2 ventral spurs.

DNA. Fig. 1037, p. 574. F0120 (Allotype El Mirage Dry Lake); F0279 (S96-23, Palmdale); F1799 (S05-11A, California City), all recovered together in Group 19 Pratti, nearest to Fast Drumming Group species.

Karyotype. 2n♂=25. T93-28 (Fig. 1046, S92-139, Alpine Butte) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

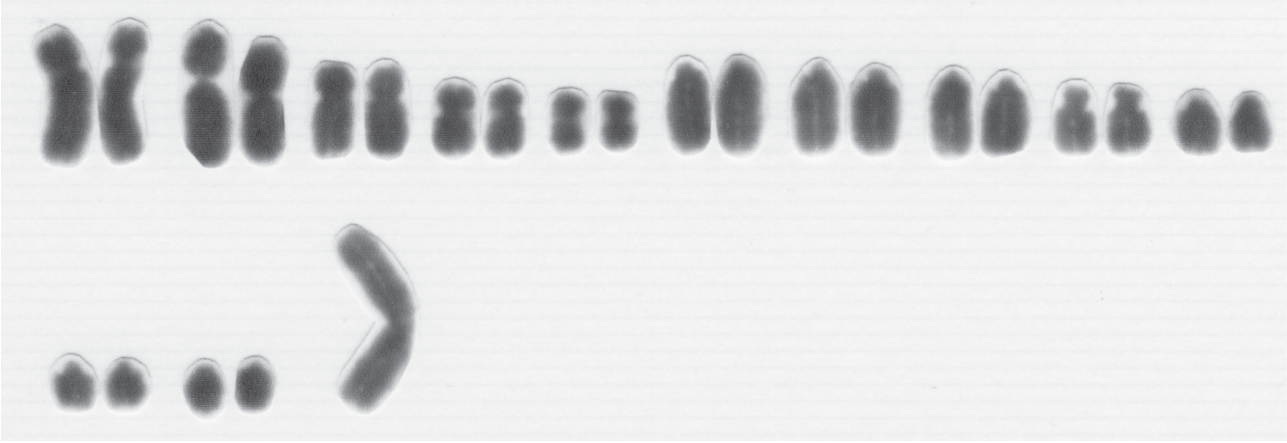


FIGURE 1046. Idiogram T93-28 *A. pratti* (S92-139).

Discussion. The Antelope Valley is in the western tip of the Mojave Desert. The holotype locality is from more eastern Victor Valley, which is near the southeast section of Edwards Air Force Base. The site appears protected from the ATV use that occurs on the nearby BLM El Mirage Off-Highway Vehicle (OHV) Recreation Area.

Group 20, Fast Drumming Group (Fig. 1047)

This Group contains 13 species, with the following characters: (1) All taxa west of Sierra Nevada. (2) Large, some megacephalic, wide pronotums, light colored abdominal bands frequently narrow in comparison to black band width. (3) All 12 known species with 2n♂=23 (except for *A. grapevine* with 2n♂=25). (4) Drum rate generally between 6–12 drums/s, without a sex clarification drum. (5) Males with small adult hooks which makes telling when they are last instars difficult. (6) Several species amongst the heaviest insects in California. Group is recovered as paraphyletic.

SPECIES WRITE UPS: *A. acton* (p. 579); *A. bakersfield* (p. 584); *A. castaneus* (p. 588); *A. chimineas* (p. 598); *A. danieli* (p. 603); *A. fremontpeak* (p. 612); *A. grapevine* (p. 616); *A. lakecachuma* (p. 621); *A. mtpinos* (p. 628); *A. pinnacles* (p. 632); *A. tarcanyon* (p. 638); *A. temblor* (p. 642); and *A. zayante* (p. 647).

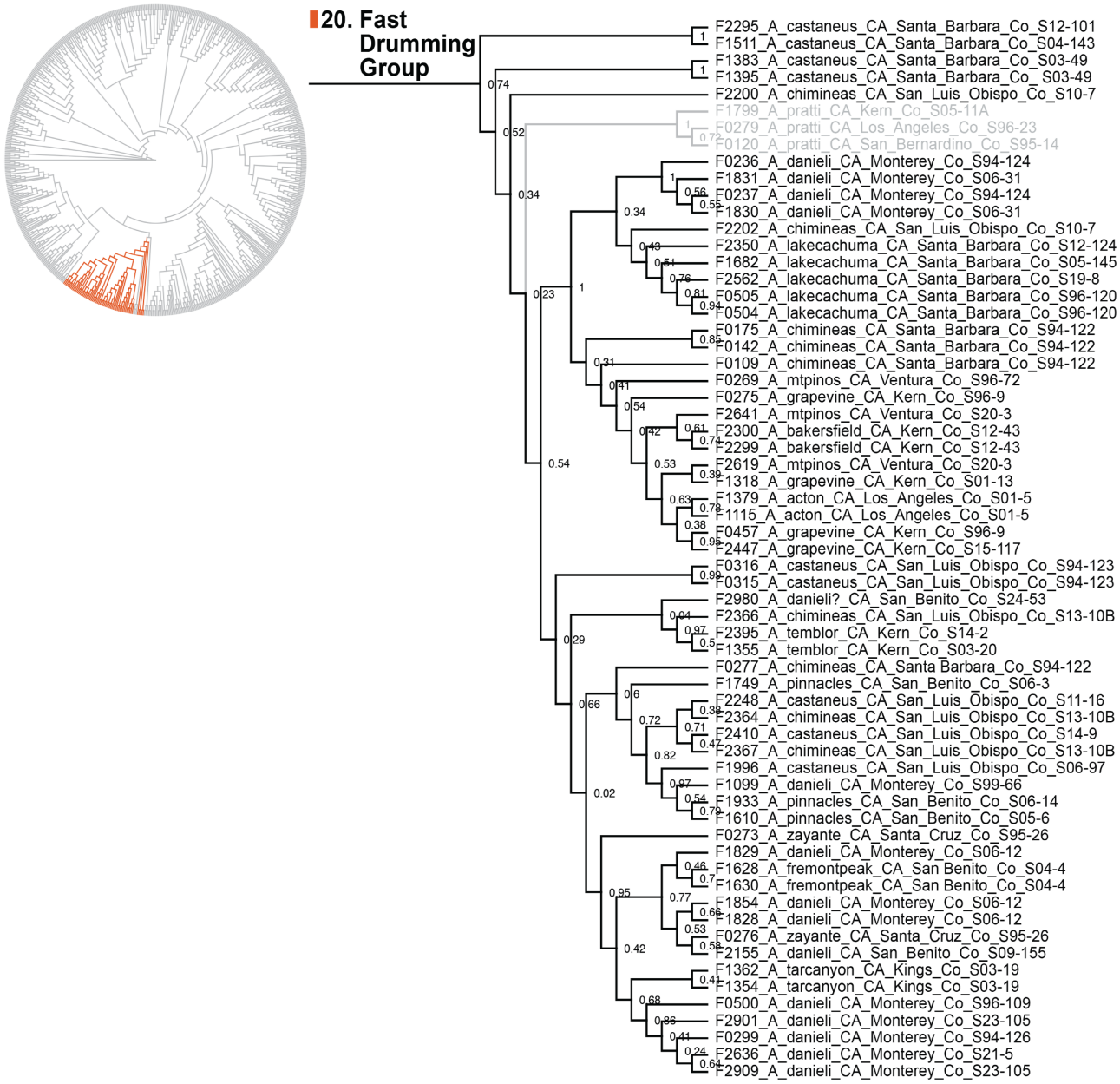


FIGURE 1047. ASTRAL tree for Fast Drumming Group.

Ammopelmatus acton Weissman, sp. nov.

Acton Wash Jerusalem Cricket

Figs 1048–1059, Tables 3, 16, 38

Distribution. (Fig. 1048). Known only from Acton Wash Wildlife Sanctuary, Santa Clara River, Acton, California.

Recognition characters. Member of Fast Drumming Group. Medium to very large, usually megacephalic, light colored, JC with 2 fore leg tibial spurs, and absence of rear leg spatulate calcars. Distinguished from nearby *A. sierrapelona* by habitat, drum rate, and DNA.

Holotype. Male (in alcohol, Fig. 1049). **California, *Los Angeles Co.,*** Acton Wash Wildlife Sanctuary, 34.469984° -118.187016°, 833m, 29-vi-2003 (S03-74), DBW. R03-18. Molt to adult 9-ix-2003. Deposited CAS, Entomology type #20114. Megacephalic. Measurements in mm: Body length 39.73, hind femur length 12.11, hind femur width 4.44. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1050) with 5 inner and 3 and 4 outer spines, 2 ventral spurs.



FIGURE 1048. Known distribution of *A. acton.*

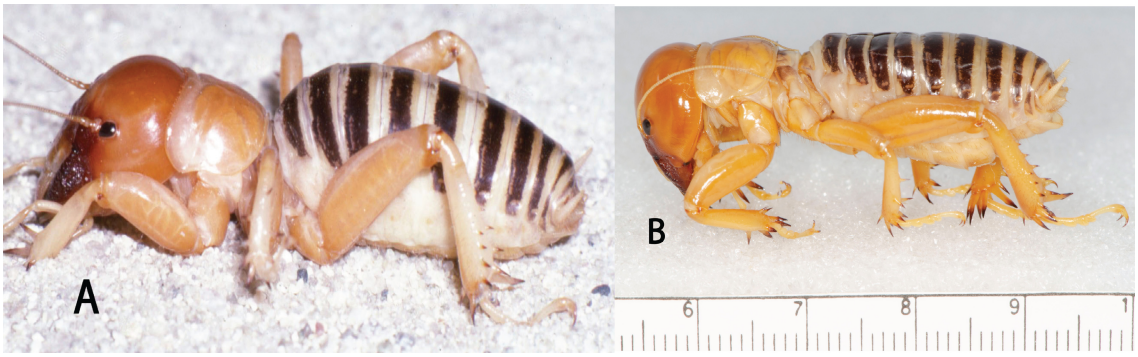


FIGURE 1049. Holotype adult male *A. acton.* A. When alive. B. When preserved.



FIGURE 1050. Left rear leg tibia adult male holotype *A. acton*. A. Showing 4 outer and 5 inner spines. B. Right rear leg tibia showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1051). Same data as holotype except 4-iii-1998 (S98-9A), I. Swift. R98-111, F0711. Molt to adult 24-ix-1998. Deposited CAS, Entomology #9080354. Measurements in mm: Body length 38.38, hind femur length 11.76, hind femur width 4.27. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1052) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1053.

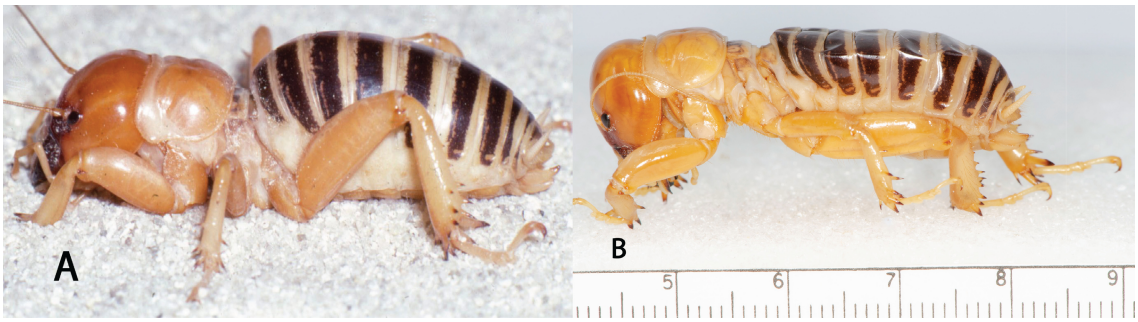


FIGURE 1051. Allotype adult female. A. When alive. B. When preserved.



FIGURE 1052. Left hind tibia allotype *A. acton.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1053. Ovipositor allotype *A. acton.*

Paratypes. ♂5 ♀7. **CALIFORNIA, *Santa Barbara Co.,*** all from type locality: 24-ii-2001 (S01-5) ♀3; 29-vi-2003 (S03-74) ♂3 ♀2; 28-v-2009 (S09-26) ♀2; 17-vi-2012 (S12-41) ♂2, 3 late instar males for testes.

Drum. Similar in both sexes except 1 male (R03-38, S03-74) with sex clarification drum (SCD). **Male:** Holotype R03-18 (Fig. 1054), 21°C shows 34 drums in 3.5s (9.7 drums/s). Paratype male (R03-38, S03-74) showing SCD (Fig. 1055) of 5 drums in 0.37s (13.5 drums/s) and calling drum of 41 drums in 4.5s (9.1 drums/s), both at 20.5°C. Four small deflections preceding SCD are 'finger drums' that elicited the SCD from that male. **Female:** Allotype R98-111 (Fig. 1056), 20°C shows 131 drums in 16.6s (7.9 drums/s).

Derivation of name. Named after the adjacent city and Sanctuary.

Habitat. The 75-acre Acton Wash Sanctuary is located in Acton, CA, and nestled in the Sierra Pelona Mountains. The main habitat is the alluvial, sandy wash banks of the Santa Clara River. Most JCs to oatmeal trail laid along trail that runs parallel to railroad tracks on northern side of wash.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

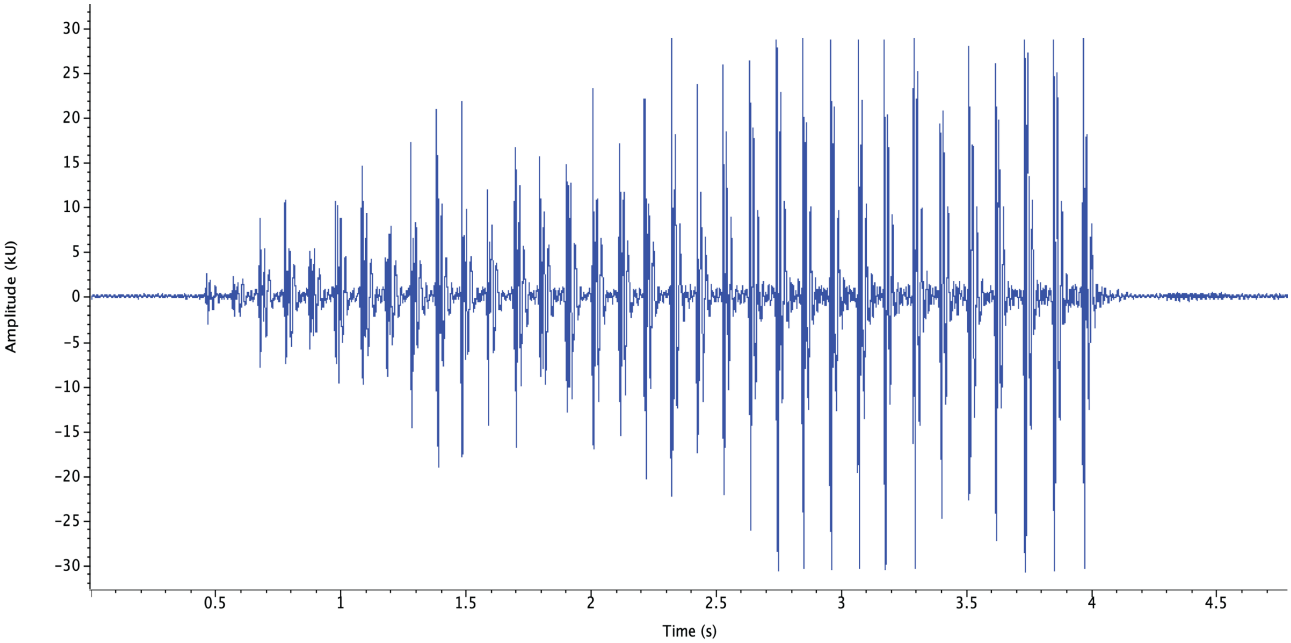


FIGURE 1054. Calling drum (R03-18) adult male holotype *A. acton.*

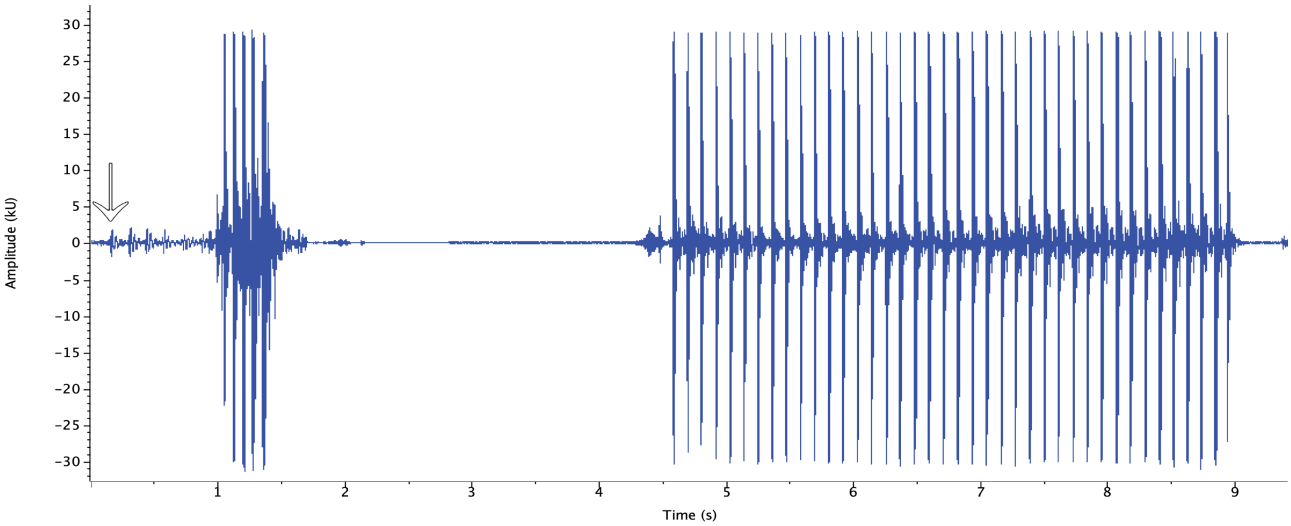


FIGURE 1055. Sex clarification drum (SCD), on left, and calling drum (R03-38), from topotype adult male *A. acton*. Note triggering "4 finger drums" (arrow) visible to left of SCD.

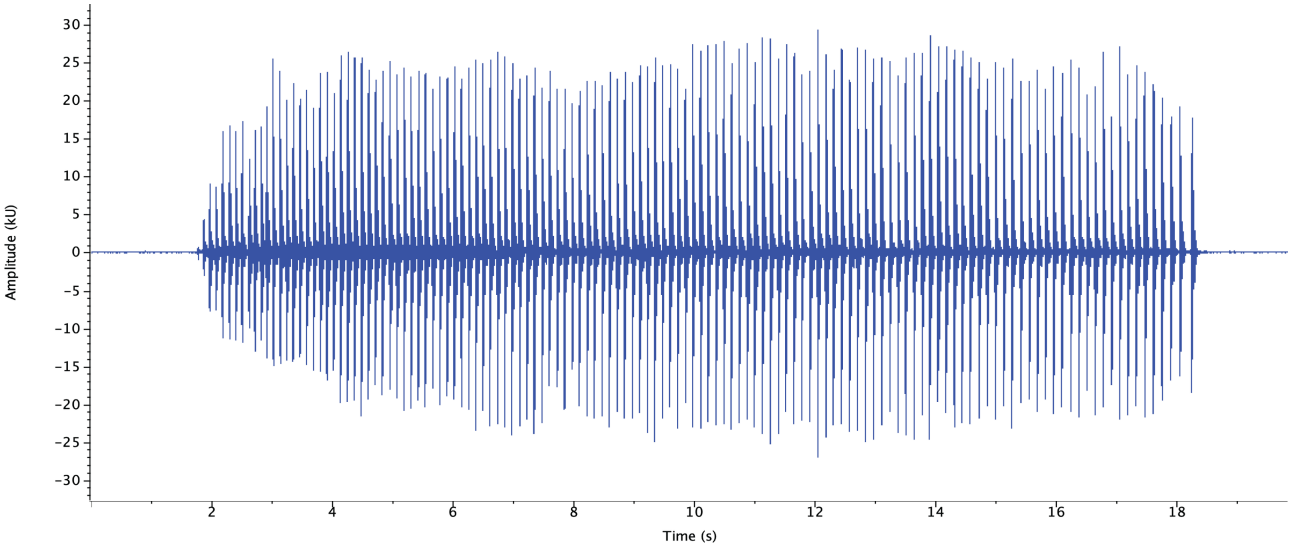


FIGURE 1056. Calling drum (R98-111) adult female allotype *A. acton*.

Variation. From some 12 individuals, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and 10 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1047, p. 579. F1115 and F1379 (both type locality S01-5) recovered in Group 20 with other Fast Drumming Group taxa *A. bakersfield*, *A. grapevine*, and *A. mtpinos.*

Karyotype. 2n♂= 23. Three type locality (S12-41) individuals all with similar results. T12-3 (Fig. 1057), T12-4 (Fig. 1058), and T12-5 (Fig. 1059) all with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Prior to the molt to adult, *A. acton* males have small hook ridges; thus making it difficult to tell when they are last instars. Thus, it is best to use time of year to gauge when to take testes.

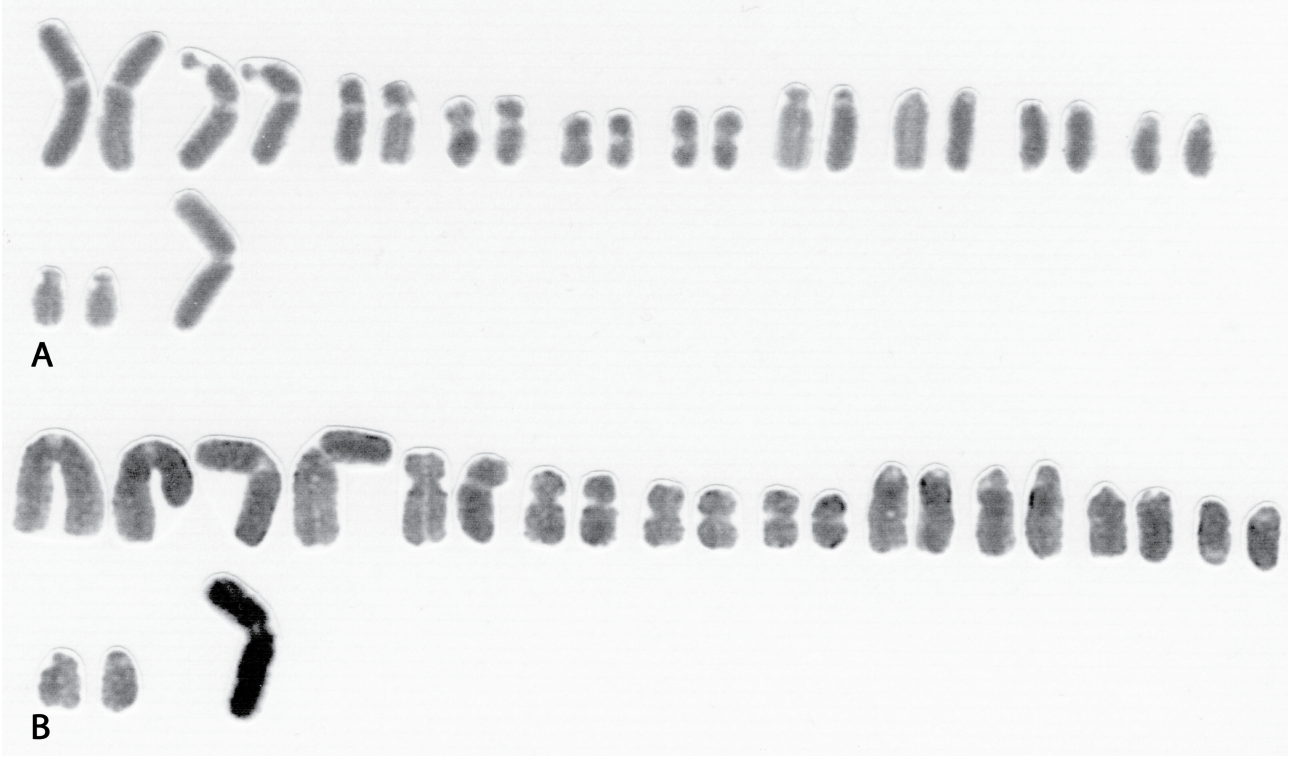


FIGURE 1057. Idiograms T12-3 *A. acton* (S12-41). A. Meiosis. B. Mitosis.

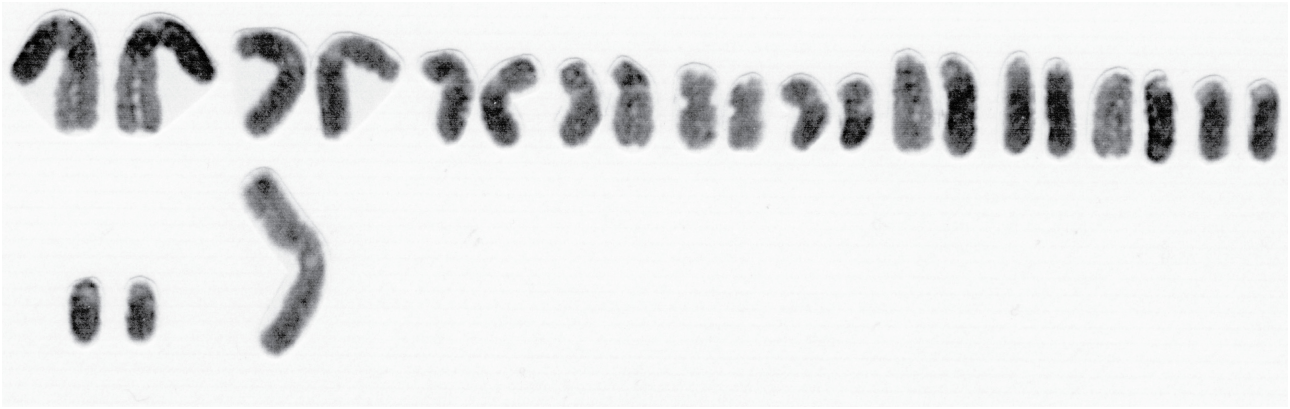


FIGURE 1058. Idiogram T12-4 *A. acton* (S12-41).

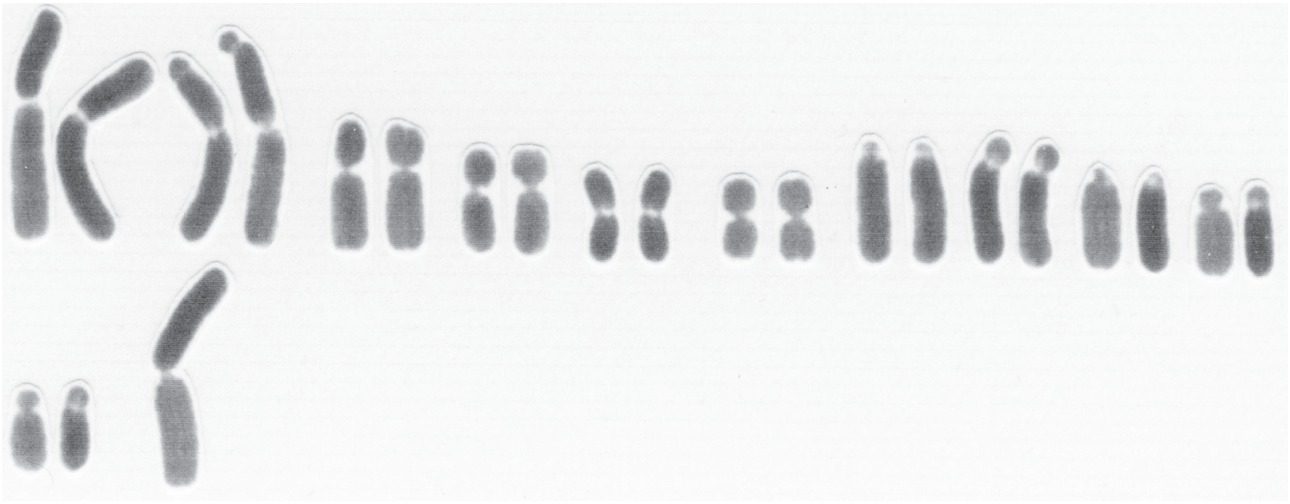


FIGURE 1059. Idiogram T12-5 *A. acton* (S12-41).

Discussion. It was difficult to a stimulate SCD in this rapid drumming taxon since one can only tap their finger so fast.

***Ammopelmatus bakersfield* Weissman, sp. nov.**
Bakersfield Jerusalem Cricket
Figs 1060–1068, Tables 2, 14, 24, 38

Distribution. (Fig. 1060). Known only from the dry Kern River sandy wash area adjacent to (north of) California State University Bakersfield.

Recognition characters. Member of Fast Drumming Group. Large, megacephalic, JC with wide, dark black abdominal stripes and a long calcar #1 in males.

Holotype. Male (in alcohol, Fig. 1061). **California, *Kern Co.,*** Kern River Parkway, dry Kern River wash, 35.35633° -119.10084°, 113m, 18-vi-2012 (S12-43) DBW, DW Weissman. R12-7. Molt to adult 11-ix-2012. Deposited CAS, Entomology type #20134. Megacephalic. Measurements in mm: Body length 41.21, hind femur length 12.19, hind femur width 4.44. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1062) with 5 inner and 3 outer spines, 2 ventral spurs.

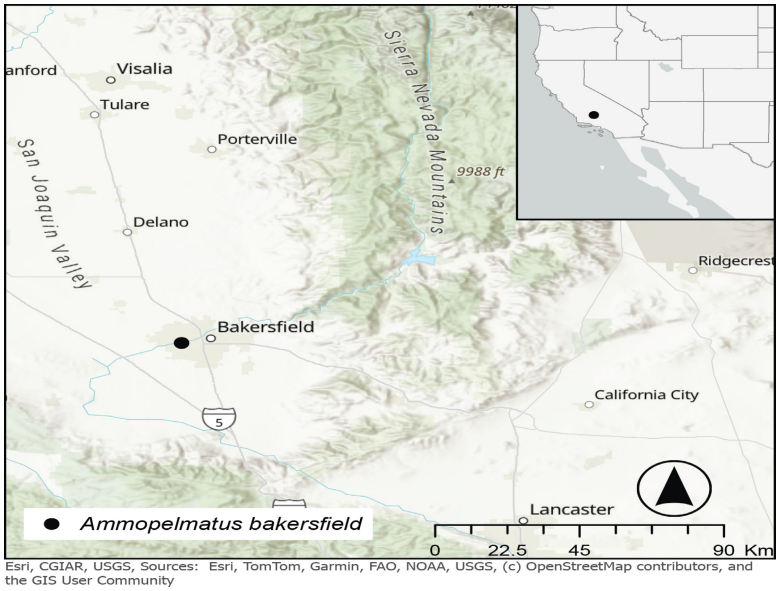


FIGURE 1060. Known distribution of *A. bakersfield.*



FIGURE 1061. Photos of adult male holotype *A. bakersfield.* A. When alive. B. When preserved.



FIGURE 1062. Left rear leg tibia in adult male holotype *A. bakersfield.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1063). Same data as holotype except R12-5, F2299. Molt to adult 27-viii-2012. Deposited CAS, CASENT #9077055. Megacephalic. Measurements in mm: Body length 45.97, hind femur length 12.81, hind femur width 5.41. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1064) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1065.

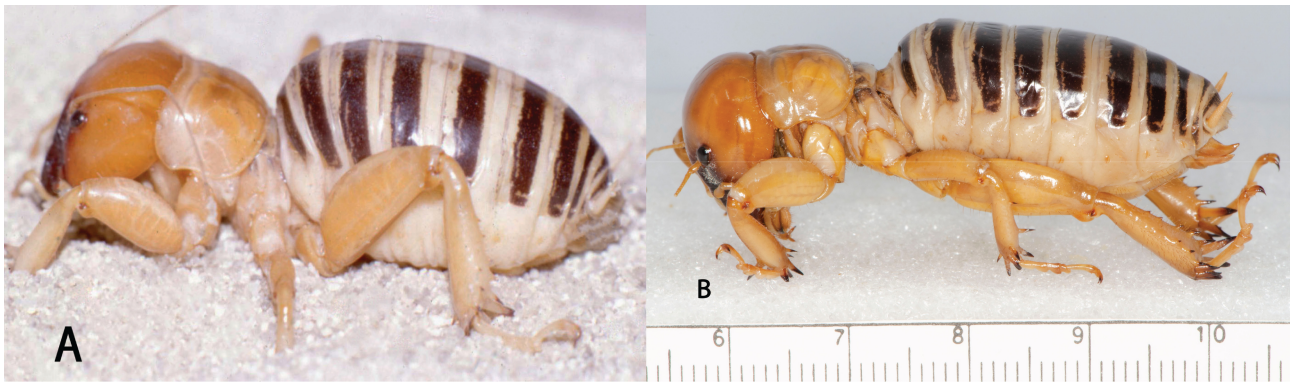


FIGURE 1063. Adult female allotype *A. bakersfield.* A. When alive. B. When preserved.



FIGURE 1064. Left rear leg tibia allotype *A. bakersfield.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Paratypes. ♀2. **CALIFORNIA, *Kern Co.,*** same data as types, ♀2.

Drum. Calling drum similar in both sexes except female's series longer. **Male:** Holotype R12-7 (Fig. 1066) showing 3 series of sequential drums. Fig. 1067 shows isolated third series from Fig. 1066, with 28 drums over 2.8s (10 drums/s) at 20.5°C. **Female:** Allotype R12-5 (Fig. 1068) with 108 drums over 12.0s (9 drums/s) at 20°C.



FIGURE 1065. Ovipositor allotype *A. bakersfield.*

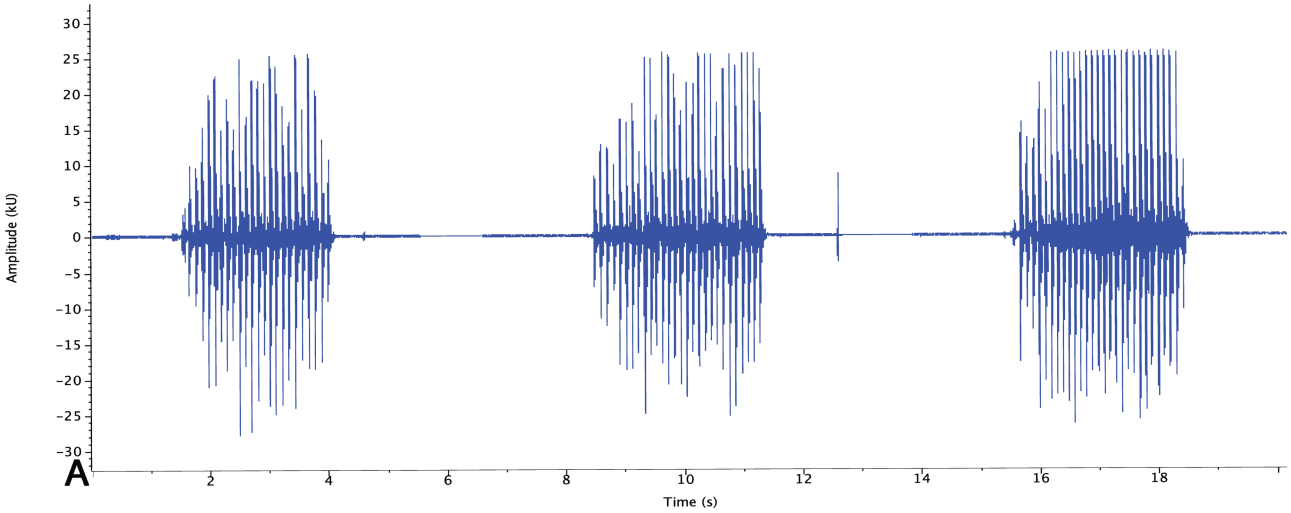


FIGURE 1066. Set of three calling drums (R12-7), in real time, for holotype adult male *A. bakersfield.*

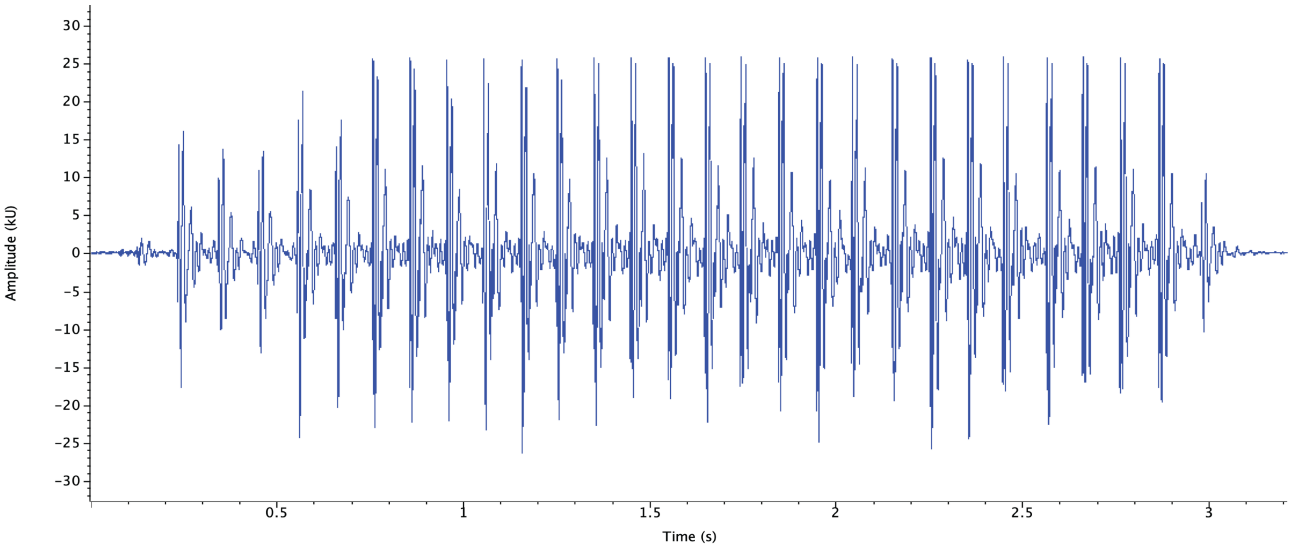


FIGURE 1067. Isolated third calling drum series (R12-7), from Fig. 1066.

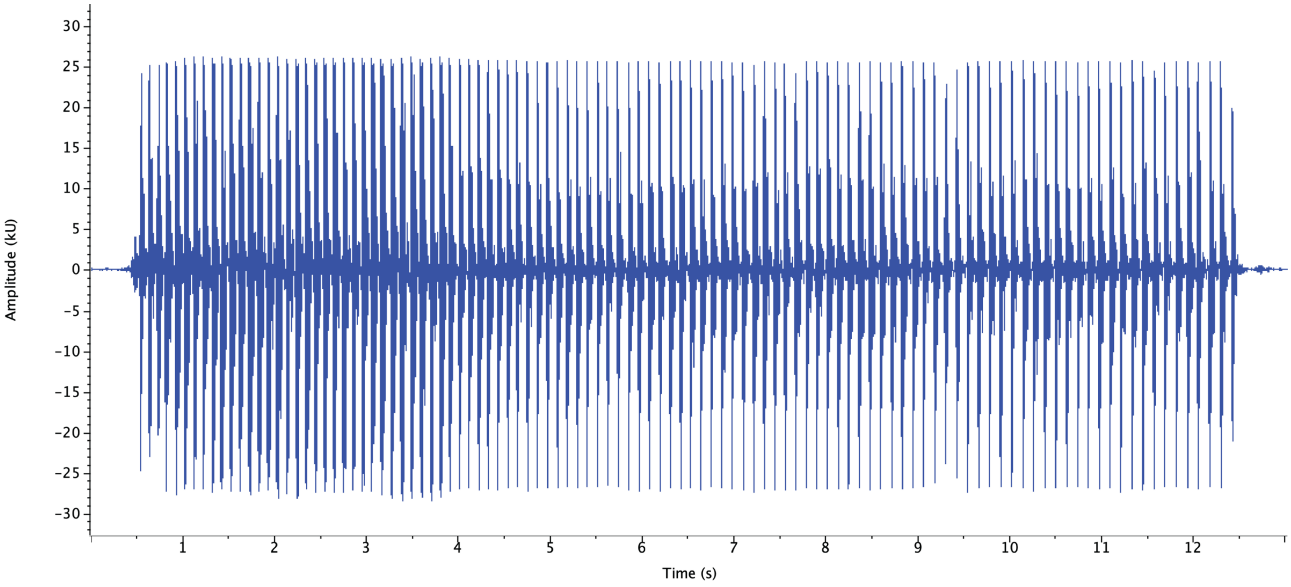


FIGURE 1068. Calling drum (R12-5) for allotype *A. bakersfield.*

Derivation of name. Named after type locality.

Habitat. Ten kg of oatmeal were laid on 2 trails in open areas of short grasses, with intermittent sand, close to Stockdale Hwy, and extending into actual dry river bed bottom with deep sand. Two JCs collected on first walk at 21:00 and two on second walk at 23:00. Holotype male collected in area of short, dead grasses (35.35633° -119.10084°) while three females collected in areas of deep sand (35.35906° -119.09832°).

Life cycle and seasonal occurrence. Probable 2-year life cycle.

Variation. Of 4 individuals, all had 2 ventral **fore** leg tibial spurs; 2 had 7, 1 had 8, and 1 had 9 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1047, p. 579. Type locality F2299 and F2300 (S12-43) recovered in Group 20 Fast Drumming, with other Fast Drumming Group members *A. acton, A. grapevine,* and *A. mtpinos.*

Karyotype. Unknown

Discussion. Given the fact that this population is the only Fast Drumming Group member known from the floor of the San Joaquin Valley, we accord it the rank of a good species until proven otherwise. The type locality of *A. bakersfield* is ~53 km due north of the nearest locality of *A. grapevine*; and 117 km southeast of the type locality of *A. tarcanyon*, the latter found on the western foothills of the San Joaquin Valley. The 3 taxa are separated by size, habitat, and climate.

***Ammopelmatus castaneus* Weissman, sp. nov.**

Vandenberg Air Force Base Brown-headed Jerusalem Cricket

Figs 1069–1088, Tables 8, 11, 17, 38

Distribution. (Fig. 1069). From coastal Vandenberg Air Force Base (VAFB), and inland for some 20 km (Purisima Hills), Santa Barbara Co.; and north almost to Cambria, San Luis Obispo Co., all generally west of the coastal mountain ranges.

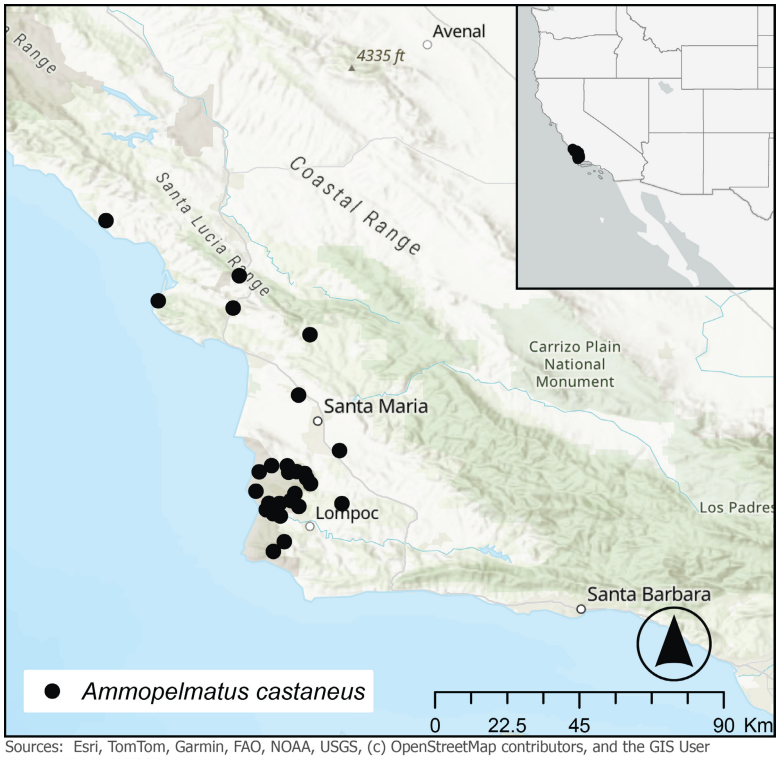


FIGURE 1069. Known distribution of *A. castaneus.*

Recognition characters. Member of Fast Drumming Group. An apparent complex of species, based on DNA, but here treated as one species because the habitats across their ~125 km, coastal, north-south distribution are generally uniform. A medium-large, generally megacephalic JC frequently characterized by a chestnut brown head (but not pronotum), a rapid calling drum between 6–9 drums/s, 2n♂=23, 2 fore leg ventral tibial spurs, either solid black (Fig. 1070A) or broken black (Fig. 1070B) abdominal bands, and, at VAFB, 1, or, less commonly, 2 hind leg ventral tibial spurs. There is no concordance between color forms and DNA clade. Distinguished from 3 other JC taxa at Vandenberg by drum rate (Table 17, p. 40). Distinguished from more southern *A. islander* that has 2n♂=25, 3 fore leg tibial spurs, normal sized head, a similar calling drum but with a sex clarification drum, different DNA, and inner rear leg tibial spines #1 always longest in *A. castaneus* while in *A. islander*, usually spines #2, or even #3, longest.



FIGURE 1070. Pattern Variation seen in *A. castaneus* on Vandenberg Air Force Base. A. Adult male S04-143 (Pine Canyon), R04-96, F1511. B. Adult female S04-146 (35th St), R05-76, F1688.

Holotype. Male (in alcohol, Fig. 1071). **California, *Santa Barbara Co.,*** Vandenberg Air Force Base, 34.6823° -120.5405°, 20m, 12-v-2012, (S12-101) A. Abela. R12-3, F2295. Molt to adult 26-viii-2012. Deposited CAS, Entomology type #20139. Megacephalic. Measurements in mm: Body length 35.97, hind femur length 10.56, hind femur width 4.19. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1072) with 5 inner and 3 outer spines, 1 ventral spur.



FIGURE 1071. Holotype adult male *A. castaneus.* A. When alive. B. When preserved.



FIGURE 1072. Left rear leg tibia adult male holotype. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1073). **California, *Santa Barbara Co.,*** Vandenberg Air Force Base, Well Rd, 34.7729° -120.4560°, 103m, 20-iv-2012 (S12-13) A. Abela. R12-24, F2309. Molt to adult 5-ix-2012. Deposited CAS, CASENT #9077056. Megacephalic. Measurements in mm: Body length 42.67, hind femur length 11.93, hind femur width 4.46. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1074) with 4 inner and 3 outer spines, 1 and 2 ventral spurs. Ovipositor Fig. 1075.

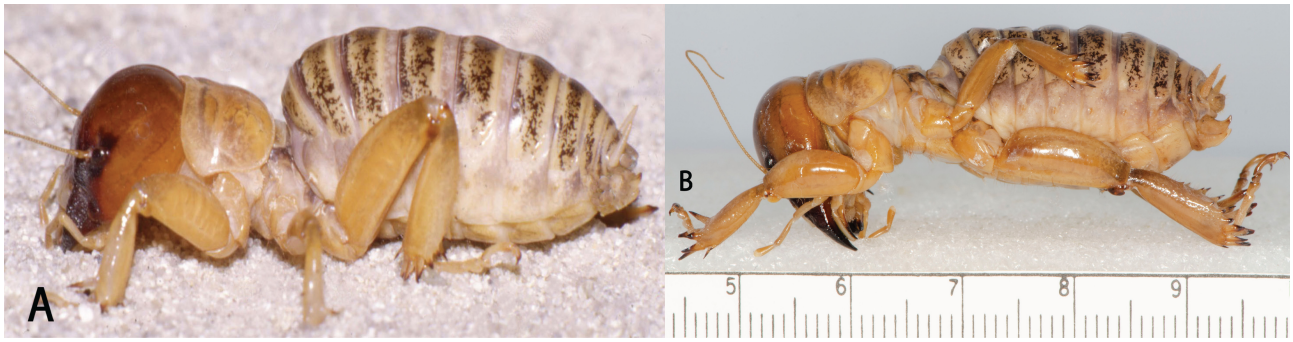


FIGURE 1073. Allotype adult female *A. castaneus.* A. When alive. B. When preserved.

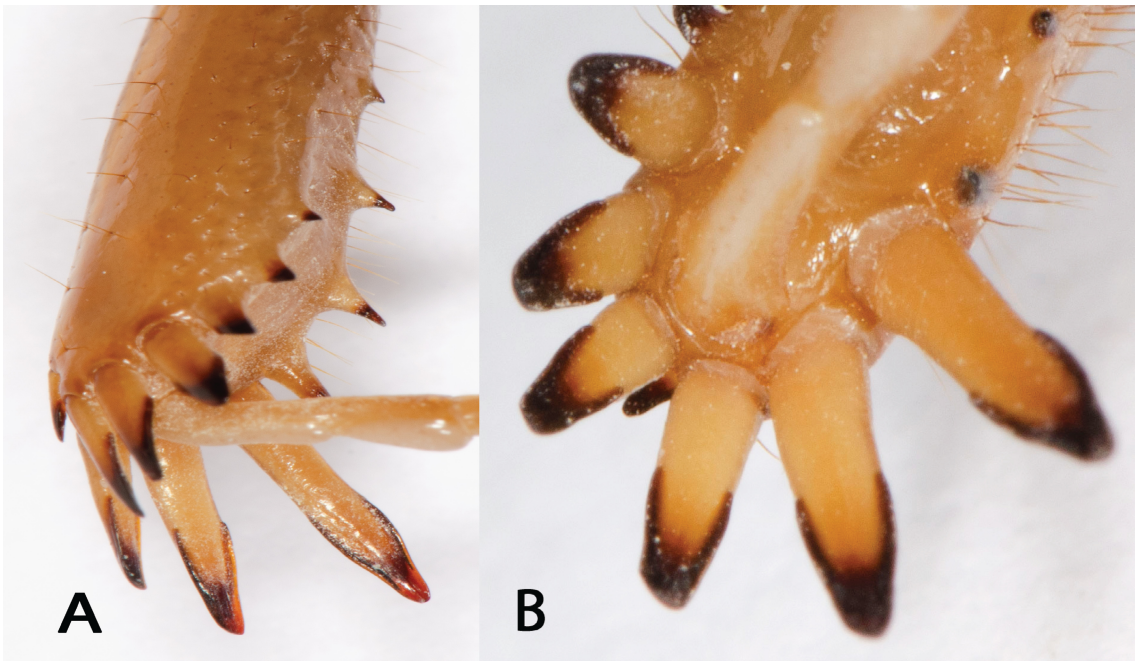


FIGURE 1074. Left rear leg tibia adult female allotype *A. castaneus*. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 1075. Ovipositor allotype *A. castaneus*.

Paratypes. ♂28 ♀58. (All paratype identifications confirmed by rapid calling drum). **CALIFORNIA, *San Luis Obispo Co.,*** Lopez Lake Recreational Area, 35.190904° -120.457474°, 164m, 27-xii-1991 (S91-133) ♂3 ♀3; 28-iii-2011 (S11-16) ♀1. Montana de Oro State Park, 35.285722° -120.882278°, 39m, 24-viii-2006 (S06-97) ♀2. Nipomo, area around Orchard and Division, 35.021386° -120.489418°, 103m, 15-iii-1985 (S85-35) ♀2; 27-xii-1986 (S86-175) ♀3; 26-xii-1987 (S87-131) ♂1 ♀3; 27-xii-1988 (S88-129) ♀1; i-iii-1992 (S92-10) ♀3; 21-xii-1994 (S94-123) ♂3 ♀3. Hwy 1, 6 m S Cambria, 35.510719° -121.028658°, 53m, 27-xii-1988 (S88-130) 100' ♂2 ♀3. Cuesta Ridge, 35.356140° -120.655472°, 702m, 17-xi-2013 (S14-9), A. Abela ♀1. San Luis Obispo, near Madonna Inn, 35.265451° -120.672688°, 48m, 8-vi-1014 (S14-16) N. Smith ♀1. ***Santa Barbara Co.,*** Vandenberg Air Force Base, all A. Abela collector: Arguello Rd, 34.610278° -120.529444°, 379m, 16-ii-2021 (S21-1) ♂1 ♀1. 34.7179° -120.5728°, 108m, 25-iii-2004 (S04-22) ♂1. Arguello Ridge, 34.609756° -120.521605°, 389m, 29-iv-2022 (S22-14) ♂1. New Mexico & 13th St, 34.717568° -120.542727°, 129m, 27-x-2004 (S04-164) ♀1. North Star Training Area, 34.8017° -120.4724°, 163m, 17-x-2004 (S04-149) ♀2; 16-xi-2004 (S04-166) ♀1. Pasture W Hwy 1, 34.7882° -120.4669°, 145m, 17-x-2004 (S04-144, S04-145) ♂1 ♀6. Perigee Rd Turnoff, 34.80627° -120.59966°, 23-xii-2004 (S04-167) ♀1. Pine Canyon Lakes, 34.7259° -120.5113°, 73m, 23-ix-2004 (S04-143) ♂2 ♀1. 34.7° -120.5798°, 91m, 14-viii-2004 (S04-146) ♀1. San Antonio Campground, 34.8051° -120.5172°, 146m, 17-x-2004 (S04-148) ♀2. Tracking Station, 34.806805° -120.495027°, 259m, 4-xi-2004 (S04-163) ♀1. Tranquillon Peak, 34.583° -120.560°, 18-x-2004 (S04-150) ♀4. Plot 2, 34.7519° -120.6088°, 69m, 14-x-2004 (S04-151) ♀1. Plot 9, 34.7026° -120.5764°, 107m, 12-x-2004 (S04-153) ♂1. Well Road, 34.7729° -120.4560°, 105m, 20-iv-2012 (S12-13) ♂1 ♀3. 34.6886° -120.5600°, 104m, 25-v-2012 (S12-101) ♂1, same 9-vii-2012 (S12-101) ♂1, same 8-vii-2012 (S12-101) ♀1. 34.6823° -120.5405°, 20m, 25-v-2012 (S12-101) ♂2. 34.7452° -120.4999°, 174m, 25-v-2012 (S12-101) ♀1. 34.7092° -120.4887°, 104m, 25-28-v-2012 (S12-101) ♂4, same except 7-vii-2012 (S12-101) ♀1. 34.8231° -120.5210°, 225m, 9-vii-2012 (S12-101) ♀1. Titan Pasture, 34.8235° -120.5651°, 120m, 20-x-2012 (S12-121) ♀1. Vandenberg Air Force Base, base housing, 3-ii-2005 (S05-14) K. Bayley ♀1. Purisima Hills, Upper Cebada Canyon, 34.7172° -120.3681°, 336m, 18-v-2003 (S03-49), P. Collins, ♀3. Santa Maria, 2390 Lake Marie Drive, 34.865865° -120.374759°, 236m, A. Abela, 4-xi-2012 (S12-121) ♂1; 30-xi-2012 (S13-10B) ♂2.

Probable placement. A morphologically similar (Fig. 1076), rapid drumming adult female from Oso Flaco Dunes (S83-81, San Luis Obispo Co), collected by PH Sullivan and FT Hovore in early June, 1983, and molting to adult on 10-ix-1983, has an orange head, 2 rear leg ventral tibial spurs, and somewhat spatulate rear leg tibial calcars (Fig. 1077), approaching those of sympatric *A. muwu.* No DNA material is available for this 1983 specimen, and several later sifting efforts, on these dunes, were unsuccessful in securing additional material. Her calling drum (R83-433) rate was 9.4–11.2 drums/s at 22°C, most consistent with *A. castaneus.* But this is our only record of this taxon from any extensive dune system.

Possible placement. We have a single adult female (Fig. 1078), with a unique drum, that was collected by A. Abela as a mid-late instar on 18-x-2004, and that molted to adult on 24-viii-2005. She was collected on Vandenberg Air Force Base at Bear Creek (S04-147, within the Burton Mesa area), around 34.623503° -120.587887°, 120m. Her adult calling drum (Fig. 1079, R05-116A) shows 21 fast drums over 2.5s (8.4 drums/s) transitioning to 27 slow drums over 8.7s (3.1 drums/s) at 20.5°C. Another series (Fig. 1080, R05-116C) with just the slow component shows 37 drums over 11.0s (3.4 drums/s) at 21°C. While the fast section of her drum is consistent with that seen in *A. castaneus,* the slow section is faster than the rate of 1.3–1.7 drums/s normally seen in *A. vandenberg*. We heard many other series heard from this female and they were both with and without a fast component. If this specimen was a male drumming, then we would call the fast portion a sex clarification drum (SCD) transitioning to a calling drum, and the species would be *A. abelai.* But no females of any JC species are known to make a SCD. Her DNA (F1689) is recovered in the VAFB Group, along with two other VAFB taxa: *A. vandenberg* and *A. abelai.* We entertain the possibility that she could be a hybrid—although we are unsure between which of the 3 taxa that occur in this area of VAFB. Further collecting efforts in the area, by A. Abela, were unsuccessful.

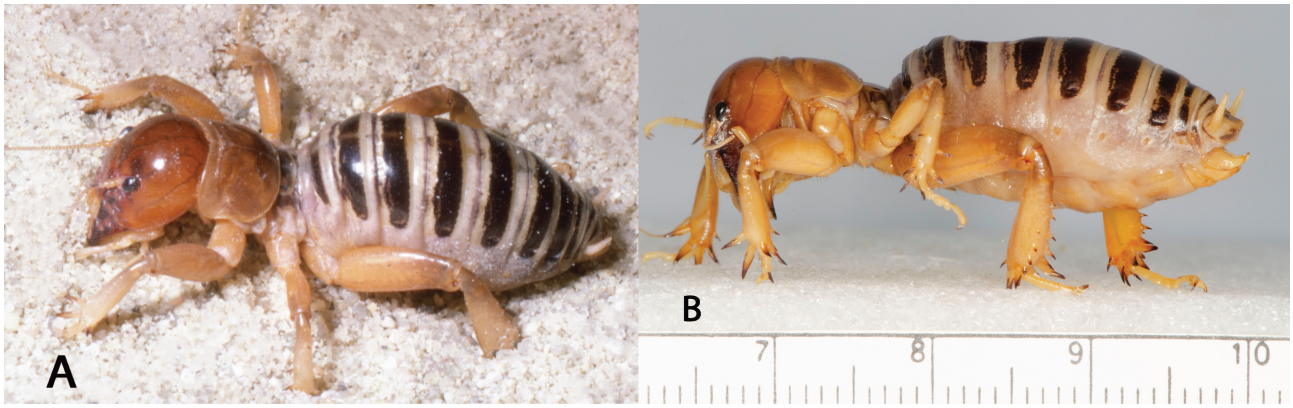


FIGURE 1076. Probable adult female *A. castaneus* from Oso Flaco Lake. A. When alive. B. When preserved.

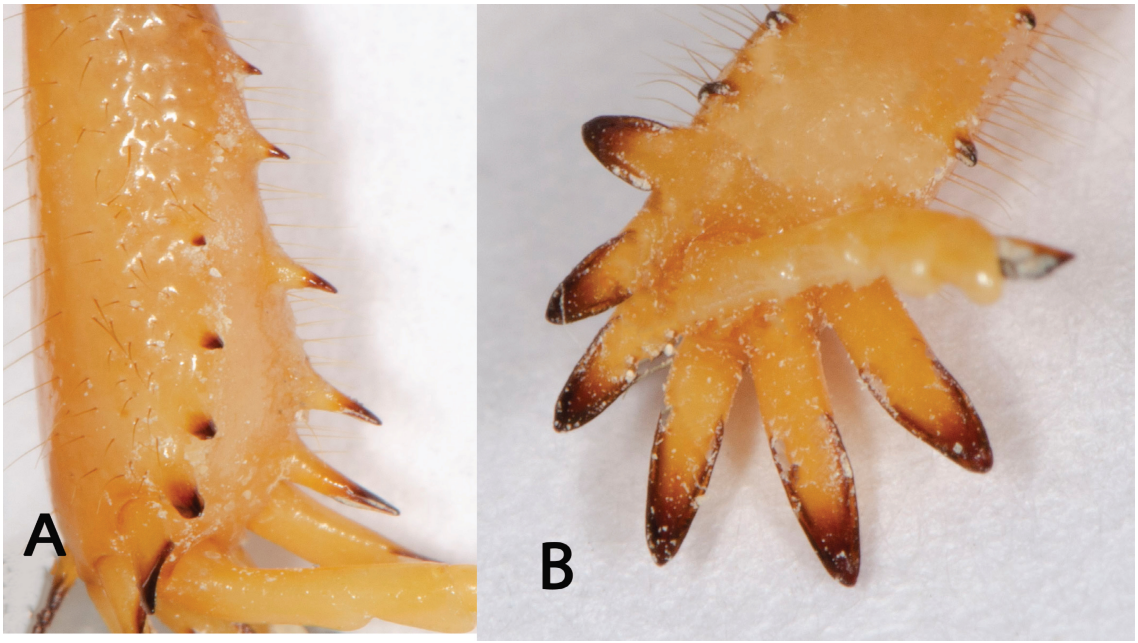


FIGURE 1077. Left rear leg tibia adult female probably *A. castaneus* from Oso Flaco Lake. A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1078. Adult female (S04-147, R05-116) VAFB, with unique drum.

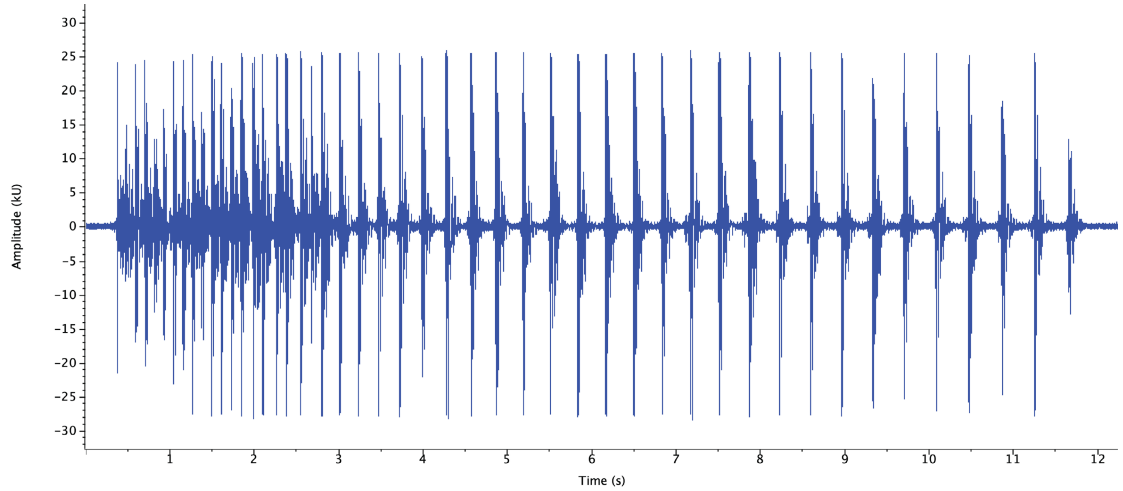


FIGURE 1079. Calling drum (R05-116A) in adult female, with unique drum.

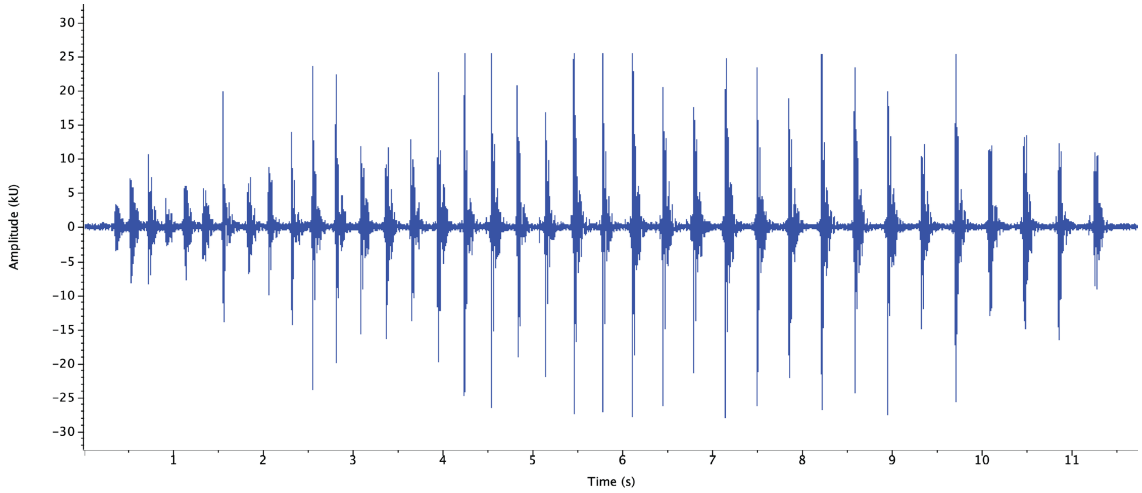


FIGURE 1080. Calling drum (R05-116C) in adult female, with unique drum.

Drum. Calling drum similar in both sexes except drum faster and series shorter in males. One adult male (S22-14, R23-5), out of 27, with a sex clarification drum (SCL) in response to finger drumming. **Male:** Holotype R12-3 (Fig. 1081) shows 48 drums over 5.9s (8.1 drums/s) at 20°C. SCD (R23-5) (Fig. 1082) in adult male (S22-14) shows 8 drums over 0.45s (17.8 drums/s) at 22.2°C. **Female:** Allotype R12-24 (Fig. 1083) shows 107 drums over 17.4s (6.1 drums/s) at 20.5°C.

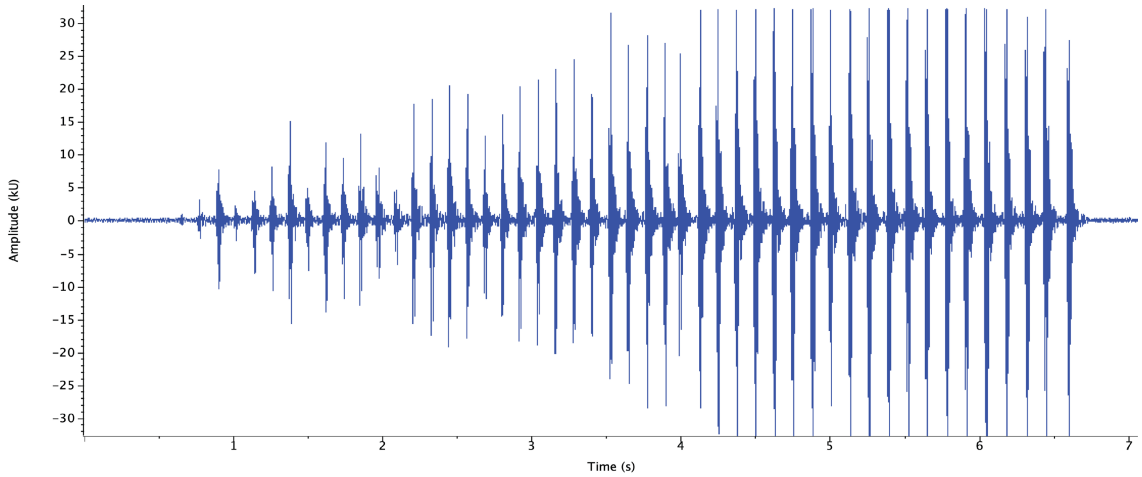


FIGURE 1081. Calling drum (R12-3) in adult male holotype *A. castaneus.*

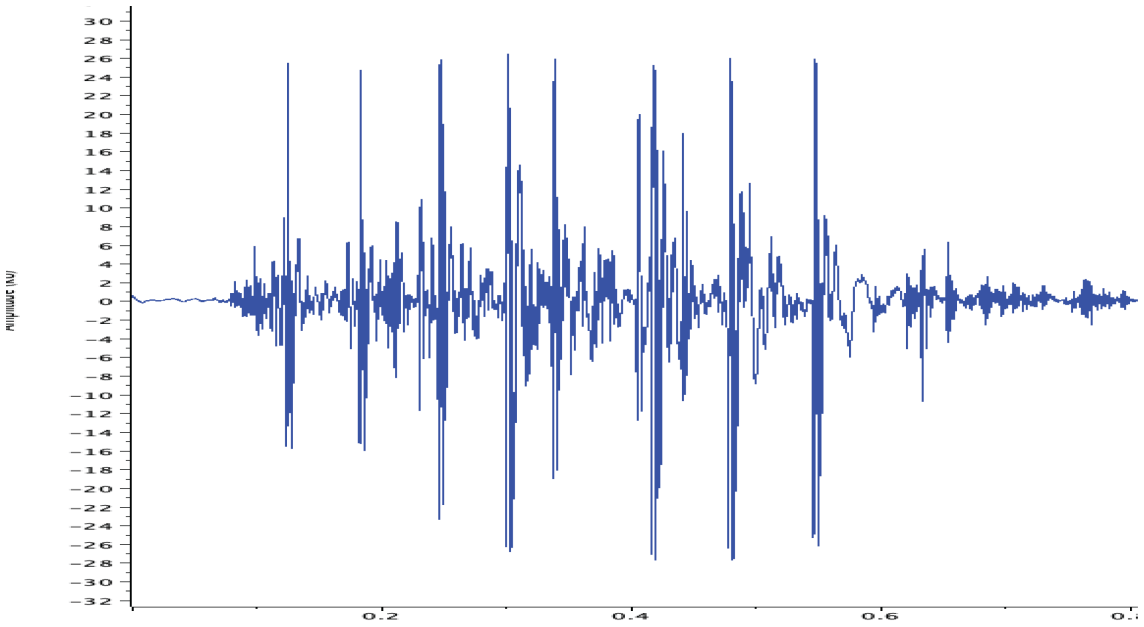


FIGURE 1082. SCD (R23-5) in adult male *A. castaneus* (S22-14).

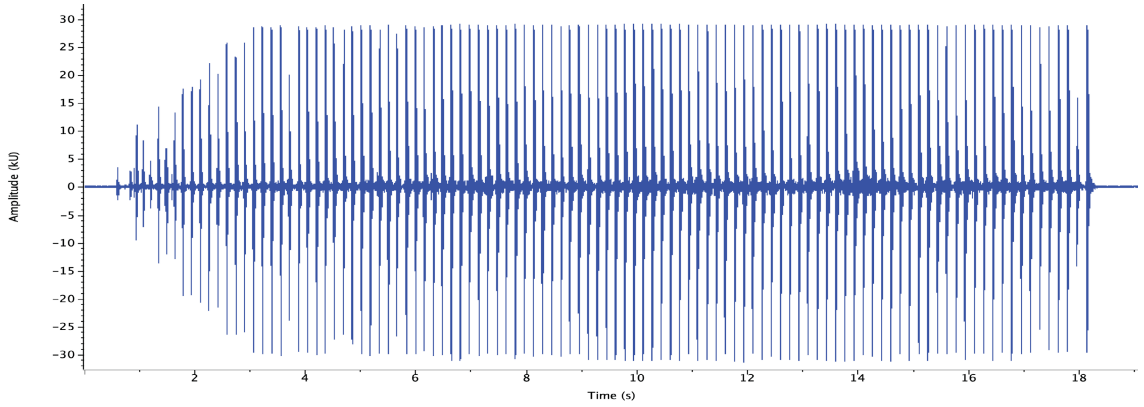


FIGURE 1083. Calling drum (R12-24) in adult female allotype *A. castaneus*

Derivation of name. "castaneus" is Latin for "of the color of chestnuts, brown", in reference to the head color of most individuals.

Habitat. Widespread on Vandenberg and in a variety of habitats. According to A. Abela, the holotype locality has sandy soils with open central coast scrub vegetation including *Ericameria ericoides, Artemisa californica, Baccharis pilularis,* and *Salvia melifera.* Allotype locality is also central coast scrub.

Life cycle and seasonal occurrence. Apparently typical 2-year life cycle.

Variation. Of some 29 VAFB individuals, all had 2 ventral **fore** leg tibial spurs; 2 had 7 and 25 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 4 and 26 had 5 inner **rear** leg tibial spines, while 27 had 3 and 2 had 4 outer **rear** leg tibial spines, and 19 (66%) had 1 and 10 (34%) had 2 ventral spurs. North of VAFB, of 29 adults, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars all with 2 ventral spurs; all had 5 inner while 23 had 3 and 4 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Abdominal stripes:** From VAFB, 8 males and 6 females with non-solid stripes, with adult female (Fig. 1070B, S04-146, R05-76) most extreme. From VAFB, 5 males and 10 females with solid stripes (as in Fig. 1070A), with the vast majority of all individuals having chestnut-colored heads. **Rear leg ventral tibial spurs:** At VAFB 66% of individuals (19 out of 29) have only 1 rear leg ventral tibial spur bilaterally. The latter is an unusual condition in *Ammopelmatus*, except for some sand dune obligate taxa like *A. muwu* and *A. kelsoensis.* Going north from VAFB, whether in Santa Barbara Co., at Orcutt; or San Luis Obispo Co., at Nipomo, individuals still have dark brown heads and variable abdominal stripes, but now

23 out of 24 (96%) adults have the more typical 2 rear leg ventral tibial spurs. And all 7 adults from Lopez Lake, San Luis Obispo Co. (S91-133), have 2 rear leg ventral tibial spurs but orange heads.

DNA. Fig. 1047, p. 579. F0315 and F0316 (both S94-123, Nipomo); F1383 & F1395 (both S03-49, Purisima Hills; F1511 (solid stripe VAFB, Fig. 1070A, S04-143); F1996 (S06-97, Montana de Oro); F2248 (S11-16, Lopez Lake); F2295 (non-solid stripe VAFB holotype, Fig. 1071, S12-101); and F2410 (S14-9, Cuesta Ridge) recovered in a large, poorly supported clade (Fig. 1047) that gives the impression of 2 or 3 subclades for these 9 *A. castaneus* samples. Unfortunately, the confidence numbers are too low to make any general conclusions. This large clade includes all of the other Fast Drumming Group (~8–10 drums/s) JC taxa: *A. acton, A. bakersfield, A. chimineas*, *A. danieli, A. fremontpeak, A. grapevine, A. lakecachuma, A. mtpinos, A. pinnacles, A. tarcanyon, A. temblor,* and *A. zayante*.

We derive these tentative divisions for *A. castaneus*. Clade 1: F1383 & F1395 (S03-49, Santa Barbara Co, Purisima Hills); F1511 (S04-143, Santa Barbara Co, VAFB); F2295 (S12-101, VAFB). Clade 2: F0315 (non-solid stripes) & F0316 (solid strips) (both S94-123, San Luis Obispo Co, Nipomo). Clade 3: F1996 (S06-97, San Luis Obispo Co, Montana de Oro); F2248 (S11-16, San Luis Obispo Co, Lopez Lake); F2410 (S14-9, San Luis Obispo Co, Cuesta Ridge).

Karyotype. 2n♂=23. Five individuals, representing 2 of the 3 DNA clades, examined and all with consistent results: T92-26 (Fig. 1084, S91-133, Lopez Lake); T95-6 (Fig. 1085) and T95-10 (Fig. 1086), both S94-123, Nipomo; T05-9 (Fig, 1087), a solid banded male (S04-145, Pasteur, VAFB); and T12-12 (Fig. 1088), a non-solid banded male (S12-13, Well Rd, VAFB), all with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

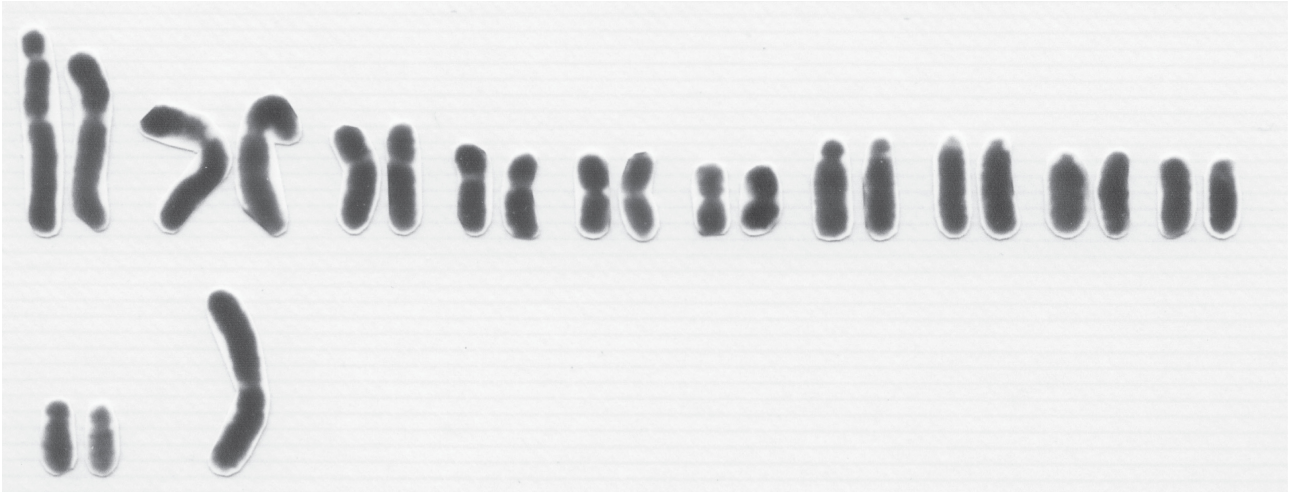


FIGURE 1084. Idiogram T92-26, Lopez Lake *A. castaneus* (S91-133).

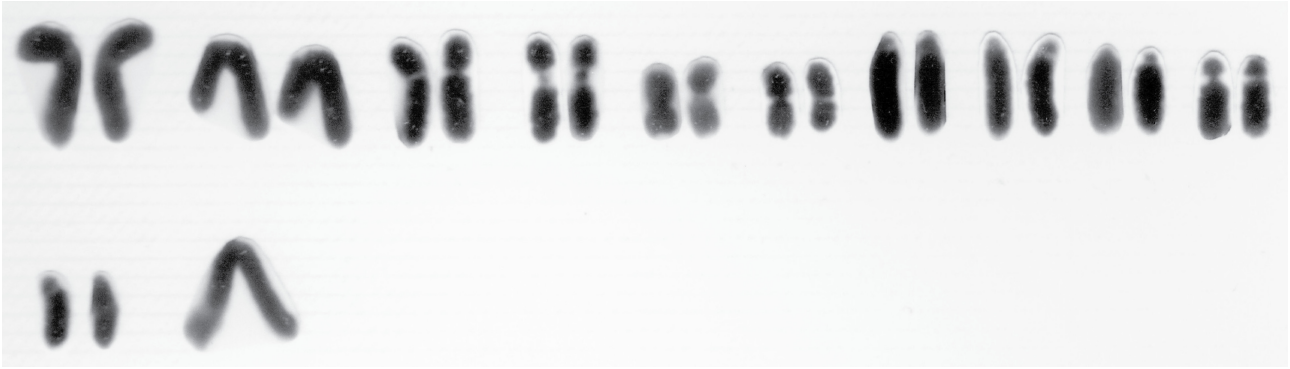


FIGURE 1085. Idiogram T95-6, Nipomo *A. castaneus* (S94-123).

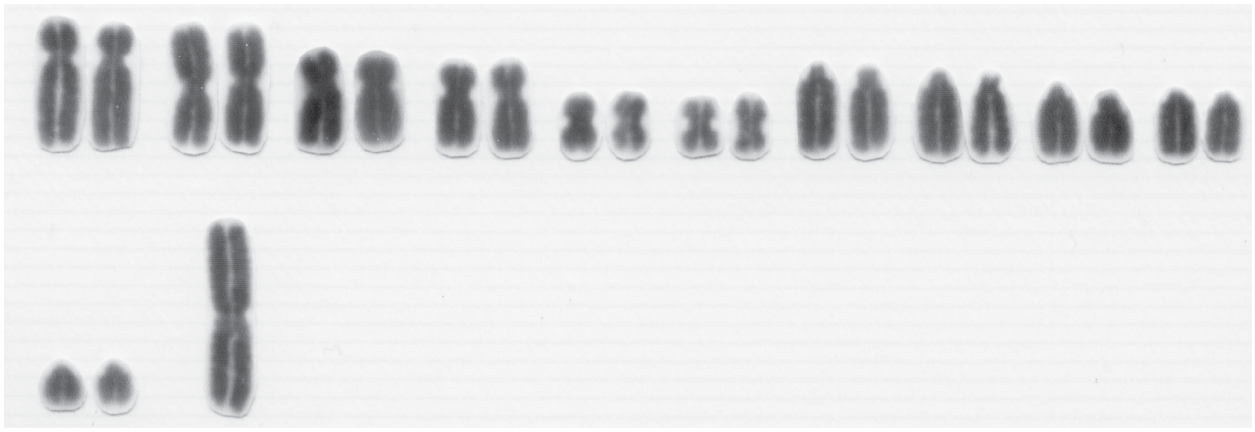


FIGURE 1086. Idiogram T95-10, Nipomo *A. castaneus* (S94-123).

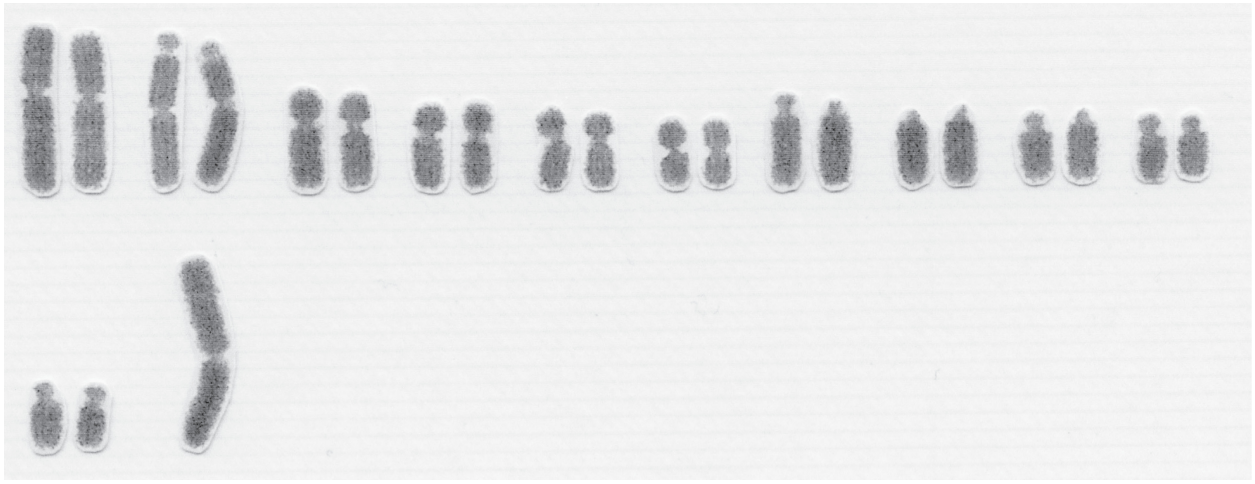


FIGURE 1087. Idiogram T05-9, solid banded male VAFB *A. castaneus* (S04-145).

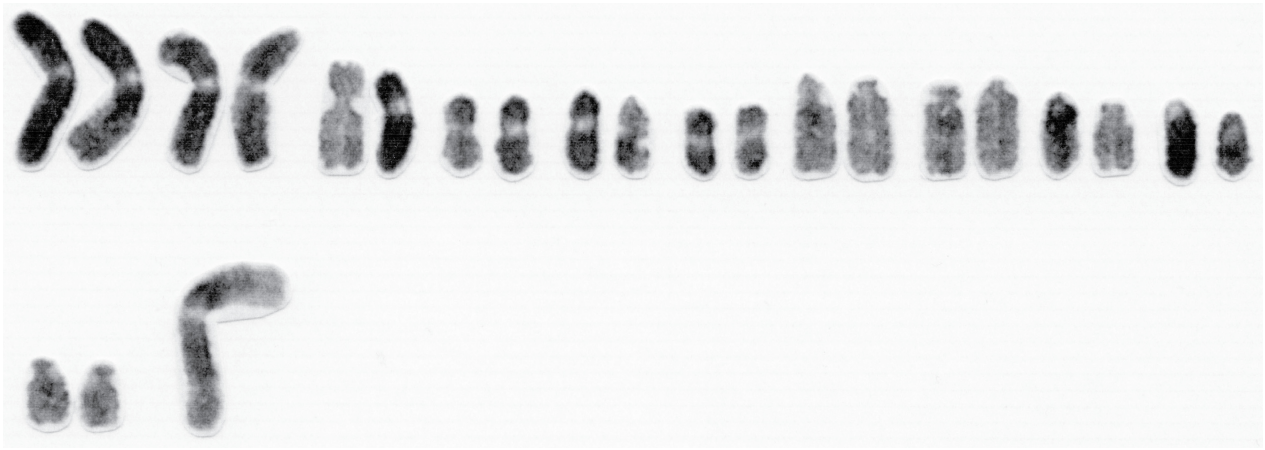


FIGURE 1088. Idiogram T12-12, broken banded male VAFB *A. castaneus* (S12-13).

Discussion. The 57 km^2 VAFB contains 4 species of *Ammopelmatus*, with *A. castaneus* being the most common. Although only *A. muwu* is specialized to coastal sand dunes, *A. castaneus* is still frequently associated with sandy habitats; but not with extensive dune situations.

At Titan Pasture (S12-121), A. Abela observed two *A. castaneus* nymphs stung by wasp *Palmodes spp*, the latter identified by W. Pulowski, Department of Entomology, CAS.

A. castaneus occurs with *A. muwu* at Pine Canyon Lakes (S04-143), and Perigee Rd turnoff (S04-167). At 2 localities on Burton Mesa, VAFB, *A. castaneus* occurs with *A. vandenberg.*

***Ammopelmatus chimineas* Weissman, sp. nov.**
Chimineas Jerusalem Cricket
Figs 1089–1101, Tables 12, 24, 38

Distribution. (Fig. 1089). Only known from the northeast facing exposure of the Sierra Madre Mts, on 12,140-hectare Chimineas Ranch Ecological Reserve, San Luis Obispo County; and Aliso Park, Santa Barbara Co., a separation of 27 km.

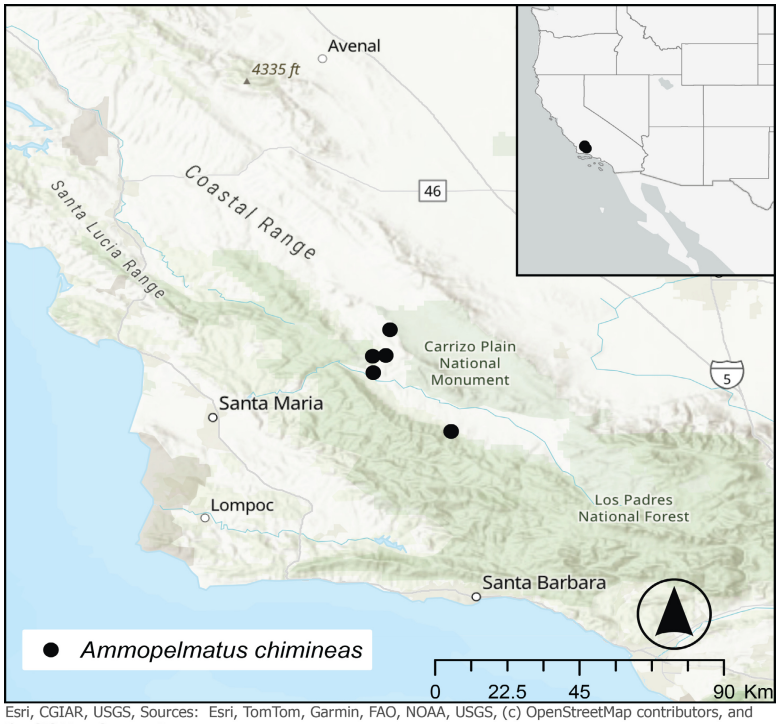


FIGURE 1089. Known distribution of *A. chimineas.*

Recognition characters. Member of Fast Drumming Group. Consistently, probably the largest species of JC, especially for females. An apparent complex of species, based on DNA, but here treated as one species. Calling drum rapid, males without a sex clarification drum. 2n♂=23. Frequently megacephalic, fore leg tibia with 2 ventral spurs, rear leg tibia with 5 inner and 3 outer spines, with inner rear leg tibial spine #1 always longest. Morphologically similar to *A. grapevine* but 2n♂=23 vs 2n♂=25 in latter. Morphologically similar to *A. temblor* but latter has 3 inner rear leg tibial spines vs 5 spines in *A. chimineas*, plus their localities are separated by the Carrizo Plain and ~48 km. From the type locality of *A. chimineas* to the type locality of the Fast Drumming Group *A. mtpinos* is 60 km, plus they are in different mountain ranges. It is 120 km to the type locality of Fast Drumming *A. tarcanyon*, with its different climatic regime.

Holotype. Male (in alcohol, Fig. 1090). **California, *San Luis Obispo Co.,*** California Valley, Chimineas Ranch Ecological Reserve, off Chimineas Ranch Road, 35.080659° -119.986404°, 489m, 31-i-18-ii-2010 (S10-7) A. Abela. R10-30, F2201. Molt to adult 14-ix-2010. Deposited CAS, Entomology type #20162. Megacephalic. Measurements in mm: Body length 43.21, hind femur length 12.15, hind femur width 4.89. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1091) with 4 inner and 3 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 1092). Same data as holotype except R10-33, F2202. Molt to adult 14-ix-2010. Deposited CAS, CASENT #9077131. Megacephalic. Measurements in mm: Body length 54.98, hind femur length 14.38, hind femur width 5.38. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1093) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1094.

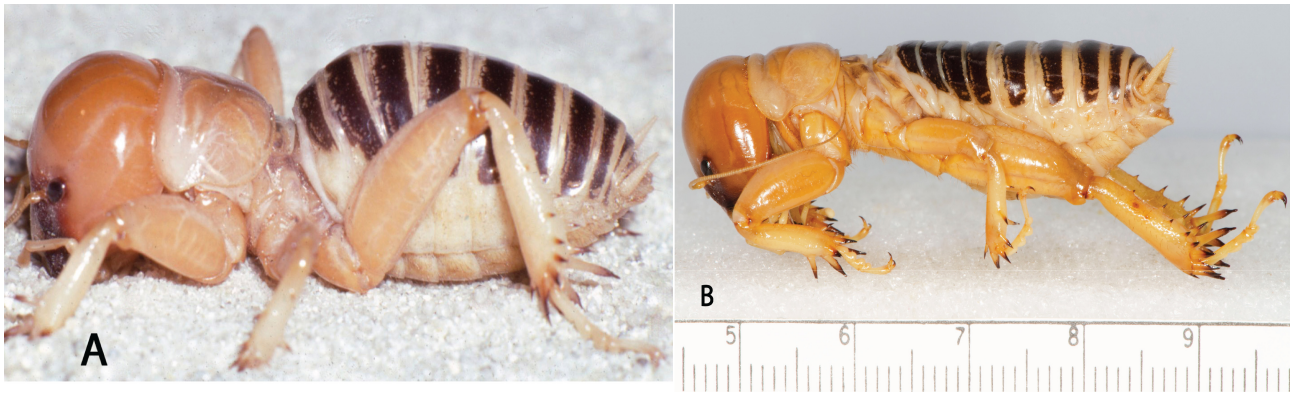


FIGURE 1090. Adult male holotype *A. chimineas.* A. When alive. B. When preserved.



FIGURE 1091. Left rear leg tibia holotype. A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

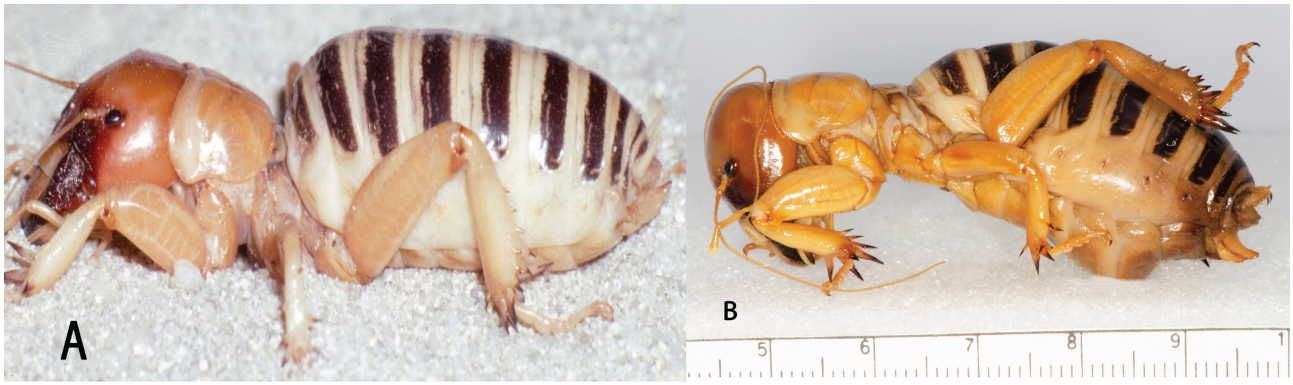


FIGURE 1092. Allotype adult female *A. chimineas.* A. When alive. B. When preserved.

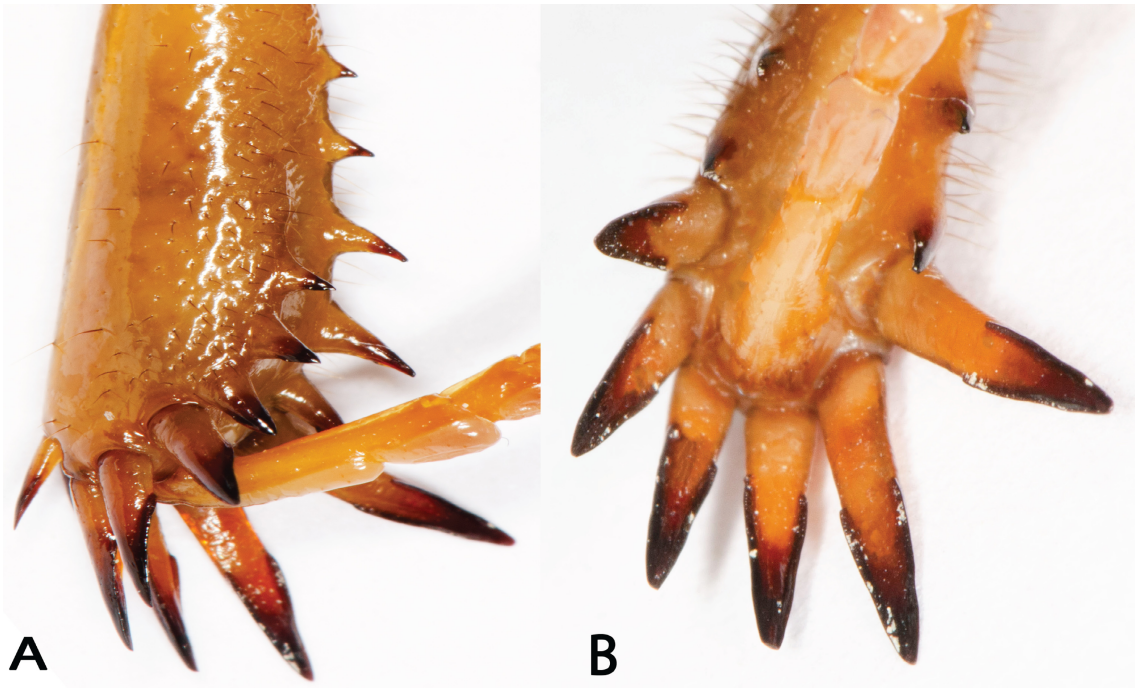


FIGURE 1093. Left rear leg tibia allotype adult female *A. chimineas*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1094. Ovipositor allotype *A. chimineas*.

Paratypes. ♂11 ♀14. **CALIFORNIA, *San Luis Obispo Co.,*** Same data as types (S10-7): ♂6 ♀5. ***Santa Barbara Co.,*** Sierra Madre Mts, Aliso Park Campground area, 34.907828° -119.768439°, 883m, 21-xii-1994 (S94-122) ♂1 ♀5; 18-xii-1996 (S96-113) ♂4 ♀4.

Probable placement: **CALIFORNIA**, ***San Luis Obispo Co.***, Flat Top, 35.206785° -119.939653°, 725m, 6-iv-2013 (S13-10B) A. Abela ♂2 ♀1, R14-7, ~10 drums/s at 19°C & R13-16, 9.7 drums/s at 21°C, F2366. Road to Chicken Water, 35.1312° -119.9513°, 755m, 7-iv-2013, A. Abela ♂1 ♀3, R13-17, ~10 drums/s at 21°C, F2367. Carrizo Canyon, 35.128916° -119.988059°, 621m, 6-iv-2013, A. Abela ♀1, R13-13, ~8.8 drums/s at 21°C, F2364.

Drum. Calling drum similar in both sexes except longer in females. **Male:** Holotype R10-30 (Fig. 1095) shows 26 drums over 2.9s (9.0 drums/s) at 20.5°C. From paratype male locality S94-122, R95-37 with 32 drums over 3.4s (9.4 drums/s) at 20°C. **Female:** Allotype R10-33 (Fig. 1096) shows 229 drums over 29.3s (7.8 drums/s) at 20°C. From paratype female locality S94-122, R96-81 with 169 drums over 21.9s (7.7 drums/s) at 20°C.

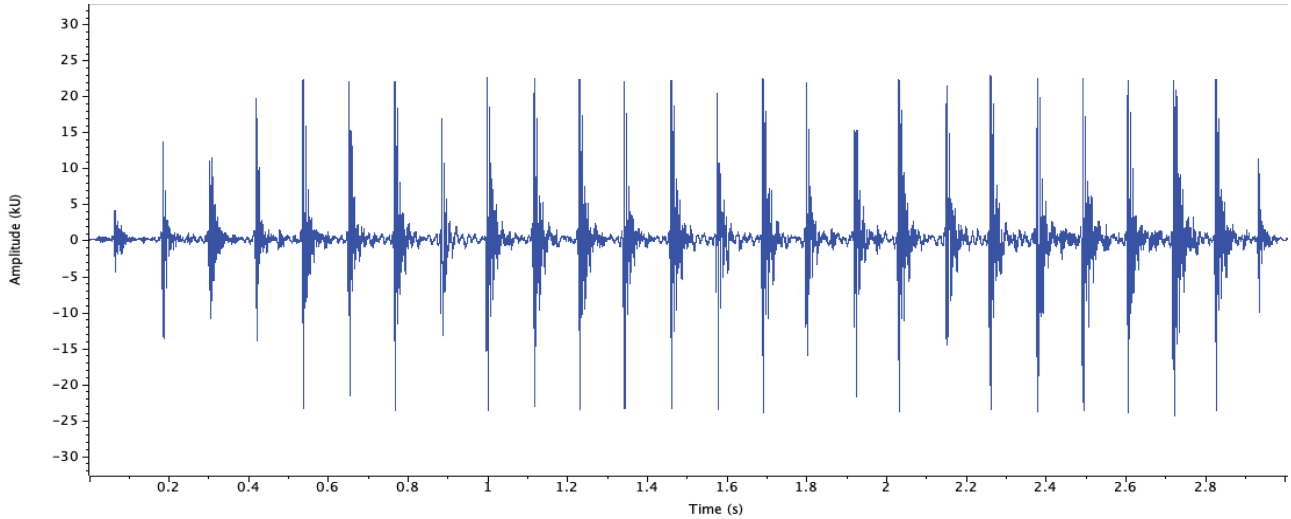


FIGURE 1095. Calling drum (R10-30) holotype adult male *A. chimineas*.

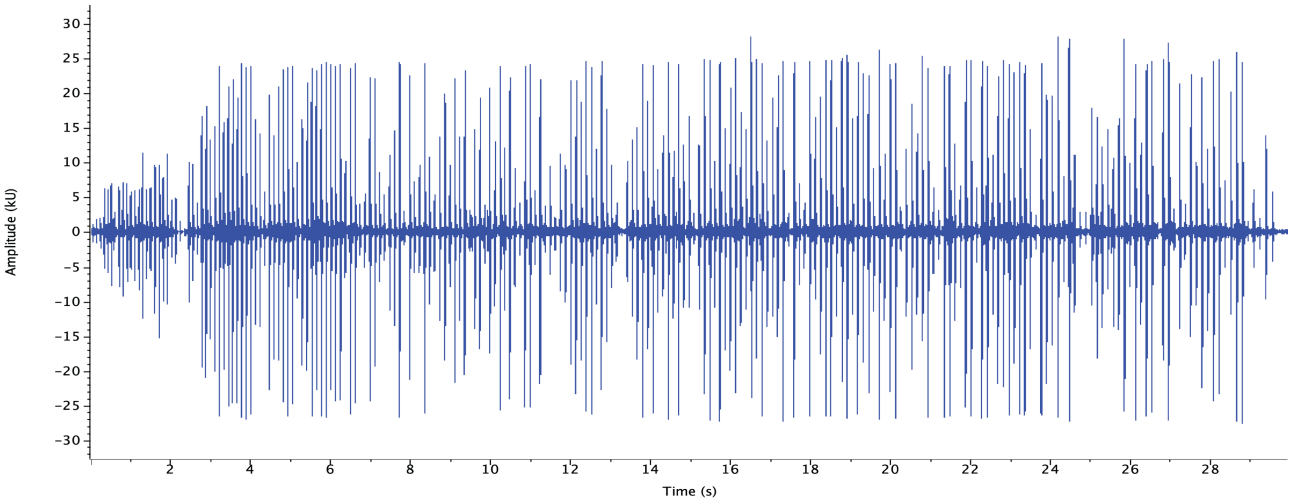


FIGURE 1096. Calling drum (R10-33) allotype adult female *A. chimineas*.

Derivation of name. Named with reference to the type locality.

Habitat. Type locality is heavily grazed open oak-savannah.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle although S94-122 (R97-51A) female, collected 21-xii-1994 as a very small nymph, molted to adult 10-viii-1997.

Variation. For 29 individuals, all had 2 ventral **fore** leg tibial spurs; 1 had 7 and 28 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 4 had 4, 24 had 5, and 1 had 6 inner **rear** leg tibial spines, and 28 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Width and darkness of black **abdominal bands** can vary. The 2 adult females in Fig. 1097 were both from S96-113, with the individual on the left molting to adult on 7-viii-1997 and whose calling drum (R97-52b) was 123 drums over 13.9s (8.8 drums/s) at 20°C. The lighter colored female on the right molted to adult on17-viii-1997 and her calling drum (R97-63) was 257 drums over 30.5s (8.4 drums/s) at 20°C.



FIGURE 1097. Color and pattern variation seen in adult topotypic females: both S96-113.

DNA. Fig. 1047, p. 579. F0109, F0142, F0175, F0277 (all Aliso Park, S94-122); F2200 & F2202 (both type locality S10-7); F2364 (Carrizo Canyon), F2366 (Flat Top), & F2367 (Road to Chicken Water), all three eastern Chimineas Ranch. All recovered in Group 20 Fast Drumming, a large, mixed, diverse clade of several other fast-drumming taxa. (*A. castaneus, A. danieli, A. fremontpeak, A. lakecachuma, A. pinnacles, A. temblor*, & *A. zayante*).

Karyotype. 2n♂=23. Two paratype locality (S96-113), and two type locality (S10-7) males examined and all similar: T97-11 (Fig. 1098) and T97-21 (Fig. 1099); and T10-1 (Fig. 1100) and T11-2 (Fig. 1101) with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. In T11-2, note better centromere location resolution when comparing mitotic vs meiotic cells.



FIGURE 1098. Idiogram T97-11 *A. chimineas* (S96-113).

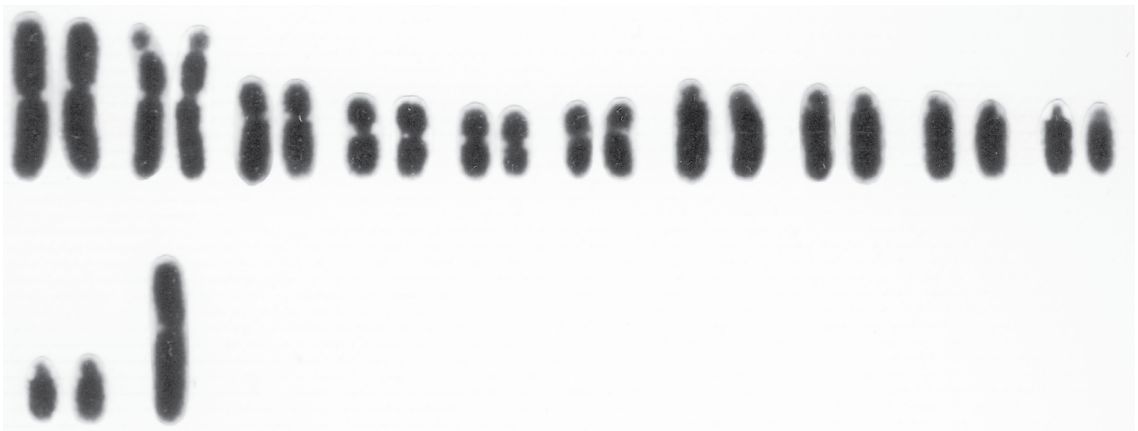


FIGURE 1099. Idiogram T97-21 *A. chimineas* (S96-113).

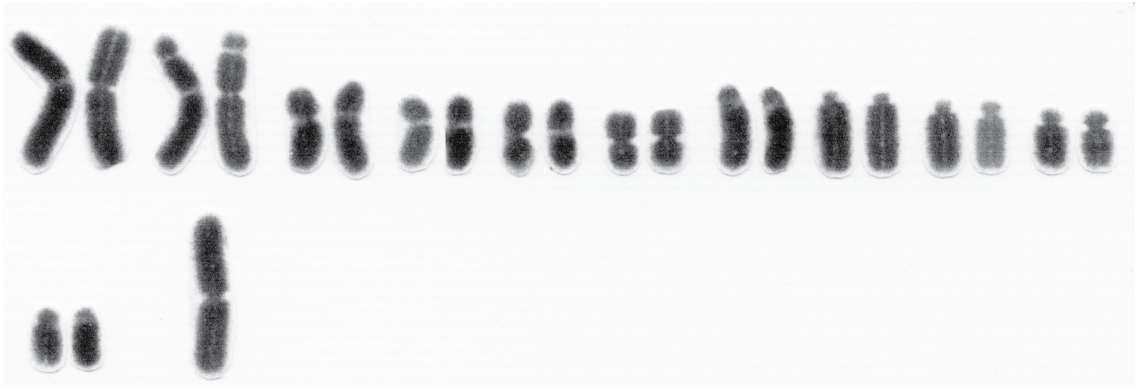


FIGURE 1100. Idiogram T10-1 *A. chimineas* (S10-7).

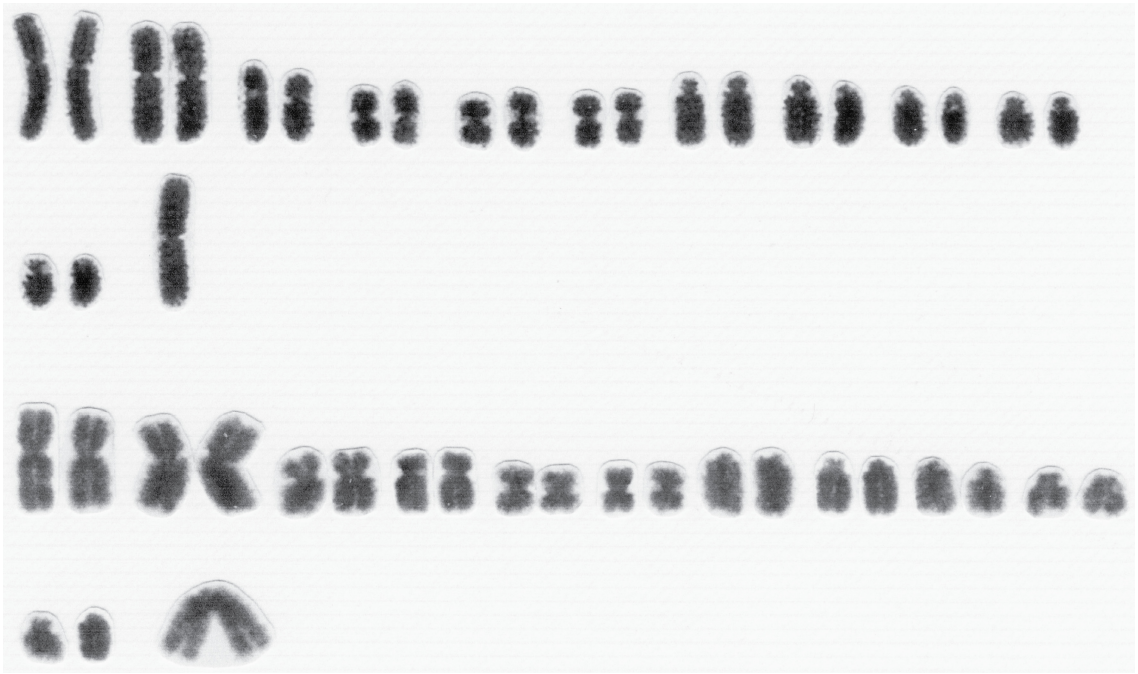


FIGURE 1101. Idiogram of two cells from T11-2 *A. chimineas* (S10-7). Top photo, from meiotic anaphase cell. Bottom photo, from mitotic anaphase cell.

Discussion. The type locality Chimineas Ranch is located 46 km East of Santa Maria on Hwy 166. Its 30,000 acres are an ecological reserve, acquired by the State of California, Department of Fish and Game, with the assistance of The Nature Conservancy and the Rocky Mountain Elk Foundation (https://lpfw.org/nearly-20-square-miles-of-land-in-san-luis-obispo-county-designated-as-north-carrizo-ecological-reserve/). The ranch is being developed as a center for ecological learning and the enjoyment of nature. It links the 250,000-acre Carrizo Plain National Monument to the NE with the 2,000,000-acre Los Padres National Forest to the SW. This general area was affected by the 2025 Gifford fire.

***Ammopelmatus danieli* Weissman, sp. nov.**
Arroyo Seco Jerusalem Cricket
Figs 1102–1118, Tables 4, 11, 12, 38

Species #3, Weissman 2001a.

Distribution. (Fig. 1102). Widely distributed in Monterey County, California, from near the coast at Seaside, across the Santa Lucia Range, and on both sides of the Salinas Valley, all west of the Gabilan Range. May range into San Benito Co. (see "Possible placement" below).

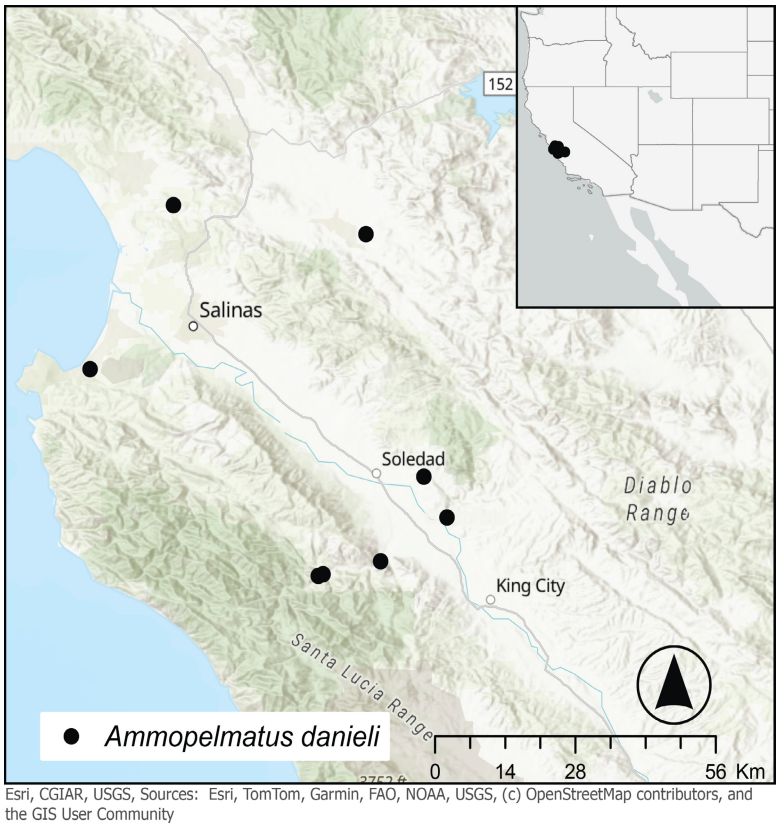


FIGURE 1102. Known distribution of *A. danieli.*

Recognition characters. Member of Fast Drumming Group. Apparently a complex (based on DNA) of medium–large, fast drumming JCs, frequently megacephalic, with variable width black abdominal bands. 2n♂=23. Separated from more northern, Fast Drumming Group *A. fremontpeak*, in the Gabilan Range and east of the Salinas Valley, where 8 out of 12 (67%) adults of *A. fremontpeak* with 4 outer rear leg tibial spines; while only 4 out of 65 (6%) adults of *A. danieli* with 4 outer rear leg tibial spines. Fremont Peak Park is ~55 km north of *A. danieli* type locality Arroyo Seco, the latter in the Santa Lucia Range, and to the west of the Salinas Valley. Separated from Fast Drumming Group *A. pinnacles*, on the eastern side of the Gabilan Range, by faster drumming rate in both sexes of *A. danieli* (Figs 1103 & 1104). *A. danieli* is also known on the eastern side of the Salinas Valley, from both Soledad and along Hwy 146. Both sites are west of Pinnacles National Park, with the latter some 10 km from the type locality of *A. pinnacles*, with The Pinnacles in between.

Holotype. Male (in alcohol, Fig. 1105). **California, *Monterey Co.,*** Santa Lucia Range, Miller's Lodge SE Arroyo Seco Picnic Area, 36.25466° -121.43208°, 192m, 22-xii-1994 (S94-124), DBW, DW Weissman. R96-40, F0255. Molt to adult 8-vii-1996. Deposited CAS, Entomology type #20165. Megacephalic. Measurements in mm: Body length 35.27, hind femur length 10.80, hind femur width 3.99. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1106) with 5 inner and 3 outer spines, 2 ventral spurs.

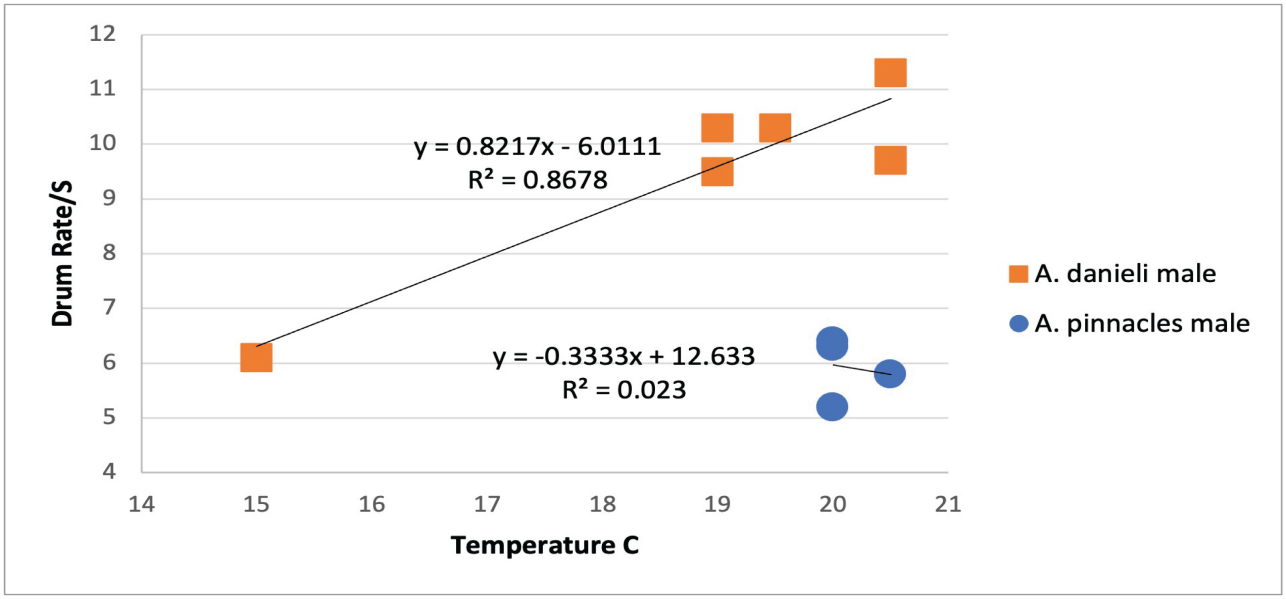


FIGURE 1103. Drumming rates in adult males of *A. danieli* vs *A. pinnacles.*

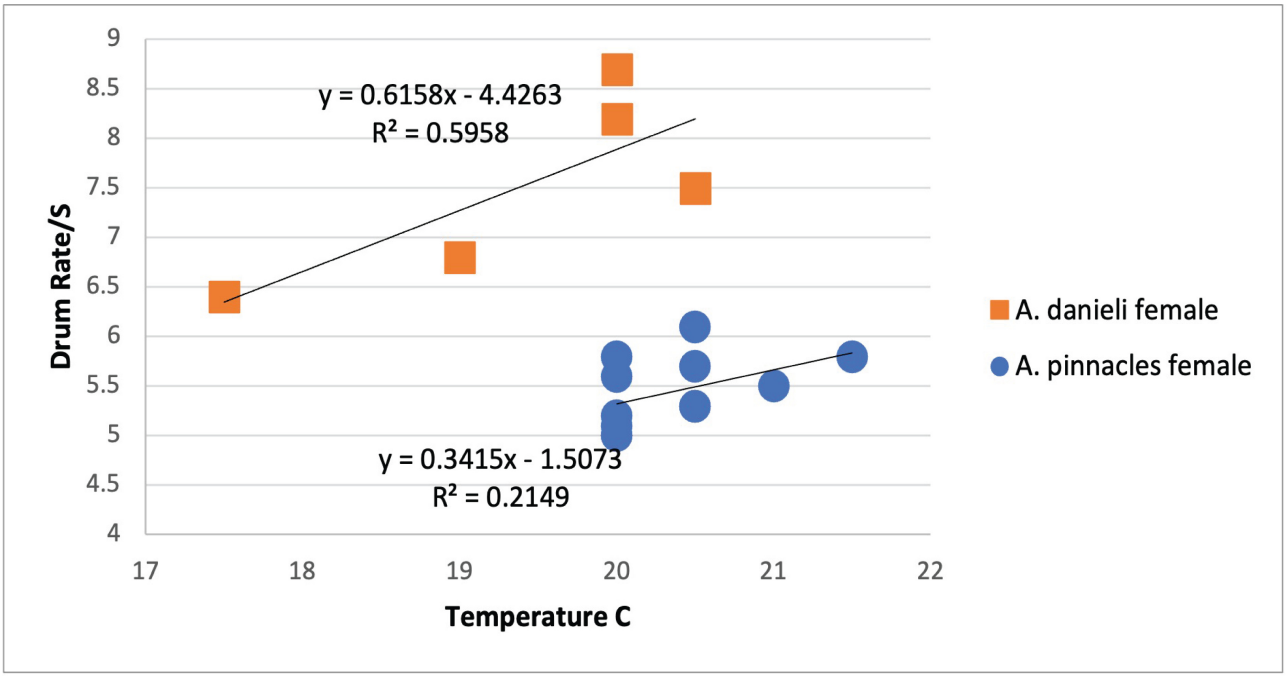


FIGURE 1104. Drumming rates in adult females of *A. danieli* vs *A. pinnacles.*



FIGURE 1105. Adult male holotype *A. danieli.* A. When alive. B. When preserved.



FIGURE 1106. Left rear leg tibia holotype male *A. danieli.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1107). Same data as holotype except R96-14, F0236. Molt to adult 28-vi-1996. Deposited CAS, CASENT #9083226. Megacephalic. Measurements in mm: Body length 39.42, hind femur length 12.21, hind femur width 4.37. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1108) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1109.

Paratypes. ♂32 ♀43. All **CALIFORNIA, *Monterey Co.,*** type locality 28-xii-1991 (S91-134) ♀3; 1-iii-1992 (S92-8) ♂1 ♀1; 27-xii-1992 (S92-146) ♂1 ♀3; 22-xii-1994 (S94-124) ♀3. Arroyo Seco Rd near junction with G16, 36.257444° -121.423558°, 221m, 22-xii-1994 (S94-125) ♂3. Big Creek Reserve, 36.0570° -121.5400°, 247m, 4-vi-1999 (S99-66) M. Caterino ♂1. Elm Ave (G16) ~0.5 m E intersection G16 and G17, 36.279317° -121.320419°, 127m, 1-iii-1992 (S92-9) ♂1 ♀1; 17-xii-1996 (S96-110) ♂3 ♀8. Hwy 146, 5 m E Soledad and 2.2 m E intersection with County Rd. G15, 36.422239° -121.242878°, 223m, 22-xii-1994 (S94-126) ♂1; 17-xii-1996 (S96-109) ♂7 ♀5; 11-iii-2021 (S21-3) ♂4 ♀4; 10-v-2021 (S21-5) 3 late instar males for testes. Hwy 146 from 0.9 to 2.9 m E Metz Rd. (County Rd. G15), 19-23-iv-1988 (S88-10) R. Macey ♂2 ♀4. King City, 39467 Metz Rd, 36.353285° -121.201404°, 93m, 9-xi-2023 (S23-105) RT Cumming ♂2. Royal Oaks, 2487 Tuckahoe Terrace, 36.880721° -121.691599°, 65m, 25-xi-2005 to 23-i-2006 (S05-166) L. Black ♂2 ♀3; 17-iv-5-vi-2006 (S06-12) ♂2 ♀6. Seaside, 1180 Wanda Ave, 36.603773° -121.841027°, 30m, 27-vii-2005 (S05-70) M. St. Mary ♀1; 29-v-2006 (S06-31) ♀1; 13-iv-2007 (S07-9) ♂1. ***San Benito Co***., Hollister, John Smith Rd, ~1 m E Fairview Rd, 36.831779° -121.346646°, 153m, 14-ix-2009 (S09-155) MF Westfall ♂1. This Hollister male (F2155) is recovered in a fast-drumming clade with *A. fremontpeak* and *A. zayante*; and this site is closest (some 16 km E) to type locality of *A. fremontpeak* in the nearby Gabilan Range. But the low elevation of this site, combined with 3 outer rear leg tibial spines, are both more consistent with that found in *A. danieli,* even if the latter is normally found farther south.

Probable placement: **CALIFORNIA, *San Benito Co.,*** Pinnacles National Park, Juniper Canyon Trail, near parking lot, 430m, 17-ii-2014 (S14-1) ♀1.

Possible placement. **CALIFORNIA, *San Benito Co.***, Clear Creek Oak Flats Campground, 36.36117° -120.76097°, 790m, 19-iv-2024 (S24-53, R24-46, F2980) A. Abela ♀1.

Drum. Calling drum similar in both sexes except faster in males and series longer in females; rare males with a sex clarification drum (SCD). **Male:** Holotype R96-40 (Fig. 1110) shows 26 drums over 2.3s (11.3 drums/s) at 20.5°C. Paratype male R22-21 (Fig. 1111, S21-3, W Pinnacles) with 3 SCD in 0.22s (13.6 drums/s) followed by 36 calling drums in 3.3s (10.9 drums/s) at 22.2°C. **Female:** Allotype R96-14 (Fig. 1112) shows 134 drums over 16.0s (8.4 drums/s) at 20°C.

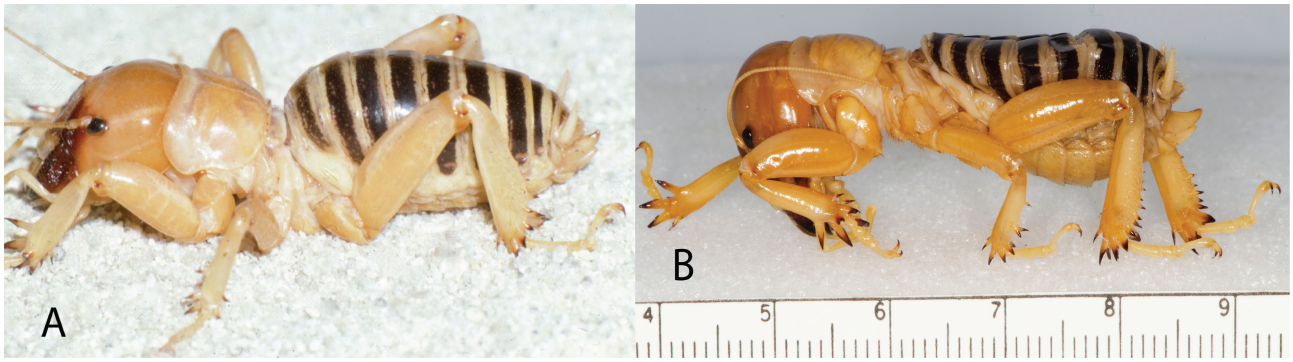


FIGURE 1107. Adult female allotype *A. danieli.* A. When alive. B. When preserved.



FIGURE 1108. Left rear leg tibia in female allotype *A. danieli.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1109. Ovipositor allotype *A. danieli*.

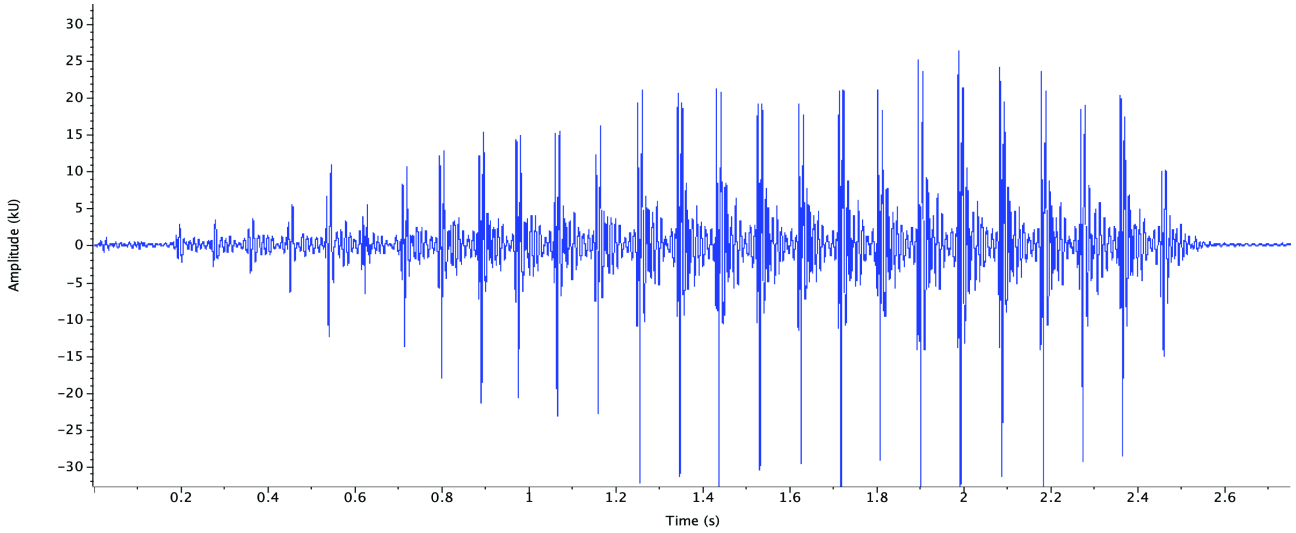


FIGURE 1110. Calling drum (R96-40) in holotype male *A. danieli.*

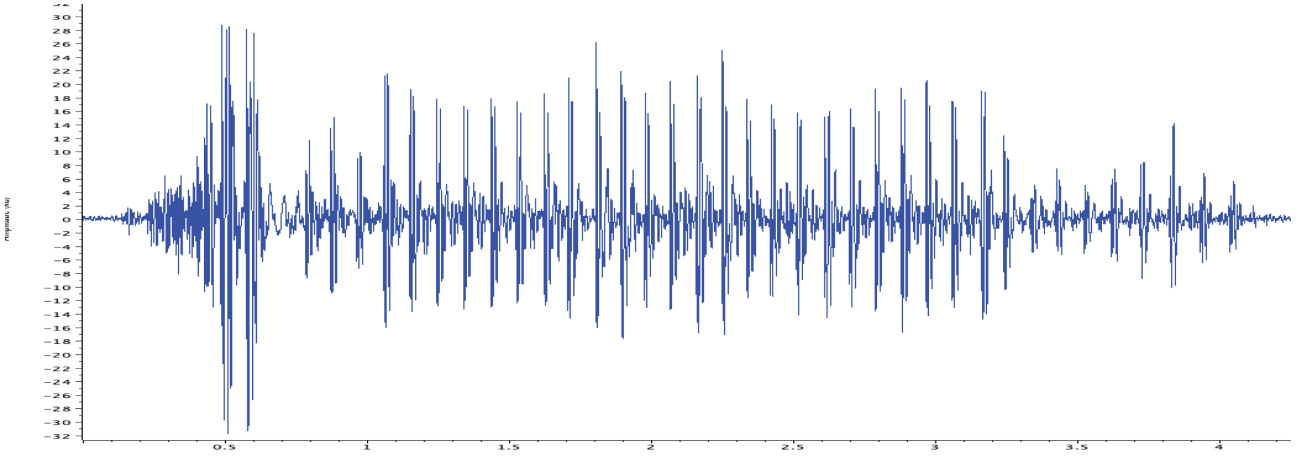


FIGURE 1111. Short SCD followed by calling drum (R22-21) in paratype adult male *A. danieli.*

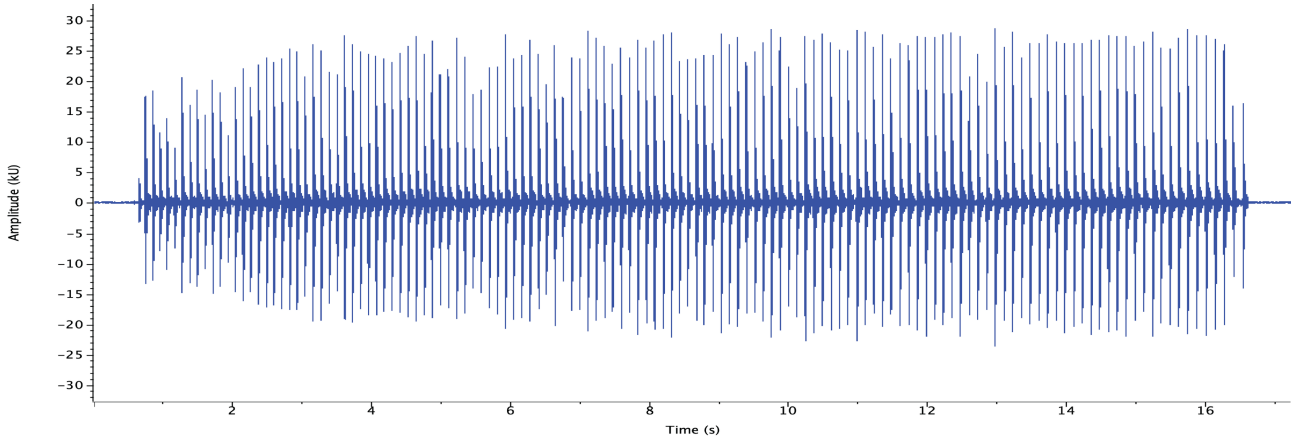


FIGURE 1112. Calling drum (R96-14) in allotype female *A. danieli.*

Derivation of name. Named for Daniel W. Weissman, who helped collect the first specimens of this species when he was 8 years old, and who has collected many more JCs since. *Habitat.* Juveniles found under rocks, at type locality, in semi-riparian situation. Adjoining areas with oaks, open grassland, and chaparral. On Elm Ave (G16),

under rocks under oaks in heavily grazed open grassland. The 1988 specimens (S88-10) were collected on the road on 2 nights, shortly after dark, during a light, warm rain. The 2021 specimens (S21-5) were collected walking on County Road G15, starting at 20:20, with air temperatures around 15°C.

Life cycle and seasonal occurrence. Apparent 2 or 3 (or longer?) year life cycle: 1 mid instar female (R97-68) collected 22-xii-1994 (S94-124) molted to adult 22-vii-1997, although other individuals collected at the same time, and as small instars, molted to adult in 1996. One early instar female (R97-32) collected 27-xii-1992 (S92-146) molted to adult 22-vii-1997. We cannot exclude a prolonged nymphal period in these individuals because of poor laboratory diet and/or suboptimal raising conditions, as discussed further by Weissman (2001a, p. 65).

Variation. Of the 46 individuals **west of the Salinas Valley**, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 4 and 44 had 5 inner **rear** leg tibial spines, and 44 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Of the 19 adults **east of the Salinas Valley**, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 4, 15 had 5, and 2 had 6 inner **rear** leg tibial spines, while 17 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. The 2 large adult males from King City (S23-105) were both megacephalic (Fig. 1113), as were many individuals from along Hwy 146 east of Pinnacles.



FIGURE 1113. Megacephalic adult male *A. danieli* from S23-105, R23-32.

DNA. Fig. 1047, p. 579. Given the fact this taxon is found on both sides of the Salinas Valley, coupled with its several different recovered placements in the multilocus tree, and in the context of our acknowledging the possibility of cryptic sister species, we thus divide specimen origins to east and west of the Salinas Valley. ***W of Salinas Valley***: F0236 and F0237 (both type locality Arroyo Seco, S94-124); F1099 (S99-66, Big Creek Reserve); F1828, F1829 & F1854 (S06-12, Royal Oaks); F1830 and F1831 (S06-31, Seaside). ***E of Salinas Valley***: F0299 (S94-126, Hwy 146); F0500 (S96-109, 5m E Soledad); F2155 (S09-155, Hollister); F2636 (S21-5, W Pinnacles); F2901 & F2909 (S23-105, King City). While all specimens recovered in Group 20 Fast Drumming, there is mixing of those collected east and west of the Salinas Valley.

Possible placement. F2980 (S24-53, Clear Creek Oak Flats).

Karyotype. 2n♂=23. Six individuals determined and all consistent: T95-39 (Fig. 1114) & T95-43 (Fig. 1115, both from type locality S94-124); T97-3 (Fig. 1116, S96-109, E Soledad); T97-23 (Fig. 1117) & T97-25 (both from

S96-110, Elm Ave); and T21-1 (Fig. 1118A) & T21-2 (Fig. 1118B) (both S21-5, W Pinnacles) with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 1114. Idiogram T95-39 *A. danieli* (S94-124).



FIGURE 1115. Idiogram T95-43 *A. danieli* (S94-124).

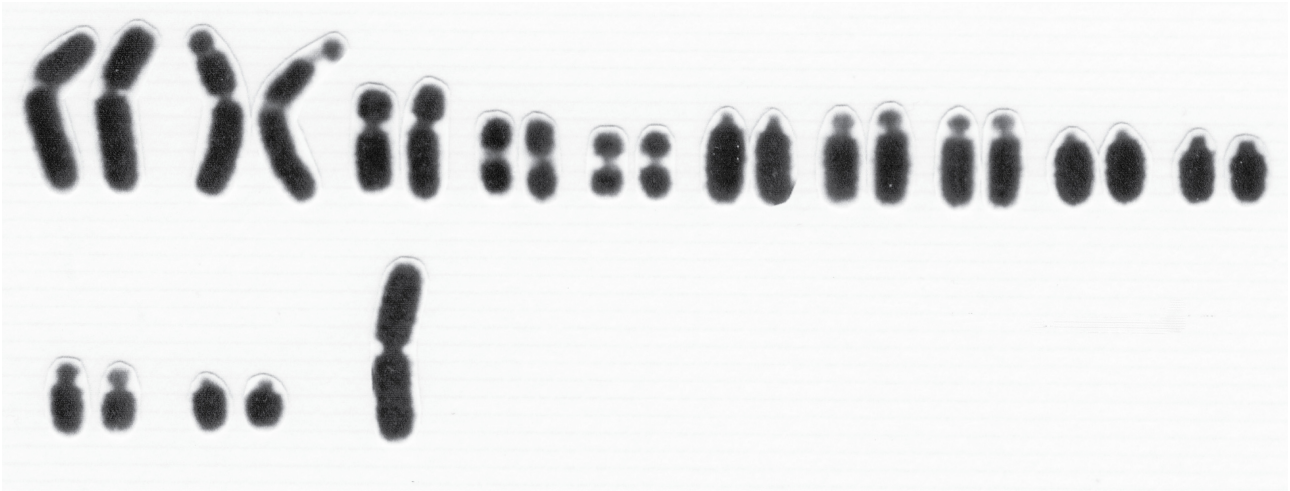


FIGURE 1116. Idiogram T97-3 *A. danieli* (S96-109).

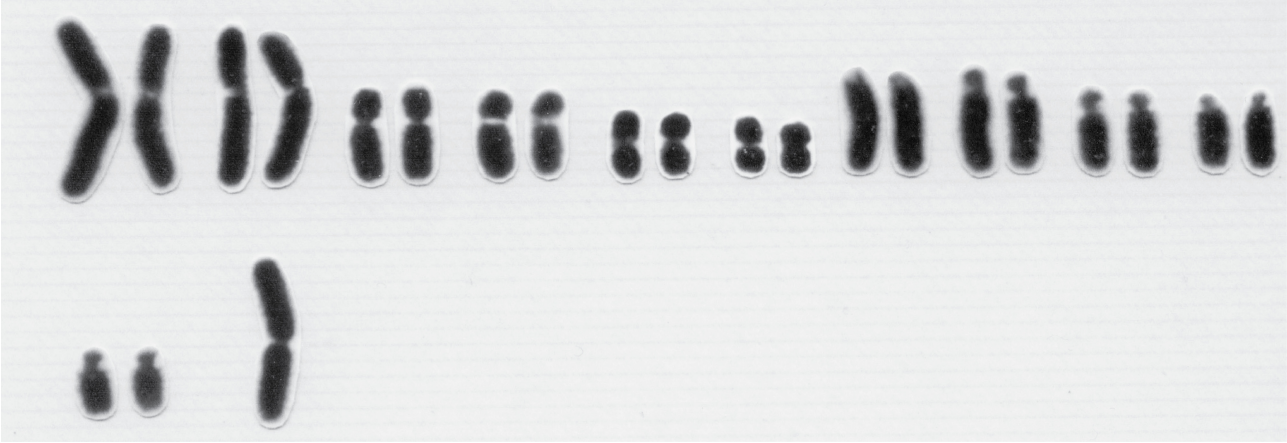


FIGURE 1117. Idiogram T97-23 *A. danieli* (S96-110).

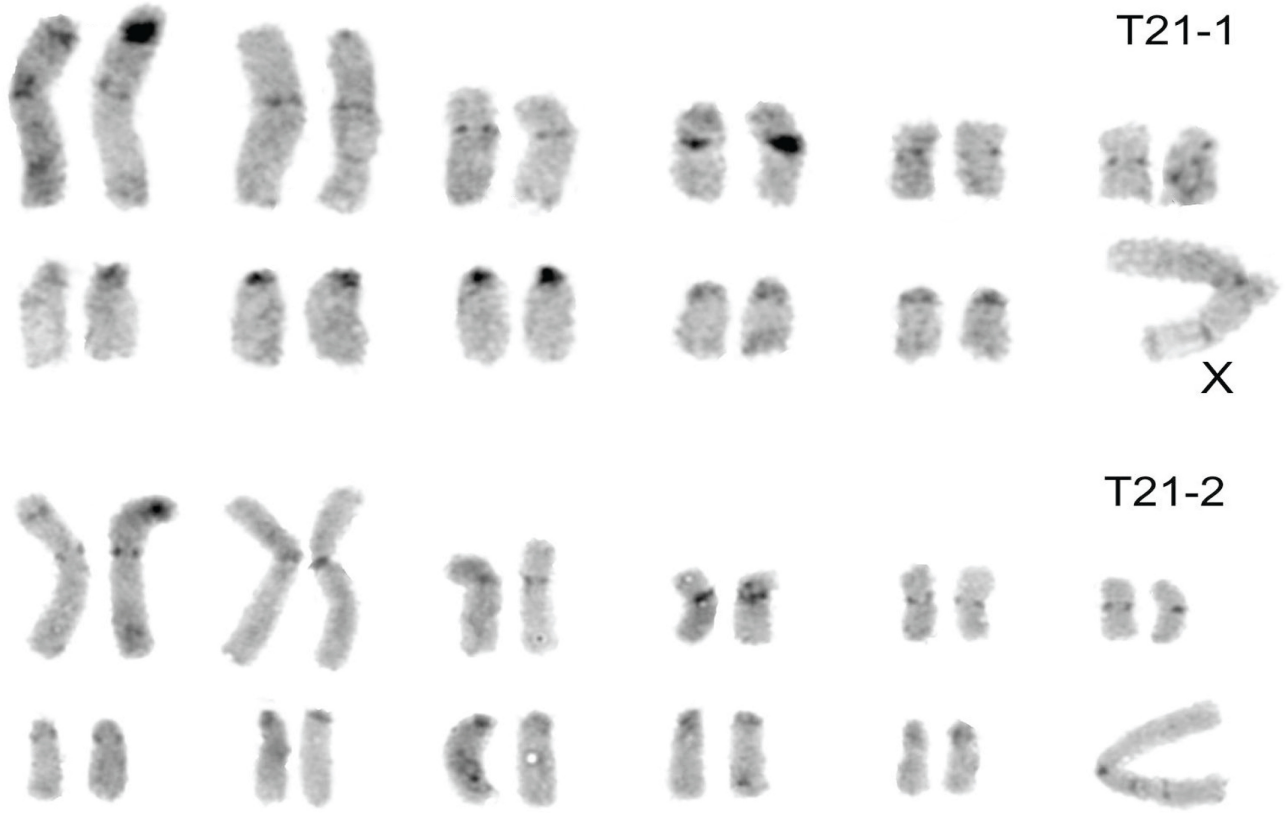


FIGURE 1118. Idiograms of A. T21-1 and B. T21-2, *A. danieli* (both S21-5). Both cells stained for C-bands.

Discussion. These paratype populations are all considered as one species since their drum and karyotypes are similar. Nevertheless, we find a mixing, in the tree, of individuals from both east and west of the Salinas Valley. Until recent times, JCs should have been able to cross the Salinas Valley, although now Hwy 101 would be a barrier (Vandergast *et al.* 2007, 2009).

Because the type locality is located only 30 meters from a semipermanent stream, we were not surprised to find many of the nymphal JCs collected there to be parasitized by horsehair worms (see Poinar & Weissman 2004).

Sympatric with *A. bigsur* at Seaside (S05-70), where the 2 species can be separated by size, drum, and DNA.

***Ammopelmatus fremontpeak* Weissman, sp. nov.**
Fremont Peak Jerusalem Cricket
Figs 1119–1127, Tables 4, 12, 38

Distribution. (Fig. 1119). Only known from the higher elevations of the Gabilan Range within Fremont Peak State Park, along the County line between Monterey and San Benito Counties, California.

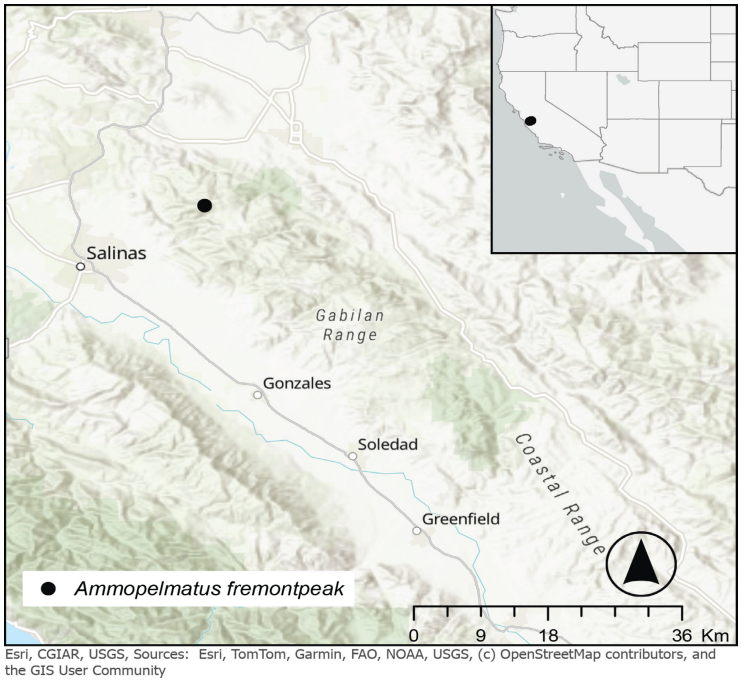


FIGURE 1119. Distribution of *A. fremontpeak.*

Recognition characters. Member of Fast Drumming Group. A large to very large JC with broad, solid black bands, a fast drum, and where 67% of individuals have 4 and 33% have 3 rear leg outer tibial spines while; in morphologically similar *A. danieli*, which is physically separated from *A. fremontpeak* by the Salinas Valley, 4% of individuals have 4 and 96% have 3 rear leg outer tibial spines. Rear leg tibial calcar #1 seems shorter than in comparably sized *A. danieli*, but we haven't done detailed morphometrics. Nymphs at type locality with orange heads, which separates them from smaller, different drumming sympatric *A. intermedioides* and *A. brachysocius.* Separated from nearby Fast Drumming Group *A. pinnacles*, found some 40 km to the southeast and also in the Gabilan Range, by habitat and slower drumming rate in the latter.

Holotype. Male (in alcohol, Fig. 1120). **California, *Monterey Co.,*** Gabilan Range, Fremont Peak State Park, 36.756700° -121.506633°, 891m, 28-ii-2004 (S04-4) DBW. R05-60, F1628. Molt to adult 4-viii-2005. Deposited CAS, Entomology type #20166. Measurements in mm: Body length 55.5, hind femur length 13.89, hind femur width 5.84. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1121) with 5 inner and 4 outer spines, 2 ventral spurs.

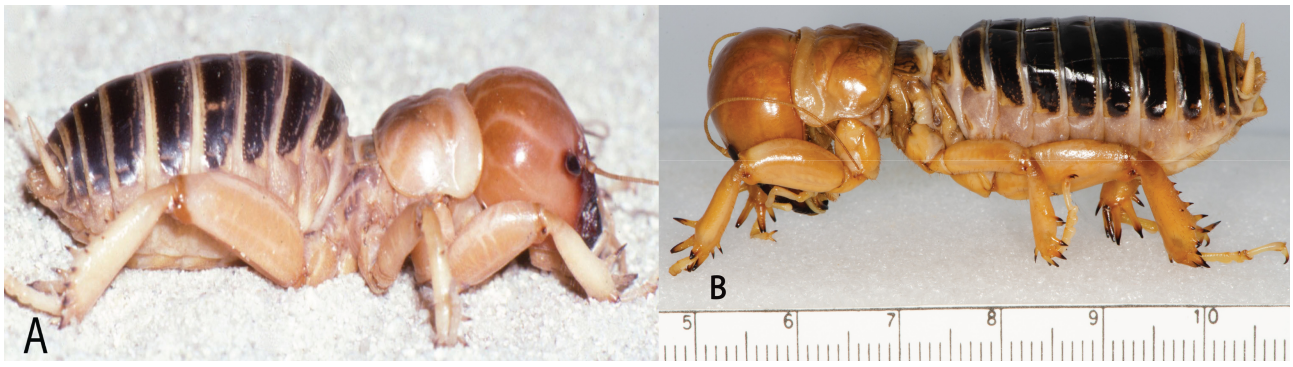


FIGURE 1120. Holotype adult male *A. fremontpeak.* A. When alive. B. When preserved.



FIGURE 1121. Right rear leg tibia adult male holotype *A. fremontpeak.* A. Showing 5 inner and 4 outer spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1122). Same data as holotype except R05-30, F1630. Molt to adult 13-viii-2005. Deposited CAS, CASENT #9079139. Measurements in mm: Body length 45.0, hind femur length 14.41, hind femur width 4.81. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1123) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1124.

Paratypes. ♂4 ♀7. **CALIFORNIA, *Monterey Co.,*** all type locality area: 21-iii-2003 (S03-7) ♀2; 28-ii-2004 (S04-4) ♂1 ♀2; 6-i-2005 (S05-4) ♂3 ♀2. ***San Benito Co.,*** San Juan Canyon Rd 6.5 m S Hwy 156, 1500', 25-vi-1982 (S82-27) ♀1.

Possible placement. **CALIFORNIA, *San Benito Co.***, Hollister, John Smith Rd, ~1 m E Fairview Rd, 36.831779° -121.346646°, 153m, 14-ix-2009 (S09-155) MF Westfall ♂1. This male (F2155) is recovered in a fast-drumming clade with *A. danieli* and *A. zayante*; and this site is closest (some 16 km E) to type locality of *A. fremontpeak* in the nearby Gabilan Range. But the low elevation of this site, combined with 3 outer rear leg tibial spines, are both more consistent with that found in *A. danieli,* even if the latter is found farther south.

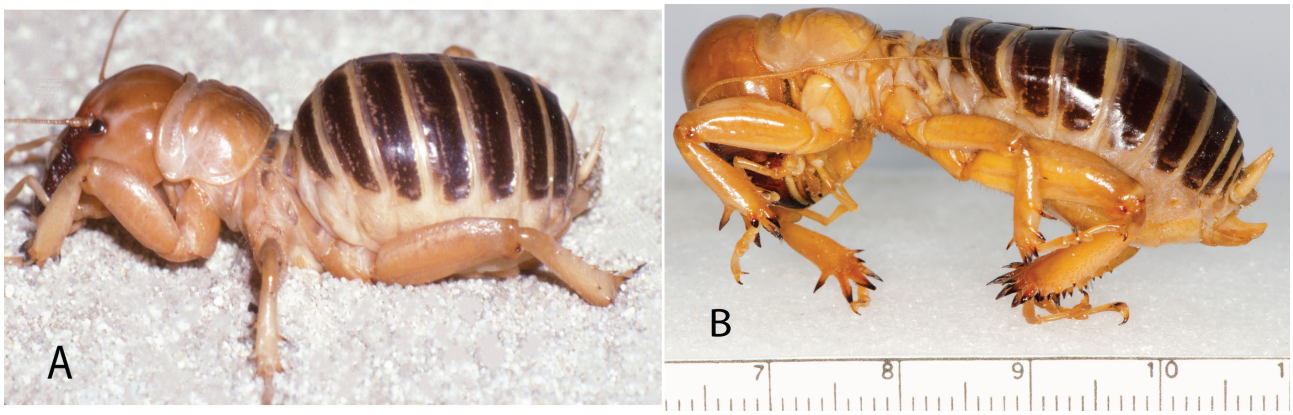


FIGURE 1122. Adult female allotype *A. fremontpeak.* A. When alive. B. When preserved.



FIGURE 1123. Left hind leg tibia allotype *A. fremontpeak.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

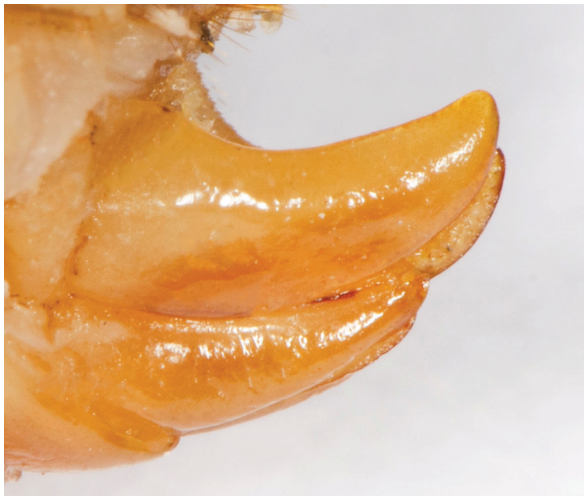


FIGURE 1124. Ovipositor allotype *A. fremontpeak*.

Drum. Calling drums similar in both sexes except faster in males, who rarely have a sex clarification drum (in male R06-70, S05-4, heard but not recorded). **Male:** Holotype R05-60 (Fig. 1125) showing 38 drums over 4.4s (8.6 drums/s) at 20°C. **Female:** Allotype R05-30 (Fig. 1126) showing 102 drums over 15.7s (6.5 drums/s) at 19°C.

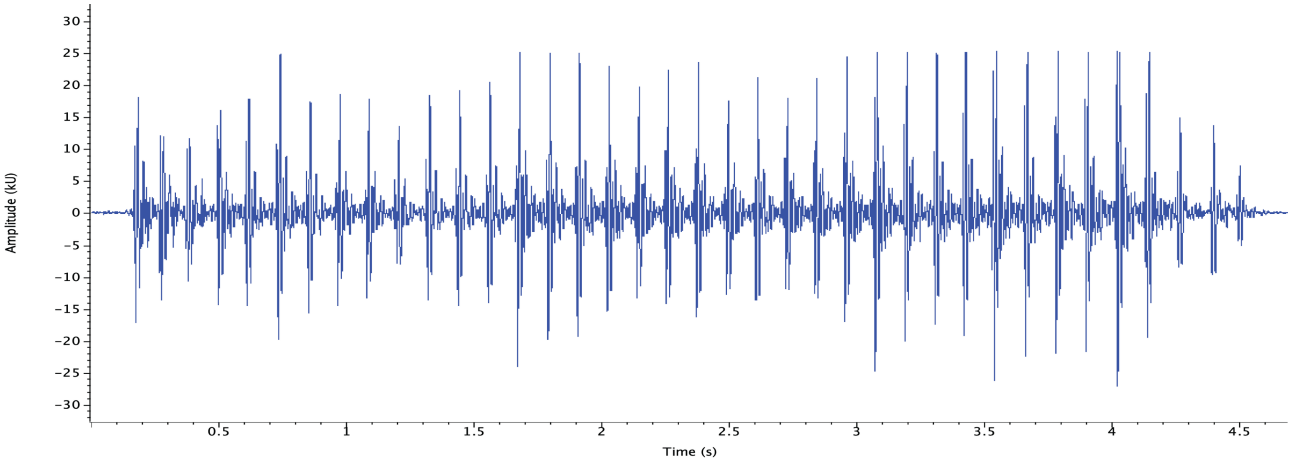


FIGURE 1125. Calling drum (R05-60) adult male holotype *A. fremontpeak.*

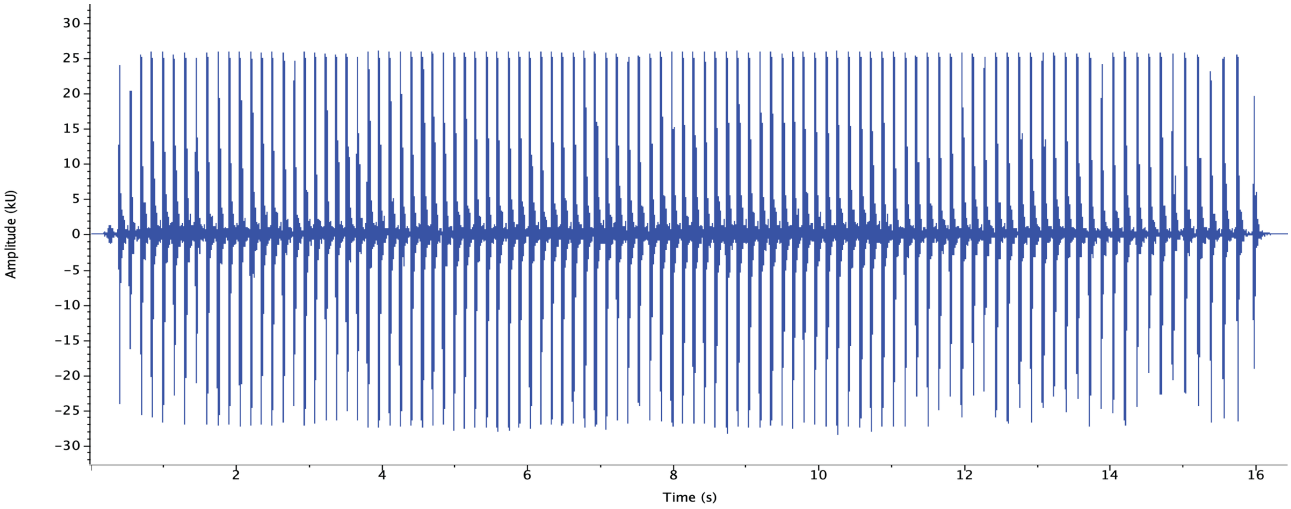


FIGURE 1126. Calling drum (R05-30) adult female allotype *A. fremontpeak.*

Derivation of name. Named after the type locality. This state park was named after John C. Frémont, who explored this area in 1846, was one of California's first 2 U.S. senators; and ran for president, in 1856, on the infant Republican Party ticket.

Habitat. Individuals from S04-4 and S05-4 were under rocks on a heavily grazed, SE facing slope while those from S03-7 were ~200m NE, under rocks, on more north facing open slopes with chaparral vegetation. Extensive pig damage was noted within the Park in 2003.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For 12 type locality individuals, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and all with 2 ventral spurs; all 12 had 5 inner **rear** leg tibial spines, while 4 had 3 and 8 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1047, p. 579. F1628 and F1630 (both type locality S04-4) recovered in poorly supported Group 20 Fast Drumming with several other Fast Drumming Group taxa.

Karyotype. 2n♂=23. Type locality T05-8 (Fig. 1127, S04-4) with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

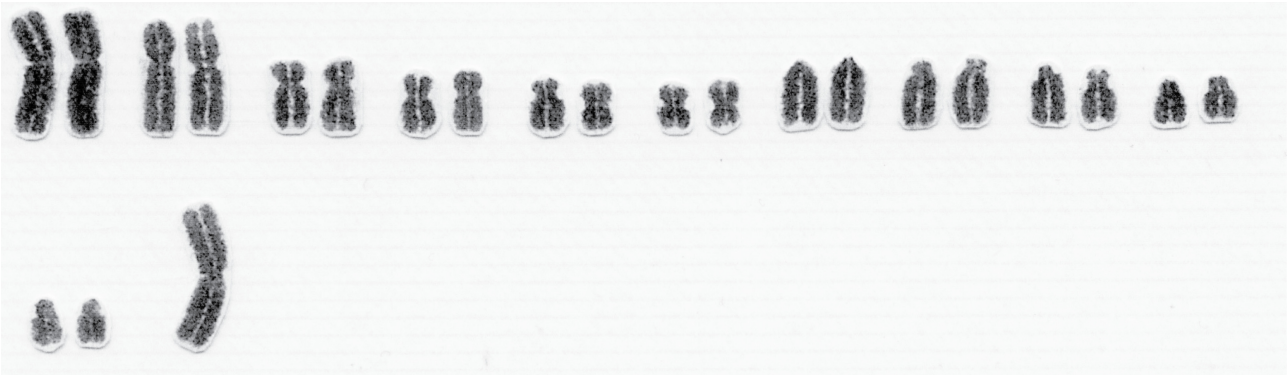


FIGURE 1127. Idiogram T05-8 *A. fremontpeak* (S04-4).

Discussion. There are 3 species of JCs essentially microsympatric at higher elevations in Fremont Peak State Park. Under the tree covered more northern facing slopes, *A. brachysocius* and the endemic *A. intermedioides* are microsympatric; while on the adjacent, more southeast facing grass covered slopes one finds the endemic *A. fremontpeak.* The calling drums of all 3 taxa are different (see Table 4, p. 32).

***Ammopelmatus grapevine* Weissman, sp. nov.**
Tehachapi Mountain Fast Drumming Jerusalem Cricket
Figs 1128–1138, Tables 2, 24, 38

Distribution. (Fig. 1128). All Kern Co., California: Tehachapi Mt Park, The Grapevine, and Tejon Ranch.

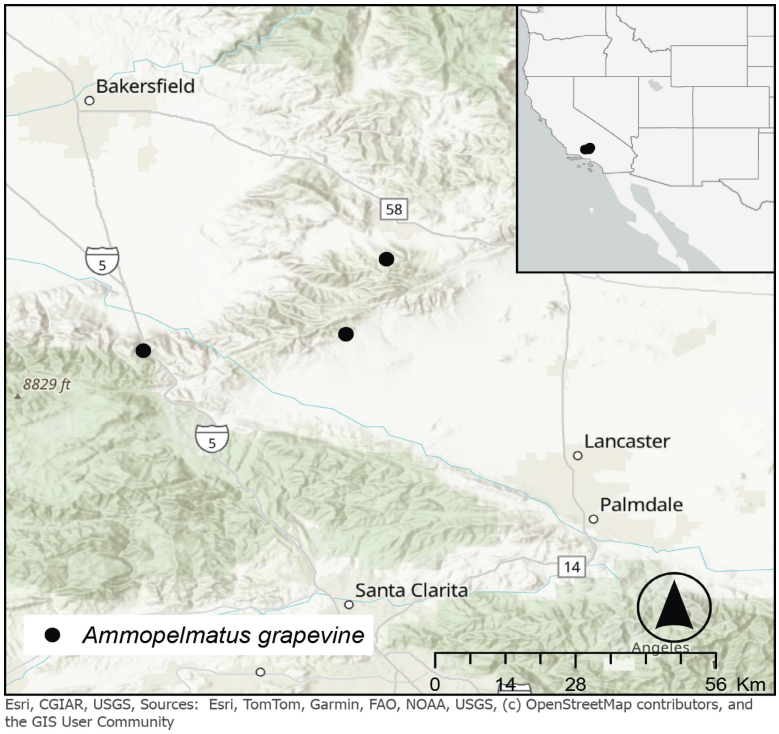


FIGURE 1128. Distribution of *A. grapevine.*

Recognition characters. Only member of Fast Drumming Group of JC species with 2n♂=25 (2n♂=23 in all other members). A large, megacephalic JC, whose adult males have a very long calcar #1; wide, black abdominal bands;

and a drum rate between 9–12 drums/s at 20°C. Can be separated from sympatric *A. crypticus* and *A. tehachapi*, at Tehachapi Mt Park, by drum rate, DNA, and usual presence of 2 (rarely 1 or 3) fore leg tibial ventral spurs while the other 2 taxa normally have 3 spurs.

Holotype. Male (in alcohol, Fig. 1129). **California, *Kern Co.,*** Tehachapi Mt Park, 35.071747° -118.487147°, 1693m, 6-iii-1992 (S92-28) DBW & VF Lee. R93-46. Molt to adult 2-viii-1993. Deposited CAS, Entomology type #20131. Megacephalic. Measurements in mm: Body length 42.05, hind femur length 12.28, hind femur width 4.56. Fore leg tibia with 2 and 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1130) with 5 inner and 2 and 4 outer spines, 2 ventral spurs.

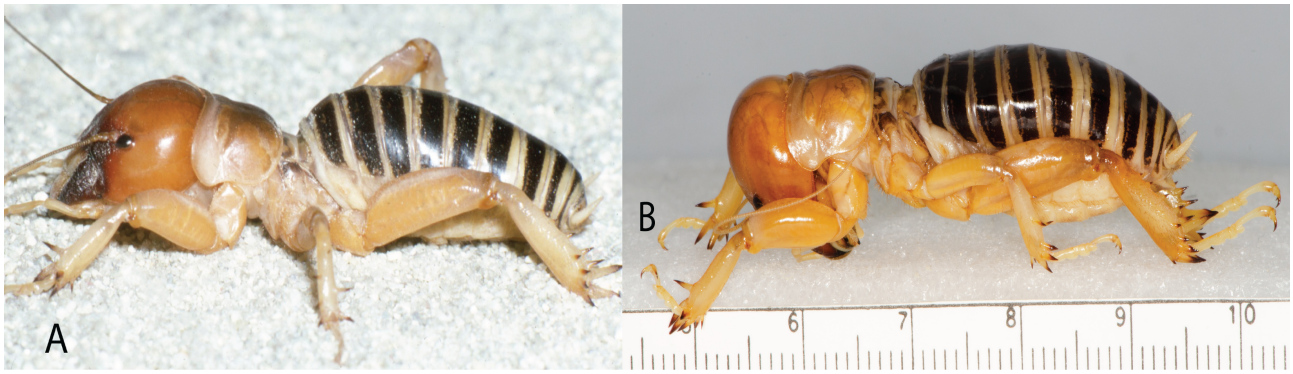


FIGURE 1129. Adult male holotype *A. grapevine.* A. When alive. B. When preserved.



FIGURE 1130. Left rear leg tibia male holotype *A. grapevine.* A. When alive. B. When preserved

Allotype. Female (in alcohol, Fig. 1131). Same locality as holotype except 23-iii-1993 (S93-15) DBW, VF Lee. R93-22. Molt to adult 3-viii-1993. Deposited CAS, CASENT #9082980. Megacephalic. Measurements in mm: Body length 37.48, hind femur length 11.15, hind femur width 4.09. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1132) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1133.

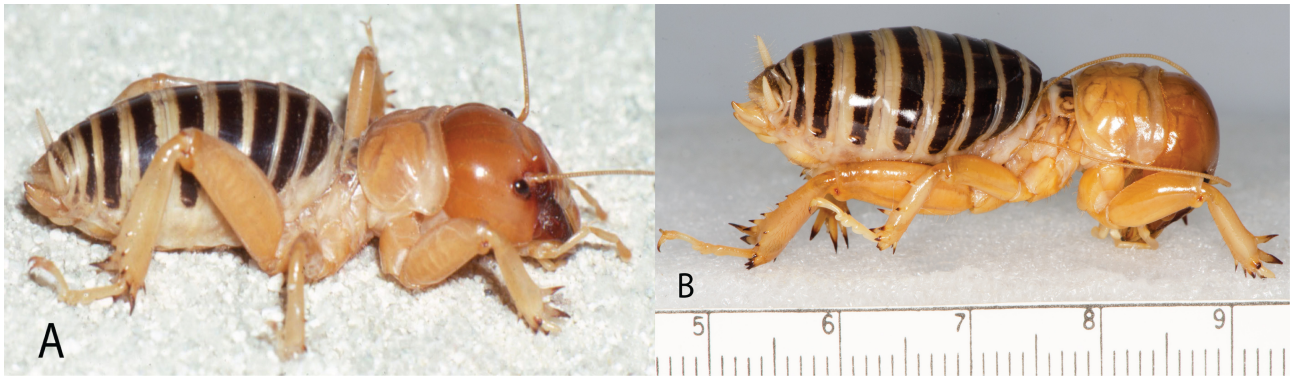


FIGURE 1131. Adult female allotype *A. grapevine.* A. When alive. B. When preserved.



FIGURE 1132. Right hind leg tibia female allotype *A. grapevine.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.



FIGURE 1133. Ovipositor allotype *A. grapevine.*

Paratypes. ♂17 ♀16. **CALIFORNIA, *Kern Co.,*** Type locality: Tehachapi Mt Park, 35.071747° -118.487147°, 1693m, 6-iii-1992 (S92-28) ♂1; 23-iii-1993 (S93-15) ♂4; 7-x-1995 (S95-104) ♂3 ♀2; 13 & 18-iii-1996 (S96-9) ♂4 ♀3. I-5 ("Grapevine") 2.3 m N Fort Tejon, pullout west side of freeway, 34.897591° -118.922817°, 768m, 9-ii-1990 (S90-2) ♂1; 23-xii-1991 (S91-130) ♀2; 6-iii-1992 (S92-31) ♂2 ♀4; 26-xii-1992 (S92-145) ♂1 ♀1; 26-ii-2001 (S01-13) ♀4. Tejon Ranch Conservancy, Sacatara Canyon, 34.92913° -118.55978°, 1336m, 21-22-viii-2015 (S15-117) J. Cole, ♂1.

Drum. Calling drum similar in both sexes except longer in female. **Male:** Holotype R93-46 (Fig. 1134) with 47 drums over 4.7s (10.0 drums/s) at 20°C. **Female:** Allotype R93-22 (Fig. 1135) with 78 drums over 9.0s (8.7 drums/s) at 20°C.

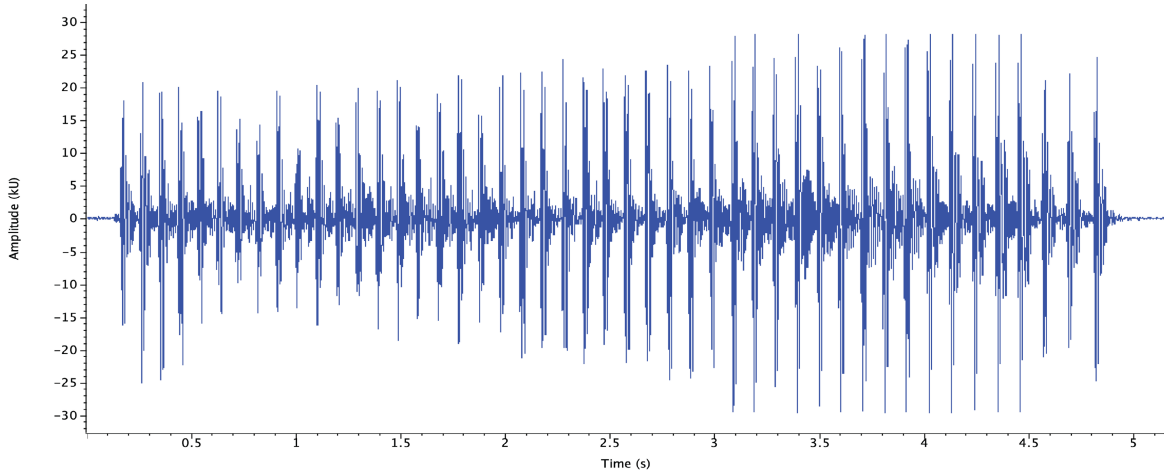


FIGURE 1134. Calling drum (R93-46) adult male holotype *A. grapevine*.

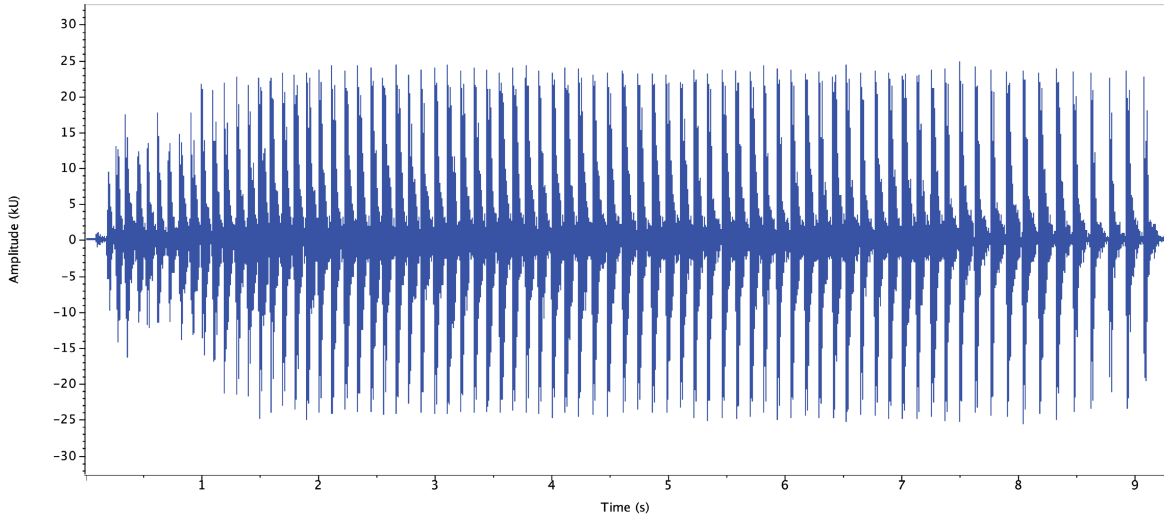


FIGURE 1135. Calling drum (R93-22) adult female allotype *A. grapevine*.

Derivation of name. According to Wikipedia, the Tehachapi Mountains are delineated from the more western San Emigdio Mountains by Tejon Pass. The dramatic incline of Interstate 5 (I-5) from the San Joaquin Valley floor up to the pass, is regionally referred to as *The Grapevine*, after Grapevine Canyon which it follows between the northern slopes of the two mountain ranges and is sometimes extended to include the portion of I-5 on the southern side of Tejon Pass, especially during snow closures. The canyon was named after native grapevines, the California grapevine (*Vitis californica*), found at springs on its slopes.

Habitat. The type locality is open pine-oak forest; while The Grapevine is open steep grassy slopes with few shrubs but lots of rocks.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For some 38 individuals, 1 had 1, 36 had 2, and 1 had 3 ventral **fore** leg tibial spurs; 3 had 7 and 35 had 8 **middle** leg tibial calcars, and 1 had 1 and 36 had 2 ventral spurs; 1 had 4, 36 had 5 and 1 had 6 inner **rear** leg

tibial spines, while 1 had 2, 34 had 3, and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Size adult females:** At both the type locality and along I-5, late winter collections typically included a number of very small, non-drumming adult females of *A. grapevine*, whose identity was confirmed by DNA sequencing.

DNA. Fig. 1047, p. 579. F0275 and F0457 (both type locality S96-9, Tehachapi Mt Park); F1318 (holotype); F2447 (S15-117, Tejon Ranch) all recovered together in Group 20 Fast Drumming, along with other Fast Drumming Group members *A. acton, A. bakersfield,* and *A. mtpinos.*

Karyotype. 2n♂=25. Two individuals determined, both from type locality Tehachapi Mt Park (S92-28), and both with 2 fore leg tibial spurs: T92-53 (Fig. 1136) and T93-30 (Fig. 1137): both with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

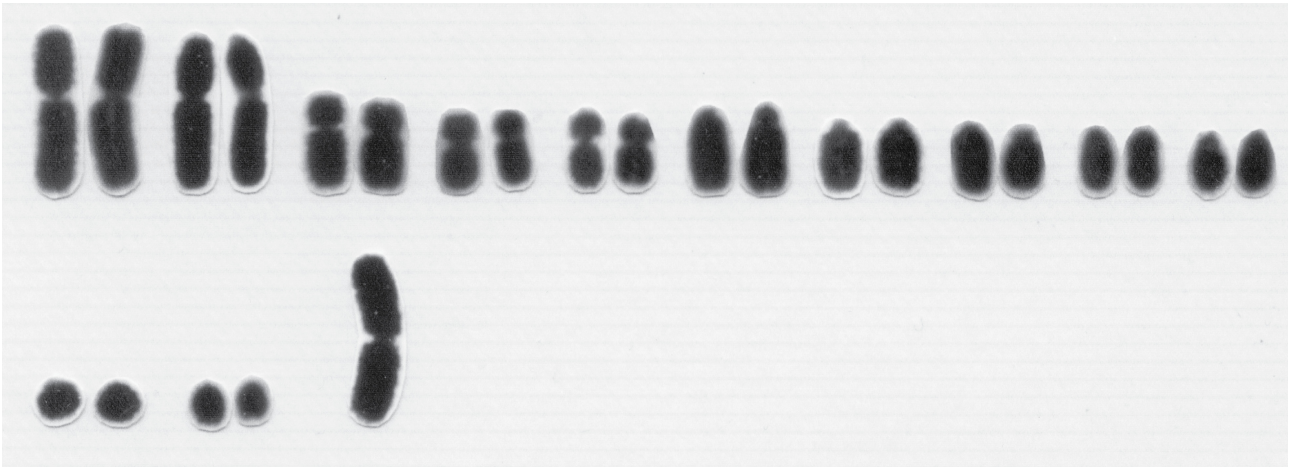


FIGURE 1136. Idiogram type locality T92-53 *A. grapevine* (S92-28).



FIGURE 1137. Idiogram type locality T93-30 *A. grapevine* (S92-28).

Discussion. There are 3 species of *Ammopelmatus* known from Tehachapi Mt Park (TMP): (1) *A. grapevine,* which at its type locality of TMP, has 2n♂=25. (2) *A. tehachapi*, which at its type locality near Arvin (where it is the only JC species), and in The Grapevine, has 2n♂=25. And (3) *A. crypticus*, which may have 2n♂=23 (see Fig. 1419, p. 756, but definitive drum and DNA confirmation lacking). Over the years we have raised 23 nymphs to adult from TMP and based exclusively on adult calling drum rate, which is the best method for separating the 3 taxa (see Table 24, p. 43), 2 adults were *A. crypticus*, 19 adults (83%) were *A. grapevine*, and 2 adults were *A. tehachapi*. Thus, the probability is that both of our randomly karyotyped late instar males from TMP were *A. grapevine.* Nevertheless, future efforts directed toward confirming these karyotype determinations should simultaneously take legs for DNA mapping, since the 3 taxa are very similar looking (Fig. 1138). Thus, *A. grapevine* appears to have 2n♂=25, based on the fact that both karyotyped type locality males have 2 fore leg tibial spurs, and is the only member of the Fast Drumming Group that does not have 2n♂=23.

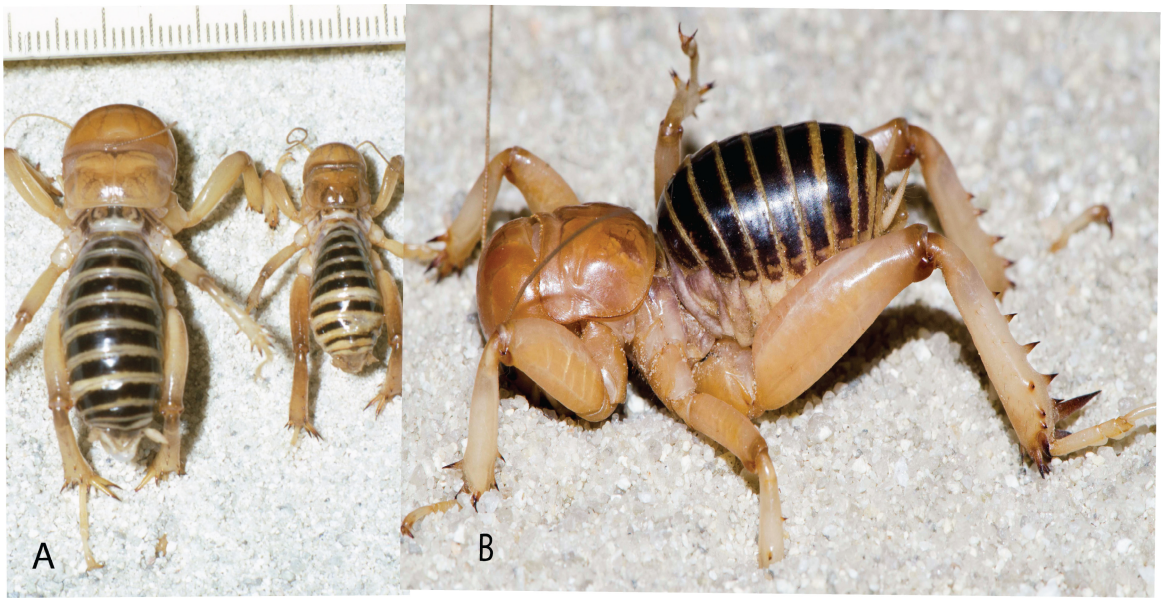


FIGURE 1138. Overall physical similarity seen in adult males of the 3 *Ammopelmatus* species at Tehachapi Mt Park. A. On left, *A. grapevine*, R93-37 (S93-15) drummed at 10.5 drums/s at 19.5°C. On right, *A. tehachapi*, R92-149 (S92-28) drummed at 1.5 drums/s at 16.5°C. B. Holotype *A. crypticus*, R15-31 (S15-116) drummed at 3.1 drums/s at 21.5°C.

Ammopelmatus lakecachuma **Weissman, sp. nov.**

Lake Cachuma Jerusalem Cricket
Figs 1139–1154, Tables 8, 12, 38

Species #25, Weissman 2001b.

Distribution. (Fig. 1139). Known only from around Lake Cachuma, located in the Santa Ynez Valley in Santa Barbara Co, California, and neighboring Santa Ynez Mountains to the south, and probably on higher (1238 m) Figueroa Mt, in the San Rafael Mountain Range, to the north.

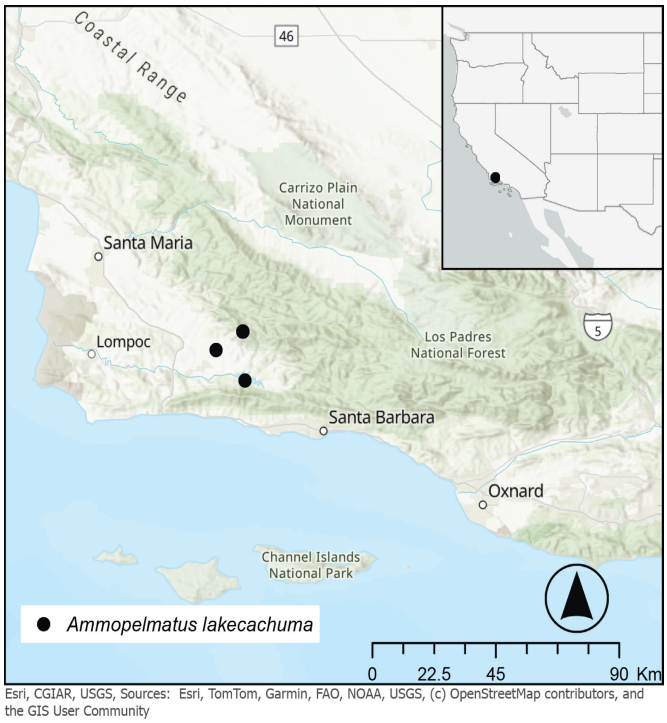


FIGURE 1139. Distribution of *A. lakecachuma.*

Recognition characters. Member of Fast Drumming Group. A large, 2n♂=23, frequently megacephalic JC sometimes with a brown head, as seen in *A. castaneus*, and from which it is separated by its larger size, even for populations (e.g., Figueroa Mt) that occur at higher elevations, and possibly by DNA. In *A. lakecachuma,* inner rear leg tibial spine #1 always longest while in geographically nearby *A. islander*, usually inner spine #2 is longest, with the 2 species recovered in different JC Groups.

Holotype. Male (in alcohol, Fig. 1140). **CALIFORNIA, *Santa Barbara Co.,*** Lake Cachuma Recreational Area, 34.573714° -119.955569°, 259m, 20-xii-1996 (S96-120) DBW, M. Caterino. R97-82, F0505. Molt to adult 25-viii-1997. Deposited CAS, Entomology type #20160. Measurements in mm: Body length 34.88, hind femur length 10.68, hind femur width 4.02. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1141) with 4 inner and 3 outer spines, 2 ventral spurs.

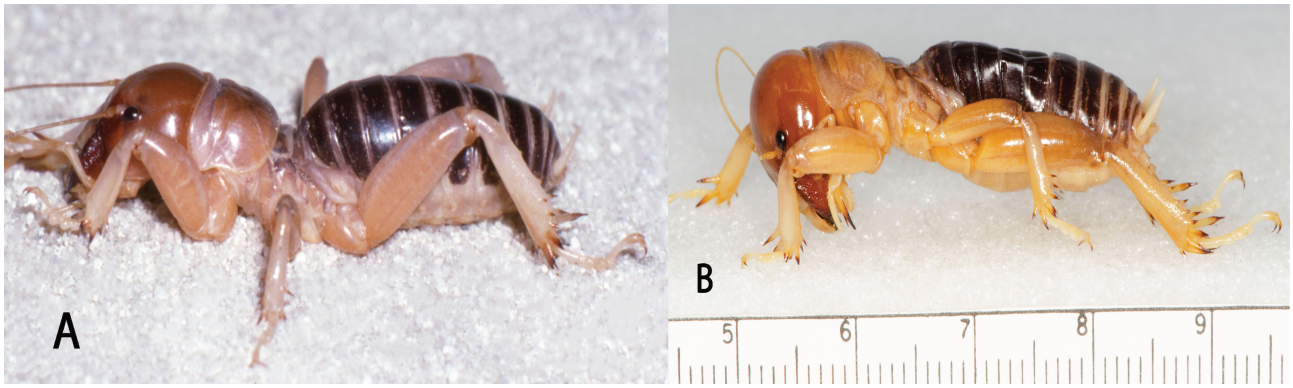


FIGURE 1140. Adult male holotype *A. lakecachuma.* A. When alive. B. When preserved.



FIGURE 1141. Left rear leg tibia adult male holotype *A. lakecachuma.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1142). Same data as holotype except 26-xii-1988 (S88-128). R89-37. Molt to adult 2-viii-1989. Deposited CAS, CASENT #9085523. Measurements in mm: Body length 35.63, hind femur length 10.02, hind femur width 4.01. Fore leg tibia with 1 or 2 ventral spurs; middle leg tibia with 7 or 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1143) with 4 inner and 2 or 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1144.

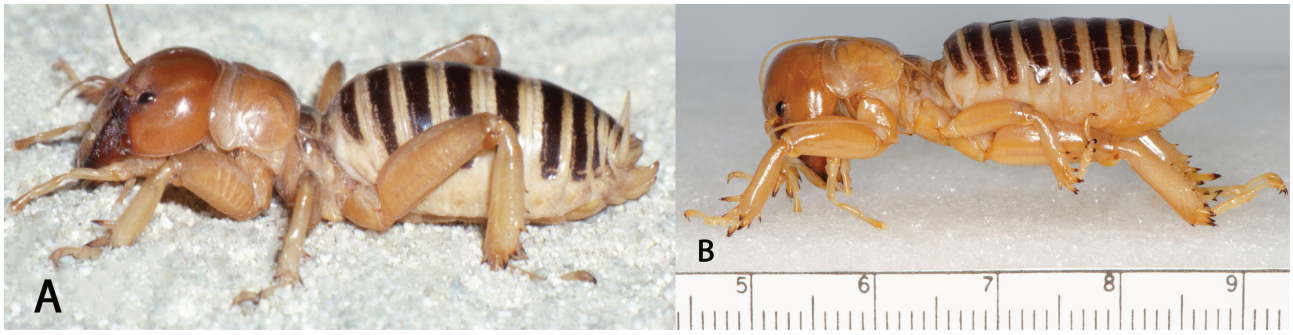


FIGURE 1142. Allotype adult female *A. lakecachuma.* A. When alive. B. When preserved.

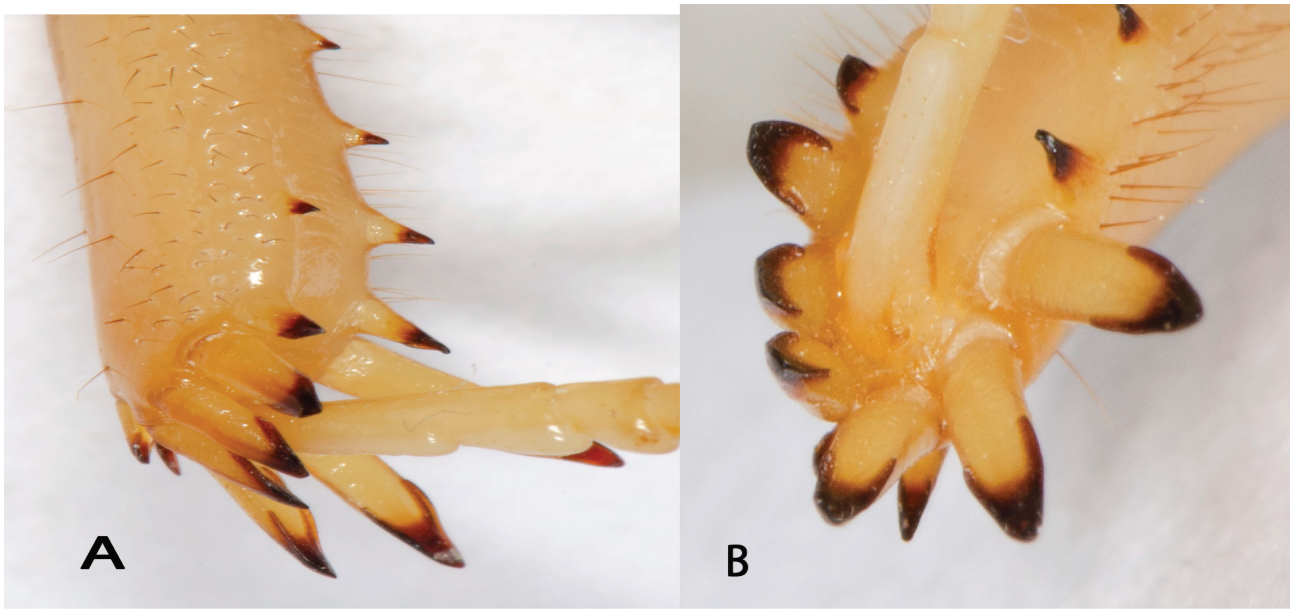


FIGURE 1143. Left rear leg tibia adult female allotype *A. lakecachuma.* A. Showing 2 outer and 4 inner spines. B. Showing shape of calcars.



FIGURE 1144. Ovipositor allotype *A. lakecachuma*.

Paratypes. ♂13 ♀20. **CALIFORNIA, *Santa Barbara Co*.**, type locality area: 26-xii-1988 (S88-128) ♂3 ♀2; 27-xii-1991 (S91-132) ♂6 ♀9; 20-xii-1996 (S96-120) ♂3 ♀9. Santa Ynez Valley, 34.6659° -120.0503°, 291m, 28-ix-2005 (S05-145) M. Caterino ♂1.

Probable placement. **CALIFORNIA, *Santa Barbara Co.***, Figueroa Mountain area, 34.721731° -119.962636°, 1238m, A. Abela: 3-ii-2019 25-xi-12 (S12-124) ♀2; 3-xii-2017 (S18-2) ♀2; 27-iii-2018 (S18-8) ♂2 ♀2; 3-ii-2019 (S19-8) ♂1. Individuals from here consistently larger than those from lower elevation, type locality Lake Cachuma. The longest adult male from Figueroa Mt was 42.27 mm; while the longest adult female was 45.82 mm. Figueroa Mt is separated by some 16 km from the type locality.

Drum. Calling drum same in both sexes although female's longer in duration. Males from Figueroa Mt with a sex clarification drum (SCD). **Male:** Holotype R97-82 (Fig. 1145) with 22 drums over 2.1s (10.5 drums/s) at 20.5°C. **Female:** Allotype R89-37 (Fig. 1146) with 94 drums over 10.5s (9.0 drums/s) at 20.5°C. R89-58 (Fig. 1147) displays a type locality male (R89-58) triggering a type locality female, who is "polite" and waits until he is finished drumming: the male had 24 drums over 2.6s (9.2 drums/s) followed 0.7s later by the female with 154 drums over 17.6s (8.8 drums/s), both at 21°C. This same drumming pattern was duplicated several times by this pair, as the individuals were in adjacent tubs on the recording bench. Of 12 type locality adult males recorded over the years, none were heard to make a SCD. **Figueroa Mt** (S19-8) **male** R19-3 (Fig. 1148) with16 drums over 1.5s (10.7 drums/s) at 22.5°C. **Figueroa Mt** (S12-124) **female** R13-40 (Fig. 1149) with 90 drums over 11.4s (7.9 drums/s) at 21°C. Two of the 3 adult males from Figueroa Mt with a SCD.

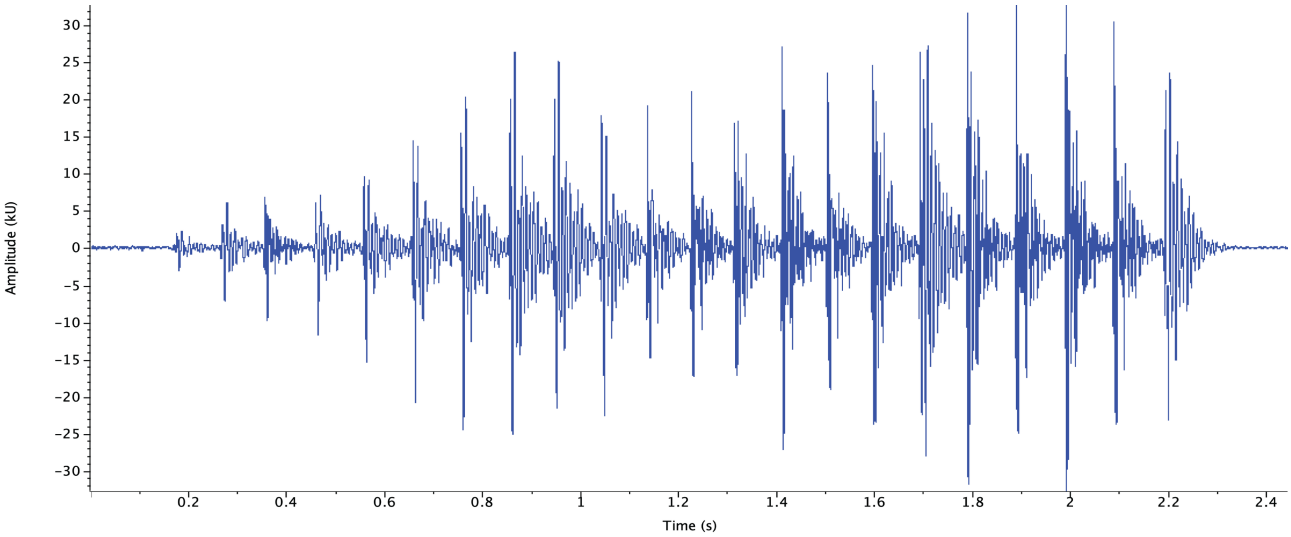


FIGURE 1145. Calling drum (R97-82) adult male holotype *A. lakecachuma.*

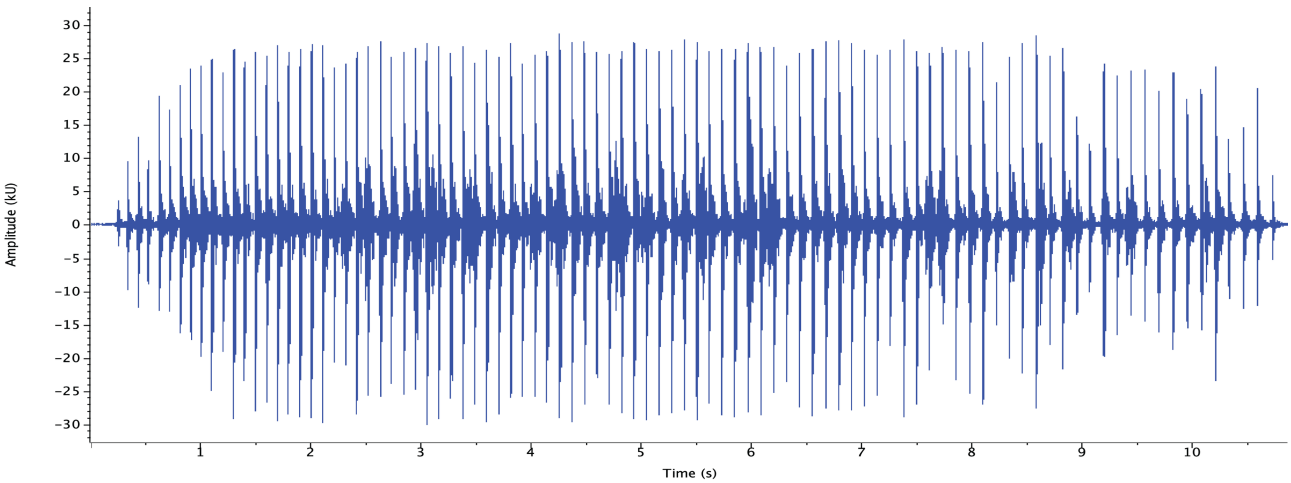


FIGURE 1146. Calling drum (R89-37) adult female allotype *A. lakecachuma*.

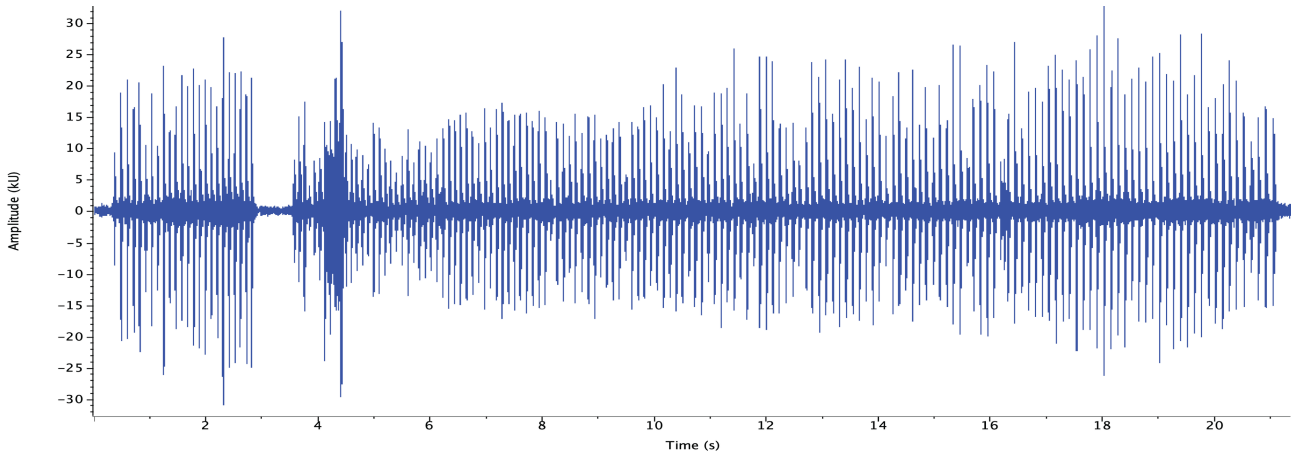


FIGURE 1147. Calling drum dueting (R89-58) adult male (left side) triggering reply (right side) from adult female (both adults from type locality S88-128).

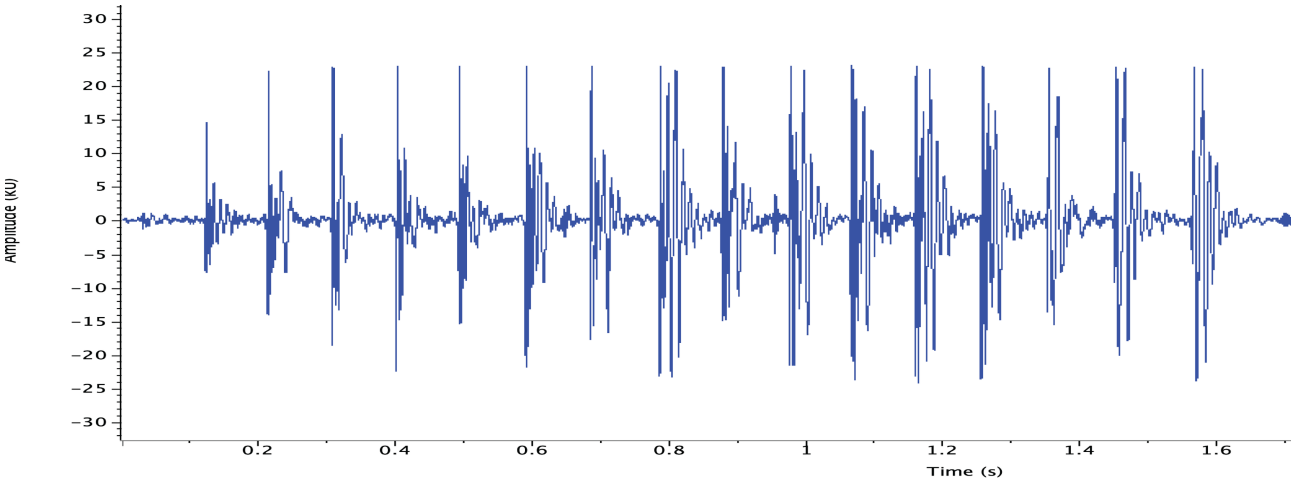


FIGURE 1148. Calling drum (R19-3) adult male, probably *A. lakecachuma,* from Figueroa Mt (S19-8).

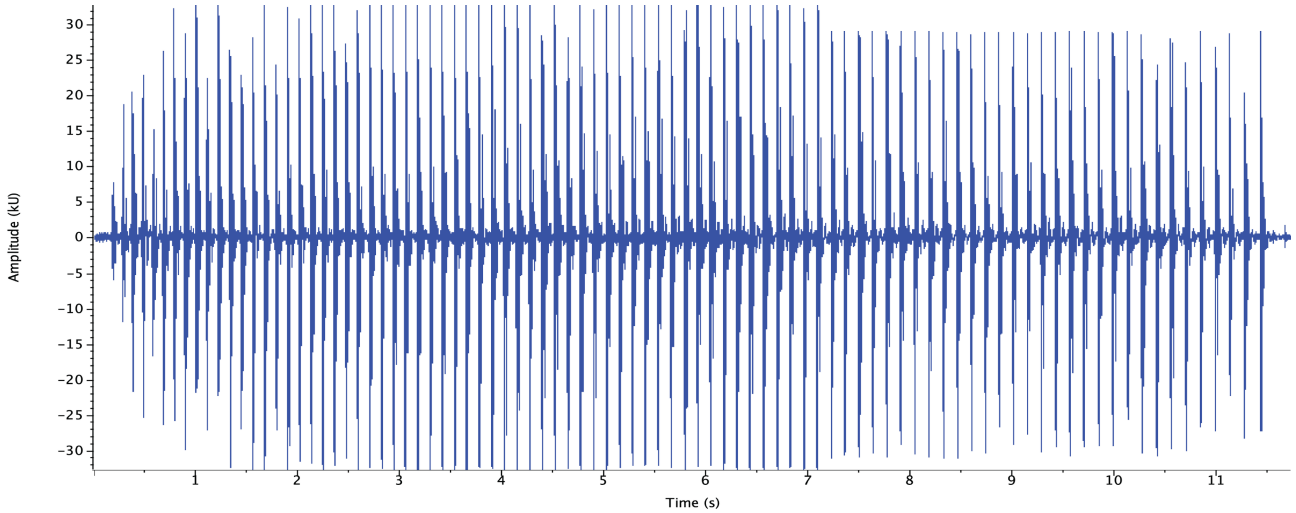


FIGURE 1149. Calling drum (R13-40) adult female, probably *A. lakecachuma*, from Figueroa Mt (S12-124).

Derivation of name. Named after the type locality.

Habitat. Under rocks around the Lake in open oak woodland—grassland areas. Interestingly, winter-collected nymphs were consistently under the largest rocks such that 2 persons were frequently required to roll them. Smaller rocks that were easily rolled by one person, and where we typically have collected every other JC species, had few or no JCs.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle. Winter collecting was good during a wet year, as in 1988, or a dry year, as in 1991.

Variation. Of 34 **Lake Cachuma** individuals, 33 had 2 and 1 had 3 ventral **fore** leg tibial spurs; 1 had 7 and 33 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 4 had 4 and 30 had 5 inner **rear** leg tibial spines, while 32 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Of 8 **Figueroa Mt** individuals, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4, 6 had 5, and 1 had 6 inner **rear** leg tibial spines, while all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1047, p. 579. F0504 and F0505 (S96-120, topotypes); F1682 (S05-145, Santa Ynez Valley; F2350 (S12-124) and F2562 (S19-8), both Figueroa Mt, all recovered together in Group 20 Fast Drumming, and in a larger clade with several other fast-drumming species (*A. acton, A. bakersfield, A. castaneus, A. chimineas, A. danieli, A. grapevine,* and *A. mtpinos*).

Karyotype. 2n♂=23. 4 males from type locality, and 1 male from Figueroa Mt examined, and all consistent: T89-30 (Fig. 1150, type locality S88-128); T92-12 (Fig. 1151, type locality S91-132); T97-19 (Fig. 1152) & T97-22 (Fig 1153, both type locality S96-120); and T20-1 (Fig. 1154, S19-8 Figueroa Mt) with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 1150. Idiogram T89-30 *A. lakecachuma* (S88-128).

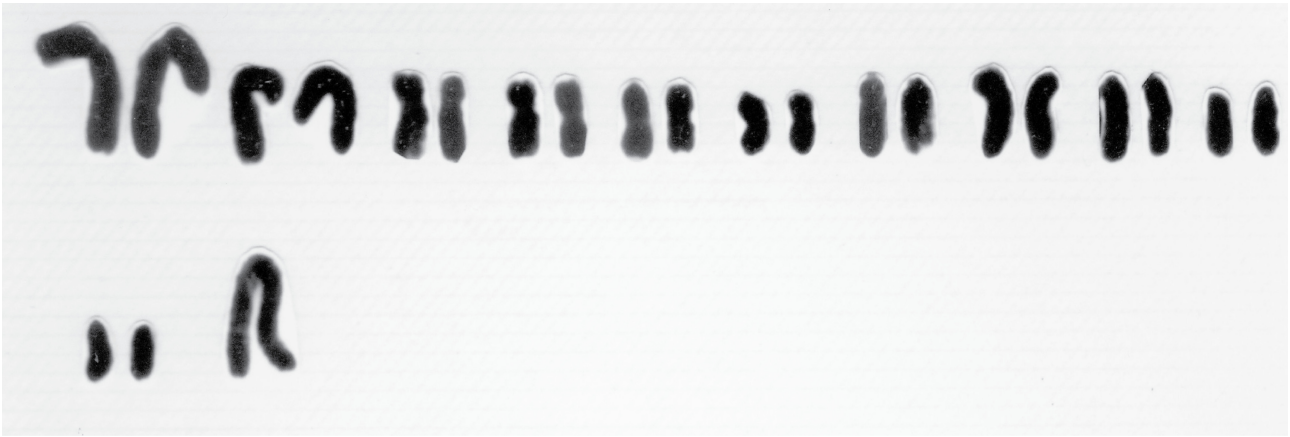


FIGURE 1151. Idiogram T92-12 *A. lakecachuma* (S91-132).



FIGURE 1152. Idiogram T97-19 *A. lakecachuma* (S96-120).

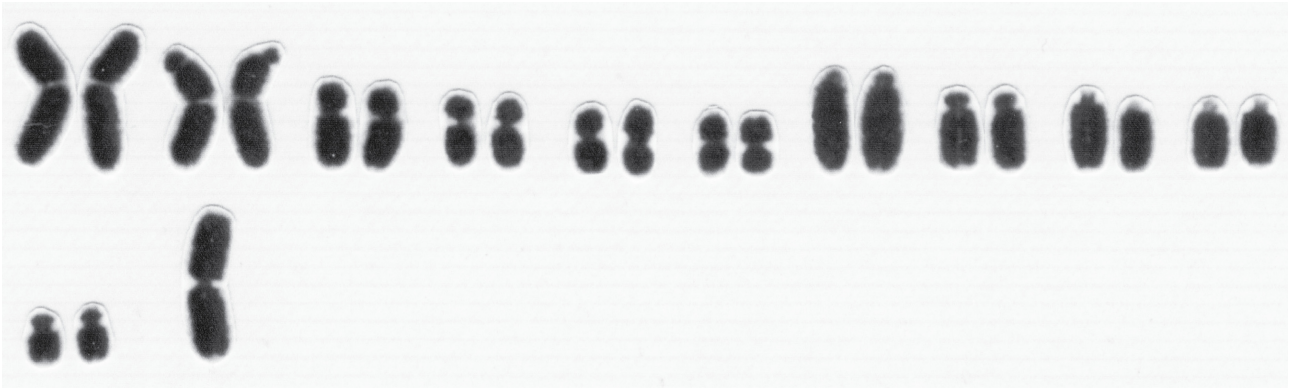


FIGURE 1153. Idiogram T97-22 *A. lakecachuma* (S96-120).

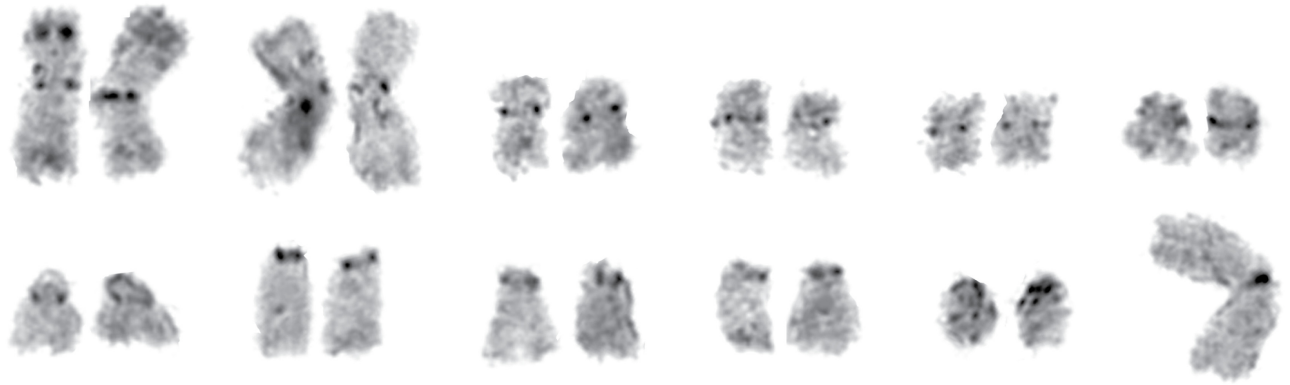


FIGURE 1154. Idiogram T20-1 *A. lakecachuma* (S19-8), using C-banding.

Discussion. This is one of the few JC species where looking under large rocks, during the winter, was fruitful. (Also, for *A. oneillpark* under large rocks at the type locality S24-19, O'Neill Regional Park, and at paratype locality S24-16, Caspers Wilderness Park). Might such large rocks provide more safety from thermal fluctuations (warmth during the day and cold at night) than small rocks do?

This is the species, from Figueroa Mt (S18-8), that was videoed drumming, and then mating, during the filming of NPR's Deep Look "Jerusalem crickets only date drummers" video, available on YouTube: https://www.youtube.com/watch?v=mHbwC-AIyTE&t=147s&ab_channel=DeepLook.

***Ammopelmatus mtpinos* Weissman, sp. nov.**
Mt Pinos Jerusalem Cricket
Figs 1155–1165, Tables 2, 10, 24, 38

Distribution. (Fig. 1155). High elevations around Mt Pinos, in Kern and Ventura Counties, California, east to Frazier Park, Kern Co.



FIGURE 1155. Distribution of *A. mtpinos.*

Recognition characters. Member of Fast Drumming Group. Large, wide dark black abdominal bands, 2n♂=23. Geographically closest Fast Drumming Group member is *A. grapevine*, but latter with 2n♂=25. Can be separated from also geographically close *A. crypticus* by drum rate; and from *A. tehachapi* by drum rate and karyotype (2n♂=25 in latter).

Holotype. Male (in alcohol, Fig. 1156). **California, *Ventura Co.,*** Mt Pinos, 34.810556° -119.111389°, 2413m, 22-viii-2020 (S20-3) AJ Abela. R20-1 & R20-2, F2619. Collected as adult. Deposited CAS, Entomology type #20221. Measurements in mm: Body length 38.46, hind femur length 12.46, hind femur width 4.36. Fore leg tibia with 2 or 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1157) with 5 inner and 3 outer spines, 2 ventral spurs.

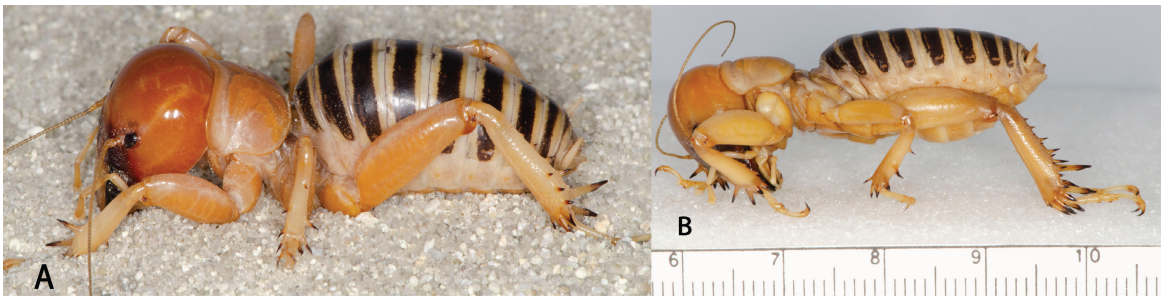


FIGURE 1156. Adult male holotype *A. mtpinos.* A. When alive. B. When preserved.



FIGURE 1157. Left rear leg tibia holotype adult male *A. mtpinos.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1158). Same data as holotype except R21-1, F2641. Molt to adult 8-vii-2021. Deposited CAS, CASENT #9080965. Measurements in mm: Body length 50.72, hind femur length 12.88, hind femur width 5.01. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1159) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1160.

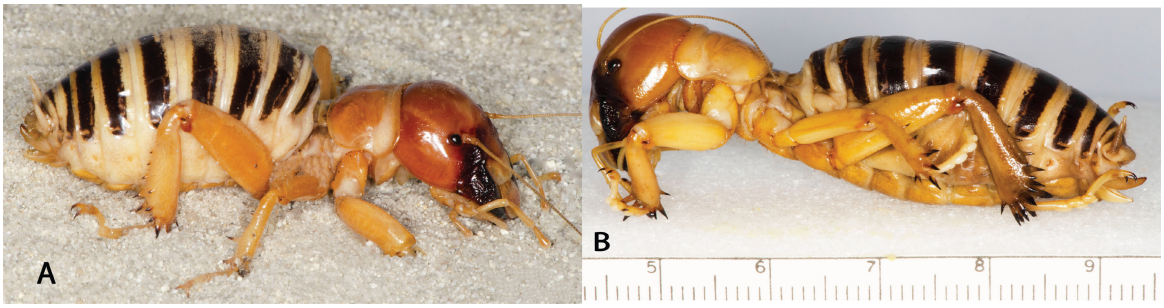


FIGURE 1158. Adult female allotype *A. mtpinos.* A. When alive. B. When preserved.



FIGURE 1159. Left hind leg tibia in adult allotype *A. mtpinos.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars. Darkened color of calcars is the result of inadequate preservation.



FIGURE 1160. Ovipositor allotype *A. mtpinos*.

Paratypes. ♂2 ♀5. **CALIFORNIA, *Kern Co.,*** Frazier Park, 34.812083° -119.146967°, 2695m, 29-vi-1996 (S96-72) GF Pratt ♂1 ♀2. Mt Pinos, McGill Campground, 34.814461° -119.101775°, 2277m, 12-ix-2015 (S15-121) DA Gray ♀1. Mt Pinos, Nordic Ski area, 34.813233° -119.126983°, 2540m, 24-viii-2006 (S06-94) ♂1. ***Ventura Co.,*** Mt Pinos, same information as holotype except 27-vi-2021 (S21-9) A. Abela ♀2.

Drum. Calling drum similar in both sexes except female's series is longer. **Male:** Holotype R20-2 (Fig. 1161) 20 drums over 2.2s (9.1 drums/s) at 22.5°. Paratype male R96-30 (Fig. 1162) with 68 drums over 7.1s (9.6 drums/s) at 20.5°C. **Female:** Allotype R21-1 (Fig. 1163) 210 drums over 24.8s (8.1 drums/s) at 23°C. Paratype female Frazier Park (S96-72), R96-50 (Fig. 1164) 297 drums over 41.0s (7.2 drums/s) at 19.5°C.

Derivation of name. Named after the type locality.

Habitat. To oatmeal trail at night (type locality S20-3); Jeffrey and Ponderosa pine forest under logs in shallow draws (S96-72). Conifer-woodland elsewhere.

Life cycle and seasonal occurrence. Apparent 2-year typical life cycle.

Variation. From 6 individuals, 4 had 2 and 2 had 3 ventral **fore** leg tibial spurs; all 6 had 8 **middle** leg tibial calcars, with 2 ventral spurs; all 6 had 5 inner **rear** leg tibial spines, and all had 3 outer **rear** leg tibial spines, and all with 2 ventral spurs.

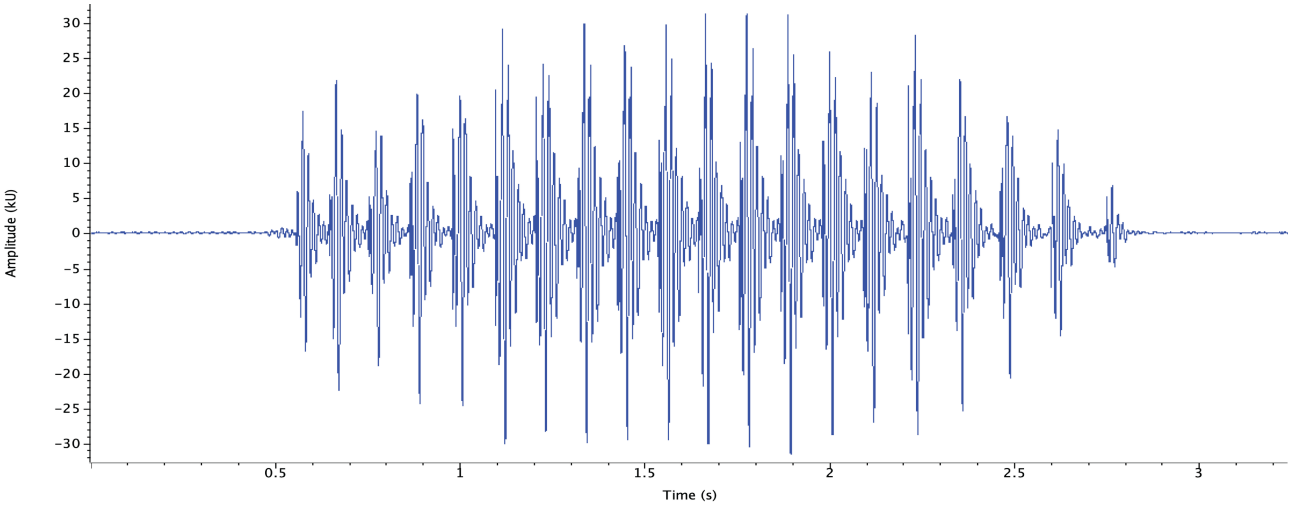


FIGURE 1161. Calling drum (R20-2) adult male holotype *A. mtpinos*.

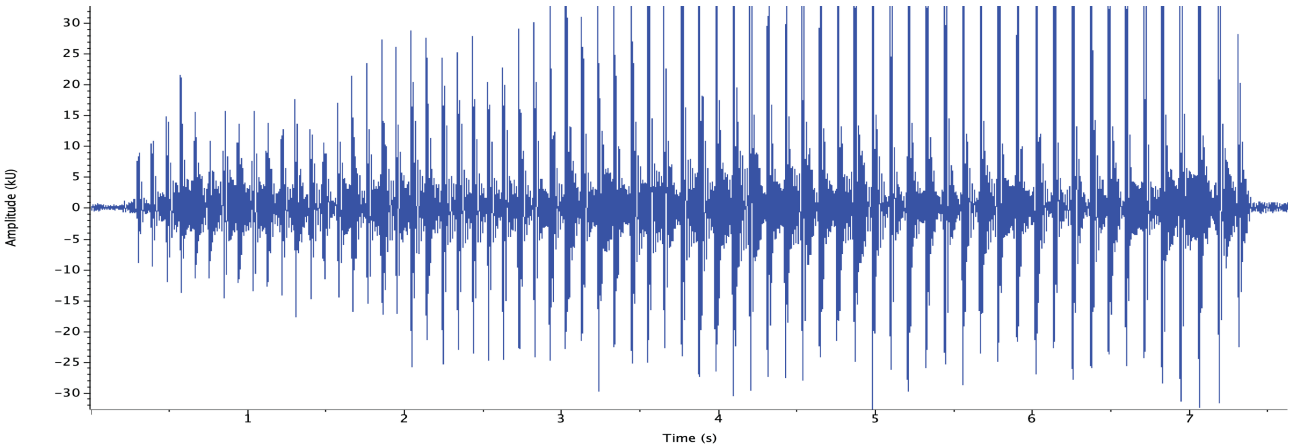


FIGURE 1162. Calling drum (R96-30) adult male paratype *A. mtpinos*.

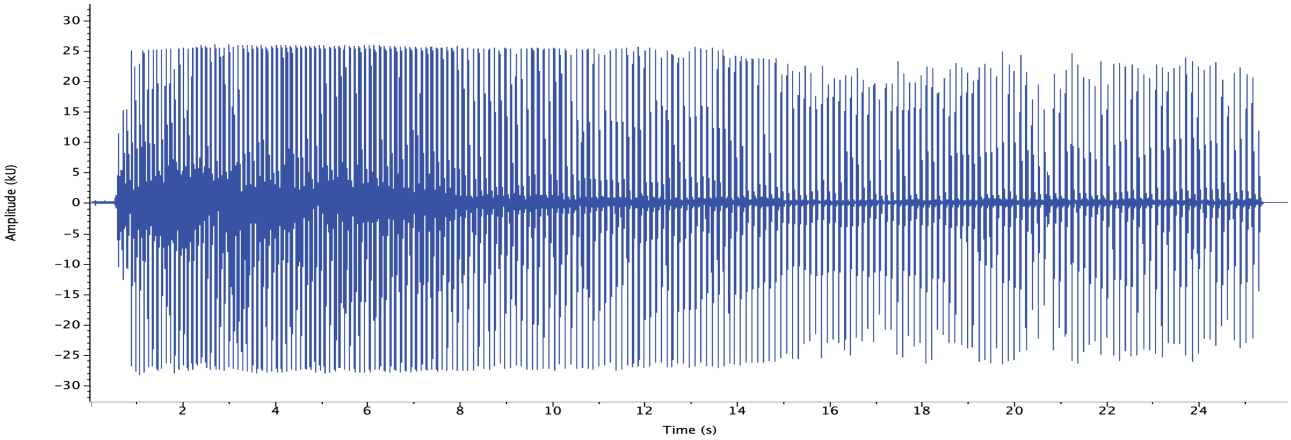


FIGURE 1163. Calling drum (R21-1) adult female allotype *A. mtpinos*.

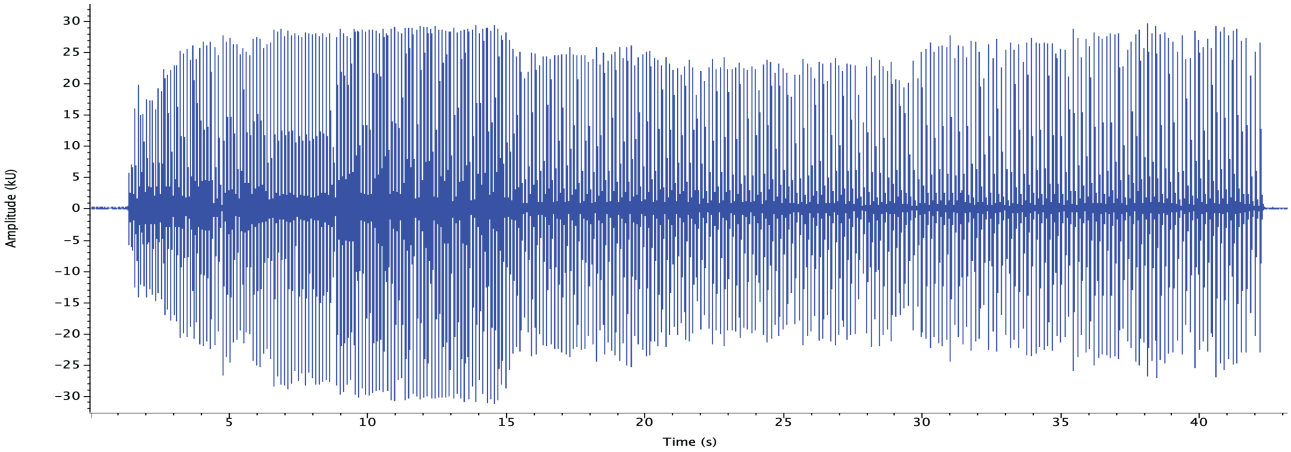


FIGURE 1164. Calling drum (R96-50) adult female paratype *A. mtpinos*.

DNA. Fig. 1047, p. 579. F0269 (S96-72, Frazier Park); F2619 & F2641 (both type locality S20-3, Mt Pinos) all recovered in Group 20 Fast Drumming, a poorly supported clade with other fast drumming species from various Southern California localities: *A. acton*, *A. bakersfield, A. chimineas,* and *A. grapevine* (2n♂=25 in latter) in same subclade.

Karyotype. 2n♂=23. T21-8 (Fig. 1165, type locality S21-9) examined with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 1165. Idiogram T21-8 *A. mtpinos* (S21-9), from mitotic C-banding cell.

Discussion. The type locality of *A. mtpinos* is some 19 km from the *A. grapevine* paratype locality (S92-31) along I-5.

***Ammopelmatus pinnacles* Weissman, sp. nov.**
Pinnacles Jerusalem Cricket
Figs 1166–1177, Tables 4, 12, 38

Distribution. (Fig. 1166). Only known from the eastern side of Pinnacles National Park.



FIGURE 1166. Distribution of *A. pinnacles.*

Recognition characters. The slowest drumming species in the Fast Drumming Group (Table 38, p. 50). A large, light colored, medium-fast (5.0–6.4 drums/s) drumming JC without intense black abdominal bands or purple markings on abdomen. 2n♂=23. Rear leg tibial calcar #1 long but not as long as seen in other rapid drumming species, such as *A. danieli*. Separated from the latter, which is found on the west side of Pinnacles National Park and has a faster calling drum (7.1–10.6 drums/s; Figs 1167 & 1168); and occupies wetter habitats where the soil is more loam and less gravely than seen on the east side of Pinnacles.

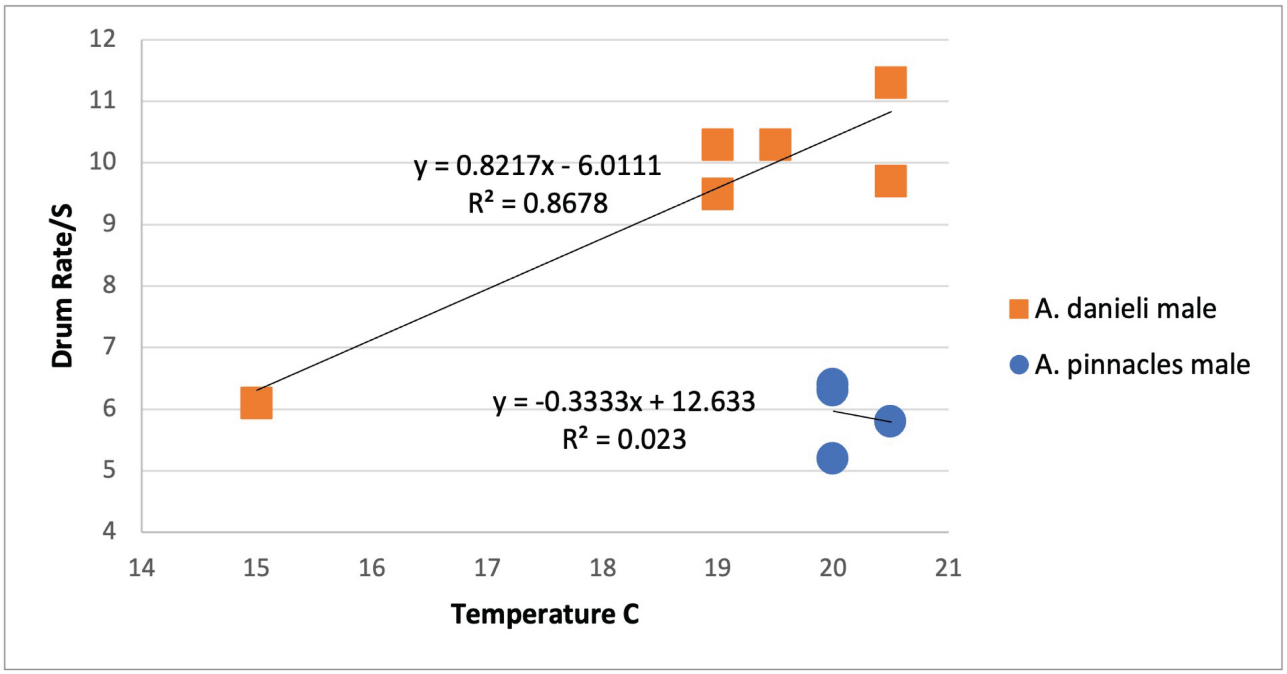


FIGURE 1167. Comparison of drumming rates in adult male *A. pinnacles* vs *A. danieli.*

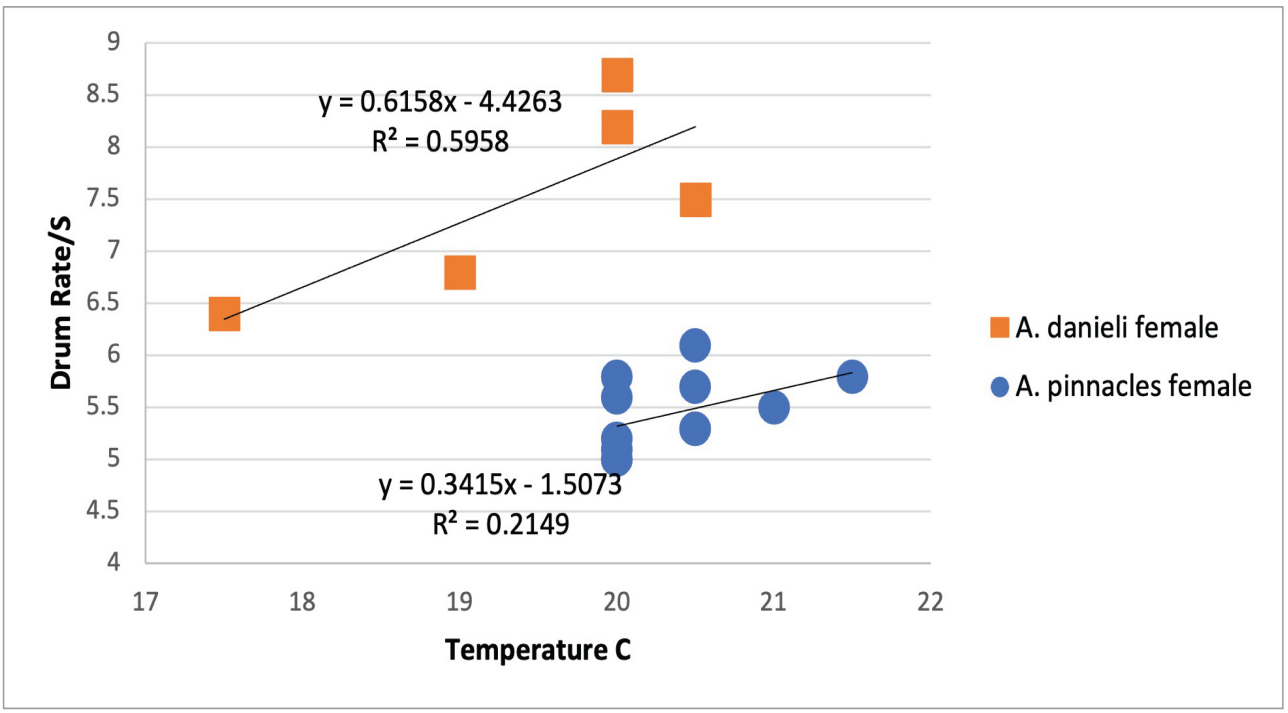


FIGURE 1168. Comparison of drumming rates in adult female *A. pinnacles* vs *A. danieli.*

Holotype. Male (in alcohol, Fig. 1169). **California, *San Benito Co.,*** Gabilan Mts, Pinnacles National Park, Chalone Campground area, 36.495586° -121.173042°, 322m, 22-iv-2006 (S06-14), DBW, P. Cook. R06-118. Molt to adult 19-ix-2006. Deposited CAS, Entomology type #20135. Measurements in mm: Body length 39.10, hind femur length 12.21, hind femur width 4.25. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1170) with 5 inner and 3 outer spines, 2 ventral spurs.

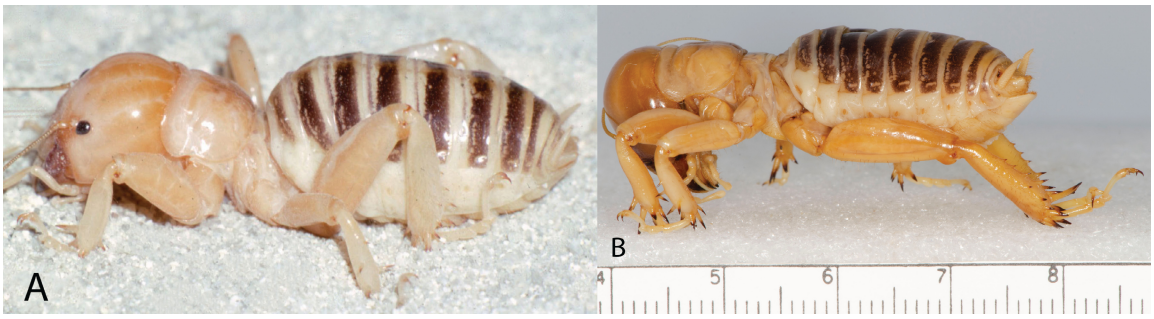


FIGURE 1169. Holotype adult male *A. pinnacles.* A. When alive. B. When preserved.

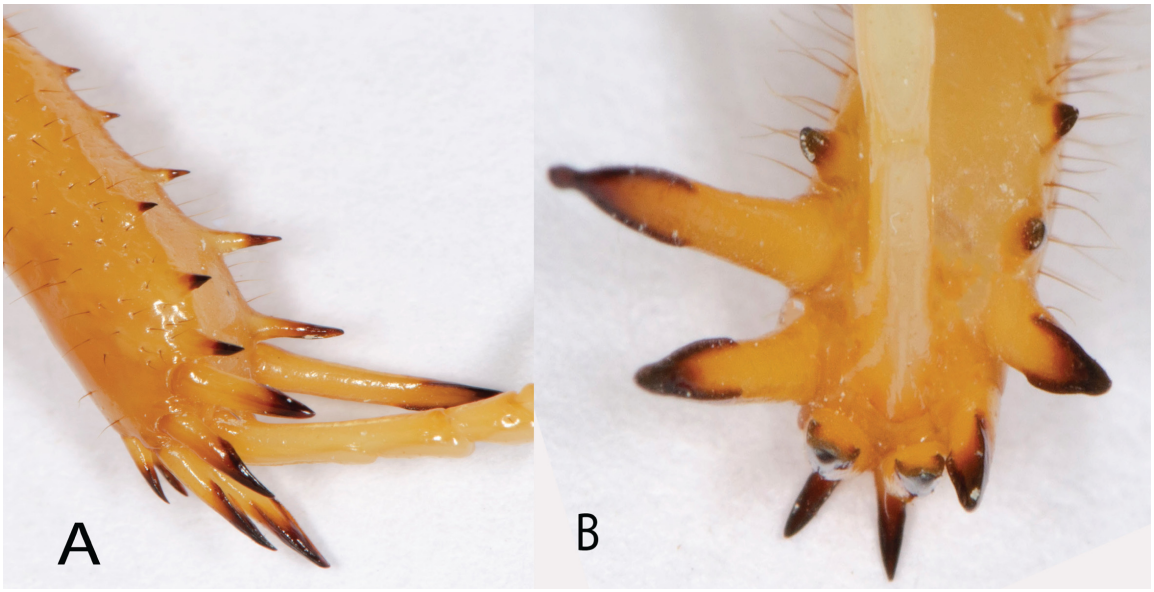


FIGURE 1170. Holotype adult male *A. pinnacles.* A. Left rear leg tibia showing 3 outer and 5 inner spines. B. Right rear leg tibia showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1171). **California, *San Benito Co.,*** area just east of eastern entrance to Pinnacles National Park, 2.25 m W Hwy 25, 36.493500° -121.151944°, 359m, 6-i-2005 (S05-6), DBW. R05-47, F1610. Molt to adult 24-viii-2005. Deposited CAS, CASENT #9079085. Measurements in mm: Body length 47.71, hind femur length 11.97, hind femur width 4.72. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1172) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1173.

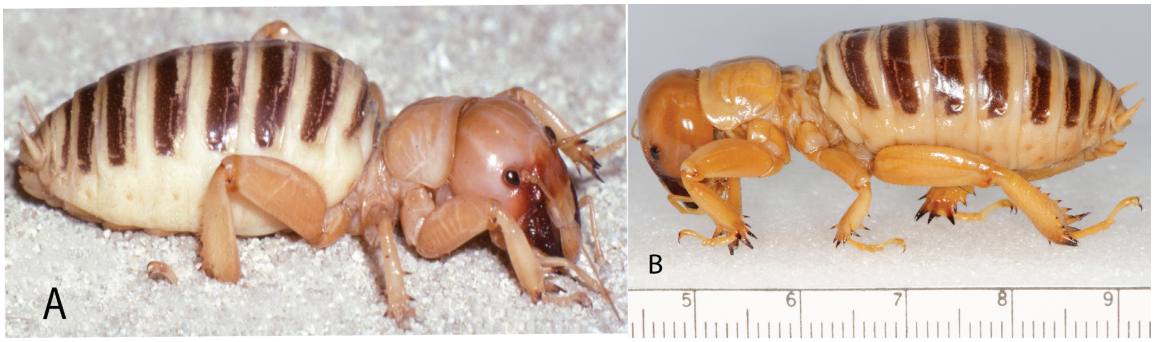


FIGURE 1171. Allotype adult female *A. pinnacles.* A. When alive. B. When preserved.



FIGURE 1172. Left rear leg tibia allotype *A. pinnacles.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1173. Ovipositor allotype *A. pinnacles.*

Paratypes. ♂3 ♀15. **CALIFORNIA**, ***San Benito Co.,*** type locality: 4-iii-2006 (S06-3) ♂2 ♀2, 22-iv-2006 (S06-14) ♀3, 23-ii-2009 (S09-4) ♂1 ♀6; 23-iii-2023 (S23-31) ♀2. Allotype locality, (S05-6) ♀2.

Drum. Calling drum similar in both sexes although longer in females, and maybe slightly faster in males. **Male:**

Holotype R06-118 (Fig. 1174) with 25 drums over 4.1s (6.1 drums/s) at 20°C. **Female:** Allotype R05-47 (Fig. 1175) with 117 drums over 23.6s (5.0 drums/s) at 20°C.

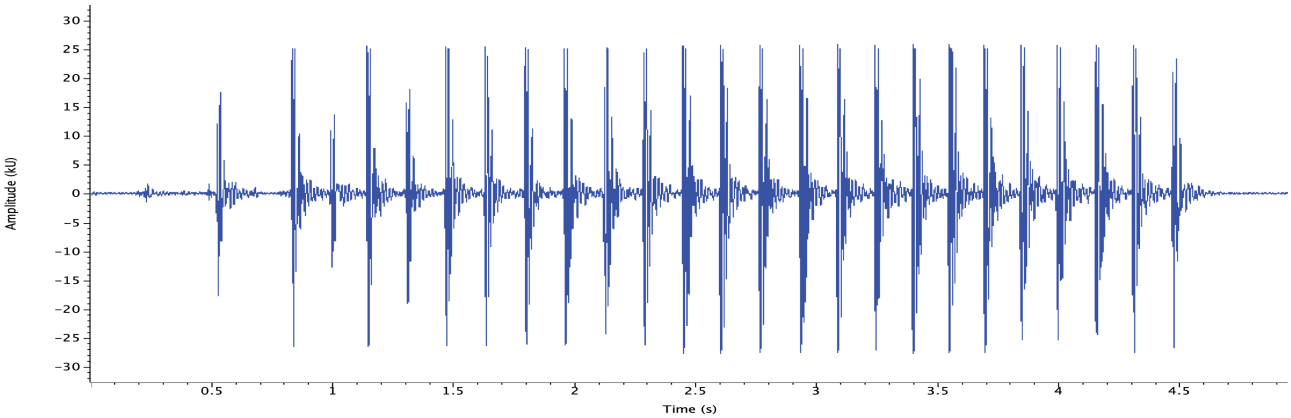


FIGURE 1174. Calling drum (R06-118) adult male holotype *A. pinnacles.*

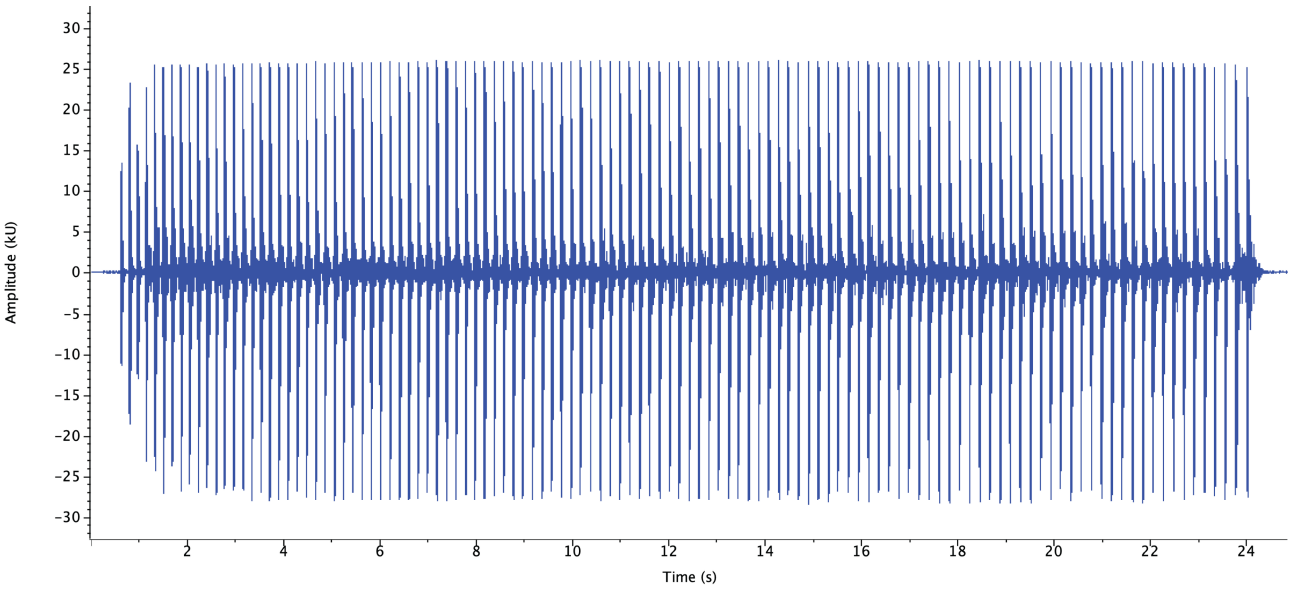


FIGURE 1175. Calling drum (R05-47) adult female allotype *A. pinnacles.*

Derivation of name. Named after the type locality.

Habitat. Holotype locality is a small seasonal drainage area with gravel substrate (not sand) and green winter grasses, although the area was lined with cement sometime after 2009. Allotype locality is low rolling foothills with chaparral vegetation, and some 3 km from the holotype site. According to Pinnacles wildlife biologist Paul G. Johnson (pers comm to DBW 25-i-2025), the east side of Pinnacles appears dryer than the west side, where the latter has more marine influence and fog extending inland via the Salinas Valley, and probably lower maximum temperatures. Consistent with that hypothesis is the common appearance of California Lace Lichen hanging from Blue Oaks on the west side but rarer on the east side.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 21 individuals, 20 had 2 and 1 had 3 ventral **fore** leg tibial spurs; all 21 had 8 **middle** leg tibial calcars, all had 2 ventral spurs; 2 had 4 and 19 had 5 **rear** leg tibial spines, all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1047, p. 579. F1610 (type locality S05-6); F1749 (S06-3); F1933 (S06-14, T07-10) recovered in Group 20 Fast Drumming, a poorly supported clade of other fast drumming taxa, all with 2n♂=23.

Karyotype. 2n♂=23. Two males examined: T07-10 (Fig. 1176, S06-14); T23-10 (Fig. 1177, S23-31) both with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X

chromosome. Note that in T07-10 idiogram, the chromosomes are arranged by centromere position; while in T23-10 idiogram, they are arranged by size.

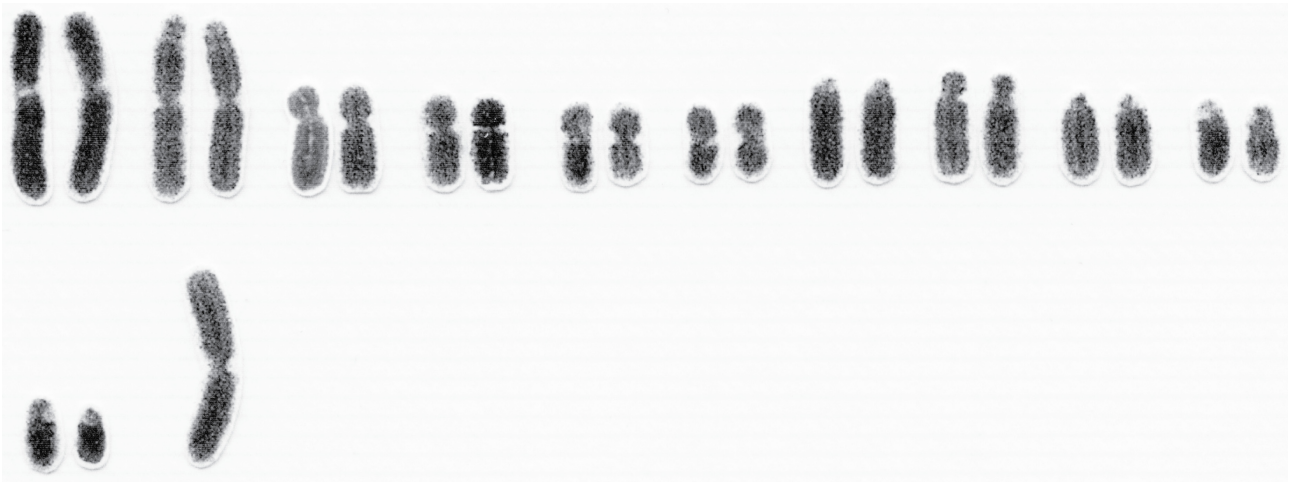


FIGURE 1176. Idiogram T07-10 *A. pinnacles* (S06-14).



FIGURE 1177. Idiogram T23-10 *A. pinnacles* (S23-31), using C-banding.

Discussion. According to Wikipedia, Pinnacles was originally established as a national monument in 1908 by President Theodore Roosevelt, and was redesignated as a national park in 2013. The Park's namesakes are the eroded leftovers of the western half of an extinct volcano that has moved 320 km from its original location on the San Andreas Fault.

Although the west side of Pinnacles (where *A. danieli* resides) is separated from the east side of Pinnacles (where *A. pinnacles* resides) by only some 3.5 km, the Pinnacles themselves, with the highest peak of 1007 m, appear to create a rain shadow effect on the east side. The only Pinnacles weather station is at Bear Gulch (36.481940° -121.182105°, 420m elevation), off of the Condor Gulch Trail, and on the east side of the Park. Average yearly (1937-2016) rainfall there is 420 mm (16.55 inches). Unfortunately, there are no weather stations on the west side. According to the Western Regional Climate Center (wrcc@dri.edu), the nearest rainfall data would come from Soledad, some 9 km west of the Park, in the Salinas Valley, and where marine influence results in cooler temperatures than seen on the eastern side of Pinnacles. At Soledad, average yearly (1903-1983) rainfall is 290 mm (11.41 inches). These rainfall numbers are inconsistent with the vegetation pattern discussed above under "Habitat", and emphasize the importance of microhabitats.

***Ammopelmatus tarcanyon* Weissman, sp. nov.**
Tar Canyon Jerusalem Cricket
Figs 1178–1187, Tables 1, 12, 13, 38

Species #26, Weissman 2001b.

Distribution. (Fig. 1178). Only known from the base of the Kreyenhagen Hills, along Big Tar Canyon Rd in the Diablo Coast Ranges southwest of Avenal, Kings Co., and from Zapato Chino Creek area, 15 km NW of Tar Canyon, Fresno Co., also in the Diablo Range foothills on the western side of the San Joaquin Valley.

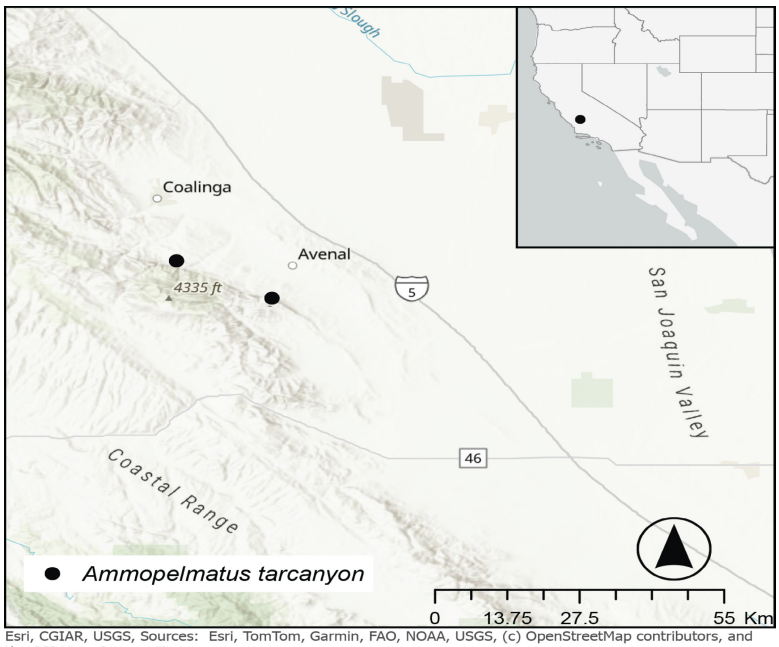


FIGURE 1178. Distribution of *A. tarcanyon.*

Recognition characters. Member of Fast Drumming Group. Medium-large to very large, megacephalic JC with prominent black abdominal bands, 2n♂=23. Distinguished from morphologically similar, nearby Fast Drumming Group *A. bakersfield* (116 km southeast), *A. chimineas* (100 km south), and *A. grapevine* (160 km southeast) by habitat and isolation. Distinguished from nearest DNA relative, *A. danieli*, by DNA, a separation of ~100 km and on different sides of the Coastal Ranges, and the finding of a sex clarification drum in *A. tarcanyon.*

Holotype. Male (in alcohol, Fig. 1179). **California, *Kings Co.,*** base of Kreyenhagen Hills 5.7 m SW Avenal on Big Tar Canyon Rd, 35.934142° -120.167356°, 412m, 18-xii-1987 (S87-121) DBW & BI Weissman. R89-79. Molt to adult 17-viii-1989. Deposited CAS, Entomology type #20136. Megacephalic. Measurements in mm: Body length 46.63, hind femur length 13.61, hind femur width 5.41. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1180) with 5 inner and 3 outer spines, 2 sets of 2 ventral spurs on left side.

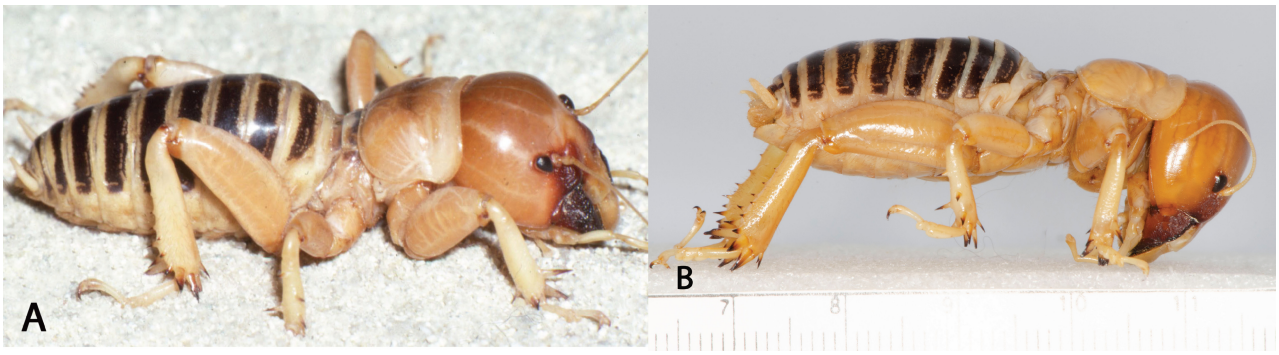


FIGURE 1179. Adult male holotype *A. tarcanyon.* A. When alive. B. When preserved.

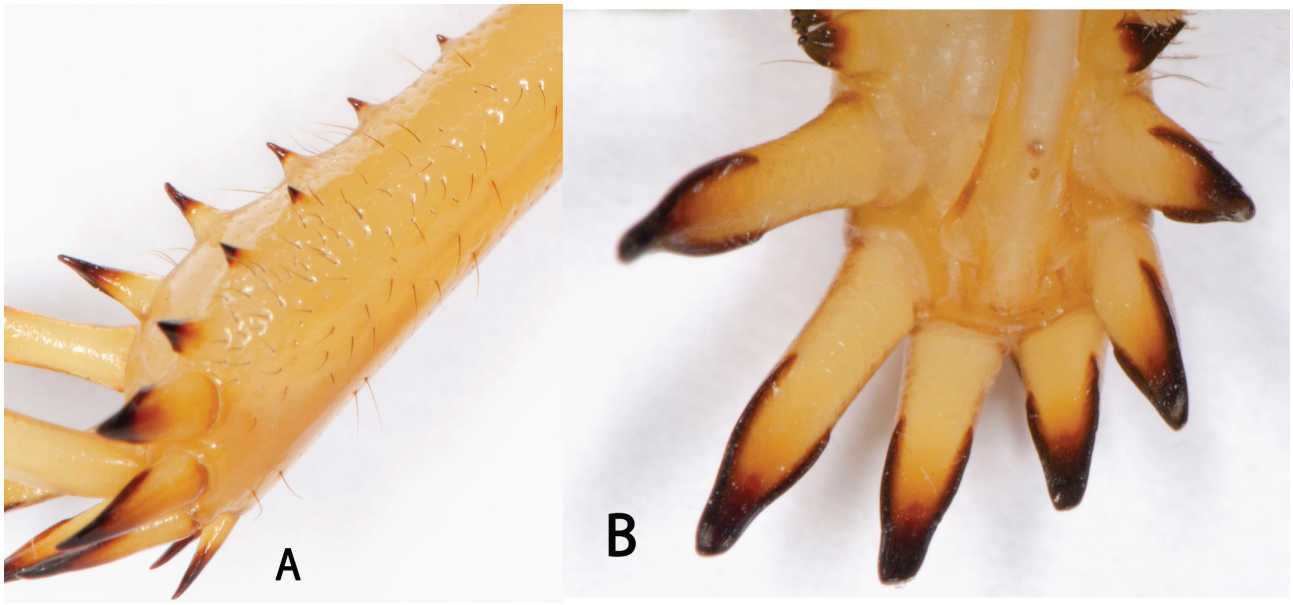


FIGURE 1180. Right hind leg tibia adult male holotype *A. tarcanyon.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1181). Same information as holotype except 17-x-1987 (S87-107). R89-28 & 34. Molt to adult 29-vii-1989. Deposited CAS, CASENT #9085132. Megacephalic. Measurements in mm: Body length 54.35, hind femur length 14.16, hind femur width 5.91. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1182) with 5 or 6 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1183.

Paratypes. ♂5 ♀10. **CALIFORNIA, *Fresno Co.,*** Zapato Chino Creek, 36.015328° -120.296045°, 338m, 21-iii-2022 (S22-2) J. Rose & G. Napolitano ♀1. Zapato Chino Creek, 36.016174° -120.292601°, 332m, 4-iv-2022 (S22-5) G. Napolitano ♂1. ***Kings Co.,*** Type locality 17-x-1987 (S87-107) ♂3; 18-xii-1987 (S87-121) ♀1; 6-iii-1992 (S92-32) 1 male used unsuccessfully for testes; 18-xii-1994 (S94-118) ♂1 ♀4; 18-iv-2003 (S03-19) ♀4.

Drum. Calling drum similar in both sexes except series longer in females and males with a sex clarification drum (SCD). **Male:** Holotype R89-79 (Fig. 1184) with 115 drums over 11.0s (10.5 drums/s) at 20°C. Paratopotype (S94-118) male R96-116 (Fig. 1185) with SCD of 3 drums over 0.22–0.24s (12.5–13.6 drums/s) followed by 43 drums over 5.0s (8.6 drums/s) at 19.5°C. **Female:** Allotype R89-28 (Fig. 1186) with 246 drums over 34.5s (7.1 drums/s) at 20.5°C.

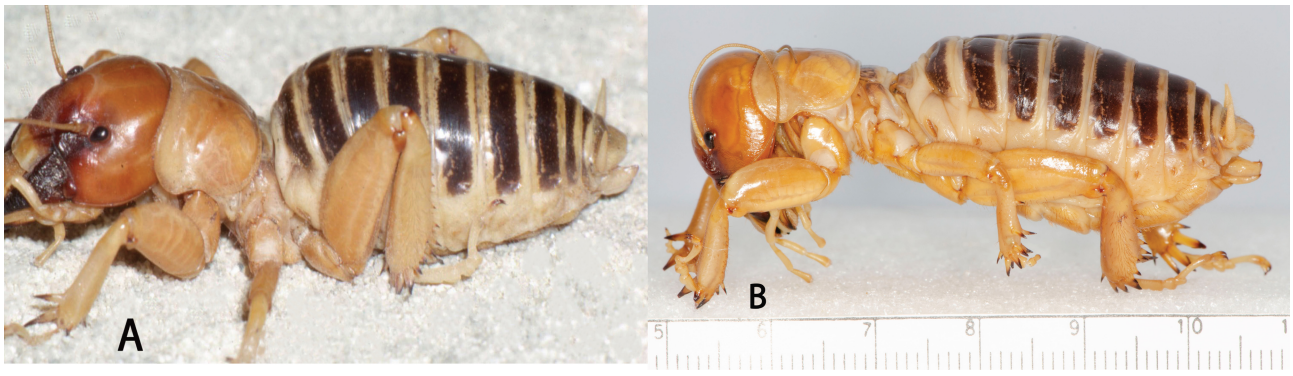


FIGURE 1181. Adult female allotype *A. tarcanyon.* A. When alive. B. When preserved.



FIGURE 1182. Left rear leg tibia adult female allotype *A. tarcanyon.* A. Showing 3 outer and 6 inner spines. B. Showing shape of calcars.



FIGURE 1183. Ovipositor allotype *A. tarcanyon.*

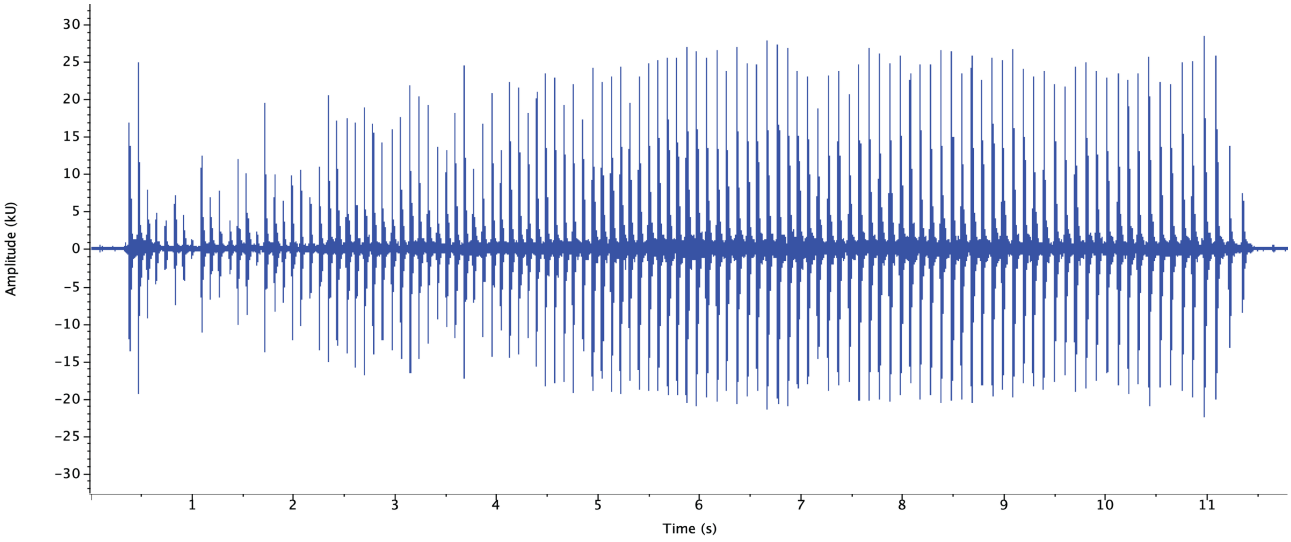


FIGURE 1184. Calling drum (R89-79) adult male holotype *A. tarcanyon.*

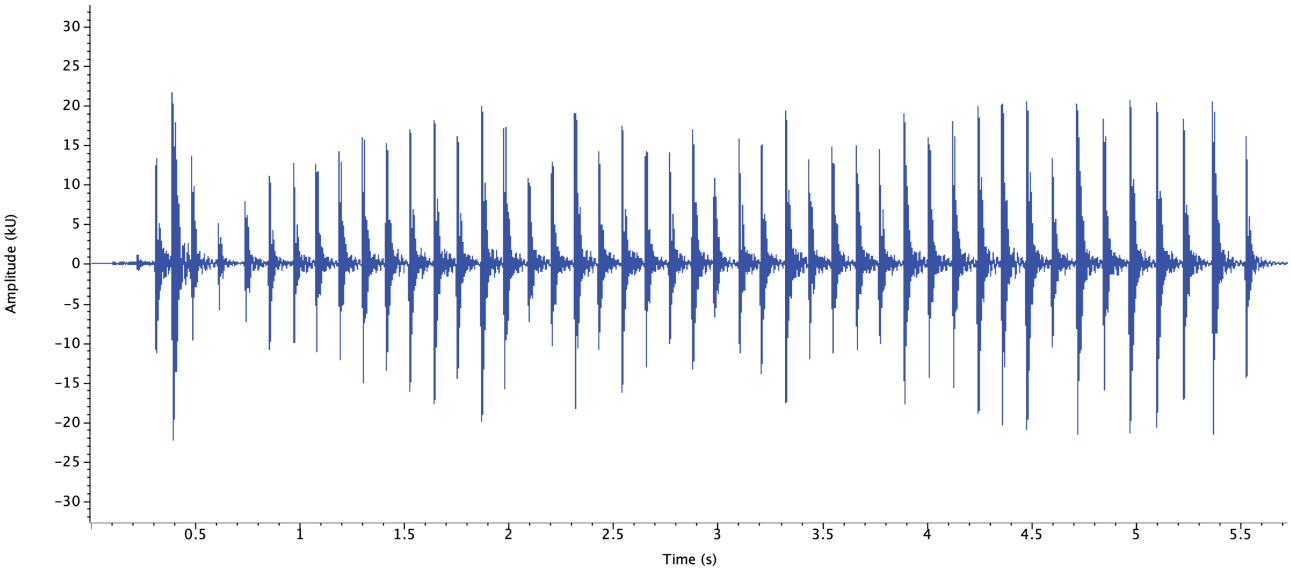


FIGURE 1185. SCD followed by calling drum (R96-116) paratopotype adult male *A. tarcanyon.*

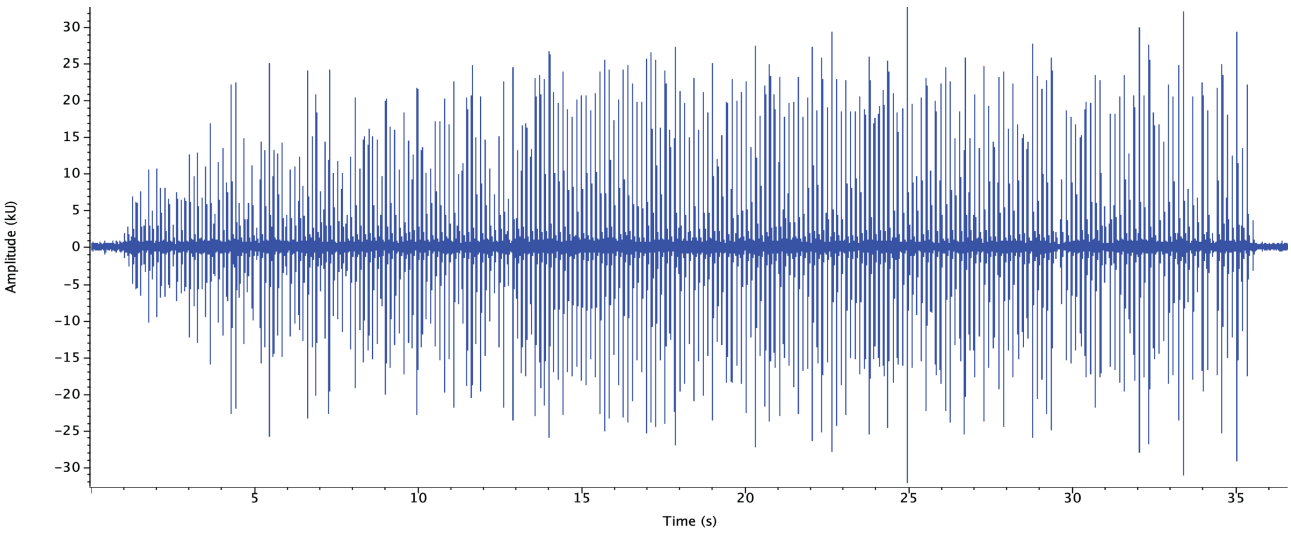


FIGURE 1186. Calling drum (R89-28) adult female allotype *A. tarcanyon.*

Derivation of name. Named after the type locality.

Habitat. Under rocks on a north facing, open, mostly grassy hillside, with oaks, adjacent to the uplifted Kreyenhagen Hills.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. Of 15 individuals, all had 2 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, and 14 had 2 and 1 had 3 ventral spurs; 13 had 5 and 2 had 6 inner **rear** leg tibial spines, and 14 had 3 and 1 had 4 outer **rear** leg tibial spines, and all with 2 ventral spurs except the holotype who has 2 sets of 2.

DNA. Fig. 1047, p. 579. F1354 & F1362 (both type locality, S03-19) recovered in a Group 20 Fast Drumming subclade, and nested within a larger clade with several other species of Fast Drumming Group JCs.

Karyotype. 2n♂=23. T03-10 (Fig. 1187, type locality S03-19), comprised of 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

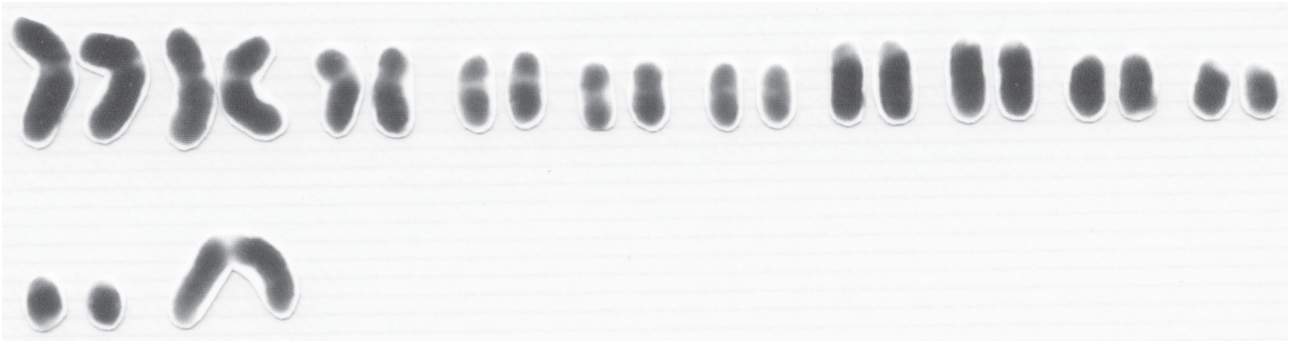


FIGURE 1187. Idiogram T03-10 *A. tarcanyon* (S03-19).

Discussion. The largest specimen of any known *Ammopelmatus* species (See Fig. 3.2 in Weissman 2001a) is probably this taxon. That poorly preserved, apparently teneral adult female was collected by Lloyd Bookout of the Kings Co. Department of Agriculture, with the following label data: California, Kings Co. (not Kern Co. as cited by Weissman 2001a), Milhan [sic] Rd, 6 m S Avenal, date unknown but probably in 1980s (L. Bookout, pers. comm to DBW). This indicated area would be Milan Rd and probably near the Kettleman Hills sandy off-road areas visible from I-5. But on Google Earth, Milan Rd does not extend north near Avenal, being farther south closer to Buttonwillow. She measures, in mm, as follows: Body length 64.66, hind femur length 15.83, hind femur width 6.56, head height 20.21. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia with 5 inner and 3 outer spines, 2 ventral spurs. Rear leg tibial calcars #3, 4, and 5 are distally expanded and spatulate. The nearest San Joaquin Valley population of another Fast Drumming Group taxon, is *A. chimineas*, located on the Chimineas Ranch, some 95 km due south of the Tar Canyon type locality. *A. bakersfield* type locality is some 100 km SE of Tar Canyon.

At a grazed, rolling hill grassland site (S01-14, 35.951746° -120.165070°, 349m, 2.3 km NE of the type locality of *A. tarcanyon*), on 26-ii-2001, we collected 2 adult female *A. nigrocapitatus* while on that same day, we found no JCs at the type locality of *A. tarcanyon*.

According to Wikipedia, The Kreyenhagen Hills are a range of foothills of the Diablo Range in western Fresno County and Kings County. The Kreyenhagen Hills form a long foothill belt in the soft formations between Reef Ridge and Kettleman Plain. They are divided into several groups, each a few miles wide, by streams crossing them at right angles. Kreyenhagen was the name of the family who originally owned the land in the area. According to ChatGPT, the name "Tar Canyon" likely derives from the presence of natural tar (or oil) seepage in the area, historically observed by Native Americans and early settlers.

Ammopelmatus temblor Weissman, sp. nov.

Temblor Range Jerusalem Cricket

Figs 1188–1196, Tables 2, 24, 38

Distribution. (Fig. 1188). Only known from the Temblor Range within the California Transverse Mountain ranges at the southern end of the San Joaquin Valley.

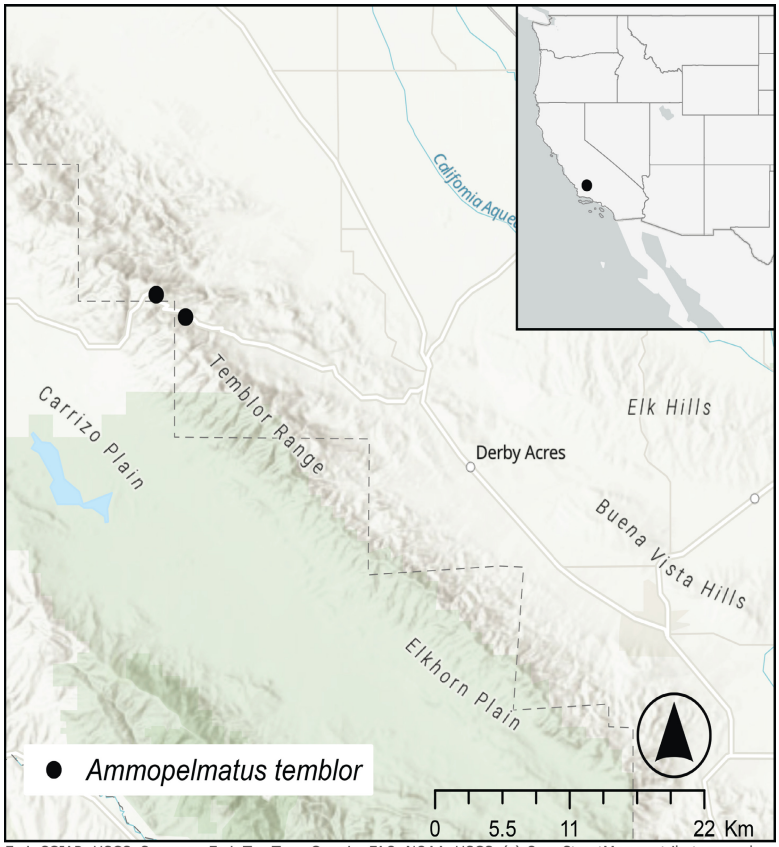


FIGURE 1188. Distribution of *A. temblor.*

Recognition characters. Large, megacephalic JC with dark black, wide abdominal bands, calling drum rapid (8–10 drums/s), rear leg tibia usually with only 3 inner spines (vs 5 inner spines for the other 12 Fast Drumming Group species). Geographically closest Fast Drumming taxon is *A. chimineas* (27 km to the southwest, with The Carrizo Plain in between). Distinguished from similar sized, and 94 km away, *A. grapevine*, by karyotype (2n♂=23 in *A. temblor* vs 2n♂=25 for *A. grapevine*) and the usual presence of only 3 inner rear leg tibial spines vs 5 in *A. grapevine.*

Holotype. Male (in alcohol, Fig. 1189). **California, *Kern Co.,*** Temblor Range, Hwy 58, 14.4 m W Hwy 33, adjacent to Call Box 58-09, 35.355139° -119.822864°, 983m, 18-iv-2003 (S03-20) DB Weissman. R03-23 & R03-24, F1355. Molt to adult 10-viii-2003. Deposited CAS, Entomology type #20132. Megacephalic. Measurements in mm: Body length 41.59, hind femur length 12.54, hind femur width 4.60. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1190) with 3 inner and 3 outer spines, 2 ventral spurs.

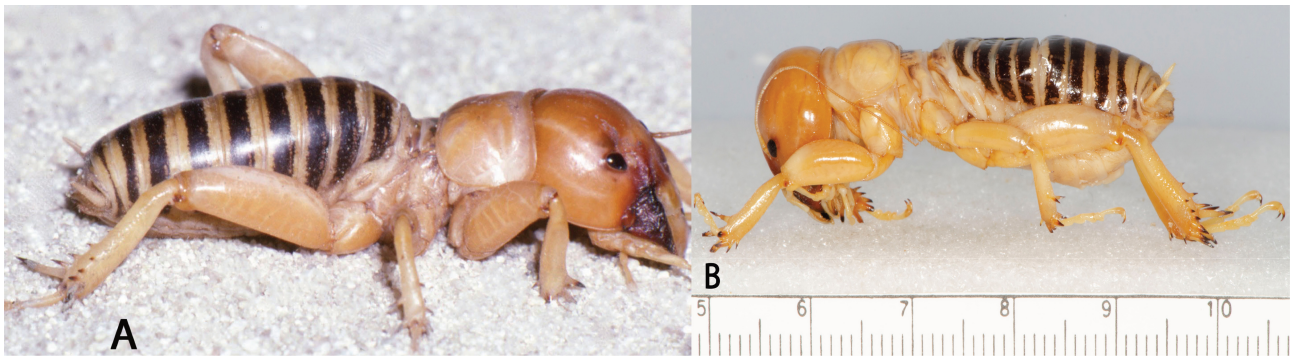


FIGURE 1189. Holotype adult male *A. temblor.* A. When alive. B. When preserved.



FIGURE 1190. Left rear leg tibia holotype adult male *A. temblor.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1191). **California, *Kern Co.,*** Temblor Range, Hwy 58 11.8 m W Hwy 33, 35.340757° -119.801326°, 822m, 6-ii-2014 (S14-2) W. Icenogle. R14-12, F2395. Molt to adult 19-vi-2014. Deposited CAS, CASENT #8414076. Megacephalic. Measurements in mm: Body length 46.42, hind femur length 11.94, hind femur width 4.55. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1192) with 3 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1193.

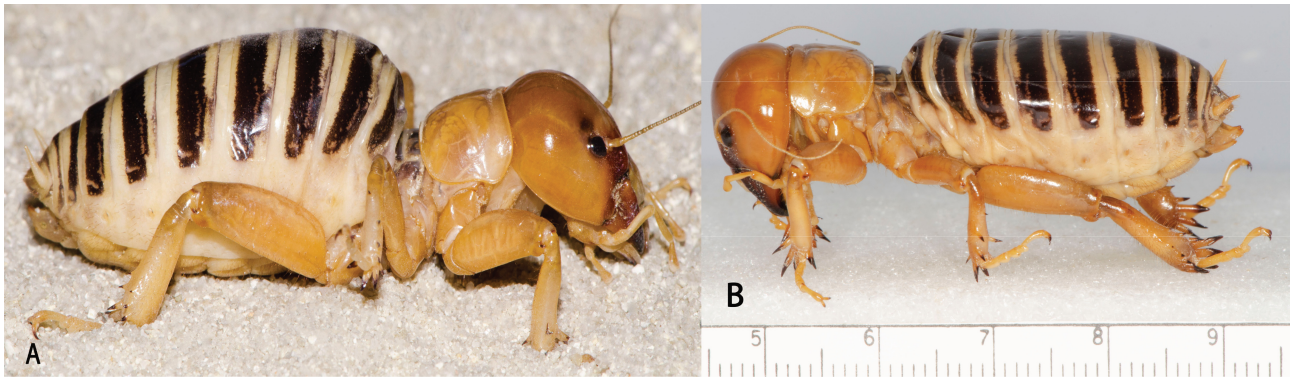


FIGURE 1191. Allotype adult female *A. temblor.* A. When alive. B. When preserved.

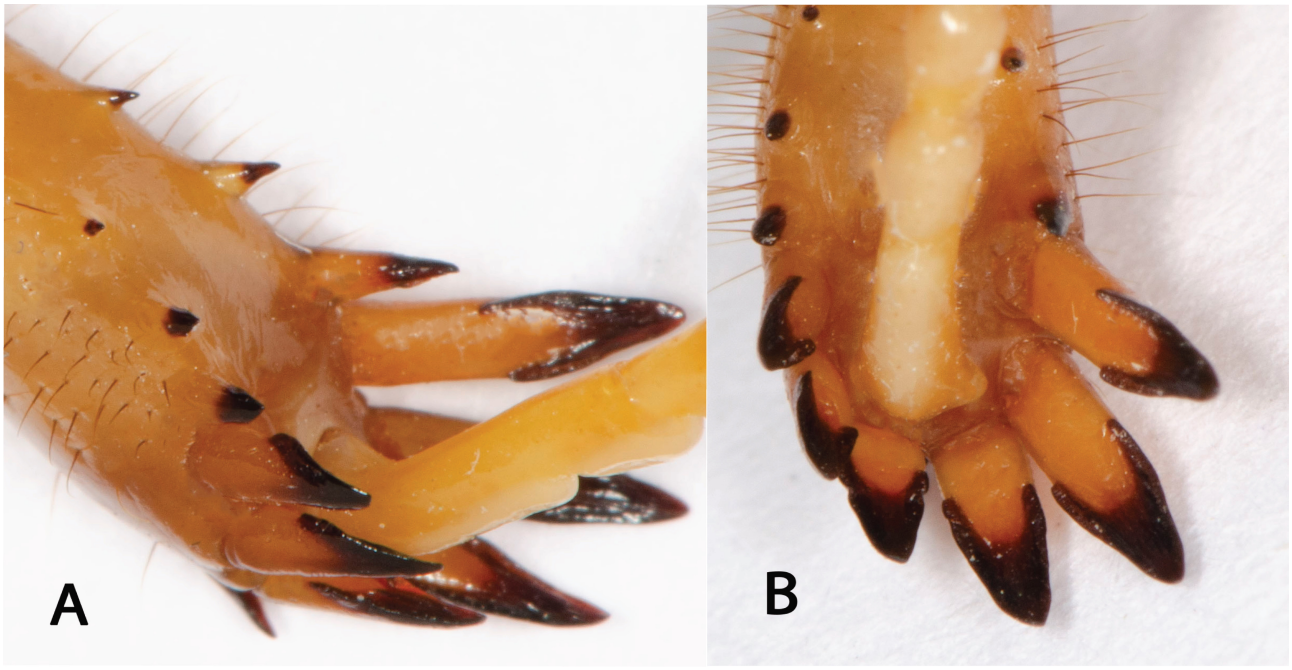


FIGURE 1192. Left rear leg tibia allotype *A. temblor.* A. Showing 3 outer and 3 inner spines. B. Showing shape of calcars.



FIGURE 1193. Ovipositor allotype *A. temblor.*

Paratypes. ♂1 ♀2. **CALIFORNIA**, ***Kern Co.***, Same locality as holotype, 18-iv-2003 (S03-20) ♂1 ♀2; 28-ii-2004 (S04-05) 1 male for testes. The type localities are separated by ~2.5 air-km from each other along Hwy 58.

Drum. Calling drums similar in both sexes, except female's longer in duration **Male:** Holotype R03-23 (Fig. 1194) with 31 drums over 3.1s (10 drums/s) at 21°C. **Female:** Allotype R14-12 (Fig. 1195) with 90 drums over 11.2s (8.0 drums/s) at 21°C.

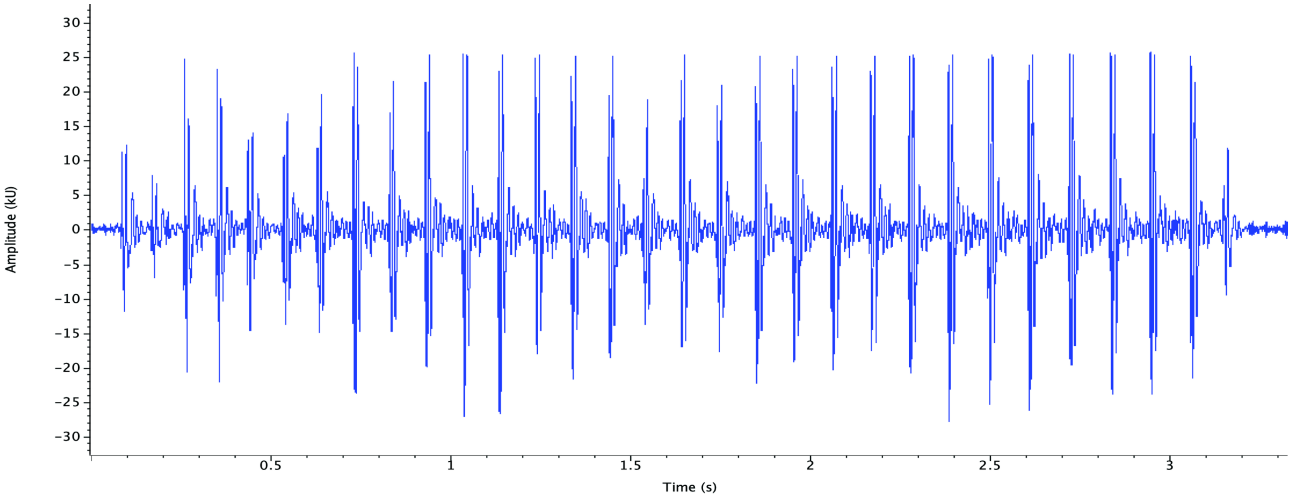


FIGURE 1194. Calling drum (R03-23) adult male holotype *A. temblor*.

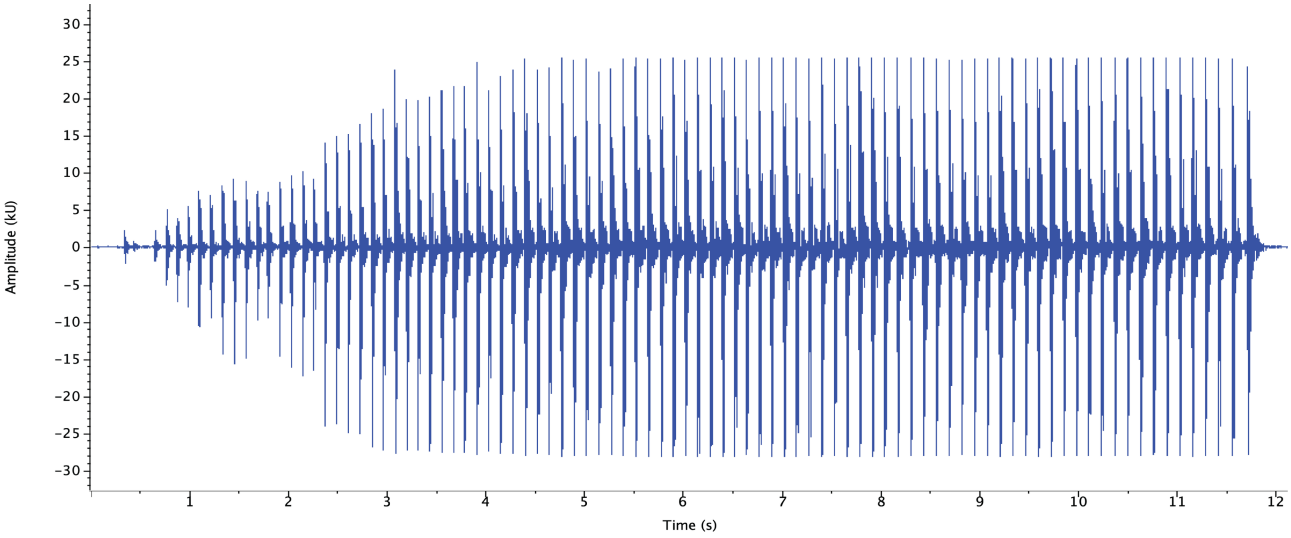


FIGURE 1195. Calling drum (R14-12) adult female allotype *A. temblor*.

Derivation of name. Named for the only mountain range where they are known.

Habitat. Open rolling grass covered hillsides with deciduous oaks and junipers. Holotype under rock in spring, allotype wandering on road at 22:00.

Life cycle and seasonal occurrence. Probably 2-year typical life cycle.

Variation. From 6 individuals (including late instar whose testes removed), 5 had 2 and 1 had 3 ventral **fore** leg tibial spurs; 1 had 7, 5 had 8 **middle** leg tibial calcars, and 1 had 1, 4 had 2, and 1 had 3 ventral spurs; 5 had 3 and 1 had 4 inner **rear** leg tibial spines, and all 6 had 3 outer **rear** leg tibial spines, and 1 had 1 and 5 with 2 ventral spurs.

DNA. Fig. 1047, p. 579. F1355 (S03-20); F2395 (S14-2) recovered together in Group 20 Fast Drumming along with other Fast Drumming species.

Karyotype. 2n♂=23. Type locality T04-6 (Fig. 1196, S04-5) with 6 metacentric or acrocentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

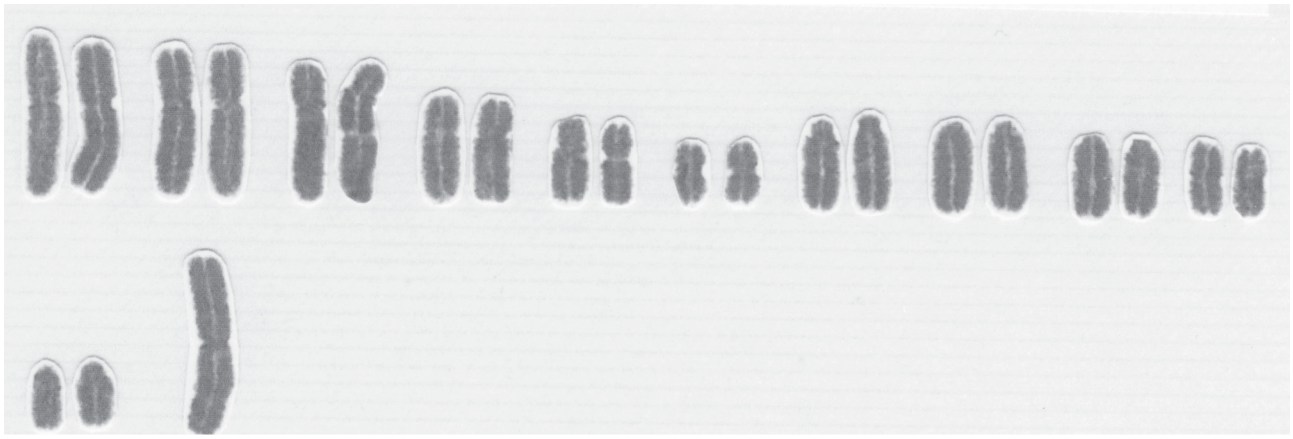


FIGURE 1196. Idiogram T04-6 *A. temblor* (S04-5).

Discussion. To the north, one encounters fast drummer *A. tarcanyon* (73 km away). To the east, one encounters fast drummer *A. bakersfield* (64 km away). To the southeast, one encounters fast drummers *A. mtpinos* (84 km away) and *A. grapevine* (94 km away). To the south, one encounters fast drummers *A. sierramadre* (28 km away) and *A. lakecachuma* (88 km away). To the west, one encounters fast drummers *A. chimineas* (27 km away, with The Carrizo Plain in between), and *A. castaneus* (100 km away). This larger area is clearly a hotbed for Fast Drumming Group species' diversity.

***Ammopelmatus zayante* Weissman, sp. nov.**
Zayante Jerusalem Cricket
Figs 1197–1208, Tables 12, 22, 38

Distribution. (Fig. 1197). Only known from the sandhill parklands around Felton, Santa Cruz Mts, Santa Cruz Co., California.

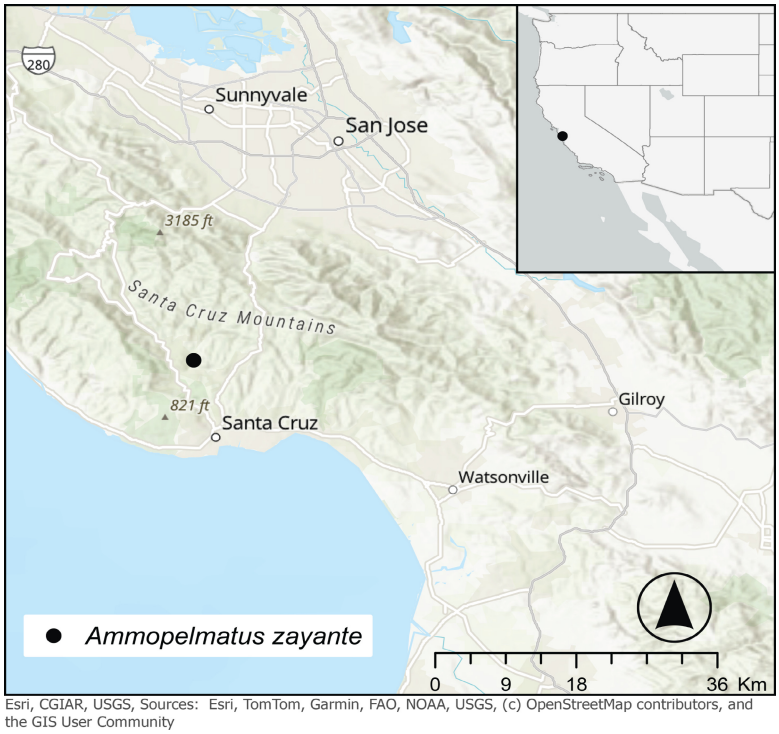


FIGURE 1197. Distribution of *A. zayante.*

Recognition characters. Restricted to sandhills of the Santa Cruz Mts. A small to medium (rarely large) sized JC, with light colored legs. Separated from sympatric dark colored legs *A. brachysocius* by 2 (in *A. zayante*) vs 3 (in *A. brachysocius*) fore leg tibial spurs, usually 5 inner and 3 outer rear leg tibial spines vs 4 inner and 2 outer spines, 2n♂=23 vs 2n♂=25 chromosomes, calling drum, sex clarification drum in *A. zayante,* and DNA. In the field, large nymphs and adults can usually be separated by the light tan vs more orange-brown leg coloration seen in *A. brachysocius.* Can be separated from inland, Fast Drumming Group *A. pinnacles* and *A. tarcanyon* by larger size in latter two and habitat. Can be separated from more southern *A. danieli* by habitat.

Holotype. Male (in alcohol, Fig. 1198). **California, *Santa Cruz Co.,*** Felton, San Lorenzo Valley Water District, Olympia Watershed, 7710 E. Zayante Rd, 37.067786° -122.054064°, 135m, 31-iii-1995 (S95-26) DBW. R96-83. Molt to adult 11-viii-1996. Deposited CAS, Entomology type #20163. Measurements in mm: Body length 34.94, hind femur length 11.42, hind femur width 3.99. Fore leg tibia with 2 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1199) with 3 or 5 inner and 2 or 3 outer spines, 2 ventral spurs.

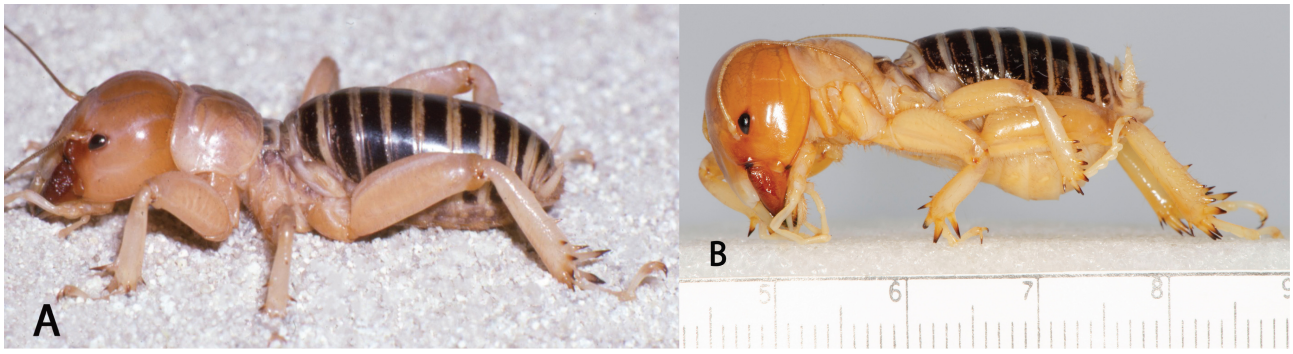


FIGURE 1198. Holotype adult male *A. zayante.* A. When alive. B. When preserved.



FIGURE 1199. Right hind leg tibia adult male holotype *A. zayante.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1200). Same data as holotype except 20-ii-7-iii-1995 (S95-18). R95-46, F0121. Molt to adult 3-ix-1995. Deposited CAS, CASENT #9081909. Measurements in mm: Body length 27.62, hind femur length 9.33, hind femur width 3.22. Fore leg tibia with 2 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1201) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1202.

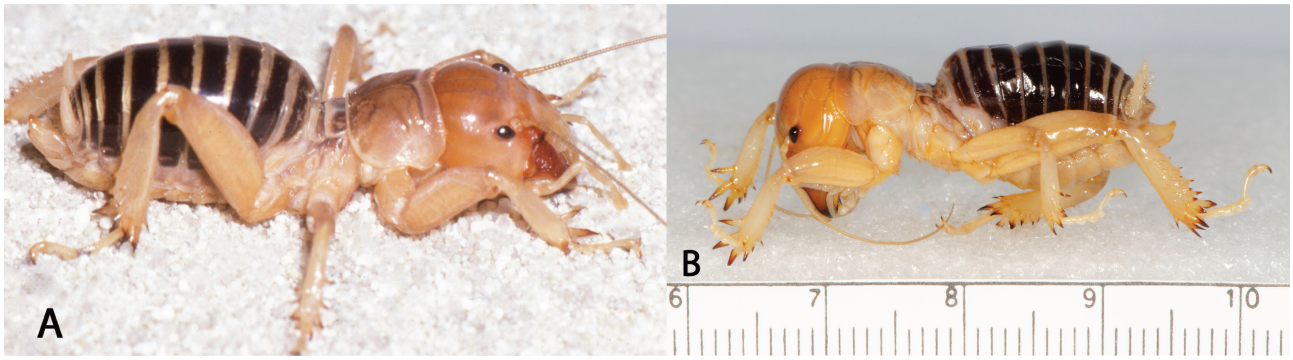


FIGURE 1200. Allotype adult female *A. zayante.* A. When alive. B. When preserved.

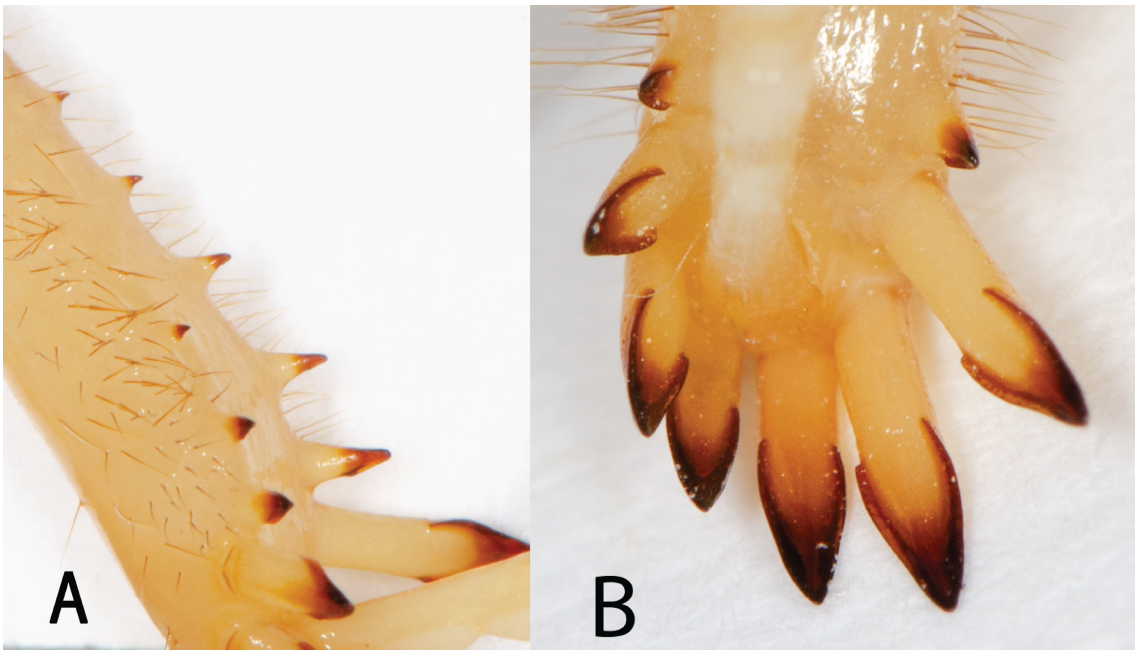


FIGURE 1201. Left rear leg tibia adult female allotype *A. zayante.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1202. Ovipositor allotype *A. zayante.*

Paratypes. ♂14 ♀13. All from type locality: 17-i-1995 (S95-1) W. Horn ♀1; 20-ii-7-iii-1995 (S95-18) ♂3 ♀2; 31-iii-1995 (S95-26) ♂6 ♀2; 20-i-1996 (S96-1) ♀1; 20-iv-1996 (S96-24) ♂4 ♀3; 25-iv-1998 (S98-33) ♀3; 23-iv-2003 (S03-23) ♂1. Ben Lomond, December, 1995, FT Hovore ♀1.

Drum. Calling drum similar in both sexes except longer in female and male with sex clarification drum (SCD). **Male:** Holotype R96-83 (Fig. 1203A) showing SCD of 13 drums over 0.91s (14.3 drums/s) and a calling drum (Fig. 1203B) of 33 drums over 3.3s (10.0 drums/s) both at 20.5°C. **Female:** Allotype R95-46 (Fig. 1204) showing 221 drums over 31.6s (7.0 drums/s) at 20°C.

Of some 15 adult males, the holotype was the only one with a documented SCD which he made in response to a nearby drumming adult female. This paucity of males with an identified SCD may reflect the difficulty of drumming a finger fast enough to elicit a SCD in many Fast Drumming Group taxa.

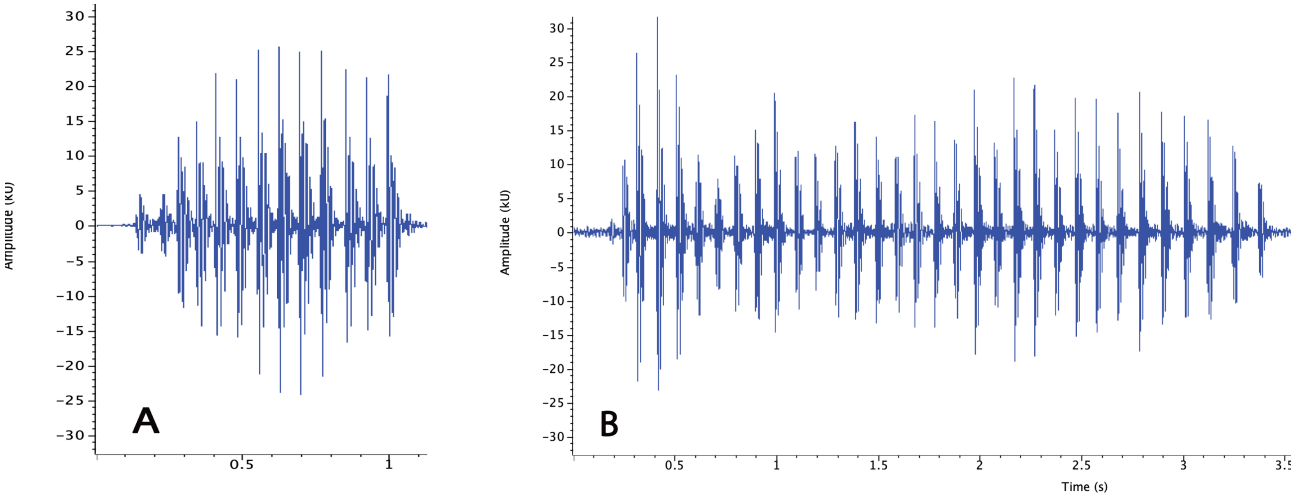


FIGURE 1203. Drumming in adult male holotype *A. zayante.* A. SCD (R96-83). B. Calling drum (R96-83).

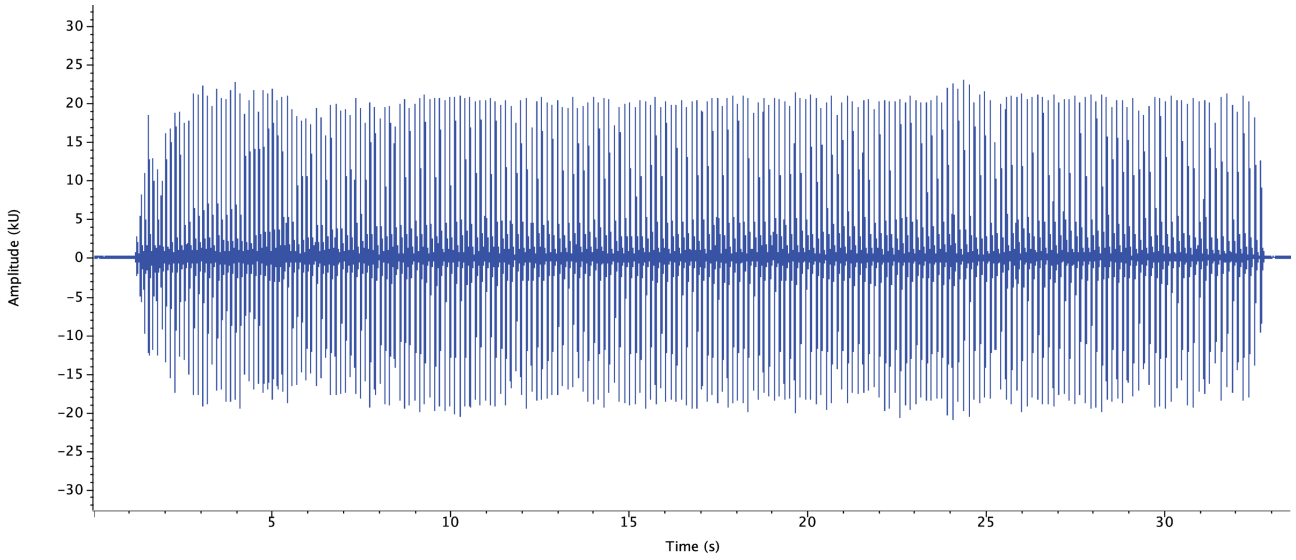


FIGURE 1204. Calling drum (R95-46) adult female allotype *A. zayante.*

Derivation of name. Named with reference to the sandy soil "Zayante series"—derived from the sandstone of the Santa Margarita formation.

Habitat. All specimens found on sand under rocks, boards, and other debris, when ground wet and cold, usually in areas under some tree cover where moisture lasts longest.

Life cycle and seasonal occurrence. Larger individuals may have a 3-year life cycle: female R01-66, S98-33 collected as a small nymph 25-iv-1998 and molted to adult 21-viii-2001. This is one of the few JC species with a probable documented 3-year life cycle. Tinkham (1965) claimed that *A. kelsoensis* had a multiyear life cycle,

but Weissman (2001a, and see p. 287) discussed why his situation was probably an anomaly due to poor raising conditions.

Variation. For 28 adults, all had 2 ventral **fore** leg tibial spurs; 1 had 7 and 27 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 7 had 4 and 21 had 5 inner **rear** leg tibial spines, while all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs. Larger adults megacephalic.

DNA. Fig. 1047, p. 579. F0273 & F0276 (both type locality S95-26) recovered in Group 20 Fast Drumming, a large, mixed clade of other Fast Drumming Group taxa.

Karyotype. 2n♂=23. Three males T99-18 (Fig. 1205), T99-19 (Fig. 1206), T99-42 (Fig. 1207) examined from the type locality (S98-33) and all similar: with 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

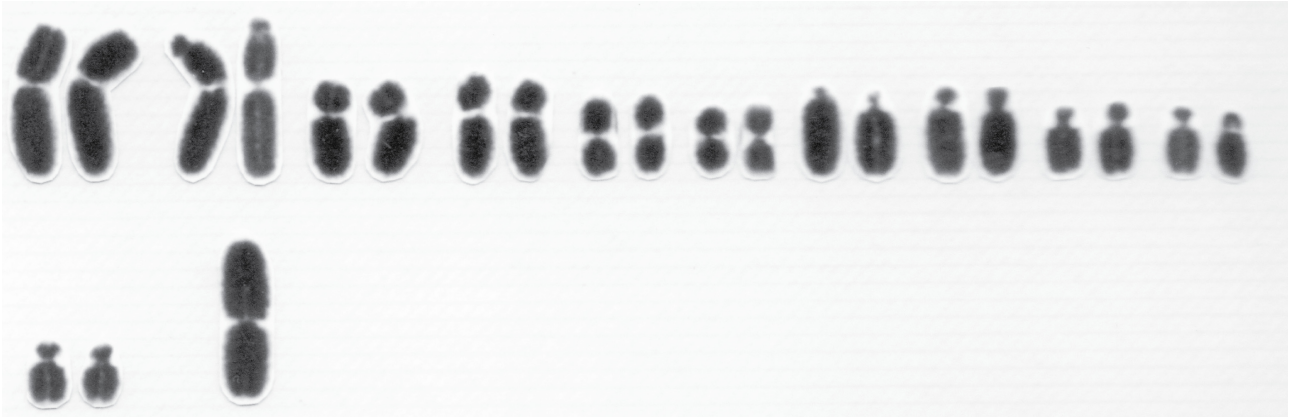


FIGURE 1205. Idiogram T99-18 *A. zayante* (S98-33).

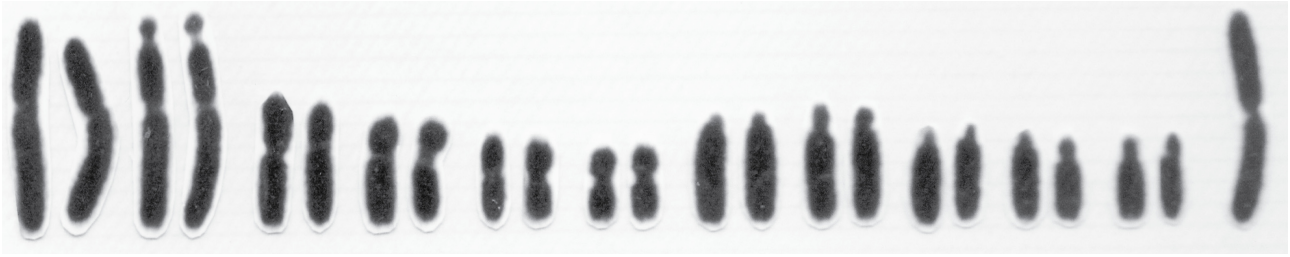


FIGURE 1206. Idiogram T99-19 *A. zayante* (S98-33).



FIGURE 1207. Idiogram T99-42 *A. zayante* (S98-33).

Discussion. The type locality Olympia Watershed is 180 acres owned by the San Lorenzo Valley Water District (SLVWD) northeast of Felton in the Zayante area (named after the sandy soil—the "Zayante series"—derived from the sandstone of the Santa Margarita formation). Fahey (2012) states that the ponderosa pines that grow at the type locality Sandhills are virtually never seen elsewhere in California at such low elevations. Once covering 6,000 to 7,000 acres, the Sandhills are now down to 4,000 acres (including only 2,500 that are completely undeveloped), displaced by home building, mining, and the introduction of nonnative animals and plants. Today the Sandhills, once contiguous, are cut into several fragments, owned and managed by different entities, including a state and a county park, and also separated by houses and a sand mining operation. Additional information can be found here: https://santacruzsandhills.com/

There are 2 insects known only from these Sandhills that are protected under the USA Endangered Species Act: The Zayante band-winged grasshopper (*Trimerotropis infantilis* Rentz & Weissman) (Hoekstra 1998, Chu 2002); and the Mount Hermon June beetle (*Polyphylla barbata* Cazier). There are four endemic sand parkland plants, with the first 2 federally listed: the Santa Cruz wallflower (*Erysimum teretifolium*), Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*), Ben Lomond buckwheat (*Eriogonum nudum* var. *decurrens*), and Bonny Doon manzanita (*Arctostaphylos silvicola*). We believe the Zayante Jerusalem Cricket may also warrant federal and state protection because its distribution is apparently similarly limited like that of the protected Zayante band-winged grasshopper.

Group 21, Vandenberg Air Force Base Group (Fig. 1208)

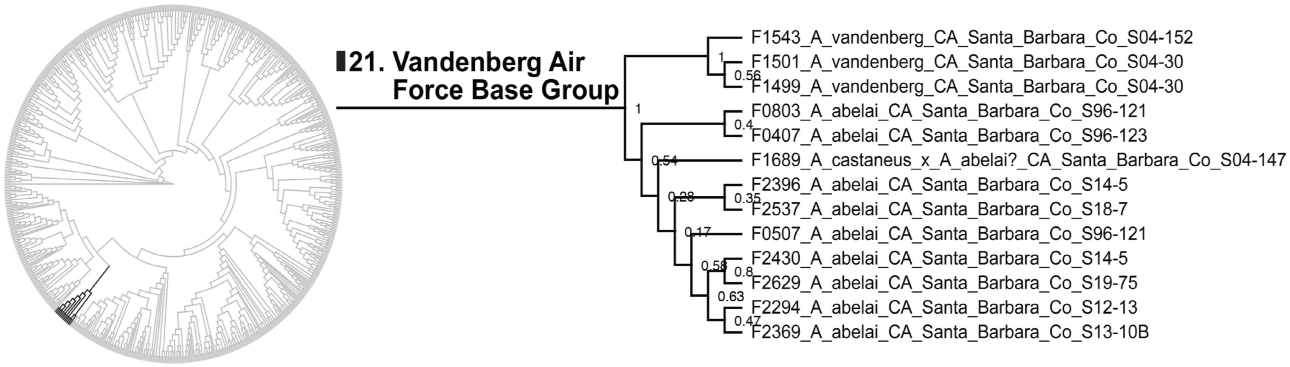


FIGURE 1208. ASTRAL tree for Vandenberg Air Force Base Group.

Two of the four species that occur in the Vandenberg-Pt Conception area are recovered together in their own clade: *A. abelai* (2n♂=25, 3 drums/s) and *A. vandenberg* (2n♂=25, 1–1.7 drums/s). The other two species at Vandenberg (*A. castaneus* and *A. muwu*) are recovered elsewhere in this Clade 11.

SPECIES WRITE UPS: *A. abelai* (p. 652) and *A. vandenberg* (p. 658).

***Ammopelmatus abelai* Weissman, sp. nov.**
Variable Jerusalem Cricket
Figs 1209–1220, Tables 8, 11, 17

Distribution. (Fig. 1209). Only known from sandy habitats in the Vandenberg Air Force Base (VAFB) and adjacent Pt Conception areas, all Santa Barbara Co., California.

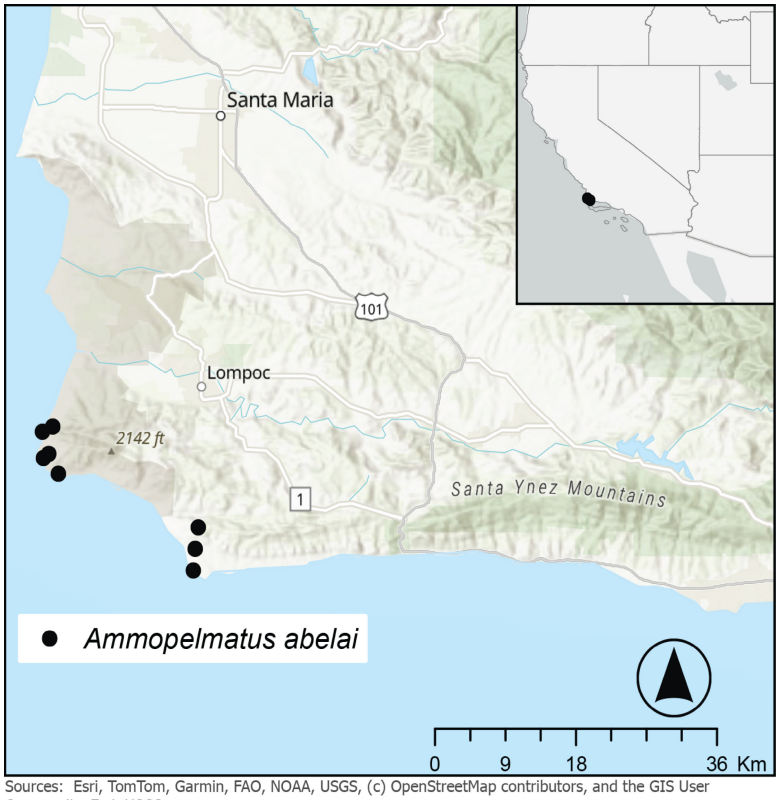


FIGURE 1209. Known distribution of *A. abelai.*

Recognition characters. Small to large sized JCs, with variable abdominal coloration in both sexes: from light colored with almost no abdominal stripes (holotype, Fig. 1210A) to very dark with wide black bands and purple coloration between bands (Fig. 1210B). Head, pronotum and legs vary in color from pale to brown, never with red as in *A. vandenberg.* The unifying characters across this broad range of color variations is a calling drum at a rate of ~3 drums/s at 20°C, males with sex clarification drum (SCD), 2n♂=25, 3 fore leg tibial spurs, and DNA from all specimens recovered in the same clade. There are 3 other JC taxa in the VAFB-Pt Conception area (Table 17, p. 40), and they can be separated from *A. abelai* as follows: *A. castaneus* is a larger JC, frequently megacephalic, with a drum rate of 6–11 drums/s, without a SCD, 2n♂=23, usually 2 fore leg tibial spurs, and different DNA. *A. muwu* is a sand dune obligate with distinctive, spatulate rear leg calcars, a similar drumming rate also with a SCD, but 2n♂=23, usually 1 fore leg tibial spur, and different DNA. *A. vandenberg* drums at 1.1–1.7 drums/s, also with a male SCD, 2n♂=25, and 3 fore leg tibial spurs. The latter is the closest relative of *A. abelai*, recovered in the same clade; they are readily separated by their different calling drum rates.

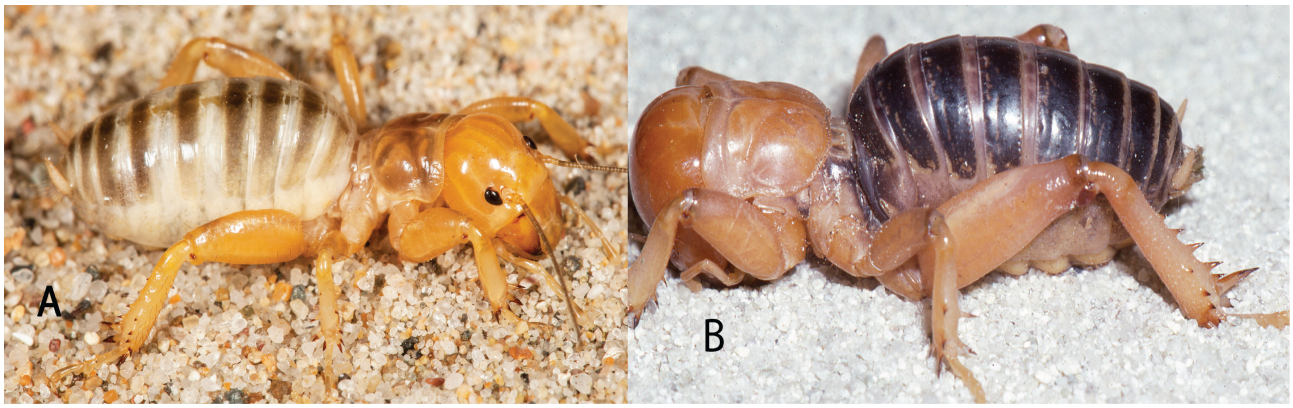


FIGURE 1210. Color variation seen in males of *A. abelai.* A. Holotype *A. abelai*, as late instar (Photo by A. Abela). B. Paratype *A. abelai*, adult male from Pt Conception, S96-121, R98-173.

Holotype. Male (in alcohol, Fig. 1211). **California, *Santa Barbara Co.,*** Vandenberg Air Force Base, Boat House, 34.558154° -120.622154°, 35m, 27-ii-2014 (S14-5) A. Abela. R14-123, F2430. Molt to adult 29-ix-2014. Deposited CAS, Entomology type #20155. Measurements in mm: Body length 37.12, hind femur length 11.78, hind femur width 4.7. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1212) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 1211. Preserved holotype male *A. abelai.*



FIGURE 1212. Left rear leg tibia holotype adult male *A. abelai*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1213). Same data as holotype except R14-13, F2396. Molt to adult 29-vi-2014. Deposited CAS, Entomology #8414318. Measurements in mm: Body length 41.61, hind femur length 10.85, hind femur width 4.34. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1214A) with 4 and 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1214B.

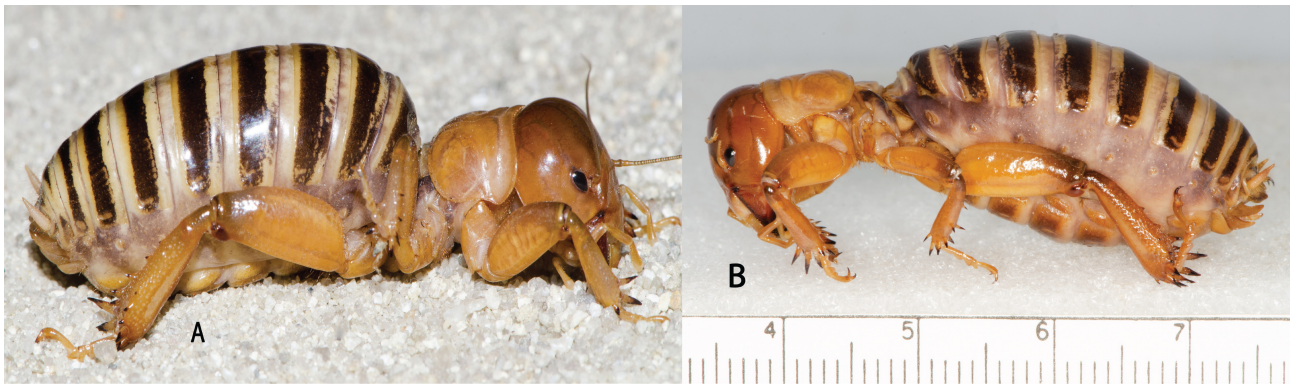


FIGURE 1213. Allotype *A. abelai.* A. When alive. B. When preserved.



FIGURE 1214. Allotype adult female *A. abelai.* A. Left rear leg tibia showing 3 outer and 4 inner spines. B. Ovipositor allotype.

Paratypes. ♂15 ♀35. **CALIFORNIA, *Santa Barbara Co.,*** Pt Conception area: 34.499790° -120.461669°, 317m, 20-xii-1996 (S96-121) ♂4 ♀5; 34.476284° -120.465224°, 83m, 20-xii-1996 (S96-122) ♀6; 34.452749° -120.467362°, 45m, 20-xii-1996 (S96-123) ♀4. Vandenberg Air Force Base (all A. Abela collector): Arguello Ridge, 34.614059° -120.539052°, 302m, 8-iii-2024 (S24-56) ♀1. Boat House 34.558154° -120.622154°, 36m, 1-iii-2014 (S14-5) ♂1 ♀5; 28-i-2018 (S18-4) ♂1 for testes; 27-iii-2018 (S18-7) ♂1 ♀3; 16-xii-2018 (S19-76) ♂1 for testes. Destroyer 34.604025° -120.640442°, 20m, 20-iv-2012 (S12-13) ♂1; 26-x-2012 (S12-121) ♀3; 17-xi-2012 (S12-124) ♀2; 1-iii-2014 (S14-6) ♂1. Pt Arguello, 34.575266° -120.639268°, 69m, 30-iii-2022 (S22-13) ♂1. SLC-5 34.609584° -120.628631°, 80m, 15-xi-2012 (S12-121) ♂2 ♀3; 13-xi-2012 (S12-124) ♂2 ♀1; 17-x-2018 (S19-75) ♀1. SLC-6 34.579954° -120.633172° 15-xi-2012 (S12-121) ♀1. South Base, 34.602991° -120.541886°, 254m, 17-ii-2024 (S24-58) ♂1. VT3, 34.58358° -120.596355°, 396m, 26-i-2024 (S24-57) ♂1.

Drum. Similar in both sexes except males with a SCD and call longer in females. Holotype male R14-123 (Fig. 1215) shows 17 drums over 5.0s (3.4 drums/s) at 21°C. Allotype female R14-13 (Fig. 1216) shows 55 drums over 18.6s (3.0 drums/s) at 20.5°C.

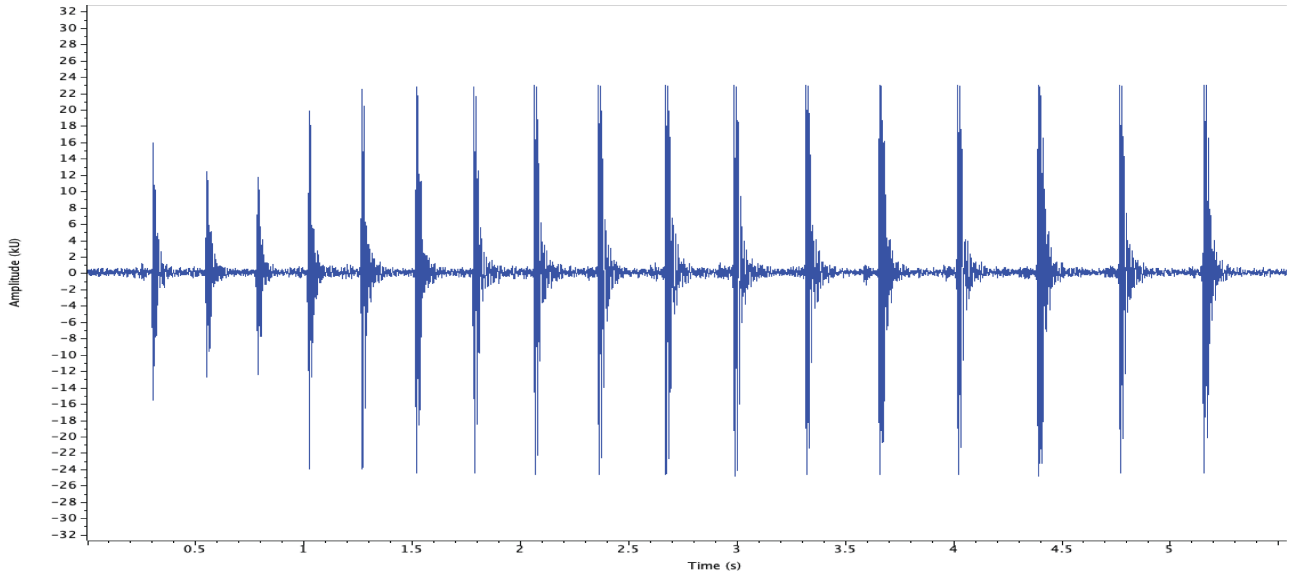


FIGURE 1215. Calling drum (R14-123) holotype male *A. abelai*.

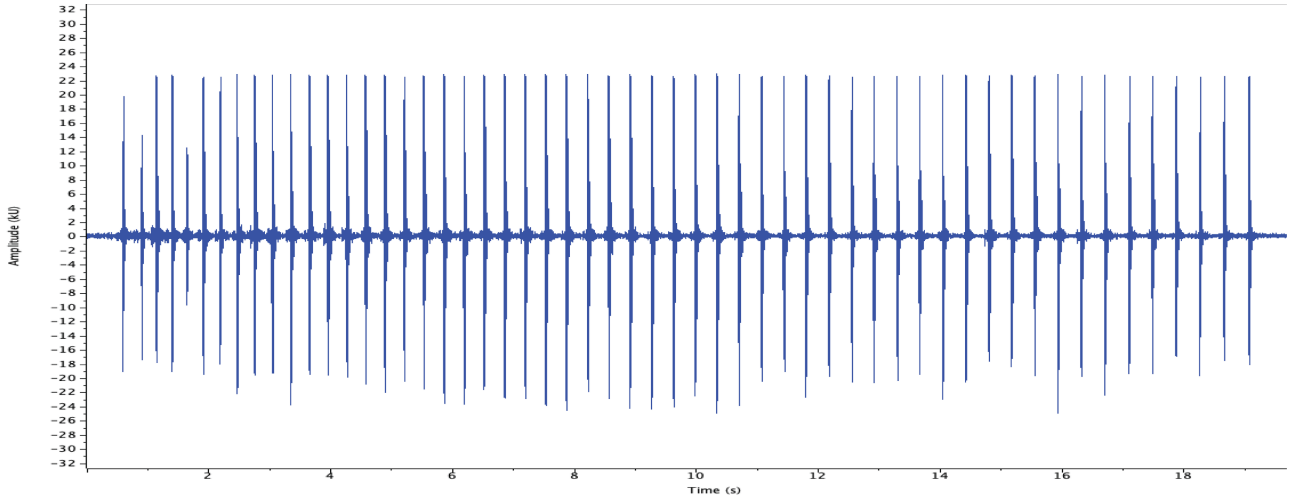


FIGURE 1216. Calling drum (R14-13) allotype female *A. abelai*.

Derivation of name. Named for Alice Abela, collector extraordinaire, who over the years has sent DBW a number of new species of JCs.

Habitat. From low rolling, sand dunes near Pt Conception Lighthouse, where under cow pies and microsympatric with *A. muwu*; to sandy grassland areas transitioning to scrub where *A. abelai* can occur with *A. castaneus*; to oak-woodland grassland areas (S96-121). At the type locality, only *A. abelai* was collected. A. Abela posits that sandy, open grasslands might favor light morphs with scrub and oak-woodland areas favoring dark morphs, with a lot of mixing at the contact zone. Our three diverse 1996 Pt Conception collection localities provide no clear answer to this hypothesis as no collected individuals were as light colored as some of those collected on VAFB. The Boat House on VAFB is separated from the Pt. Conception Lighthouse area by ~18.5 km, with both sites coastal and with similar, sandy habitat.

Individuals collected in the oak-woodland-grassland habitat at Pt Conception (S96-121) were behaviorally unique for all collected *Ammopelmatus* taxa: around half of the 15 collected adults and nymphs were under bark of tree trunks or under bark on fallen logs and large branches. One individual was exposed with a pick-ax almost 4 cm

deep in a soft oak log. Previously, only *Stenopelmatus* JCs were collected in such situations (Weissman *et al.* 2021). None of these Pt Conception individuals hopped, as seen in many *Stenopelmatus* species.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. From 40 individuals, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 38 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 38 had 5 and 2 had 6 inner **rear** leg tibial spines, and 38 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Adult male (Fig. 1210B, S96-121, R98-173, F0803) from Pt Conception is the darkest individual seen.

DNA. Fig. 1208, p. 652. F0407 (S96-123, Pt Conception); F0507 and F0803 (both S96-121, Pt Conception); F2294 (S12-13, Destroyer), F2369 (S13-10B, SLC 6), F2396 (allotype, S14-5, Boat House), F2430 (S14-6, Destroyer), F2537 (S18-7, Boat House), and F2629 (S19-75, SLC 5), with all 9 individuals recovered together in Group 21 Vandenberg Air Force Base, with *A. vandenberg.*

Karyotype. 2n♂=25. Three testes yielded results with slight variation: T97-16 (Fig. 1217, S96-121, Pt Conception) shows 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T18-2 (Fig. 1218, S18-4, type locality Boat House on VAFB) shows 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. T20-3 (Fig. 1219, C-bands, S19-76, type locality Boat House on VAFB) shows 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

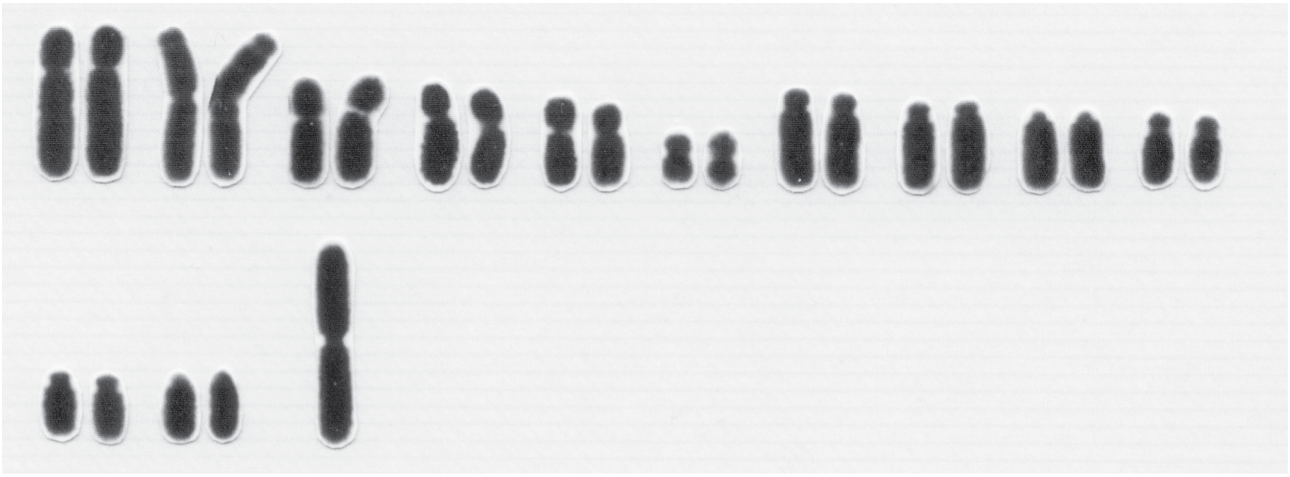


FIGURE 1217. Idiogram T97-16 *A. abelai* (S96-121).



FIGURE 1218. Idiogram T18-2 *A. abelai* (S18-4), using C-banding.



FIGURE 1219. Idiogram T20-3 *A. abelai* (S19-76), using C-banding.

Discussion. Initially, given the color diversity of individuals of *A. abelai*, and in the absence of DNA data, we were unsure as to how many taxa were represented. But given the subsequent concordant DNA, drums, karyotypes, and populations with intermediate-colored individuals (Fig. 1220), we are confident that only one species is represented here. We also know from Appendix 2, and the analysis discussed on p. 18 and 53, that in the 42 situations where 2 (or 3) *Ammopelmatus* taxa are sympatric, that there is always a difference in diploid chromosome number and/or calling drum rate between those 2 taxa. Since we did not find either difference between any sympatric color morph pair, such a finding is also consistent with our decision.

Along with *A. mescaleroensis*, this is the most color variable JC taxon. As opposed to having just 2 color phases, as seen in *A. castaneus, A. navajo,* and *A. yubalake*, we find color variation and mixed populations throughout the limited range of *A. abelai*.

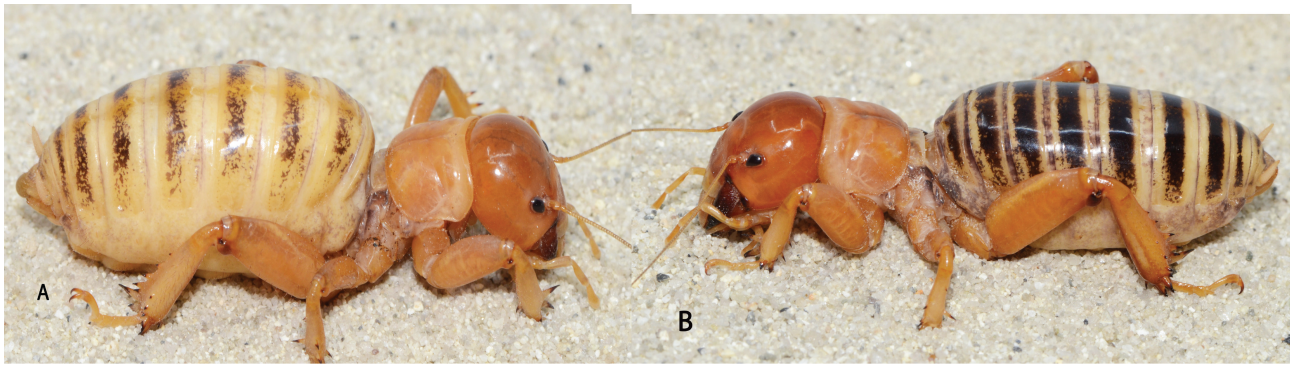


FIGURE 1220. Two adult females *A. abelai* from type locality (S18-7), Boat House, showing further color variation in this species. A. R18-51. B. R18-44.

***Ammopelmatus vandenberg* Weissman, sp. nov.**

Vandenberg Red-headed Jerusalem Cricket
Figs 1221–1232, Tables 8, 17

Distribution. (Fig. 1221). Only found on the Burton Mesa area of Vandenberg Air Force Base (VAFB), Santa Barbara Co., California.

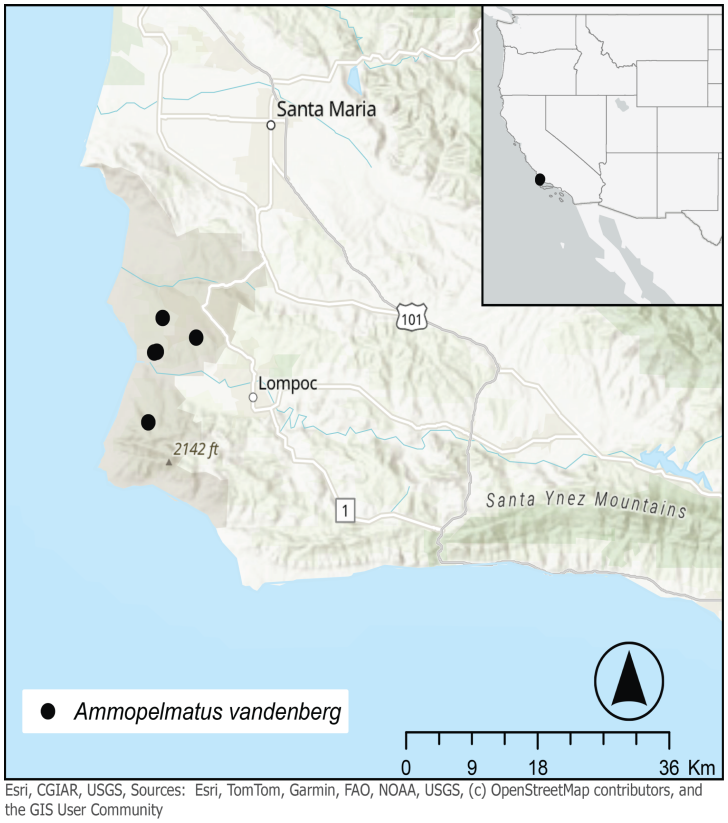


FIGURE 1221. Distribution of *A. vandenberg.*

Recognition characters. A (rarely) small to large JC with wide, dark black abdominal bands that stand out against the distinctive orange-reddish or reddish-orange head, pronotum, and all 6 legs. Calling drum of 1.1–1.7 drums/s, slowest of any JC species at VAFB or Pt Conception area. Can be separated by drum rate from the 3 other *Ammopelmatus* taxa at VAFB: *A. abelai* and *A. muwu* both drum around 3 drums/s while *A. castaneus* drums faster at 8–10 drums/s. On Burton Mesa, *A. vandenberg* was sympatric with one male of *A. castaneus* at S04-22 (Plot 8) and S04-153 (Plot 9). These are the only records of a non-*A. vandenberg* on Burton Mesa. Those 2 taxa can be separated by drum rate, DNA, number of fore leg tibial spurs, and a brown (in *A. castaneus*) vs red (in *A. vandenberg*) head, although that latter difference can be subtle.

Holotype. Male (in alcohol, Fig. 1222). **California, *Santa Barbara Co.,*** Vandenberg Air Force Base, Burton Mesa, Plot 10, 34.7018° -120.5795°, 98m, 29-iv-2004 (S04-30) A. Abela. R04-81, F1499. Molt to adult 3-ix-2004. Deposited CAS, Entomology type #20138. Measurements in mm: Body length 37.79, hind femur length, 11.71 hind femur width 4.37. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1223) with 5 inner and 3 outer spines, 2 ventral spurs.

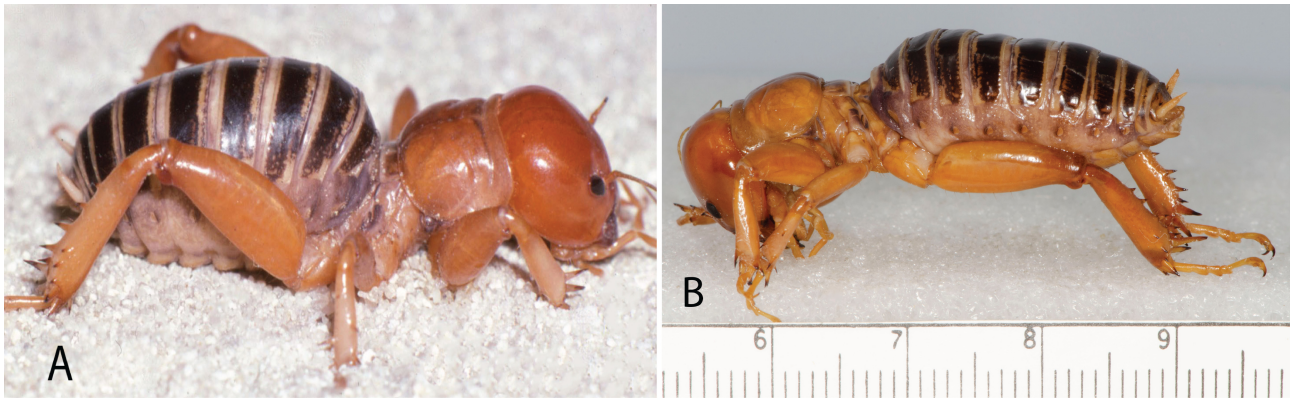


FIGURE 1222. Adult male holotype *A. vandenberg.* A. When alive. B. When preserved.

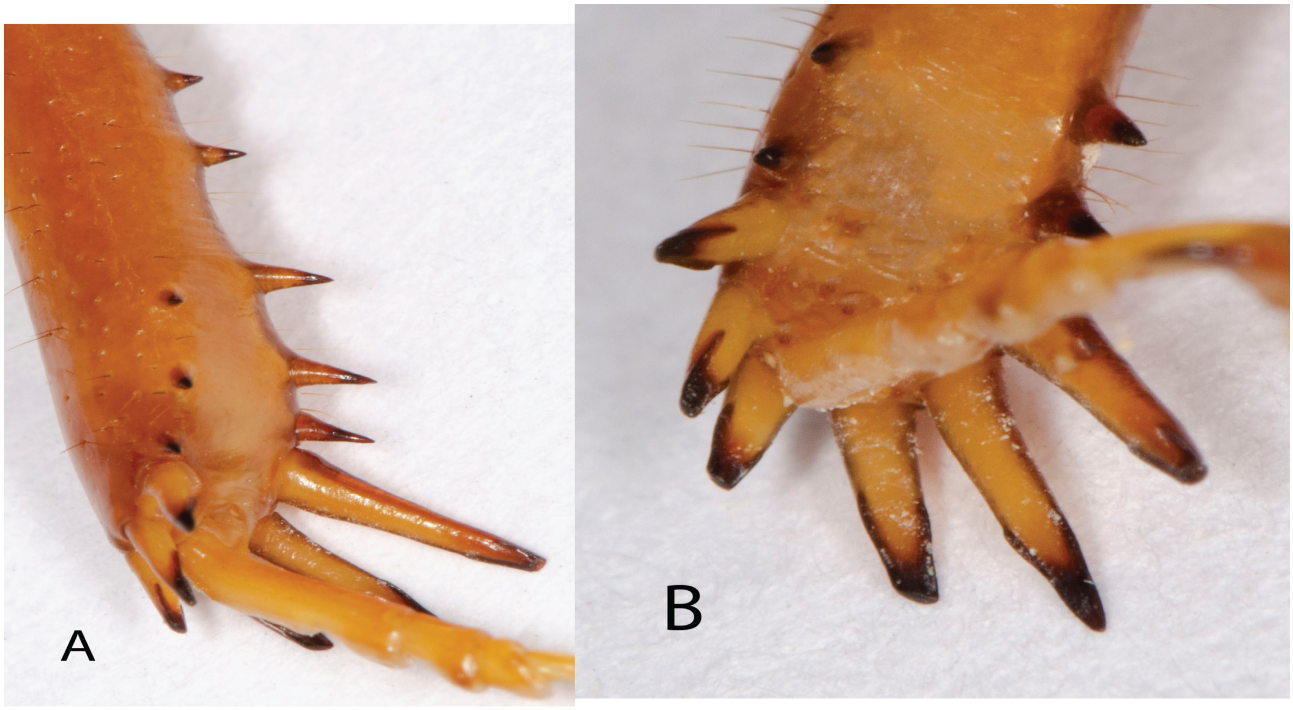


FIGURE 1223. Left rear leg tibia adult male holotype *A. vandenberg.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1224). **California, *Santa Barbara Co.,*** Vandenberg Air Force Base, Burton Mesa, Plot 8, 34.7179° -120.528°, 105m, 20-viii-14-x-2004 (S04-152) A. Abela. R04-95, F1519. Collected as adult. Deposited CAS, CASENT #9079234. Measurements in mm: Body length 29.85, hind femur length 8.32, hind femur width 3.22. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1225) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1226.

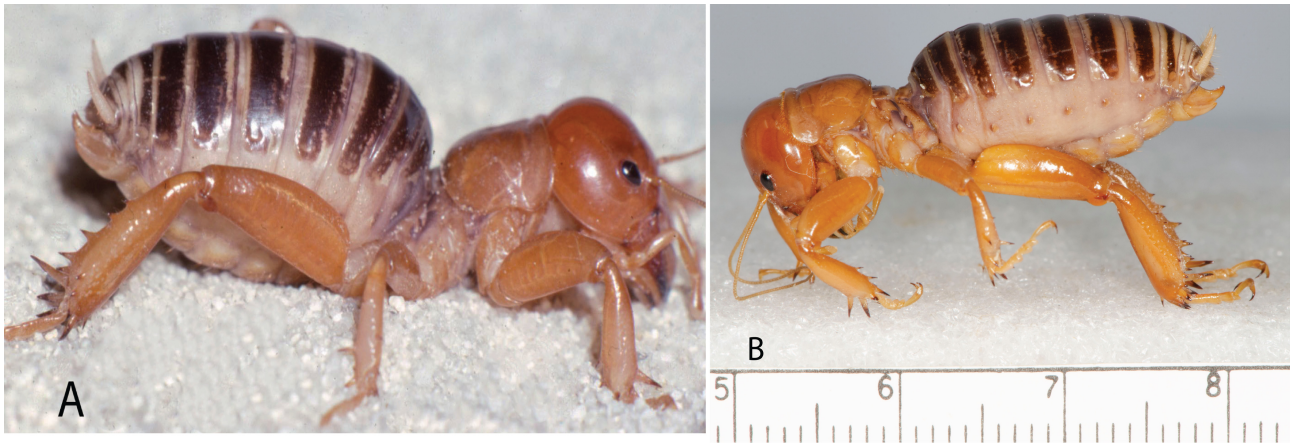


FIGURE 1224. Adult female allotype *A. vandenberg.* A. When alive. B. When preserved.



FIGURE 1225. Left rear leg tibia adult female allotype *A. vandenberg.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1226. Ovipositor allotype *A. vandenberg.*

Paratypes. ♂21 ♀13. **CALIFORNIA, *Santa Barbara Co.,*** Vandenberg Air Force Base, A. Abela, all Burton Mesa area, with the following GPS: Plot 2 (34.702327° -120.576237°, 106m); Plot 4 (34.718834° -120.577725°, 107m); Plot 6 (34.739247° -120.569181°, 107m); Plot 8 (34.7179° -120.5280°, 123m); Plot 9 (34.7026° -120.5764°, 107m); Plot 10 (34.7018° -120.5795°, 102m). The collection dates are as follow: 25-26-iii-2004 (S04-22, Plot 10) ♀3; 29-iv-2004 (S04-30, Plots 8, 9, 10) ♂3 ♀2; 20-viii-14-x-2004 (S04-152, Plot 8; S04-153, Plot 9; S04-154, Plot 10) ♂16 ♀7; 25-v-9-vii-2012, (S12-101, Plots 2, 4, 6) ♂2 ♀1.

Possible placement. We have a single adult female (Fig. 1227), with a unique drum, that was collected by A. Abela as a mid-late instar on 18-x-2004, that molted to adult on 24-viii-2005. She was collected on Vandenberg Air Force Base at Bear Creek (S04-147), around 34.626000° -120.586841°, 125m. Her adult calling drum (Fig. 1228, R05-116A) shows 21 fast drums over 2.5s (8.4 drums/s), transitioning to 27 slow drums over 8.7s (3.1 drums/s) at 20.5°C. Another series (R05-116C) with just the slow component shows (Fig. 1229) 37 drums over 11.0s (3.4 drums/s) at 21°C. Many other series were heard from this female and they were both with and without a fast component. Her multilocus Astral DNA F1689 is recovered in a subclade with *A. abelai* and *A. vandenberg.* If this were a male drumming, then we would call the fast portion a sex clarification drum (SCD) transitioning to a calling drum, and the species would be *A. abelai.* But females of no JC species are known to make a SCD and her DNA is recovered as discussed above. Alice Abela says (pers. comm. to DBW, 6-ix-2024) that this area not on the Burton Mesa, which stops at the Santa Ynez River Valley.



FIGURE 1227. Live Bear Creek (S04-147) adult female of unknown species, with non-specific drum (R05-116).

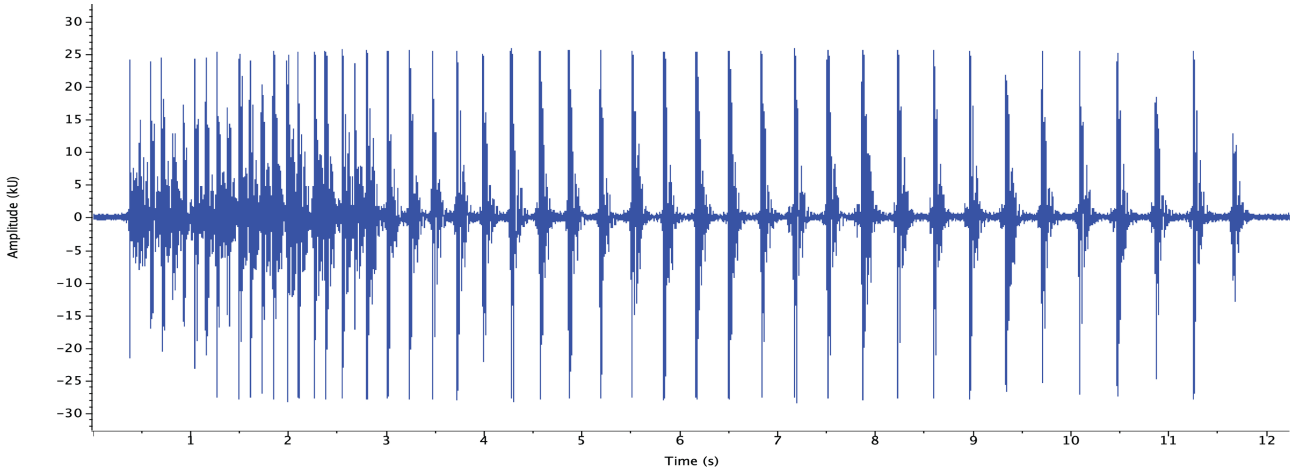


FIGURE 1228. Calling drum (R05-116A) of unknown adult female species from Vandenberg.

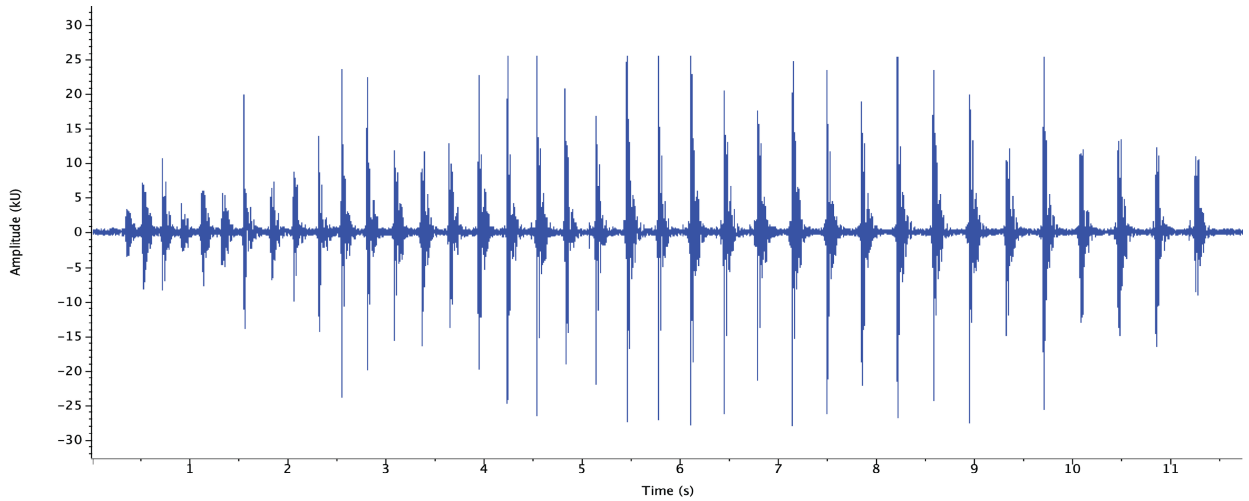


FIGURE 1229. Calling drum (R05-116C) of same unknown adult female species from Vandenberg, here without the fast component.

Drum. Calling drum similar in both sexes except longer in female, and male with sex clarification drum (SCD). **Male:** Holotype (Fig. 1230, R04-81) with 2 SCD followed by 16 drums over 10.1s (1.6 drums/s) at 18°C. Another SCD in this male of 3 drums in 0.17s (17.6 drums/s). **Female:** Allotype (Fig. 1231, R04-95) with 34 drums over 24.0s (1.4 drums/s) at 18.5°C.

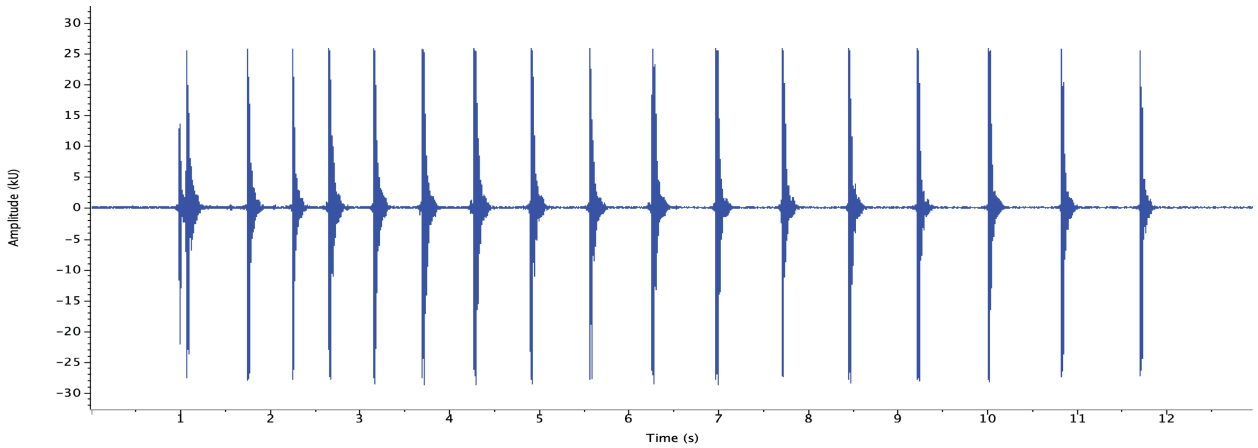


FIGURE 1230. Calling drum (R04-81) adult male holotype *A. vandenberg.*

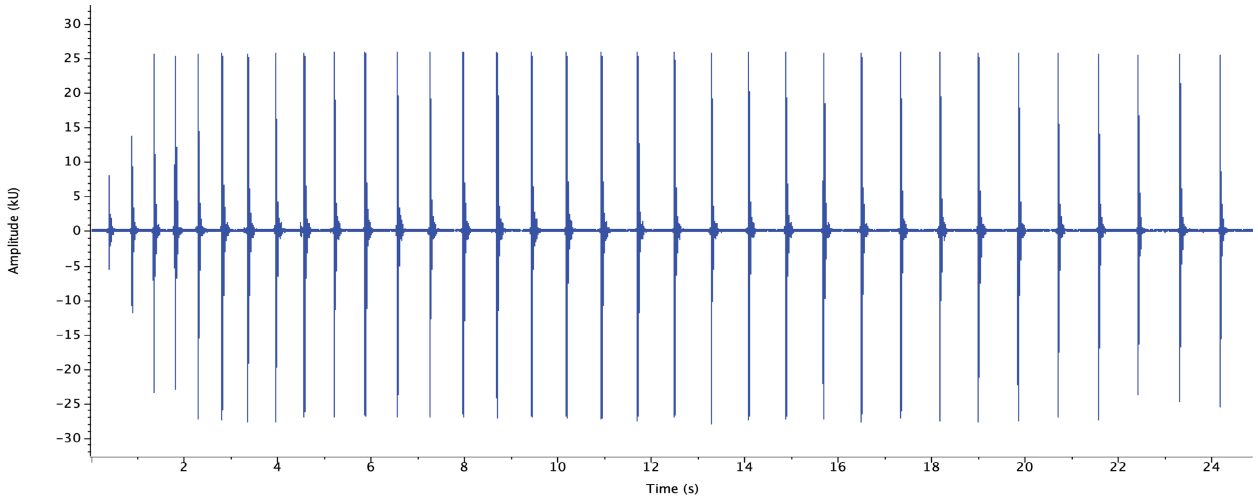


FIGURE 1231. Calling drum (R04-95) adult female allotype *A. vandenberg.*

Derivation of name. Named after Vandenberg Air Force Base, its only definitively known locality.

Habitat. Type locality Burton Mesa is chaparral with some areas regenerating after ~1997 fire. Dominant plants include *Arctostaphylos purissima, Adenostoma fasciculatum, Ceanothus impressus,* and *C. cuneatus*, all on generally sandy soils. Specimens mostly collected from pitfall traps.

Alice Abela writes (pers comm to DBW 1-xii-2020): "The large 'Burton Mesa' area should be the land between the Purisima Hills and Santa Ynez River, but I can't find any maps with the landform drawn out. I think current vegetation classifications now have mostly shifted to calling the plant community maritime chaparral but sometimes I'll still see Burton Mesa Chaparral listed as a subtype of maritime chaparral. Dominant plant components would be *Arctostaphylos purissima, A. rudis, Ceanothus impressus, C. cuneatus,* and *Adenostoma fasciculatum*. Shrub stature and density and proportion of the species differ by site with length of time since the last fire having a big influence."

Life cycle and seasonal occurrence. Apparent 2-year typical life cycle.

Variation. Of 33 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 7 and 32 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 32 had 5 and 1 had 6 inner **rear** leg tibial spines, and 32 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1208. p. 652. F1499 (holotype S04-30, Plot 10); F1501 (S04-30, Plot 10); F1543 (S04-152, Plot 8) recovered in Group 21 Vandenberg Air Force Base, and closest to *A. abelai.* Both taxa with a male SCD, 2n♂=25, and 3 fore leg tibial spurs. They are readily separated by their distinctive calling drum rates and the reddish head seen in *A. vandenberg*, a condition unknown in *A. abelai.* The two species are not known to be anywhere sympatric.

Karyotype. 2n♂=25. Two individuals examined from the type locality (S04-30, Plot 10), and both similar: T04-1 (Fig. 1232), T04-5 (no photo) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 1232. Idiogram T04-1 *A. vandenberg* (S04-30).

Discussion. Given the color variation seen in *A. abelai*, drum rate is the best method to identify this taxon at Vandenberg Air Force Base.

Group 22, San Gabriel/ Sierra Pelona Mts Group (Fig. 1233)

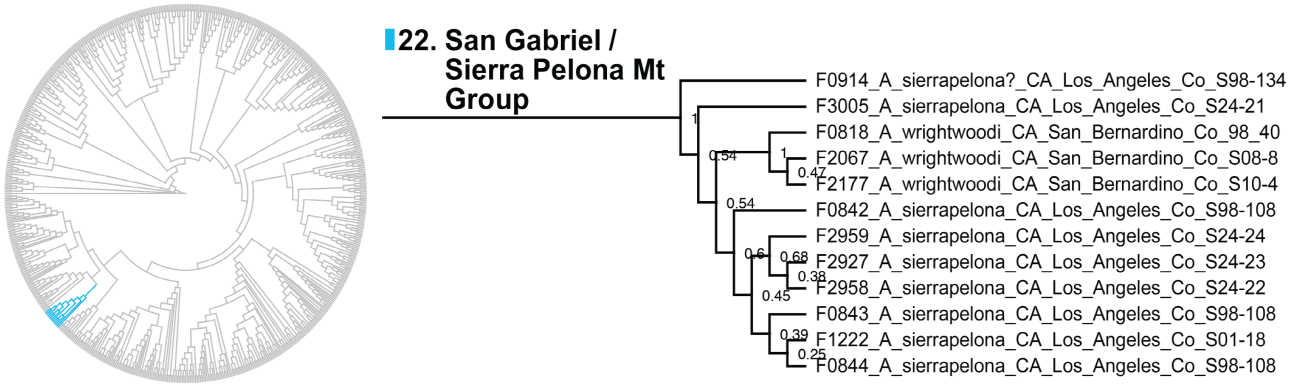


FIGURE 1233. ASTRAL tree for San Gabriel/Sierra Pelona Mt Group.

This Group contains two species from adjacent mountain ranges that are recovered together. *A. sierrapelona* (2n♂=25; 4.5–5 drums/s) and *A. wrightwoodi* (2n♂=unknown; 4.5 drums/s).

SPECIES WRITE UPS: *A. sierrapelona* (p. 665) and *A. wrightwoodi* (p. 669).

***Ammopelmatus sierrapelona* Weissman, sp. nov.**
Sierra Pelona Mountains Jerusalem Cricket
Figs 1234–1243, Tables 3, 19

Distribution. (Fig. 1234). Only known from the Sierra Pelona Mountains, Los Angeles County, California; with small intrusions into the adjacent San Gabriel Mountains.

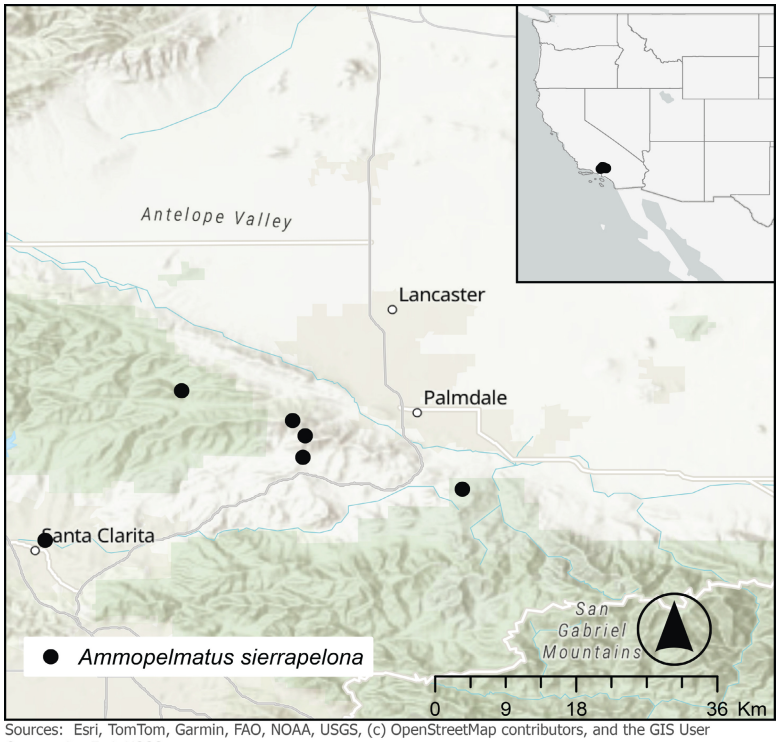


FIGURE 1234. Distribution of *A. sierrapelona.*

Recognition characters. Medium-large size JC almost restricted to Sierra Pelona Mts, calling drum of 4.5–5.5 drums/s, with a sex clarification drum (SCD), and 2n♂=25. Differs from the other two JC species known from Sierra Pelona Mts, as follows: From *A. acton* (2n♂=23), by habitat, drum rate, and DNA. From *A. sangabriel* (2n♂=23, S04-3 & S24-21), by drum rate and DNA.

Holotype. Male (in alcohol, Fig. 1235). **California, *Los Angeles Co.,*** Sierra Pelona Mountains, dirt road to Mt. McDill, 34.56714° -118.25893°, 1549m, 27-ii-2024 (S24-24) DBW, DW Weissman. R24-14, F2959. Molt to adult 12-viii-2024. Deposited CAS, Entomology type #20115. Measurements in mm: Body length 49.1, hind femur length 13.44, hind femur width 5.19. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1236) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 1237). Same data as holotype except R24-34, F2974. Molt to adult 9-ix-2024. Deposited CAS. Measurements in mm: Body length 38.06, hind femur length 9.03, hind femur width 3.56. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1238) with 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1239.



FIGURE 1235. Adult male holotype *A. sierrapelona.* A. When alive. B. When preserved.

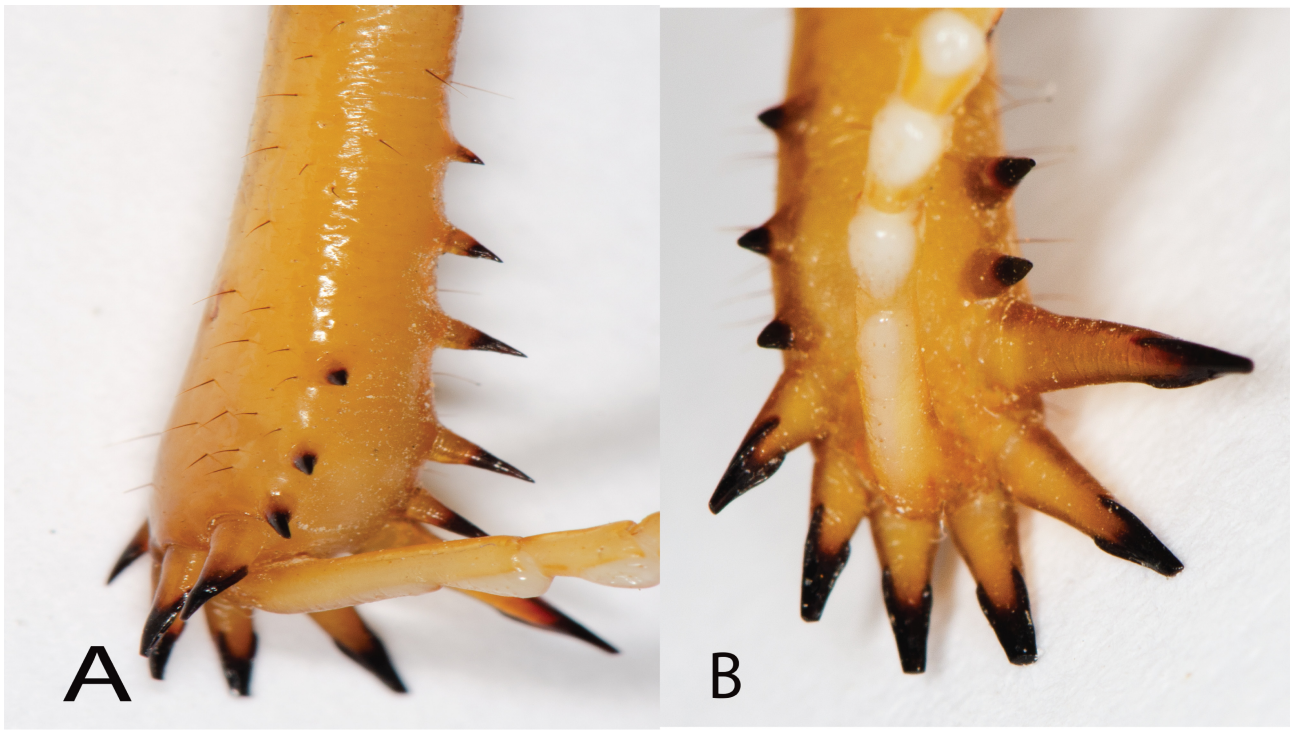


FIGURE 1236. Left rear leg tibia adult male holotype *A. sierrapelona.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1237. Adult female allotype *A. sierrapelona.* A. When alive. B. When preserved.



FIGURE 1238. Left rear leg tibia adult female allotype *A. sierrapelona.* A, Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

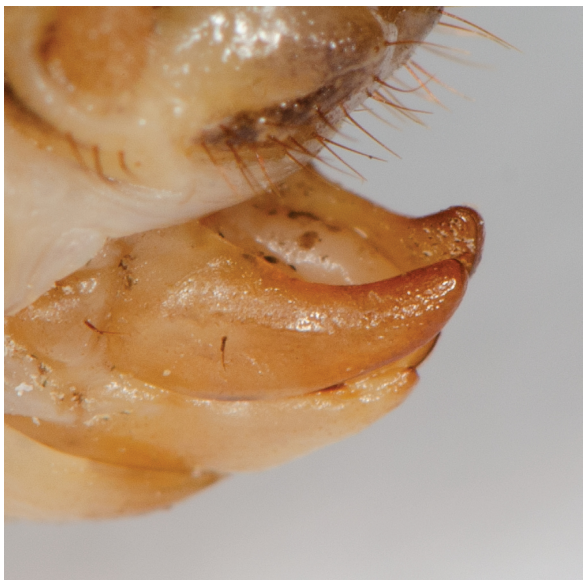


FIGURE 1239. Ovipositor allotype *A. sierrapelona.*

Paratypes. ♂4 ♀23. **CALIFORNIA, *Los Angeles Co.,*** Foothills Sierra Pelona Mts, 34.52391° -118.24714°, 1050m, 27-ii-2024 (S24-22) ♂1 ♀7. Sierra Pelona Mts, 34.54919° -118.24455°, 1404m, 27-ii-22024 (S24-23) ♀1. Same data as holotype, S24-24, ♀8. Road to Mt McGill, 1-xi-1998 (S98-108), I. Swift ♂1 ♀6. 7m E Acton, off Mt Emma Rd, 34.486458° -118.064348°, 1191m, 27-ii-2001 (S01-18) I. Swift ♂1. Soledad Canyon ~3.5 m W Pinetree. 34.426380° -118.542677°, 350m, 2-xii-1998 (S98-134) I. Swift ♂1. Spunky Canyon Rd, 34.60218° -118.38623°, 1046m, 27-ii-2024 (S24-21) ♀1.

Drum. Similar between sexes except that males with sex clarification drum (SCD) and female series are longer. **Male:** Holotype R24-14 (Fig. 1240) shows 43 drums in 7.4s (5.8 drums/s) at 21.4°C. **Female:** Allotype R24-34

(Fig. 1241) shows 93 drums in 17.2s (5.4 drums/s) at 22.0°C. Other topotypic (S24-24) adult female calling drums include: R24-23, 6.4 drums/s at 21.5C°; R24-26, 5.1 drums/s at 22.7C°; R24-29, 5.5 drums/s at 23.6C°; R24-30, 5.2 drums/s at 21.6C°.

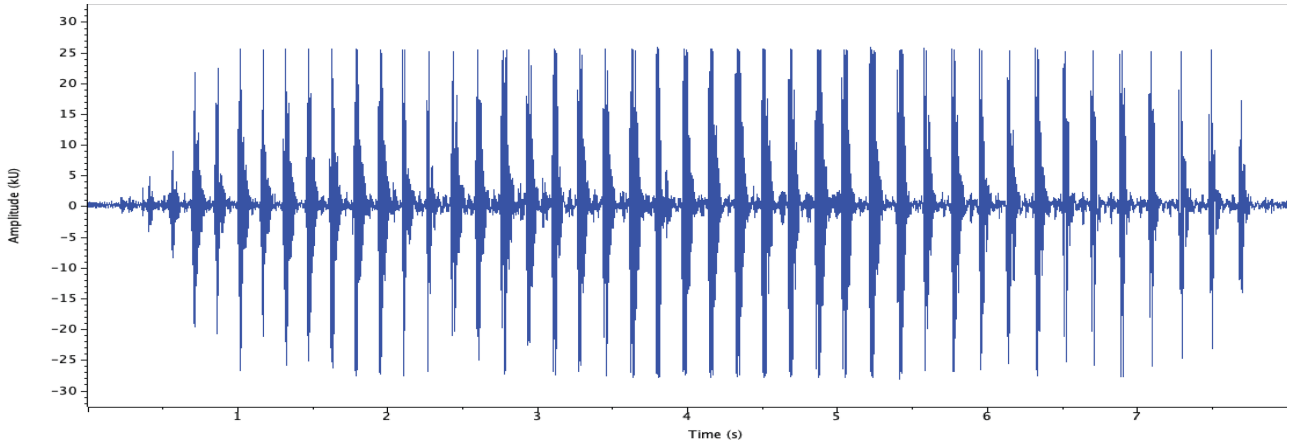


FIGURE 1240. Calling drum (R24-14) adult male holotype *A. sierrapelona.*

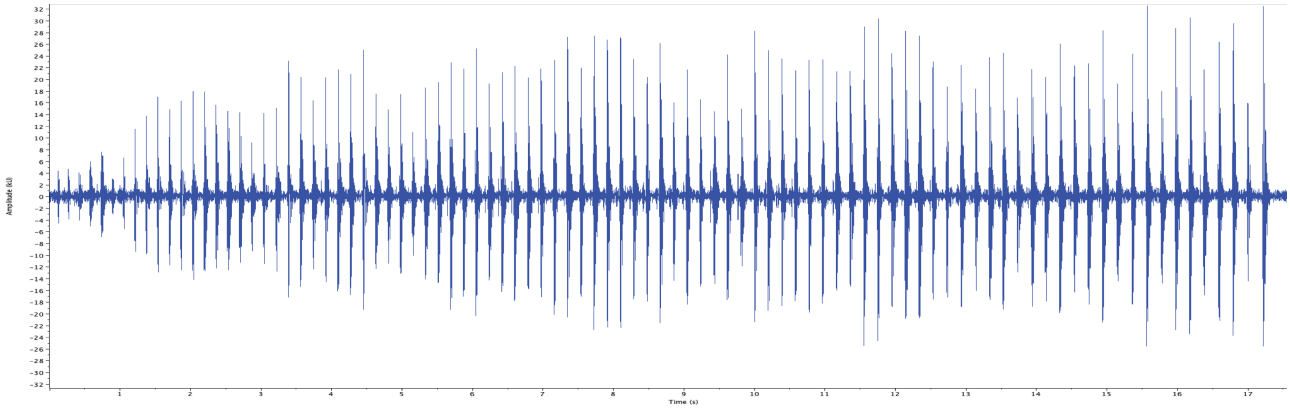


FIGURE 1241. Calling drum (R24-34) adult female allotype *A. sierrapelona.*

Derivation of name. Named after the Sierra Pelona Mts, the type locality.

Habitat. Under rocks in open grassland. Between 300–1370m.

Life cycle and seasonal occurrence. When collected, S98-108 series included 1adult male, 3 adult females, and 3 mid—late instar female nymphs. Type locality (S24-24) collection included 4 adult females; 2 late instar males and 2 late instar females; 3 mid instar males and 9 mid instar females, and 3 individuals too small to determine.

Variation. From 17 individuals in type series, all had 3 ventral **fore** leg tibial spurs; 9 had 7 and 8 had 8 **middle** leg tibial calcars, 16 with 2 and 1 with 3 ventral spurs; 2 had 4 and 15 had 5 inner **rear** leg tibial spines, 16 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color** (Fig. 1242) can also be darker.

DNA. Fig. 1233, p. 664. F0842, F0843, F0844 (all S98-108); F0914 (S98-134, Soledad Canyon); F1222 (S01-18); F2927 (S24-23, 1404m) F2958 (S24-22, 1050m); F2959 (S24-24, 1549m); F3005 (S24-21, Spunky Canyon) recovered together in Group 22 San Gabriel/ Sierra Pelona Mt, along with *A. islander* and *A. wrightwoodi.*

Karyotype. 2n♂=25. T24-19 (Fig. 1243, type locality S24-24) shows 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.



FIGURE 1242. Darker color in topotypic adult female (S24-24, F2928) *A. sierrapelona.*

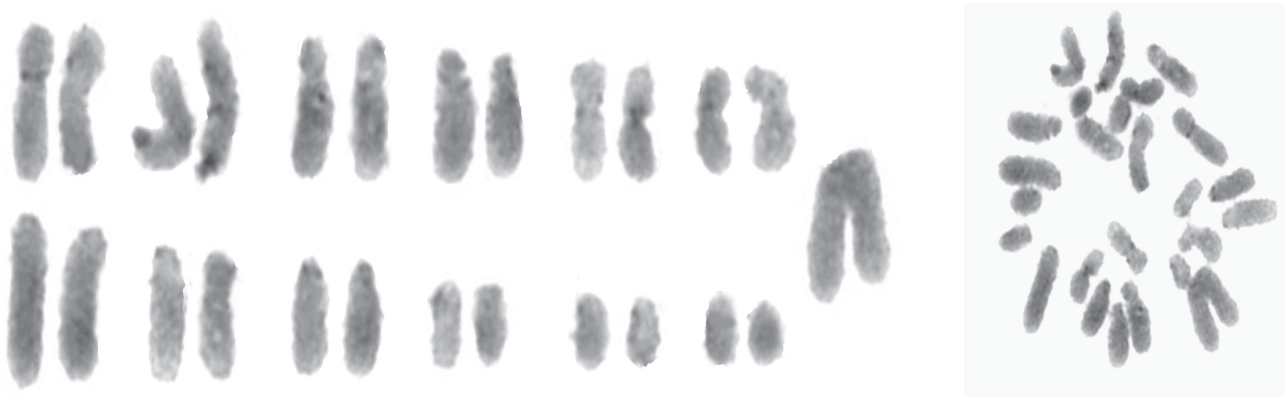


FIGURE 1243. Idiogram T24-19 *A. sierrapelona* (S24-24), using C-banding, with original anaphase cell on right.

Discussion. Adults and juveniles very aggressive once into laboratory. In Soledad Canyon (S98-134), may be sympatric with *A. hovorei* (F0915), but unknown how close the 2 individuals collected there were to each other.

***Ammopelmatus wrightwoodi* Weissman, sp. nov.**
Wrightwood Jerusalem Cricket
Figs 1244–1251, Tables 3, 6, 19

Distribution. (Fig. 1244). Only known from the NE side of the San Gabriel Mts, at 1975m; and 19 km almost due E, at 991m elevation, in the Cajon Pass area.

Recognition characters. Medium sized JC that drums at 5 drums/s. Distinguished from nearby *A. hovorei* by DNA. Distinguished from the two other species of striped San Gabriel Mts JCs as follows: *A. sangabriel* drums at 1 drum/s; *A. bigpines* drums at 8.6 drums/s. Distinguished from nearest relative *A. sierrapelona* by general color and stripe pattern (compare Fig. 1245 with Fig. 1235, of *A. sierrapelona*), and found at opposite ends of the San Gabriel Mts.

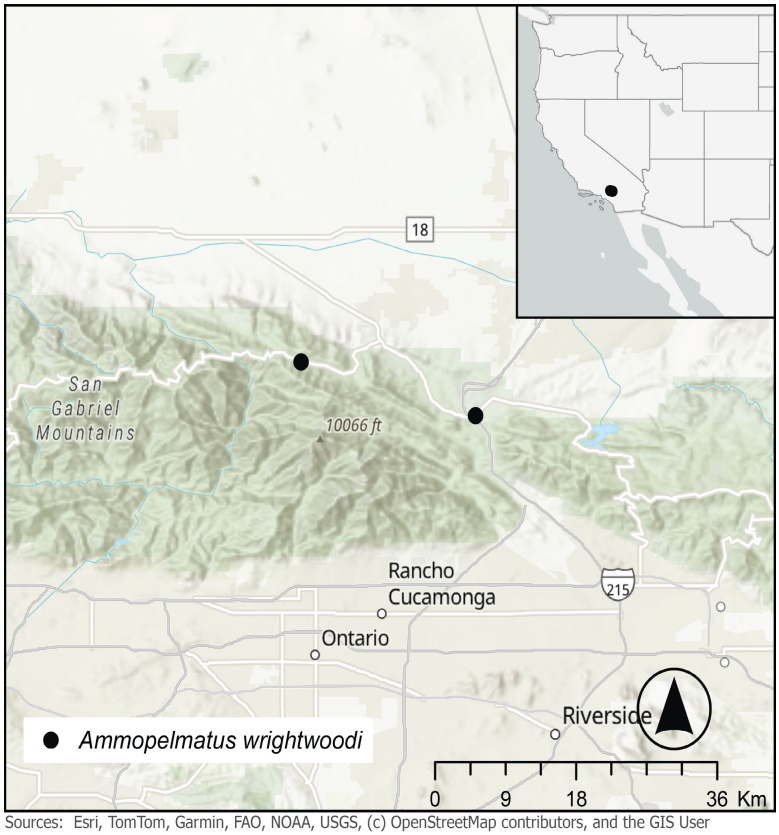


FIGURE 1244. Distribution of *A. wrightwoodi.*

Holotype. Male (in alcohol, Fig. 1245). **California, *San Bernardino Co.,*** Cajon Pass, Hwy 138, 0.2 m E of Interstate 15, at mile post 15.50, 34.312100° -117.470456°, 974m, 4-ii-2008 (S08-8) DB Weissman. R08-41, F2067. Molt to adult 17-ix-2008. Deposited CAS, Entomology type #20291. Measurements in mm: Body length 37.90, hind femur length 10.86, hind femur width 4.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 6 calcars, 2 ventral spurs; hind leg tibia (Fig. 1246) with 4 or 5 inner and 3 outer spines, 2 ventral spurs.

Allotype. Female (in alcohol, Fig. 1247). Same data as holotype except 24-i-2010 (S10-4). DBW & VF Lee. F2177. Collected as adult. Deposited CAS, Entomology #8413673. Measurements in mm: Body length 35.06, hind femur length 9.70, hind femur width 3.74. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1248) with 4 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1249.



FIGURE 1245. Adult male holotype *A. wrightwoodi.* A. When alive. B. When preserved.



FIGURE 1246. Left rear leg tibia adult male holotype *A. wrightwoodi.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1247. Adult preserved female allotype *A. wrightwoodi.*



FIGURE 1248. Left rear leg tibia adult female allotype *A. wrightwoodi.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

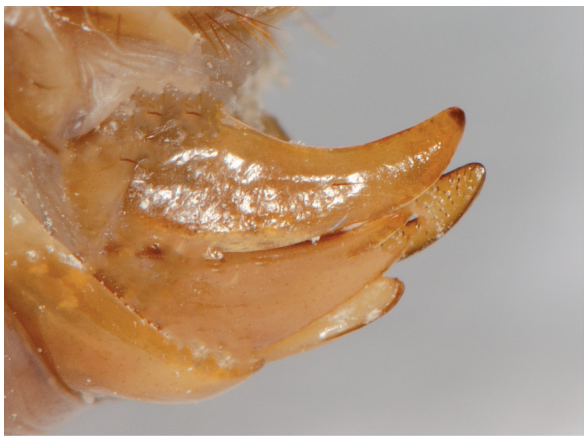


FIGURE 1249. Ovipositor allotype *A. wrightwoodi.*

Paratypes. ♂1. **California, *Los Angeles Co.,*** San Gabriel Mts, ~3 km W Wrightwood, 34.368681° -117.668167°, 1975m, 15-v-1998 (S98-40) I. Swift ♂1.

Drum. **Male.** Holotype R08-41 (Fig. 1250) with 26 drums over 5.2s (5.0 drums/s) at 20°C. Paratype adult male (S98-40, R98-174, Fig. 1251) with 34 drums over 7.4s (4.6 drums/s) at 17.5°C.

Derivation of name. Named after the paratype area, because of its easier access and more natural conditions than the type locality.

Habitat. Type locality is a steep, grassy slope, with lots of rocks, and with a drainage area at the bottom. Whole area surrounded by various freeways.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.

Variation. From 3 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 6 and 2 had 7 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 2 had 5 inner **rear** leg tibial spines, and all had 3 outer **rear** leg tibial spines, all with 2 ventral spurs.

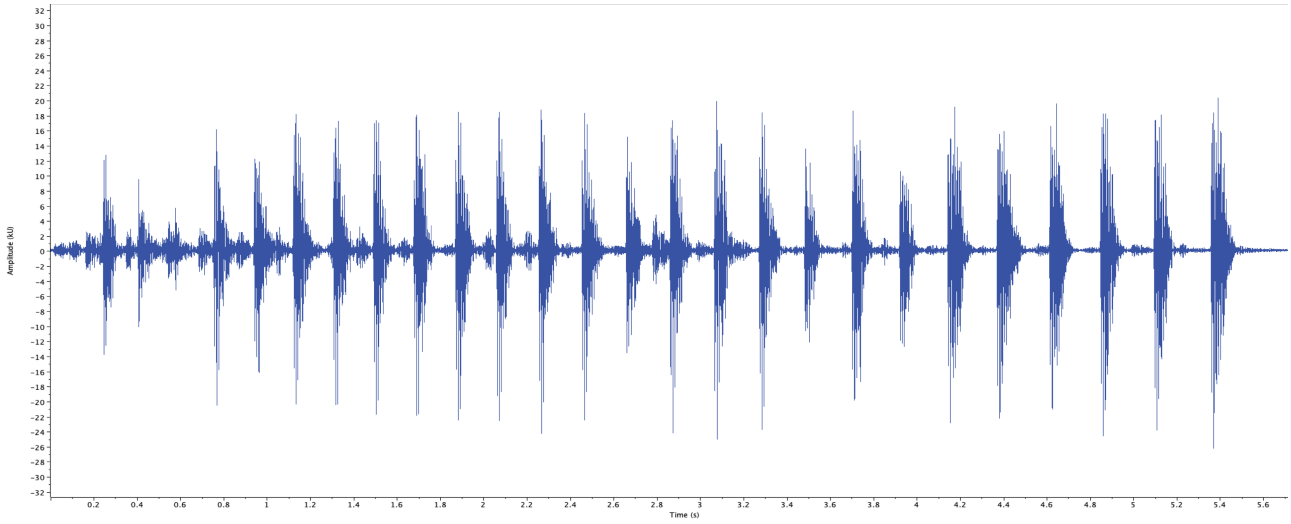


FIGURE 1250. Calling drum (R08-41) adult male holotype *A. wrightwoodi.*

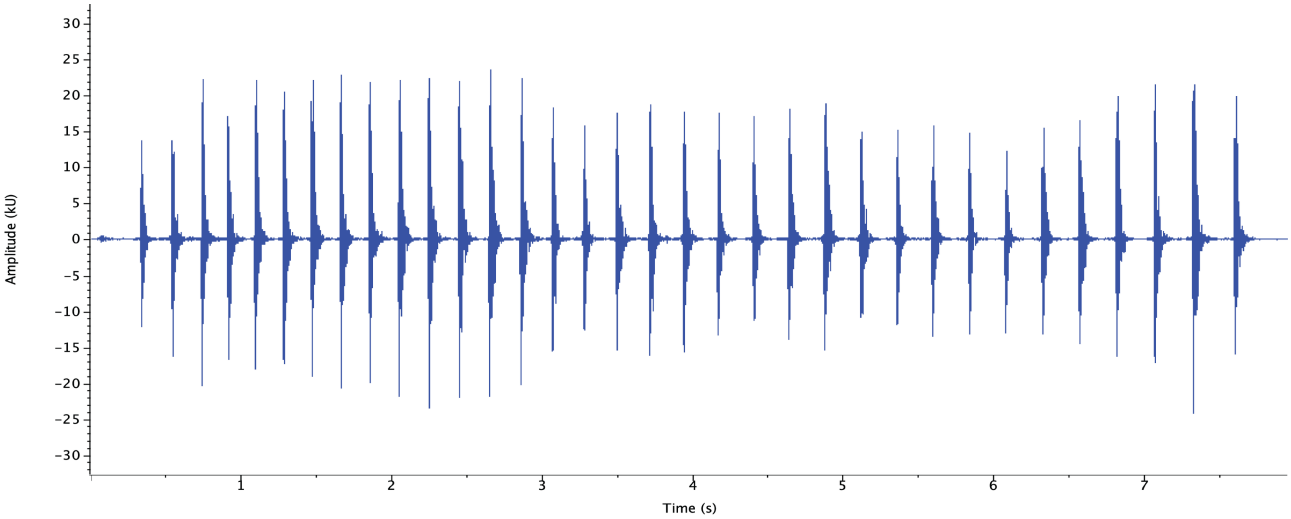


FIGURE 1251. Calling drum (R98-174) adult male paratype *A. wrightwoodi.*

DNA. Fig. 1233, p. 664. F0818 (paratype male S98-40); F2067 (holotype male); and F2177 (allotype female) all recovered together in Group 22 San Gabriel/ Sierra Pelona Mt, and closest to *A. sierrapelona.*

Karyotype. Unknown.

Discussion. A. wrightwoodi occurs at paratype locality S98-40 with *A. sangabriel*; the two similar species can be separated by DNA and slower drum (R98-8) of 1.1 drums/s at 20°C in the latter. The type locality Cajon Pass area is the division between the San Gabriel and San Bernardino Mountain Ranges.

Group 23, Islander Group (Fig. 1252)

While the two species (*A. hovorei* and *A. islander*) in this Group drum similarly (5–6 drums/s) and have the same chromosome number (2n♂=25), they are different ecologically and geographically separated.

SPECIES WRITE UPS: *A. hovorei* (p. 674) and *A. islander* (p. 680).

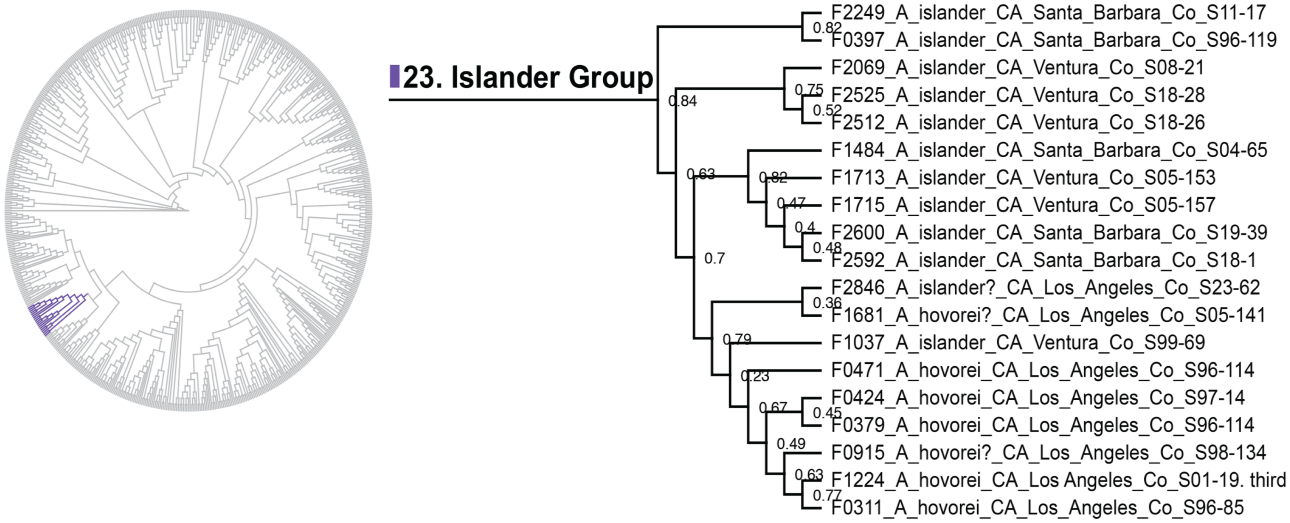


FIGURE 1252. ASTRAL tree for Islander Group.

Ammopelmatus hovorei **Weissman, sp. nov.**
Placerita Canyon Jerusalem Cricket
Figs 1253–1266. Tables 3, 19

Distribution. (Fig. 1253). Found in a triangle of Saugus to the north, Santa Clarita to the south, and Placerita Canyon in the western foothills of the San Gabriel Mts to the east, all Los Angeles County, California.

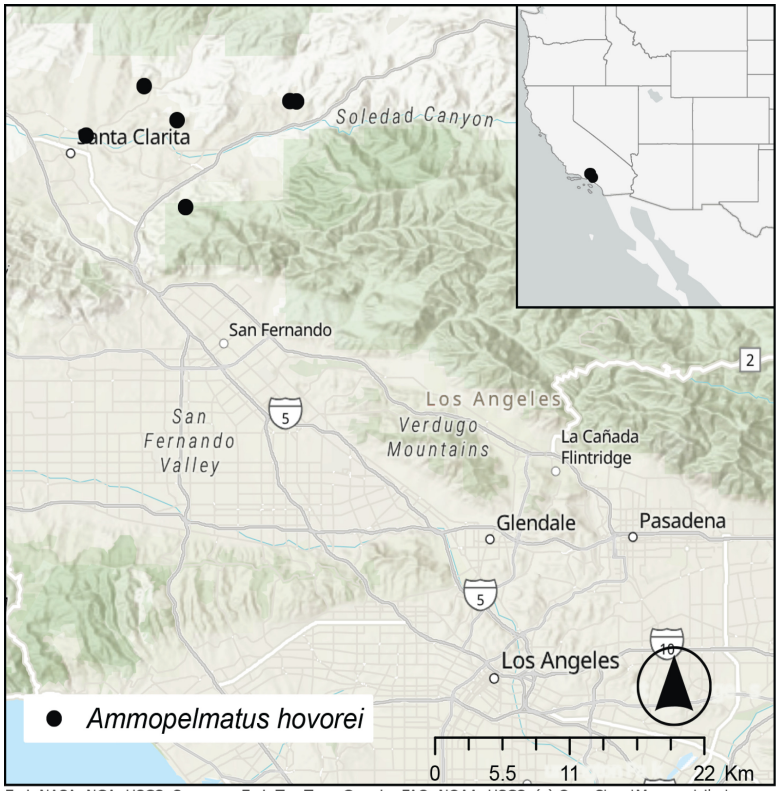


FIGURE 1253. Distribution of *A. hovorei.*

Recognition characters. Medium to large JC typically with wide, black abdominal stripes, although variable (Fig. 1254). 2n♂=25. Calling drum 4.6–6.0 drums/s at 20°C, males with a sex clarification drum (SCD). We have combined the individuals from Placerita Canyon and Santa Clarita, even though from distinct habitats, because they are found from localities that are geographically close, with similar drums and karyotypes, and their DNAs are recovered together. Nevertheless, individuals from the two localities do differ (see below) in width of black abdominal bands, darkness of bands, and how far bands go laterally on abdomen; indicating that further investigations are warranted. Differs from nearest relative *A. islander* by habitat (coastal vs inland) and some 75 km separation.

Holotype. Male (in alcohol, Fig. 1254). **California, *Los Angeles Co.,*** Placerita Canyon Nature Center, 34.377092° -118.469722°, 465m, 18-xii-1996 (S96-114) DBW & M. Caterino. R97-28, F0471. Molt to adult 25-vii-1997. Deposited CAS, Entomology type #20130. Measurements in mm: Body length 34.83, hind femur length 13.56, hind femur width 5.18. Fore leg tibia with 3 ventral spurs; middle leg tibia with 6 calcars (1 side missing), 2 ventral spurs; hind leg tibia (Fig. 1255) with 5 inner and 3 outer spines, 2 ventral spurs.

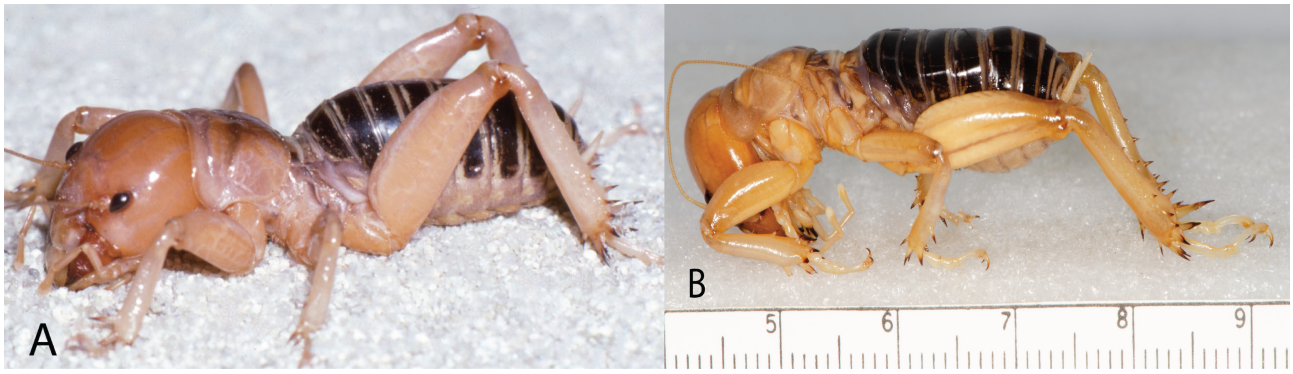


FIGURE 1254. Holotype adult male *A. hovorei.* A. When alive. B. When preserved.



FIGURE 1255. Left rear leg tibia adult male holotype *A. hovorei.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1256). Same data as holotype except 23-xii-1991 (S91-131) DBW & DW Weissman. R92-51 & R92-61. Molt to adult 24-viii-1992. Deposited CAS, CASENT #9083167. Measurements in mm: Body length 39.27, hind femur length 13.14, hind femur width 5.33. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1257) with 5 or 6 inner and 3 or 4 outer spines, 2 ventral spurs. Ovipositor Fig. 1258.



FIGURE 1256. Adult female allotype *A. hovorei.* A. When alive. B. When preserved.

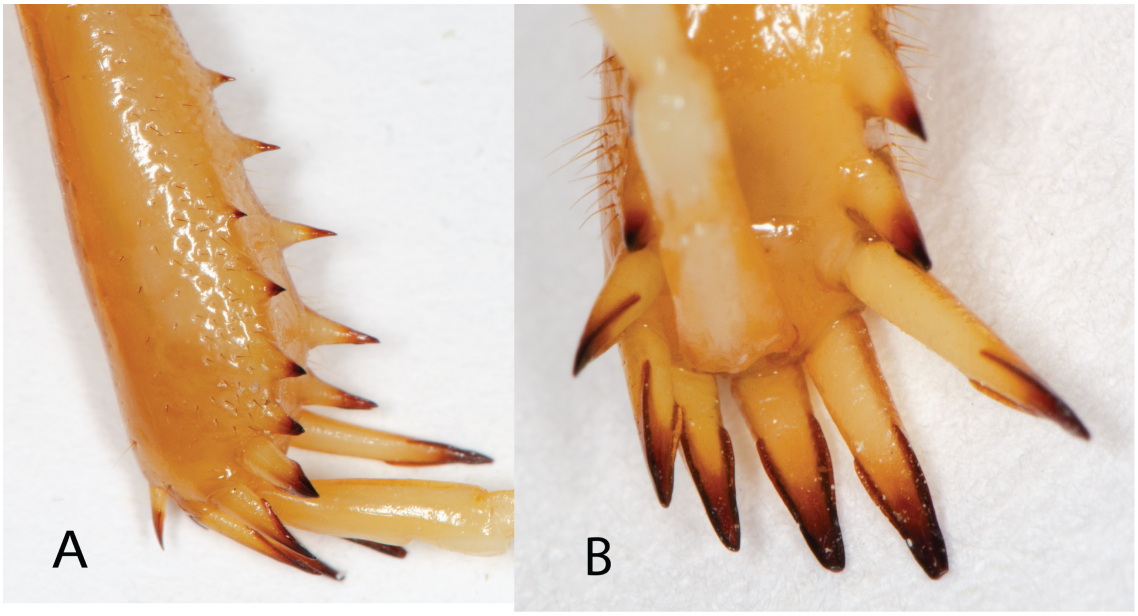


FIGURE 1257. Left rear leg tibia adult female allotype *A. hovorei.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

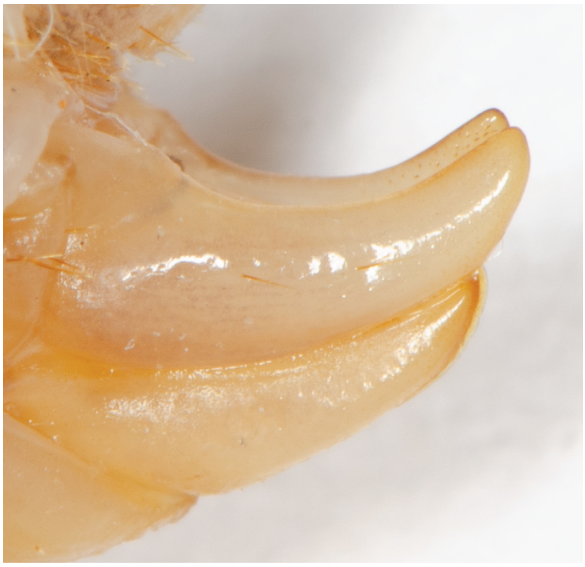


FIGURE 1258. Ovipositor allotype *A. hovorei*.

Paratypes. ♂18 ♀19. **CALIFORNIA, *Los Angeles Co.,*** type locality, 21-xii-1982 (S82-151) PH Sullivan ♂1 ♀4; 23-xii-1991 (S91-131) ♂2 ♀3; 26-xii-1992 (S92-144) ♂7 ♀1; 18-xii-1996 (S96-114) ♂5 ♀6. Canyon Country, Whites Canyon Rd, 34.437° -118.476°, 526m, 4-i-1999 (S99-4) I. Swift ♀1. Santa Clarita, 14734 Sundance Place, 34.450175° -118.393222°, 588m, FT Hovore: 15-x-1996 (S96-85) ♂1 ♀1; 31-i-1997 (S97-14) ♀1. Santa Clarita, Tick Canyon Rd, 34.449956° -118.388297°, 542m, 27-iii-2001 (S01-17) FT Hovore ♀1. Saugus, intersection of Benz Rd and Copper Hill Dr, 34.460515° -118.500156°, 437m, 28-ii-2001 (S01-19) I. Swift ♂2. Soledad Canyon, ~3.5 m W Pinetree, 34.42638° -118.54267°, 350m, 30-xii-1998 (S98-134) I. Swift ♀1.

Possible placement. **CALIFORNIA, *Los Angeles Co.,*** Eagle Rock/ Highland Park area, 4720 Baltimore St, 34.118453° -118.212339°, 187m, 28-ix-2005 (S05-141) H. Eike, ♂1. This male was recorded (R05-99) at 6.0 drums/s at 20°C; and recovered (F1681) in the same clade as 6 other individuals of *A. hovorei*. His locality is some 40 km SE of the type locality and south of the San Gabriel Mts, hence our hesitancy in assigning him to *A. hovorei.*

Drum. Calling drum similar in both sexes but usually longer in females; males with a sex clarification drum, although not recorded. **Male:** Holotype (Fig. 1259, R97-28) 102 drums over 18.3s (5.6 drums/s) at 20°C. **Female:** Allotype with 2 series analyzed (Fig. 1260, R92-61) 45 drums over 5.7s (7.9 drums/s) and Fig. 1261 with 324 drums over 55.4s (5.8 drums/s), both at 20°C.

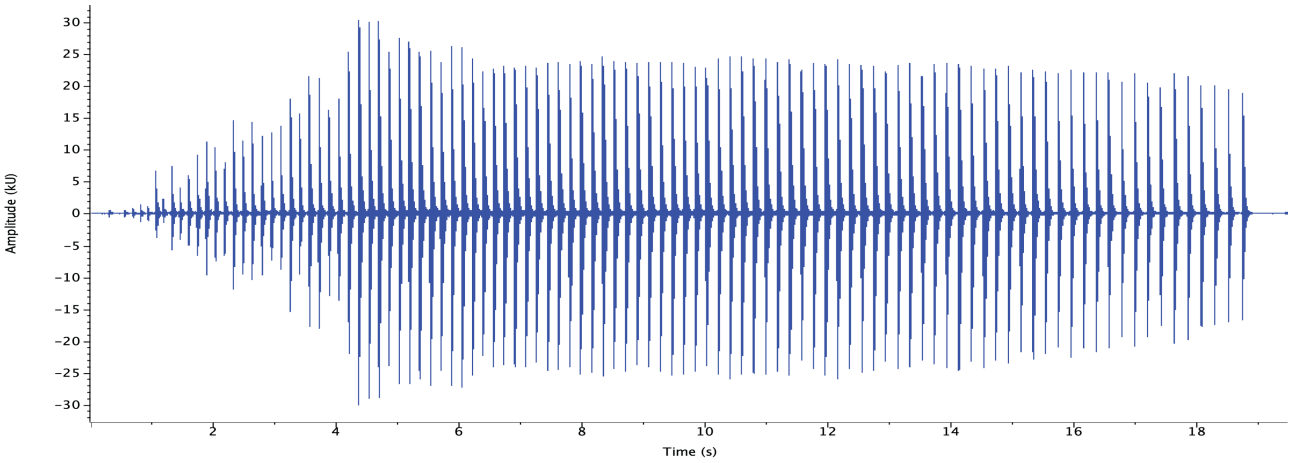


FIGURE 1259. Calling drum (R97-28) adult male holotype *A. hovorei.*

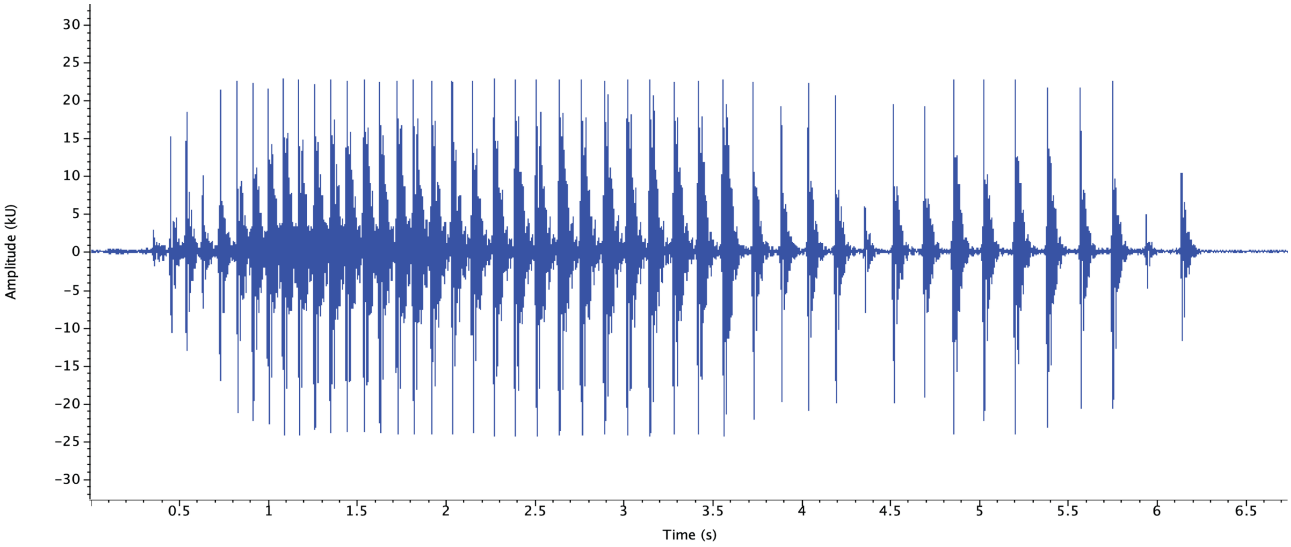


FIGURE 1260. Calling drum (R92-61) adult female allotype *A. hovorei.*

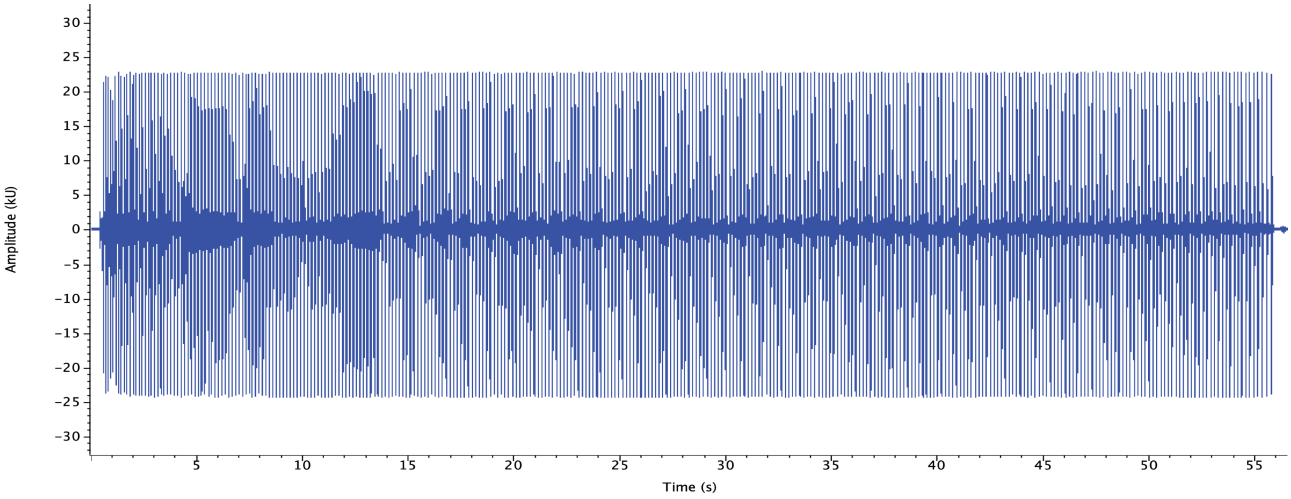


FIGURE 1261. Long calling drum (R92-61) adult female allotype *A. hovorei.*

Derivation of name. Named in memory of Frank T. Hovore, great conservationist and companion, who was the Natural-areas Supervisor for the Los Angeles County Department of Parks and Recreation for many years after being head naturalist at Placerita Canyon Nature Center.

Habitat. Placerita Canyon is an east-west running canyon featuring cool, shaded oak woodlands, chaparral covered slopes and a seasonal stream. The area around Santa Clarita is interior sage scrub with scattered junipers.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Of 31 individuals from **Placerita Canyon**, 2 had 2 and 29 had 3 ventral **fore** leg tibial spurs; 1 had 6, 1 had 7, and 29 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4, 29 had 5 and 1 had 6 inner **rear** leg tibial spines, and 29 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. Of 8 individuals from **Santa Clarita**, all had 3 ventral **fore** leg tibial spurs; all had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 6 had 5 and 1 had 6 inner **rear** leg tibial spines, and 6 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Abdominal black bands:** Individuals at type locality have wider bands and darker abdominal colors when compared with those from Santa Clarita (Fig. 1262A, S96-85, R97-102), although Placerita Canyon male (Fig. 1263A, S92-144, R94-49) and female (Fig. 1263B, S82-151, R83-489) approach those seen at Santa Clarita and Saugus (Fig. 1262B, S01-19, R01-81). In any case, we can't find any morphological, drum, karyotype, or DNA difference between these sites and given their proximity to each other (some 10 km separation), despite clear habitat differences, we choose to treat them as one species, but encourage further investigation. Perhaps the color differences are attributable to those habitat differences?

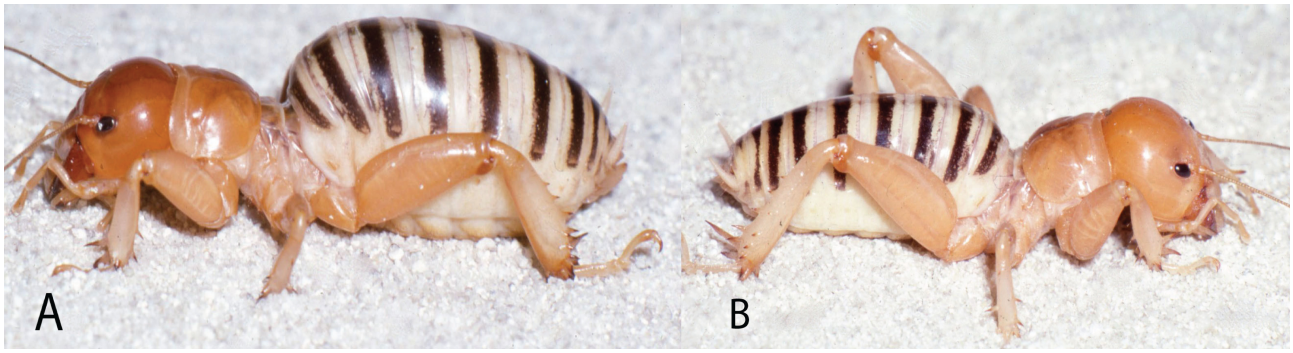


FIGURE 1262. Narrow abdominal banded adults of *A. hovorei.* A. Adult female from Santa Clarita (S96-85, R97-102). B. Adult male from Saugus (S01-19, R01-81).

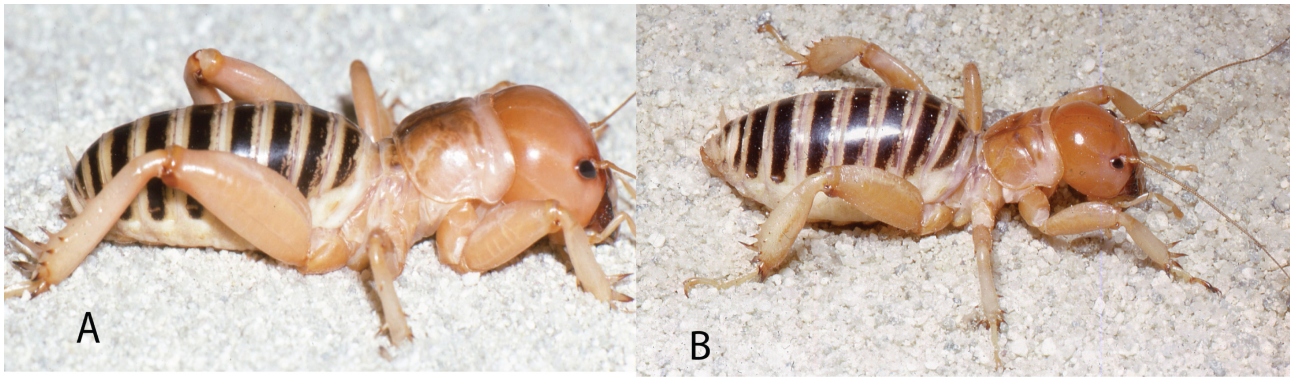


FIGURE 1263. Type locality, narrow abdominal banded adults of *A. hovorei.* A. Adult male (S92-144, R94-49). B. Adult female (S82-151, R83-489).

DNA. Fig. 1252, p. 674. F0311 (S96-85, Santa Clarita); F0379 (type locality S96-114); F0424 (S97-14, Santa Clarita); F0471 (type locality S96-114); F0915 (S98-134, Soledad Canyon); F1224 (S01-19, Saugus) all recovered in Group 23 Islander and closest to *A. islander.*

Karyotype. 2n♂=25. 3 males determined but with conflicting results: T92-24 (Fig. 1264, type locality S91-131); T97-2 (Fig. 1265, type locality S96-114) both with 4 metacentric or submetacentric autosomal pairs; 8 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. In contrast, Santa Clarita T97-20 (Fig. 1266, S96-85) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. These differences should be verified with additional samples, especially in light of the associated habitat and climatic differences.

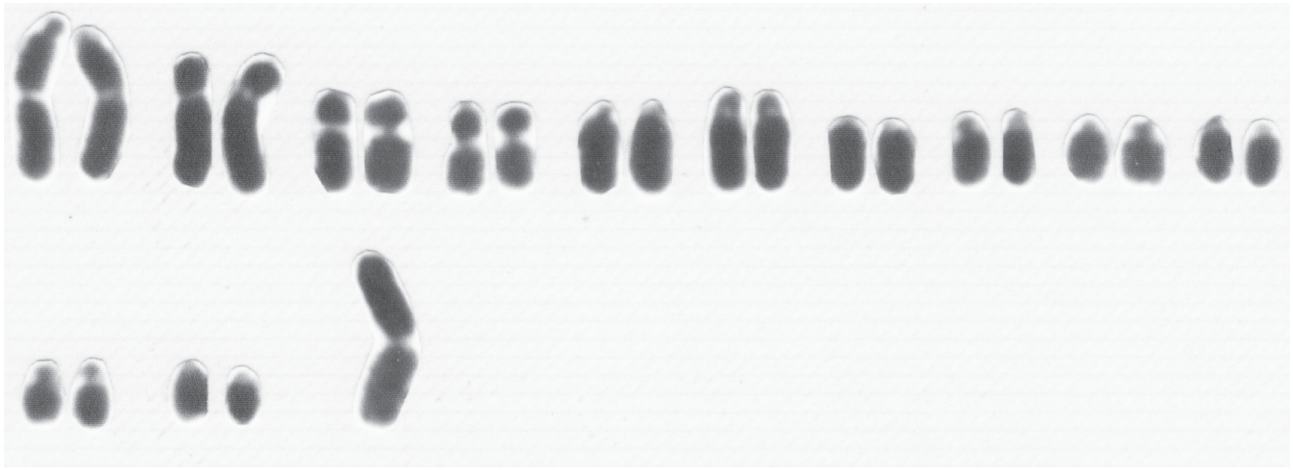


FIGURE 1264. Idiogram T92-24 *A. hovorei* (S91-131).



FIGURE 1265. Idiogram T97-2 *A. hovorei* (S96-114).



FIGURE 1266. Idiogram T97-20 *A. hovorei* (S96-85).

Discussion. A. hovorei occurs microsympatric at Placerita Canyon with the less common *A. mahogani.* It may be sympatric in Soledad Canyon (S98-134) with *A. sierrapelona* (F0914), but we are not certain since we didn't collect the two specimens from there.

The type locality is home to the famous "Oak of the Golden Dream", where gold was first discovered in California in 1842 (https://scvhistory.com/scvhistory/signal/worden/lw012496.htm).

The paratype locality of Santa Clarita is some 10 km NE of the type locality but is warmer and dryer than the type locality (see under Habitat above). Santa Clarita was incorporated in December 1987 as the union of four unincorporated communities: Canyon Country, Newhall, Saugus, and Valencia. Santa Clarita lies within the Santa Clarita Valley, bounded by the San Gabriel Mountains to the east, the Santa Susana Mountains to the south and west, and the Sierra Pelona Mountains to the north.

Ammopelmatus islander **Weissman, sp. nov.**

Channel Island Jerusalem Cricket
Figs 1267–1283, Tables 8, 10, 11

Misidentified as both *A. fuscus* and *A. intermedius* in Rentz & Weissman (1981).
Species #16, Weissman 2001b.

Distribution. (Fig. 1267). Known from all 4 northern California Channel Islands, in addition to San Nicolas Island in the southern Channel Islands; and adjacent coastal Central California areas in Santa Barbara and Ventura Counties.

Recognition characters. Small–large JC with a medium-fast calling drum (~ 6 drums/s at 20°C), sex clarification drum (SCD), black abdominal stripes, 2n♂=25, and fore leg tibia with 3 ventral spurs. Can be distinguished from more northern *A. castaneus* that has 2n♂=23, a faster calling drum, 2 fore leg ventral tibial spurs, and different DNA. Can be distinguished from more southern Santa Monica Mts *A. leei* (2n♂=23) and *A. lakesherwood* (2n♂=25), where both have different DNA. Differs from nearest relative *A. hovorei* by habitat (inland vs coastal) and some 75 km separation.

Holotype. Male (in alcohol, Fig. 1268). **California, *Santa Barbara Co.,*** Santa Cruz Island, Field Station area, 33.997011° -119.726261°, 77m, 10-vii-2004 (S04-64) DBW, BI Weissman. R04-59, F1483. Molt to adult 15-ix-2004. Deposited CAS, Entomology type #20159. Measurements in mm: Body length 42.30, hind femur length 13.77, hind femur width 5.5. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1269) with 5 inner and 3 outer spines, 2 ventral spurs.

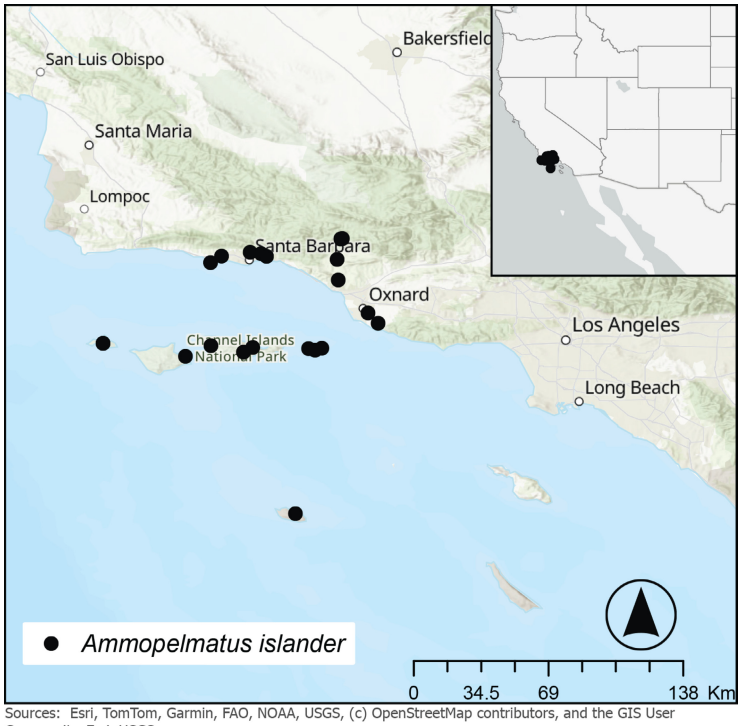


FIGURE 1267. Distribution of *A. islander.*

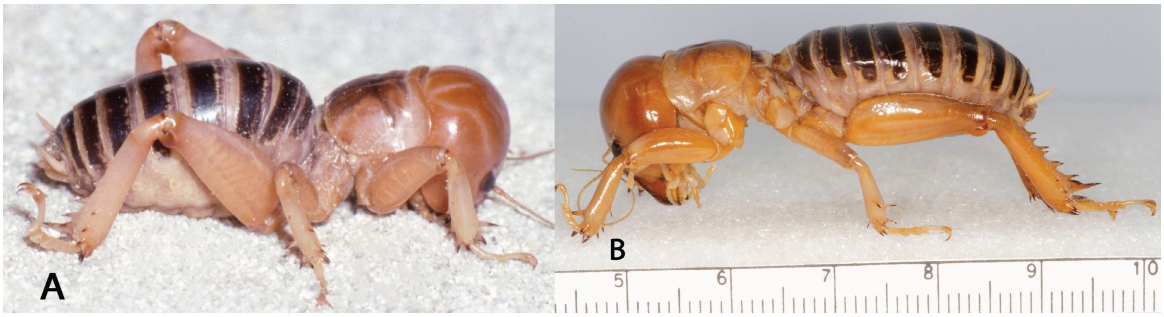


FIGURE 1268. Adult male holotype *A. islander.* A. When alive. B. When preserved.

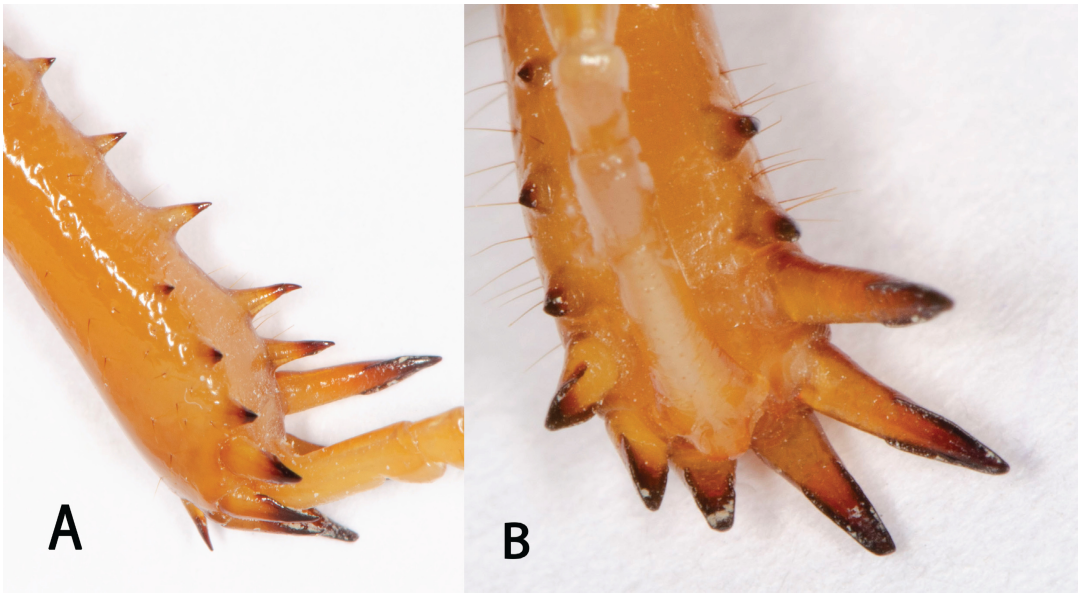


FIGURE 1269. Left rear leg tibia adult male holotype *A. islander.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1270). Same data as holotype except R04-107, F1532. Molt to adult 6-x-2004. Deposited CAS, CASENT #9079161. Measurements in mm: Body length 35.59, hind femur length 9.87, hind femur width 4.09. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1271) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1272.

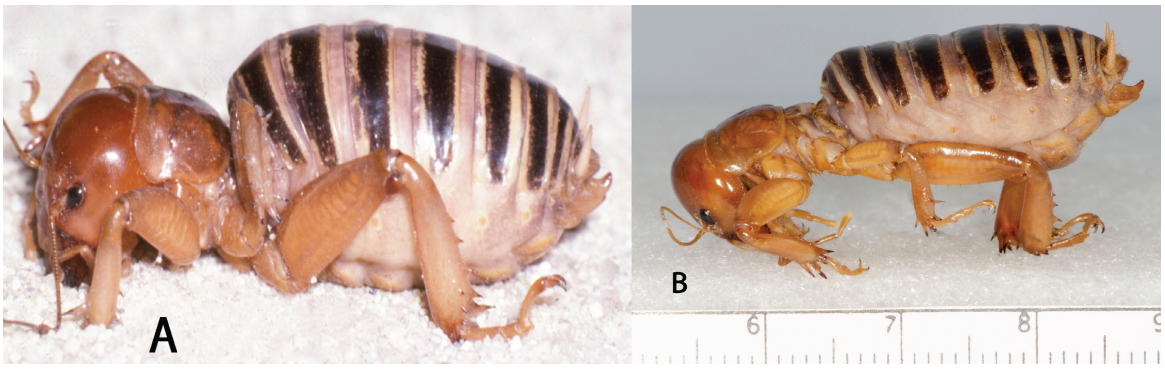


FIGURE 1270. Adult female allotype *A. islander.* A. When alive. B. When preserved.



FIGURE 1271. Left rear leg tibia allotype female *A. islander.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

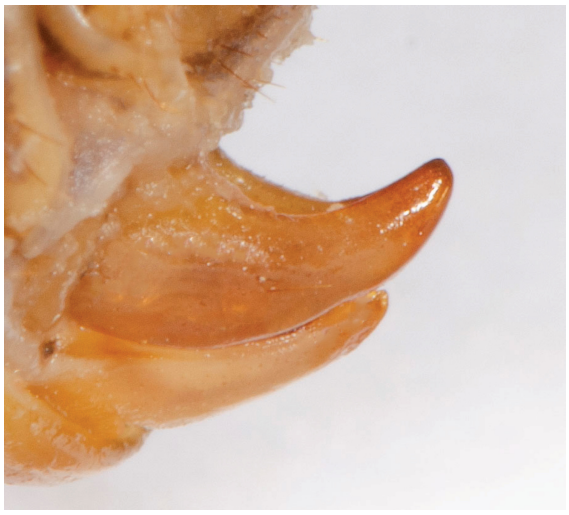


FIGURE 1272. Ovipositor allotype *A. islander*.

Paratypes. ♂60 ♀87. **CALIFORNIA, *Santa Barbara Co.,*** Coal Oil Pt. Reserve, 34.407941° -119.877653°, 8m, 29-iii-2011 (S11-17) ♂1 ♀1. Goleta, 6233 W. Morland Place, 34.437747° -119.827011°, 8m (S13-10B) J. Fischer ♂1. 2-v-2013 (S13-10B), J. Fischer ♂1. Montecito, 1781 Glen Oaks Dr., 34.436555° -119.619967°, 72m, 18-ix-15-x-2002 (S02-66) R. Doutt ♂12 ♀7. Montecito, 11-xii-1994, W. Sakai ♀1. Montecito, E. Mountain Drive, ~34.448945° -119.645023°, 199m, 23-vi-2003 (S03-80) D. Palmer & J. Starrett ♀2. San Miguel Island, Lester Ranch House area, 34.037616° -120.372374°, 168m, 27-28-ii-1984 (S84-9) C. Drost ♂2 ♀2; ~34.037624° -120.372360°, 18-ii-2018 (S18-1) W. Hoyer ♂1. Santa Cruz Island, Central Valley, P. Schuyler, 31-viii-1983 (S83-128) ♀1; 13-xi-1983 (S83-149) ♀2. Santa Cruz Island, Christy Beach, 34.026672° -119.875962°, 4m, 2-vi-1988 (S88-53) L. Laughrin ♂1 ♀1. Santa Cruz Island, type locality area, 5-10-iv-1983 (S83-25) L. Laughrin ♀3; 3-16-v-1983 (S83-31) L. Laughrin ♂2; 4-vi-1987 (S87-39) L. Laughrin ♂1 ♀3; 5-viii-1987 (S87-94) L. Laughrin ♂1; mid-April, 1988 (S88-9) L. Laughrin ♀4; 10-vii-2004 (S04-64 & S04-65) ♂5 ♀7; 12-vii-2018 (S18-30) ♂2. Santa Cruz Island, Prisoner's Harbor, 34.018617° -119.683585°, 4m, 11-vii-2004 (S04-65) ♂2 ♀1. Santa Rosa Island, Becher's Bay, 33.977913° -119.993091°, 50m, 10-v-1989 (S89-15) C. Drost ♀1; Soledad Canyon, 26-xii-1988 (S88-133) C. Drost ♀1; 1 m N airstrip, early July (S89-50) C. Drost ♂2. Santa Ynez Mts, Santa Barbara, Skofield City Park, 34.455347° -119.695544°, 254m, 26-xii-1983 (S83-169) ♂3 ♀4; 27-xii-1986 (S86-174) ♀4; 20-xii-1996 (S96-119) ♂3 ♀9. ***Ventura Co.,*** Anacapa Island: West Island, 34.013301° -119.426605°, 23-ix-1986 (S86-120) C. Drost ♂1; 7-vii-1987 (S87-90) M. Ramirez ♀2; Middle Island, 34.005776° -119.396661°, 5m, 17-vi-1970; East Island, 26-vi-1984 (S84-62) C. Drost ♂1 ♀4; 34.0152° -119.3656°, 52m, 26-vi-2008 (S08-58) M. Caterino ♀2. Ojai, 1151 Lake Ave, 34.422528° -119.295199°, 195m, 9-v-2008 (S08-21) S. Cook ♂1. Oxnard, 2411 Farragut Ct., ~3 m from ocean, 34.176736° -119.152943°, 15m, C. Fujita, April, 1992 (S92-120) ♂3 ♀3; October, 2005 (S05-157) ♂1 ♀7. Pt Mugu, 34.12964° -119.10657°, 2m, 22-vii-2019 (S19-39) E. Howe ♂1. San Nicolas Island, barracks area, 33.255992° -119.487013°, 130m, 14-vii-1-xi-1999 (S99-69) G. Smith ♂3 ♀7. Ventura, 73 Fraser Ln, 34.328198° -119.289949°, 52m, 20-x-2005 (S05-153) P. Mills ♂1. Hwy 33, north Wheeler Springs, 34.516405° -119.277537°, 650m, 11-vii-2018 (S18-26) ♂4 ♀3. Hwy 33, north Wheeler Springs, Holiday Campground, 34.517337° -119.277815°, 646m, 11-vii-2018 (S18-27) ♂1 ♀1. Hwy 33, near Wheeler Gorge Nature Trail, 34.518293° -119.270996°, 592m, 11-vii-2018 (S18-28) ♂2 ♀4.

Possible placement. **CALIFORNIA, *Los Angeles Co.,*** Santa Monica Mts., Array 111, 34.121845° -118.724873°, 223m, 17-vi-2023 (S23-62) K. DeLaney ♂1 for testes (T23-3). This light-colored male (Fig. 1273), with 2n♂=25, was recovered (F2846) in a clade with 11 individuals of *A. islander.* This is possibly the only individual of *A. islander* known from the Santa Monica Mts.



FIGURE 1273. Last instar male (S23-62), with 2n♂=25 (T23-3), that was recovered (F2846) in a clade with *A. islander*; and if *A. islander,* would be the only documented Santa Monica Mts individual.

Drum. Calling drums similar in both sexes except longer in females. Adult males, and rare nymphs (S96-119, with a sex clarification drum (SCD). **Male:** Holotype R04-59 (Fig. 1274) showing 49 drums over 8.3s (5.9 drums/s)

at 18.5°C. Skofield City Park, **male** R97-103 (Fig. 1275) shows 44 drums over 6.7s (6.6 drums/s) at 20°C. At least 2 late instar males from Skofield City Park (S83-169 and S96-119) produced a SCD, while other nymphs produced a calling drum, all while dueting with each other. **Female:** Allotype R04-107 (Fig. 1276) showing 91 drums over 17s (5.4 drums/s) at 19.5°C. Skofield City Park, **female** R84-54 (Fig. 1277) shows 77 drums over 14.5s (5.3 drums/s) at 20.5°C.

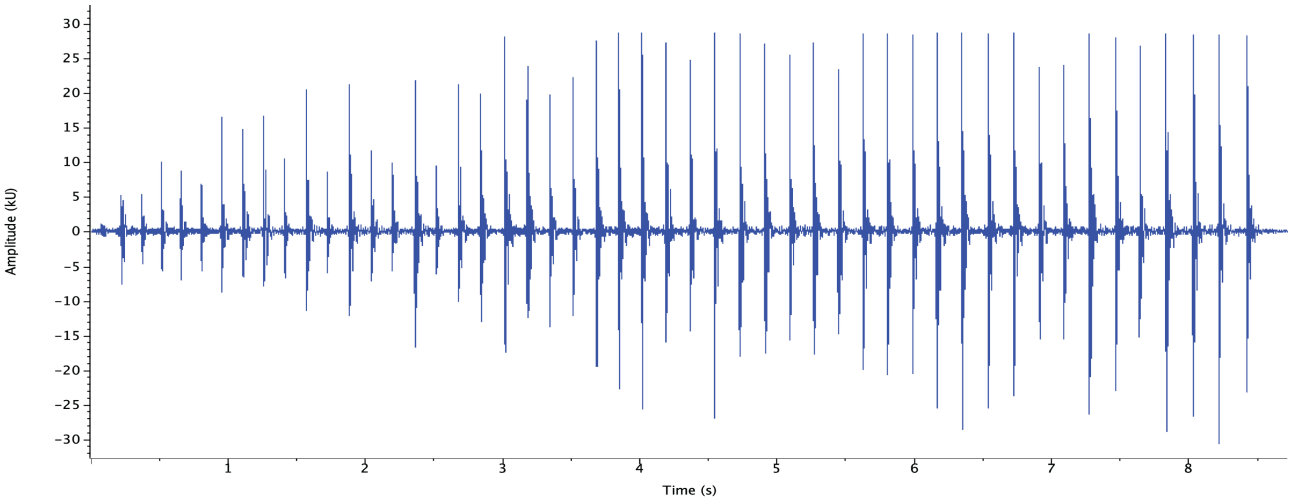


FIGURE 1274. Calling drum (R04-59) holotype adult male *A. islander*.

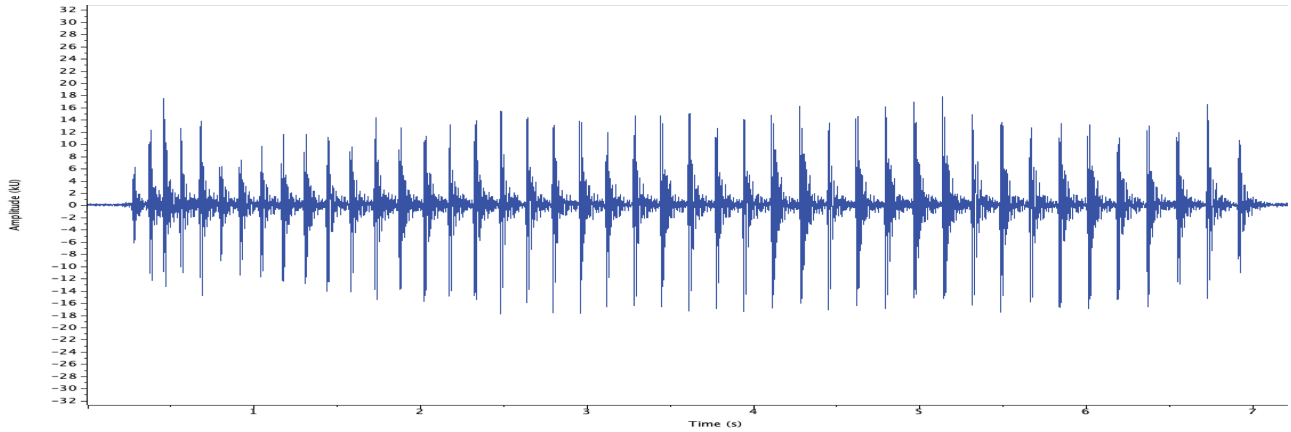


FIGURE 1275. Calling drum (R97-103) Skofield City Park paratype male *A. islander*.

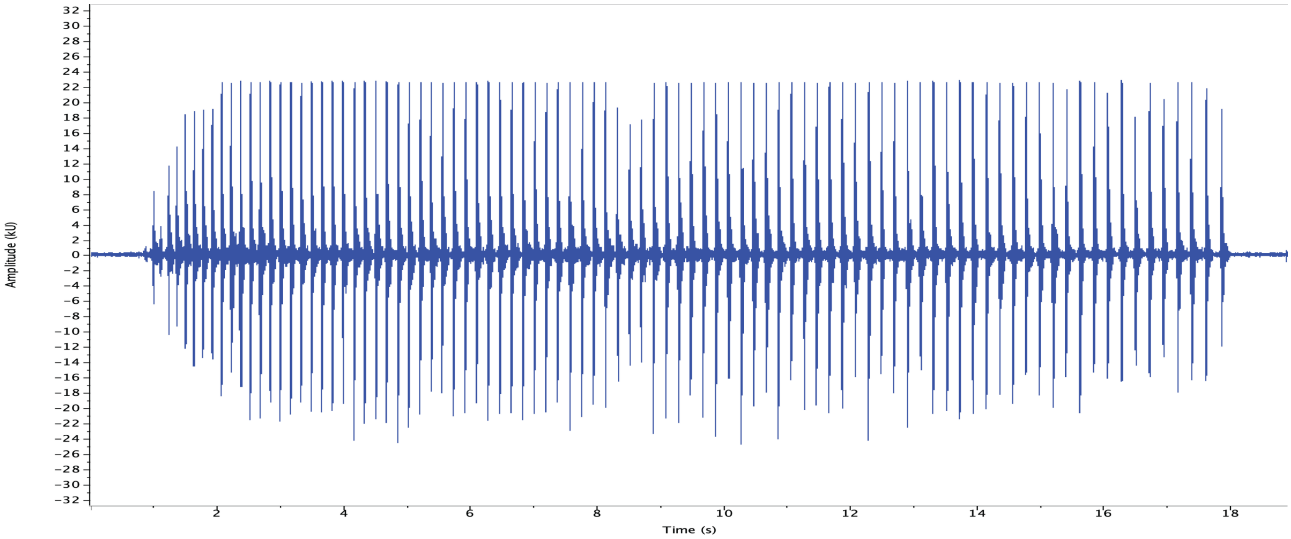


FIGURE 1276. Calling drum (R04-107) adult female allotype *A. islander*.

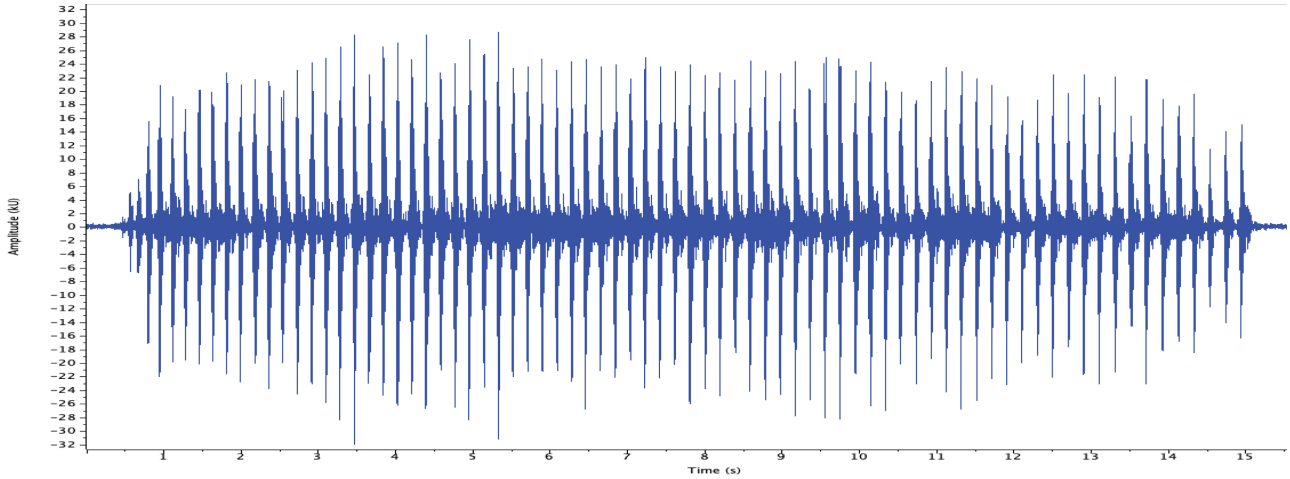


FIGURE 1277. Calling drum (R84-54) Skofield City Park adult female paratype *A. islander*.

Derivation of name. "islander" is Greek for island, in reference to its type locality being Santa Cruz Island.

Habitat. Found over most of Santa Cruz Island from chaparral to coastal bluff habitats. Skofield City Park is oak-woodland-grassland.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. For 18 adults on ***Santa Cruz Island***, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 16 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and 15 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 10 adults on ***San Nicolas Island***, all had 3 ventral **fore** leg tibial spurs; 2 had 7 and 16 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, and 15 had 3 and 3 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. For 56 adults on mainland ***Santa Barbara and Ventura Counties***, 1 had 2 and 55 had 3 ventral **fore** leg tibial spurs; 2 had 7 and 53 had 8 **middle** leg tibial calcars, 2 with 1 and 53 with 2 ventral spurs; all had 5 inner **rear** leg tibial spines, while 4 had 2, 50 had 3, and 4 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Length of rear leg inner tibial spines:** In all 18 individuals from Montecito, inner spine #1 longer than inner spine #2. In 15 of 18 individuals from nearby (separated by 7.2 km) Skofield Park, inner spine #2 longer than inner spine #1. **Color:** Single adult male (S18-1, R19-50) from San Miguel Island (Fig. 1278) with black abdominal bands wider than elsewhere. **Size:** Three of the adults (1♂ and 2♀) from Hwy 33 were huge; although, in general, those adults on the mainland are smaller than those from the Channel Islands.



FIGURE 1278. Adult male San Miguel Island (S18-1, R19-50) showing wide black abdominal bands.

DNA. Fig. 1252, p. 674. F0397 (S96-119, Skofield Park); F1037 (S99-69, San Nicolas Island); F1484 (type locality S04-65, Santa Cruz Island); F1713 (S05-153, Ventura); F1715 (S05-157, Oxnard); F2069 (S08-21, Ojai); F2249 (S11-17, Coal Oil Point Reserve); F2512 (S18-26, Hwy 33); F2525 (S18-28, Wheeler Gorge); F2592 (S18-1, San Miguel Island); F2600 (S19-39, Pt Mugu) recovered in Group 23 Islander, with *A. hovorei.*

Karyotype. 2n♂=25. 6 males examined in total, and all consistent. T97-24 (Fig. 1279) and T97-26, both S96-119, Skofield Park; T99-20 (Fig. 1280) and T99-29 (Fig. 1281), both S99-69, San Nicolas Island; T04-8 (Fig. 1282) and T04-16 (Fig. 1283), both type locality S04-64, Santa Cruz Island, all with 4 metacentric or submetacentric autosomal pairs; 8 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

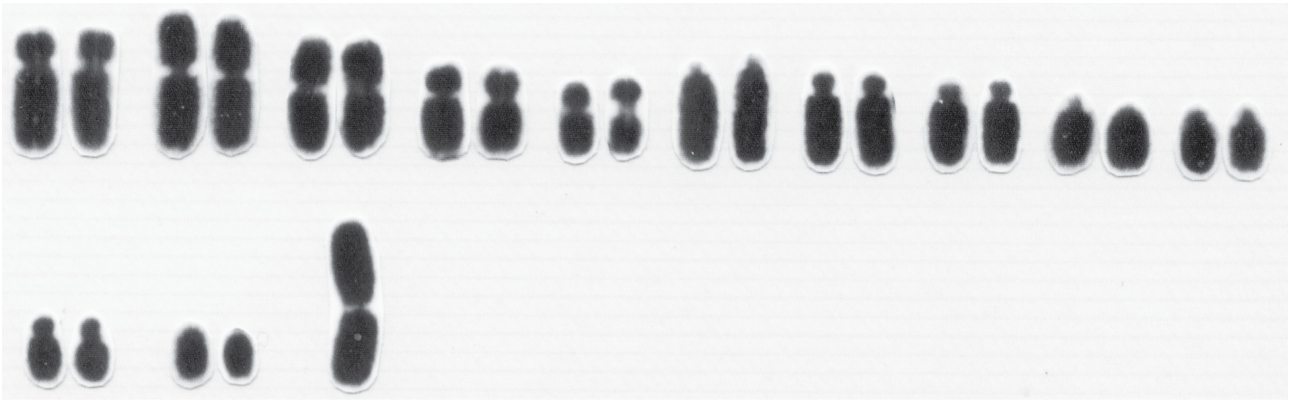


FIGURE 1279. Idiogram T97-24 *A. islander* (S96-119).

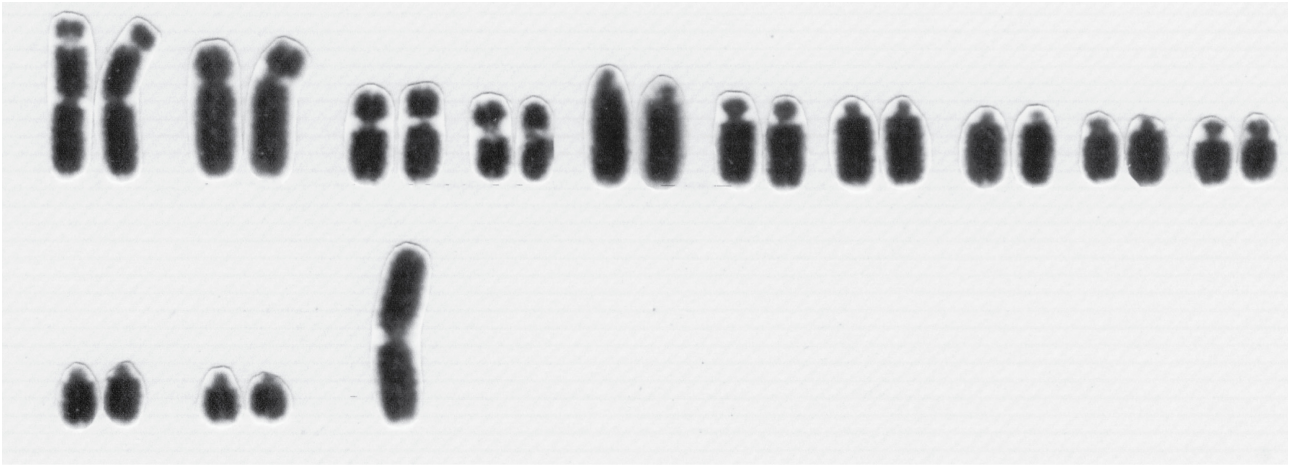


FIGURE 1280. Idiogram T99-20 *A. islander* (S99-69).

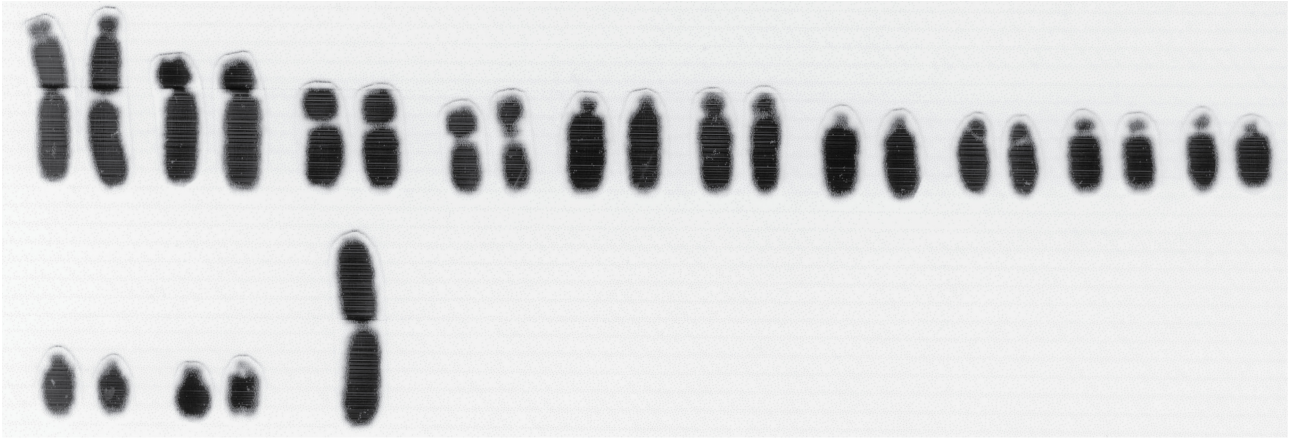


FIGURE 1281. Idiogram T99-29 *A. islander* (S99-69).

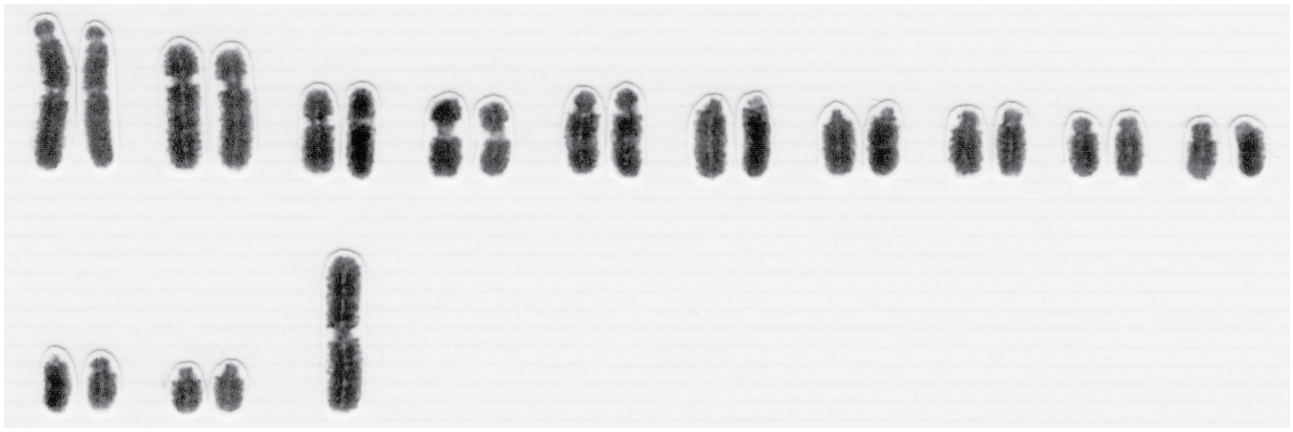


FIGURE 1282. Idiogram T04-8 *A. islander* (S04-64).



FIGURE 1283. Idiogram T04-16 *A. islander* (S04-64).

Discussion. San Nicolas Island is part of the U.S. Navy's Pacific Missile Test Center. Laughrin (1973), in his extensive study of the endemic fox (*Urocyon littoralis dickeyi*) on San Nicolas Island, failed to find any evidence of Jerusalem cricket head capsules, or other parts, in 95 scats from across the Island. In that same work, Laughrin documented JC parts in fox scats from the California Channel Islands of San Miguel, Santa Rosa, Santa Cruz and Santa Catalina. The first specimen-documented JC (deposited at CAS) on San Nicolas Island is a large adult male, from the base area, collected on 18-x-1981, by S. Miller and C. Nagano. Since Rentz and Weissman (1981) did not collect any JC specimens on San Nicolas Island during the early 1970s, coupled with Laughrin's 1973 results, the possibility of a recent introduction, sometime after 1973, was immediately considered. Kovach & Dow (1981a, b), in their 1980 studies on the endemic San Nicolas Island fox and introduced cat, do not discuss JCs as being present on San Nicolas Island, or list them in scats (Table 8, Table 4, respectively) of their reports. In subsequent independent correspondence with S. Kovach (DBW, November, 2000) and R. Dow (DBW, January, 2021), both authors independently recalled seeing JC parts in fox scats all over the Island, especially in canyons, in spring, 1980, despite such information not being included in their papers. Cypher *et al.* (2017) noted JC parts present in fox scats on San Nicolas Island between 2006–2012. But if JCs were introduced on San Nicolas Island sometime after 1973, how could they subsequently spread so quickly over the 58 km^2 island, such that they were commonly found in fox scats in 1980? For the present, we leave this question unanswered, but we note that foxes are adept at documenting the presence of JCs on the Channel Islands, as we discuss on p. 680 for *A. catalinae*. On the other hand, the presence of the same species on both the Northern Channel Islands and San Nicolas Island, despite their lack of a land bridge, has been claimed for Channel Island deer mice (Becker *et al.* 2025), possibly resulting from past Chumash trade routes. And we are purposely ignoring the claimed occurrence (Rentz & Weissman 1981) of the endemic silk spinning cricket *Cnemotettix spinulus* Rentz & Weissman on both the Northern Channel Islands and

San Nicolas Island, pending our upcoming revision of this genus. This species, or any JC, is not known from San Clemente Island (Rentz & Weissman, 1981, Phillips *et al.* 2007).

Our live 1999 San Nicolas Island series was provided by Island naturalist Grace Smith, with assistance from Navy personnel on the Island, from mostly around the base and barrack's area. Based on morphology, karyotype, drum, and DNA, these specimens are inseparable from those on Santa Cruz Island and from Oxnard, Ventura Co., the latter being the location of Pt Mugu Naval Air Station, from which much gear and supplies are flown and shipped to San Nicolas Island. When DBW visited San Nicolas Island on 2-vii-2019, he was unsuccessful finding any specimens despite extensive oatmeal trails laid in several locations around the base. Subsequently, Alice Abela laid oatmeal trails on San Nicolas Island on the following dates: 13-ix-2021 (S21-47, no specimens); 26-v-2022 (no specimens); 27-28-vi-2022 (S22-18, no specimens); and 15-vi-2023, with only the last date yielding one small nymph near the greenhouse.

The Oxnard specimens (S92-120), originally collected by C. Fujita, were brought to the Los Angeles County Insect Zoo, for identification, because they were eating through thin plastic irrigation pipes in strawberry fields.

Group 24, Southern California Group #4 (Fig. 1284)

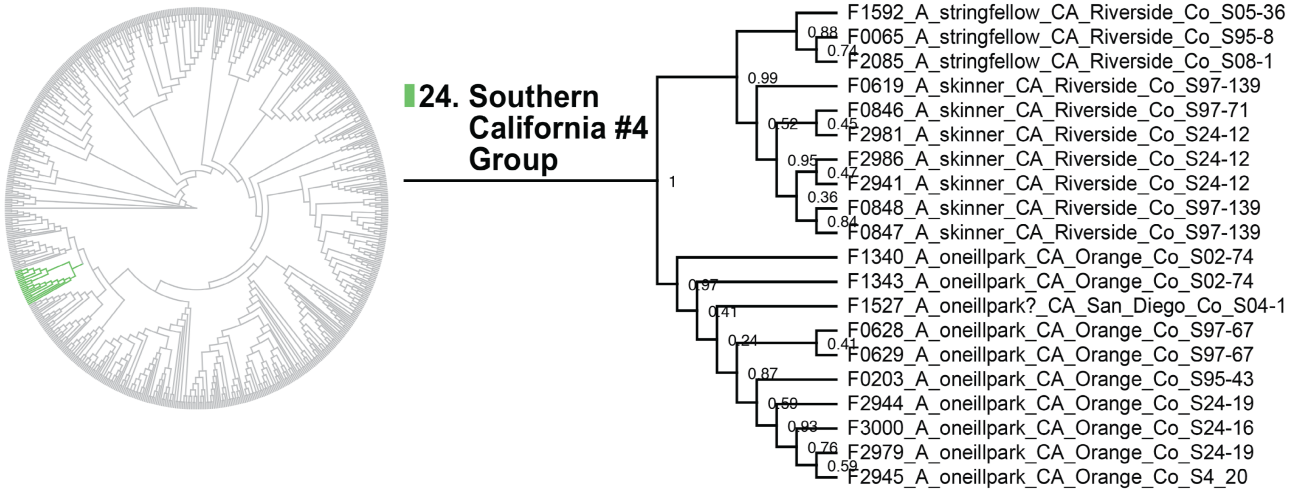


FIGURE 1284. ASTRAL tree for Southern California #4 Group.

This Group contains three species with similar drum rates and all with 2n♂=25.

SPECIES WRITE UPS: *A. oneillpark* (p. 688); *A. skinner* (p. 696); and *A. stringfellow* (p. 701).

***Ammopelmatus oneillpark* Weissman, sp. nov.**
Orange County Jerusalem Cricket
Figs 1285–1302, Tables 5, 21

Distribution. (Fig. 1285). Restricted to Orange County, California.

Recognition characters. A (rarely) small to large JC with medium fast calling drum of 5.9 to 7.7 drums/s, a sex clarification drum (SCD), and 2n♂=25, the latter distinguishing it from similar-drumming, morphologically inseparable, coastal, more northern *A. ballonadark* and *A. leei*; and more southern *A. fisheri*, all 3 of which have 2n♂=23. Abdomen dark and infused with cream and purple patterning; black stripes usually broad (but see Fig. 1297 below). Separated from *A. santarosaplateau* (2n♂=23), also in the Santa Ana Mts, by slower drum rate in *A. oneillpark*, DNA, and karyotype. Separated from *A. skinner* (2n♂=25) by slower drum rate in latter.

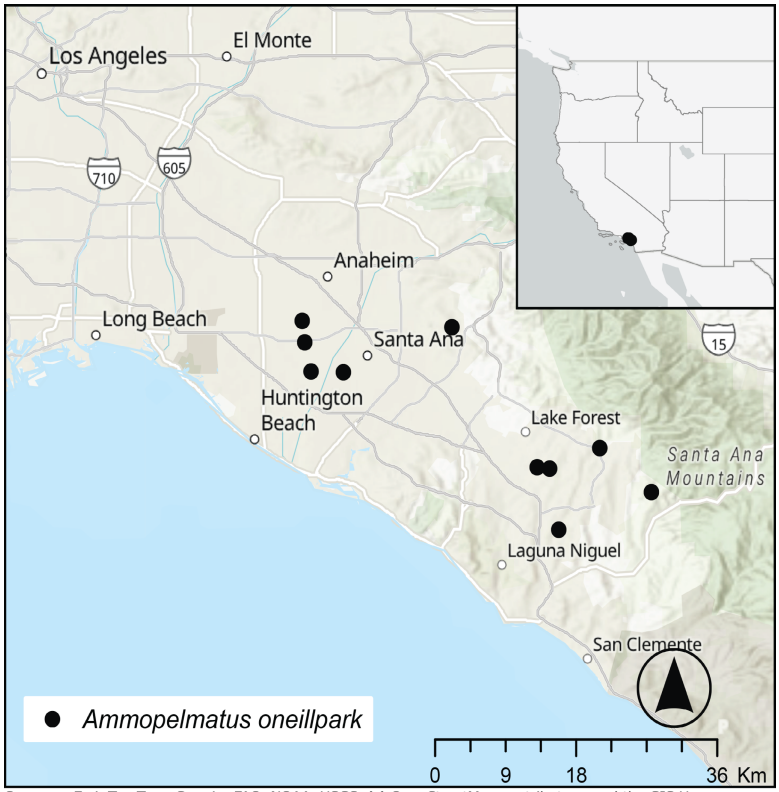


FIGURE 1285. Distribution of *A. oneillpark.*

Holotype. Male (in alcohol, Fig. 1286). **California, *Orange Co.,*** O'Neill Regional Park, 33.65029° -117.60349°, 280m, 26-ii-2024 (S24-19) DBW, DW Weissman. Molt to adult 27-ix-2024. R24-54, F2996. Deposited CAS, Entomology type #20187. Measurements in mm: Body length 45.26, hind femur length 14.12, hind femur width 5.04. Fore leg tibia with 3 or 4 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1287) with 5 inner and 3 or 4 outer spines, 2 ventral spurs.

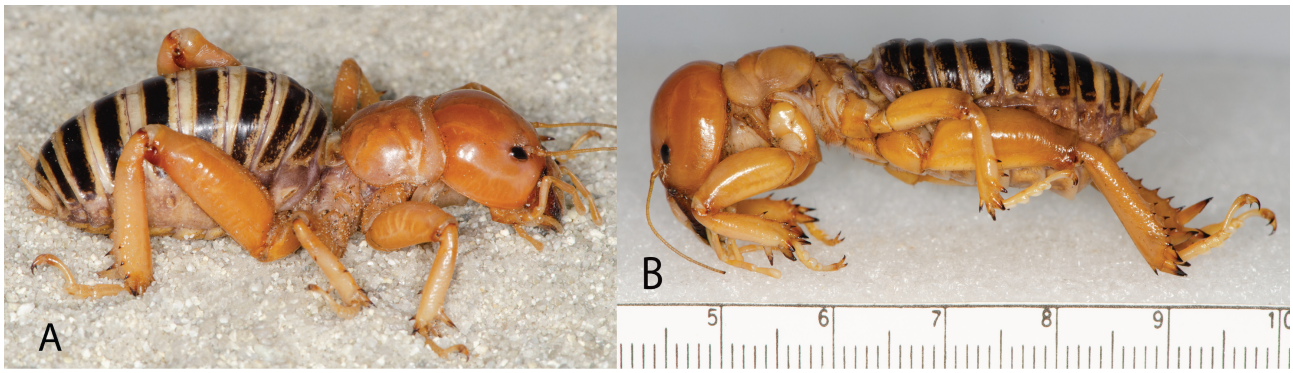


FIGURE 1286. Adult male holotype *A. oneillpark.* A. When alive. B. When preserved.



FIGURE 1287. Left rear leg tibia adult male holotype *A. oneillpark.* A. Showing 4 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1288). Same data as holotype except R25-2, F3002. Molt to adult 20-ix-2024. Deposited CAS. Measurements in mm: Body length 43.10, hind femur length 12.67, hind femur width 4.59. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1289) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1290.

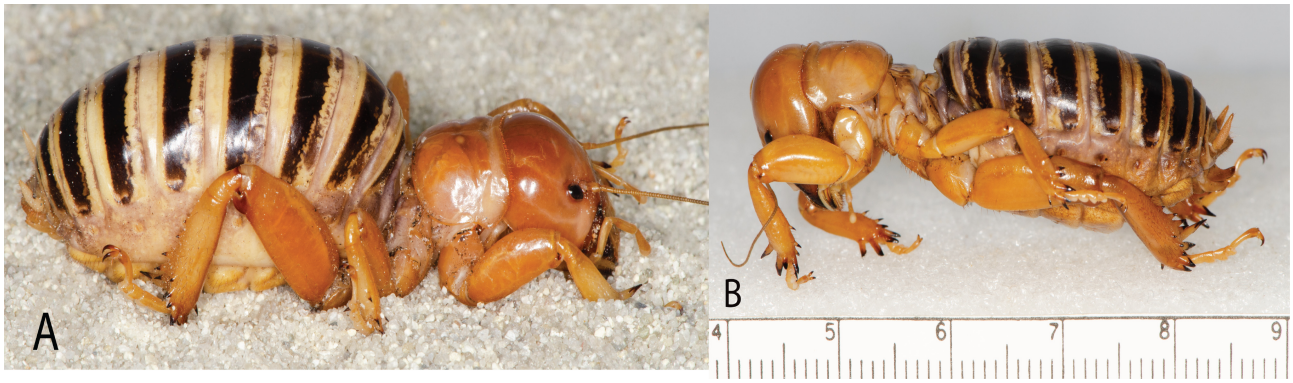


FIGURE 1288. Adult female allotype *A. oneillpark.* A. When alive. B. When preserved.

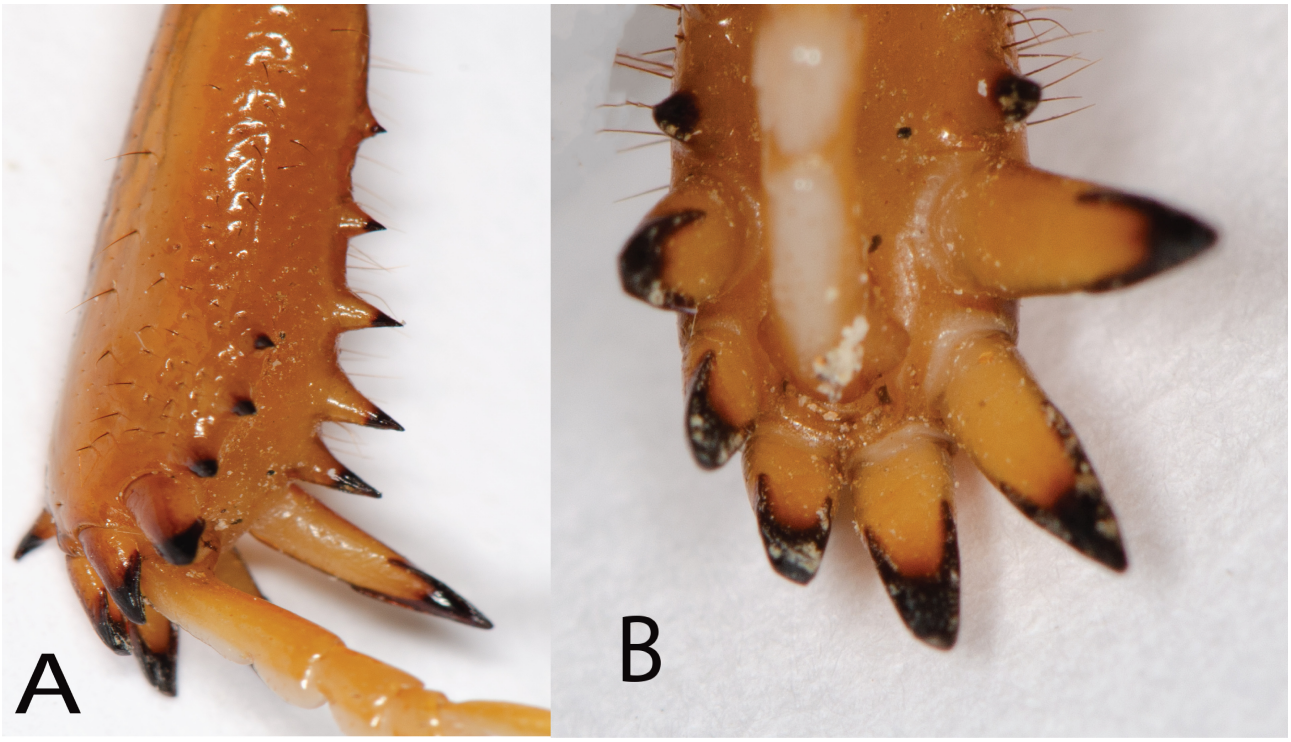


FIGURE 1289. Left rear leg tibia adult female allotype *A. oneillpark.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1290. Ovipositor allotype *A. oneillpark.*

Paratypes. ♂19 ♀19. **CALIFORNIA, *Orange Co.,*** Laguna Canyon, 4-v-1995 (S95-43) OF Clarke ♀1. Garden Grove, 13702 Taft St, 33.763893° -117.941792°, 23m, 15-xi-1994 (S94-114) R. Ortiz ♂1. Garden Grove, 12101 Diane St, 33.786999° -117.944710° 12-xii-2008 (S08-89) S. Bennett ♂1. Garden Grove, near Orange Co. Vector Control Office, 8-xi-1991 (S91-121) S. Bennett ♂1. Laguna Canyon, 4-v-1995 (S95-43) OF Clarke ♀1. Mission Viejo, 23012 Via San Gabriel, 33.628207° -117.660935°, 211m, all R. Allen, x-xi-2001 (S02-74) ♂1 ♀2; 20-ix-2003 (S03-139) ♀2. xi-2023 to ii-2024 (S24-20) ♂1. Mission Viejo, 22916 Via Pimiento, 33.629667° -117.675300°, 171m, 28-xi-18-xii-1995 (S95-125) R. Allen ♂2. O'Neill Regional Park, Trabuco Creek Trail, 33.562549° -117.650498°, 104m, 2-iii-1992 (S92-14) ♂2 ♀1; 20-xii-1992 (S92-142) ♂2 ♀3. O'Neill Regional Park, near Park Office, 33.65029° -117.60349°, 280m, 26-ii-2024 (S24-19) ♂2 ♀3. Ronald W. Caspers Wilderness Park, various

localities within Park, 26-ii-2024 (S24-16, S24-17, S24-18) ♂1 ♀3. Santa Ana, 2118 W. Dahl Lane, 33.731734° -117.897460°, 18m, 17-xi-2005 (S05-165) S. Bennett ♂2 ♀2. Santa Ana, residential backyard, 9-xii-1996 (S96-128) S. Bennett ♀1. Santa Ana, 9941 Brier Ln, 33.780166° -117.773003°, 208m, 4-x-2006 (S06-118) J. Crumley ♂1. Santa Ana, 1126 S. Driftwood, 33.732564° -117.934556°, 17m, 20-xi-2010 (S10-81) TJ Cooling ♂1. Starr Ranch, 33.602922° -117.544281°, 338m, 11-vi-1997 (S97-67) R. Fisher ♂1 ♀1.

Possible placement: **California, *Orange Co.,*** Camp Pendleton, 33.32626° -117.49208°, 39m, 29-i-2004 (S04-1), pitfall trap CPN 8, D. Clark. R04-112, F1527. This locality is disjunct from the paratype records and is being explored further, although this male is recovered with other specimens of *A. oneillpark* in ASTRAL tree.

Drum. Calling drum similar in both sexes, but male with a sex clarification drum (SCD) and series longer in females. **Male:** Holotype R24-54 (Fig. 1291) with 36 drums over 4.7s (7.7 drums/s) at 17.8°C. Other paratype males include R03-4 (S02-74, Fig. 1292) with 65 drums over 9.6s (6.8 drums/s) at 16°C. SCD in paratype male (R91-94, S91-121) showing (Fig. 1293) 3 SCD over 0.24s (12.5 drums/s) followed by 75 drums over 12.7s (5.9 drums/s) both at 14.5°C. Paratype male (R06-109, S06-118) recorded at 20°C, showing (Fig. 1294) 67 drums in 10.9s (6.1 drums/s). **Female:** Allotype R25-2 (Fig. 1295) with 294 drums over 49.6s (5.9 drums/s) at 16.8°C. Other paratype female includes R03-2 (S02-74, Fig. 1296) with 240 drums over 40.7s (5.9 drums/s) at 16°C.

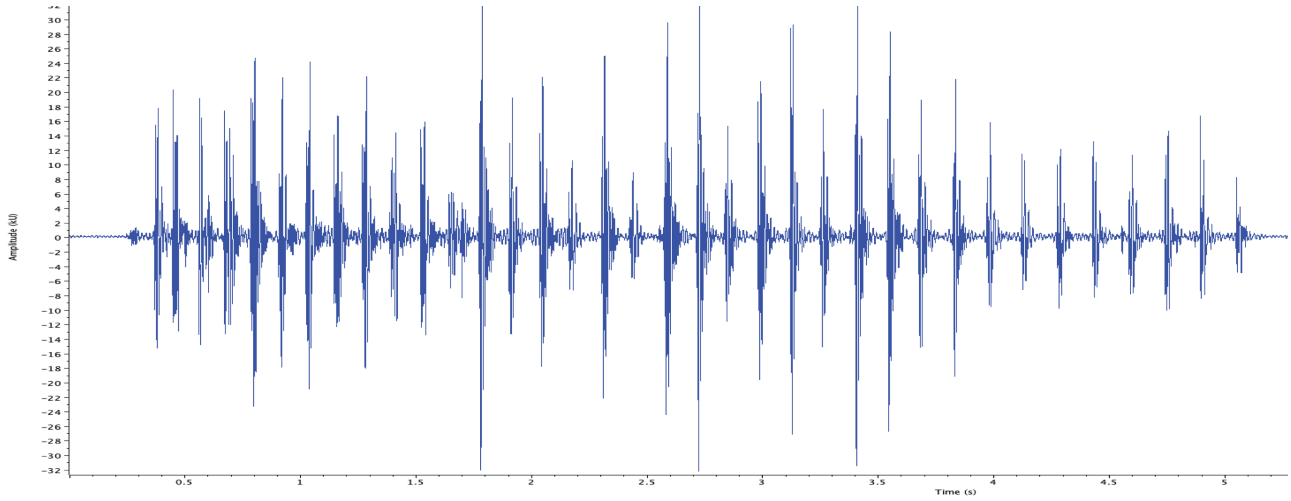


FIGURE 1291. Calling drum (R24-54) holotype adult male *A. oneillpark.*

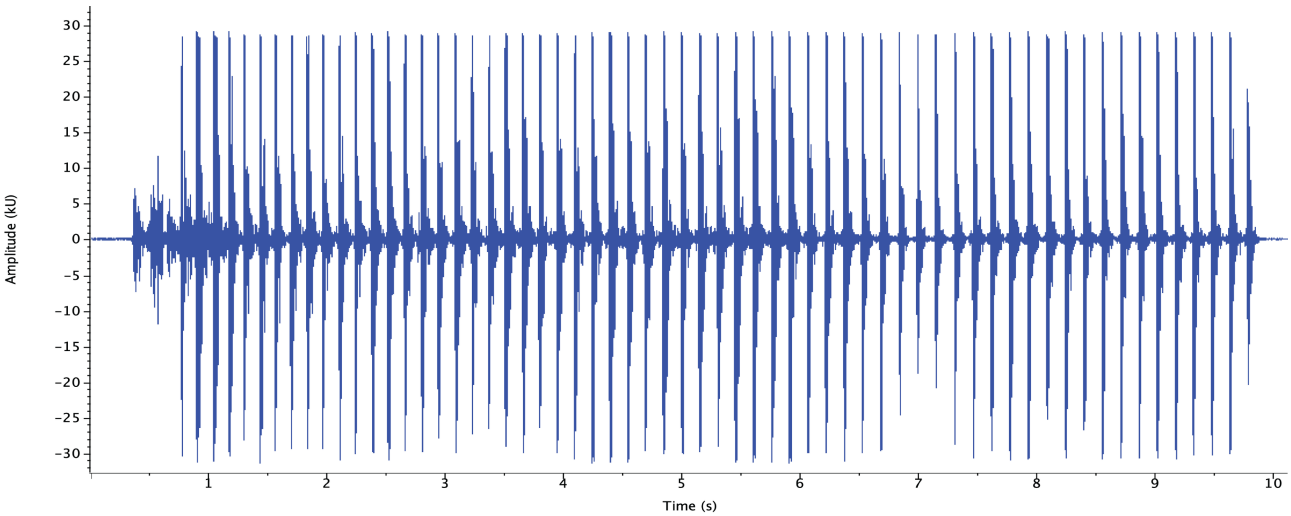


FIGURE 1292. Calling drum (R03-4) paratype adult male *A. oneillpark.*

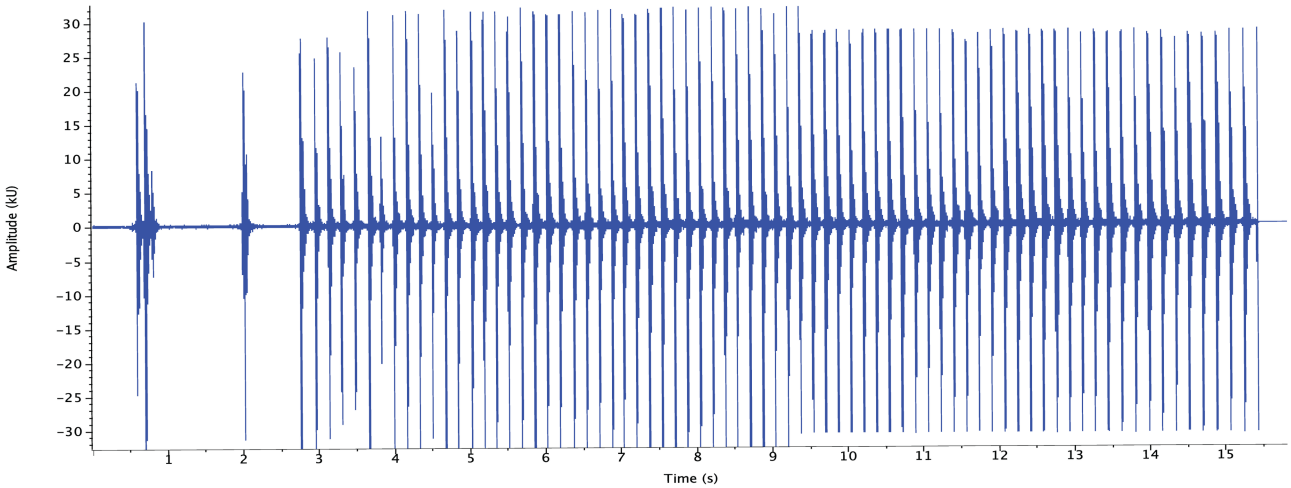


FIGURE 1293. Calling drum (R91-94) in paratype adult male *A. oneillpark*, with SCD.

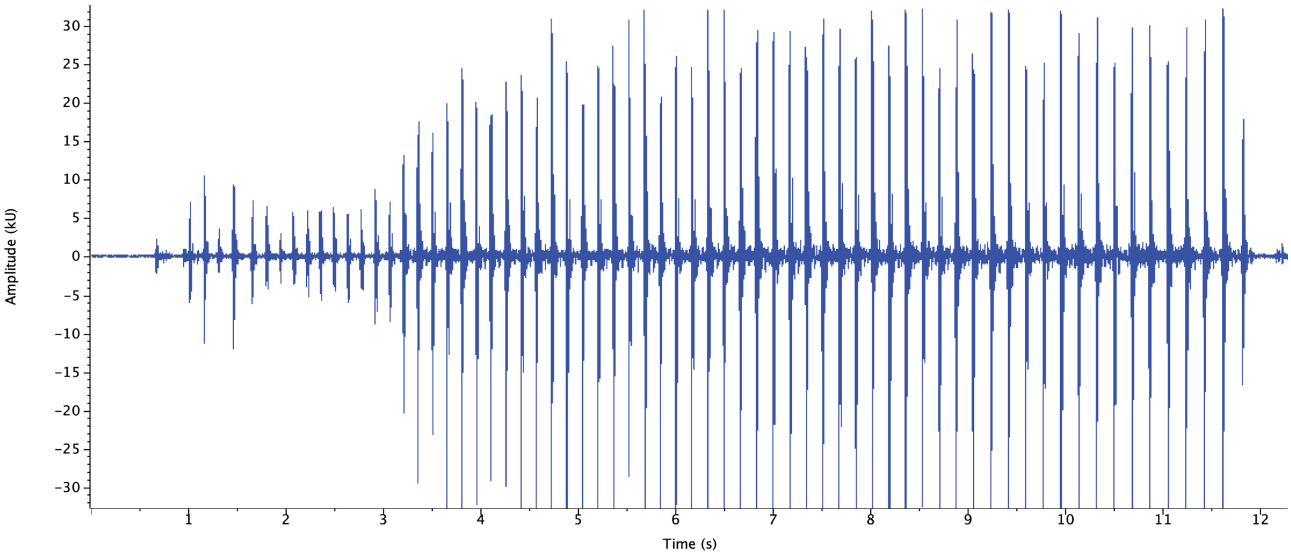


FIGURE 1294. Calling drum (R06-109) paratype adult male *A. oneillpark.*

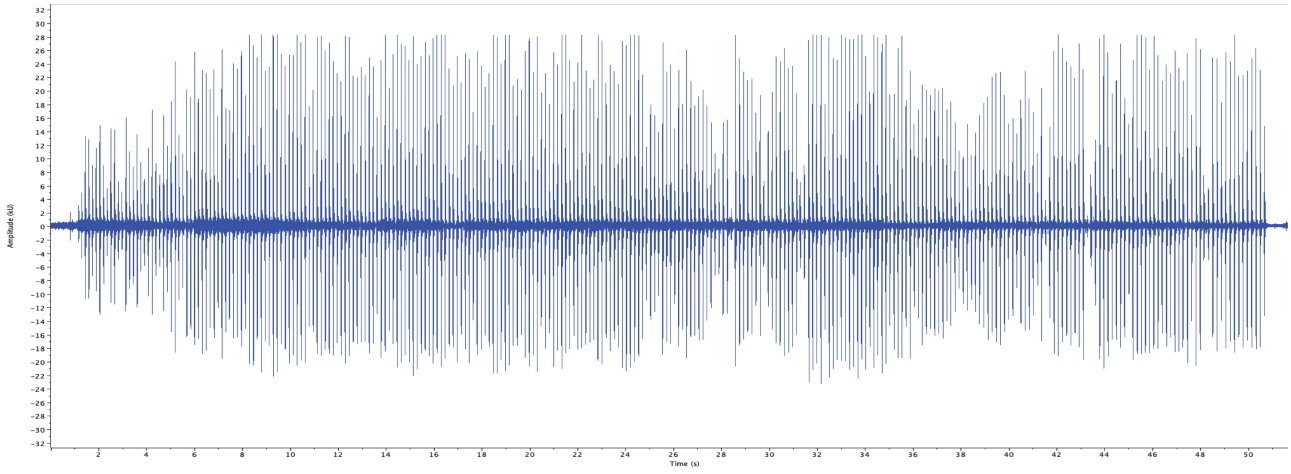


FIGURE 1295. Calling drum (R25-2) adult female allotype *A. oneillpark.*

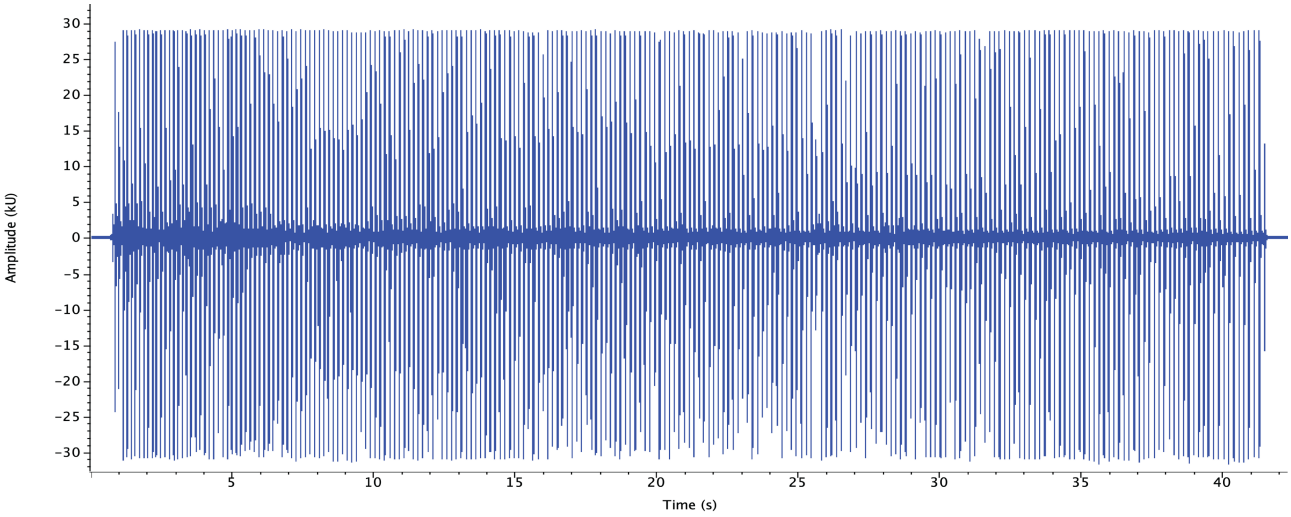


FIGURE 1296. Calling drum (R03-2) paratype adult female *A. oneillpark.*

Derivation of name. Named in reference to type locality.

Habitat. Type locality O'Neill Regional Park is open live oak and sycamore woodland, grassland. Mission Viejo (S02-74) locality is a residential neighbor with sandy soil and some open spaces. Mission Viejo (S95-125) locality is coastal sagebrush scrub with live oaks and sycamores along creek area.

Life cycle and seasonal occurrence. Apparent 2-year life cycle. We believe that adults of both sexes have a reproductive dormancy period, as the interval between the molt to adult and the first calling drum (at type locality) was from 5 weeks to 3.5 months (see further discussion on p. 26).

Variation. From some 35 individuals, 1 had 2, 31 had 3, and 2 had 4 ventral **fore** leg tibial spurs; 8 had 7 and 26 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 32 had 5 inner **rear** leg tibial spines, and 26 had 3 and 8 had 4 outer **rear** leg tibial spines, while 33 had 2 and 1 had 3 ventral spurs. Overall abdominal color pattern can vary from Fig. 1288 to that displayed by adult female (Fig. 1297) from S05-165 (Santa Ana, F1739).



FIGURE 1297. Adult female *A. oneillpark* (S05-165, Santa Ana, F1739) showing color variation.

DNA. Fig. 1284, p. 688. F0203 (S95-43, Laguna Canyon); F0628 & F0629 (S97-67, Starr Ranch); F1340 & F1343 (S02-74, Mission Viejo); F2944 (type locality S24-19, O'Neill Park); F2945 (S24-20, Mission Viejo); F2979

(type locality S24-19, O'Neill Park); F3000 (S24-16, Caspers) all recovered in Group 24 Southern California #4; a poorly supported clade of several other taxa, all with a drum rate of around 6 drums/s.

Karyotype. 2n♂=25. 5 males examined: T93-6 (Fig. 1298, S92-142, type locality O'Neill Regional Park); T03-8 (Fig. 1299) and T03-9 (Fig. 1300), both Mission Viejo, S02-74; T06-7 (Fig. 1301, S05-165, Santa Ana); T24-17 (Fig. 1302, S24-19, type locality O'Neill Regional Park) all with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

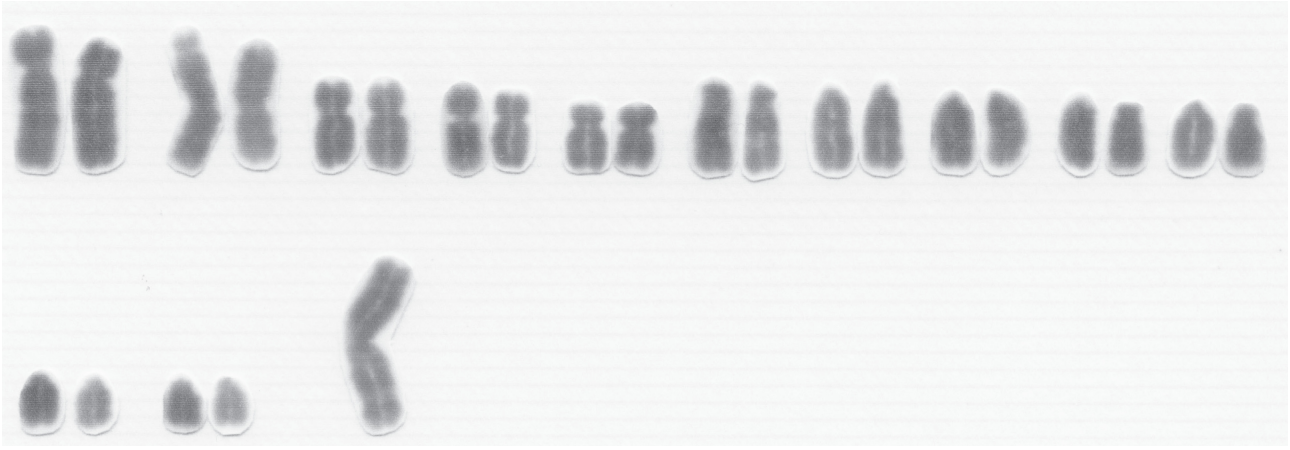


FIGURE 1298. Idiogram T93-6 *A. oneillpark* (S92-142).



FIGURE 1299. Idiogram T03-8 *A. oneillpark* (S02-74).

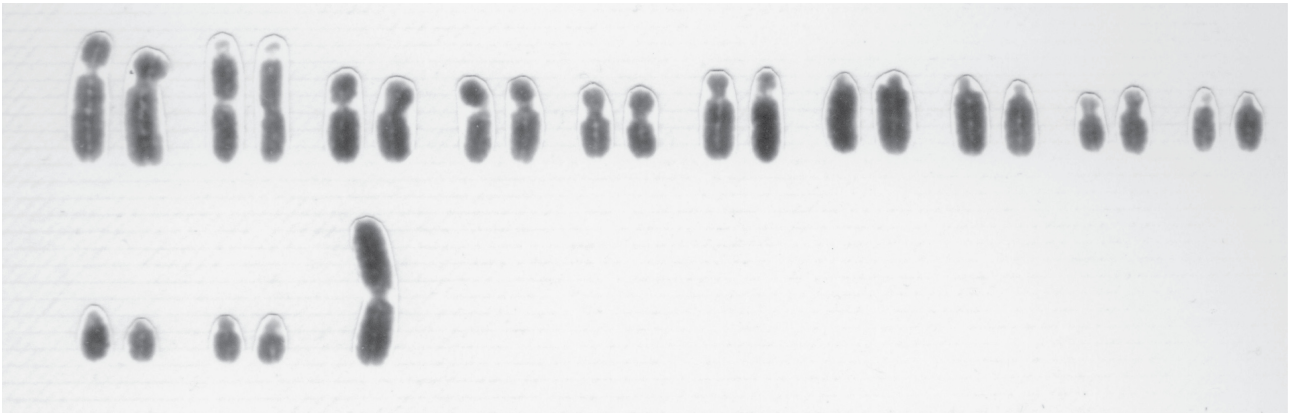


FIGURE 1300. Idiogram T03-9 *A. oneillpark* (S02-74).

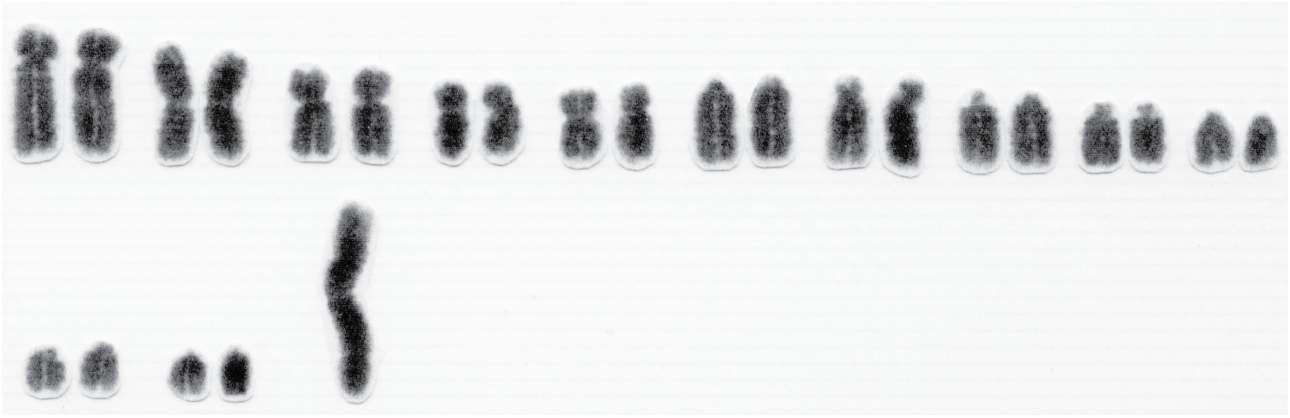


FIGURE 1301. Idiogram T06-7 *A. oneillpark* (S05-165).



FIGURE 1302. Idiogram T24-17 *A. oneillpark* (S24-19).

Discussion. Most *A. oneillpark* specimens were recorded at cooler temperature, as opposed to the preferred 20°C, since although individuals molt to adult in early fall, the laboratory has cooled off by the time they start drumming. This drumming delay, of up to 3.5 months, may be because *A. oneillpark* adults appear to have an adult reproductive dormancy period (see p. 26).

The type locality O'Neill Regional Park is 1820 hectares in size.

A. oneillpark is found at Caspers (S24-19) and Starr Ranch (S97-67) with the less common *A. mahogani.*

***Ammopelmatus skinner* Weissman, sp. nov.**

Skinner Lake Jerusalem Cricket

Figs 1303–1311, Table 6

Distribution. (Fig. 1303). Known from only a small area of Riverside Co., California, between Lake Skinner and Murrieta Hot Springs to the west.

Recognition characters. A large, medium-fast drumming (4.7–5.4 drums/s), typically brown headed JC with a probable adult reproductive dormancy period. 2n♂=25. Physically indistinguishable from Riverside Co. *A. calimesa* (2n♂=23) and *A. stringfellow* (2n♂=25), but *A. skinner* is separated by its slower drum rate, different DNA, and distance separation (some 36 km S from type locality of *A. calimesa*; and 60 km SE from type locality of *A. stringfellow*). From more southern adjacent San Diego Co. *A. fisheri* (2n♂=23) and *A. kirai* (2n♂=23), can be distinguished, from *A. skinner*, by DNA and karyotype. From more western adjacent Orange Co. *A. oneillpark* (2n♂=25), can be distinguished from *A. skinner* by faster drum rate in former.



FIGURE 1303. Distribution of *A. skinner*.

Holotype. Male (in alcohol, Fig. 1304). **California, *Riverside Co.,*** Borel Rd, 33.570040° -117.035686°, 499m, 25-ii-2024 (S24-12) DBW, DW Weissman. R24-36 & R24-42, F2986. Molt to adult 23-ix-2024. Deposited CAS, Entomology type #20169. Measurements in mm: Body length 50.39, hind femur length 14.33, hind femur width 5.14. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1305) with 5 or 6 inner and 3 or 4 outer spines, 2 ventral spurs.

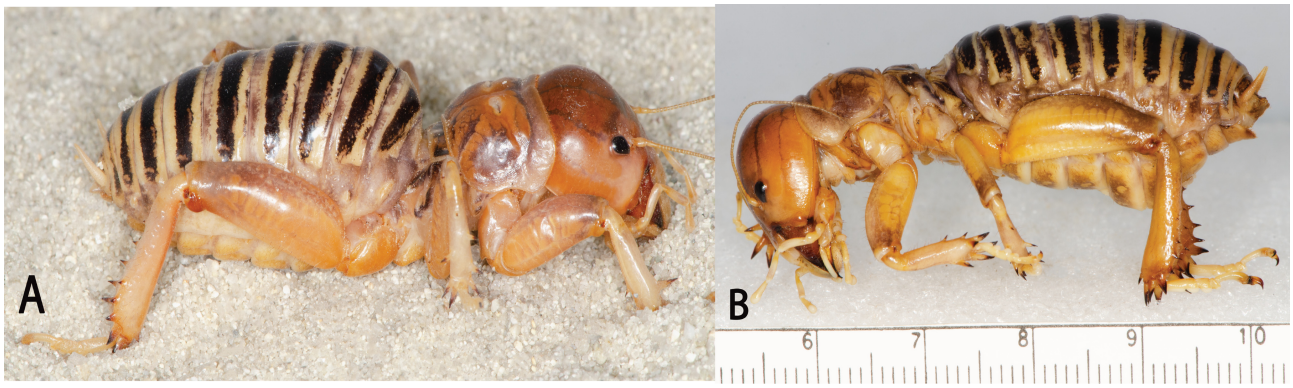


FIGURE 1304. Holotype adult male *A. skinner.* A. When alive. B. When preserved.

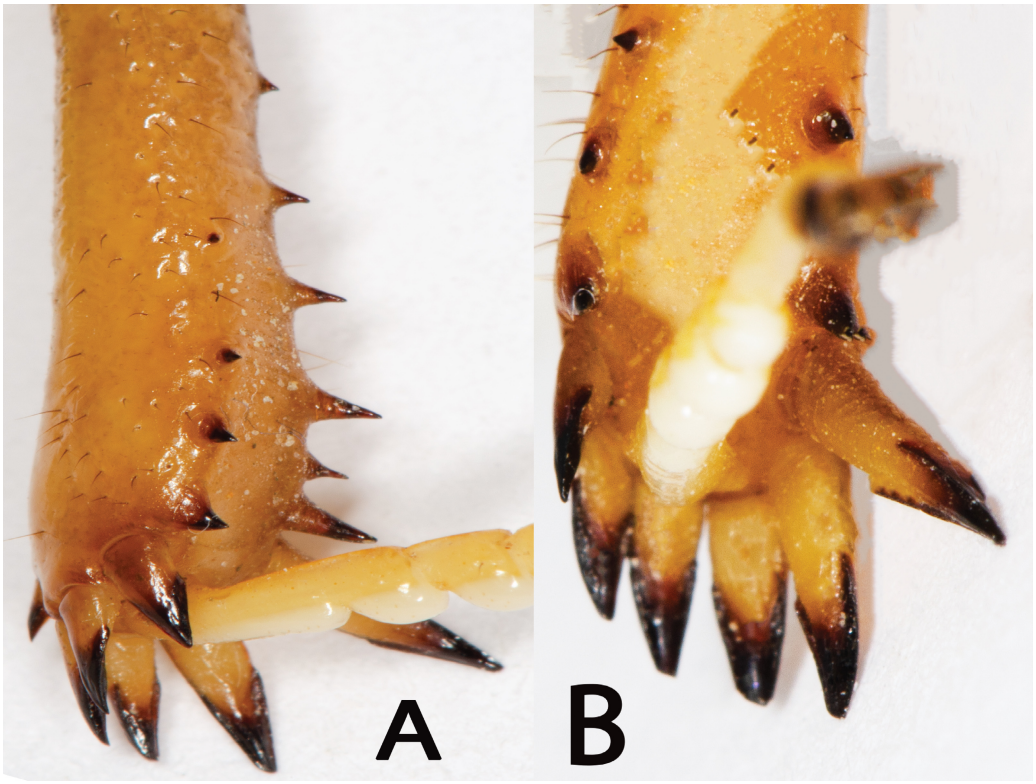


FIGURE 1305. Left rear leg tibia adult male holotype *A. skinner.* A. Showing 4 outer and 6 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1306). Same data as holotype except R24-51, F2994. Molt to adult 23-ix-2024. Deposited CAS. Measurements in mm: Body length 50.59, hind femur length 12.4, hind femur width 5.33. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1307) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1308.



FIGURE 1306. Adult female allotype *A. skinner.* A. When alive. B. When preserved.

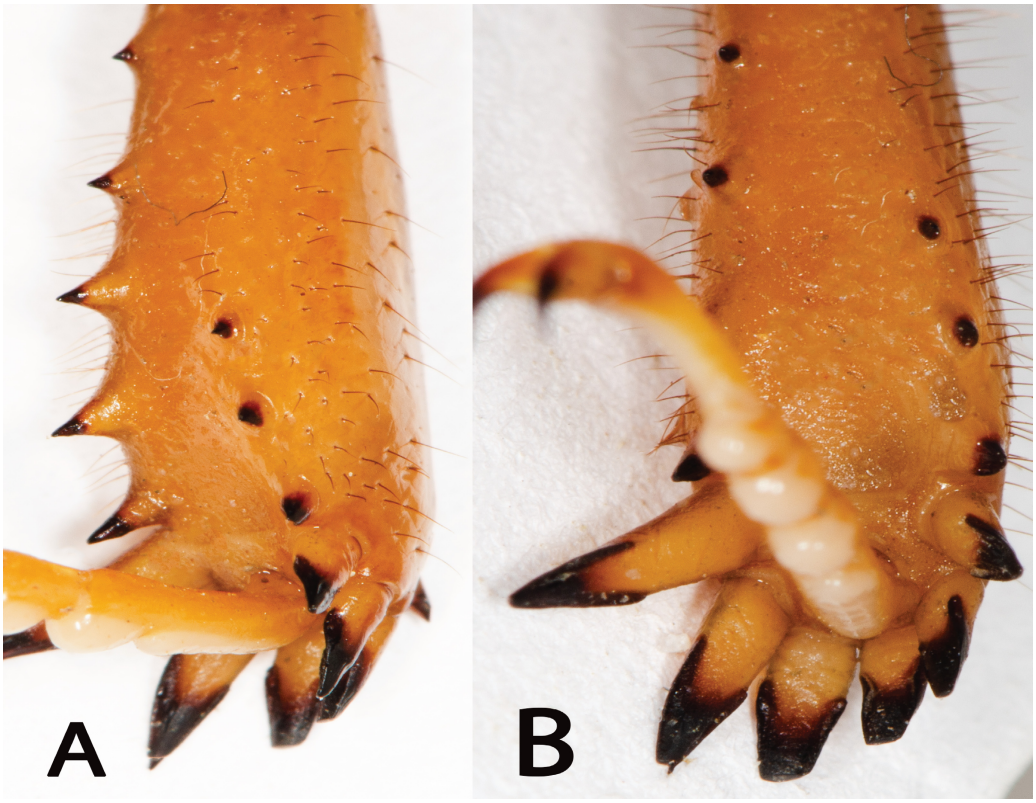


FIGURE 1307. Right rear leg tibia adult female allotype *A. skinner.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.



FIGURE 1308. Ovipositor allotype *A. skinner.*

Paratypes. ♂2 ♀5. **CALIFORNIA, *Riverside Co.,*** type locality, same information as types, S24-12, ♀3. South of Skinner Reservoir, 33.57523° -117.04500°, 501m, 3-vii-1997 (S97-71), R. Fisher ♂1. Murrieta Hot Springs, 33.569280° -117.163503°, 356m, 29-xi-1997 (S97-139) GR Ballmer ♂1 ♀2.

Drum. Same in both sexes except male with sex clarification drum (SCD), and female with longer series. Holotype **male**: Fig. 1309A, R24-42 shows calling drum of 71 drums over 13.2s (5.4 drums/s) at 17.6°C. SCD (Fig. 1309B, R24-36) shows 3 drums over 0.15 s (20 drums/s) at 21.6°C. Allotype **female:** (Fig. 1310, R24-51) shows 234 drums over 50s (4.7 drums/s) at 16.8°C.

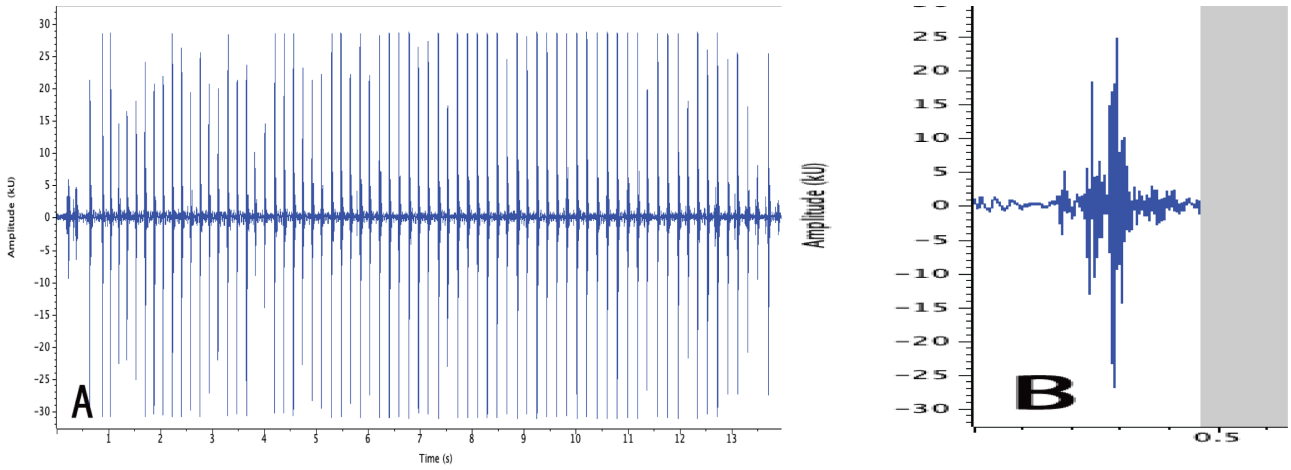


FIGURE 1309. Drumming in adult male holotype *A. skinner.* A. Calling drum (R24-42). B. SCD (R24-36).

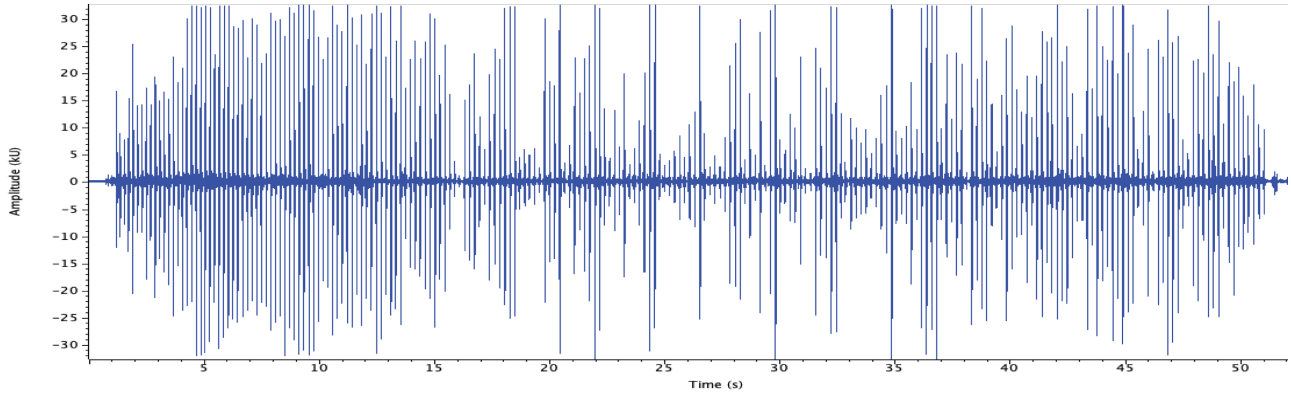


FIGURE 1310. Calling drum (R24-51) adult female allotype *A. skinner.*

Derivation of name. Named after the nearby Skinner Reservoir.

Habitat. Type locality is a small, grass covered dome with many small rocks, *Opuntia* cactus, and a few shrubs, where JCs were found only on west facing slope. At S97-71, locality is a hillside covered with annual grasses and buckwheat (*Eriogonum* sp.), with male from a live pitfall trap.

Life cycle and seasonal occurrence. Probably typical 2-year life cycle.We believe this taxon may also have an adult reproductive dormancy period (see p. 26). Of five nymphs raised to adult, in 2024, we found the following: **Male** #1, molt to adult 23-ix, first calling drum on 11-xi, although he made SCD as early as 17-x in response to finger drumming. We recorded him 4 times before 11-xi without him producing a calling drum. **Female** #1, molt to adult 19-ix, first calling drum 29-xi. Female #2, molt to adult 22-ix, first calling drum 19-xi. Female #3, molt to adult 23-ix, first calling drum 24-xi. Female #4, molt to adult 3-x, first calling drum 29-xi. These delays of 2.3 weeks to 2.5 months between the molt to adult and the first spontaneously heard, or finger-stimulated, calling drum, compare to a normal interval delay of 10 days to 3 weeks, after the molt to adult, for taxon without a reproductive dormancy (see p. 469 for a summary of intervals seen in *A. santarosaplateau*, which we collected 21 km almost due west of the type locality of *A. skinner*, at an elevation 80m higher).

Variation. From 11 individuals, all had 3 ventral **fore** leg tibial spurs; 1 had 6, 2 had 7, and 8 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 9 had 5 and 2 had 6 inner **rear** leg tibial spines, 9 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1284, p. 688. F0619 (S97-139, Murrieta Hot Springs); F0846 (S97-71, Lake Skinner); F0847 & F0848 (both S97-139, Murrieta Hot Springs); F2941, F2981, F2986 (all three type locality S24-12), all recovered together in Group 25 Southern California #5, and closest to *A. stringfellow.*

Karyotype. 2n♂=25. T24-14 (Fig. 1311, type locality S24-12) with 6 metacentric or submetacentric autosomal pairs; 6 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

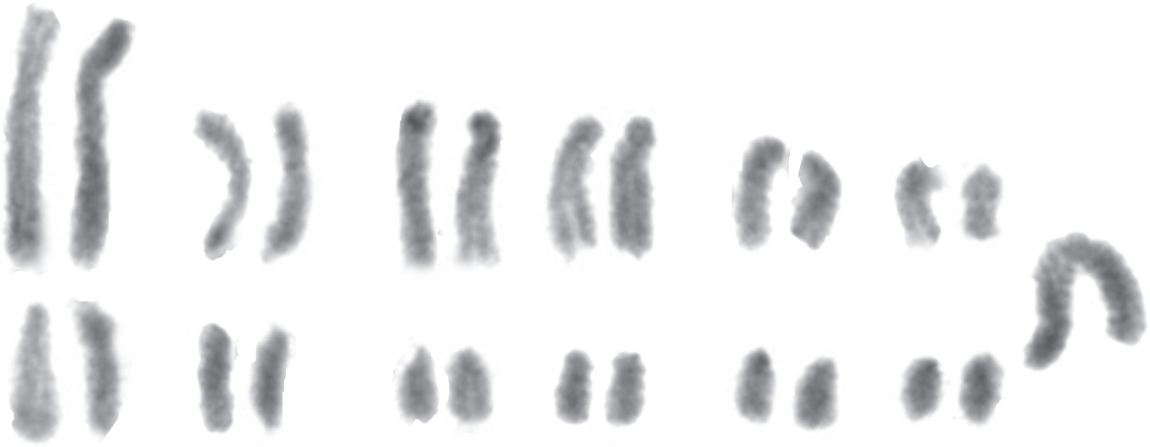


FIGURE 1311. Idiogram T24-14 A. skinner (S24-12).

Discussion. We initially chose as allotype, a female (S97-71) from a site 3.4 km north of the original holotype male (R98-210, 4.1 drums/s at 13.5°C). This female drummed (R97-122) at 7.6 drums/s at 20°C, a rate difference we attributed to the different recording temperatures. She was then recovered in the tree (F0538) very different than that original male holotype (Murrieta Hot Springs, F0619). With our subsequent collection of the larger series of *A. skinner* in 2024, we realized our error, and her workup continues.

***Ammopelmatus stringfellow* Weissman, sp. nov.**
Stringfellow Jerusalem Cricket
Figs 1312–1322, Table 6

Species #27, Weissman 2001b.

Distribution. (Fig. 1312). Known only from Riverside Co., California.

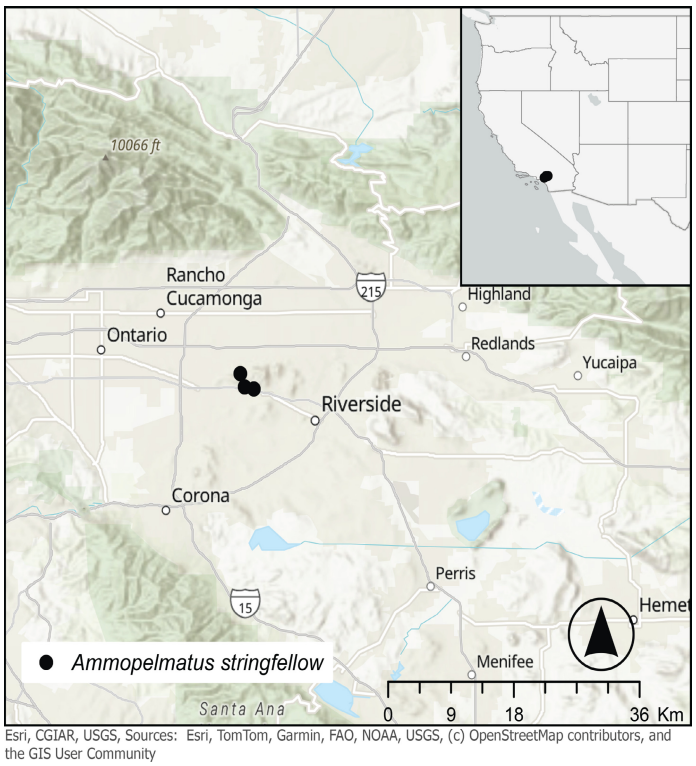


FIGURE 1312. Distribution of *A. stringfellow.*

Recognition characters. A medium-large, generally dark colored, medium fast drumming (5.5–7 drums/s at 20°C) JC with a sex clarification drum (SCD), 2n♂=25, and generally 3 fore leg tibial spurs. Separated from microsympatric *A. icenoglei* by DNA, and length of rear leg inner tibial spine #3. Separated from nearby, similar drumming *A. calimesa* and *A. kirai* by chromosome number (2n♂=25 vs 2n♂=23 in latter two taxa) and DNA. Separated from nearest DNA relative *A. skinner* by latter's slower drum rate, brown head, and larger size.

Holotype. Male (in alcohol, Fig. 1313). **California, *Riverside Co.,*** Jurupa Mts above Stringfellow Acid Pits, 34.017631° -117.455747°, 344m, 2-ii-2008 (S08-1) DBW. R08-50, F2085. Molt to adult 19-x-2008. Deposited CAS, Entomology type #20167. Measurements in mm: Body length 39.23, hind femur length 11.16, hind femur width 4.31. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1314) with 5 inner and 4 outer spines, 2 ventral spurs.

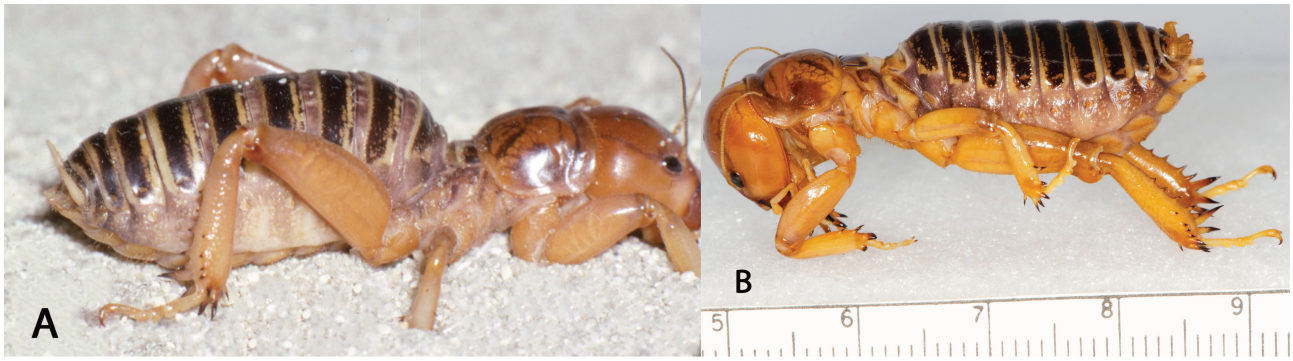


FIGURE 1313. Adult male holotype *A. stringfellow.* A. When alive. B. When preserved.

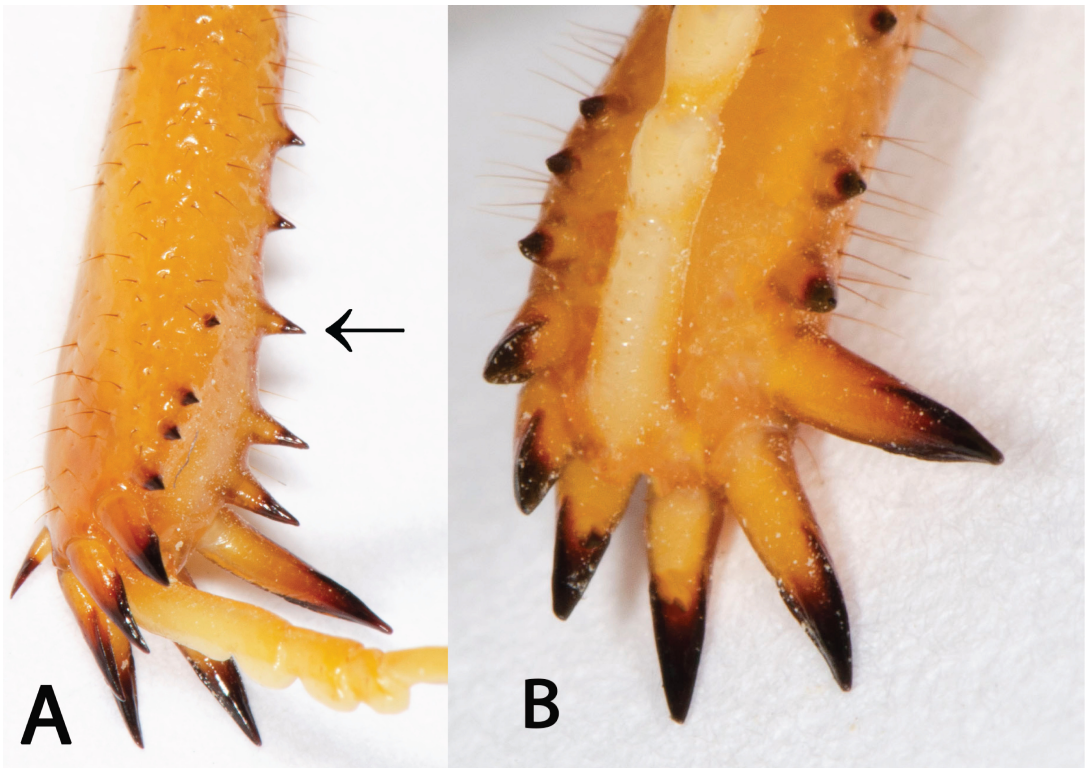


FIGURE 1314. Left rear leg tibia adult male holotype *A. stringfellow.* A. Showing 4 outer and 5 inner spines. Note how inner rear leg spine #3 (arrow) not longer than inner spines #1 and #2. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1315). **California, *Riverside Co.,*** 800m to west of holotype locality, 34.020025° -117.467558°, 327m, 27-iv-1988 (S88-14) W. Icenogle. R88-121 & R88-146. Molt to adult 9-x-1988. Deposited CAS, CASENT #9085596. Measurements in mm: Body length 36.73, hind femur length 11.43, hind femur width 4.92. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1316) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1317.

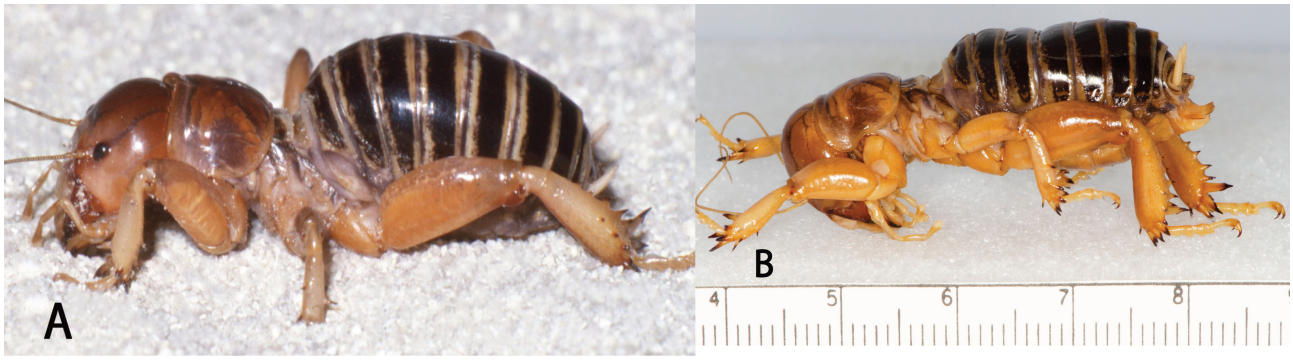


FIGURE 1315. Adult female allotype *A. stringfellow.* A. When alive. B. When preserved.

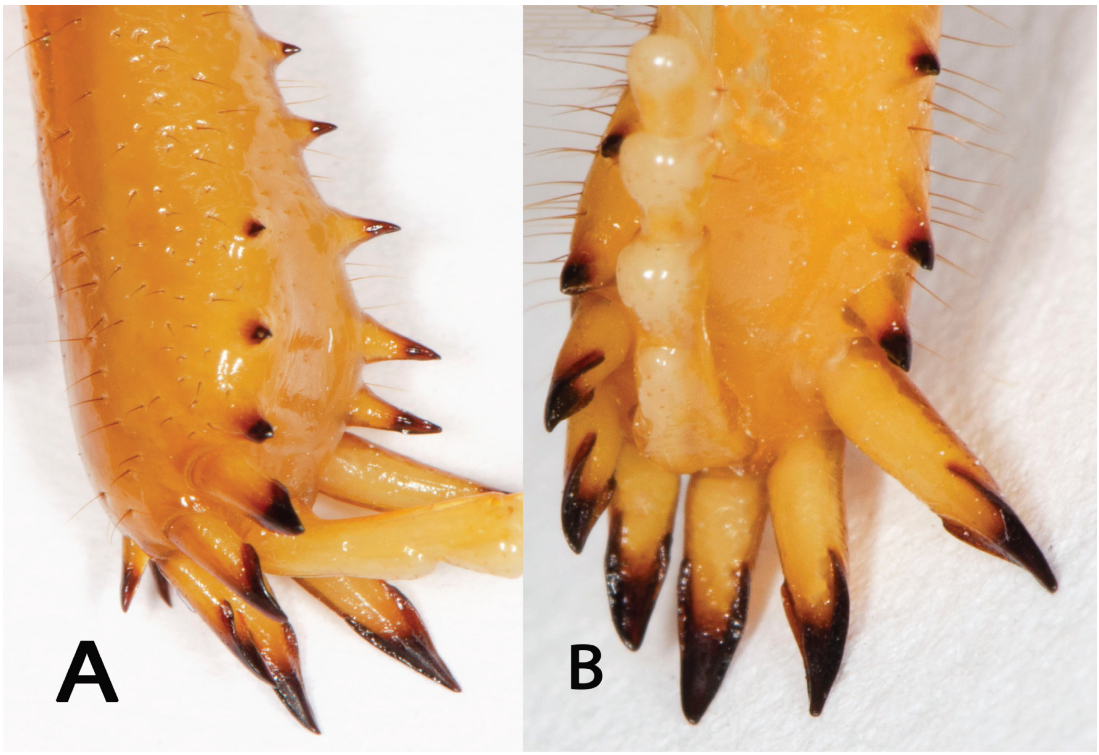


FIGURE 1316. Left rear leg tibia adult female allotype *A. stringfellow.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

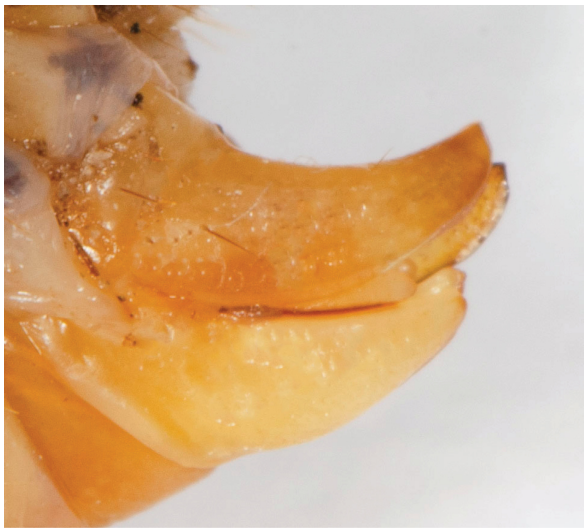


FIGURE 1317. Ovipositor allotype *A. stringfellow.*

Paratypes. ♂8 ♀16. **CALIFORNIA, *Riverside Co.*** Same as holotype locality ♀1; 6-i-1989 (S89-1) W. Icenogle ♀4. Same as allotype locality: 27-iv-1988 (S88-14) ♂1 ♀3; 8-29-iii-1992 (S92-49) W. Icenogle ♀4; 16-iii-1993 (S93-34) W. Icenogle ♂2; 24-iii-4-iv-1994 (S94-15) W. Icenogle ♂4 ♀2; 25-ii-2001 (S01-7) ♀2; mid-iii-2005 (S05-36) W. Icenogle ♀2. Jurupa Hills, NW Stringfellow acid pits, 34.0356° -117.4731°, 391m, January, 1995 (S95-8) G. Ballmer ♂1 ♀1.

Possible placement (since DNA lacking). **CALIFORNIA, *Riverside Co.,*** Norco on Hwy 31 along Santa Ana River Basin, 33.872895° -117.666974°, 144m, 22-xi-1986 (S86-155) W. Sakai ♂1: R86-79 5.4 drums/s at 15°C. Riverside, 23-x-1984 (S84-70) RK Velten ♂1: R84-44, 6–6.6 drums/s at 17°C. ***San Bernardino Co.,*** Colton, 11876 Reche Canyon Rd, 34.036120° -117.283396°, 356m, 17-iii-1994 (S94-6) C. Lovell ♂1. This male drummed (R94-99) at 7.2 drums/s, at 19.5°C, and with a sex clarification drum.

Drum. Calling drum same in both sexes except longer in females, and males with a SCD. **Male:** Holotype R08-50 (Fig. 1318) with 68 drums over 10.7s (6.4 drums/s) at 19.5°C. Paratype R94-113 (Fig. 1319) with 56 drums over 8.0s (7 drums/s) at 19°C. SCD (Fig. 1320) same paratype male shows 3 drums over 0.23s (13.0 drums/s) also at 19°C. **Female:** Allotype R88-121 (Fig. 1321) with 165 drums over 25.8s (6.4 drums/s) at 19.5°C.

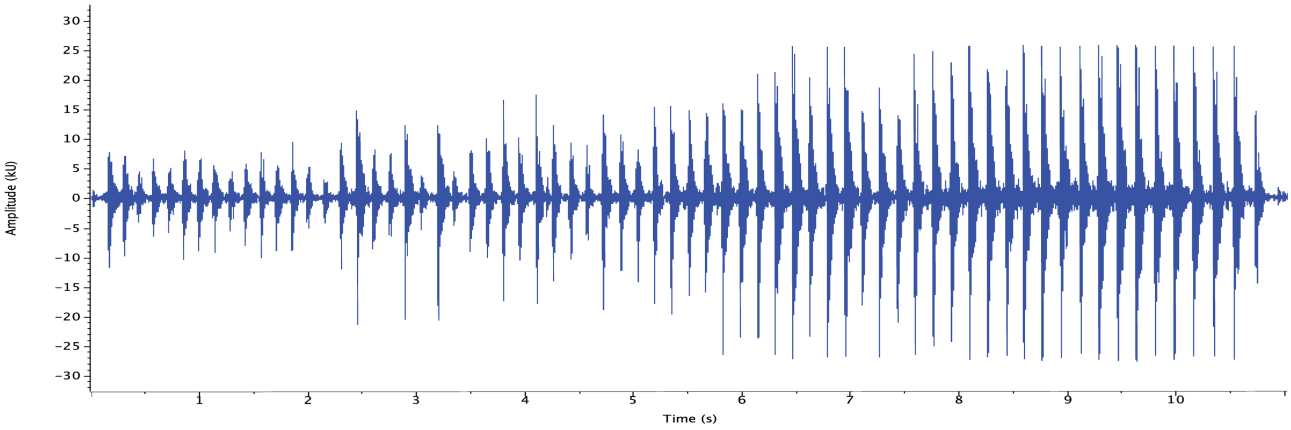


FIGURE 1318. Calling drum (R08-50) adult male holotype *A. stringfellow.*

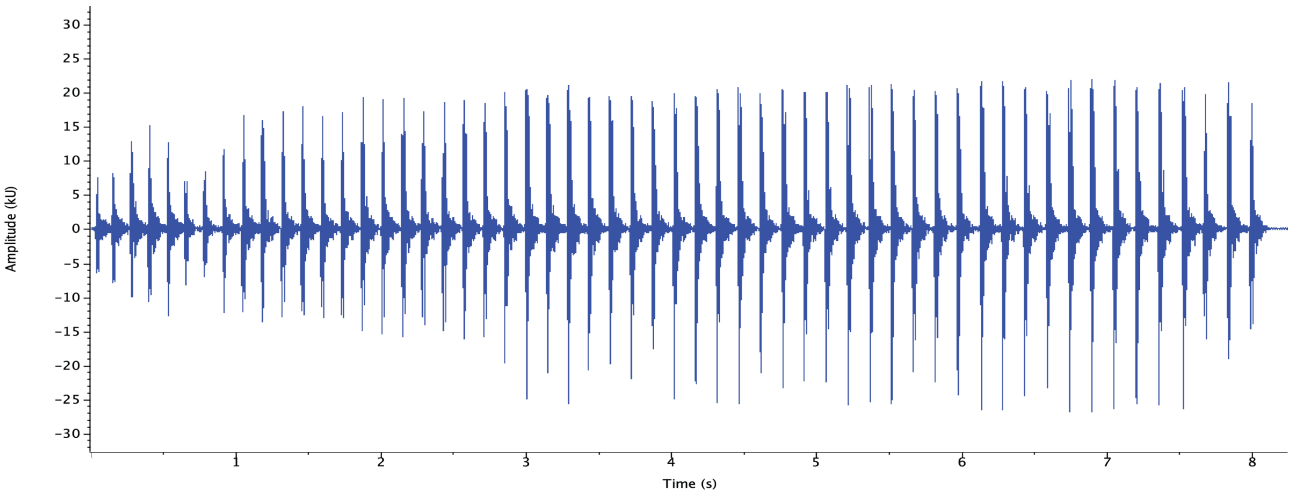


FIGURE 1319. Calling drum (R94-113) adult male paratype *A. stringfellow.*

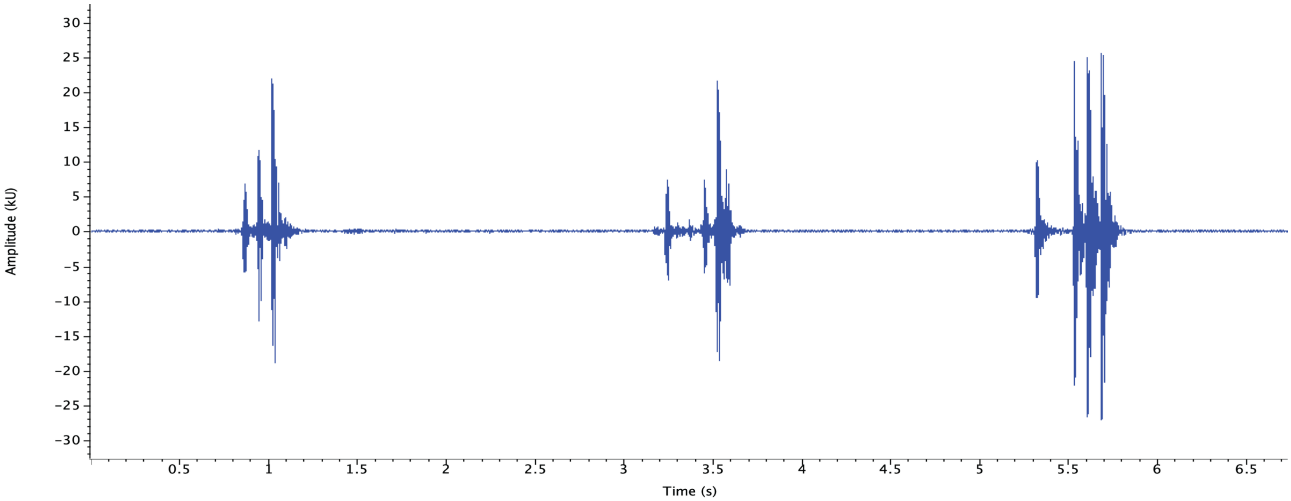


FIGURE 1320. SCD (R94-113) from same male as in Fig. 1319.

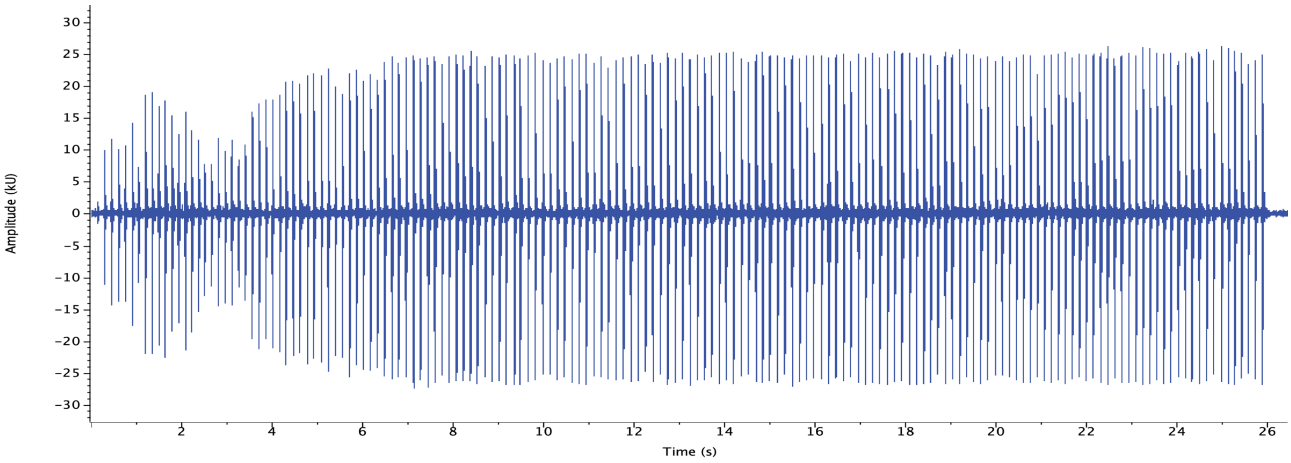


FIGURE 1321. Calling drum (R88-121) adult female allotype *A. stringfellow.*

Derivation of name. Named in reference of the type locality's accidental proximity to the Stringfellow Acid Pits, declared, in the early 1980s, during the Reagan Administration, as California's most toxic Superfund. The site was involved in numerous government irregularities that were labeled Sewergate. The area is currently managed by the California Department of Toxic Substances Control, which estimates that the cleanup effort will take approximately 500 years (Wikipedia, accessed January, 2021).

Habitat. Under trash and rocks on grassy covered hillsides with sparse vegetation.

Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.

Variation. Of 26 individuals, 1 had 2, 24 had 3, and 1 had 4 ventral **fore** leg tibial spurs; 9 had 7 and 17 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 26 had 5 **rear** leg tibial spines, and 20 had 3 and 6 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. The 3 adults from Murrieta Hot Springs (S97-139) appear to have slower calling drum rates than those from the type locality, but the sample size is small.

DNA. Fig. 1284, p. 688. F0065 (S95-8, Jurupa Hills); F1592 (allotype locality, S05-36); and F2085 (holotype, S08-1) are recovered together in Group 24 Southern California #4, and closest to *A. skinner.*

Karyotype. 2n♂=25. Two type locality males (T92-13, S92-49; T05-11, S05-36, Fig. 1322) examined and both consistent: 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

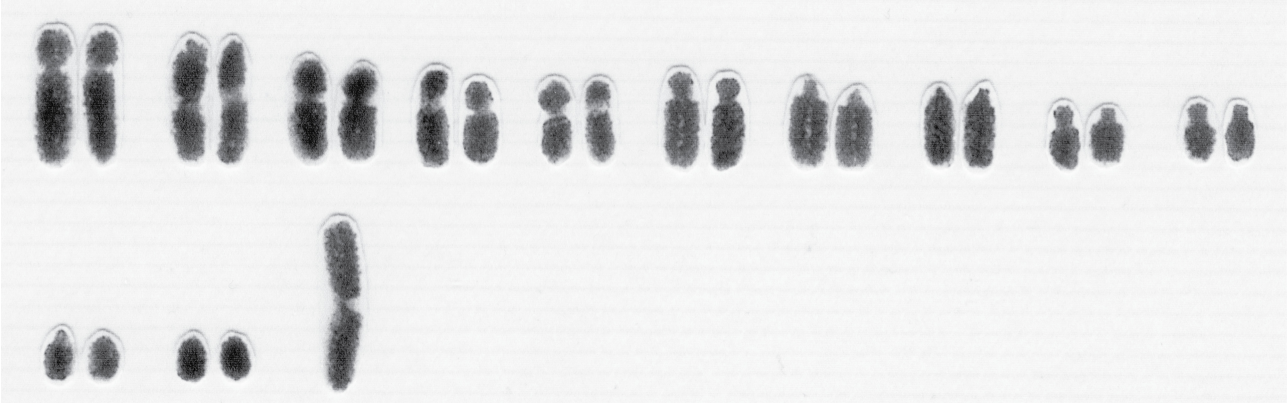


FIGURE 1322. Idiogram T05-11 *A. stringfellow* (S05-36).

Discussion. Microsympatric at allotype locality, and Colton site (S94-6), with less common *A. icenoglei*, but easily separated from latter by drum and not enlarged rear leg tibial inner 3rd spine (Fig. 1314). Some older DBW labels says "Glen Avon", but that entity was incorporated into Jurupa Valley in a 2011 election.

Group 25, Southern California Group #5 (Fig. 1323)

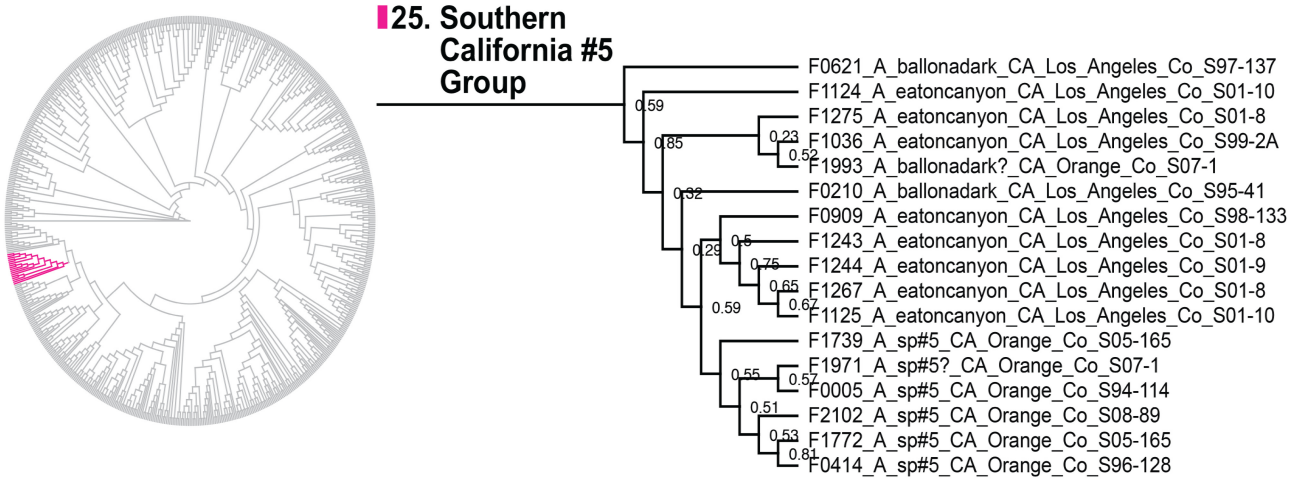


FIGURE 1323. ASTRAL tree for Southern California #5 Group.

This Group contains 2 described (and 1 undescribed) species that drum similarly but differ in chromosome number.

SPECIES WRITE UPS: *A. ballonadark* (2n♂=23, p. 706) and *A. eatoncanyon* (2n♂=25, p. 712).

***Ammopelmatus ballonadark* Weissman, sp. nov.**
Dark Ballona Dunes Jerusalem Cricket
Figs 1324–1334. Table 3

Distribution. (Fig. 1324). Known from a few coastal sandy habitats and dunes in Los Angeles County, California. May get into Orange County, but discussed below with field work continuing.

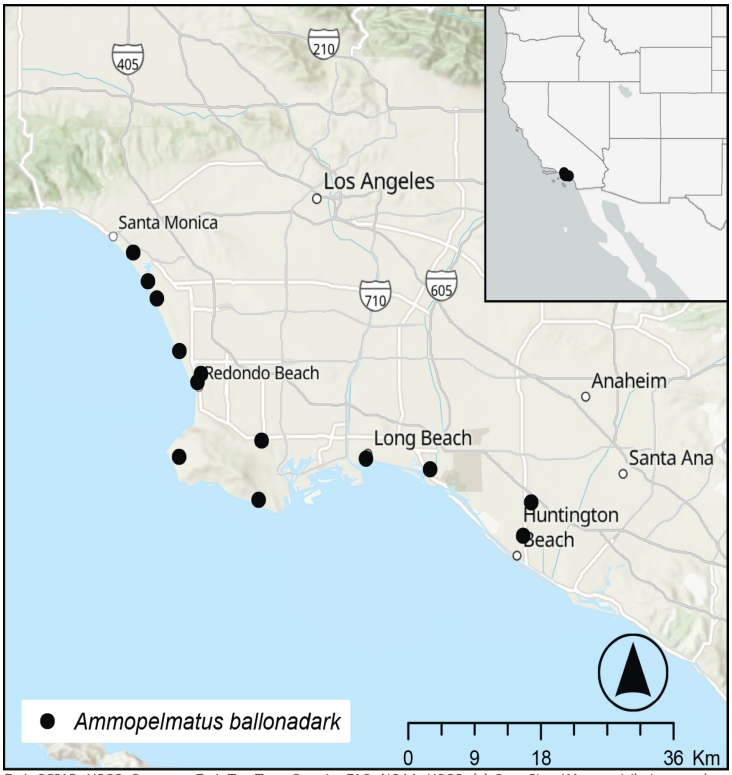


FIGURE 1324. Known distribution of *A. ballonadark.*

Recognition characters. Medium to large sized JC with dark body color and broad, black abdominal stripes, rear leg tibial calcar #1 longest (as opposed to calcar #2 in *A. sakai*), calling drum rate of 5.1–7.0 drums/s, males with sex clarification drum (SCD), 2n♂=23, both sexes equally common (as opposed to female-predominate nymphs in *A. sakai*). Sympatric with *A. sakai*, but separated by lighter color, slower drum (0.6 drums/s), and DNA. Distinguished from 2n♂=23 coastal Santa Monica Mts *A. leei* by DNA. Distinguished by karyotype (2n♂=25) and DNA from Santa Monica Mts *A. lakesherwood*. Distinguished by karyotype (2n♂=25) from more northern, coastal *A. islander*; and by karyotype (2n♂=25) from more southern, coastal *A. oneillpark.* Nearest DNA relative *A. eatoncanyon* is more inland and has 2n♂=25.

Holotype. Male (in alcohol. Fig. 1325A, topotypic male; Fig. 1325B, holotype). **California, *Los Angeles Co.,*** Playa del Rey, Ballona Wetlands, 33.961310° -118.449236°, 2m, 18-xii-1996 (S96-116) DBW & M. Caterino. R97-181 & R97-182, F0593. Molt to adult 6-ix-1997. Deposited CAS, Entomology type #20122. Measurements in mm: Body length 35.31, hind femur length 12.58, hind femur width 4.40. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1326) with 5 inner and 3 outer spines, 2 ventral spurs.

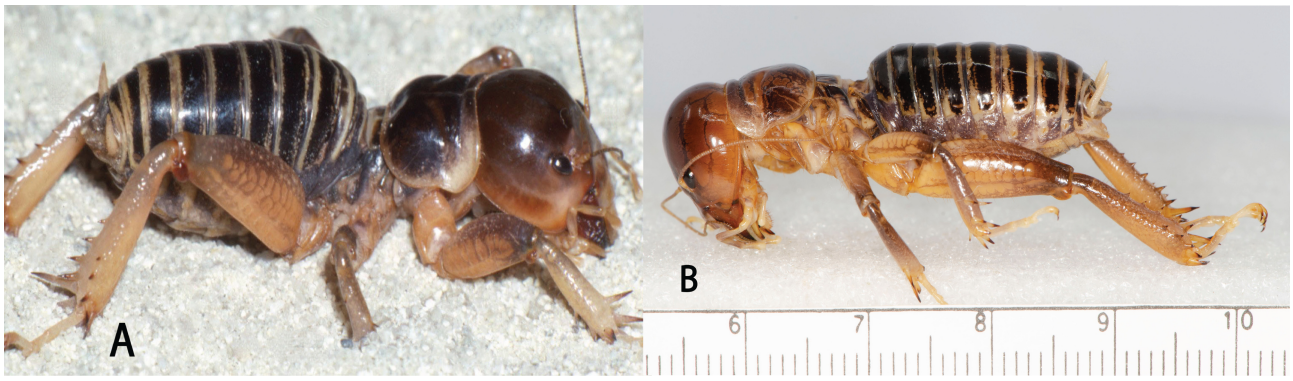


FIGURE 1325. Photos of male *A. ballonadark.* A. Topotypic live adult male (S87-129, R89-94). B. Preserved adult male holotype.



FIGURE 1326. Left rear leg tibia holotype male. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1327). Same collecting information as holotype except R98-166, F0802. Molt to adult 20-ix-1998. Deposited CAS, CASENT #9080795. Measurements in mm: Body length 43.04, hind femur length 12.49, hind femur width 4.85. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1328) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1329.



FIGURE 1327. Adult female allotype *A. ballonadark.* A. When alive. B. When preserved.

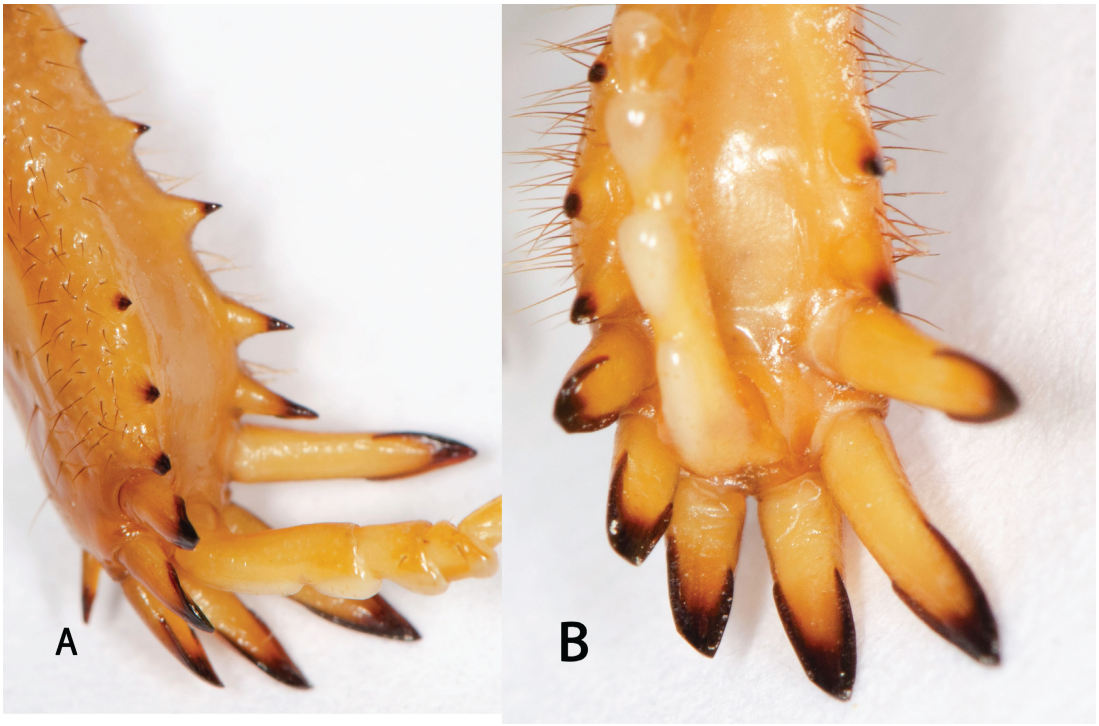


FIGURE 1328. Left rear leg tibia in adult female allotype



FIGURE 1329. Ovipositor allotype *A. ballonadark.*

Paratypes. ♂31 ♀35. **CALIFORNIA, *Los Angeles Co.,*** type locality Ballona Wetlands, 13-i-1985 (S85-4) WH Sakai ♂1; 14-iv-1985 (S85-40) WH Sakai ♂3; 10-xi-1985 (S85-126) WH Sakai ♂1 ♀3; 23-xi-1985 (S85-134) WH Sakai ♀1; 22-xii-1985 (S85-147) WH Sakai ♂2 ♀2; 4-x-1986 (S86-129) WH Sakai ♂1 ♀2; 15-xi-1986 (S86-152) WH Sakai ♀1; 23-xii-1986 (S86-172) ♀6; 21-xii-1987 (S87-129) ♂2 ♀2; 9-ii-1988 (S88-4) WH Sakai ♂2 ♀2; 21-xii-1988 (S88-127) ♀1; late February, 1989 (S89-5 & S89-7) W. Sakai ♀4; 11-iii-1989 (S89-7) W. Sakai ♂1; 1-iv-1989,WH Sakai ♀1; 17-ix-1990 (S90-99) FT Hovore ♂1; 15-xii-1990 (S90-108) ♂1 ♀1; 12-i-1991 W. Sakai ♀1; 2-iii-1992 (S92-13) ♂1; 20-xii-1992 (S92-143) ♂4; 4-xi-1996 (S96-88) WH Sakai ♀1; 29-xi-1997 (S97-137) WH Sakai ♀2; 20-xii-1998 (S98-131) ♂1. Playa del Rey, 31-x-1985 (S85-119) W. Sakai ♂1; 2-xii-1985 (S85-150) WH Sakai ♂1. East Long Beach, 33.766386° -118.183354°, 13m, 23-x-2007 (S07-103) R. James ♂1. El Segundo, 23-xi-1985 (S85-135) WH Sakai ♂1. El Segundo Dunes, 33.942506° -118.438447°, 38m, ii-1988 D. Hawks ♀1. Lomita, 1833 261st St, 33.786176° -118.310694°, 37m, 29-iv-2006 (S06-22) C. Perkins ♂1. Manhattan Beach, 33.884733°

-118.410902°, 30m, 20-x-2005 (S05-155) B. Lacey ♂1. Palos Verdes Estates, Paseo Lunado Dr., 33.768314° -118.411230°, 91m, 18-v-1995 (S95-41) GF Pratt ♂1 ♀1. Redondo Beach, 33.850591° -118.3888848°, 13-x-1986 (S86-137) WH Sakai ♂1; 30-v-1987 (S87-43) W. Sakai ♀1. Redondo Beach, 1613 Spreckles Ln, 33.859538° -118.384592° 51m, T. Yagi, ♀1. San Pedro, 28 Titan Dr, 33.721143° -118.314298°, 111m, 20-xi-2005 (S05-170) T. French ♂1. Santa Monica, 3rd St and Pacific, 18-iii-1987 (S87-11) W. Sakai, 1 male for testes; Venice, 513 ½ San Juan Ave., 33.992906° -118.467241°, 7m, 26-x-2005 (S05-158) B. Sackett ♂1. Venice, 11-xi-1992, W. Sakai ♀1.

Drum. Calling drum similar in both sexes except longer in female and male with a sex clarification drum. **Male:** Holotype (R97-182, Fig. 1330) with 63 drums in 11.5s (5.5 drums/s) at 19.5°C. **Female:** Allotype (R98-166, Fig. 1331) with 152 drums in 25.6s (5.9 drums/s) at 18.5°C.

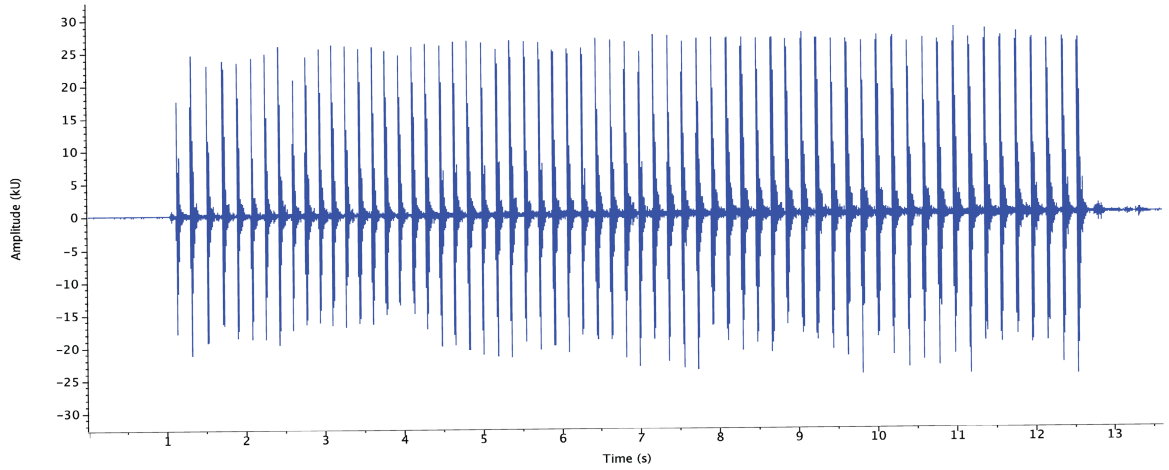


FIGURE 1330. Calling drum (R97-182) holotype adult male *A. ballonadark*.

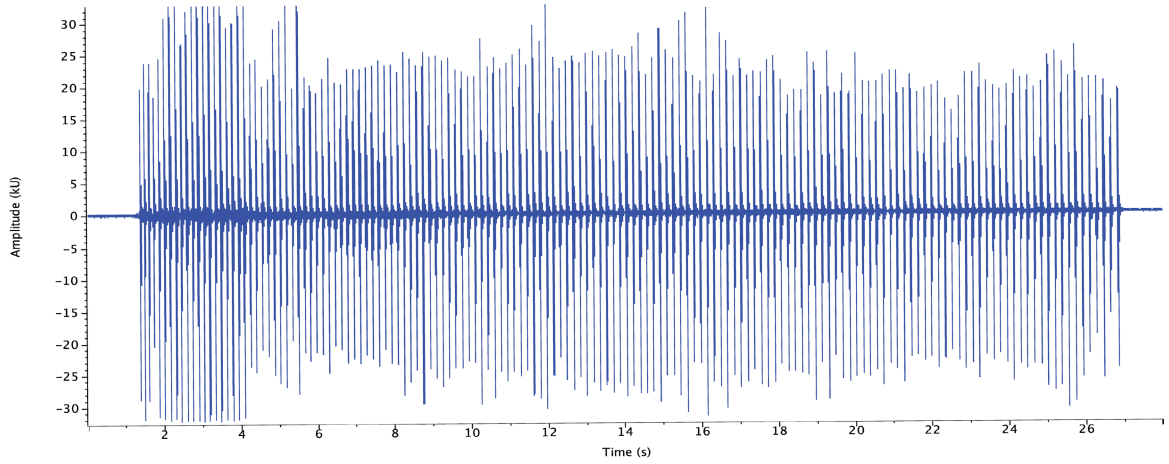


FIGURE 1331. Calling drum (R98-166) allotype adult female *A. ballonadark.*

Derivation of name. Named after the locality with the most collected individuals, and to distinguish it from the sympatric, light body-colored *A. sakai.*

Habitat. Coastal sandy habitats and low-lying sand dunes, as far as 14 blocks from the beach (e.g., S05-155). At type locality, found under construction debris.

Life cycle and seasonal occurrence. Apparent 2-year typical life cycle.

Variation. From 34 individuals, all had 3 ventral **fore** leg tibial spurs; 5 had 7 and 28 had 8 **middle** leg tibial calcars, all had 2 ventral spurs; 30 had 5 and 4 had 6 inner **rear** leg tibial spines, and 32 had 3 and 2 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs.

DNA. Fig. 1323, p. 706. F0210 (S95-41, Pales Verdes Peninsula); F0621 (S97-137, type locality) both recovered in Group 25 Southern California #5, closest to inland *A. eatoncanyon.*

Karyotype. 2n♂=23. Three males T88-4 (Fig. 1332, S88-4), T88-19 (Fig. 1333, S87-129), and T88-22 (S87-

129) all from the type locality checked. All show 6 metacentric or submetacentric autosomal pairs; 5 acrocentric or telocentric autosomal pairs; and 1 metacentric X.

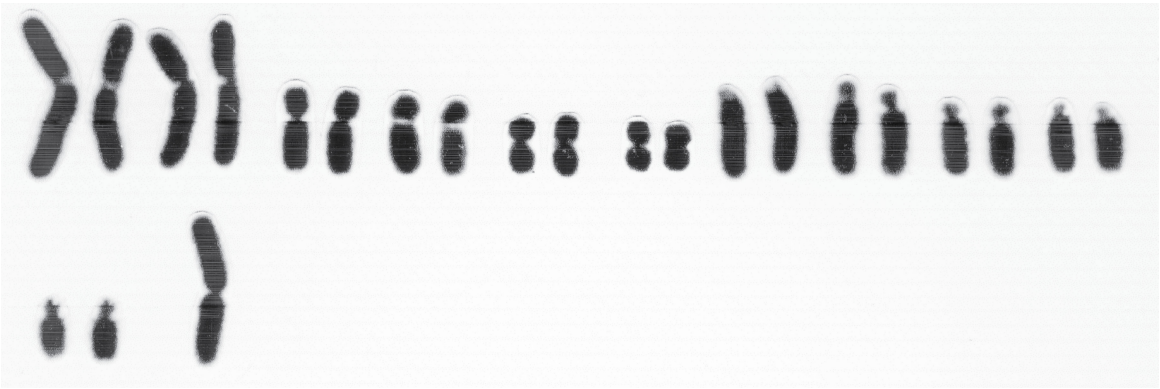


FIGURE 1332. Idiogram T88-4 (from type locality, S88-4) *A. ballonadark*.



FIGURE 1333. Idiogram T88-19 (from type locality, S87-129) *A. ballonadark*.

Discussion. A. ballonadark individuals microsympatric, and more common than *A. sakai* at type locality. At coastal Hellman Ranch, in Orange Co. near Seal Beach (S07-1), both a light male (Fig. 1334A, F1971, R07-52, 7.8 drums/s at 20°C) and dark female (Fig. 1334B, F1993, R07-72, 5.4 drums/s at 16°C) occur of what we think may be *A. ballonadark*, since they are recovered together with type locality material. Nevertheless, we want to check karyotypes at Hellman Ranch since *A. ballonadark* has 2n♂=23; and more southern *A. oneillpark* has 2n♂=25, the latter also recovered in that same clade. To further complicate this situation, a third Hellman Ranch dark male individual (S07-99, R07-69) drummed similarly (7.6 drums/s at 19°C) but his DNA (F1987) was recovered elsewhere near *A. ballmeri* and *A. cahuilaensis.*

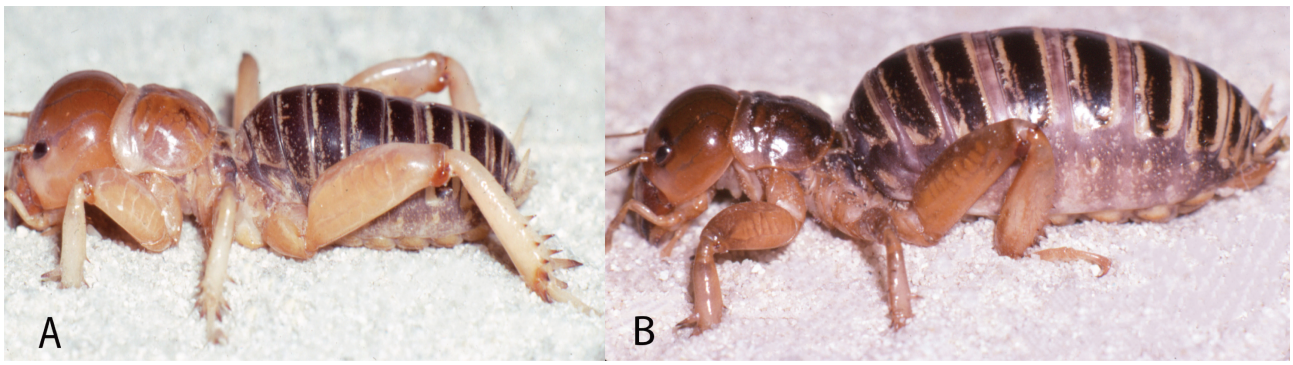


FIGURE 1334. Two color phases of possibly live adult *A. ballonadark* from Hellman Ranch (both S07-1). A. Male R07-52, F1971. B. Female R07-72, F1993.

***Ammopelmatus eatoncanyon* Weissman, sp. nov.**
Eaton Canyon Jerusalem Cricket
Figs 1335–1348, Tables 3, 19

Species #6, Weissman 2001a, p. 69. Mislabeled as from Santa Monica Mts in Weissman (2001a, p. 61), but this is the species that deploys, if rarely, an anal, defensive discharge.

Distribution. (Fig. 1335). Known only from a narrow, linear area 7.3 km in length, on the southern side of the San Gabriel Mts, between Eaton Canyon Natural Area and Arcadia Wilderness Park, Los Angeles Co., California.

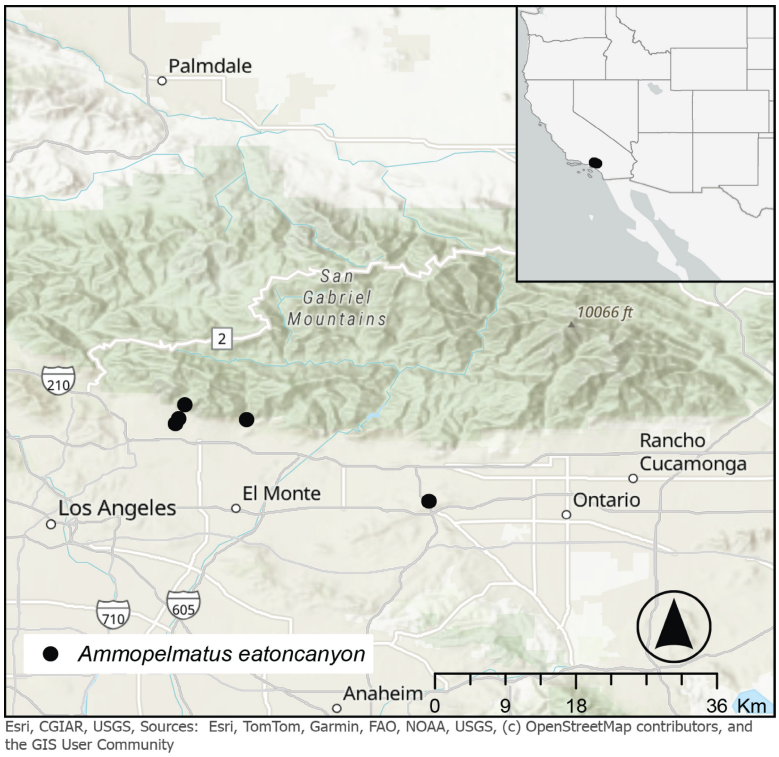


FIGURE 1335. Distribution of *A. eatoncanyon.*

Recognition characters. Medium-large size, medium fast drumming JC with SCD, 2n♂=25, frequently with purple areas on the lower sections of the abdomen. Separated (Table 19) from the five other San Gabriel Mt JCs species by drum rate and DNA.

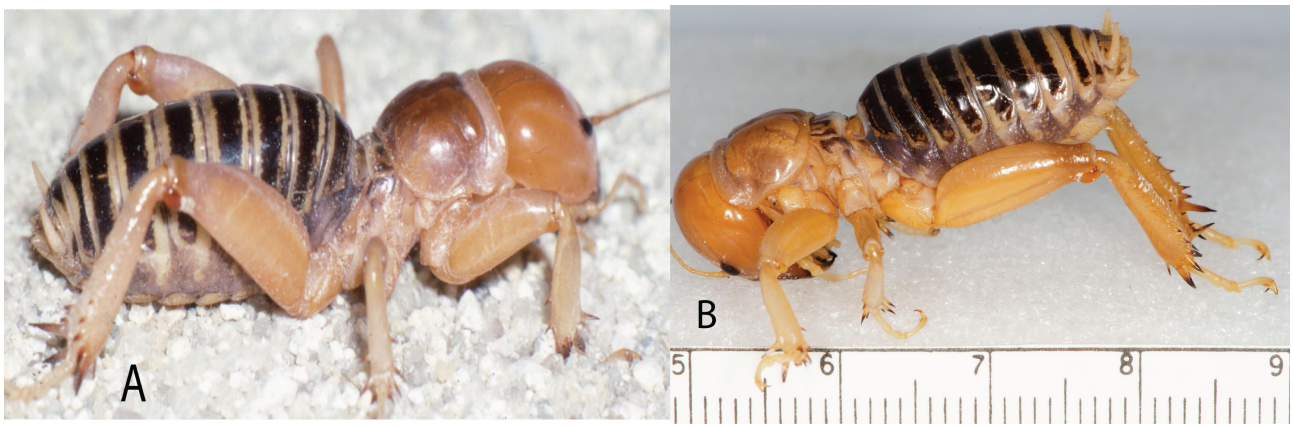


FIGURE 1336. Holotype adult male *A. eatoncanyon.* A. When alive. B. When preserved.

Holotype. Male (in alcohol, Fig. 1336). **California, *Los Angeles Co.,*** Eaton Canyon Natural Area, 34.177131° -118.097064°, 292m, 25-ii-2001 (S01-10) DBW & VF Lee. R01-121, R01-123, F1248. Molt to adult 10-x-2001. Deposited CAS, Entomology type #20184. Measurements in mm: Body length 32.86, hind femur length 11.65, hind femur width 4.42. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1337) with 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 1337. Left rear leg tibia adult male holotype *A. eatoncanyon.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1338). **California, *Los Angeles Co.,*** Henninger Flats Natural Area, 34.193461° -118.090022°, 774m, 25-ii-2001 (S01-9) DBW & VF Lee. R01-110. Molt to adult 30-ix-2001. Deposited CAS, CASENT #9078746. Measurements in mm: Body length 40.43, hind femur length 11.67, hind femur width 4.64. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1339) with 4 or 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1340.

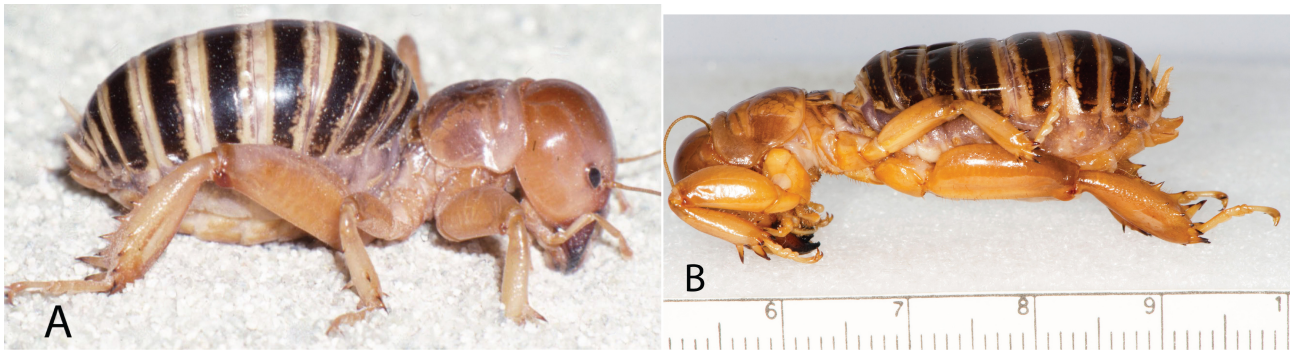


FIGURE 1338. Adult female allotype *A. eatoncanyon.* A. When alive. B. When preserved.

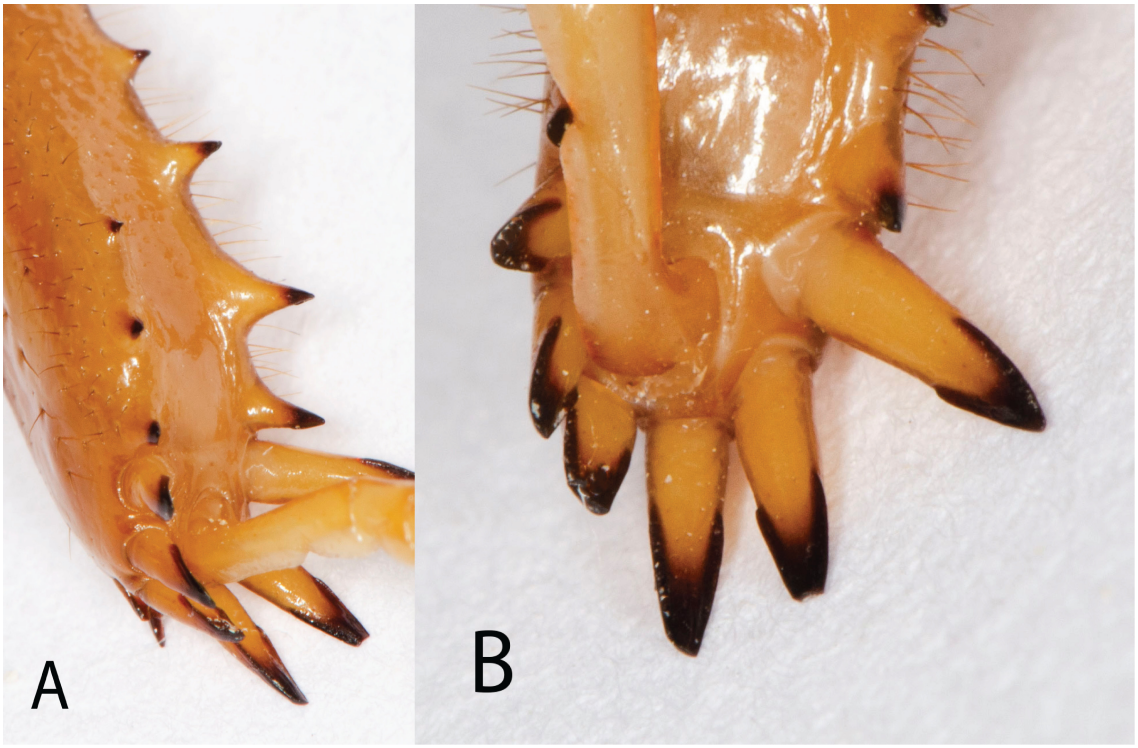


FIGURE 1339. Left rear leg tibia holotype adult female *A. eatoncanyon.* A. Showing 3 outer and 4 inner spines. B. Showing shape of calcars.

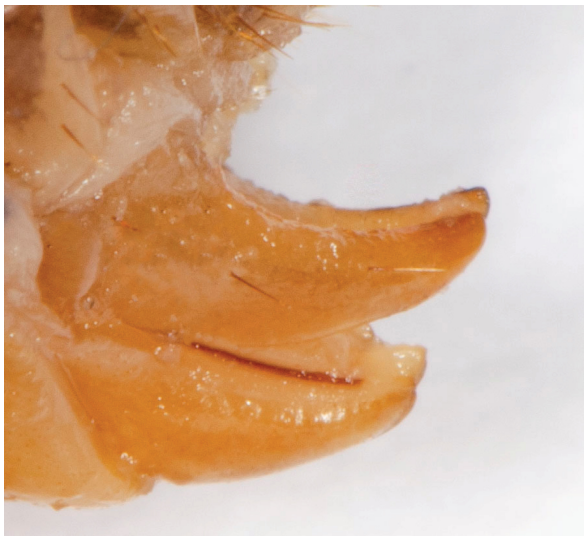


FIGURE 1340. Ovipositor allotype *A. eatoncanyon*.

Paratypes. ♂18 ♀48. **CALIFORNIA**, ***Los Angeles Co.,*** Holotype locality, 26-xii-1982 (S82-152) ♂1 ♀4; 23-xii-1983 (S83-164) ♂4 ♀9; 14-iii-1985 (S85-31) ♂1 ♀5; 18-x-1986 (S86-140) ♂3 ♀4; 25-ii-2001 (S01-10) ♂1 ♀10. Allotype locality, 25-ii-2001 (S01-9) ♂2 ♀13. Arcadia Wilderness Park, 34.176008° -118.019161°, 258m, 25-ii-2001 (S01-8) ♂2 ♀3. Pasadena, 1445 Coolidge Ave, 34.171090° -118.100786°, 266m, 9-xi-1998 (S98-133) G. Lockhard ♂1.

Possible placement. An individual (F1036) from San Dimas, Bonelli Park, 34.0795° -117.8100°, 312m, I. Swift, 30-x-1998 (S98-107) ♂2 ♀1 & 22-i-1999 (S99-2A) ♂1, was recovered near both *A. ballonadark* and *A. eatoncanyon.* He drummed [R99-111] at 6.0 drums/s, at 18°C, and had a sex clarification drum. Given his inland location, some 29 km SE of the type locality, he is most consistent with *A. eatoncanyon.* Unfortunately, we lack a

karyotype since *A. ballonadark* [2n♂=23] and *A. eatoncanyon* [2n♂=25], which are very similar, can be separated by chromosome count.

Drum. Calling drums similar in both sexes except that males with a sex clarification drum (SCD). **Male:** Holotype R01-123 (Fig. 1341) with 45 drums over 8.0s (5.6 drums/s) at 19°C. Paratype R01-102, S01-9 (Fig. 1342) with 3 SCD, the longest of 9 drums over 1.1s (8.1 drums/s) at 19°C. **Female:** Allotype R01-110 (Fig. 1343) with 59 drums over 8.4s (7 drums/s) at 18°C.

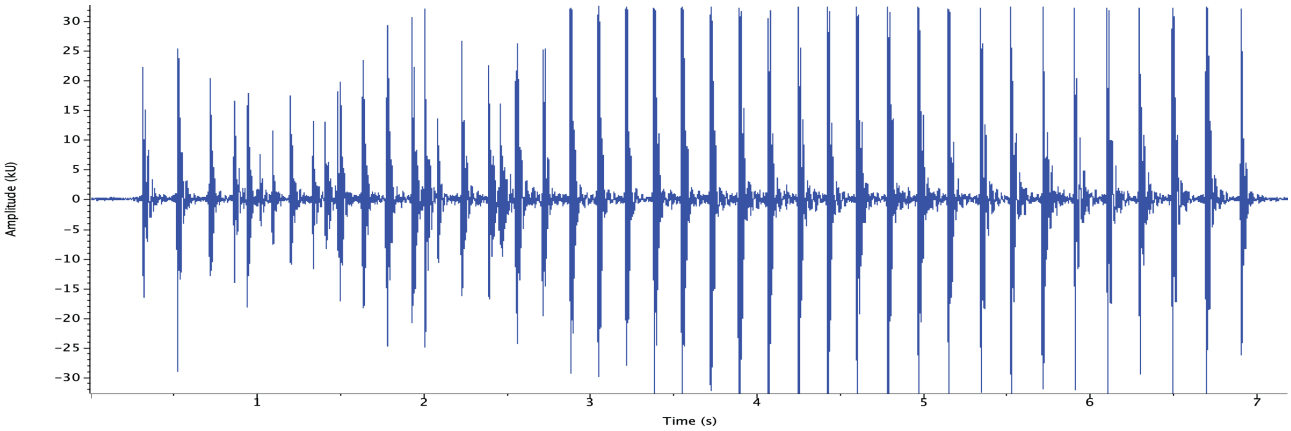


FIGURE 1341. Calling drum (R01-123) of holotype adult male *A. eatoncanyon*.

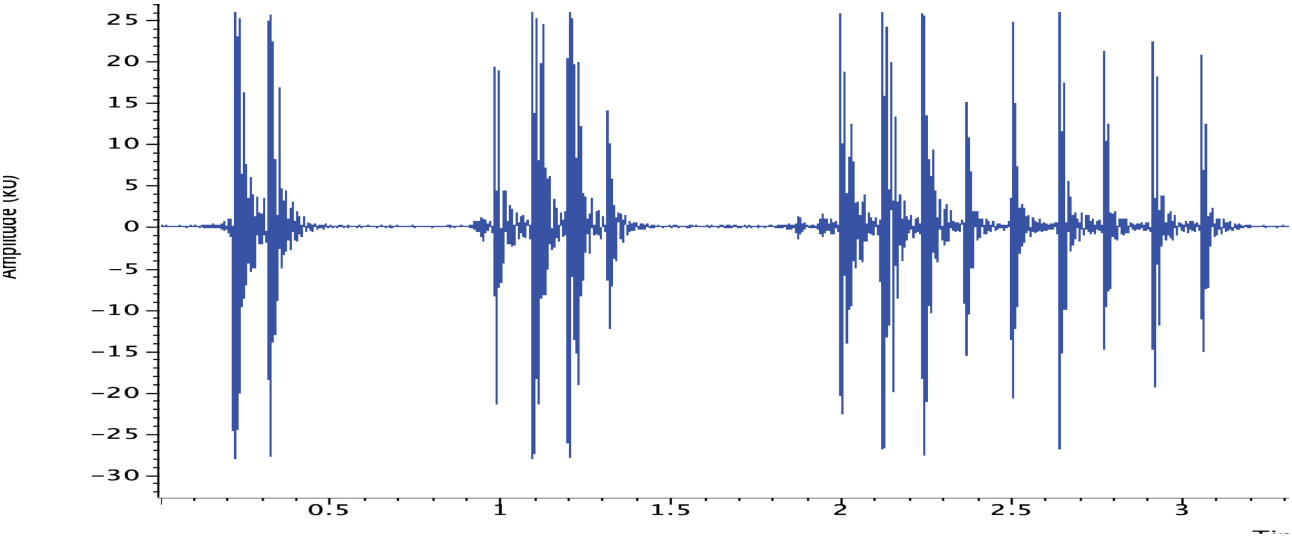


FIGURE 1342. Sex clarification drums (R01-102) paratype adult male *A. eatoncanyon*.

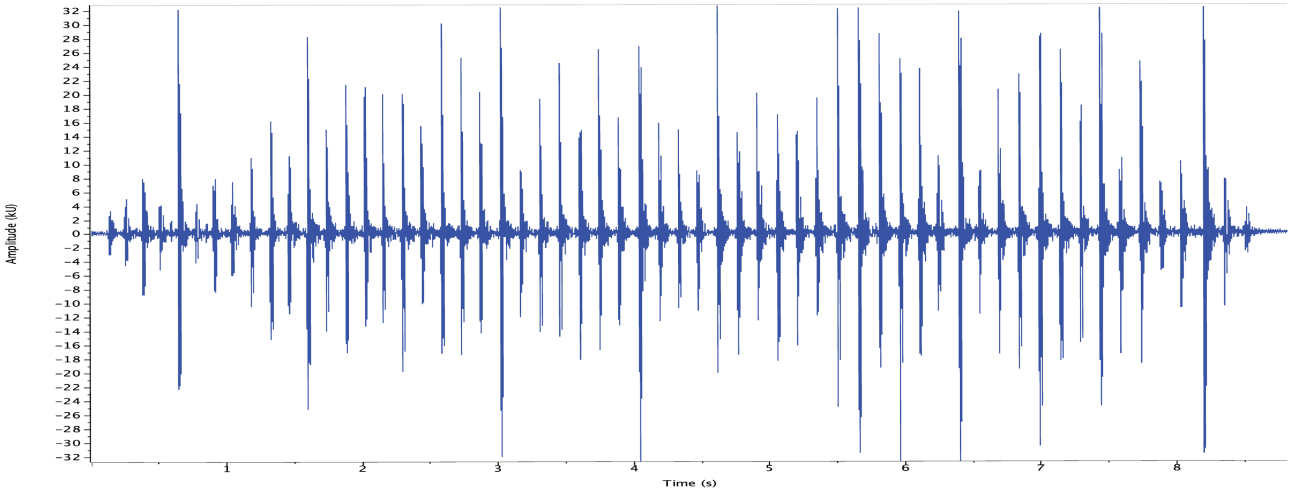


FIGURE 1343. Calling drum (R01-110) allotype adult female *A. eatoncanyon*.

Individuals of both sexes, from paratype locality Wilderness Park (S01-8), were recorded at either 15°C and 18.5-19°C, so we also present those results: **Male:** R01-148 with 87 drums over 17.5s (5.0 drums/s); **Female:** R01-143 with 93 and 317 drums over 19s (4.9 drums/s) and 63s (5.0 drums/s) respectively), both at 15°C. **Male:** R01-132 (Fig. 1344) shows 57 drums over 7.5s (7.6 drums/s) at 19°C; **Female:** R01-114 (Fig. 1345) shows 69 drums over 9.3s (7.4 drums/s) at 18.5°C.

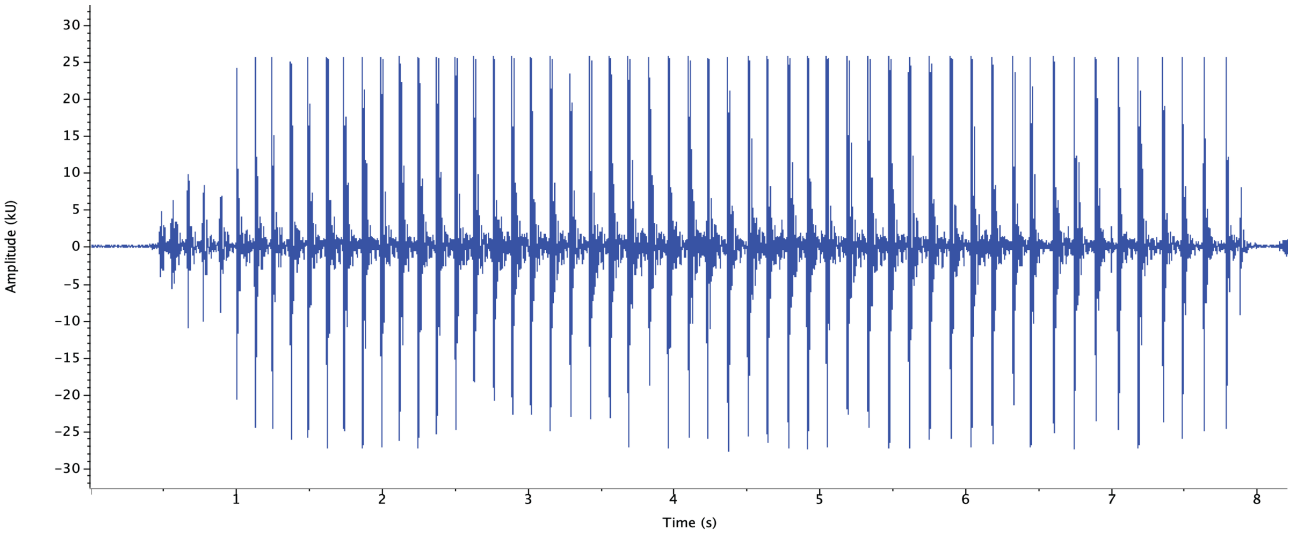


FIGURE 1344. Calling drum (R01-132) paratype adult male *A. eatoncanyon*.

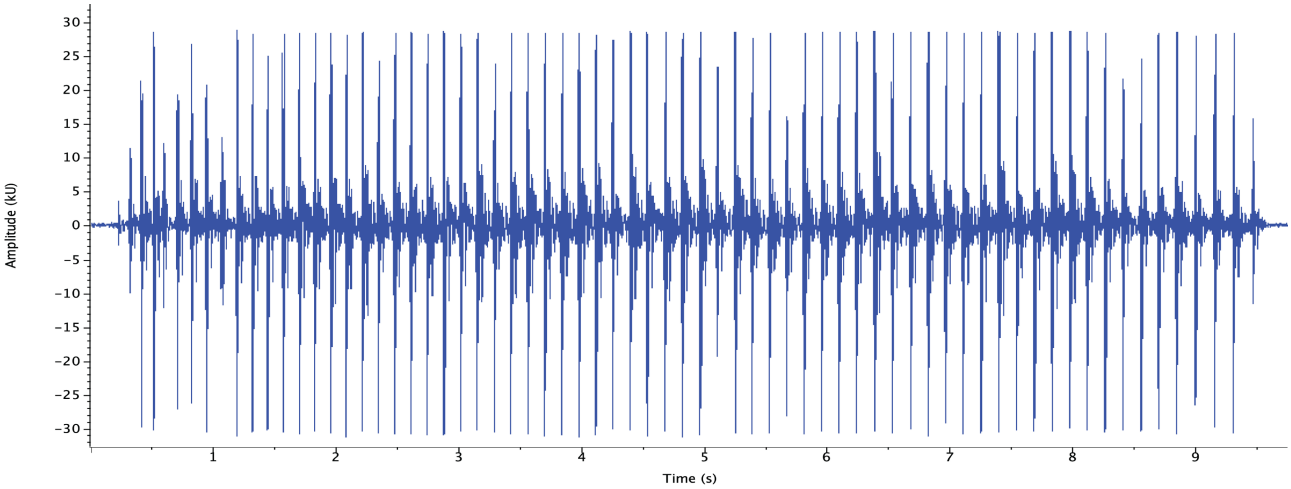


FIGURE 1345. Calling drum (R01-114) paratype adult female *A. eatoncanyon*.

Derivation of name. Named in reference to the holotype locality.

Habitat. Holotype locality is mixed-shrub riparian while higher Henninger Flats area with pines, *Rhus, Yucca,* and grasses. Wilderness Park site is dry river bed bottom and flood plain area, with rocks and various shrubs.

Life cycle and seasonal occurrence. Apparent 2-year typical life cycle.

Variation. Of 45 individuals, all had 3 ventral **fore** leg tibial spurs;10 had 7 and 34 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 44 had 5 inner **rear** leg tibial spines, and 44 had 3 and 1 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. In general, rear leg inner tibial spine #1 is longer than #2 which is longer than #3. Head color varies from brown (Fig. 1338) to orange (Fig. 1336).

DNA. Fig. 1323, p. 706. F0909 (S98-133, Pasadena); F1036 (S99-2A, Bonelli Park); (F1124 & F1125 (both type locality, S01-10); F1243 (S01-8, Wilderness Park); F1244 (S01-9, Henninger Flats); F1267 (S01-8, Wilderness Park); F1275 (S01-8, Wilderness Park) recovered in Group 25 Southern California #5, along with *A. ballonadark* (2n♂=23) and *A.* sp. #5.

Karyotype. 2n♂=25. Three males examined and all consistent: Type locality Eaton Canyon T01-16 (Fig. 1346, S01-10); Arcadia Wilderness Park T01-46 (Fig. 1347, S01-8); and allotype locality Henninger Flats T01-47 (Fig. 1348, S01-9) all with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome.

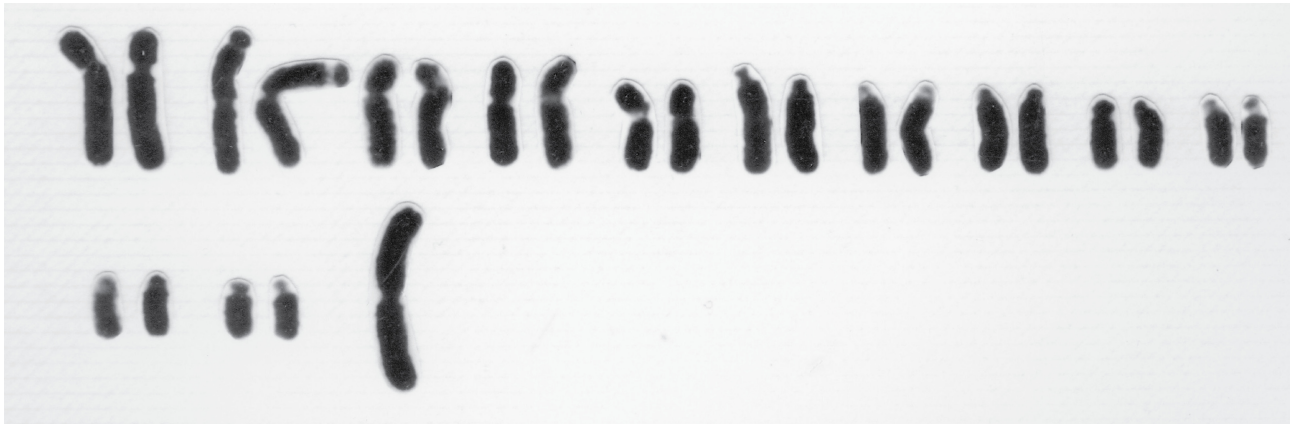


FIGURE 1346. Idiogram T01-16 *A. eatoncanyon* (S01-10).

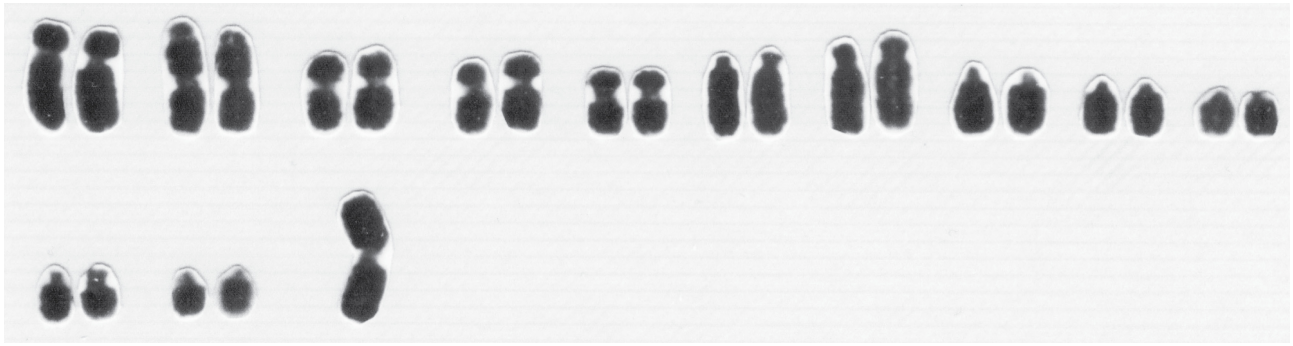


FIGURE 1347. Idiogram T01-46 *A. eatoncanyon* (S01-8).

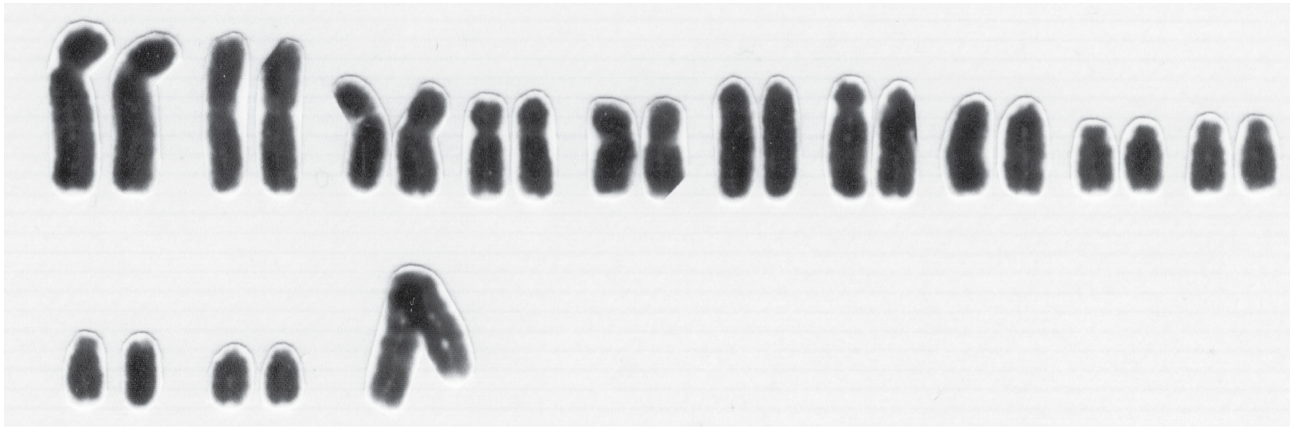


FIGURE 1348. Idiogram T01-47 *A. eatoncanyon* (S01-9).

Discussion. We chose an allotype from a site ~2 km away, and ~470 m higher, than the holotype site because we had no photographs of live females from the holotype locality.

Microsympatric at Eaton Canyon and Arcadia Wilderness Park with *A. mahogani.* In 1982, equal numbers of nymphs of both species were found, at the type locality, by turning over rocks along nature trails. In 2001, during a wet year, *A. eatoncanyon* more common than *A. mahogani,* although latter appears to prefer more shaded microhabitats.

The type locality Eaton Canyon Nature Center was ravaged by the catastrophic Eaton Fire of January, 2025: https://www.latimes.com/travel/newsletter/2025-01-16/the-wild-eaton-canyon-nature-recovery-the-wild

Group 26, Santa Monica Mts Group (Fig. 1349)

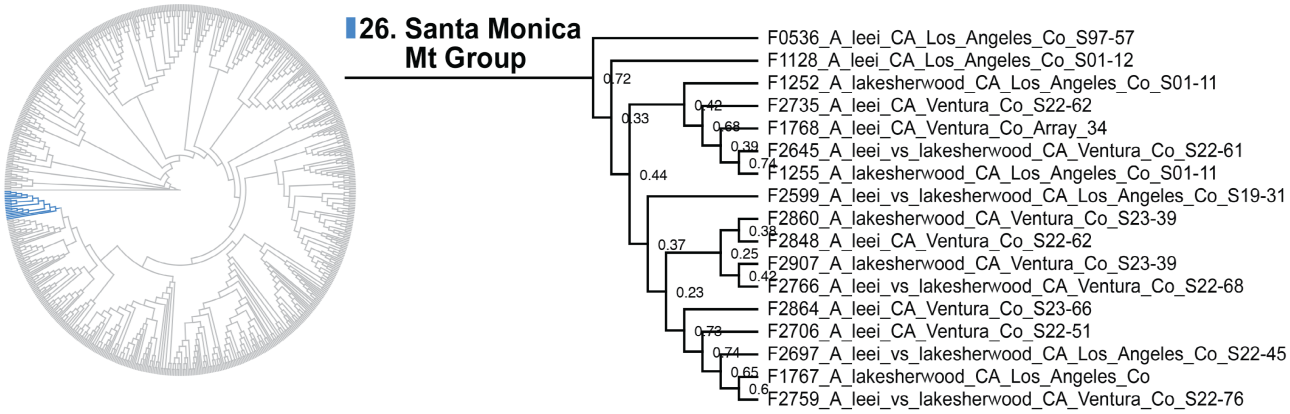


FIGURE 1349. ASTRAL tree for Santa Monica Mt Group.

This Group contains two species with identical morphology, ecology, and calling drums, and only differ in 2n♂=23 in *A. leei* vs 2n♂=25 in *A. lakesherwood.*

SPECIES WRITE UPS: *A. lakesherwood* (p. 718) and *A. leei* (p. 725).

***Ammopelmatus lakesherwood* Weissman, sp. nov.**
Lake Sherwood Jerusalem Cricket
Figs 1350–1364, Tables 3, 10, 23

Distribution. (Fig. 1350). Only known from the Santa Monica Mts and the Simi Hills, in Los Angeles and Ventura Counties, California.

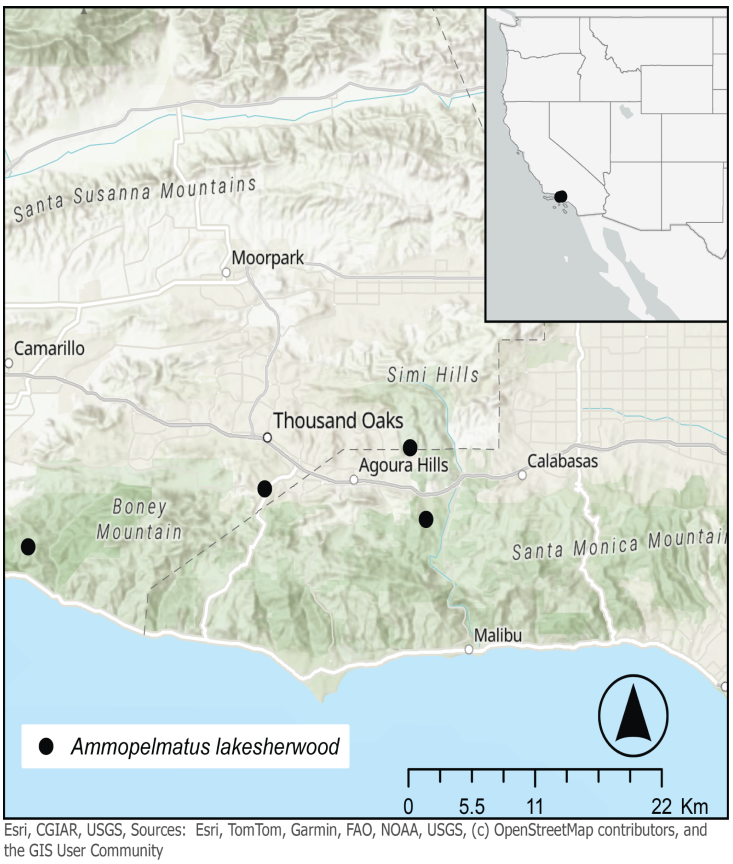


FIGURE 1350. Distribution of *A. lakesherwood.*

Recognition characters. A large, dark, medium-fast drumming, sometimes megacephalic JC only known from the Santa Monica Mts, and north across Hwy 101 in the Simi Hills. 2n♂=25. Morphologically inseparable from, and with similar drumming rate as *A. leei* (Figs 1351 & 1352), but latter species has 2n♂=23. Recovered together in Astral tree as nearest neighbors. Not known to be anywhere microsympatric and cytologically documented hybrids (with 2n♂=24) unknown. Can only be separated from 2n♂=25 *A. islander*, to the west of the Santa Monica Mts, by differences in DNA.

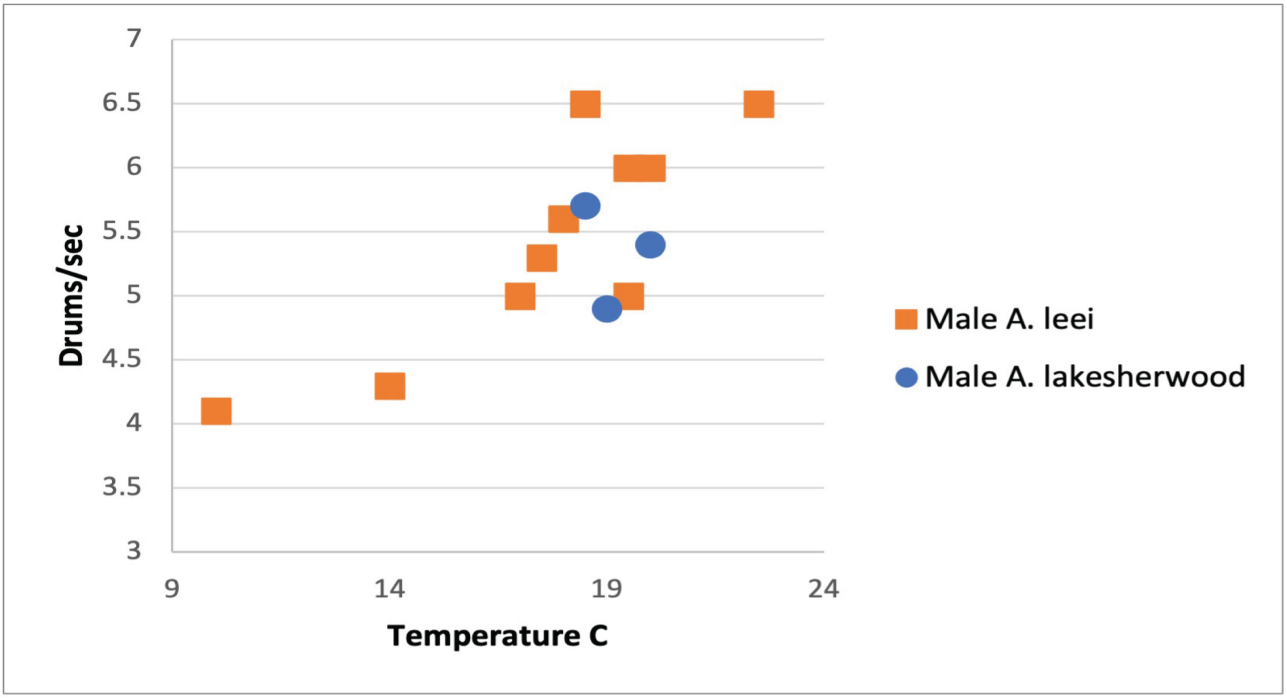


FIGURE 1351. Regression of temperature vs drumming rate in male *A. leei* compared to *A. lakesherwood.*

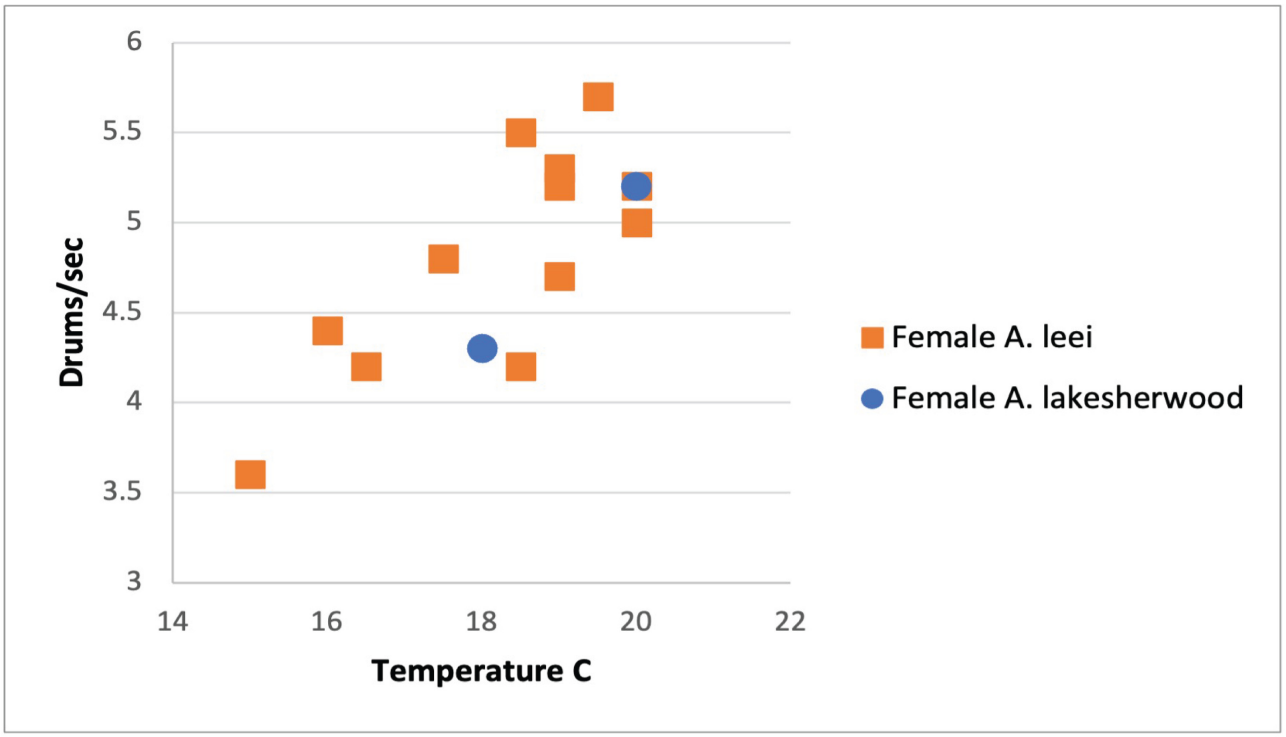


FIGURE 1352. Regression of temperature vs drumming rate in female *A. leei* compared to *A. lakesherwood.*

Holotype. Male (in alcohol, Fig. 1353). **California, *Ventura Co.,*** Highway 23S just east of Lake Sherwood Reservoir, 34.142062° -118.850754°, 289m, 25-ii-2001 (S01-11) DBW & VF Lee. R01-97, F1252. Molt to adult 18-ix-2001. Deposited CAS, Entomology type #20123. Measurements in mm: Body length 40.45, hind femur length 14.85, hind femur width 5.64. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1354) with 5 inner and 3 outer spines, 2 ventral spurs.

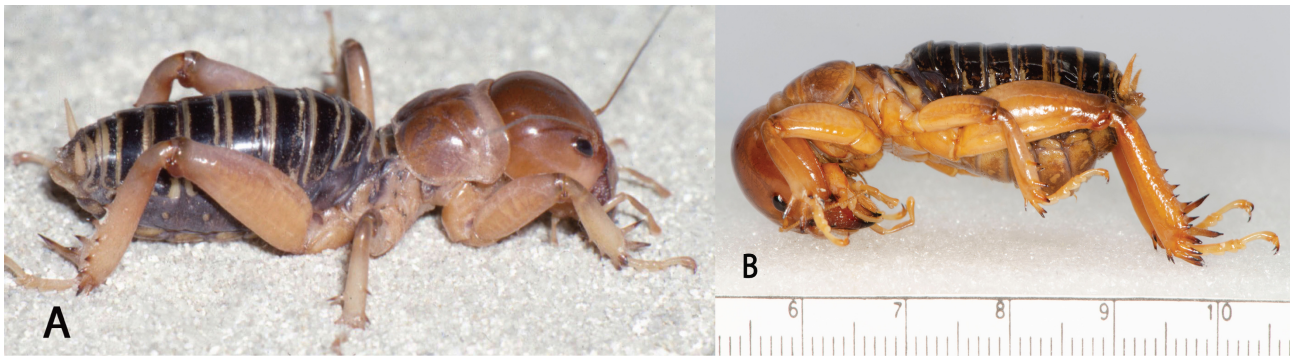


FIGURE 1353. Holotype adult male *A. lakesherwood.* A. When alive. B. When preserved

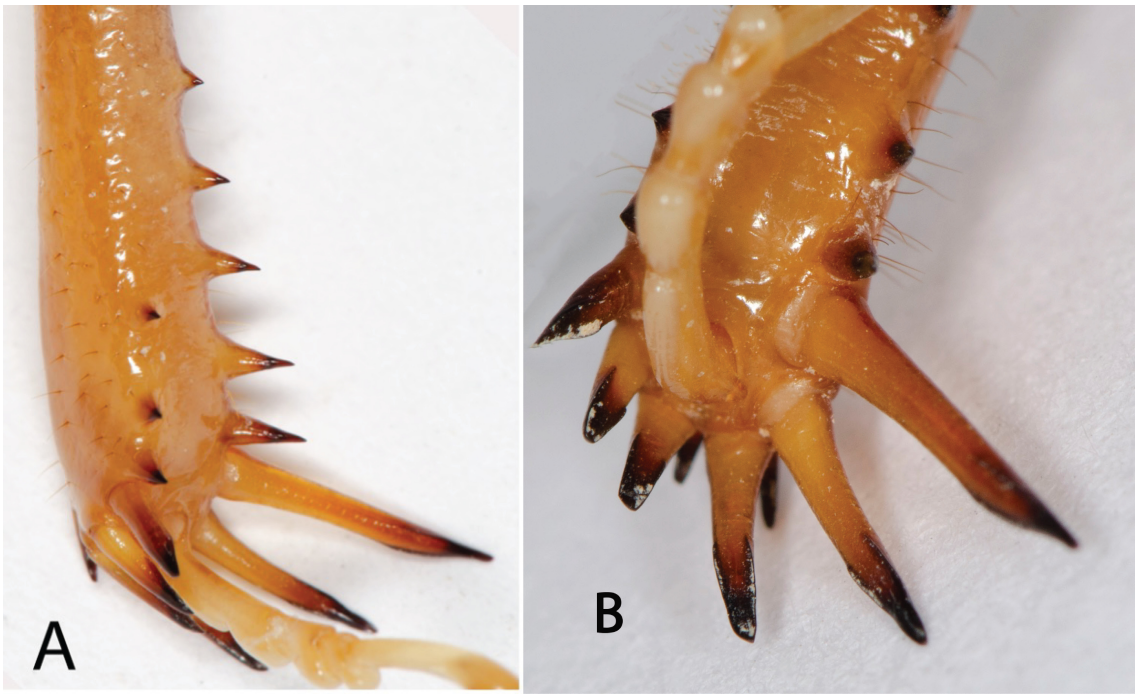


FIGURE 1354. Left rear leg tibia adult male holotype *A. lakesherwood.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1355). Same data as holotype except R01-117, F1255. Molt to adult 8-x-2001. Deposited CAS, CASENT #9078852. Measurements in mm: Body length 42.03, hind femur length 11.84, hind femur width 5.09. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1356) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1357.



FIGURE 1355. Adult female allotype *A. lakesherwood.* A. When alive. B. When preserved.

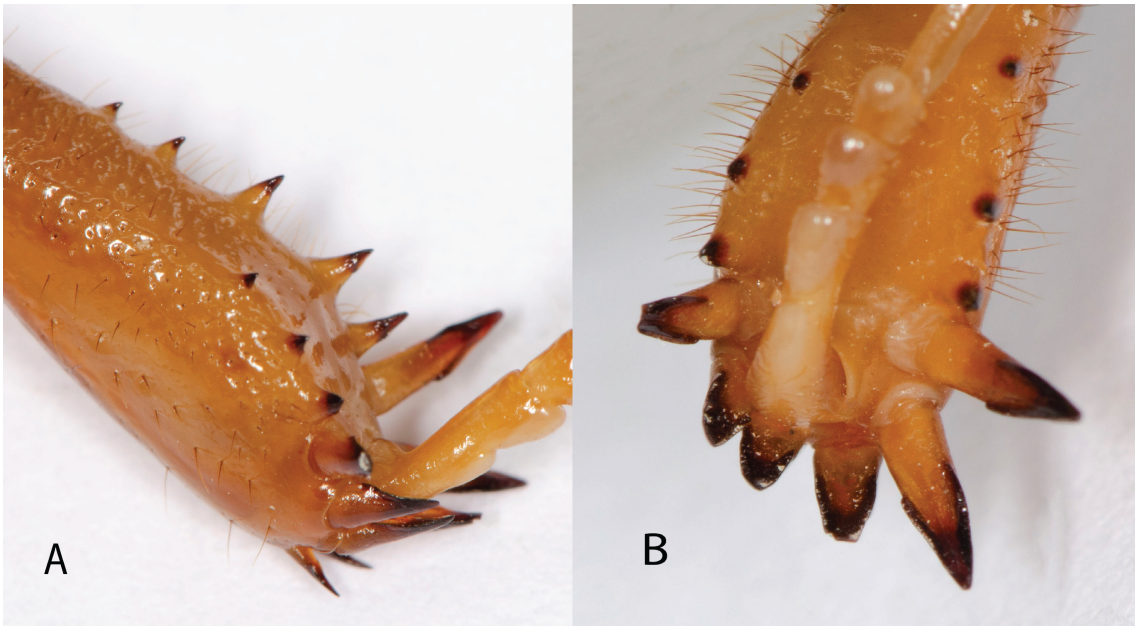


FIGURE 1356. Left rear leg tibia adult female allotype *A. lakesherwood.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1357. Ovipositor allotype *A. lakesherwood*.

Paratypes. ♂2 ♀5. All citations confirmed by male karyotype counts. **CALIFORNIA, *Los Angeles Co.,*** Same data as holotype, ♂2 ♀1. Santa Monica Mts, Array 111, 34.121845° -118.724873°, 223m, 17-vi-2023 (S23-62) K. Delaney ♂1 for testes. Simi Hills, Lower Cheeseboro, 34.169266° -118.737304°, 344m, A. Vandergast ♂1 for testes. ***Ventura Co.,*** Santa Monica Mts, Array 28, 34.103640° -119.035336°, 232m, 23-28-iv-2023 (S23-39) K. Delaney ♂1 for testes, ♀4.

Drum. Calling drums similar in both sexes except longer in females and males with a sex clarification drum. **Male:** Holotype R01-97 (Fig. 1358) with 66 drums (first 5 irregular drums not counted) in 12.0s (5.5 drums/s) at 20°C. **Female:** Allotype R01-117 (Fig. 1359) with 143 drums (first few irregular drums not counted) in 33.4s (4.3 drums/s) at 18°C.

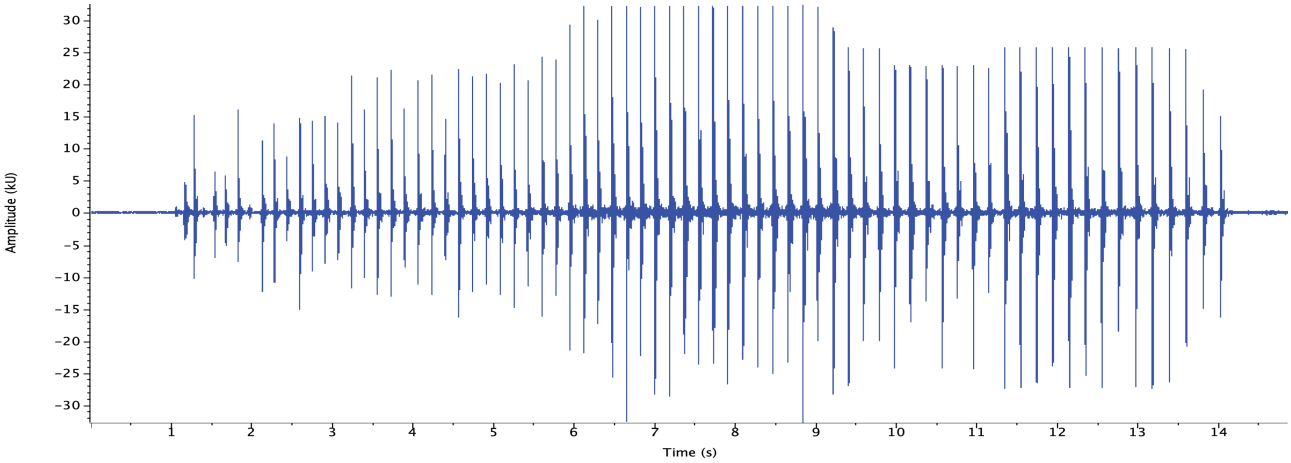


FIGURE 1358. Calling drum (R01-97) adult male holotype *A. lakesherwood.*

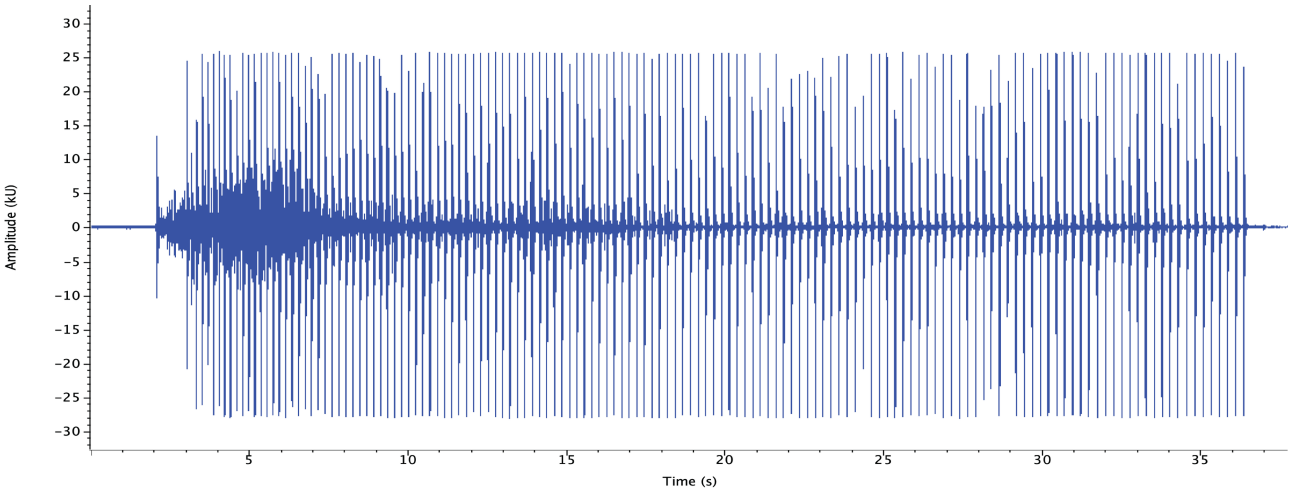


FIGURE 1359. Calling drum (R01-117) adult female allotype *A. lakesherwood.*

Derivation of name. Named after the proximity of the type locality to Lake Sherwood Reservoir.

Habitat. Open hillsides with chaparral vegetation. Under rocks on super saturated soil during a wet winter.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. From 7 individuals (including 2 late instar males used for testes), all had 3 ventral **fore** leg tibial spurs; 1 had 6, 4 had 7 and 2 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 1 had 4 and 6 had 5 inner **rear** leg tibial spines, while all had 3 outer **rear** leg tibial spines, and 6 with 2 and 1 with 4 ventral spurs.

DNA. Fig. 1349, p. 718. At least 1 male, from each paratype population, had its karyotype confirmed as 2n♂=25. If the DNA is from same last instar male as karyotyped, then testes number followed by **. We note this distinction since it is possible that both *A. lakesherwood* and *A. leei* could be sympatric, and we have no way to separate the two species except for karyotype. F1252 and F1255 (both topotypic S01-11, T01-9); F1767 (Simi Hills, Lower

Cheeseboro, T06-3**); F2860 & F2907 (both S23-39, Array 28, T23-18**) recovered in Group 26 Santa Monica Mts with *A. leei*, where both species are each other's closest relative.

Karyotype. 2n♂=25. 4 individuals checked: T01-9 (Fig. 1360, type locality S01-11); T06-3 (Fig. 1361, Simi Hills, Lower Cheeseboro); T23-3 (Fig. 1362, S23-62, Array 111); T23-18 (Fig. 1363, S23-39, Array 28) all with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and 1 metacentric X chromosome. Some cells from T23-18 (S23-39) with B chromosomes, as seen at metaphase I (Fig. 1364A, 2 Bs) and anaphase (Fig. 1364B, 3 Bs).



FIGURE 1360. Idiogram T01-9 *A. lakesherwood* (S01-11).

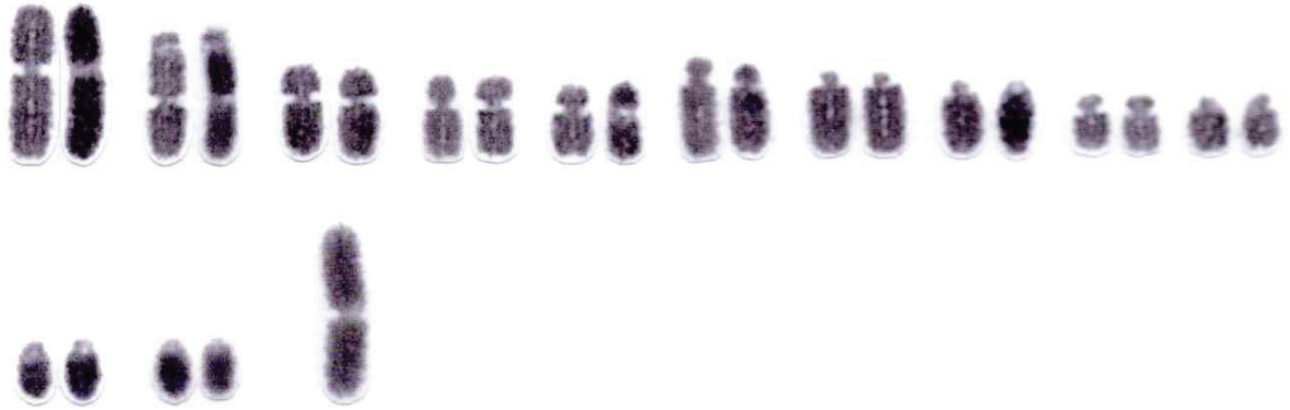


FIGURE 1361. Idiogram T06-3 *A. lakesherwood* (Lower Cheeseboro).

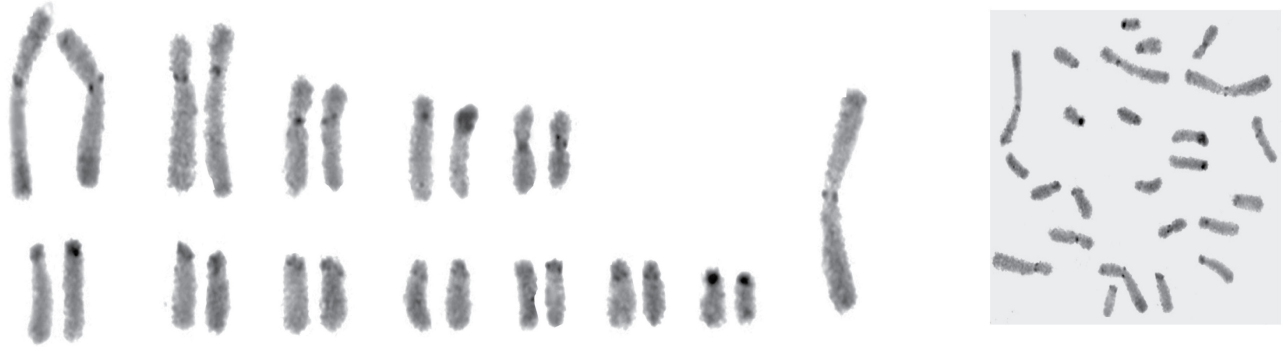


FIGURE 1362. Idiogram T23-3 *A. lakesherwood* (S23-62), using C-banding. Idiogram prepared from anaphase cell on right.



FIGURE 1363. Idiogram T23-18 *A. lakesherwood* (S23-39), using C-banding.

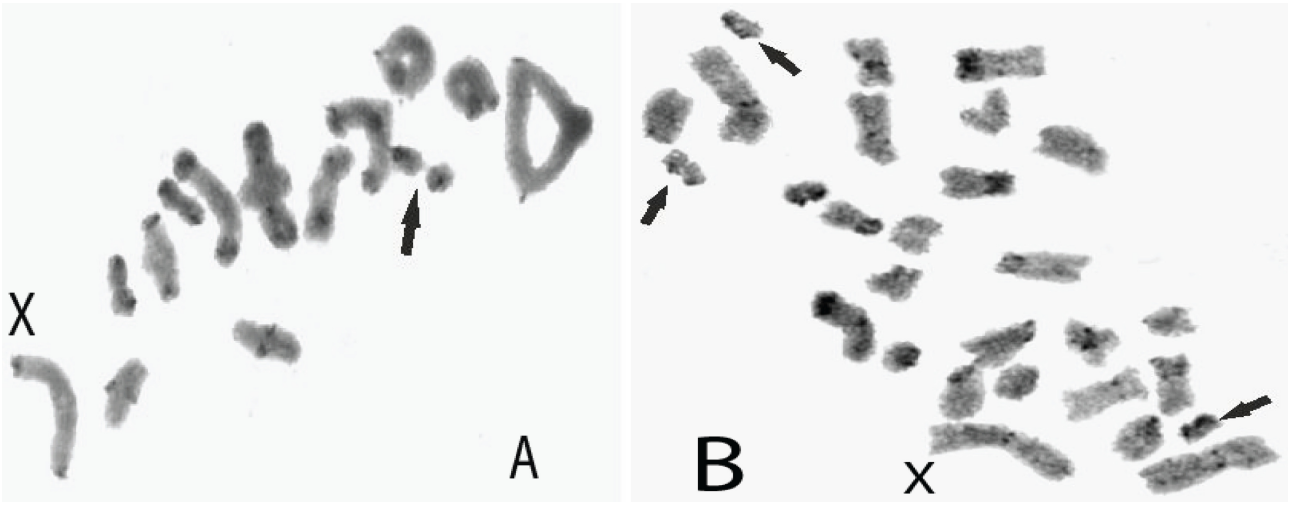


FIGURE 1364. Cells of *A. lakesherwood* male (T23-18, S23-39) with B chromosomes, using C-banding. Same individual as in Fig. 1363. A. Metaphase I of meiosis showing 2 B chromosomes (arrow). X chromosome indicated. B. Anaphase cell in same male showing 3 B chromosomes (arrows).

Out of 92 examined *Ammopelmatus* species, only 4 are known to have B chromosomes. We thus find it intriguing that two of them are found essentially sympatric in the Santa Monica Mts. We initially thought that these individuals with B chromosomes might represent hybrids, with unbalanced karyotypes, as described elsewhere in western USA *Trimerotropis* grasshopper hybrids (John & Weissman 1977, John 1983, John *et al.* 1983, Shaw *et al.* 1998). But if these JCs are 2n♂=23 *A. leei* x 2n♂=25 *A. lakesherwood*, with the count reduction (in *A. leei*) most likely the product of a single centric fusion in *A. lakesherwood*, then we would expect cells in any hybrid male to have 24 chromosomes. And in testicular meiotic cells, we might expect to find unbalanced gamets and trivalents, as documented in the above references. Instead, we find neither. What we do find are cells within the same individual, with 1–3 extra, small chromosomes. A situation most readily explained by these extra elements being B (supernumerary) chromosomes.

Discussion. This is one of two striped JC species occurring in the Santa Monica Mts, along with the unstriped *A. mahogani*. In the absence of the different karyotypes, we would have called all these striped specimens, representing both *A. leei* and *A. lakesherwood*, the same taxon, since there is no other way to separate them.

It is possible that 1 individual male of a third striped taxon, *A. islander*, was also collected in the Santa Monica Mts (S23-62, Array 111, F2846, T23-3, 2n♂=25). He is recovered in Group 23 Islander with other individuals of *A. islander*.

***Ammopelmatus leei* Weissman, sp. nov.**
Point Dume Jerusalem Cricket
Figs 1365–1378. Tables 3, 10, 23

Probably 2009 Vandergast *et al*. "S. santamonica"

Distribution. (Fig. 1365). Known from both the Santa Monica Mts and adjacent Simi Hills, Los Angeles and Ventura Counties, California.

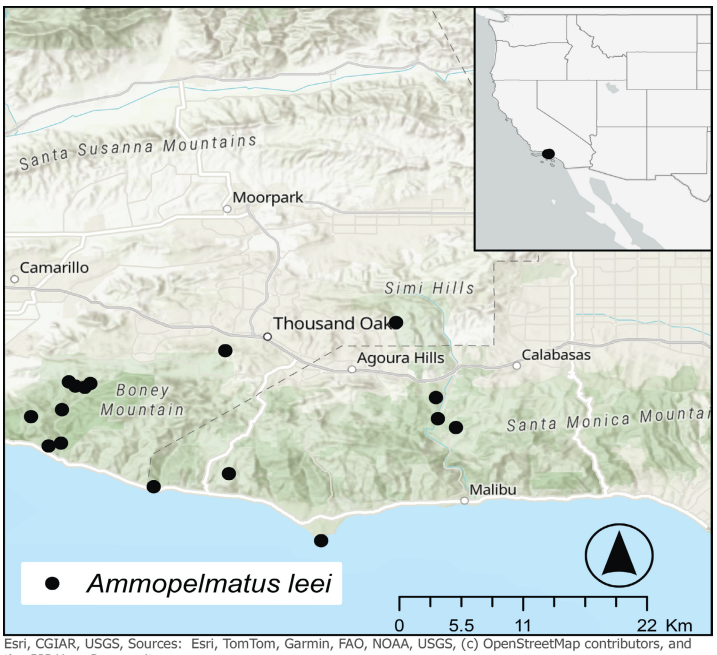


FIGURE 1365. Distribution of *A. leei.*

Recognition characters. Medium-large JC with dark body, usually wide, black abdominal stripes, calling drum rate between 5.5–6.5 drums/s, sex clarification drum (SCD), and 2n♂=23. There are three morphologically and similar drumming JC species known from around the Santa Monica Mts: Distinguished from *A. lakesherwood*, which has 2n♂=25, only by karyotype. Differs from *A. ballonadark* (2n♂=23) by color, and perhaps DNA. Can only be separated from 2n♂=25 *A. islander*, to the west of the Santa Monica Mts, by chromosome count and different DNA of the latter.

Holotype. Male (in alcohol, Fig. 1366). **CALIFORNIA, *Los Angeles Co.,*** Point Dume State Nature Preserve, 34.001425° -118.805905°, 46m, 4-vi-1997 (S97-57), DBW & VF Lee. R97-134, F536. Molt to adult 11-ix-1997. Deposited CAS, Entomology type #20124. Measurements in mm: Body length 40.83, hind femur length 12.61, hind femur width 5.19. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1367) with 5 inner and 3 outer spines, 2 ventral spurs. Rear leg tibial calcars not spatulate.

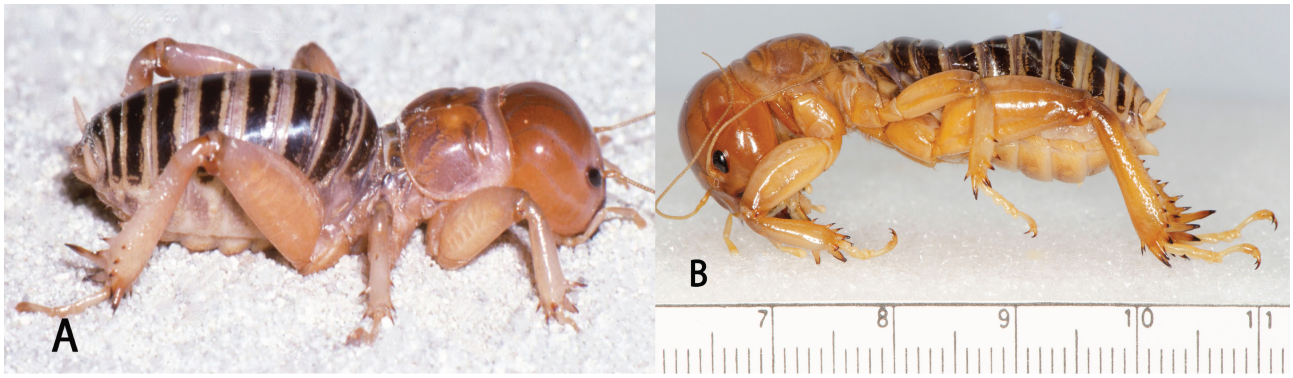


FIGURE 1366. Adult male holotype *A. leei.* A. When alive. B. When preserved.

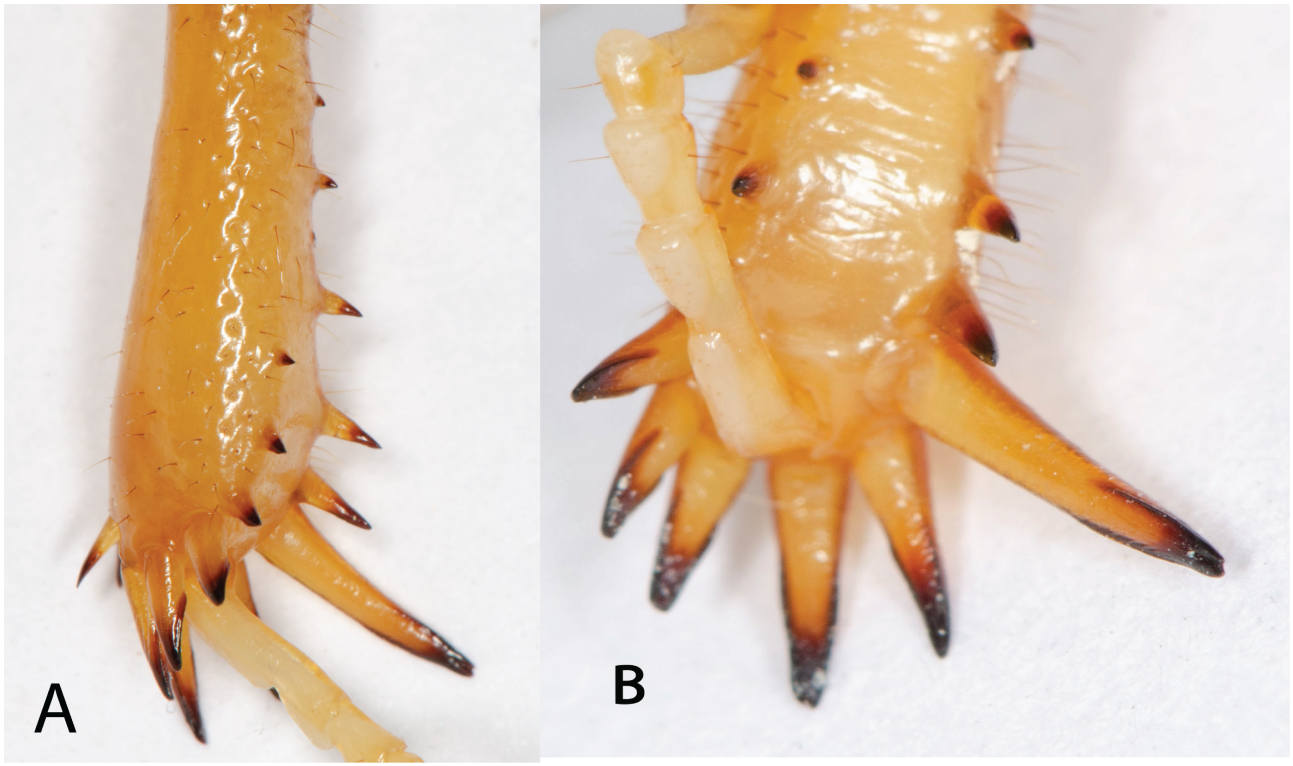


FIGURE 1367. Left rear leg tibia adult male holotype *A. leei.* A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1368A live paratype, Fig. 1368B, preserved allotype). Same data as holotype except R97-183, F588. Molt to adult 1-x-1997. Deposited CAS, CASENT #9080541. Measurements in mm: Body length 36.57, hind femur length 11.37, hind femur width 4.28. Fore leg tibia with 3 ventral spurs; middle leg tibia with 7 calcars, 2 ventral spurs; hind leg tibia (Fig. 1369) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1370.

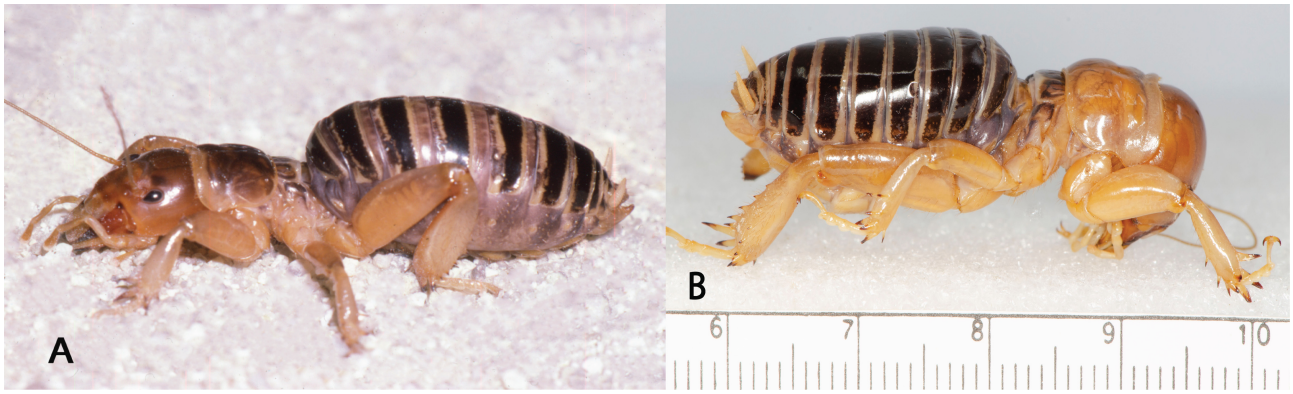


FIGURE 1368. Adult female *A. leei.* A. Live paratype from Charmlee Park (S87-130, R88-52). B. Preserved allotype.



FIGURE 1369. Right rear leg tibia allotype *A. leei.* A. Showing 5 inner and 3 outer spines. B. Showing shape of calcars.



FIGURE 1370. Ovipositor allotype *A. leei*.

Paratypes. ♂27 ♀32. All confirmed by male karyotype counts of 2n♂=23, and all individuals from either Santa Monica Mts or Simi Hills. **CALIFORNIA, *Los Angeles Co***., same data as holotype ♂3; 27-xii-1989 (S89-93) ♀4; 2-iii-1992 (S92-12) ♂1. Charmlee Wilderness Park, 34.058819° -118.879527°, 407m, 5-xii-1983 (S83-157) PH Sullivan ♀2; 23-xii-1985 (S85-148) ♂1 ♀1; 26-xii-1986 (S86-173) ♂1 ♀1; 21-xii-1987 (S87-130) ♂2 ♀8; 27-xii-1989 (S89-92) ♂1 ♀3; 19-iii-1995 (S95-25) ♂1; 18-xii-1996 (S96-115) ♀3; 25-ii-2001 (S01-12) ♀5. Array 55, 34.098292° -118.698337°, 222m, 11-viii-2023 (S23-91) K. Delaney ♂1 for testes. Array 56, 34.105865° -118.712722°, 179m, K. Delaney, 26-v-2023 (S23-56) ♂2 for testes; 9-viii-2023 (S23-92) K. Delaney ♂1 for testes. Array 60, 34.123940° -118.714300°, 253m. Array 71, 34.168970° -118.741421°, 326m, 24-v-2024 (S24-30) K. Delaney ♂1 for testes. ***Ventura Co.,*** Array 29, 34.107618° -119.037458°, 233m, 30-vi-2023 (S23-64) K. Delaney ♂1 for testes. Array 34, 34.132760° -118.994560°, 177m, K. Delaney ♂1 for testes. Array 65, 34.212427° -118.800558°, 399m, 23-v-2024 (S24-31) K. Delaney ♂1 for testes. Array 69, 34.188209° -118.746114°, 366m, 11-vii-2023 (S23-66) K. Delaney ♂1 for testes. Array 70, 34.183396° -118.748477°, 393m, 24-v-2024 (S24-32) K. Delaney ♂1 for testes. Array 88, 34.135977° -118.990101°, 153m, 26-iv-2023 (S23-45) K. Delaney ♂1 for

testes. Pt Mugu State Park, Array 89, 34.133789° -119.002108°, 185m, 8-11-xi-2022 (S22-62) K. Delaney ♂10. Array 90, 34.137374° -119.007267°, 309m, K. Delaney, 8-11-xi-2022 (S22-63) ♂6 ♀1; 25-27-iv-2023 (S23-46) ♂1 for testes. Array 93, 34.113570° -119.012775°, 75m, 28-iv-2023 (S23-48) K. Delaney ♀1. Array 94, 34.082531° -119.023419°, 259m, 28-iv-2023 (S23-49) K. Delaney ♀2. Array 96, 34.084938° -119.013539°, 33m, 28-iv-2023 (S23-51) K. Delaney ♂2 for testes. Array 101, 34.047617° -118.939536°, 83m, 14-vi-2023 (S23-62) K. Delaney ♀1. Array 102, 34.164090° -118.882390°, 374m, 25-31-x-2022 (S22-51) K. Delaney ♂1 ♀1.

Drum. Calling drums similar between sexes except females with a longer drum and males with a sex clarification drum. **Male:** Holotype (Fig. 1371, R97-134) with 31 drums over 5.3s (5.8 drums/s) at 19.5°C. Paratype males with 49 drums in 8.3s (5.9 drums/s, R97-187, 20°C) and 34 drums in 5.1s (6.7 drums/s, R97-188, 19.5°C). **Female:** Allotype (Fig. 1372, R97-183) with 145 drums over 26.5s (5.5 drums/s) at 19°C.

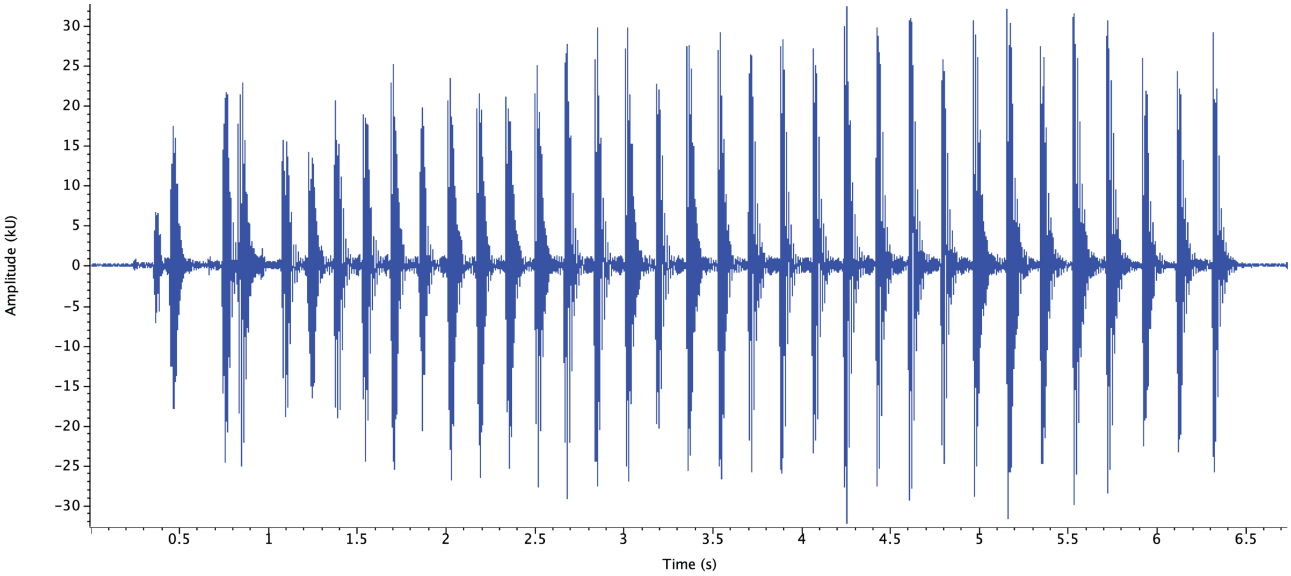


FIGURE 1371. Calling drum (R97-134) holotype adult male *A. leei.*

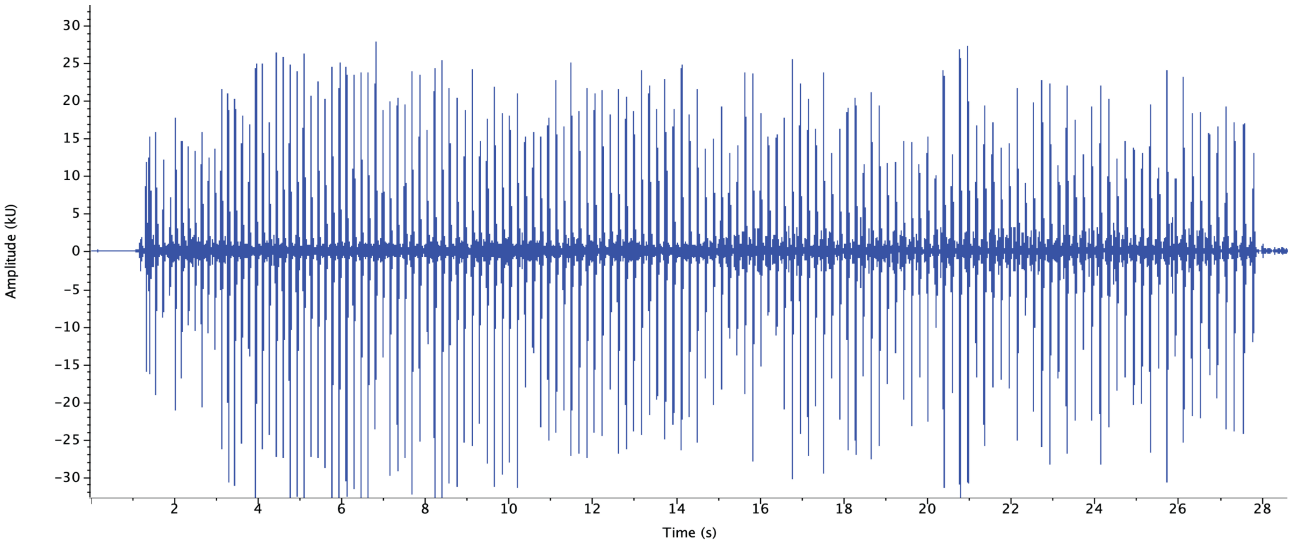


FIGURE 1372. Calling drum (R07-183) adult female allotype *A. leei.*

Derivation of name. Named for Vincent F. Lee, who helped the senior author collect many JCs over the years, and, as was his typical behavior, never complained even when awoken at 04:30, as the sky was getting light, for one last walk of the oatmeal trail at Pt. Dume.

Habitat. The type locality is a sandy coastal bluff with *Coreopsis* and other coastal scrub vegetation. Charmlee Park and Topanga State Park are more inland and with more chaparral vegetation.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. From 28 individuals, all had 3 ventral **fore** leg tibial spurs; 14 had 7 and 12 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 26 had 5 and 1 had 6 inner **rear** leg tibial spines, all with 3 outer **rear** leg tibial spines, and all with 2 ventral spurs. The black abdominal bands are generally thinner in those individuals from **Charmlee Park** when compared with the type locality, but not always. At **Pt. Dume**, 4 of 5 individuals with 8 calcars while at Charmlee Park, 7 of 9 individuals with 7 calcars and only 2 with 8 calcars.

DNA. Fig. 1349, p. 718. At least 1 male, from each paratype population, had its karyotype confirmed as 2n♂=23. If the DNA is from same last instar male as karyotyped, then testes number followed by **. We note this distinction since it is possible that both *A. leei* and *A. lakesherwood* could be sympatric, and we have no way to separate the two species except for karyotype. F0536 (holotype Pt Dume, T97-12), F1128 (S01-12, Charmlee Park, T01-49); F1768 (Array 34, Ventura Co, T06-8**); F2706 (S22-51, Array 102, T23-12); F2735 (S22-62, Array 89, T23-5); F2848 (S22-62, Pt Mugu State Park, T23-5**); F2864 (S23-66, Array 69, T23-22**) recovered in Group 26 Santa Monica Mts, in a mixed clade with *A. lakesherwood*, where both species are each other's closest relatives.

Karyotype. 2n♂=23. T97-12 (Fig. 1373, S97-57, type locality Pt. Dume); T01-49 (Fig. 1374, S01-12, Charmlee Park); T06-8 (Fig. 1375, Array 34); T06-13 (Fig. 1376, Array 60) with 6 metacentric or submetacentric autosomal pairs, 5 acrocentric or telocentric autosomal pairs, and 1 metacentric X chromosome. T23-4 (S23-48, Array 93); T23-5^{++} (S22-62, Array 89); T23-6 (S23-51, Array 96); T23-8 (S23-51, Array 96); T23-9 (S23-56, Array 56); T23-12 (S22-51, Array 102); T23-13 (S23-64, Array 29); T23-14^{++} (S22-63, Array 90); T23-15^{++} (S22-63, Array 90); T23-16 (S23-46, Array 90); T23-17 (S23-49, Array 94); T23-19^{++} (S23-45, Array 88); T23-20^{++} (S23-61, Array 101); T23-21 (S22-63, Array 90); T23-22 (S23-66, Array 69); T23-23 (S23-56, Array 56); T23-31 (S23-91, Array 55); T23-32 (S23-92, Array 56); T24-30 (S24-30, Array 71); T25-1 (S24-32, Array 70); T25-2 (S24-31, Array 65). Five individuals had B chromosomes, and are denoted by "$^{++}$" after the testes number. Two cells from T23-20 are shown in Fig. 1377; one cell without any B chromosomes and one cell with two B chromosomes. Other cells in T23-20 had from 0 to 3 B chromosomes.



FIGURE 1373. Idiogram T97-12 *A. leei* (S97-57).

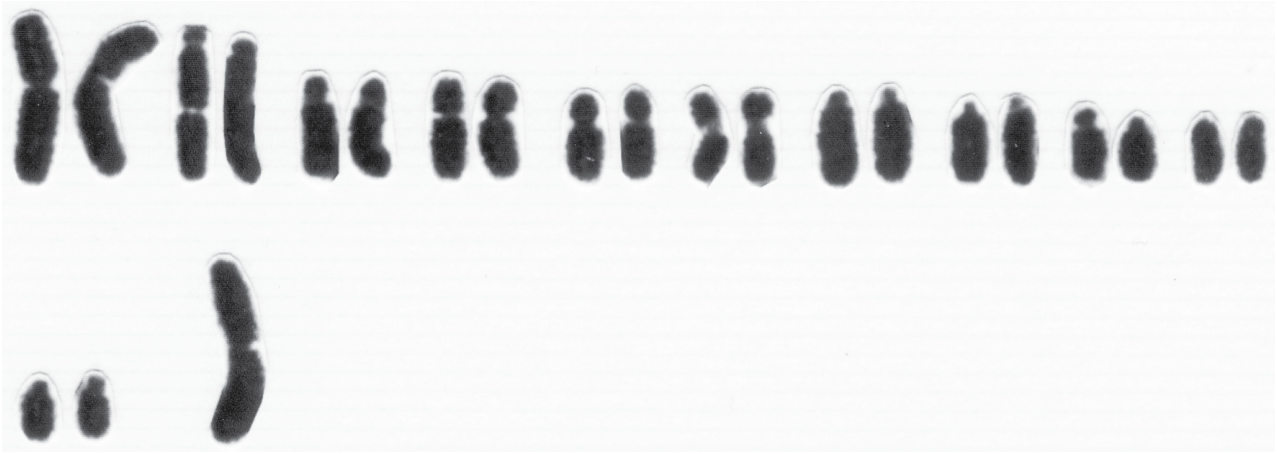


FIGURE 1374. Idiogram T01-49 *A. leei* (S01-12).



FIGURE 1375. Idiogram T06-8 *A. leei* (Array 34).

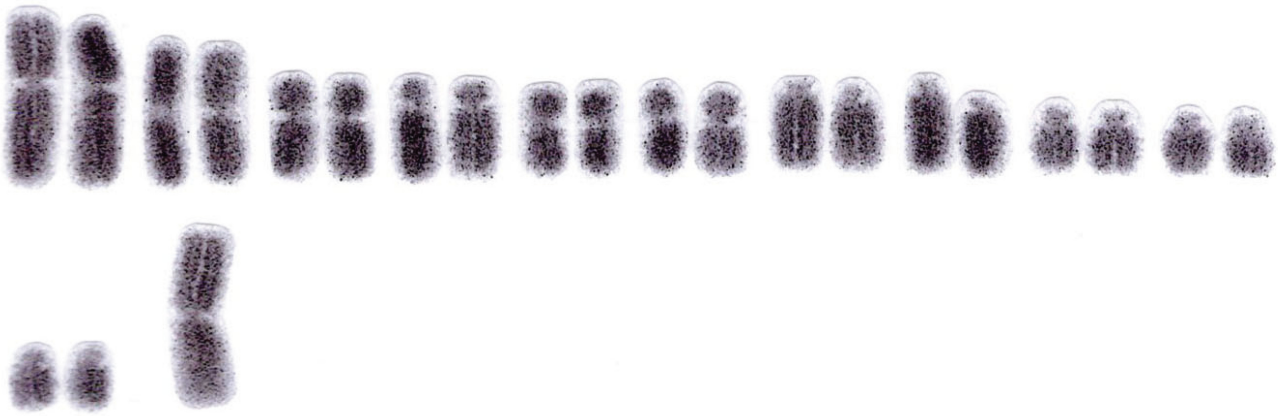


FIGURE 1376. Idiogram T06-13 *A. leei* (Array 60).

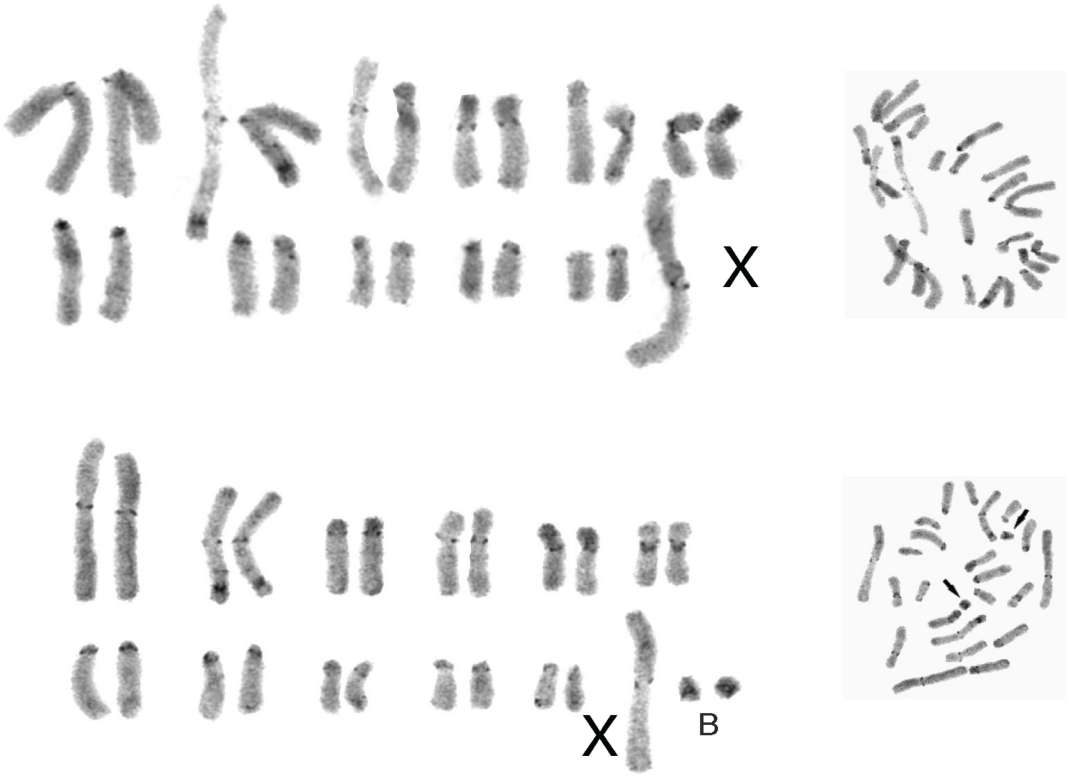


FIGURE 1377. Idiograms T23-20 *A. leei* (S23-61), using C-banding. Top cell without any B chromosomes. Cell to right is mitotic cell from which idiogram (on left) was made. Bottom cell with 2 B chromosomes. Cell to right is mitotic cell, with arrows pointing to B chromosomes, from which idiogram (on left) was made. X chromosome labeled in both idiograms.

Discussion. We arrived at the type locality on 4-vi-1997, at 00:30, when it was cool and windy. After finding one wandering late instar male JC, we placed some 4 kg oatmeal and slept for 90 minutes. Subsequent walks at 02:45 and 04:30 yielded 6 and 2 JCs respectively. Fortunately, the oatmeal trail was unaffected by kangaroo rat activity at those late hours.

Point Dume Nature Preserve, a California State Park, is also the type locality for the decticine katydid *Aglaothorax morsei tectinota* (Rentz & Weissman), subsequently synonymized (Cole *et al.* 2025) under *A. costalis* (Rentz and Weissman); and is the most northern known locality (Rentz & Weissman 1981) for the mogoplistine cricket *Cycloptilum distinctum* Hebard.

We observed a unique behavior during a mating attempt between a Charmlee Park male *A. leei* (S86-173, R87-48, R87-78, & R87-79) and a virgin female—unknown if they are the same species—from Northridge, Los Angeles Co. (S87-42, R87-54). Over several minutes, and with various stimulations such as rotating their enclosure or being touched by the female, this male extruded (Fig. 1378) his internal phallic lobes and elevated his abdomen, as if he was releasing a pheromone. We saw no reaction from the female and mating did not occur. But this extrusion, whose function is unknown in this context, is the same (see photos in Weissman *et al.* 2008) as seen during mating immediately after the males anchors his hooks and right before he passes his spermatophore.

At the paratype localities of Charmlee Park and Pt Mugu State Park, *A. leei* occurs microsympatric with *A. mahogani.*



FIGURE 1378. Adult male paratype *A. leei* raising his abdomen and extruding his internal phallic lobes, a uniquely witnessed activity of unknown function.

Uncertain Species Group. In the absence of DNA results, we have 5 taxa with unknown affinities, 3 of which (marked by *) we make a tentative placement. Based on geography and morphology, we tentatively place *A. chinalake* in the Mojave Desert Group; and we tentatively place *A. comanchus* and *A. sonoraensis* in the Fuscus Group.

SPECIES WRITE UPS: *A. angelusoaks* (p. 732); *A. bigpines* (p. 735); **A. chinalake* (p. 264); **A. comanchus* (p. 490); **A. sonoraensis* (p. 521).

***Ammopelmatus angelusoaks* Weissman, sp. nov.**
Angelus Oaks Jerusalem Cricket
Figs 1379–1385, Tables 6, 18

Distribution. (Fig. 1379). Only known from the area around Angelus Oaks in the San Bernardino Mts of Southern California.



FIGURE 1379. Known distribution of *A. angelusoaks.*

Recognition characters. Medium sized JC similar in size to *A. bartonflats*, also from the San Bernardino Mts, but differs from latter in faster drum rate: 3.2 drums/s in *A. angelusoaks* vs 1.4–1.7 drums/s in latter species. Also, with faster drumming rate than third stripped San Bernardino Mts species *A. ashleighi.*

Holotype. Male (in alcohol, Fig. 1380). **California, *San Bernardino Co.,*** San Bernardino Mts, Angelus Oaks, 34.147498° -116.978606° 1793m, 10-xii-1991 (S91-126) DC Hawks. R92-32. Molt to adult 6-viii-1992. Deposited CAS, Entomology type #20224. Measurements in mm: Body length 35.29, hind femur length 12.23, hind femur width 4.14. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1381) with 4 and 5 inner and 3 outer spines, 2 ventral spurs.



FIGURE 1380. Holotype adult male *A. angelusoaks.* A. When alive. B. When preserved.

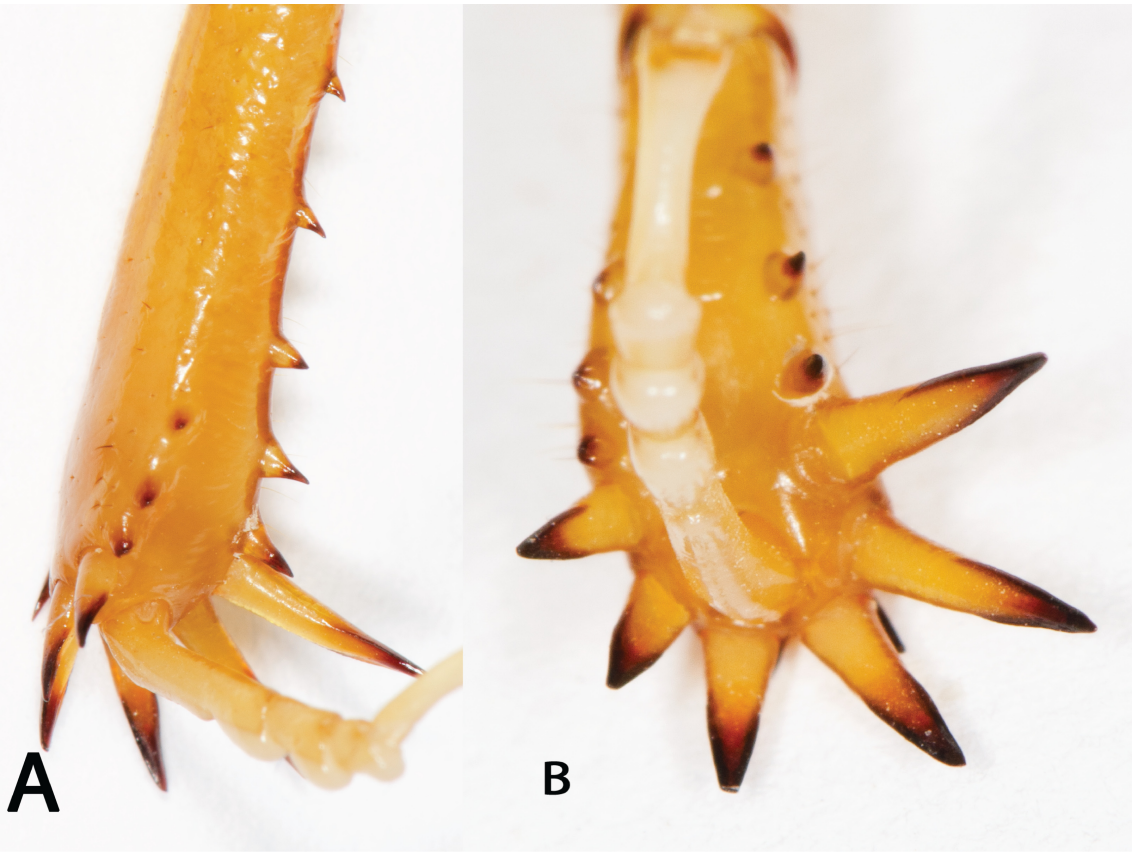


FIGURE 1381. Holotype *A. angelusoaks.* A. Left rear leg tibia showing 3 outer and 5 inner spines. B. Same tibia showing shape of calcars.

Allotype. Female (in alcohol, Fig. 1382). Same data as holotype except collected as adult. Deposited CAS, CASENT #9082209. Measurements in mm: Body length 28.16, hind femur length 9.32, hind femur width 3.40. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1383) with 5 inner and 3 outer spines, 2 ventral spurs. Ovipositor Fig. 1384.



FIGURE 1382. Allotype adult female *A. angelusoaks*, preserved specimen.



FIGURE 1383. Left rear leg tibia allotype adult female *A. angelusoaks*. A. Showing 3 outer and 5 inner spines. B. Showing shape of calcars.



FIGURE 1384. Ovipositor allotype *A. angelusoaks.*

Paratypes. None

Drum. Holotype **male** (R92-32, Fig. 1385): 37 drums over 11.5s (3.2 drums/s) at 20°C. Female drum unknown.

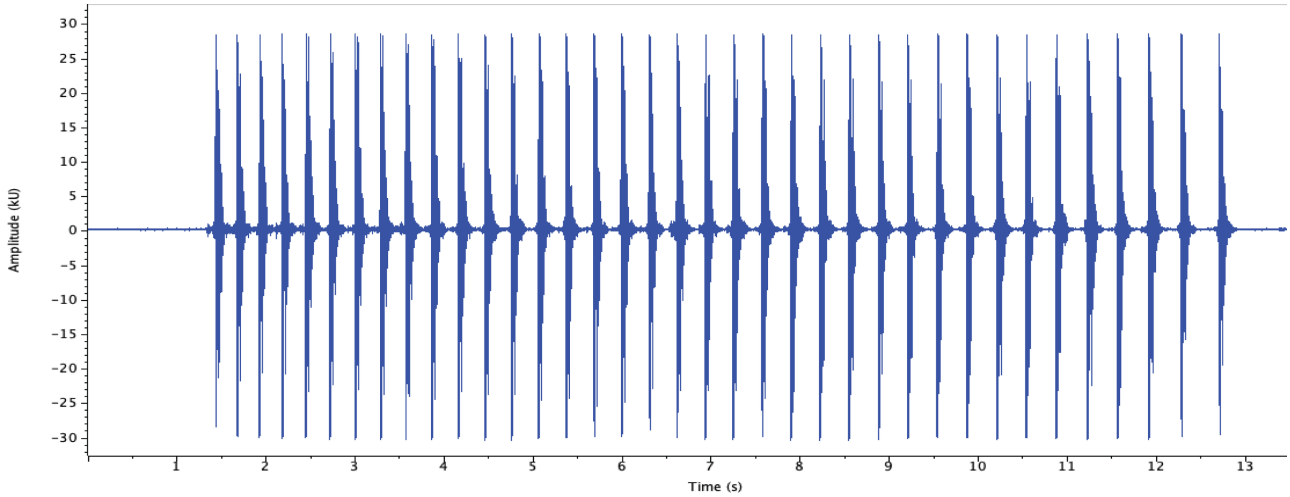


FIGURE 1385. Calling drum (R92-32) holotype adult male *A. angelusoaks.*

Derivation of name. Named after type locality.
Habitat. Pine-oak woodland.
Life cycle and seasonal occurrence. Apparent typical 2-year life cycle.
Variation. Holotype and allotype only specimens known.
DNA. unknown
Karyotype. unknown
Discussion. We continue efforts to collect more specimens to clarify relationships through DNA sequencing.

***Ammopelmatus bigpines* Weissman, sp. nov.**
Big Pines Jerusalem Cricket
Figs 1386–1389, Tables 3, 19

Distribution. (Fig. 1386). Only known from around Big Pines in the San Gabriel Mts of Southern California.

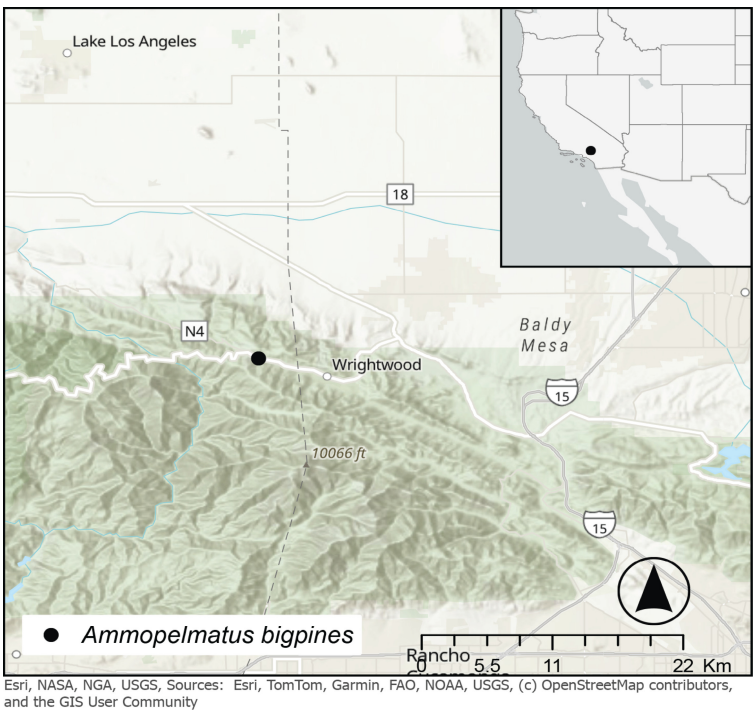


FIGURE 1386. Known distribution of *A. bigpines.*

Recognition characters. Small, high elevation, fast drumming (8.6 drums/s at 18°) JC. Distinguished from nearby *A. sangabriel* by slower drum (0.7–1.0 drums/s) in latter.

Holotype. Male (in alcohol, Fig 1387). **California, *Los Angeles Co.,*** San Gabriel Mts, Hwy 2, ~0.5 m SE Big Pines, 34.374341° -117.682457°, 2033m, 8-vi-1983 (S83-65B) DBW. R83-484 and R83-493. Molt to adult 3-x-1983. Deposited CAS, Entomology type #20192. Measurements in mm: Body length 26.45, hind femur length 8.02, hind femur width 2.90. Fore leg tibia with 3 ventral spurs; middle leg tibia with 8 calcars, 2 ventral spurs; hind leg tibia (Fig. 1388) with 5 or 6 inner and 3 outer spines, 2 ventral spurs.



FIGURE 1387. Preserved adult male holotype *A. bigpines.*



FIGURE 1388. Rear leg tibia in holotype *A. bigpines.* A. Right hind tibia showing 5 inner and 3 outer spines. B. Left hind tibia showing shape of calcars.

Female. Unknown.

Paratypes. None

Drum. **Male:** Holotype R83-493 (Fig. 1389) with 63 drums over 7.3s (8.6 drums/s) at 18°C. First few drums not counted as recording unclear. **Female:** Unknown.

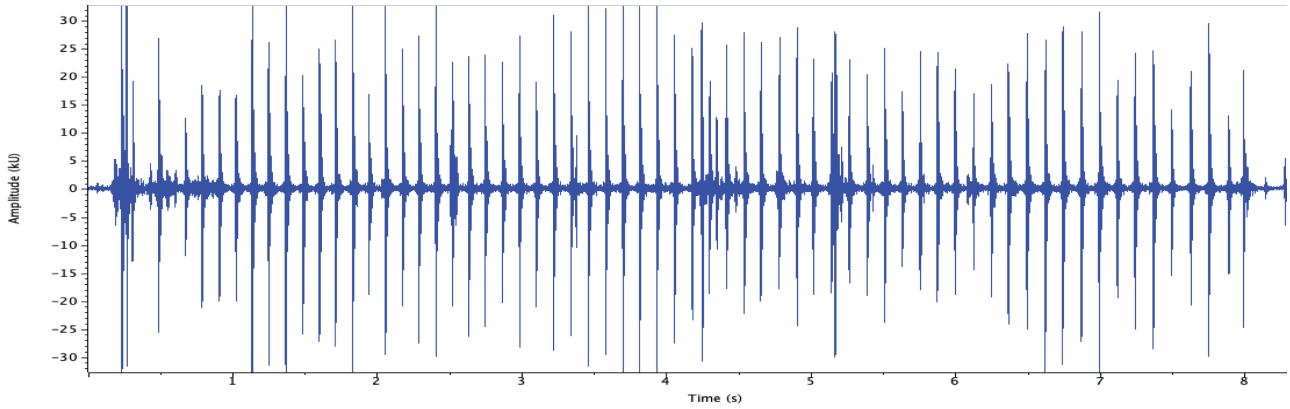


FIGURE 1389. Calling drum (R83-493) of holotype male *A. bigpines.*

Derivation of name. Named in reference to the nearest town.

Habitat. Collected under a board on a steep slope in open pine woodland.

Life cycle and seasonal occurrence. Apparent 2-year life cycle.

Variation. Only known from holotype.

DNA. Unknown.

Karyotype. Unknown.

Discussion. The type locality is 3.7 km SE of S83-66, Camp Teresita Pines, where *A. sangabriel* was found at a similar elevation in what appeared to be similar habitat.

Synonyms: new or old. Two names fall into this category.

SPECIES WRITE UPS: *A. californicus* (p. 737); *A. monahansensis* (p. 739).

***Ammopelmatus californicus* (Brunner von Wattenwyl)**

Figs 1390–1392

1888. *Stenopelmatus californicus.* Verhandlungen der Kaiserlich-Koniglichen Zoologisch-Botanischen Gesellschaft in Wien 38:261. Holotype adult female (Figs 1390 & 1391): (1) Vancouver Deyrolle leg Coll. Br. v. W. (2) Ile Vancouver (3) red label "Type" (4) 4775b (5) Stenopelmatus longispina Br. W. (6) Coll. Nat. Mus. Wien. Deposited NHMW Vienna. Body length 42 mm. Hind tibia (Fig. 1392A) with 4 outer and 5 inner spines, 2 ventral spurs. Face (Fig. 1392B) without furrow. Although the original description clearly says "Patria [natural habitat]: Vancouver" for both this species and *S. longispina*, the labels on both type specimens indicate "Ile [Island] Vancouver" as the collection locality. There is a city of Vancouver located in both SW Washington and on the mainland of British Columbia, Canada.

1916. *Stenopelmatus longispina.* Hebard. Journal New York Entomological Society, 24:80.

1929. *Stenopelmatus californicus.* Karny. Annals Naturhistorisches Museum Wien, 43:41. Karny cited proper holotype female, #4775b. When DBW examined this type in 1998, and the male holotype of *S. longispina,* the type labels had been switched between the two specimens. The labels were returned to their proper specimens.

1937. *Stenopelmatus longispina.* Karny. Genera Insectorum, 206:44.

2021. *Ammopelmatus californicus.* Weissman *et al.* Zootaxa 4917, 1-122. **We herein confirm Hebard's 1916 synonymy of *A. californicus* as a junior synonym of *A. longispinus*** (see p. 182 for further discussion).



FIGURE 1390. Holotype adult female *A. californicus*.



FIGURE 1391. Holotype adult female *A. californicus*.

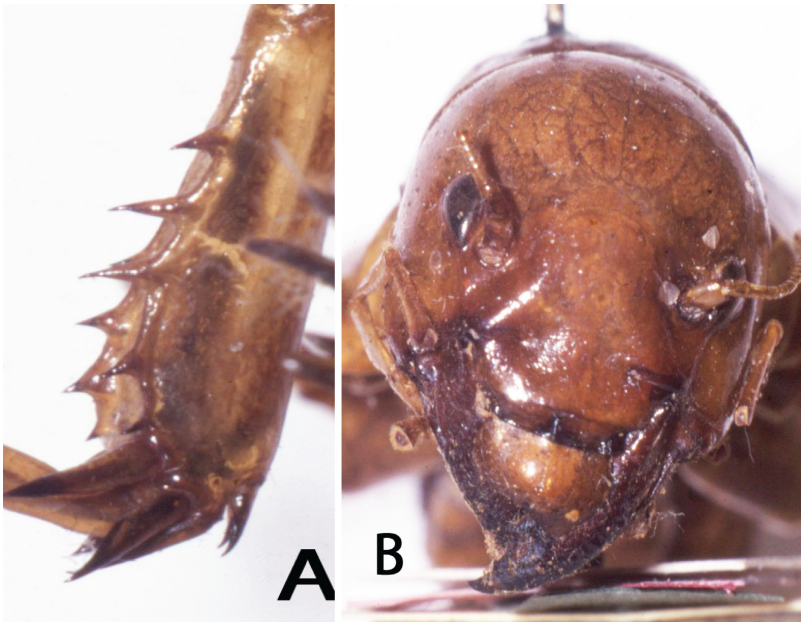


FIGURE 1392. Holotype adult female *A. californicus.* A. Left rear leg tibia showing 4 outer and 5 inner spines. B. Face showing absence of furrow but unnatural indentation on right side.

Ammopelmatus monahansensis **(Stidham & Stidham)**

Figs 1393–1403

2001. *Stenopelmatus monahansensis.* Southwestern Entomologist, 26, 221–226.

Holotype male, **Texas, *Ward Co.,*** Monahans Sandhills State Park, 25-ix-1982. Deposited at Texas A&M University, College Station, Texas.

2021. *Ammopelmatus monahansensis.* Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on rear leg spines, distribution, and DNA. **New status: junior synonym of *Ammopelmatus mescaleroensis***: see p. 500 for further discussion.

Recognition characters. The most extreme examples of megacephalism (Fig. 1393) in any JC species are seen in adults of both sexes from Monahans Sandhills. Both (Fig. 1394) outer and inner rear leg tibial spines #1 are posteriorly flattened; and in some of the largest specimens, they are spatulate in shape (Fig. 1394B). Fore leg tibia usually with 3 spurs; middle leg tibia always with 8 calcars; and rear leg tibia (Fig. 1395A) usually with 5 inner and 3 outer spines. Ovipositor Fig. 1395B. Adult males (Figs 1396 & 1397) similar to adult females.

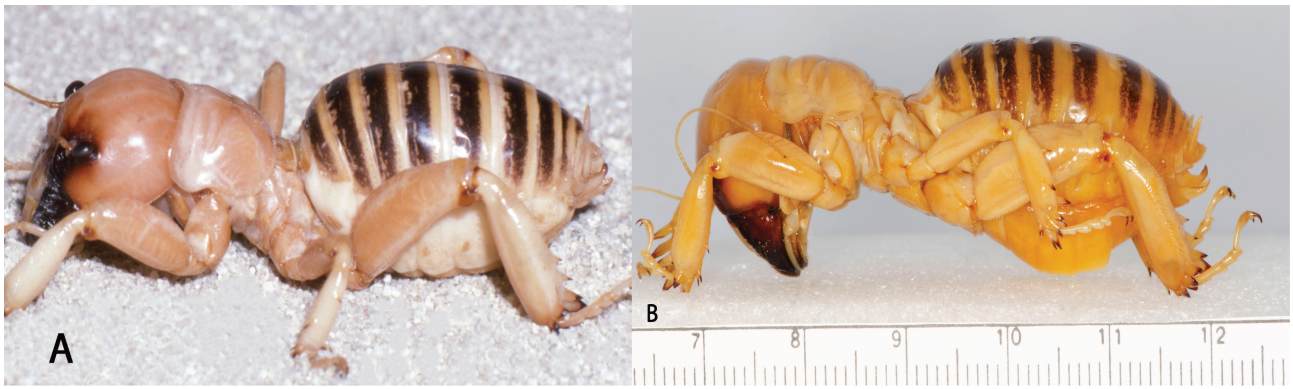


FIGURE 1393. Huge megacephalic adult female "*A. monahansensis*""(S95-90, R95-59, F0150). A. When alive. B. When preserved.

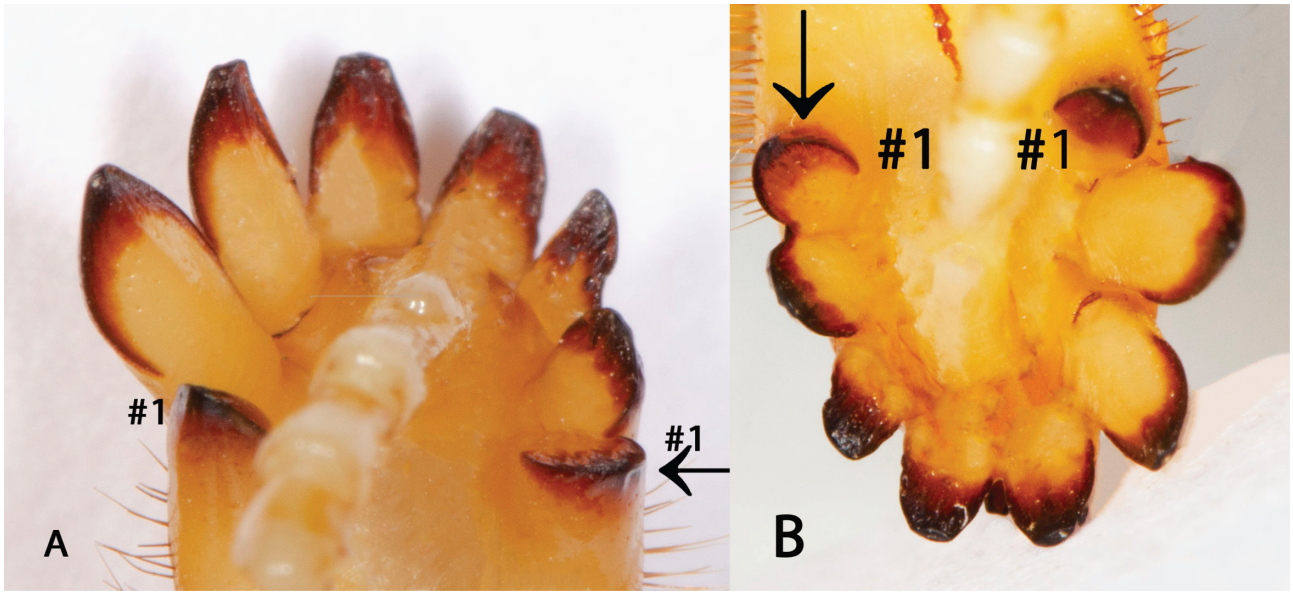


FIGURE 1394. Two perspectives of left rear leg tibial spines, adult female *A. mescaleroensis* from Monahans Sand Dunes (S95-59, R95-90). A. Showing flat posterior-facing outer tibial spine #1 (arrow) on right side of photo. B. Showing flat posterior-facing outer tibial spine #1 (arrow) on left side of photo. Also note flat face of inner spine #1 on right side of photo.

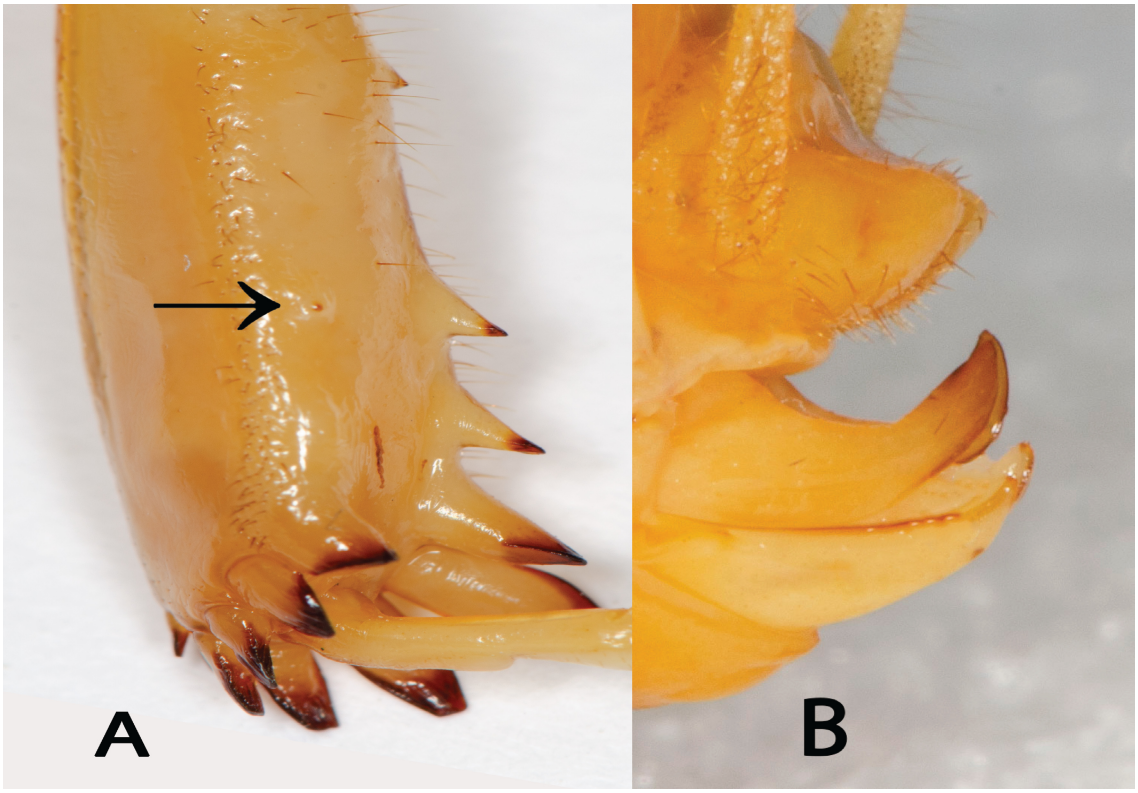


FIGURE 1395. A. Left rear leg tibia adult female Monahans Sands (S95-59, R95-90) showing 2 outer (spine #2 very small: arrow) and 4 inner spines. B. Ovipositor in same adult female.



FIGURE 1396. Live adult male type locality Monahans Sands (S95-59, R95-114).



FIGURE 1397. Left rear leg tibia in same adult male as Fig. 1396. A. Showing 3 outer and 5 inner spines, with the most proximal one being very small. B. Showing shape of calcars.

Although Stidham & Stidham (2001) recognized the diagnostic importance of the rear leg outer tibial spine #1, they incorrectly labeled it the "proximal medial truncate spine-PMS" in their Fig. 1, and mislabel the left hind tibia as the right one in both their Fig. 1A and 1B. One can confirm this mislabeling because the longest calcar in the rear leg ringlet of 6 is always on the inner side of the tibia (calcar #1—see Fig. 4B, p. 14). They do correctly characterize this same spine, on their p. 223, as being the distal, lateral enlarged truncate spine, but then later reiterate their initial error, on p. 224, when discussing "…the single proximal medial truncate spine on the hind tibia."

Drum. Both sexes have similar drum rates, but call longer in females. Male (Fig. 1398, S95-59, R95-114) with

10 drums over 8.1s (1.2 drums/s) at 19°C. Female (Fig. 1399, S95-59, R95-90) with 17 drums over 13.5s (1.3 drums/s) at 20°C.

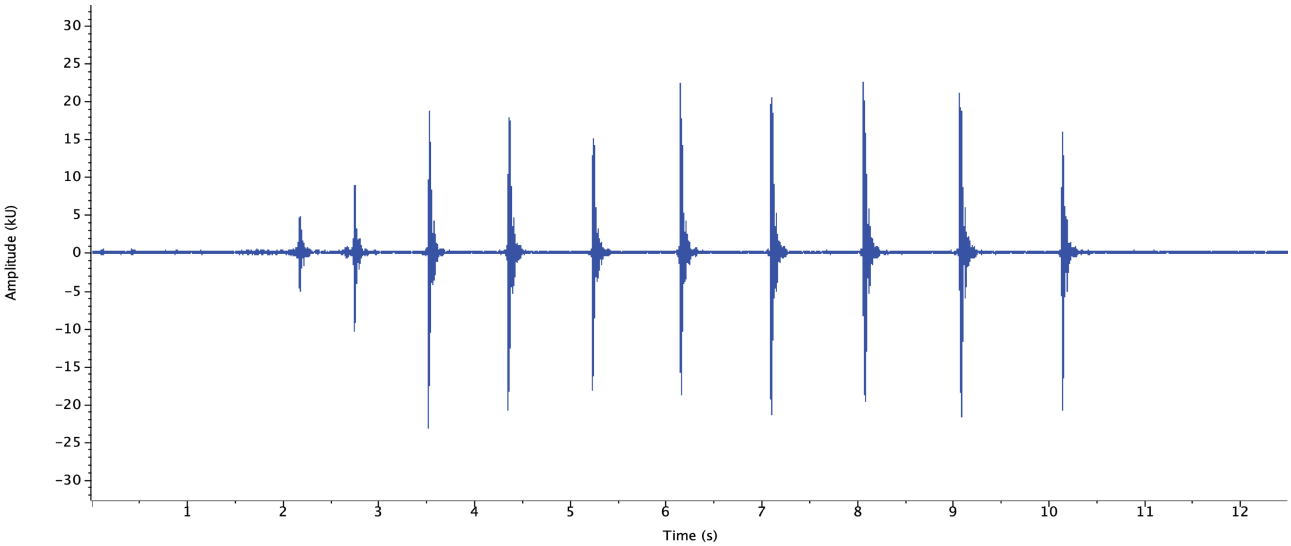


FIGURE 1398. Calling drum (R95-114) topotypic adult male "*A. monahansensis*" showing 10 drums over 8.1s (1.2 drums/s) at 19°C.

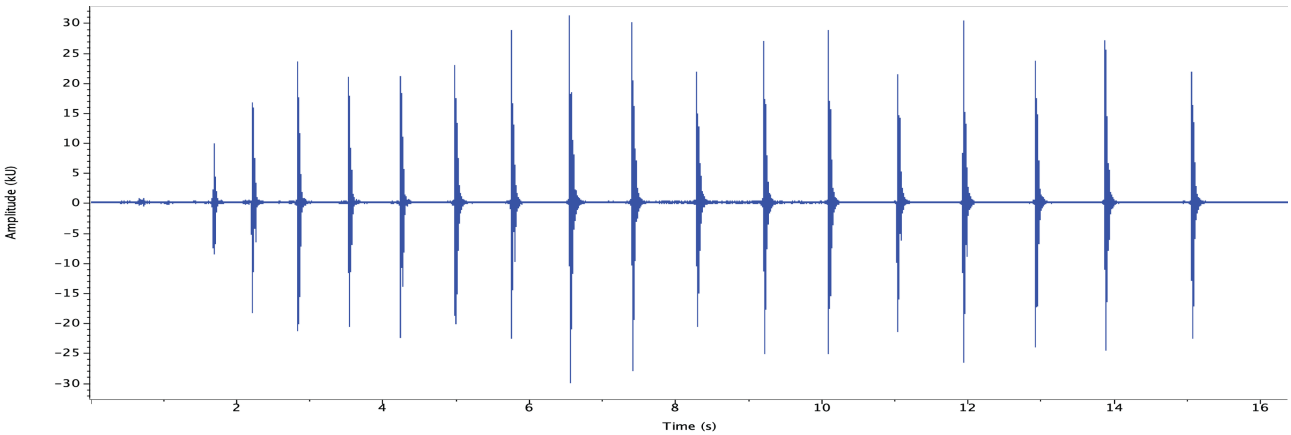


FIGURE 1399. Calling drum (R95-90) topotypic adult female "*A. monahansensis*" showing 17 drums over 13.5s (1.3 drums/s) at 20°C.

Derivation of name. Named after the type locality

Life cycle and seasonal occurrence. Wandering late instars and adults more common in late summer and early fall.

Variation. Of 26 light colored type locality Monahans Sands morphs, 1 had 2 and 25 had 3 ventral **fore** leg tibial spurs; all 26 had 8 **middle** leg tibial calcars, all with 2 ventral spurs; 2 had 3, 8 had 4, and 16 had 5 inner **rear** leg tibial spines, and 21 had 3 and 5 had 4 outer **rear** leg tibial spines, all with 2 ventral spurs. **Color:** 24 of 25 individuals were light colored morphs, the only dark individual (a male, Fig. 1400) photographed as a late instar.



FIGURE 1400. Late instar male, dark morph "*A. monahansensis*" from Monahans Sandhills (S92-37).

Specimens examined. **TEXAS, *Ward Co.,*** Monahans Sandhills State Park, 31.621865° -102.810412°, 830m, 31-viii-1986 (S86-110) E. Gonzales ♂1; 22-ix-1986 (S86-121) E. Gonzales ♂1; 13-x-1986 (S86-136) E. Gonzales ♀1; 31-vii-1991 (S91-98) ♀1; 10-15-ix-1991 (S91-106) K. Benad ♂2; 28-ix-1991 (S91-111) ♂3 ♀1; 18-x-1991 (S91-117) K. Benad ♂2 ♀5; 25-x-1991 ♀1; 10-23-xii-1991 (S91-124) ♂1 ♀2; 25-ii-1992 (S92-6) K. Benad ♀1; 22-24-iii-1992 (S92-37) K. Benad ♂1; 21-vii to 26-ix-1995 (S95-59) ♂2 ♀1. Monahans, Nelson Ave, 31.5878° -102.8749°, 801m, 9-x-1991 (S91-113) K. Benad ♂1.

DNA. Fig. 885, p. 490. F0085, F0167 (type locality S95-59) both recovered in a large clade of many individuals of *A. mescaleroensis* from diverse locations throughout the species' range.

Karyotype. 2n♂=25. Type locality T92-25 (Fig. 1401, S91-111) with 5 metacentric or submetacentric autosomal pairs; 7 acrocentric or telocentric autosomal pairs; and one metacentric X chromosome.

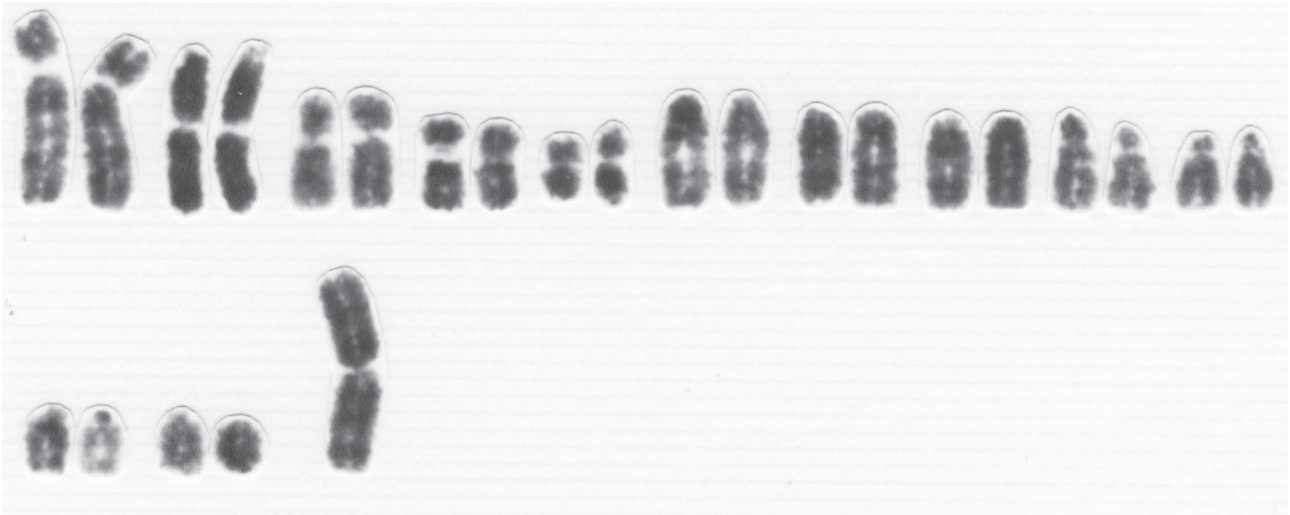


FIGURE 1401. Idiogram T92-25 "*A. monahansensis*" (S91-111).

Discussion. Stidham & Stidham (2001) listed 4 differences, shown below in parenthesis, between their *A. monahansensis* and Tinkham's *A. mescaleroensis,* which we now address, in the order presented by the Stidhams, to justify our synonymizing of the two taxa.

(1) *A. monahansensis* is of an "extremely pale color" rather than black. This is true, but only when one is dealing with individuals from open dune situations. Those individuals living on heavily vegetated dunes, whether

at Mescalero Dunes (see color morph data from Desert Sagebrush Lizard study, p. 512) or around Eunice (S10-61), New Mexico, are darker. And there are also populations that contain mixed individuals, such as near Eunice (S07-77) (see Fig. 910, p. 505). In our studies, 1 of 25 individuals (Fig. 1400, S92-37) sent to us by the park staff at Monahans was black. This color predominance is expected given the more open, poorly vegetated dunes seen at Monahans in comparison with normally heavily vegetated Mescalero Sand Dunes.

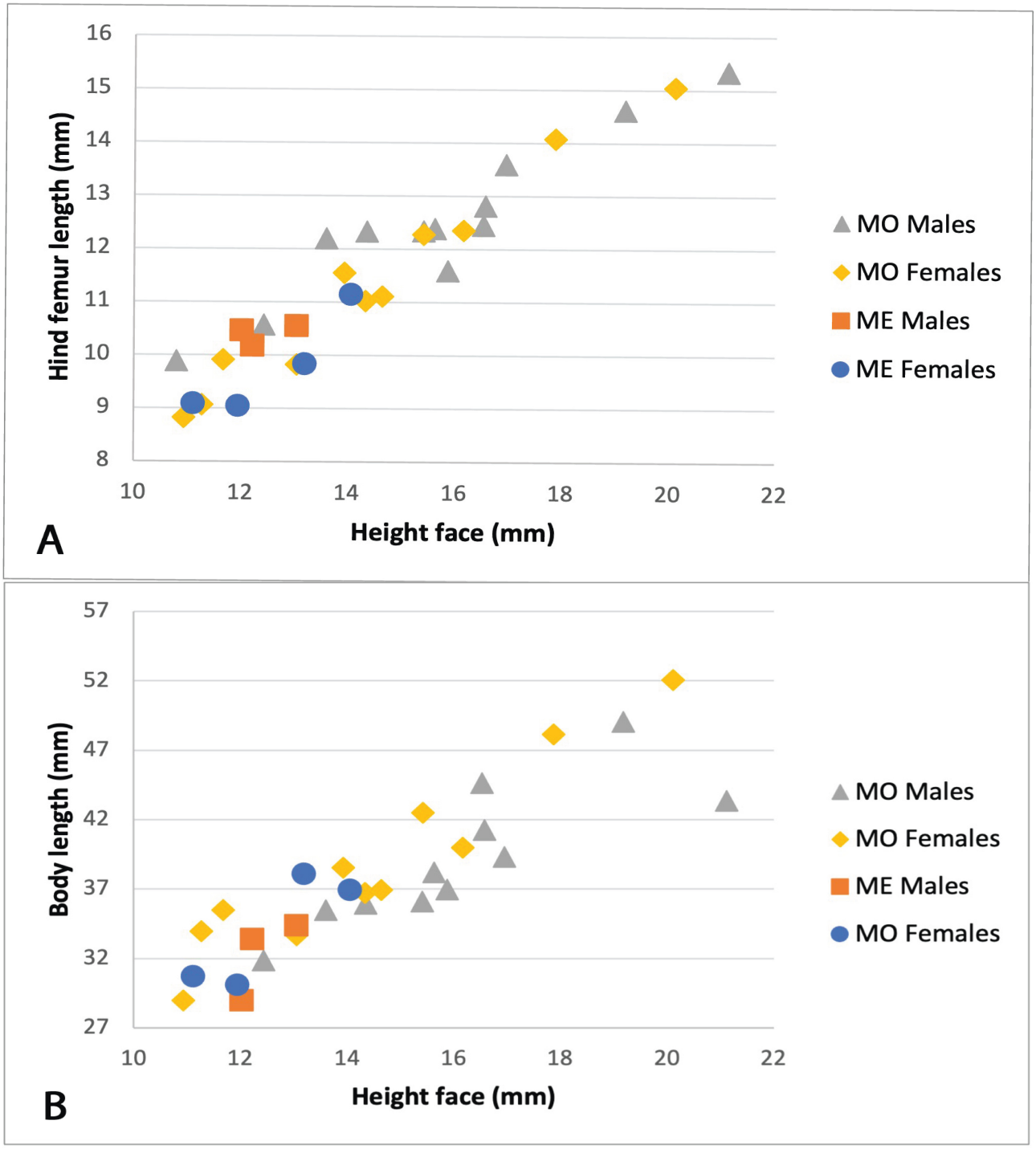


FIGURE 1402. Relationship of physical features in type locality "*A. monahansensis*". A. Between height of face and hind femur length in 23 light colored adult morphs from Monahans (MO) and 7 light colored adult morphs from Mescalero (ME). Note how none of the Mescalero adults are megacephalic. B. Between height of face and total body length in 23 light colored adult morphs from Monahans (MO) and 7 light colored adult morphs from Mescalero (ME).

(2) *A. monahansensis* individuals display "consistent megacephalism," although the Stidhams (2001) only examined 4 adults, from 3 different localities, in their type series (on their p. 224), and had only 5 juveniles of *A. mescaleroensis* for comparison. Analysis of our sample of 24 type locality, light-colored adults—also alluded to by Weissman (2001b)—gives actual data (Fig. 1402A) to support this assertion of consistent megacephalism: adults of both sexes at Monahans are frequently (>60%, depending on criteria used) megacephalic, with the largest specimen being a female 52.1 mm in body length with a face height of 20.1 mm (Fig. 1393, S95-59, R95-90). In all cases, the height of the face is greater than the hind femur length. Yet, megacephalism is also a consistent difference (Fig. 1402A) between the light morphs at Monahans and the 7 light morphs from Mescalero, where such extreme megacephalism is unknown. But, most importantly, all light colored adults fall along the same regression line (Fig. 1402A) regardless of their locality of origin or sex. It appears that many light morph individuals at Monahans simply grow to a larger size with an accompanying, and proportionate, increase in head size. This relationship (Fig. 1402B) applies whether one is using hind femur length or body length as a gauge for size. Light morphs from Mescalero (Fig. 1402A), and dark morphs from anywhere, are generally not megacephalic, although they do fall along the same regression line as the normal and megacephalic light morphs from Monahans. And all individuals of all colors from all localities, do have protruding bead-like eyes. Thus, megacephalism is not a valid character for demarcating "*A. monahansensis*" from *A. mescaleroensis.*

While the cause for this localized megacephalism at Monahans is unknown, we wonder if it could be linked to living in an open dune situation and being light colored? Elsewhere, Weissman (2001a) notes how JCs use their heads for digging, especially in sand. Weissman (2001b) also notes how female JCs have longer calling drums than their conspecific males, perhaps indicating that females drum for longer to allow males more time to search for them. Could it be that these 2 factors, perhaps combined with a different predator situation at Monahans compared to Mescalero Sands, favor megacephalism at the former as a means for JCs to dig faster into the sand?



FIGURE 1403. Face of adult female *A. mescaleroensis* from Monahans Sand Dunes (S95-59, R95-90) showing darkening of mandibles.

(3) "Lack of dorsal, subapical, spurs on the fore tibiae" is a condition seen in both *A. monahansensis* and *A. mescaleroensis,* and can't be used to separate the two taxa since neither taxon has any dorsal, subapical, spurs on the fore tibiae. Both taxa do have 2 or 3 ventral spurs on the front legs.

(4) "…Non-overlapping geographical range" is inaccurate, as documented by treated vs non-treated herbicide studies presented on p. 512 under *A. mescaleroensis*; and the staff collecting of 1 dark morph (see Fig. 1400, S92-37), out of 25 total specimens, at Monahans. In fact, the Stidhams (2001, p. 224) appear to have seen a "…single immature female [that] has a darker brown color…" in their sample that we suspect may represent the dark morph of *A. mescaleroensis.*

Hebard (1916) discussed 4 morphological characters associated with megacephalism: (1) proportionate broadening of the pronotum, (2) unusually globose occiput, (3) occasionally protruding bead-like eyes, and (4) more than usually roughened exposed portion of the jaws. To this list, we add darkening of the mandibles on the entire lower half of the face in megacephalic adults (see Fig. 1403).

We thank the staff at Monahans for posting signs around the Park asking that collected JCs be brought alive to the main office, where they were sent to DBW for study. We took this action after an early summer visit was unproductive.

Unplaced species: all herein designated nomen dubium

SPECIES WRITE UPS: *A. cephalotes* (p. 746); *A. fasciatus* (p. 747); *A. hydrocephalus* (p. 748); *A. irregularis* (p. 750); *A. oculatus* (p. 753); *A. terrenus* (p. 754).

Ammopelmatus cephalotes (Walker)

Figs 1404 & 1405

1869. *Stenopelmatus cephalotes* Walker. Catalogue of the specimens of Dermaptera Saltatoria in the collection of the British Museum 1:195. Holotype (Fig. 1404) adult male based on presence of fully formed hooks: (1) red label holotype (2) W. coast of Amer (3) Stenopelmatus cephalotes Walker. Deposited NHMUK. Megacephalic. Measurements in mm: Body length 31.5, hind femur length 14.5, hind femur width 5.1. Type (Fig. 1405) with 5 inner and 3 outer rear leg tibial spines. Innermost #1 calcar long, as seen is Longispinus Group.

1916. *Stenopelmatus fuscus.* Hebard, Journal New York Entomological Society, 24, 74. This synonymy clearly in error since *S. fuscus* is not found along the West coast of America.

2021. *Ammopelmatus cephalotes.* Weissman *et al.* (2020) Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based of rear leg tibial spines and geographic locality. **New status: Nomen dubium**, given lack of adequate locality data and any calling drum information.

Derivation of name. "cephalo" is Greek for "with a head or headed", apparently in reference to the megacephalic condition of the holotype.

Discussion. Designating this name nomen dubium is an easy call because there is no specific locality given and the "west coast of America", in 1869, has uncertain borders, and could include anywhere from southern Canada as far south as the border with Mexico.

Within the western United States, the Longispinus Group (see p. 135) includes a number of species with a similar elongated rear leg #1 tibial calcar. The Group ranges, along the coast, from southwest Canada to central California. Almost all members share a uniform karyotype; but with different trilling patterns in their calling drums, and different numbers of rear leg tibial spine arrangements. The 5 inner and 3 outer rear leg tibial pattern, seen with this specimen, would most closely agree with *A. longispinoides.* But the latter is almost never megacephalic. Plus, there are a number of other California taxa with a long rear leg tibial calcar #1, leaving its identification impossible.

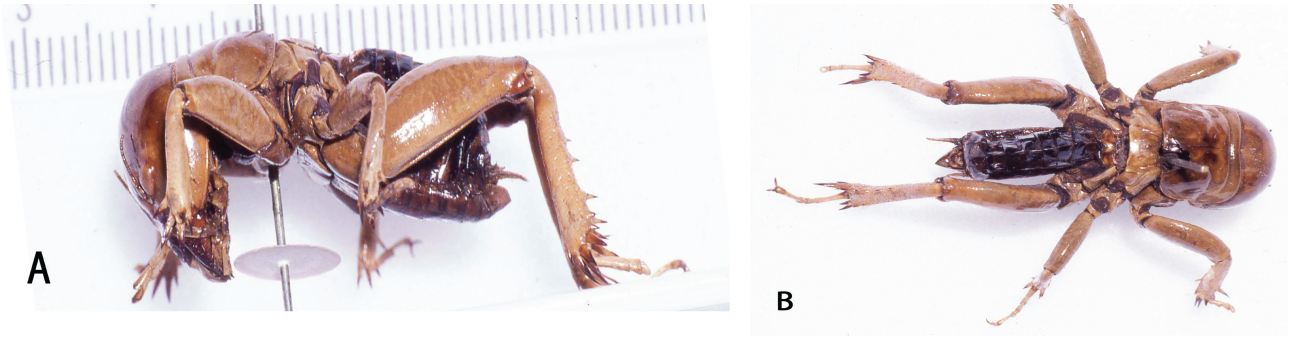


FIGURE 1404. Holotype adult male *A. cephalotes*.



FIGURE 1405. Holotype adult male left rear leg tibia showing 3 outer and 5 inner spines.

Ammopelmatus fasciatus **(Thomas)**

Fig. 1406

1872. *Stenopelmatus fasciatus.* In Hayden. U.S. Geological Survey of Montana and Adjacent Territory 1871. Annual Report of Progress 5:434. Southern Idaho. The original type series may have contained more than 1 male and 1 female, but all that now exists (Scudder 1899) in USNM (Type No. 1115) is the red labeled female specimen (Fig. 1406) below (removed from its Riker mount to photograph), which is at least a couple of molts from adult.

1916. *Stenopelmatus fuscus.* Hebard, Journal New York Entomological Society, 24, 74. This synonymy clearly in error since *S. fuscus* not found in Idaho.

2021. *Ammopelmatus fasciatus.* Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus*, based on length of spines on rear tibia and locality data. **New status: Nomen dubium** as there are several species known from southern Idaho from which this juvenile type can't be separated.



FIGURE 1406. Holotype juvenile female *A. fasciatus.*

***Ammopelmatus hydrocephalus* (Brunner von Wattenwyl)**
Figs 1407–1409

1888. *Stenopelmatus hydrocephalus.* Verhandlungen der Kaiserlich-Koniglichen Zoologisch-Botanischen Gesellschaft in Wien 38:261. Holotype megacephalic adult female (Figs 1407 & 1408): (1) Californien Thomas leg. Coll. Br. V. W. (2) red label Type (3) 10150 (4) coll. Nat. Mus. Wien (5) S. hydrocephalus m. Measurements in mm: Body length 36.5, height of head 17.3, left femur length (missing right femur) 15.0, left tibia length 13.2. Left rear tibia (Fig. 1409A) with 5 inner and 3 outer spines, 2 ventral spurs. Face (Fig. 1409B) without furrow. Deposited in NHMW Vienna.

1906. *Stenopelmatus cephalotes* Walker 1869. Kirby, A Synonymic Catalogue of Orthoptera. Vol. II, Orthoptera Saltatoria, Achetidae et Phasgonuridae, 2:112, placed *S. hydrocephalus* as junior synonym of *S. cephalotes.*

1916. *Stenopelmatus fuscus.* Hebard, Journal New York Entomological Society, 24, 74. This synonymy clearly in error since *S. fuscus* is not in California.

2021. *Ammopelmatus hydrocephalus.* Weissman *et al.,* Zootaxa, 4917, 1-122. Transferred to *Ammopelmatus* based on rear leg tibial spines. **New status here designated: nomen dubium** based on lack of adequate locality information, distinguishing morphological features, and the presence of several taxa in California that can be megacephalic.



FIGURE 1407. Adult female holotype *A. hydrocephalus.*



FIGURE 1408. Adult female holotype *A. hydrocephalus.*

Derivation of name. "hydrocephalus" refers to a medical condition in which fluid accumulates in the brain, typically in young children, resulting in enlargement of the head.

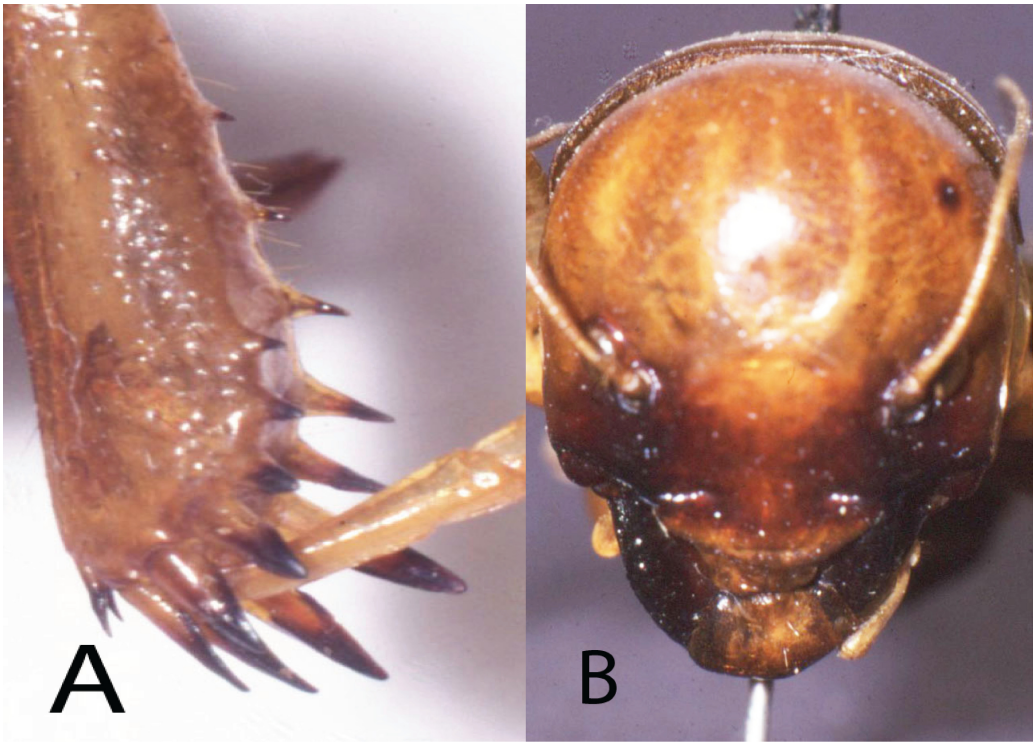


FIGURE 1409. Holotype adult female *A. hydrocephalus.* A. Left rear leg tibia showing 3 outer and 5 inner spines. B. Face showing absence of furrow.

***Ammopelmatus irregularis* (Brunner von Wattenwyl)**
Figs 1410–1414

1888. *Stenopelmatus irregularis*. Verhandlungen der Kaiserlich-Koniglichen Zoologisch-Botanischen Gesellschaft in Wien 38:261. Syntype series included specimens from Arizona, Mazatlán, and California, although measurements were only given for a female 47 mm in length, with a hind femur of 16.5 mm and hind tibia of 16 mm in length. Unfortunately, we are not told which specimen these measurements are from; nor how many specimens there are in the syntype series from these localities. We now address these syntype localities in order: (1) An Arizona specimen was designated as lectotype by Karny, in 1929 (see below). (2) Harald Bruckner of NHMW Vienna has located (pers comm to DBW 10-vii-2023) 3 adult females (Fig. 1414), from Mazatlán, in Box 25. All 3 adults appear to have been collected by Steindachner, according to H. Brucker, but no more information is available. We find the following notable spination for these individuals: Female #1 has 3 fore tibia spurs and 8 middle leg calcars; Female #2 has 2 fore tibia spurs and 8 middle leg calcars, 2 spurs; and Female #3 has 3 fore tibia spurs and 8 middle calcars. All three females have 2 ventral spurs on the middle leg tibia; with the hind leg tibia having 2 outer and 5 inner spines with 2 ventral spurs. Surprisingly, these specimens from Mazatlán are the only JC records from the Mexican state of Sinaloa that we are aware of. (3) We have not found a 'type' labeled specimen from California, nor did Hubbell (1960) in any European Museum, although given the diversity of *Ammopelmatus* taxa in California, any specimen(s) in the syntype series from 'California' would be of little use without more precise locality information.

1916. *Stenopelmatus longispina*. Hebard, Journal New York Entomological Society, 24, 80, as a junior synonym of *S. longispina*.

1929. *Stenopelmatus irregularis*. Karny, Annals Naturhistorisches Museum Wien 43:41. Karny (1929) designated, as lectotype, the adult female from Arizona (Fig. 1410) with these labels (Fig. 1411): (1) Coll. Br. v. W. ex Mus. Godeffroy Arizona (2) 10.439 (3) red label Type (4) Coll. Nat.-Mus. Wien (5) S. irregularis. Measurements in mm: Body length 36.3, hind femur length 15.8, hind tibia length 15.6. Fore tibia with 3 ventral spurs; Middle tibia with 8 calcars, 2 ventral spurs; Hind tibia (Fig. 1412) with 2 outer and 5 inner spines but inner spines on both legs in unusual arrangement: most distal is small while 2nd spine is larger and offset while #3 through #5 are normal

in position. There are 2 ventral spurs on the rear leg. Ovipositor (Fig. 1413A), and the face is without a furrow (Fig. 1413B). Specimen in NHMW Vienna.

1937. *Stenopelmatus longispina.* Karny, Genera Insectorum, 206, 44.

2021. *Ammopelmatus irregularis.* Weissman *et al.* Zootaxa, 4917, 1–122. Moved to *Ammopelmatus* based on rear leg spines and geographic location.

We are unsure what to do with this name because no species in the Longispinus Group, as *A. irregularis* was synonymized by Hebard (1916), occurs in Arizona; and the whole syntype series lacks an adult male. We thus **change its status to nomen dubium** given the uncertainty as to its identity and our lack of any morphologically similar Arizona specimens: In Table 25 (p. 44) we summarize the characters of the 3 taxa that we recognize in Arizona: *A. grayi, A. navajo,* and *A. portal.* None of these species has the particular rear leg inner spine #1 seen in the lectotype.



FIGURE 1410. Adult female lectotype *A. irregularis*, in different views.

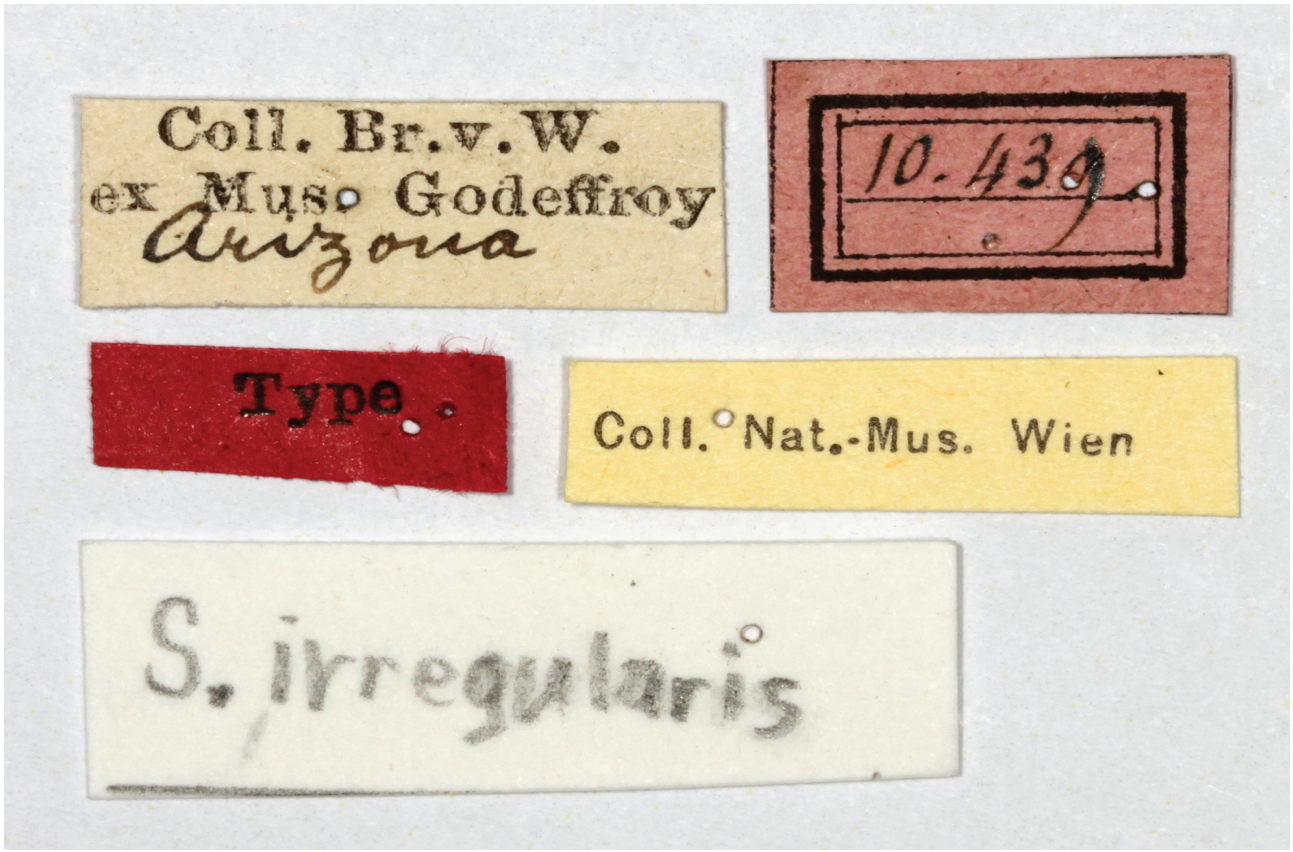


FIGURE 1411. Label data from lectotype adult female *A. irregularis* (photo H. Bruckner).

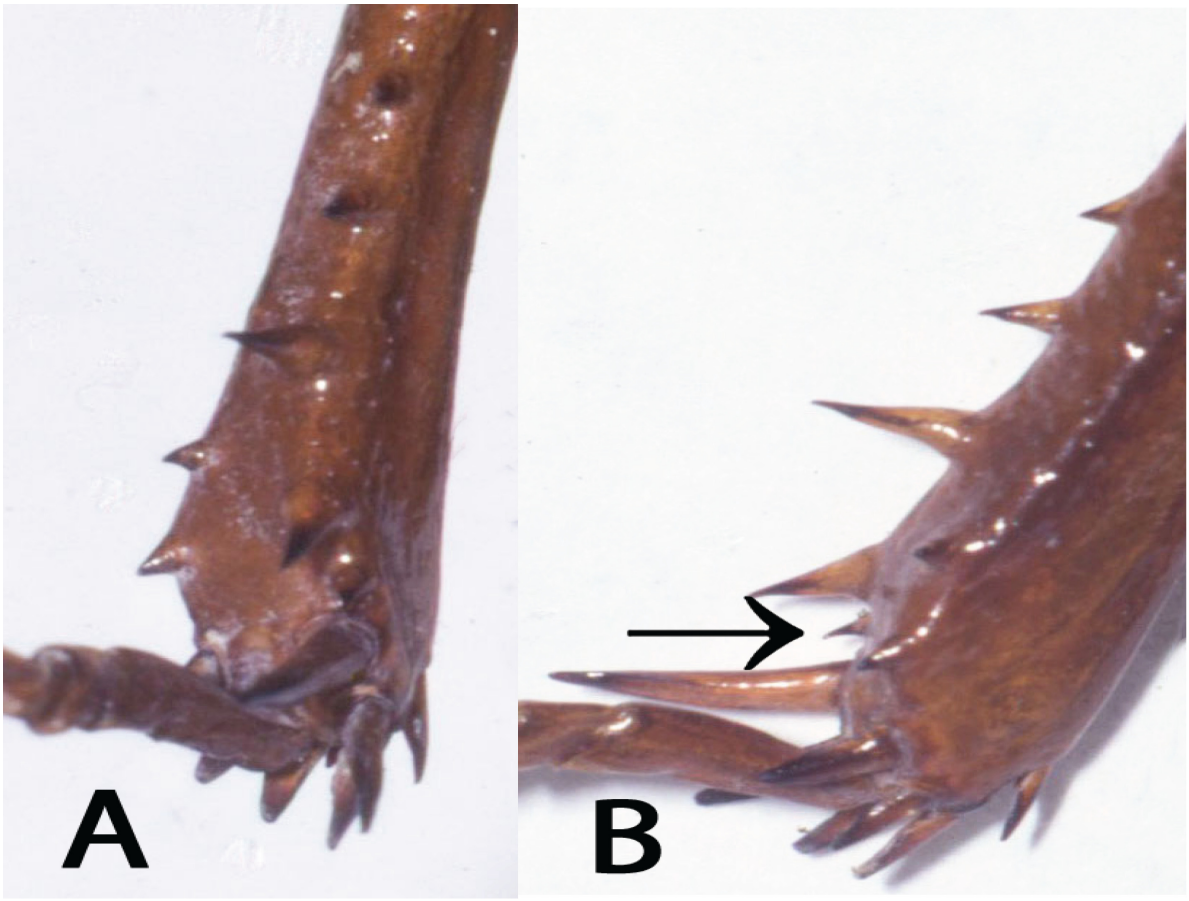


FIGURE 1412. Adult female lectotype *A. irregularis*, from Arizo*na.* A. Left rear leg tibia showing inner spine #1 smaller than inner spine #2. B. Right rear tibia lectotype showing slightly different perspective on right side, and clearer view of smaller spine #1 (arrow).

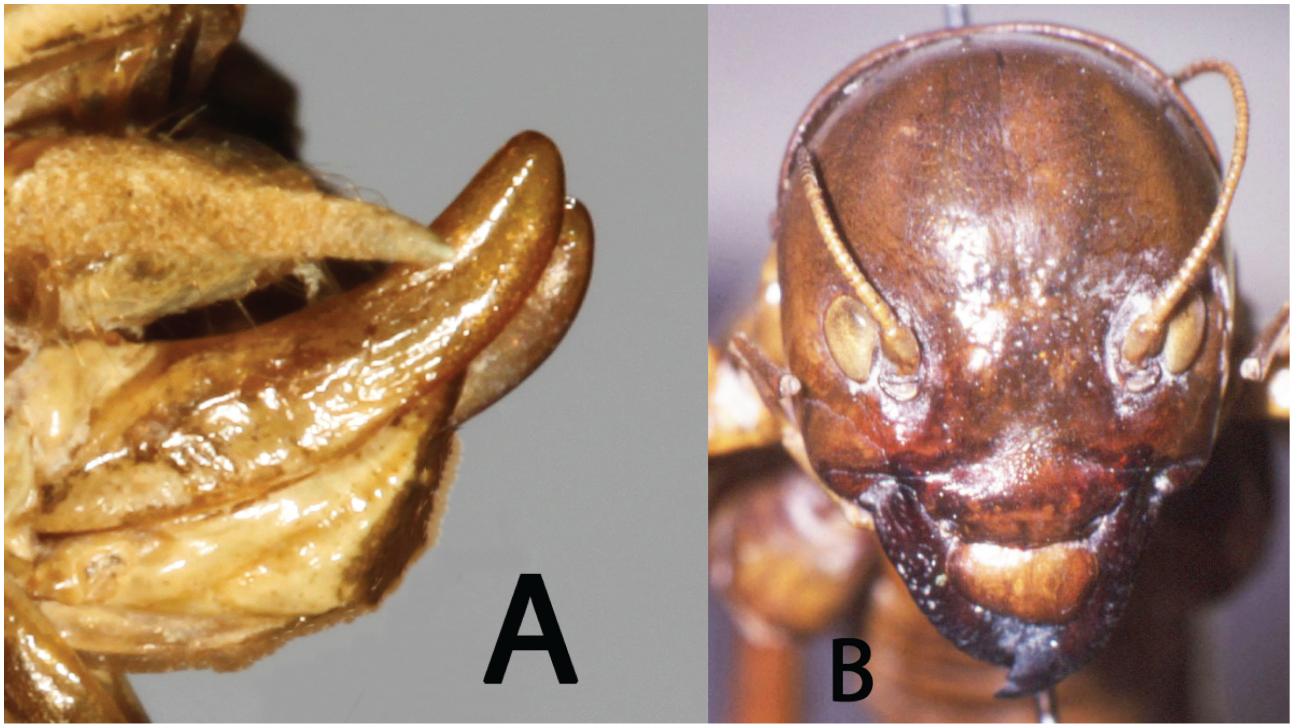


FIGURE 1413. Lectotype adult female *A. irregularis.* A. Ovipositor. B. Face showing absence of furrow.



FIGURE 1414. Syntype adult females of *A. irregularis*, from Mazatlán, Mexico. A. Specimens. B. Labels (same for each specimen). (Photos H. Bruckner).

Derivation of name. We wonder if "irregularis" refers to the alignment of the rear leg tibial spines not being linear, but irregularly spaced? This condition is also seen in certain specimens of at least the following *Ammopelmatus* taxa: *A. bigsur*, *A. catalinae*, *A. descansodunes*, *A. longispinoides*, *A. mtshasta*, and *A. rentzi.* This rear inner leg spine arrangement is also similar to that seen in the neotype of *Stenopelmatus talpa*, and the probable adult female of *S. talpa* in Vienna (Weissman *et al.* 2021, p. 98).

Discussion. The three adult females from Mazatlán, in the collection of NHMW Vienna, are intriguing. First off, how did these specimens get into that collection? If collected by Steindachner, were they collected during his time aboard the Hassler Expedition, which went from Boston to San Francisco between 1871 and 1872? This appears unlikely since according to James Henry Blake's summary of the Hassler Expedition (https://viewer.lib.harvard.edu/example/manifest/?manifestId=https://iiif.lib.harvard.edu/manifests/drs:11806543&_gl=1*ez0z1w*_ga*MzQ0NzczMDUxLjE3NDcxNTc0NDM.*_ga_3CXC97RWEK*czE3NDcxNTc0NDMkbzEkZzEkdDE3NDcxNTgxNjUkajYwJGwwJGgw), they stopped in Acapulco and Magdalena Bay, Mexico, but not in Mazatlán. And how did the specimens get to Vienna? Since most of the material from that expedition was supposedly deposited at Harvard or The Smithsonian (https://siarchives.si.edu/collections/auth_exp_fbr_eace0019)? And the three specimens are dated 1879, which might represent when they were given to Brunner von Wattenwyl. Perhaps Steindachner visited Mazatlán at another time?

We also refer the reader to p. 521, where we describe *A. sonoraensis*, the only JC specimen known from the Sinaloa neighboring Mexican state of Sonora.

Ammopelmatus oculatus (Scudder)

Figs 1415 & 1416

1876. *Stenopelmatus oculatus.* Bulletin U.S. Geological and Geographical Survey of the Territories 2: 261. (1) Utah Packard (2) Scudder's Type 1876 (3) S. H. Scudder coll. (4) red label: Type 8752 (5) [Deposited] ANSP. Pinned megacephalic adult male (Fig. 1415), with hooks. Measurements in mm: Body length 30, hind femur length 13. Face without furrow (Fig. 1416A). Rear leg tibia (Fig. 1416B) with 5 inner and 3 outer spines.

1906. *Stenopelmatus cephalotes* Walker 1869. Kirby, A Synonymic Catalogue of Orthoptera. Vol. II, Orthoptera Saltatoria, Achetidae et Phasgonuridae. 2:112, moved *S. oculatus* to junior synonym of *S. cephalotes.*

1916. *Stenopelmatus fuscus.* Hebard, Journal New York Entomological Society, 24, 74, moved *S. oculatus* to junior synonym of *S. fuscus*, in error since the latter does not occur in Utah.

2021. *Ammopelmatus oculatus.* Weissman *et al.*, Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus*, based on rear leg spines and collection locality. **New status: nomen dubium**, because there are four species of *Ammopelmatus* known from Utah (Table 33, p. 47), coupled with lack of specific locality data, drumming information, and DNA for the holotype.



FIGURE 1415. Holotype adult male *A. oculatus.*

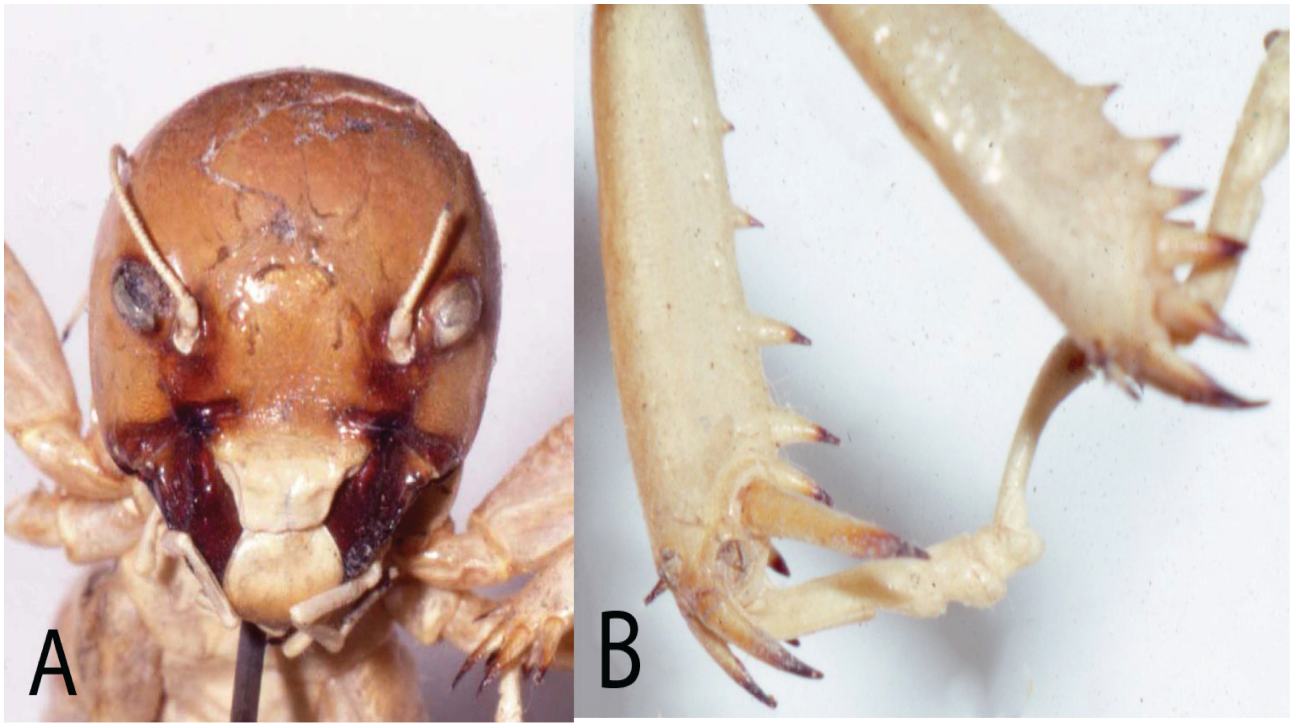


FIGURE 1416. Holotype adult male *A. oculatus.* A. Showing megacephalism and absence of furrow. B. Rear leg tibial spines holotype *A. oculatus* showing 5 inner and 3 outer.

***Ammopelmatus terrenus* (Rehn)**
Figs 1417 & 1418

1902. *Stenopelmatus terrenus*. Entomological News, 13, 240. Holotype probably last instar female, from "Texas." Measurements in mm: Body length 29.2, hind femur length 10.7. Hind leg tibia with 2 outer and 4 inner spines. Deposited at ANSP, Type No. 5178. The holotype is a puzzling specimen (Fig. 1417) in that she clearly has alternating black and yellow stripes on most tergites, consistent with *A. mescaleroensis*, and some species in the Longispinus Group. But *A. mescaleroensis* is the only large JC known from Texas. The holotype also has a long #1 calcar (Fig. 1418)

in the ringlet of 6, but this character is generally variable, and non-diagnostic, with females of both *A. mescaleroensis* and species in the Longispinus Group. And a quick look at the holotype (Fig. 1418) shows that the most distal, outer hind leg tibial spine #1 does not have a flattened, rear facing face, but is attenuate (gradually tapering apically), which clearly rules out this specimen being *A. mescaleroensis.* Additionally, Hebard (1916) says:

> "Rehn's name, *terrenus,* is based upon a typical immature female which has, however, been dried after immersion in alcohol, with pronotum more decidedly constricted caudad than usual as a result. The specimen probably came from California, having been obtained from the Cope Collection of reptiles, where it had been doubtless incorrectly labeled. Another immature male specimen of the same size and from the same lot, correctly recorded by Rehn as *longispina,* bears the same labeling."

2021. *Ammopelmatus terrenus.* Weissman *et al.,* Zootaxa, 4917, 1–122. Transferred to *Ammopelmatus* based on length of rear leg tibial spines.

In response to the type's subadult status, a confusing constellation of morphological characters, and uncertainty as to its geographic origin, we **change its status from junior synonym of *A. longispina*** (as per Hebard 1916) **to nomen dubium.**

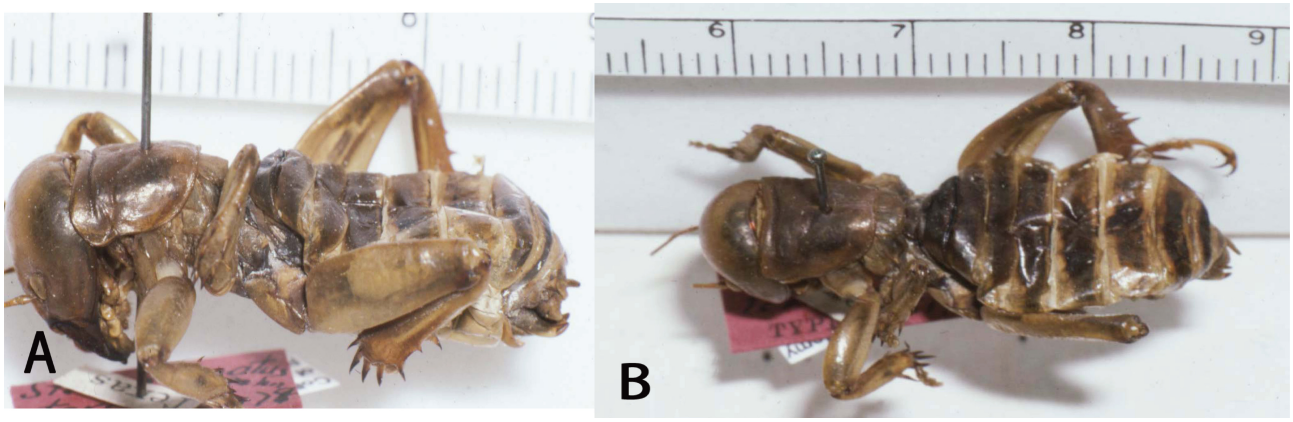


FIGURE 1417. Holotype last instar female *A. terrenus*, showing two different perspectives.

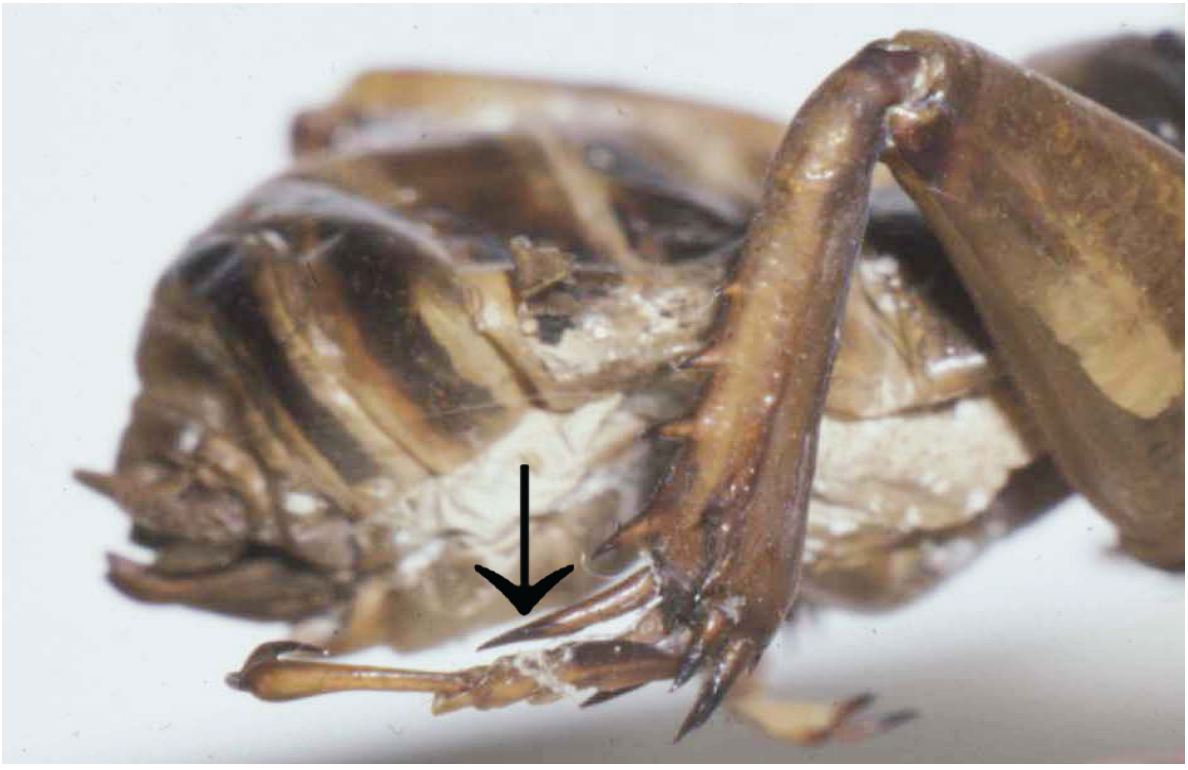


FIGURE 1418. Holotype *A. terrenus.* Note long calcar #1 (arrow) and attenuate outer spine #1.

Derivation of name. Rehn (1902): 'terrenus' in allusion to the Mexican name "niña del tierra" (sic) (child of the earth), applied to individuals of this genus in the Southwestern United States and Mexico.

Discussion

We utilized acoustic, morphological, cytological, and molecular data to test concordance in species' boundaries. Our results at the (higher) Group levels were consistent between different runs.

What percentage of *Ammopelmatus* species have we described?

In our earlier paper on *Stenopelmatus* JCs (Weissman *et al.* 2021), we estimated that as little as 30% of the species' diversity in Mexico and Central America could be known, an estimate subsequently supported by Gutiérrez-Rodríguez *et al.* (2022). For the United States and Baja California *Ammopelmatus* JCs, we estimate (hope) that we have covered a number closer to 90% of the existing species. Those areas most likely to contain undescribed taxa include the Mojave Desert, where a combination of isolated mountain ranges, with poor access roads, continued droughts, and little collecting, indicate that they appear to harbor endemic taxa, e.g., the Kokoweef Peak (*A. kokoweef*) and the Piute Mt Range *(A. piute*). But even areas with good road access can have rare, undescribed endemics: e.g., the San Gabriel Mts, with *A. wrightwoodi* and *A. bigpines*, known from only one or two individuals. Also known from only one or two individuals are *A. anzaborrego* from outside Anza Borrego State Park; *A. crypticus* from the Tehachapi Mts; *A. evansi* from the Crescent Dunes in Nevada; *A. kennedymeadowsdos* from the southern Sierra; *A. bajasur* from Baja California Sur, Mexico; and *A. sonoraensis* from Sonora, Mexico.

Populations that need further investigations

(1) We strongly suspect that *A. mahogani* and *A. portal* represent a complex of sister species given the diversity of both, as shown in the genetic trees; and the fact that many populations appear isolated in sky island situations. Nevertheless, these isolated populations are morphologically indistinguishable with similar karyotypes and calling drums.

(2) Other species with apparent genetic divergence shown in the trees include *A. castaneus, A. chimineas, A. danieli, A. dogtown,* and *A. springville*.

(3) Along the I-5 Grapevine, at a paratype locality (S01-13) of *A. grapevine,* we karyotyped (Fig. 1419) a male nymph (T01-73) with 2n♂=23. This nymph had 2 fore leg tibial spurs, which is consistent with *A. grapevine,* but the latter has 2n♂=25. Unfortunately, we did not take a leg for DNA analysis but we wonder if this could be *A. crypticus*? Since the most likely other taxon there, *A. tehachapi*, also has 2n♂=25.

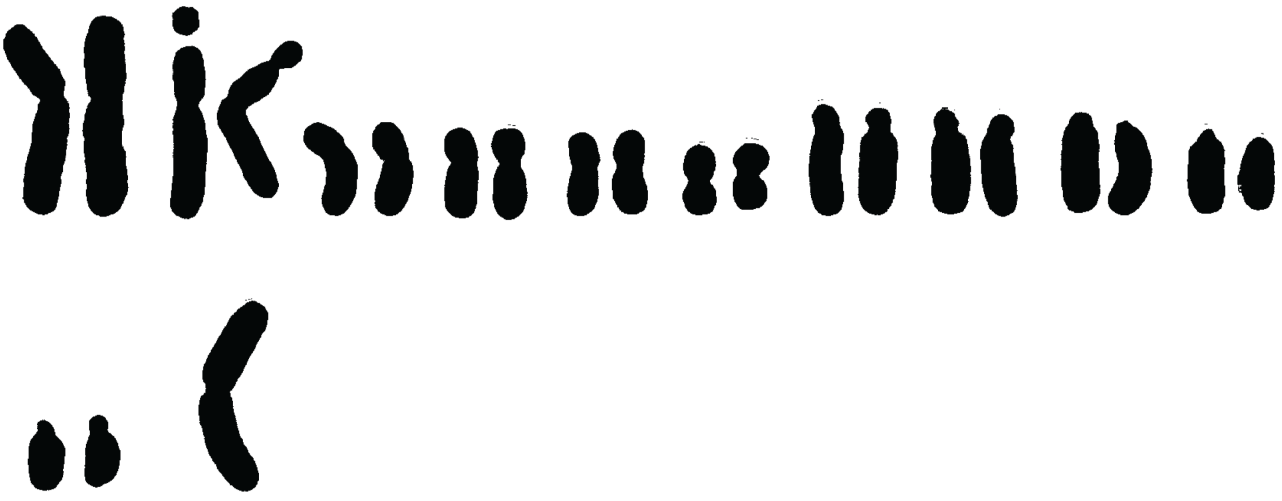


FIGURE 1419. Karyotype of unknown taxon (T01-73, S01-13) clearly showing 2n♂=23.

(4) Harald Bruckner of NHMW Vienna has located (pers comm to DBW 10-vii-2023), 3 adult females (Fig. 1420), from Mazatlán, in Box 25, apparently representing part of the syntype series of *A. irregularis* (see p. 750). All 3 adults appear to have been collected by Steindachner, according to H. Bruckner, but no more information is available. These specimens from Mazatlán are the only JC records from the Mexican state of Sinaloa that we are aware of. According to Wikipedia: Franz Steindachner took part in the Hassler Expedition of 1871–1872, a journey that circumnavigated South America from Boston to San Francisco. That time period would be appropriate for his collecting at Mazatlán, and this issue is discussed further, on p. 753, under *A. irregularis*.



FIGURE 1420. Three adult females apparently from the syntype series of *A. irregularis.* (Photo H. Bruckner).

(5) Seven possible new species are indicated, in the Astral tree, by either "*A.* sp. #1, #2, #3, #4, #5, #6, or #7". We are continuing our field work on these populations and anticipate presenting more definitive results in the future.

Conservation issues and endangered species

As of February, 2026, there are currently no species of JCs protected under the US Endangered Species Act or under any state Endangered Species Act, although the California Fish and Wildlife Service lists (https://wildlife.ca.gov/Data/CNDDB/Invertebrates#insects-orthoptera) *A. cahuilaensis*, *A. kelsoensis*, and *A.* muwu as species of special concern. Our results suggest that *A. muwu* (p. 567) is distributed in several areas within the old Pt Conception Bixby Ranch (now the Jack and Laura Dangermond Preserve), as well as on Vandenberg Space Force Base, and so may be sufficiently protected (also see Yan *et al.* 2025). Limited distributions and uncertainties in future habitat suitability associated with climate change and drought are factors that provide evidence for retaining *A. cahuilaensis* (p. 425) and *A. kelsoensis* (p. 281) on the California Species of Special Concern.

The following USA taxa could be considered for addition to the California Species of Special Concern given a combination of limited distributions, habitat modification, and unknown effects from climate change, especially increased temperatures and decreases in rainfall: *A. ballmeri* (p. 418) from Riverside Co., CA; *A. etiwanda* (p. 384) from Riverside Co., CA; *A. evansi* (p. 320) from Crescent Dunes, NV; *A. joshuatree* (p. 276) from Joshua Tree National Park, CA; *A. kokoweef* (p. 535) from San Bernardino Co., CA; *A. sakai* (p. 390) from Los Angeles Co.,

CA; and *A. zayante* (p. 647) from Santa Cruz Co., CA. There are three taxa from the Baja California Peninsula, Mexico, that could also warrant an evaluation for protection: *A. descansodunes* (p. 80) from the Descanso Dunes, Baja California; *A. sanmartinensis* (p. 125) from Isla San Martin and the adjacent Peninsula, Baja California; and *A. sanfrancisco* (p. 121) from the San Francisco Mts, Baja California Sur.

We are unsure what effects climate change will have on JC populations; and just as importantly, on the ability of researchers to monitor their populations. With an increase in droughts, especially in winter and spring when JCs are most easily obtained under objects while the ground is cool and wet, collecting will be negatively impacted. Late spring and summer are good times to use oatmeal trails to collect JCs that are on the surface at night, apparently looking for food and/or mates. Will drought and increased day and nighttime temperatures decrease such surface wanderings? Or will JCs largely be able to escape the hardships of drought and increased temperatures by burrowing deeper into the ground? Short of using a backhoe for excavation, how does one effectively monitor JC populations to see how they are doing?

We believe that we have already seen significant local climate changes. For example, from 1986–1990, at DBW's Los Gatos, CA, house, some 160 adult *A. brachysocius* were collected in the late fall and early winter after falling into a swimming pool. This large sample was subsequently used by Weissman *et al.* (2008) to demonstrate sexual dimorphism for rear leg femur length. Anecdotally, since the mid 1990s, minimum winter temperatures in Los Gatos have increased and first fall rains have come later, the latter documented for California as a whole (see Luković *et al.* 2021); and similarly for Baja California (Zermeño-Díaz 2025). Concomitant with these weather changes has been a decrease in the number of adult JCs collected such that yearly totals are now single digits. But whether this decrease is the result of actual population declines or just decreased nocturnal surface wandering is unknown. How to monitor population levels of all JCs, and not just those that are endangered, will be a future challenge, since it is difficult to distinguish between decreased surface wandering, where JCs can be easily collected, and actual subterranean decreases in population sizes. The sampling technique of Prentice *et al.* (2011) should be useful for those species living in sandy habitats.

Areas for future study

1. Are there correlations between substrate composition and texture, and the specialization seen in male rear leg calcar shape, especially in both the Lightfooti and Longispinus Groups? Can these correlations be tied to populations of certain taxa (see p. 24) where individuals are polymorphic for abdominal color? What factors (genetic vs edaphic) cause these color dimorphisms, for example, as seen in *A. mescaleroensis* from Mescalero Dunes, and elsewhere (discussed on p. 512)? Is this a case of negative frequency-dependent natural selection (Nosil *et al.* 2024)? On the other hand, since all JCs are usually strictly nocturnal, it is unclear how body color differences are appreciated by predators when sunlight is minimal.
2. Is the spacing of inner and outer rear leg tibial spines of taxonomic significance? Clearly the number of spines is taxonomically useful.
3. How important are calling drum characters, such as length of drum bursts, loudness, intervals between bursts, whether receiving adult is "polite", i.e., waits for the first drummer to finish their drum before answering, etc., in the female's decision to duet? Does the male always go to the female? Especially in *A. kennedymeadows* and *A. brockovichi* where the male's drum is longer than the female's drum. Does the 50% slower and 100% faster species drumming rate cutoff criteria always work to separate morphologically similar taxa?
4. Could there be taxonomic and phylogenetic information in the shape of the non-sclerotized, adult male phallic lobes, as claimed by Suastes-Jiménez *et al.* (2023), and which are unfolded and expanded during mating, as seen in Fig. 1i (Weissman *et al.* 2008), and as documented by Hubbell (1977, p. 277) in camel crickets; and Weissman *et al.* (2024) in JCs? Might the everted male genitalia have a pheromone release function, as suggested by *A. leei* (Fig. 1378, p. 731)? What are the best techniques to unfold and preserve these expanded lobes? Species in the Lightfooti Group partially unfold their phallic lobes upon being killed by injection (see Fig. 6, p. 16).
5. Would a more precise determination of autosomal and sex chromosome centromere positions, within and between species, when coupled with various chromosome coloring techniques, be of phylogenetic usefulness, as in Warchałowska-Śliwa *et al.* (2013, 2021).

6. In the Lightfooti Group, where the 10 known species have chromosome numbers ranging from 2n♂=19, 21, 23, and 25, Table 39 (p. 51) shows that there is not a simple relationship between number of arms (NF number in males) and chromosome number reduction. This lack of relationship supports a reduction mechanism other than just multiple Robertsonian fusions. Further efforts to clarify these steps might also answer the question of why the Lightfooti Group includes the only species that appear to have undergone multiple chromosome number reductions during speciation.
7. Determine how to get mated adult female JCs to oviposit, so that complete life histories can be investigated. And to see if attempts at hybridization can help document species boundaries more accurately. Interestingly, Davis (1927, p. 163) seems to have been successful in finding various natural egg clutches, some apparently "lined with a paper-like substance."
8. How widespread, and for what characters, has morphological convergence occurred in JCs?
9. For most taxa living in areas of California without a deep winter freeze, adult males are rarely collected during winter (and spring) months, while adult females can be readily found. Laboratory results show that adult females are longer lived than adult males (mated or not) but what role does male complicit, post-coital sexual cannibalism (see p. 25) play in this distorted sex ratio? Do those females still alive in the spring continue to oviposit?
10. Can JCs somehow gauge the size of the rock that they take refuge under during the cold, wet winter months, where it seldom freezes, in coastal California? We generally find individuals under small to medium sized rocks (defined as those rocks that are easy to look under), when the lowest nighttime temperatures are above 5°C. Big rocks that are difficult to roll, seem to be favored when nighttime temperatures approach freezing. Can individuals somehow sense the size of the rock (and the amount of thermal protection that it will provide)? Once daytime temperatures exceed 16°C, or the soil dries out, then JCs appear to burrow down. Finding more than one JC under a rock is unusual; can they sense the presence of another nearby JC; who they might want to avoid because of potential cannibalism? Do JCs spend the entire winter under the same rock or do they move around on warm winter days?
11. When temperatures drop, are JCs protected from freezing by internal antifreeze compounds? At unexpected low temperatures, are they still able to dig down into the warmer soil since we never find frozen ones under rocks, even when those rocks are covered with snow (as at Kennedy Meadows for *A. kennedymeadows*)? In contrast, individuals of *A. joshuatree* (p. 280) appear to have been frozen when sifted from their type locality during mid-February collecting.
12. Are there phylogenetic characters present in the size and shape of the adult male hooks? We know that last instar males of the Fast Drumming Group have the smallest ridges known, which makes determining when they are last instars, for when to take testes, difficult. In contrast, last instars of the Longispinus Group have high ridges frequently with an overhanging lip. But we have not analyzed, between Groups, the size and shape of the adult hooks.
13. Would a species' survey of cutaneous hydrocarbons be of phylogenetic use, such as shown by Neems & Butlin (1995) and Sevgili *et al.* (2025)?
14. What are the major factors that contribute to speciation in JCs? Is it calling drum differences, karyotype changes, habitat specialization and isolation in a flightless group with poor dispersal ability, etc.; and which evolutionary forces come first (see Palacios-Gimenez *et al.* 2025 for an attempted analysis on the function of karyotype changes in speciation)? Are there parallels with the diversification situation seen in California trapdoor spiders (Newton *et al.* 2023)?
15. Despite our combining the typical morphological and genetic analysis to our speciation situation in the JC genus *Ammopelmatus*, we have the added "benefit" of information from karyotype, calling song, and multiple taxa with restricted distributions. Yet our best efforts to fold all of these data sources into an integrative taxonomy have been frustrating. Might a future combination of integrative taxonomy and artificial intelligence be more successful?

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APPENDIX 1. List of diploid number in *Ammopelmatus* taxa; and those species with sex clarification drums and/or nymphs that drum.

Species	2n♂=	SCD documented? Y=yes N=no **no live adult males studied	Nymphs drum? Y=yes N=no
A. abelai	25	Y	N
A. acton	23	Y	N
A. angelusaoks	?	N	N
A. anzaborrego	?	N	N
A. argus	?	Y	Y
A. ashleighi	25	N	Y
A. bajasur	?	**	?
A. bakersfield	?	N	N
A. ballmeri	23	N	N
A. ballonadark	23	Y	Y
A. bartonflats	25	Y	N
A. bigpines	?	N	N
A. bigsur	25	N	N
A. brachysocius	25	N	N
A. briani	25	N	N
A. brockovichi	25	Y	N
A. bruneaudunes	21	Y	N
A. cahuilaensis	25	Y	N
A. calimesa	23	Y	N
A. carsoncity	23	Y	Y
A. castaneus	23	Y	N
A. catalinae	25	N	N
A. cathedralgorge	25	Y	N
A. cedarview	25	N	N
A. chimineas	23	N	N
A. chinalake	?	**	N
A. christmasvalleydunes	19	Y	N
A. clarki	25	**	N
A. comanchus	?	**	?
A. coralpink	25	N	N
A. coyflat	25	Y	N
A. crypticus	?	Y	N
A. danieli	23	Y	N
A. davewerneri	25	N	Y
A. descansodunes	25	N	N
A. dogtown	?	N	N
A. eatoncanyon	25	Y	Y
A. ensenada	25	N	N
A. etiwanda	23	N	N
A. evansi	?	N	N
A. finnon	25	N	N
A. fisheri	23	Y	N

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APPENDIX 1. (Continued)

Species	2n♂=	SCD documented? Y=yes N=no **no live adult males studied	Nymphs drum? Y=yes N=no
A. fremontpeak	23	Y	N
A. fuscus	?	N	N
A. glacierlodge	25	N	Y
A. glennville	25	Y	N
A. gomezfarias	?	N	N
A. grahami	25	N	N
A. grapevine	25	N	N
A. grayi	25	Y	N
A. hovorei	25	Y	N
A. icenoglei	25	N	N
A. idaho	19	Y	N
A. intermedioides	?	N	N
A. intermedius	23	N	Y
A. islander	25	Y	Y
A. joshuatree	25	Y	Y
A. juniperdunes	21	Y	Y
A. kelsoensis	?	Y	N
A. kennedymeadows	25	N	Y
A. kennedymeadowsdos	?	**	Y
A. kirai	23	Y	N
A. knighti	25	Y	N
A. kokoweef	?	**	?
A. lagunahanson	23	Y	N
A. lakecachuma	23	Y	N
A. lakesherwood	25	Y	N
A. larumorosa	25	Y	N
A. leei	23	Y	N
A. lightfooti	23	Y	N
A. lincolncounty	?	Y	N
A. longispinoides	25	N	N
A. longispinus	?	**	?
A. mahogani	25	N	Y
A. mescaleroensis	25	N	Y
A. monolake	25	N	Y
A. mtpinos	23	N	N
A. mtshasta	25	N	Y
A. muwu	23	Y	Y
A. navajo	25	N	Y
A. nigrocapitatus	25	Y	N
A. oneillpark	25	Y	N
A. owensvalley	23	Y	Y
A. pictus	25	N	N
A. pinnacles	23	N	N

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APPENDIX 1. (Continued)

Species	2n♂=	SCD documented? Y=yes N=no **no live adult males studied	Nymphs drum? Y=yes N=no
A. pinyonpines	25	Y	Y
A. piute	?	**	?
A. portal	23	Y	N
A. pratti	25	N	N
A. reno	25	N	Y
A. rentzi	25	N	N
A. rusti	23	Y	N
A. sakai	23	N	N
A. sandiego	25	N	N
A. sanfrancisco	?	N	N
A. sangabriel	23	N	N
A. sanjacinto	23	Y	N
A. sanmartinensis	?	N	N
A. sanpedromartir	25	Y	N
A. santarosaplateau	23	Y	N
A. sierrapelona	25	Y	Y
A. skinner	25	Y	N
A. smithi	25	Y	N
A. sonoraensis	?	**	?
A. springville	25	Y	N
A. stringfellow	25	Y	N
A. tarcanyon	23	Y	Y
A. tehachapi	25	Y	N
A. temblor	23	N	N
A. tomsplace	23	Y	N
A. vandenberg	25	Y	N
A. warnermts	?	**	?
A. westgardpass	?	N	N
A. whitewater	25	Y	N
A. winnemucca	21	Y	N
A. wrightwoodi	?	N	N
A. yubalake	25	N	N
A. zayante	23	Y	N

APPENDIX 2. List of *Ammopelmatus* species that are sympatric with each other.

Combination #	State	County	Locality	Species combinations	Male calling drum	Male chromosome #
					drums/s	
1	CA	Alameda	Oakland Hills	*A. intermedius*	trills	23
				A. longispinoides	trills	25
2	CA	Fresno	Tuolumne Co.	*A. rentzi*	long to short trills	25
				A. springville	5-6 d/s	25
3	CA	Kern	Tehachapi Mt Park	*A. crypticus*	3 d/s	unknown
				A. grapevine	10 d/s	25
				A. tehachapi	1.5 d/s	25
4	CA	Los Angeles	Ballona Dunes	*A. ballonadark*	5.5 d/s	23
			El Segundo Dunes	*A. sakai*	0.6 d/s	23
5	CA	Los Angeles	Eaton Canyon	*A. eatoncanyon*	5.6 d/s	25
			Wilderness Park	*A. mahogani*	0.7 d/s*	25
6	CA	Los Angeles	Placerita Canyon Nature Center	*A. hovorei*	5.6 d/s	25
			San Gabriel Mts	*A. mahogani*	0.7 d/s*	25
7	CA	Los Angeles	Charmlee Park	*A. leei*	5.8 d/s	23
			Santa Monica Mts	*A. mahogani*	0.7 d/s*	25
8	CA	Los Angeles	Winter Creek area	*A. mahogani*	0.7 d/s*	25
			San Gabriel Mts	*A. sangabriel*	0.7 d/s	23
9	CA	Los Angeles	Wrightwood area	*A. sangabriel*	0.7 d/s	23
			San Gabriel Mts	*A wrightwoodi*	4.5 d/s	unknown
10	CA	Los Angeles	Eaton Canyon	*A. eatoncanyon*	5.6 d/s	25
			Wilderness Park	*A. mahogani*	0.7 d/s*	25
11	CA	Monterey	Seaside	*A. bigsur*	trills	25
				A. danieli	10 d/s	23
12	CA	Orange	Caspers Park, Starr Ranch	*A. oneillpark*	5.9-6.8d/s	25
			Santa Ana Mts	*A. mahogani*	0.7 d/s*	25
13	CA	Riverside	Santa Rosa Plateau	*A. santarosaplateau*	8-10d/s	23
			Santa Ana Mts	*A. mahogani*	0.7d/s*	25

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APPENDIX 2. (Continued)

Combination #	State	County	Locality	Species combinations	Male calling drum	Male chromosome #
					drums/s	
14	CA	Riverside	Palm Springs Dunes	*A. cahuilaensis*	4.8 d/s	25
				A. calimesa	7.3 d/s	23
15	CA	Riverside	Whitewater Canyon area	*A. cahuilaensis*	4.8 d/s	25
				A. whitewater	1 d/s	25
16	CA	Riverside	Calimesa	*A. calimesa*	7.3 d/s	23
				A. mahogani	0.7 d/s*	25
17	CA	Riverside	Cherry Valley	*A. calimesa*	7.3 d/s	23
				A. mahogani	0.7 d/s*	25
				A. whitewater?	0.7 d/s	unknown
18	CA	Riverside	Timoteo Canyon, Colton	*A. icenoglei*	16.3 d/s	25
				A. stringfellow	6.4 d/s	25
19	CA	Riverside	Garner Valley	*A. mahogani*	0.7 d/s*	25
			San Jacinto Mts	*A. pinyonpines*	8.8 d/s	25
20	CA	Riverside	various San Jacinto Mts localities	*A. mahogani*	0.7 d/s*	25
				A. sanjacinto	4-6.5 d/s	23
21	CA	San Benito	Fremont Peak SP	*A. brachysocius*	trills to single drums	25
				A. intermedioides	long to short trills	unknown
				A. fremontpeak	8.6 d/s	23
22	CA	San Bernardino	Etiwanda Wash area	*A. ballmeri*	4.9 d/s	23
				A. etiwanda	1 d/s	23
23	CA	San Bernardino	Colton	*A. stringfellow*	7.2 d/s	25
				A. icenoglei	16 d/s	25
24	CA	San Bernardino	San Bernardino Mts	*A. mahogani*	0.7 d/s*	25
				A. ashleighi	0.7–1.1 d/s	25
25	CA	San Diego	Torrey Pines, Pala	*A. fisheri*	5 d/s	23

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APPENDIX 2. (Continued)

Combination #	State	County	Locality	Species combinations	Male calling drum	Male chromosome #
					drums/s	
				A. mahogani	0.7 d.s*	25
26	CA	San Diego	various—see text	*A. fisheri*	5 d/s	23
				A. sandiego	7.5 d/s	25
27	CA	San Francisco	San Francisco Zoo	*A. intermedius*	trills	23
				A. longispinoides	trills	25
28	CA	San Mateo	Pacifica	*A. intermedius*	trills	23
				A. longispinoides	trills	25
29	CA	Santa Barbara	Pt. Conception	*A. muwu*	3.3 d/s	23
				A. abelai	3 d/s	25
30	CA	Santa Barbara	Osa Flaca Dunes	*A. castaneus*	8 d/s	23
			Vandenberg Air Force Base	*A. muwu*	3.3 d/s	23
			Montana de Oro			
31	CA	Santa Barbara	Vandenberg Air Force Base	*A. castaneus*	8 d/s	23
				A. vandenberg	1.6 d/s	25
32	CA	Santa Clara	Los Gatos	*A. brachysocius*	trills to single drums	25
				A. pictus	1.5 short trills/s	25
33	CA	Santa Cruz	Felton Sandhills	*A. brachysocius*	trills to single drums	25
				A. zayante	14.3 d/s	23
34	CA	Tulare	Kennedy Meadows	*A. kennedymeadows*	6.7 d/s	25
				A. kennedymeadowsdos	5 d/s	unknown
35	CA	Tuolumne	western Sierra foothills	*A. pictus*	0.3 long trills/s	25
				A. rentzi	1.5 short trills/s	25
36	NM	Cibola, McKinley	El Malpais, Gallup,	*A. fuscus*	1.5 d/s	unknown

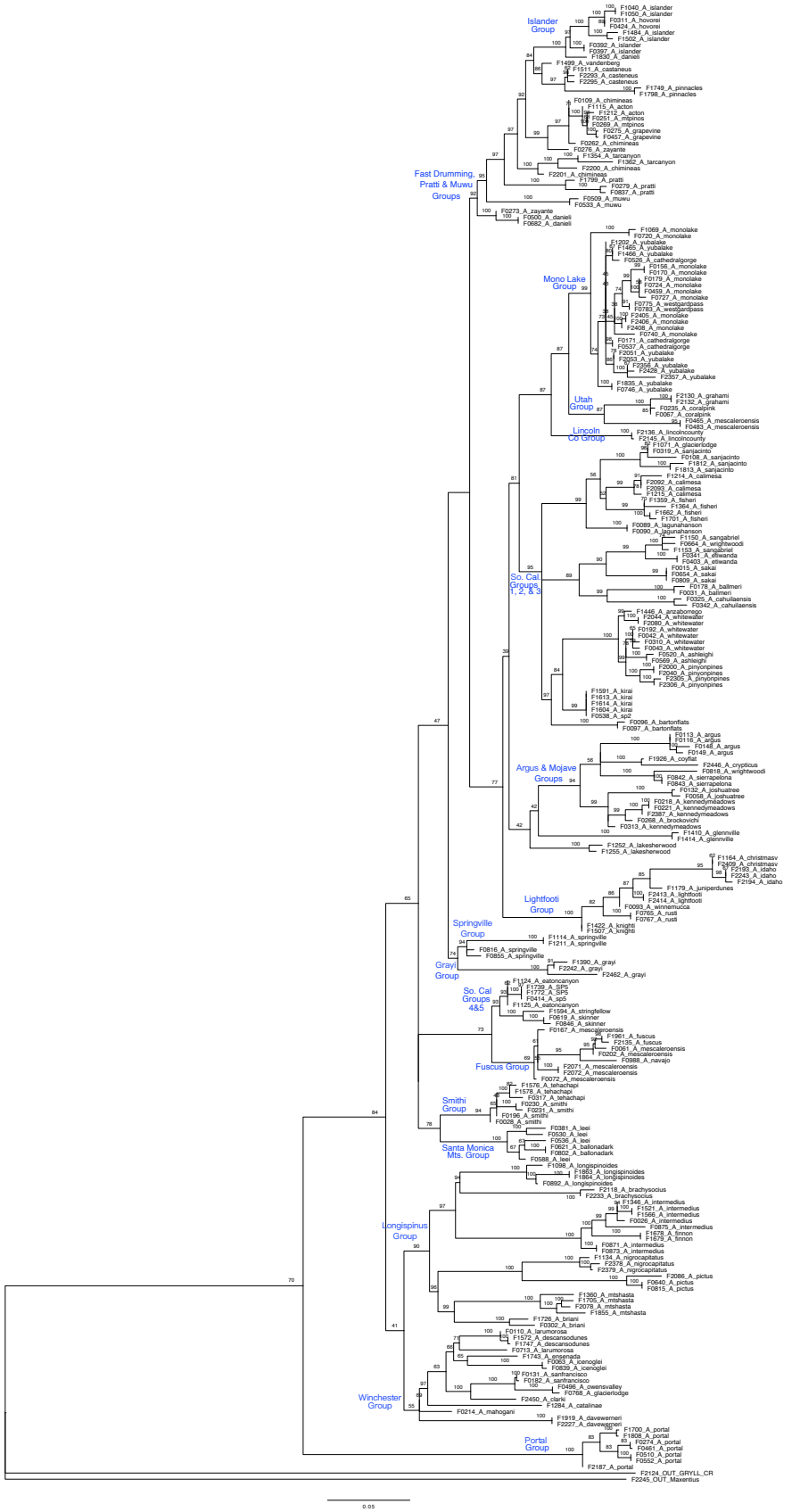
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APPENDIX 2. (Continued)

Combination #	State	County	Locality	Species combinations	Male calling drum	Male chromosome #
					drums/s	
		Sandoval, & Socorro	Bandelier, & Sevilleta	*A. portal*	3 part drum	23
37	NV	Carson City	Carson City	*A. carsoncity*	4.6 d/s	23
				A. reno	1.7 d/s	25
38	NV	Churchill	Blow Sand Mt	*A. knighti*	4.5 d/s	25
				A. rusti	6 d/s	23
39	NV	Churchill	Fallon Range Training Complex	*A. knighti*	5.3 d/s	25
				A. monolake	1.8 d/s	25
40	OR	Harney	Alvord Lake Dunes	*A. lightfooti*	3.2 d/s	23
				A. monolake	1.8 d/s	25
41	OR	Lake	Christmas Valley Dunes	*A. christmasvalleydunes*	3.6 d/s	19
				A. monolake	1.8 d/s	25
42	Mexico	Baja California	Laguna Hanson area	*A. lagunahanson*	4.1-4.3 d/s	23
				A. larumorosa	7 d/s	25

Pairs with different calling drums: 32	Pairs with different chromosome numbers: 21	* female calling drums different than males
Pairs with similar calling drums but different chromosome counts: 9	Pairs with same chromosome numbers but different drums: 16	
Incomplete information: 1	Incomplete information: 4	

APPENDIX 3. Maximum likelihood *Ammopelmatus* consensus tree of concatenated mtDNA 12S and COI sequence data.



Maximum likelihood consensus tree of concatenated mtDNA 12S and COI sequence data produced in IQ-Tree v. 3.0.1 with support values from 1000 ultrafast bootstrap replicates. Major groups are displayed on their corresponding clade in blue text.