

FIGURE 6. Distribution of Ovatus Group species.

## *Aglaothorax ovatus* (Scudder, 1899)

*Tropizaspis ovata*—Scudder, 1899: 84.

*Aglaothorax ovatus*—Caudell, 1907: 291 (A revision in status).

*Aglaothorax ovatus*—Tinkham, 1944: 289. (Incorrect synonymy).

*Neduba (Aglaothorax) ovata*—Rentz & Birchim, 1968: 69 (A revision in status).

*Neduba (Aglaothorax) ovata longicauda*—Rentz & Birchim, 1968: 71 **New junior subjective synonym.**

Fig. 6 (distribution), Fig. 7 (male and female habitus, calling song, male and female terminalia, karyotype), Plate 4 (male terminalia), Plate 7 (female subgenital plate), Plate 10 (male titillators), Plate 14 (male calling song).

**Common name.** Ovate Shieldback.

**History of recognition.** Described in *Tropizaspis* from a single male California specimen without a specific locality (Scudder 1899). After *Tropizaspis* fell as a *nomen nudum*, *ovatus* was designated as the type species of *Aglaothorax* (Caudell 1907), initially using the feminine gender. Confused with both *A. gurneyi* and *A. segnis* (Tinkham 1944). Transferred to *Neduba (Aglaothorax)* with *armiger* (Rehn & Hebard 1920) and *segnis* (Rehn & Hebard 1920) relegated to subspecies and the description of three new subspecies: *gigantea*, *longicauda*, and *tinkhamorum* (Rentz & Birchim 1968). Transferred back to *Aglaothorax* (Rentz & Colless 1990) where this species is currently classified (Cigliano *et al.* 2025). We raise *armiger*, *giganteus*, *segnis*, and *tinkhamorum* to species status based on morphological, phylogenetic, and cytogenetic evidence. Intergrades were reported between *ovatus* and *longicauda* (Rentz & Birchim 1968), and after examining large series from many populations, we conclude that more variation exists within than between *longicauda* and *ovatus* and synonymize the former name.

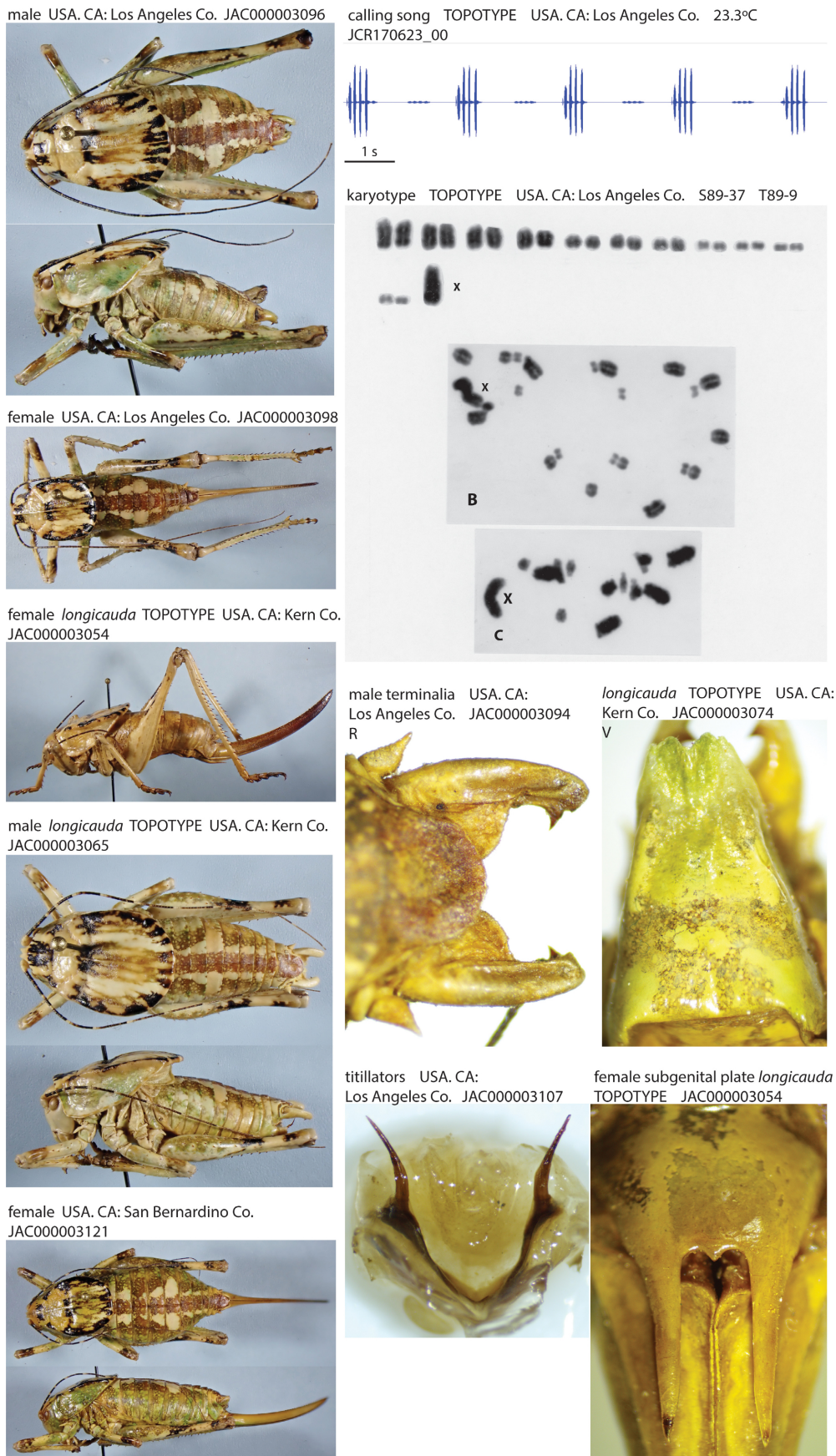
**Type material.** The holotype male is in the Academy of Natural Sciences of Philadelphia (ANSP). Images of the type are available at OSFO (Cigliano *et al.* 2025). The type locality of *ovatus* was narrowed to northern Los Angeles County (Rentz & Birchim 1968) where the fringes of the Mojave Desert meet the north slope of the San Gabriel Mountains. We specify the vicinity of Llano, Los Angeles County, California, USA as the type locality.

PARATYPES EXAMINED: (n=6) *longicauda* USA, CA, Kern Co., E side of Sierra Nevada below Walker Pass, 35.662453, -118.026740, 1372 m, 28-V-1954, no collector, CAS, 1♀; Walker Pass, 35.662453, -118.026740, 22-VIII-1938, ER Tinkham, CAS, 5♂.

TOPOTYPES EXAMINED: (n=50) *ovatus* USA, CA, Los Angeles Co., 2 miles S of State Highway 138 on County Road 4, 34.47615, -117.81777, 1280 m, 9-VI-1989, d B Weissman, d C Lightfoot, CAS, 3♂; 4.5 miles west of desert Springs on Highway 138, 35.521625, -115.396298, 1-VI-1957, RX Schick, LACM, 1♂; Bob's Gap, 4 miles north of County Road N4 on Bob's Gap Road, 34.4550, -117.8139, 1300 m, 18-VI-2006, JA Cole, LACM, 2♂; County road N4 near Llano, 34.505828, -117.817841, 1280 m, 6-VIII-1988, d B Weissman & d C Lightfoot, CAS, 1♂; Largo Vista Road (county Road N4) at Fort Tejon Road, 34.46916, -117.76633, 1179 m, 14-VI-2017, JA Cole, LACM, 6♂; same data except JAC, 1♀; Largo Vista Road (county Road N4), 1 mile south of Fort Tejon Road, 34.4530, -117.7649, 1277 m, 22-VI-2008, JA Cole, LACM, 3♂; *longicauda* USA, CA, Kern Co., 1.3 miles E of Walker Pass on State Highway 178, 35.662450, -118.003532, 1460 m, 5-VIII-1988, DB Weissman, DC Lightfoot, CAS, 2♂; Freeman Canyon, 1.5 miles southeast of Walker Pass on SR178, 35.6509, -118.0055, 1470 m, 10-VII-2003, JA Cole, JF Eguizabal, LACM, 3♂, 1♀; same data except JAC, 1♂; Freeman Canyon, 2 miles west of Summit on SR178, 35.6514, -118.0048, 1454 m, 13-14-VII-2005, JA Cole, LACM, 6♂; same data except 24-VI-2008, AMNH, 1♂; same data except JAC 1♂, 1♀; same data except LACM, 1♂, 1 pair in copula; Freeman Canyon, 3.3 miles northwest of SR14 on SR178, 35.62278, -117.95278, 1213 m, 31-V-2023, JA Cole, C Wong, LACM, 1♂; same data except JAC, 1♂, 1♀; Freeman Canyon, SR178 3 miles west of SR14, 35.62019, -117.9502, 1086 m, 28-V-2017, JA Cole, JAC, 2♂; same data except LACM, 3♂; Jawbone Butterbrecht Area of Critical Environmental Concern, SR178 at SR14, 35.60239, -117.91468, 1011 m, 28-V-2017, JA Cole; LACM, 4♂; same data except JAC, 2♂; Walker Pass, 35.662453, -118.026740, 1060 m, 18-VIII-1982, d B Weissman, CAS, 2♂.

**Measurements.** (mm, ♂n=21, ♀n=9) Hind femur ♂17.39–20.96, ♀19.49–23.55, pronotum total length ♂11.60–14.61, ♀12.17–15.70, prozona length ♂5.41–6.70, ♀5.73–7.45, metazona dorsal length ♂6.19–8.10, ♀6.41–8.30, pronotum constriction width ♂3.37–4.60, ♀4.00–4.82, metazona dorsal width ♂7.64–9.83, ♀8.60–10.28, head width ♂5.27–6.79, ♀6.05–7.80, ovipositor length ♀17.88–28.84.

**Distribution.** Distributed widely but locally across the Mojave Desert of California from the desert floor (624 m, JA Cole, LACM) to high elevations (1470 m, JA Cole & JF Eguizabal, LACM).



**FIGURE 7.** *A. ovatus* male and female habitus, calling song, male and female terminalia, and karyotype. Idiogram top panel A shows  $2n_{\text{♂}}=23$  karyotype; B. Mitotic plate showing all 23 chromosomes; C. Metaphase I. On all 3 photos, single X chromosome is marked.

**Habitat.** Creosote desert, pinyon-juniper, and Joshua tree woodlands. On California juniper (*Juniperus californica* Carriere), Mormon Tea (*Ephedra* spp.), Creosote Bush (*Larrea tridentata* (DC.) Coville), Cholla (*Opuntia* spp.), and Joshua Tree (*Yucca brevifolia*). Generally found in low bushes but may be arboreal in Joshua trees and junipers. When disturbed at night, *A. ovatus* retreat into thorny vegetation or towards the base of yucca leaves.

**Seasonal occurrence.** Adults active from spring (9-V-1941, EC VanDyke, CAS) into fall (13-X-1995, G Pratt, CAS). Nymphs from April (15-IV-1957, DM Horton, LACM). Adult activity commences earlier in the season at low elevations.

**Stridulatory file.** (n=21) length 4.00–5.70 mm, 68–107 teeth, tooth density  $18.5 \pm 1.9$  (14.4–21.4) teeth/mm.

**Song.** (n=86) Loud, incessant song with frequently produced echemes (“chirps”). The calling song was onomatopoeically described as “zic-zic-zic, zic-zic-zic-zic” (Tinkham 1944) which corresponds to one 3 and one 4 pulse train echeme, respectively. Pulse trains  $80 \pm 20$  ms in length repeat at a rate of  $9.16 \pm 0.96$  s<sup>-1</sup>. Mean peak frequency is  $14.13 \pm 3.02$  kHz, with ultrasonic peak frequencies as high as 23.75 kHz revealed in recordings with high frequency equipment. Variable length echemes group on average  $6 \pm 11$  pulse trains. Males tend to begin a bout of singing with isolated pulse trains and add pulse trains to echemes as singing continues. In rare circumstances males may produce large numbers of pulse trains in an echeme, such as after separating from a female post-mating. The maximum pulse train number that we have observed in an echeme is 106. Echemes are repeated frequently, being separated by 1–5 s (mean  $1.87 \pm 0.79$  s) silent intervals. Males may produce irregular bouts of song at dusk, with onset of calling in one instance timed exactly at sundown. Wary males cease singing some distance from an observer and are sensitive to white light. Males are alternating chorusers. When in proximity, males produce only 1–2 pulse trains that may constitute an aggressive interaction. Males may stridulate loudly when handled.

**Karyotype.** (n=9)  $2n \text{♂} = 23(22t + Xt)$ , topotype T89-9 (S89-37).

**Recognition.** Morphology, coloration, geography. Body ground coloration most often green but also may be tan or light brown. The abdominal dorsum has a longitudinal reddish stripe and the tegmina are white, unlike *A. gurneyi* in which the body coloration is always wood brown, the abdomen lacks a dorsal reddish stripe, and the tegmina are brown. The pronotum has broad longitudinal white stripes and fine brown stripes on the disk, lacking in all other *Ovatus* Group species which have at most fine black streaks on the disk; *A. armiger* and *A. tinkhamorum* have the center of the pronotal disk largely unmarked. The *A. ovatus* male paraproct process has a subapical, ventrally directed heavy tooth in contrast with the apical tooth and slender processes of *A. segnis* and *A. strobilion*. The prozona is not heavily rugose like that of *A. giganteus*. The *A. ovatus* ovipositor is typically longer than the hind femur; all other *Ovatus* Group species have the ovipositor shorter than the hind femur. The distribution of this species encompasses the Mojave Desert ecosystem.

**Notes.** This is the iconic Shield-backed Katydid featured in field guides (e.g. Capinera *et al.* 2004) as an exemplary orthopteran of the Mojave Desert. Isolation at higher elevations around the periphery of the desert as pinyon-juniper habitats retreated due to warming climate was advanced as a biogeographical hypothesis (Rentz & Birchim 1968). This hypothesis is partially supported by phylogeographic structure (Figs. 2–4) that may reflect geographic isolation. Expanded sampling shows that *A. ovatus* is not limited to the fringes of the Mojave Desert, but occupies a wide range of elevations from 600 to 1500 m. Although the habitat of this katydid occurs over a wide geographic expanse, populations of *A. ovatus* are scattered, which may be the result of localized extinction, the hottest parts of the desert no longer being habitable by the lineage, coupled with low dispersal ability.

Subspecies *longicauda* applied to populations from the Scodie Mountains at the extreme southeastern corner of the Sierra Nevada at Walker Pass, Kern County, California, where to the east pinyon-juniper habitats descend through Joshua Tree woodland down to creosote desert. The subspecific epithet described the long ovipositors in females of this population, which approach 30 mm in length while ovipositors of *A. ovatus* range from 18–23 mm in length. Ovipositors are longer than the hind femur in both *longicauda* and *A. ovatus*, but scaling by hind femur length as a proxy for body size diminishes the apparent extremes: *longicauda* ovipositors are 15–20% longer than the hind femur, while *A. ovatus* ovipositors are 1–10% longer. Extreme ovipositor length in *longicauda* thus correlates with massive female body size. Morphological intermediates were reported between southern Sierra Nevada and nominate Mojave Desert *A. ovatus* (Rentz & Birchim 1968), and *longicauda* exemplars were scattered among the phylogeographic structure of the *Ovatus* Group populations (Figs. 2–4). We therefore abandon *longicauda* as a subspecific category.

We describe a mating sequence in a Los Angeles County population that adds to what is known of mating in this species (Rentz & Birchim 1968). During pair formation and while the female was orienting, the male

emitted brief pulse trains, often in pairs, that were of qualitatively low amplitude (not measured). The female then mounted the male, whereupon the male paraprocts grasped the base of the female subgenital plate and held on throughout copulation. During copulation the male titillator arms periodically scraped against the female ovipositor. Spermatophore transfer took approximately 2 min. When pairs separated, the males sometimes made a long series of loud pulse trains.

**Material examined.** (n=149) **All USA, CA, Inyo Co.,** Argus Mountains, NE of Ridgecrest, 35.622456, -117.670897, 1790 m, 7-16-IX-1995, GF Pratt, CAS, 1♂; Argus Range, Birchum Spring, 35.966502, -117.466261, 13-X-1995, G Pratt, CAS, 1♀; Argus, 35.747177, -117.395335, 18-VII-1973, K Beany, CAS, 1♂; China Lake NAWS, Haiwee Spring, 36.116988, -117.756274, 6-VI-2003, G Pratt, C Pierce, CAS, 2♂; China Lake NAWS, Lower Haiwee Spring, 36.116988, -117.756274, 18-V-1996, G Pratt, J Emmel, CAS, 1♂; China Lake NAWS, Mtn. Springs Cyn., 35.722282, -117.624163, 17-VII-1998, G Pratt, M van Tilborg, CAS, 1♂; China Lake NWC, Birchum Spring, 35.722282, -117.624163, 5-VIII-1995, G Pratt, C Pierce, CAS, 1♂; **Kern Co.,** 10 miles S of Inyokern, 35.501852, -117.812567, 7-VI-1962, GH Nelson and family, CAS, 2♀; 3 miles W of junction Hwys 178 and 14 on Hwy 178, 35.61919, -117.94957, 1158 m, 9-VI-1983, d B Weissman, CAS, 5♂; 3.7 mi. E Sopp Rd & Powerline Rd., 16-VI-1998, G Pratt, E van Baal, CAS, 2♂; 32 miles N of Mojave, 35.516665, -118.173965, 1006 m, 9-VI-1983, d B Weissman, CAS, 5♂, 1♀; 5 miles W of junction Hwys 178 and 14 on Hwy 178, 35.63757, -117.97683, 1341 m, 9-VI-1983, d B Weissman, CAS, 6♂, 1♀; about 0.5 miles S of junction Hwys 14 and 178 on Hwy 14, 35.59455, -117.90621, 945 m, 9-VI-1983, d B Weissman, CAS, 4♂; about 10 miles NW of Inyokern, Short Canyon, 35.749397, -117.938780, 1158 m, 9-VI-1983, d B Weissman, CAS, 7♂; Edwards AFB, East Rosamond Hills, 34.909421, -118.063683, 2-V-1996, G Pratt, B deeyhers, CAS, 1♂; Jawbone Canyon, 35.308294, -118.025905, 789 m, 8-VII-1973, E Rau, LACM, 2♂, 1♀; jct. Backus Road and Tehachapi Willow Springs Road, 34.95072, -118.29014, 725 m, 28-V-2009, d B Weissman, d C Lightfoot, CAS, 3♂; Mojave desert, Randsburg, 35.2833, -117.9333, 27-V-1073, AJ Gaudin, CSUN, 1♀; Red Rock Canyon Park, on plateau N of park off Highway 14, 30 mi. N Mojave, 35.487653, -118.173965, 28-VI-1976, PH Sullivan, CAS, 1♂, 1♀; Sierra Nevada, Jawbone Canyon, 35.308294, -118.025905, 23-V-2017, MM Dickson, CSUN 1♂; SR14, 4.5 miles south of SR178, 35.54594, -117.92847, 933 m, 28-V-2009, d B Weissman, d C Lightfoot, CAS, 1♂; Tehachapi Pass, 35.10219, -118.28369, 13-V-1953, LACM, 2♂; Wheeler Ridge, 35.004413, -118.949546, 294 m, 13-V-1953, LACM, 1♂; **Los Angeles Co.,** Los Angeles, 1-VII, Coquillett, USNM, 1♂; same data except VII, Coquillett, USNM, 1♂; Acton Canyon, Sierra Hwy., 0.5 mi. E Crown Valley Rd., 34.473883, -118.199520, 915 m, 20-VI-2003, JN Hogue, JA Cole, CSUN, 3♂; Edwards AFB, 165th St, 34.926088, -117.935068, 7-V-1997, G Pratt, C Pierce, CAS, 2♂; Mint Canyon, 34.429162, -118.442305, 15-V-1962, S Nakagawa, CSUN, 3♂; same data except V-1962, Frolich, CSUN, 1♀; Mojave, -35.052470, -118.173964, 840 m, 15-IV-1957, d M Horton, LACM, 1♂; Old Nadeau Road at Pearblossom Highway, 5 miles south of Palmdale, 34.5236, -118.0956, 903 m, 13-VI-2003, JA Cole, LACM, 2♂; Palmdale, 34.579434, -118.116461, 9-V-1941, EC Vanduyke, CAS, 1♂; Palmdale, 5 miles east, 34.579403, -118.028361, 29-IV-1956, F Sala, LACM, 1♀; Sierra Highway, 0.6 miles west of Crown Valley Road, Acton, 34.4936, -118.1834, 929 m, 13-VI-2003, JA Cole, J Hogue, LACM, 1♂; same data except 17-VI-2003, JA Cole, J Hogue, LACM, 3♂; same data except JAC, 1♂; same data except 18-19-VI-2008, JA Cole, LACM, 4♂; same data except 20-VI-2003, JA Cole, J Hogue, AMNH, 1♂, 1♀; same data except JAC, 1♂; same data except LACM, 1♀; same data except 23-VI-2005, JA Cole, LACM, 5♂; same data except 21-VI-2018, JA Cole, JAC, 1♂; same data except 25-V-2017, JA Cole, LACM, 5♂, 1♀; same data except JAC, 2♂, 1♀; Sierra Highway, 0.6 miles west of Crown Valley Road, Acton, 34.49393, -118.18736, 870 m, 29-VI-2003, d B Weissman, CAS, 13♂, 1♀; **San Bernardino Co.,** China Lake NAWS, Eagle Crags, Mesquite Spring, 35.401136, -117.017850, 9-VI-1995, G Pratt, C Pierce, CAS, 1♂; Coolgardie Road, 3.3 miles northwest of Copper City Road, 33.09538, -117.03453, 1095 m, 15-VI-2019, JA Cole, LACM, 3♂; same data except JAC, 1♂; Copper City Road, 4.7 miles north of Irwin Road, Barstow, 35.05157, -116.98058, 1131 m, 15-VI-2019, JA Cole, JAC, 1♂; Copper City Road, 5 miles north of Irwin Road, Barstow, 35.05585, -116.98421, 1160 m, 15-VI-2019, JA Cole, LACM, 4♂; same data except JAC, 1♂; desert Springs, 34.4333, -117.6333, 11-V-1955, no collector, CAS, 1♀; desert Springs, 34.4333, -117.6333, 1219 m, 25-VI-1956, ER Tinkham, CAS, 3♂; Granite Mountains wash, 2 miles southwest of SR247 off Spinel Street, 34.5574, -116.9882, 1004 m, 1-2-V-2013, JA Cole, LACM, 11♂; same data except JAC, 1♀; Mojave River, 35.045321, -116.305388, 1-VII-1937, R Miller, CAS, 1♀; Mountain Pass, 35.470260, -115.544998, 1400 m, 4-VIII-1991, d B Weissman, d C Lightfoot, CAS, 6♂, 1♀.