

## *Neduba convexa* Caudell, 1907

Fig. 9 (distribution), Fig. 16 (male and female habitus, calling song, male and female terminalia, karyotype), Plate 4G (male calling song), Plate 7A–C (male ventral sclerites), Plate 9H (male titillators), Plate 11G (female subgenital plate).

**Common name.** Convex Shieldback.

**History of recognition.** This taxon was described as a variety of *N. carinata* (Caudell 1907). The type series included specimens from widely separated localities in California: Mount Shasta and Napa County. We resolved the taxonomy in relation to topotypes from the Mount Shasta type locality designated by Rentz & Birchim (1968). The North Coast Range type material from Napa County belongs to *N. ambagiosa* (see species account above).

**Type material.** The type specimen is a lectotype male from Mt. Shasta, Siskiyou Co., in the USNM. Images of the type are available at OSFO (Cigliano *et al.* 2020). TOPTYPES EXAMINED (n = 19): USA, CA, Siskiyou Co., 7♂, McBride Camp, 4 mi. E of Mount Shasta City on Rd A10, 41.409294N, 122.117727W, 1433 m, 2-IX-1983, DB Weissman, CAS; 1♂, same data except 29-VI-1992, DB Weissman, CAS; 7♂, McBride Springs Campground, 4 mi. NE of Mount Shasta City, 41.3529N, 122.28328W, 1487 m, 1-2-VIII-2013, JA Cole, LACM; 3♂, same data except JAC; 1♂, same data except 22-25-VIII-2019, JA Cole, JAC.

**Measurements.** (mm, ♂n = 27, ♀n = 5) Hind femur ♂18.38–20.60, ♀21.42–24.22, pronotum total length ♂8.50–10.36, ♀7.78–9.50, prozona length ♂2.95–4.45, ♀3.39–4.60, metazona dorsal length ♂5.03–6.55, ♀4.39–5.17, pronotum constriction width ♂2.35–3.06, ♀2.57–3.04, metazona dorsal width ♂5.38–6.95, ♀5.55–6.05, head width ♂4.06–4.87, ♀5.03–5.80, ovipositor length ♀15.80–21.19.

**Distribution.** Widely distributed in the northern Central Valley and Cascade Range of Northern California, extending east along the junction of the Sierra Nevada and Cascade Range to the Diamond Mountains.

**Habitat.** Understory vegetation, tangles, and leaf litter of chaparral and mixed conifer forests. Also, in remaining northern Central Valley riparian forests.

**Seasonal occurrence.** Specimens suggest a long summer and fall adult activity from July (1-VII-2000, JA Cole, LACM) through November (10-XI-1948, HP Chandler, CAS). Nymphs have been collected from early April through late August. Adult activity will commence earlier in the lower elevations of the Central Valley.

**Stridulatory file.** (n = 8) length 3.1–3.9 mm, 106–145 teeth, tooth density  $35.3 \pm 2.8$  (29.7–38.2) teeth/mm.

**Song.** (n = 14) The male song is of the “zwee-zwee type with PTR  $2.6 \pm 0.3$  s<sup>-1</sup> at 25°C, MPTL 308.1 ± 51.1 ms, and PTF 14.0 ± 0.8 kHz. OPT are well developed. A distinct amplitude increase commences at the middle of each MPT. Males are nocturnal and may sing in aggregations.

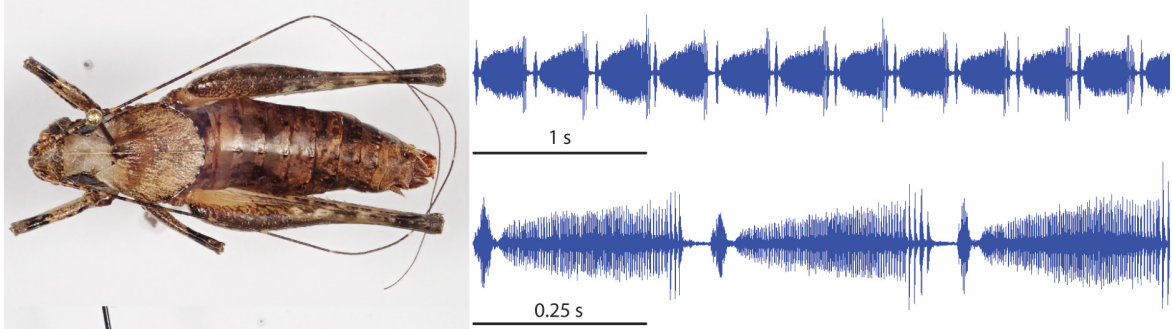
**Karyotype.** (n = 15)  $2n♂ = 26$  (2m + 22t + XtYt). T83-48, S83-119, topotype.

**Recognition.** *N. convexa* can be confused with *N. longiplutea* distributed to the west, but the latter has a male ventral sclerite lateral process that is longer than the shaft, unlike the reverse condition in the former. To the south and north of *N. convexa* are *N. radicata* and *N. cascadia*, respectively, both of which have small lateral process on the male ventral sclerite. *N. ambagiosa* is also similar but males usually have a more conical ventral sclerite apex and that is a Coast Range species. Females may often be separated from *N. longiplutea* by the lack of a bifurcate subgenital plate apex, but this is variable in *N. convexa*. The *N. radicata* subgenital plate is wider than long with a deep notch, and that of *N. cascadia* does not have curved apical margins. The song of *N. radicata* to the south has a faster PTR, whereas the song of *N. cascadia* to the north has a slower PTR.

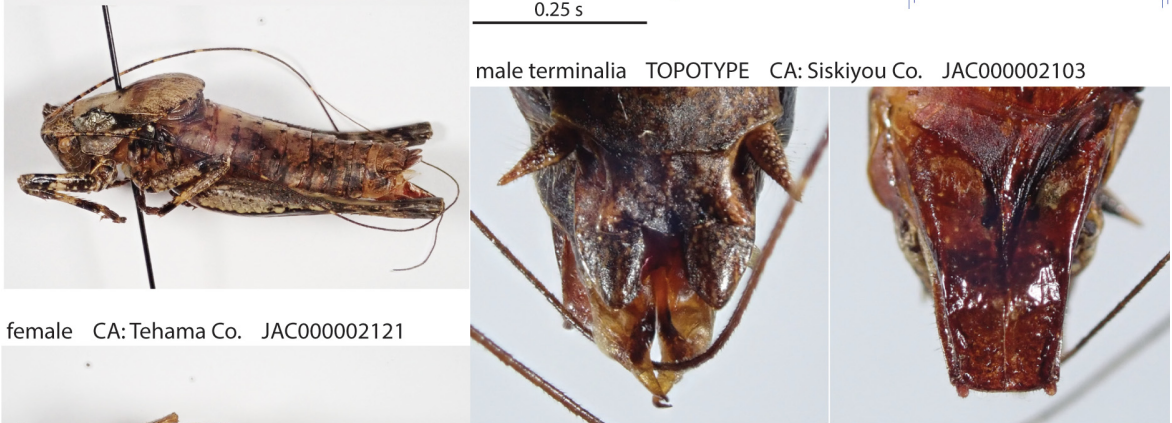
**Notes.** This species has a wide range and can be locally abundant. *N. convexa* was probably widespread in the Central Valley riparian forests before modification of the region for agriculture. Local variation is evident. Males from the populations along the Feather River Drainage and Laufman Campground in the Diamond Mountains tend to have flatter ventral sclerite apices (Plate 7C) and are genetically distinct (Figs. 3–5), but these populations are not reliably separable using any character. Further study may conclude that cryptic species are present along this east-west transect across the northern rim of the Central Valley and the Sierra Nevada. The physiology of this species is apparently adapted for activity at cold temperatures. On Mount Shasta, males sang between 10–15°C. When brought into the laboratory at standard temperature, individuals became hyperactive and did not survive long (JAC pers. obs.).

**Material examined.** (n=88) All USA, CA, Butte Co., 1♀ nymph, Chico, 39.728494N, 121.837478W, 59 m, 7-V-1968, T Kone, B Wilkey, W Wiard, CSCA; 6♂, Sacramento River State Park, Indian Fishery Day Use Area, 39.70522N, 121.93905W, 42 m, 18-VII-2015, JA Cole, DB Weissman, LACM; Lassen Co., 3♂, 2♀,

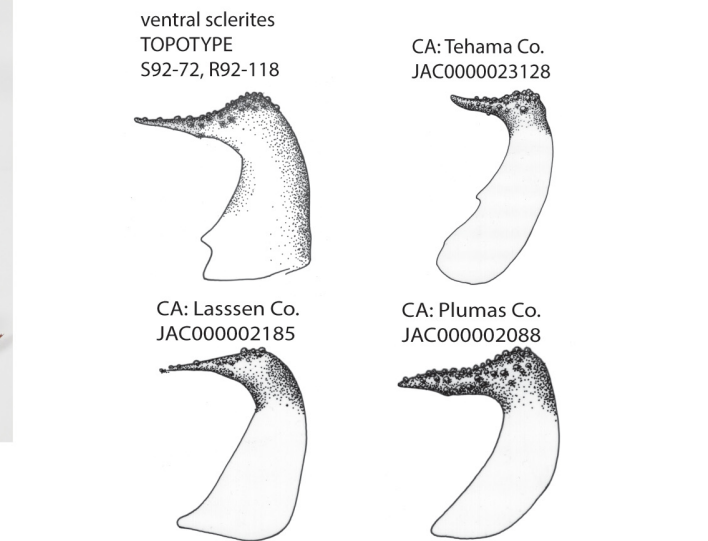
male TOPOTYPE CA: Siskiyou Co. JAC000002106 calling song TOPOTYPE CA: Siskiyou Co. 25.5°C S92-72 R92-118



male terminalia TOPOTYPE CA: Siskiyou Co. JAC000002103



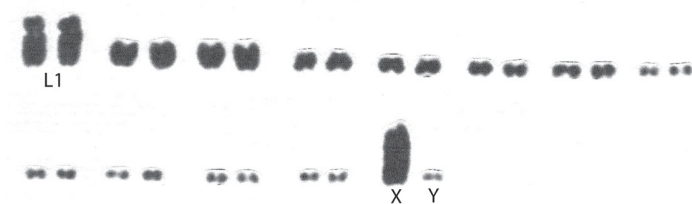
female CA: Tehama Co. JAC000002121



female terminalia CA: Plumas Co. JAC000002094



karyotype TOPOTYPE CA: Siskiyou Co. S83-119 T83-48



**FIGURE 16.** *N. convexa* male and female habitus, calling song, male and female terminalia, karyotype.

Dyer Mountain Rdg., 40.239055N, 121.03246W, 2279 m, 27-VIII-1968, FL Blanc, CSCA; 1♂, Laufman Campground, Plumas National Forest, 3.5 mi. S of Milford on Milford Grade Rd., 40.135N, 120.3483W, 1554 m, 13-14-VIII-2002, JA Cole, LACM; 1♂, same data except JA Cole, JAC; 2♂, same data except 18-VII-2012, JA Cole, LACM; 5♂, same data except 8-VIII-2014, JA Cole, DB Weissman, LACM; **Plumas Co.**, 1♂, Almanor, 40.217386N, 121.17413W, 1377 m, 16-VII-1940, no collector, CAS; 2♂, Hallsted Campground, 0.25 mi. W of Twain on SR 70, 40.0174N, 121.0745W, 864 m, 1-4-VII-2000, JA Cole, LACM; 3♂, same data except 13-16-VII-2004, JA Cole, LACM; 1♂, 2♀, same data except JAC; 1♂, same data except 15-17-VIII-1997, JA Cole, LACM; 4♀, same data except 7-10-IX-2001, JA Cole, LACM; 1♂, same data except 15-17-VIII-1998, JA Cole, LACM; 1♂, Johnsville, 39.76073N, 120.695498W, 1573 m, 16-VII-1973, RA Belmont, BMED; 1♂, same data except 9-VIII-1961, JS Buckett, BMED; 1♂, same data except 25-VIII-1961, JS Buckett, BMED; 1♂, same data except 9-X-1974, H Pini, BMED; 1♀, Meadow Valley, 39.929612N, 121.060791W, 1153 m, 30-X-1954, B Forbs, BMED; 2♂ adults, 1♂ nymph, same data except 5-VII-1924, EC Van Dyke, CAS; 1♀, Quincy, 39.936836N, 120.947176W, 27-IX-1967, J Badaj, CSCA; **Shasta Co.**, 1♂, Bridge Bay Rd., yacht area, 40.75611N, 122.32167W, 4-VIII-1980, no collector, CAS; 1♂, Burney Fall, 41.010716N, 121.652765W, 853 m, 10-XI-1948, HP Chandler, CAS; 1♂, Crystal Lake, 40.934999N, 121.556861W, 1585 m, 2-IX-1953, HP Chandler, CAS; 1♀ nymph, Hat Creek, 40.829684N, 121.508994W, 1003 m, 10-VII-1952, GF Pronin, CAS; 2♂, same data except 11-VIII-1964, RE Pinger, CSCA; 1♀, same data except 19-VIII-1951, no collector, CAS; 1♀ nymph, same data except 20-VIII-1951, GF Pronin, CAS; 1♂, 4♀, same data except 22-VII-1965, S Seminoff, CSCA; 1♀ nymph, same data except 23-VI-1951, GF Pronin, CAS; 1♂, same data except 25-VIII-1951, GF Pronin, CAS; 1♀ nymph, Iron Mountain Mine, 40.675427N, 122.52807W, 305 m, 30-VII-1947, HP Chandler, CAS; 1♂, Lamoine, 40.977927N, 122.430847W, 377 m, 2-IX-1970, RE Whipp, CSCA; 1♀, Whiskeytown, 40.63876N, 122.559737W, 390 m, 10-X-1976, TR Haig, CSCA; **Siskiyou Co.**, in addition to type material (above), 1♀, Castle Lake, 41.227294N, 122.383254W, 1554 m, IX-1953, HP Chandler, CAS; 1♀, Dunsmuir, 41.208209N, 122.271953W, 698 m, 7-VII-1970, V Pierce, CSCA; 1♀, Specimen Gulch, 41.13986N, 123.124485W, 25-VII-1967, AD & GJ Keuter, CAS; **Tehama Co.**, 1♂ nymph, 7 mi. NE Red Bluff, 40.25019N, 122.141936W, 4-IV-1961, T Gallion, CSCA; 11♂, 1♀, Potato Patch Campground, Lassen National Forest, 21.5 mi. SW of Chester off SR36 and SR32, 40.1894N, 121.5315W, 1128 m, 19-20-VII-2012, JA Cole, LACM; 4♂, same data except JAC; ♂3, ♀2, same data except 7-VIII-2014, JA Cole, DB Weissman, CAS.

### *Neduba cascadia* Cole, Weissman, & Lightfoot, sp. n.

Fig. 9 (distribution), Fig. 17 (male and female habitus, calling song, male and female terminalia, karyotype), Plate 1F–H (live habitus), Plate 4H (male calling song), Plate 7E (male ventral sclerite), Plate 11H (female subgenital plate).

**Common name.** Cascade Shieldback.

**History of recognition.** None.

**Type material.** HOLOTYPE MALE: **USA, OR, Jackson Co.**, Wildcat Campground, Hyatt Lake Complex, Cascade-Siskiyou National Monument, 42.18283N, 122.44775W, 1531 m, 27-29-VII-2016, JA Cole, JAC000002023 [specimen barcode], DNA218 [genomic], SING0616 [DNA extraction], JCR160727\_02 [recording], 125 [teeth], 3.7 [mm stridulatory file length], tegmen in gelcap below specimen, deposited in CAS, Entomology type #19708.

PARATYPES (n = 12): 5♂, same data as holotype, LACM; 4♂, same data as holotype, CAS; 1♂, same data as holotype, JAC; 1♀, same data as holotype except 28-VIII-2019, DB Weissman & DC Lightfoot, CAS; 1♀, Woodruff Meadow, 30 mi. SW Crater L., 42.885125N, 122.509206W, 6-VIII-1960, JR Helfer, CAS.

**Measurements.** (mm, ♂n = 7, ♀n = 1) Hind femur ♂18.05–18.95 ♀19.91, pronotum total length ♂9.20–9.81, ♀8.85, prozona length ♂3.01–4.65, ♀4.55, metazona dorsal length ♂5.10–6.80, ♀4.30, pronotum constriction width ♂2.07–2.30, ♀2.55, metazona dorsal width ♂6.50–7.25, ♀6.49, head width ♂4.10–4.68, ♀5.02, ovipositor length ♀16.00.

**Distribution.** Southern Cascade and Siskiyou mountain ranges of southern Oregon.

**Habitat.** Understory and edges of coniferous forest.

**Seasonal occurrence.** Scant records are from mid-July through late August. Adult activity probably lasts from midsummer through fall until first frosts.

**Stridulatory file.** (n = 4) length 3.4–3.7 mm, 125–133 teeth, tooth density  $36.7 \pm 2.1$  (33.8–38.8) teeth/mm.