

**Song.** (n = 6) Typical Convexa Clade “zwee-zwee” song type but with a significantly slower PTR of  $1.8 \pm 0.1 \text{ s}^{-1}$  (ANCOVA  $P = 1.08 \times 10^{-5}$ ) and longer MPTL of  $498.2 \pm 65.5 \text{ ms}$  (ANCOVA  $P = 4.27 \times 10^{-11}$ ) than all other Convexa Clade taxa. PTF is  $13.9 \pm 2.2 \text{ kHz}$ .

**Karyotype.** (n=2)  $2n \text{♂} = 26 (2m + 22t + Xt + Yt)$  T19-16, S19-90, paratopotype.

**Recognition.** The male ventral sclerite of *N. cascadia* has a blunt apex with scattered large tubercles and a short lateral process that blends into the shaft by an obtuse angle. This contrasts with *N. convexa* and *N. longiplutea*, both distributed to the south, which have the ventral sclerite apex low if not flat and a long lateral process with numerous fine tubercles that are arranged in rows. *N. steindachneri* to the north has a mushroom-shaped ventral sclerite with few large tubercles and a blunt, recurved lateral process. The female subgenital plate is unique among the Convexa Clade in having straight apical margins. The slow PTR separates the song of *N. cascadia* from all other Carinata Group species; *N. steindachneri* to the north has the fastest PTR in this species Group.

**Etymology.** *cascadia*, reflecting the southern Cascade Range distribution.

**Notes.** The distribution of this species lies between that of *N. steindachneri* to the north and *N. convexa* to the south. Further studies are needed to determine the limits of the ranges of northern Carinata Group taxa. Museum specimens from intermediate localities are nymphs and are only tentatively identified as this species. The calling songs and genitalia of all three species differ, so sympatry may be expected if these differences confer reproductive isolation. That calling song extremes of PTR occur in two species with adjacent ranges suggests prezygotic reproductive isolation mediated by calling song.

**Material examined.** In addition to type material (above), QUESTIONABLE PLACEMENT (n = 3): **USA, OR, Jackson Co.**, 2♀ nymphs, Little Applegate River, 42.198722N, 123.045356W, 701 m, 6-VIII-1950, B Malkin, CAS; 1♀ nymph, Union Creek, 42.906905N, 122.445598W, 7-31-VIII-1950, B Malkin, CAS.

### *Neduba steindachneri* (Herman, 1874)

Fig. 9 (distribution), Fig. 18 (male and female habitus, calling song, male and female terminalia, karyotype), Plate 1E (live habitus), Plate 4I (male calling song), Plate 7D (male ventral sclerite), Plate 9I (male titillators), Plate 11I (female subgenital plate).

**Common name.** Steindachner’s Shieldback.

**History of recognition.** Originally described in *Tropizaspis* from Fox Island, Puget Sound, Washington. Caudell (1907) synonymized this species under *N. carinata*. This species was subsequently removed from synonymy on the basis of the wide distance between type localities, but without examination of specimens (Rentz & Birchim 1968). **NEW COMBINATION:** *N. picturata* (Scudder 1899) is transferred under the synonymy of this species, rather than *N. diabolica*, given the type was collected during the Northwestern Boundary Survey (Caudell 1907). This survey, from 1857-1861, was led by B.R. Kennerly, along the 409-mile-long Canadian-US border between the Rocky Mountains and Point Roberts on coastal Washington.

**Type material.** The syntype series of males and females is in NMW Vienna. Lectotype male here chosen as the adult whose images appear, along with collection labels, on the OSFO (Cigliano *et al.* 2020). Label data of this specimen is as follows:

Small square label: “Stein-/dachner /1869[typed]/Califor [handwritten over label]

Wide rectangular label [handwritten]: Type n. sp. steindachneri/Fox Island Pouget Sound/1874 (<http://orthoptera.speciesfile.org/Common/basic/ShowImage.aspx?TaxonNameID=1141747&ImageID=208936>)

TOPOTYPES EXAMINED (n = 4): WA, Pierce Co., 4♂, Puget Sound, Fox Island, 47.235925N, 122.626948W, 16-VIII-1986, DB Weissman, CAS

**Measurements.** (mm, ♂n = 20, ♀n = 1) Hind femur ♂16.72–21.00, ♀19.80, pronotum total length ♂7.61–9.55, ♀7.56, prozona length ♂3.34–4.41, ♀1.94, metazona dorsal length ♂4.15–5.83, ♀5.62, pronotum constriction width ♂1.95–2.55, ♀2.60, metazona dorsal width ♂5.65–6.90, ♀5.50, head width ♂3.71–4.45, ♀4.69, ovipositor length ♀14.18.

**Distribution.** Central Oregon Cascade and Coast Ranges north to coastal British Columbia.

**Habitat.** Understory of fir and fir-oak forests. On grasses, low branches, *Ribes*, and leaf litter.

**Seasonal occurrence.** Summer through fall, from July (6-VII-1926, CL Hubbs, CAS) through September (19-IX-2015, JA Cole, LACM).

**Stridulatory file.** (n = 11) length 3.5–4.0 mm, 108–127 teeth, tooth density  $31.3 \pm 2.3$  (27–35.3) teeth/mm.

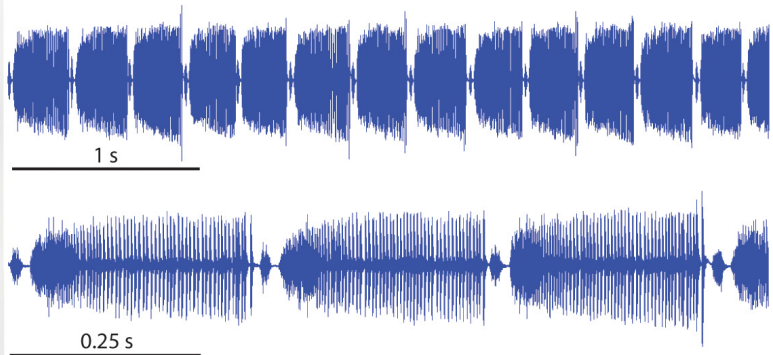
**Song.** (n = 26) Male songs are of the zwee-zwee type with PTR  $3.7 \pm 0.4$  s<sup>-1</sup>, faster than all other Convexa Clade species except some males of *N. radicata*. Males sometimes add partial PT when initiating song bouts. MPTL is  $250.4 \pm 47.6$  ms. The OPT is poorly developed or absent. PTF is  $13.1 \pm 1.7$  kHz. Males are nocturnal singers.

**Karyotype.** (n = 5)  $2n_{\text{♂}} = 26$  (2m + 22t + XtXt) T86-74, S86-95, topotype.

male WA: Kitsap Co. JAC000002396



calling song TOPOTYPE WA: Pierce Co. 24.5°C S86-95 R86-185



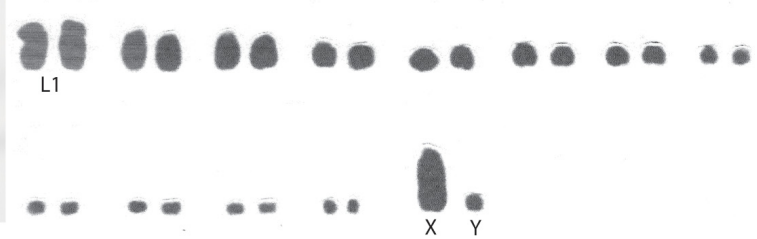
female WA: Mason Co.



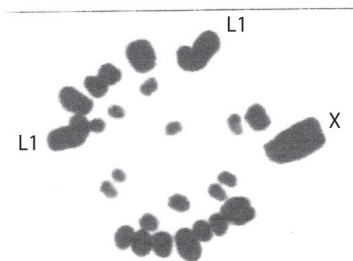
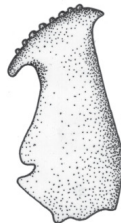
male terminalia OR: Benton Co. JAC000002374



karyotype TOPOTYPE WA: Pierce Co. S86-95 T86-74



female terminalia WA: Mason Co. ventral sclerite  
TOPOTYPE  
S86-95, R86-182



**FIGURE 18.** *N. steindachneri* male and female habitus, song, male and female terminalia, karyotype.

**Recognition.** The male ventral sclerite is mushroom-shaped with a short, broad shaft and a wide, evenly curved apex with a short, blunt, recurved anterolateral projection. Tubercles are large, sparse, and confined to the apex. The

titillators of *N. steindachneri* begin curvature after the midpoint of the shaft and are not as strongly curved dorsally ( $>90^\circ$ ) as seen in most other Carinata Group species (Plate 9). Stridulatory file tooth density (27–35 teeth/mm) is lower than that of *N. convexa* (2-sample *t*-test,  $P = 5.48 \times 10^{-3}$ ) and also trends lower than *N. cascadia* (33–39 teeth/mm). The female subgenital plate is pentagonal, flat, subequal in length and width, and with curved apical margins and a strongly pointed apex, which separates this species from *N. cascadia* females which have straight apical margins and from *N. convexa* and *N. longiplutea* females which have plates that are longer than wide. The song is unique in having reduced or absent OPT. The PTR is faster than all other *convexa* clade species. This species has the most northern range of any *Neduba* (Fig. 9).

**Notes.** *N. steindachneri* is locally common in the forest understory of the western slopes of Oregon and Washington Cascade Range and primarily the eastern slopes of the Oregon and Washington coastal ranges. A phylogeographic break separates populations north and south of the Willamette River (Figs. 3–4) that suggests historical isolation that indicates historical isolation. Hybridization with *N. cascadia* is possible and should be sought from populations in central Oregon, where the ranges of these two species overlap.

**Material examined.** (n = 28) **USA, OR, Benton Co.,** 8♂, McDonald-Dunn Forest, Corvallis, 44.60382N, 123.33253W, 144 m, 18-IX-2015, JA Cole, LACM; 1♂, same data except JAC; 5♂, same data except 19-VII-1982, DC Lightfoot, CAS; **Columbia Co.,** 1♀, Wilson Creek, 46.07701N, 123.02315W, EH Nast, CAS; **Hood River Co.,** 1♂, 1♀, Hood R., 45.70556N, 121.52028W, 122 m, 17-VII-1931, RH Beamer, CAS; **Marion Co.,** 1♂, Sublimity, Silver Creek Falls, 45.000267N, 122.840916W, 167 m, 19-VIII-1945, W Blehm, CAS; **Multnomah Co.,** 3♂, Dabney State Park, 45.51766N, 122.35429W, 22 m, 19-IX-2015, JA Cole, JAC; 5♂, Oxbow Regional Park Day Use Area, SE Gordon Creek Rd., 1.2 mi. SE jct. Hurlburt Rd., 45.49821N, 122.27871W, 59 m, 19-IX-2015, JA Cole, JAC; 1♂ same data except JAC; 1♂, SE Gordon Creek Rd., 2.7 mi. S jct. Hurlburt Rd., 45.4784N, 122.28107W, 257 m, 19-IX-2015, JA Cole, JAC sound record; **Tillamook Co.,** 1♂, Tillamook, 45.51667N, 123.71667W, 30-VII-1926, CL Hubbs, CAS; **WA, Kitsap Co.,** 1♂, Holly, 47.557593N, 122.978488W, 3 m, 6-VII-1926, CL Hubbs, CAS; 5♂, Margarete Ranch, Port Orchard, 47.47137N, 122.65009W, 1525 m, 13-14-VIII-2013, JA Cole, LACM; 2♂, same data except JAC; **Mason Co.,** 1♂, 1♀, Lake Cushman, 47.487964N, 123.266471W, 244 m, 27-VIII-1919, P Putnam, CAS, **Pierce Co.,** see Type material (above). QUESTIONABLE PLACEMENT: **OR, Douglas Co.,** 1♂ nymph, Drain, 43.658731N, 123.318699W, 9-VI-2014, EC VanDyke, CAS.

**Material from databases not examined by us (n = 7): CANADA, BC, Departure Bay,** 49.20, 123.98W, 1925, GJ Spencer, Symbiota Collections of Arthropods Network (SCAN, <https://scan-bugs.org/portal>); UBC Campus 49.26N, 123.25W, 3-X-1946, D Evans, SCAN; Gailano Island, 48.93N, 123.45W, 4-IX-1971, J Scudder, SCAN; same data except 1971, J Scudder, SCAN; same data except 11-X-1976, GGE Scudder, SCAN; same data except 1976, GGE Scudder, SCAN; Vancouver Island, 49.66667N, 125.83333W, 9-VIII-2007, J Miskelly, SINA.

## Propsti Group

The Propsti Group contains a single species, the Santa Catalina Island endemic (Fig. 8) *N. propsti*. The Group is defined by having a single spine on the fore tibia located on the posterior margin, a pair of prosternal spines, darkened male tegminal apices, and a female subgenital plate that is over half again as long as wide. Only *N. lucubrata* from mainland California shares this suite of characters, but this species has a smaller body size, a male subgenital plate that narrows from base to apex along the lateral carinae, and a song that consists of a bout (chirp) structure (Plate 5C) whereas the song of *N. propsti* is continuous (Plate 4J). The karyotype is unique.

### *Neduba propsti* Rentz & Weissman, 1981

Fig. 19 (distribution), Fig. 20 (male and female habitus, calling song, drumming, male and female tremulation karyotype), Plate 2A (live habitus), Plate 4J (male calling song), Plate 7F (male ventral sclerite), Plate 10A (male titillators), Plate 11J (female subgenital plate).

**Common name.** Santa Catalina Island Shieldback.

**History of recognition.** Described as a Santa Catalina Island endemic (Rentz & Weissman 1981). Listed under *Aglaothorax* in OSFO for unspecified reasons (Cigliano *et al.* 2020).

**Type material.** The holotype male is in the CAS collection. Images of the holotype are available at OSFO (Cigliano *et al.* 2020).