Western North American Naturalist 82(4), © 2022, pp. 704–718

A review of *Psilochalcis* Kieffer (Hymenoptera: Chalcidoidea: Chalcididae) from the western United States with descriptions of three new species from Utah and surrounding states

Mark J. Petersen[1,*], Robert L. Johnson[2], and Val Jo Anderson[3]

[1]*Department of Plant and Wildlife Sciences, Brigham Young University, Provo, UT 84602*
[2]*Department of Biology, Brigham Young University, 3115A Monte L. Bean Life Science Museum, Provo, UT 84602*
[3]*Department of Plant and Wildlife Sciences, Brigham Young University, 5025 LSB, Provo, UT 84602*

Abstract.—A review of *Psilochalcis* Kieffer (Hymenoptera: Chalcididae) species in the western United States is presented, with the addition of 3 new species: *Psilochalcis adenticulata* Petersen, new species; *Psilochalcis minuta* Petersen, new species; and *Psilochalcis quadratis* Petersen, new species. Morphological diagnoses and distributions are given for each species. A dichotomous key to the *Psilochalcis* species of North America is presented.

Resumen.—Se presenta una revisión de las especies de Psilochalcis Kieffer (Hymenoptera: Chalcididae) en el oeste de los Estados Unidos, con la incorporación de tres nuevas especies: una nueva especie de *Psilochalcis adenticulata* Petersen, una nueva especie de *Psilochalcis minuta* Petersen y una nueva especie de *Psilochalcis quadratis* Petersen. En este trabajo se presentan diagnósticos morfológicos y distribuciones para cada especie. Además, se ofrece una clave dicotómica de las especies de *Psilochalcis* de Norteamérica.

Chalcidid wasps (Hymenoptera: Chalcididae) are distinguishable from most other Chalcidoidea by enlarged hind femora with a row of ventral teeth and a small, indistinct prepectus. Body color is usually nonmetallic and entirely black, entirely yellow, or black and yellow (Narendran and van Achterberg 2016), and legs often have yellow or red patches (Stringer et al. 2012). Chalcididae are similar to Leucospidae (the 2 families having previously been combined; Bouček 1997) but can be distinguished from them by having the forewing flat over gaster when not in flight, an exposed labrum, a broad, oval tegula, and sexual dimorphic differences in the antennae (Bouček 1974, Bouček and Halstead 1997). According to Bouček and Halstead (1997), understanding of family Chalcididae, including its division into subfamilies and genera, has changed little for at least 150 years. These authors recognize 15 genera of Chalcididae in North America, one of which is *Psilochalcis* Kieffer.

Jean-Jaques Kieffer (1905) described the genus *Psilochalcis* (Hymenoptera; Chalcididae). Within Chalcididae, *Psilochalcis* is distinguished by the apex of the hind tibia, which is truncate and has 2 spurs. The marginal vein does not reach the anterior margin of the forewing, and a transverse carina occurs on the prosternum. In males, the antennal scape usually has a protruding denticle, and the first flagellomere is anelliform. In females, the ovipositor usually reaches or exceeds the apex of the gaster. Nikol'skaya's (1960) revision of *Psilochalcis* included 17 species worldwide. Bouček (1984) documented *Psilochalcis* as having 20 described species worldwide. More recently, new species of *Psilochalcis* have been documented from Iran (Delvare et al. 2011) and India (Narendran and Kahn 2011). Delvare (2017) listed 51 species worldwide, and the Universal Chalcidoidea Database (Noyes 2019) currently reports 60 species of *Psilochalcis*, with 2 names unavailable. Palearctic and Nearctic *Psilochalcis* species show no indication of overlap in their distributions (Johnson et al. 2001). The literature suggests that <20 species of *Psilochalcis* are known from the

*Corresponding author: mark.petersen@canyonsdistrict.org

Western Hemisphere (Bouček 1992), with an estimate of 10 undescribed species occurring in the Nearctic region (Bouček and Halstead 1997). Wall and Berberet (1975) reported *P. mirabilis* (Bouček) from North America. However, Grissell and Schauff (1981) determined this to be based on a misidentification, while confirming that *P. mirabilis* is a valid species, known only from the Palearctic region. Ultimately (prior to the present study), 5 *Psilochalcis* species are documented to occur in North America, all from the United States. *Psilochalcis deceptor* (Grissell and Schauff), *P. threa* (Grissell and Schauff), and *P. usta* (Grissell and Schauff) are known from Texas and Oklahoma, parasitizing pupae of Pyralidae and Gelechiidae (Grissell and Schauff 1981). *Psilochalcis hespenheidei* (Bouček) is known from Arizona and Hawaii, with no hosts reported (Bouček 1984). *Psilochalcis brevialata* Grissell and Johnson is known only from California, parasitizing pupae of Pyralidae (Johnson et al. 2001). No *Psilochalcis* species have been reported as occurring in Utah (Noyes 2019).

Currently, little taxonomic work is being conducted on *Psilochalcis*. Most university and institutional collections still use the antiquated name *Invreia* Masi in referencing their holdings of *Psilochalcis*. Bouček (1992) synonymized *Invreia* with *Psilochalcis* nearly 30 years ago. The extent of *Psilochalcis* is poorly understood, particularly within the western United States. We review known *Psilochalcis* species of the western United States, including descriptions of 3 new species, and provide a taxonomic key for species identification.

METHODS

Specimen Collection

Malaise traps (Malaise 1937, Townes 1962) are utilized extensively for surveying insects (Skvarla et al. 2021), predominantly trapping day-flying Hymenoptera and Diptera (van Achterberg 2009). Malaise trap samples from a 2006–2007 insect habitat study in the eastern Great Basin of Utah (Johnson et al. 2008) were examined for *Psilochalcis* specimens. A total of 677 specimens were retrieved, representing 3 undescribed *Psilochalcis* species, as determined by the taxonomic key of Grissell and Schauff (1981). Subsequent Malaise trapping conducted from 2019 to 2021 yielded 610 additional specimens representing 2 of the same 3 undescribed species retrieved previously. In total, the first undescribed species is represented by only 7 specimens, whereas the second and third species are represented by 773 and 507 specimens, respectively.

We also examined *Psilochalcis* specimens from Brigham Young University, Provo, Utah (BYUC); Utah State University, Logan, Utah (EMUS); University of Idaho, Moscow, Idaho (WFBM); Washington State University, Pullman, Washington (WSU); Colorado State University, Fort Collins, Colorado (CSUC); California Academy of Sciences, San Francisco, California (CAS); and Texas A&M University, College Station, Texas (TAMU). Because 2 of the 3 undescribed species aligned closest to *P. usta* in the key (Grissell and Schauff 1981), type specimens of *P. usta* were obtained from the Smithsonian, National Museum of Natural History (USNM). Repository abbreviations follow Evenhuis (2021).

Morphological Traits

Specimens of known *Psilochalcis* species were compared against those of the 3 undescribed species, noting the morphological differences. Specimen morphology was examined using an Olympus SZX16 stereomicroscope (5.25–120.75×), in combination with cellSens Standard version 1.8 (Olympus Corporation) for taking measurements. Morphological characters (Fig. 1) were selected for species comparison, based on those commonly used in the original descriptions of the 5 described North American *Psilochalcis* species. Morphological terminology follows that of Gibson (1997).

RESULTS AND DISCUSSION

Psilochalcis adenticulata Petersen, new species

(Figs. 2–4, 5a, 6a, 7a, 8)

DIAGNOSIS.—Male distinguished by the following: (1) antennal scape without a protruding denticle; (2) vertex, and mesosoma with noticeably erect pilosity; (3) gastral tergum 1 is dorsally reticulate, with a narrow sulcus within a thin polished band along dorsal posterior margin.

DESCRIPTION, MALE.—Length 3.2–4.0 mm (holotype 3.7 mm).

Color. Black, except the following: radicle, apex of clava brown; teeth of mandible, apex

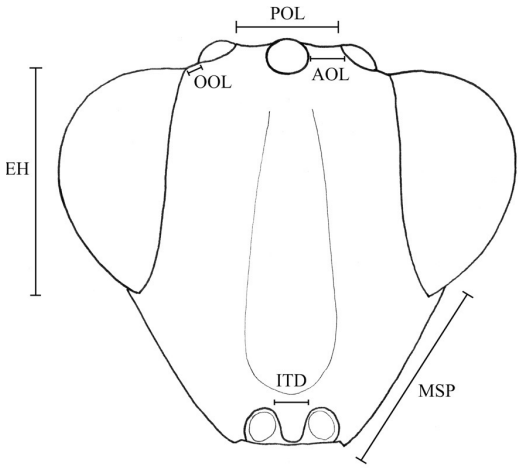


Fig. 1. Generalized *Psilochalcis* head, anterior view. EH = eye height, ITD = intertorular distance, MSP = malar space, AOL = anterior ocellar line, POL = posterior ocellar line, OOL = ocular ocellar line.

of procoxa, apex and base of profemur, metatrochanter, apex of metafemur, tibiae, tarsi orange to red brown (variation: tegula orange to brown, 1/4–1/3 of apical inner surface of metafemur orange to red brown, outer surface orange, sometimes with black patch in basal half); body setae white; forewing hyaline; submarginal vein light brown; marginal and stigmal veins brown.

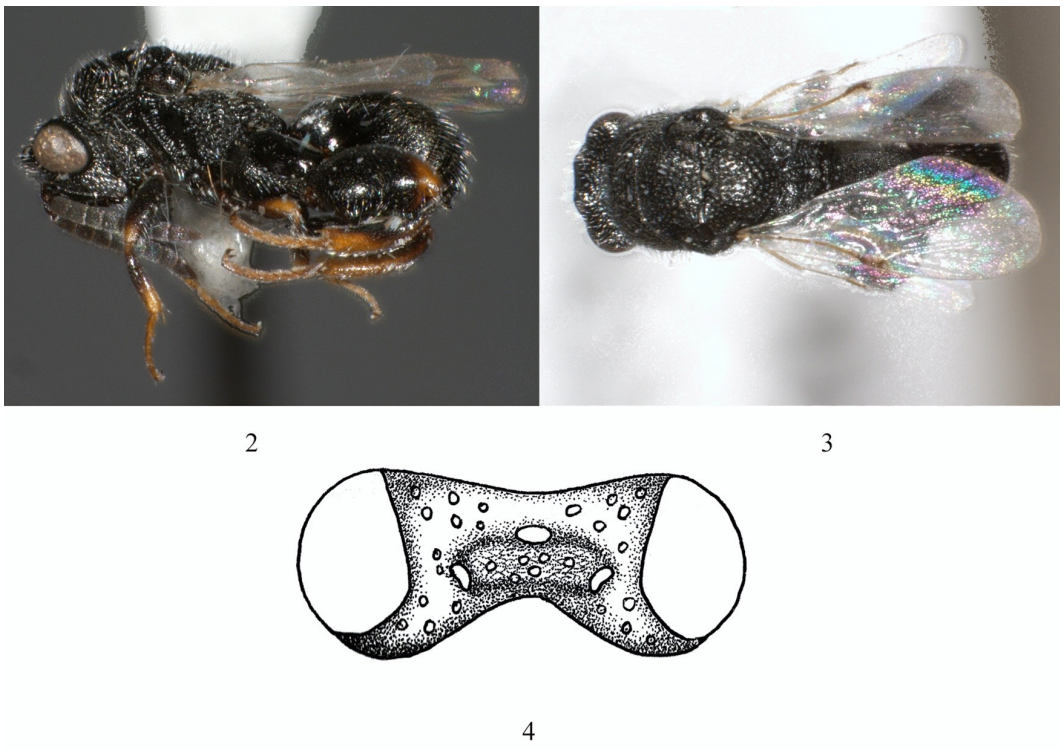
Head. Face width nearly equal to height (1.0:1.1); eye with sparse setae 1.0–1.5× ommatidia diameters in length, 1.5–2× own length apart; MS 0.5–0.7× eye EH (2:3), with punctures nearly contiguous, with dense appressed setae, malar carina present, not reaching inferior margin of eye, inferiorly joining with inferior margin of MS producing a triangular panel (variation: malar carina curving posteriorly but not reaching posterior genal margin); scrobe transversely rugulose, nearly reaching anterior ocellus; face with nearly contiguous setigerous punctures, with setae ca. 4× own puncture diameter in length, becoming erect at midpoint of eye along preorbital carina up to and including vertex; vertex flattened, densely reticulate throughout, medially punctate, posterolaterally sparsely punctuate (Fig. 4); POL 3.0–4.5× OOL; AOL 1.5–2.4× OOL; posterior ocellus diameter slightly less than OOL (4:5); inferior margin of clypeus rounded between lateral margins of toruli, protruding slightly outward; torulus diameter 0.6–1.0× ITD; antennomeres length ratio, beginning with scape 50:11:2:18:16:14:14:15:13:14:28; scape ca. 4.7× longer than wide, narrowing in apical fourth, widening again at apex, apex roundly truncate, without incised denticle on exterior margin (Fig. 5a), not reaching anterior ocellus, in lateral view reaching midpoint of eye (Fig. 2); pedicel slightly shorter than wide (2:3).

Mesosoma. Pronotum : mesoscutum : mesoscutellum : propodeum ratio ca. 6:9:10:6 in dorsal view; pronotum dorsally with setigerous punctures less than 1 puncture diameter apart, with erect setae 4–5× own puncture diameter in length, interstices reticulate, lateral panel punctate, interstices reticulate, polished ventrally, ventral strip reticulate; mesoscutum and mesoscutellum with same setigerous sculpture (Fig. 6a) and setae length as dorsal pronotum; mesoscutellum setae noticeably erect in lateral view, posterior margin rounded; propodeum with submedian, accessory, sublateral, and lateral carinae, accessory carina arching posteriorly and medially, joining submedian carina circa midpoint of propodeum, forming a distinctive cell (Fig. 7a), weak transverse carinae, interstices reticulate, posterolateral margin slightly acute, posteriorly not reaching the extent of petiolar foramen; metafemur ca 1.7× longer than wide, outer surface reticulate and setose; forewing ca. 2.5× longer than wide (5:2), submarginal:marginal:stigmal veins ratio ca. 30:6:1.

Gaster. Tergum 1 in dorsal view ca. 0.5× gaster length (4:9), dorsally reticulate, the posterior margin with a transverse sulcus within a polished band ending at dorsolateral margin, laterally polished with sparse setigerous punctures anteriorly; tergum 2 posterior margin dorsally polished, without setae, laterally, anterior portion polished becoming reticulate and setose posteriorly.

DESCRIPTION, FEMALE.—Not known.

COMMENTS.—The most unique diagnostic character of *P. adenticulata* is the lack of a protruding denticle on the male antennal scape. All other North American *Psilochalcis* species possess a protruding denticle in males. In *P. hespenheidei*, the scape is broadly triangular (Fig. 5f); *P. brevialata*, *P. deceptor* (Fig. 5e), and *P. threa* have the scape incised with an upward-pointing denticle; *P. minuta* new species (Fig. 5b), *P. quadratis* new species (Fig. 5c), and *P. usta* (Fig. 5g) have the scape incised with outward-pointing denticle.



Figs. 2–4. *Psilochalcis adenticulata* new species, male. **2,** Lateral habitus. **3,** Dorsal habitus. **4,** Vertex, dorsal view.

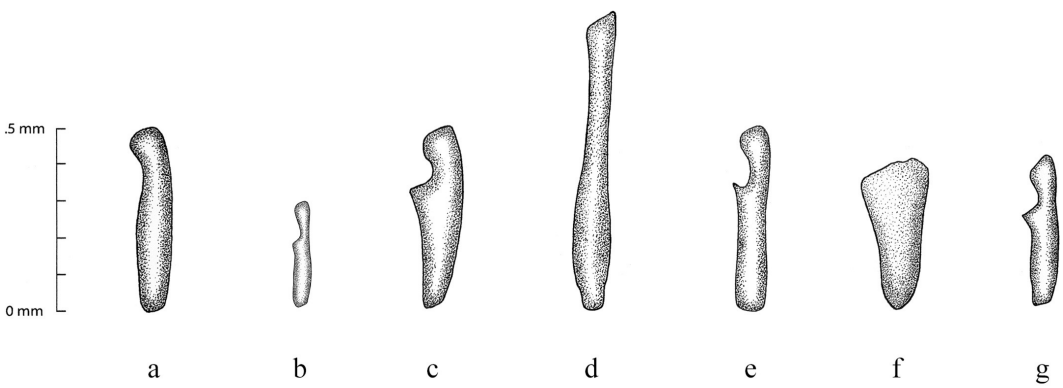


Fig. 5. *Psilochalcis* spp. antennal scape, dorsal view. ***a,*** *P. adenticulata* new species, male. ***b,*** *P. minuta* new species, male. ***c,*** *P. quadratis* new species, male. ***d,*** *P. quadratis* new species, female. ***e,*** *P. deceptor,* male. ***f,*** *P. hespenheidei,* male. ***g,*** *P. usta*, male.

In Bouček's revision (1951) of European *Psilochalcis* species, 4 *Psilochalcis* species are described as lacking a denticle on the antennal scape: (1) *P. rufitarsis* (Illiger); (2) *P. immaculata* (Rossi); (3) *P. ligustica* (Masi); (4) *P. subaenea* (Masi). A thorough review of species descriptions (Masi 1929) places *P. adenticulata* most similar to *P. rufitarsis* with respect to the antennal scape, but differing in shape of the scape apex, length of anellus, shape of mesofemur, and coloration of legs and metafemur (Bouček 1951). Running *P. adenticulata* through Nikol'skaya's (1960) key places it with *P. novitzkyi* (Bouček) with respect to the shape

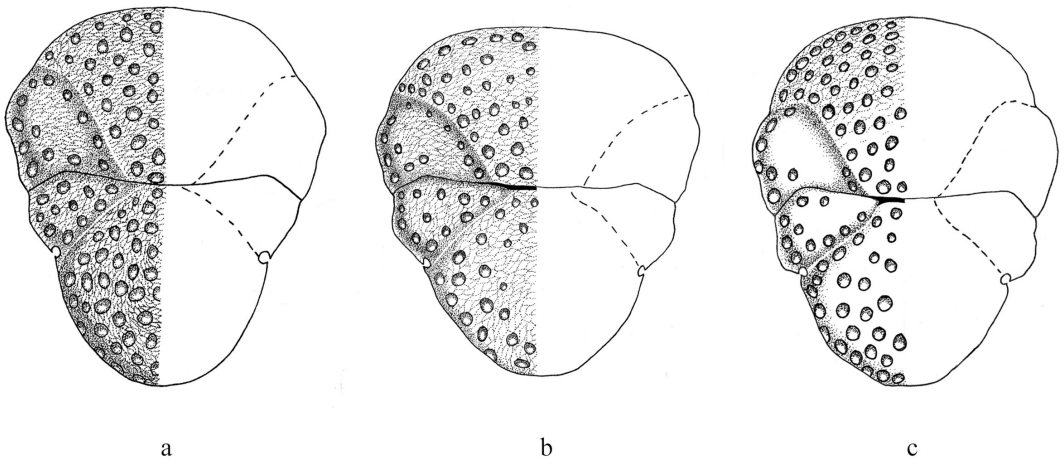


Fig. 6. *Psilochalcis* spp. mesoscutum and mesoscutellum, dorsal view. ***a***, *P. adenticulata* new species, male. ***b***, *P. minuta* new species, female. ***c***, *P. quadratis* new species, female.

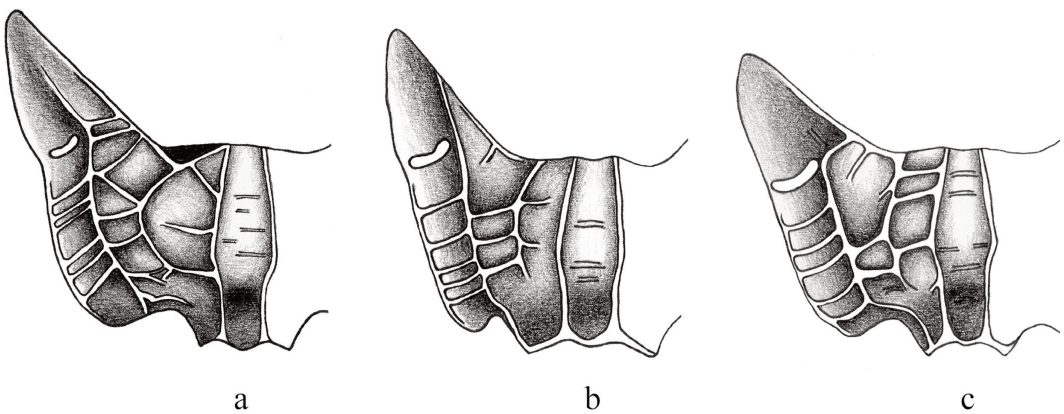


Fig. 7. *Psilochalcis* spp. propodea, dorsal view. ***a***, *P. adenticulata* new species, male. ***b***, *P. minuta* new species, female. ***c***, *P. quadratis* new species, female.

of the mesofemur. However, *P. novitzkyi* is described as having a protruding denticle on the antennal scape. Moreover, *P. rufitarsis* and *P. novitzkyi* are known only from the Palearctic region (Noyes 2019).

ETYMOLOGY.—Species epithet references the antennal scape lacking a protruding denticle.

MATERIAL EXAMINED.—*Holotype*. "Utah, Juab Co., Tintic Valley, 39.72314°N, 112.20226°W, 5233 ft, 26 Jul 2006, coll. R.L. Johnson/Malaise trap, sagebrush habitat" (♂ BYUC).

Paratypes. **New Mexico:** *Eddy Co.*: Sitting Bull Falls, 17 May 1988, N. Jorgensen (2♂ WSU). **Nevada:** *Clark Co.*: Hidden Valley, Moapa, 36.6539°N, 114.6011°W, 1565 ft, 1–15 Aug 2011, R.L. Johnson & J.A. Sharp (7♂ BYUC); same data except 15–31 Aug 2011 (4♂ BYUC); 1–15 Sep 2011 (1♂ BYUC). **Utah:** *Juab Co.*: Tintic Valley, 39.71356°N, 112.16980°W, 5336 ft, 8 Jun 2006, R.L. Johnson (2♂ BYUC); Tintic Valley, 39.71475°N, 112.16943°W, 5338 ft, 8 Jun 2006 (1♂ BYUC); Tintic Valley, 39.72314°N, 112.20226°W, 5233 ft, 26 Jul 2006 (2♂ BYUC); Tintic Valley, 39.75257°N, 112.20272°W, 5248 ft, 26 Jul 2006 (1♂ BYUC). *Utah Co.*: W. side Utah Lake, 1 Jul 1979, S.M. Clark (1♂ BYUC). *Washington Co.*: Pintura, 10 Jul–14 Aug 1986, W.J. Hanson (1♂ EMUS); Beaver Dam Slope, 16 Jun 1983 (1♂ EMUS); Lytle Ranch, 1–4 Jul 1992, D. Judd & D. Feener (1♂ EMUS).

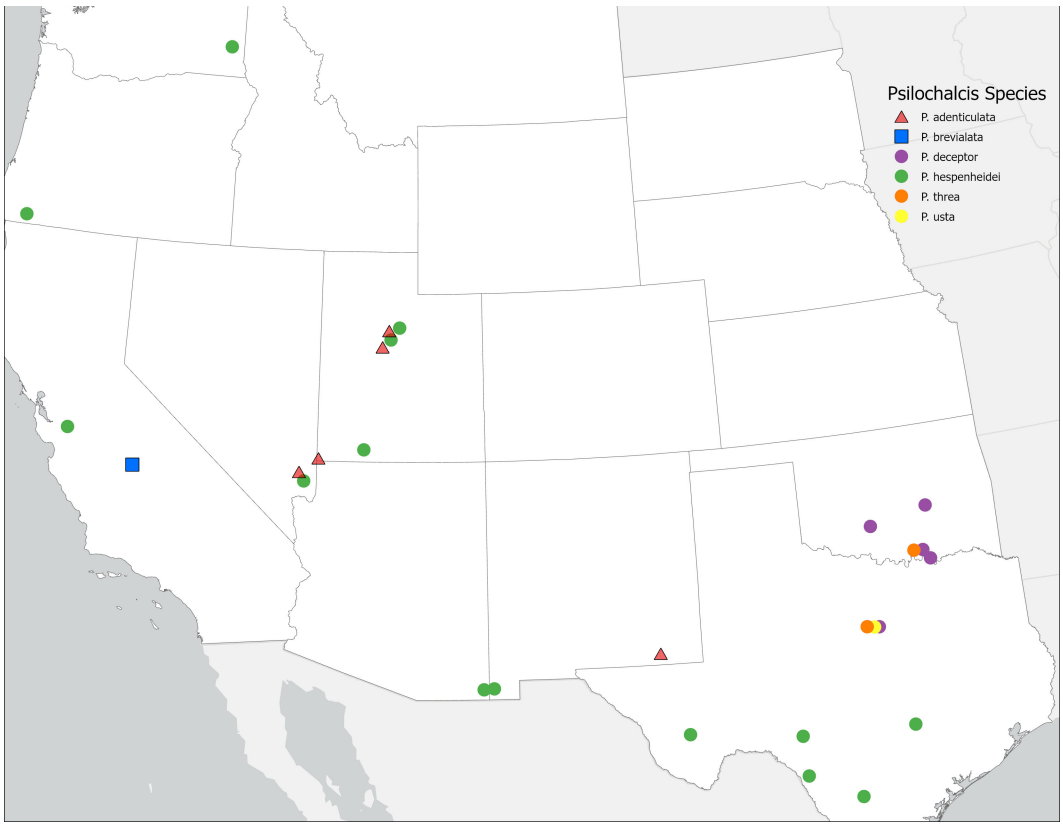


Fig. 8. Western United States distribution of *Psilochalcis adenticulata* new species, *P. brevialata*, *P. deceptor*, *P. hespenheidei*, *P. threa*, and *P. usta*. Note: *P. brevialata* is known only from material reared from a culled fig warehouse in Fresno County, California. *Psilochalcis deceptor*, *P. threa*, and *P. usta* are known only from cultured laboratory stock from cultivated peanut crop. It is not known if these species occur naturally in the United States. The occurrence of *P. hespenheidei* is shown only for the western United States. It is also known to occur in Oahu, Hawaii (Bouček 1984), and for the first time it is reported from Coahuila, Mexico (not shown).

DISTRIBUTION.—*Psilochalcis adenticulata* is known from a few counties in New Mexico, Nevada, and Utah (Fig. 8).

Psilochalcis brevialata Grissell and Johnson
Psilochalcis brevialata Grissell and Johnson, *in* Johnson et al. 2001:779
(Fig. 8)

TYPE LOCALITY.—USA, California, Fresno County, Horticulture Crops Research Lab, 10 Jan 2000.

DIAGNOSIS.—Distinguished by the following: (1) eye with setae 2–3 ommatidia diameters in length, 1–1.5× own length apart; (2) punctures of upper face with carinate walls; (3) malar space rugulose with dense appressed silvery white setae; (4) female, forewing barely reaching the dorsal posterior margin of tergum 3.

COMMENTS.—*Psilochalcis brevialata* has the longest eye setae length of any North American *Psilochalcis* species. Females of *P. brevialata* are most similar to females of *P. quadratis* new species, with both having the forewing not reaching the gaster apex. In *P. brevialata*, the forewing barely reaches the dorsal posterior margin of tergum 3, while *P. quadratis* new species has the forewing reaching and usually extending well beyond the dorsal margin of tergum 3.

DISTRIBUTION.—*Psilochalcis brevialata* is known only from laboratory-reared material collected from a culled fig warehouse in Fresno County, California (Johnson et al. 2001). No material has been reported outside of this setting. It is not known if this species occurs naturally in the United States. See Fig. 8.

Psilochalcis deceptor (Grissell and Schauff)
Invreia deceptor Grissell and Schauff 1981:2
(Figs. 5e, 8)

Type locality.—USA, Texas, Comanche Co., 3 mi W DeLeon, 10 Aug 1978.

Diagnosis.—Distinguished by having tergum 1 polished, without sculpture, both dorsally and laterally.

Comments.—*Psilochalcis deceptor* is most similar to *P. threa*, with both having a thin protruding flange on posterolateral margin of prosternum. Males of both species have an upward-pointing denticle on the antennal scape. *Psilochalcis deceptor* differs from *P. threa* in having tergum 1 polished both dorsally and laterally (*P. threa* with tergum 1 reticulate both dorsally and laterally).

Material examined.—**Texas:** *Comanche Co.*: 3 mi W DeLeon, Laboratory cultured stock, 1978, S. Johnson (2♀, 1♂ TAMU).

Distribution.—*Psilochalcis deceptor* is known only from cultured material collected from cultivated peanut crop from Oklahoma: Bryan, Grady, Hughes, and Marshall Counties; Texas: Comanche County (Fig. 8). It is not known if this species occurs naturally in the United States.

Psilochalcis hespenheidei (Bouček)
Invreia hespenheidei Bouček 1984:59
(Figs. 5f, 8)

Type locality.—USA, Arizona, Cochise County, Cave Creek Canyon, Chiricahua Mountains, Southwest Research Station, 5 July 1981.

Diagnosis.—Female distinguished by (1) gaster apex rounded; (2) ovipositor shifted ventrally, positioned well short of gaster apex, never visible from above; (3) tergum 3 in dorsal view longest of any gastral tergite; (4) prominent triangular clypeal projection extending outward over labrum. Male distinguished by (1) antennal scape triangular, ca. 2× longer than width at apex (Fig. 5f); (2) pedicel in anterior view rounded medially, ca. 1.5× wider than 1st funicular antennomere.

Comments.—*Psilochalcis hespenheidei* has clearly observed and unique characters that are not easily confused with any other North American *Psilochalcis* species. As discussed by Bouček (1984), it forms its own distinct species group.

Material examined.—**Arizona:** *Cochise Co.*: Portal, 26 Jun 1958, W.F. Barr (1♀ WFBM); Miller Canyon, Huachuca Mountains, 10 Aug 1989, W.F. Barr (1♀ WFBM); Bog Spring, Madera Canyon, 25 Jun 1985, W.F. Barr (1♂ WFBM); Madera Canyon Lodge, 5 Jun 1989, W.F. Barr (17♂ WFBM). *Pima Co.*: Tucson, 3 Jun 1998, R.S. Beal (1♀ CSUC); Santa Cruz Co.: 24.5 km E Amado, 22 Jul 1987, W.F. Barr (2♀, 1♂ WFBM). **California:** *Santa Clara Co.*: San Antonio Valley, W.F. Barr (1♀ WFBM). **Oregon:** *Josephine Co.*: 3 mi N O'Brien, 28 Aug 1963, W.F. Barr (1♀ WFB7M). **Nevada:** *Clark Co.*: Logandale, 19–21 Jun 1981, R. Nelson (1♀ BYUC); Hidden Valley, Moapa, 36.6539°N, 114.6011°W, 15–30 Jun 2012, R.L. Johnson (1♀, 1♂ BYUC). **New Mexico:** *Lea Co.*: 32°24.7′N, 103°40.9′W, Site #2, 20 Jun 1979, D.R. Delorme & H.L. Carrola (1♀ TAMU). *Luna Co.*: Columbus, June 1931, Beck & Call (1♀ BYUC). **Texas:** *Frio Co.*: 6 mi SE. Pearsall, 7 Jul 1972, E.E. Grissell & J. Smith (4♂ TAMU); *Jeff Davis Co.*: 5 mi S Ft. Davis, 6 Jun 1972, W.E. Clark (1♂ TAMU). *Kinney Co.*: 15 mi SE Del Rio, 20 Aug 1965, J.C. Shaffner (1♂ TAMU). *Travis Co.*: Heap Farm, 11 mi S Austin, 2 Aug 1972, E.E. Grissell (3♀, 4♂ TAMU). *Vale Verde Co.*: Turo, 29 May 1989, W.F. Barr (1♀ WFBM); 18 mi NE Juno, 29 May 1989, W.F. Barr (1♀ WFBM). **Utah:** *Cache Co.*: Four-Mile Canyon, 2–11 Jul 1992, W. Hanson & S. Keller (1♀ USU). *Emery Co.*: Wild Horse Creek, Goblin Valley, 26–28 Jul 1982, Parkers & Griswold (4♂ USU). *Kane Co.*: Glendale, 8 Jun 1966, G.F. Knowlton (1♀ USU). *Utah Co.*: Goshen Canyon, 39.9016°N, 111.8935°W, 4747 ft, 29 Jul 2015, S.M. Clark (1♀ BYUC); Provo, Slate Canyon, 29 Jun 1998, S.M. Clark (1♀ BYUC). *Washington Co.*: Santa Clara, 30 May 1973, F. Parker & P. Torchio (1♀ USU). **Washington:** *Whitman Co.*: Almota, 22 Aug 1987, W.J. Turner (1♀ WSU). **Mexico: Coahuila:** 6.2 mi SE Emiliano Zapata, 17 Aug 1983, W.F. Barr (1♀ WFBM).

Distribution.—*Psilochalcis hespenheidei* is known from Arizona and Hawaii (Bouček 1984) and now is reported as occurring in 2 new counties in Arizona and several counties in California, Oregon, Nevada, New Mexico, Texas, Utah, and Washington (Fig. 8). Now reported as also occurring in Coahuila, Mexico.

***Psilochalcis minuta* Petersen, new species**
(Figs. 5b, 6b, 7b, 9–11, 14)

Diagnosis.—*Psilochalcis minuta* is distinguished by the following: (1) body length no

9 10

Figs. 9–10. *Psilochalcis minuta* new species, female. **9,** Lateral habitus. **10,** Dorsal habitus.

greater than 2.5 mm; (2) mesosoma punctate, interstices reticulate-aciculate; (3) female—antennal scape apex reaching and/or exceeding vertex (Fig. 9); (4) apex of ovipositor sheath truncate (Figs. 9, 11).

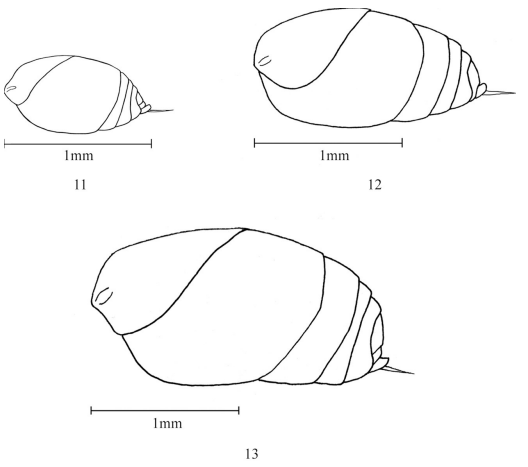
DESCRIPTION, FEMALE.—Length 1.8–2.3 mm (holotype 1.9 mm).

Color. Black except the following: antennal scape through clava, mandibles, pro and mesocoxae, profemur, margins of mesofemur, metatrochanter, apex of metafemur, base of mesotibia, exterior three-fourths of metatibia brown; pro and mesotrochanters, apex of profemur, apex, median, and base of mesofemur, protibia, base and apex of mesotibia, apical one-fourth and interior of metatibia, tarsi, hypopygium light brown/yellow; forewing hyaline; submarginal vein whitish yellow; marginal and stigmal veins brown.

Head. Face width equal to face height (1:1); eye with setae ca 1.5 ommatidia diameters in length, ca 1.5× own length apart; MS 0.7–0.9× EH (5:6), densely punctate, finely setose, without malar carina; scrobe rugulose, not reaching anterior ocellus; face with setigerous punctures, setae 2–3× own puncture diameter in length, becoming erect at inferior margin of eye along preorbital carina up to and including vertex; vertex rounded, reticulate/punctate, especially posteromedial; POL 4.0–6.0× OOL; AOL 1.5–2.7× OOL; posterior ocellus diameter slightly longer than OOL (4:3); clypeus inferior margin straight between medial margins of toruli, not protruding outward (variation: some with short clypeal projection over labrum); torulus diameter 0.6–1.0× ITD; antennomere length ratio, beginning with scape 47:20:8:7:9:8:8:9:8:8:20; scape in lateral view reaching or exceeding vertex.

Mesosoma. Pronotum mesoscutum:mesoscutellum:propodeum ratio ca. 2:3:3:2 in dorsal view; pronotum with setigerous punctures ca. 1× puncture diameter apart, setae 1.5–2× own puncture diameter in length, interstices reticulate–aciculate, lateral panel sparsely punctate to ventral margin, ventral strip reticulate; mesoscutum with same setigerous sculpture and setae length as dorsal pronotum; mesoscutellum with setigerous punctures 1× puncture diameter apart, interstices reticulate–aciculate throughout, median without punctures, posterior margin rounded (Fig. 6b); propodeum with submedian, accessory, sublateral, and lateral carinae present, accessory carina diagonal, joining with sublateral carina near midpoint of propodeum (Fig. 7b) (variation: some with accessory carina not reaching sublateral carina), weak transverse carinae, interstices finely punctate, posterolateral margin acute, not reaching extent of petiolar foramen; metafemur ca. 1.9× longer than wide, outer surface finely reticulate, setose; forewing ca. 2.4× longer than wide (7:3), submarginal:marginal:stigmal veins ratio ca. 15:3:1.

Gaster. In lateral view ovate, posteriorly acuminate (Fig. 11); tergum 1 dorsally ca. 0.5× gaster length (5:9), four-fifths coarsely reticulate, with wide polished band at posterior margin, polished laterally; tergum 2 dorsally ca. 0.4× length of tergum 1, reticulate to



Figs. 11–13. *Psilochalcis* spp. female gaster, lateral view. **11,** *P. minuta,* new species. **12,** *P. usta*. **13,** *P. quadratis,* new species.

posterior margin (variation: some with dorsal median polished at posterior margin), dorsal posterior margin emarginate, laterally reticulate; tergum 3 dorsal posterior margin emarginate; tergites 3–6 dorsal three-fourths polished, with thin reticulate setigerous posterior band; tergum 6 acutely inclined, clearly visible from above (Fig. 11); ovipositor sheath with dorsal margin concave to straight, apex truncate, ventral margin convex, clearly visible from above (Fig. 11).

Description, Male.—Length 1.5–2.5 mm (allotype 1.7 mm).

Color. Black except the following: metafemur dark brown to black; radicle, scape, pedicel, pro- and mesocoxae, apex of metacoxa, pro- and mesofemora, base and apex of metafemur dark brown; labrum, mandible orange to brown; denticle, anellus, funicular antennomeres, apices of pro- and mesofemora, apices of tibiae, light brown; tarsi, yellow to light brown.

Body. Sculpture, setae, and structure same as for female except the following: face width slightly greater than face height (8:7); MS 0.6–0.9× EH (4:5); POL 4.0–9.0× OOL; AOL 2.0–4.5× OOL; antennal scape ca. 6× longer than wide, apex rounded, denticle emerging from exterior margin at two-thirds scape length; denticle equal to or slightly wider than width of scape at apex, point of denticle pointing outward (Fig. 5b); antennomere length ratio, beginning with scape 27:8:2:8:8:6:7:7:6:9:15; face and MS setae appressed; mesoscutellum sculpture punctate throughout (female without punctures in median).

Comments.—*P. minuta* runs to *P. usta* in Grissell and Schauff (1981) but differs from it in having the lateral panel of the pronotum and ventral strip punctate. In *P. usta*, the lateral panel of the pronotum is polished and the ventral strip reticulate. In females of *P. minuta*, the apex of the ovipositor sheath is truncate (Figs. 9, 11) and rounded in *P. usta* (Fig. 12). In males of *P. minuta,* the denticle width is subequal to the apical width of the scape (Fig. 5b). In *P. usta*, the denticle width exceeds the apical width of the scape (Fig. 5g).

Etymology.—Species epithet references the small size.

Material examined.—*Holotype*. "Utah, Juab Co., Yuba, 39.45430°N, 111.96667°W, 5292 ft, 10 Aug. 2006, coll. R.L. Johnson/malaise trap, pinyon/juniper habitat" (♀ BYUC).

Allotype. "Utah, Juab Co., Yuba, 39.45350°N, 111.96699°W, 5297 ft., 26 Jul 2006, coll. R.L. Johnson/malaise trap, pinyon/juniper habitat" (♂ BYUC).

Paratypes. **Utah:** *Iron Co.*: Cedar City, 37.43848°N, 113.22392°W, 5974 ft, 3–10 Aug 2019, M.K & J.E Sanders (1♂); same data except 11–17 Aug 2019 (1♀, 1♂); 1–6 Sep 2019 (1♀, 1♂). *Juab Co.*: Gilson Mountains, 39.65849°N, 112.24926°W, 5381 ft., 29 Jul–6 Aug 2021, M.J. Petersen & R.L. Johnson (6♀); same data except 7–20 Aug 2021 (10♀); 21 Aug–1 Sep 2021 (4♀, 1♂); Sage Valley, 39.34207°N, 112.05164°W, 5355 ft, 17–27 Jul 2020 (1♀, 2♂); same data except 28 Jul–7 Aug 2020 (14♀, 2 ♂); 8–18 Aug 2020 (2♀, 1♂); Sage Valley, 39.31385°N, 112.04212°W, 5055 ft, 28 Jul–7 Aug 2020 (1♀); Tintic Valley, 39.78396°N, 112.15729°W, 5750 ft, 26 Jul 2006, R.L. Johnson (1♀); same data except 3–17 Jul 2007 (1♀); Tintic Valley, 39.78422°N, 112.15594°W, 5750 ft, 10 Aug 2006 (1♂); same data except 5–19 Jun 2007 (1♀ BYUC); 3–17 Jul 2007 (1♀); Tintic Valley, 39.78431°N, 112.15489°W, 5762 ft, 5–19 Jun 2007 (1♀); same data except 19 Jun–3 Jul 2007 (1♀); 3–17 Jul 2007 (1♀); 14–28 Aug 2007 (1♀); Tintic Valley, 39.75257°N, 112.20272°W, 5248 ft, 19 Jun–3 Jul 2007 (1♀); Yuba, 39.45350°N, 111.96699°W, 5297 ft, 8 Jun 2006 (1♂); same data except 26 Jul 2006 (5♀, 2♂); 1 Jul 2007 (2♀); 28 Aug–11 Sep 2007 (2♀); Yuba, 39.45380°N, 111.96674°W, 5300 ft, 26 Jul 2006

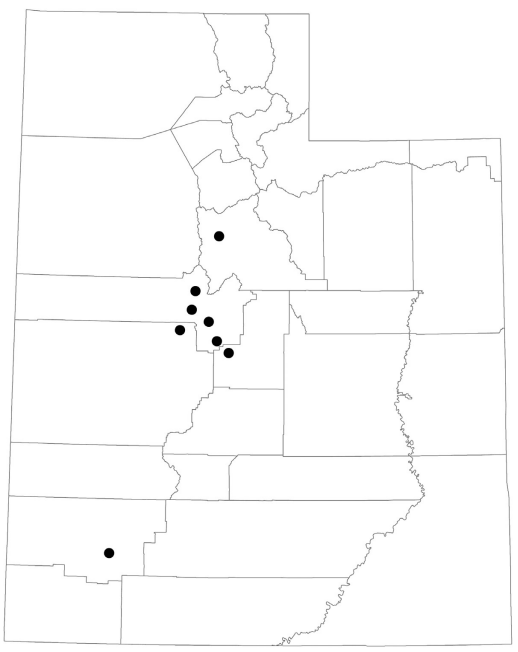


Fig. 14. Utah distribution of *Psilochalcis minuta* new species. This species occurs predominantly in central Utah but is also known from Iron County in southern Utah.

(22♀, 10♂); same data except 10 Aug (15♀, 1♂); 9 Sep 2006 (1♀); 5–19 Jun 2007 (1♀); 19 Jun–3 Jul 2007 (1♀, 1♂); 3–17 Jul 2007 (8♀, 2♂); 17–31 Jul 2007 (2♀); 14–28 Aug 2007 (2♀, 1♂); Yuba, 39.45430°N, 111.96667°W, 5292 ft, 8 Jun 2006 (1♂); same data except 26 Jul 2006 (29♀, 22♂); 10 Aug (25♀, 6♂); 9 Sep 2006 (4♀); 5–19 Jun 2007 (3♂); 19 Jun–3 Jul 2007 (1♀, 2♂); 3–17 Jul 2007 (1♀, 1♂); 17–31 Jul 2007 (1♀); 28 Aug–11 Sep 2007 (1♀); 11–25 Sep 2007 (6♀, 1♂); Yuba, 39.27123°N, 111.58028°W, 5280 ft, 7–27 Jul 2020, M.J. Petersen & R.L. Johnson (5♀, 2♂); same data except 28 Jul–7 Aug 2020 (44♀, 9♂); 8–18 Aug 2020 (30♀, 2♂); Yuba, 39.23087°N, 111.57473°W, 5251 ft, 17–27 Jul 2020 (62♀, 36♂); 28 Jul–7 Aug 2020 (189♀, 35♂); 8–18 Aug 2020 (66♀, 5♂); Yuba, 39.23102°N, 111.57254°W, 5166 ft, 17–27 Jul 2020 (1♀); same data except 28 Jul–7 Aug 2020 (1♀); 8–18 Aug 2020 (1♀, 1♂). *Millard Co*.: Oak Creek Sinks, 39.48876°N, 112.35678°W, 4774 ft, 29 Jul–6 Aug 2021, M.J. Petersen & R.L. Johnson (3♀, 2♂); same data except 7–20 Aug 2021 (4♀); 7–20 Aug 2021 (1♀). *San Pete Co*.: Antelope Valley, 39.23526°N, 111.75134°W, 5750 ft, 5–19 Jun 2007, R.L. Johnson (1♂); Antelope Valley, 39.23594°N, 111.75281°W, 5776 ft, 9 Sep 2006 (1♀); same data except 24 Apr–5 May 2007 (1♀); 17–31 Jul 2007 (2♀); Antelope Valley, 39.23655°N, 111.75351°W, 5790 ft, 24 Apr–5 May 2007 (1♀); same data except 14–28 Aug 2007 (1♀). *Utah Co*.: Lake Mountain, 40.21209°N, 111.97083°W, 5308 ft, 21 Aug–1 Sep 2021, M.J. Petersen & R.L. Johnson (2♀).

*All cited material resides at BYUC.

DISTRIBUTION.—*Psilochalcis minuta* is only known to occur in Utah. It is predominantly known from Juab, Millard, Utah, and San Pete Counties in central Utah. It is also known from Iron County in southern Utah (Fig. 14).

Psilochalcis quadratis Petersen, new species

(Figs. 5c–d, 6c, 7c, 13, 15–18)

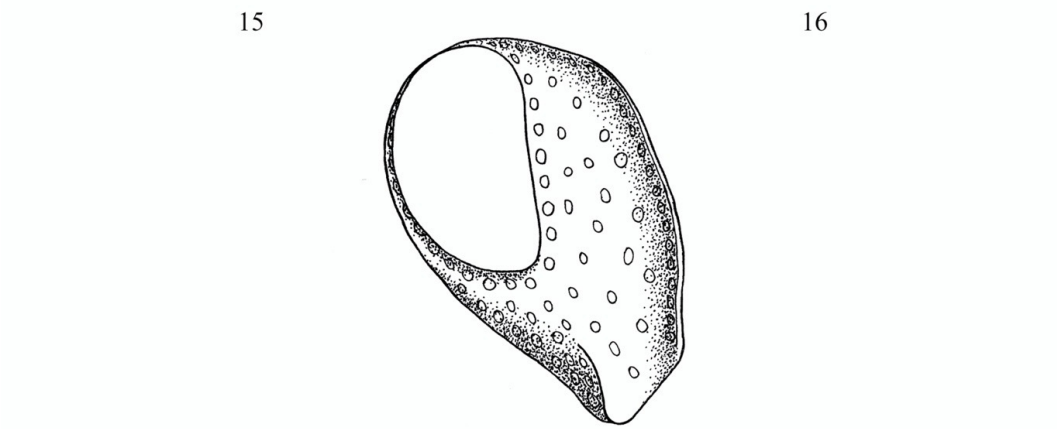
DIAGNOSIS.—Distinguished by the following: (1) body length usually greater than 3.5 mm; (2) malar space with polished triangular tooth-like panel along inferior margin from which malar carina emerges; (3) female—gaster apex truncate, tergum 6 vertical or nearly so.

DESCRIPTION, FEMALE.—Length 3.7–4.9 mm (holotype 4.3 mm).

Color. Black except the following: antennal scape through clava, labrum, mandible, tegula, pro- and mesolegs, basal half of metacoxa, metafemur, tibae (except black marginal carinae), tarsi, hypopygium, and ovipositor orange; forewing hyaline; submarginal vein light yellow; marginal and stigmal veins brown; translucent area below marginal vein orange brown.

Head. Face width nearly equal to face height (1:1.1); eye with setae ca. 2 ommatidia diameters in length, 1–1.5× own length apart; MS 0.5–0.7× EH (2:3), punctate, sparsely setose, malar carina not reaching inferior margin of eye, inferiorly joining with inferior margin of MS producing a rounded tooth-like polished panel (Fig. 17) (variation: some with a few setigerous punctures on panel's lateral margin); scrobe finely rugulose, superiorly punctate, nearly reaching anterior ocellus; face with setigerous punctures, setae 2× own puncture diameter in length, becoming erect at midpoint of eye along preorbital carina up to and including vertex; vertex somewhat flattened, punctate throughout; POL 3.0–3.5× OOL; AOL ca. 1.5× OOL; posterior ocellus diameter equal to OOL (1:1); clypeus inferior

15



16

17

Figs. 15–17. *Psilochalcis quadratis* new species, female. **15,** Lateral habitus. **16,** Dorsal habitus. **17,** Head, lateral view.

margin rounded beyond lateral margins of toruli, slightly projecting outward; torulus diameter ca. 0.5× ITD; antennomere length ratio, beginning with scape 51:20:10:10:10: 9:9:9:8:8:15; scape in lateral view reaching midpoint of eye (Fig. 15).

Mesosoma. Pronotum : mesoscutum : mesoscutellum : propodeum ratio ca. 6:7:6:5 in dorsal view; pronotum dorsally with setigerous punctures less than one puncture diameter apart, setae ca. 3× own puncture diameter in length, interstices anteriorly reticulate–aciculate, median polished, lateral panel punctate to ventral margin, ventral strip punctate; mesoscutum with same setigerous sculpture and setae length as dorsal pronotum, interstices anteriorly reticulate–aciculate, posteriorly polished, lateral lobe with punctures 1–2 puncture diameters apart; mesoscutellum with setigerous punctures 1–2 puncture diameters apart, median polished, interstices anteriorly polished to aciculate, posterior margin rounded (Fig. 6c); propodeum with submedian, accessory, sublateral, and lateral carinae, accessory carina posteriorly reaching midpoint of propodeum, strong transverse carina, interstices polished to sparsely punctate, posterolateral margin slightly acute, nearly reaching extent of petiolar foramen (Fig. 7c); metafemur ca. 1.9× longer than wide, sparsely setose, outer surface sparsely punctate/aciculate; forewing ca. 2.5× longer than wide (5:2), submarginal : marginal : stigmal veins ratio ca. 22:4:1.

Gaster. In lateral view quadrate, dorsal posterior apex strongly convex (Fig. 13, 15); tergum 1 dorsally 0.3–0.6× gaster length, reticulate to posterior margin, laterally with faint minute reticulations making surface

slightly dull (variation: some with lateral surface polished); tergum 2 in dorsal view ca. 0.6× length of tergum 1, posterior margin emarginate, laterally punctate, with some punctures petal-like; tergum 3 dorsal posterior margin emarginate; tergum 6 vertical or nearly so (Fig. 13, 15); ovipositor sheath with dorsal margin straight, apex pointed, apex to ventral margin convex (Fig. 13, 15); epipygium and ovipositor sheath barely visible from above.

DESCRIPTION, MALE.—Length 3.1–3.9 mm (allotype 3.8 mm).

Color. Same as for female. Additionally, interior scape margin dark brown; exterior scape margin and denticle orange to brown; funicular antennomeres exteriorly gray/brown, interiorly orange.

Body. Sculpture and structure same as for female except the following: face width equal to face height (1:1); POL 3.0–3.5× OOL; AOL 1.4–2.0× OOL; antennal scape 3× longer than broad, apex truncate, denticle emerging at three-fifths scape length; denticle 1.3× wider than width of scape at apex, point of denticle pointing outward (Fig. 5c); antennomere length ratio, beginning with scape: 53:15:3:22:17:16:17:16:16:15:28; MS 0.5× EH (1:2); face and MS setae densely appressed; pronotum, mesoscutum, and mesoscutellum setae more erect; mesoscutellum setae ca. 4× own puncture diameter in length.

COMMENTS.—*Psilochalcis quadratis* runs to *P. usta* in Grissell and Schauff (1981) but differs from it in having the lateral panel of the pronotum and ventral strip punctate. In *P. usta*, the lateral panel of the pronotum is polished and the ventral strip reticulate. Tergum 1 of *P. quadratis* is dorsally reticulate to posterior margin. In *P. usta*, tergum 1 is dorsally reticulate with a polished posterior band. Females of *P. quadratis* have the gaster apex truncate. *Psilochalcis usta* females have the gaster apex acuminate. Females of *P. quadratis* are similar to *P. brevialata* in having the forewing reaching the posterior margin of tergum 3. However, this trait is quite variable in *P. quadratis*, with some specimen forewings reaching and many extending well beyond tergum 3.

ETYMOLOGY.—Species epithet references the shape of the gaster.

MATERIAL EXAMINED.—*Holotype*. "Utah, Juab Co., Yuba, 39.44125°N, 112.00100°W, 5047 ft., 9 Sep 2006, coll. R.L. Johnson/malaise trap, cheatgrass habitat" (♀ BYUC).

Allotype. "Utah, Juab Co., Yuba, 39.44125°N, 112.00100°W, 5047 ft, 26 Jul 2006, coll. R.L. Johnson/malaise trap, cheatgrass habitat" (♂ BYUC).

Paratypes. **Utah:** *Box Elder Co*.: Corrine, 13 Aug 1929, G.F. Knowlton (1♀ USU); same data except 22 Aug 1929 (1♂ USU); Lampo, 8 Aug 1931, G.F. Knowlton (1♀ USU). *Cache Co*.: Petersboro, 6 Jul 1948, G.E. Bohart (1♀ USU). *Juab Co*.: Gilson Mountains, 39.65849°N, 112.24926°W, 5381 ft, 29 Jul–6 Aug 2021, M.J. Petersen & R.L. Johnson (1♀, 1♂); same data except 7–20 Aug 2021 (2 ♂); 21 Aug–1 Sep 2021 (1♀); Sage Valley, 39.31385°N, 112.04212°W, 5055 ft, 17–27 Jul 2020, M.J. Petersen & R.L. Johnson (2♀, 1♂); same data except 28 Jul–7 Aug 2020 (3♀); 8–18 Aug 2020 (1♀); Sage Valley, 39.34207°N, 112.05164°W, 5355 ft, 8–18 Aug 2020 (1♂); Tintic Valley, 39.72314°N, 112.20226°W, 5233 ft, 10 Aug 2006, R.L. Johnson (1♂); same data except 28 Aug–11 Sep 2007 (1♂); Tintic Valley, 39.75257°N, 112.20272°W, 5248 ft, 9 Sep 2006 (1♂); same data except 3–17 Jul 2007 (1♂); Yuba, 39.43857°N, 112.0024°W, 5041 ft, 8 Jun 2006, R.L. Johnson (1♂); same data except 26 Jul 2006 (54♀, 33♂); 10 Aug 2006 (31♀, 30♂); 9 Sep 2006 (3♀, 5♂); 30 May–5 Jun 2007 (7♂); 5–19 Jun 2007 (1♀, 4♂); Yuba, 39.46994°N, 112.0047°W, 5054 ft., 26 Jul 2006 (30♀, 49♂); same data except 10 Aug 2006 (25♀, 35♂); 9 Sep 2006 (5♀, 9♂); 22–30 May 2007 (4♂); 19 Jun–3 Jul 2007 (1♂); Yuba 39.44125°N, 112.00100°W, 5047 ft, 8 Jun 2006 (1♀); same data except 26 Jul 2006 (23♀, 27♂); 10 Aug 2006 (24♀, 17♂); 9 Sep 2006 (2♀, 4♂); 30 May–5 Jun 2007 (8♂); Yuba, 39.41016°N, 111.99285°W, 5096 ft, 10 Aug 2006 (1♂); same data except 14–28 Aug 2007 (1♂); Yuba, 39.45201°N, 111.99307°W, 5136 ft, 17–31 Jul 2007 (1♀); Yuba, 39.45618°N, 111.99165°W, 5156 ft, 26 Jul 2006 (1♀); Yuba, 39.45763°N, 111.99073°W, 5146 ft, 26 Jul 2006 (2♀); same data except May–5 Jun 2007 (1♀, 1♂); 28 Aug–11 Sep 2007 (1♀); Yuba, 39.26229°N, 112.00220°W, 5063 ft, 17–27 Jul 2020, M.J. Petersen & R.L. Johnson (2♀, 8♂); same data except 28 Jul–7 Aug 2020 (9♀, 10♂); 8–18 Aug 2020 (1♀, 2♂); Yuba, 39.23102°N, 111.57254°W, 5166 ft, 28 Jul–7 Aug 2020 (1♀, 1♂); Yuba, 39.27123°N, 111.58028°W, 5280 ft, 17–27 Jul 2020 (1♀); same data except 28 Jul–7 Aug 2020 (1♀); 8–18 Aug 2020 (5♀); Yuba, 39.23087°N, 111.57473°W, 5251 ft, 17–27 Jul 2020 (3♀);

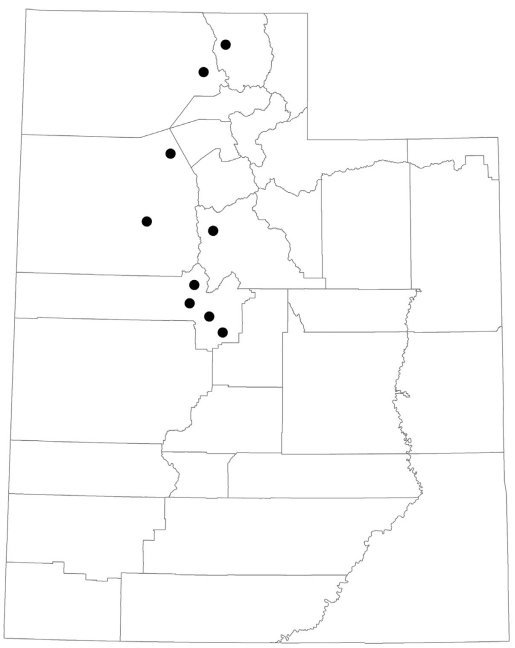


Fig. 18. Utah distribution of *Psilochalcis quadratis* new species. This species is only known from counties in central and northern Utah.

same data except 28 Jul–7 Aug 2020 (1♀, 1♂). *Tooele Co.*: Lake Point, 27 Aug 1929, G.F. Knowlton (1♀ USU); Orr's Ranch Skull Valley, 12 Aug 1949, G.F. Knowlton (1♀ USU). *Utah Co.*: Lake Mountain, 40.24126°N, 111.98340°W, 5031 ft, 7–20 Aug 2021, M.J. Petersen & R.L. Johnson (1♀).

*All cited material resides at BYUC unless otherwise noted.

Distribution.—*Psilochalcis quadratis* is only known to occur in Utah. It is known from Box Elder, Cache, Juab, Utah, and Tooele Counties in central and northern Utah (Fig. 18).

Psilochalcis threa (Grissell and Schauff)
Invreia threa Grissell and Schauff 1981:8
(Fig. 8)

Type locality.—Oklahoma, Marshall Co., 9 Sep 1978.

Diagnosis.—Distinguished by having tergum 1 evenly reticulate both dorsally and laterally.

Material examined.—**Texas:** *Comanche Co.*: 3 mi W DeLeon, 10 Aug 1978, R.L. Sams (1♀ paratype no. 134, TAMU).

Distribution.—*Psilochalcis threa* is known only from cultured material collected from cultivated peanut crop from Oklahoma, Marshall Co. and Texas, Comanche Co. (Fig. 8). It is not known whether this species occurs naturally in the United States.

Psilochalcis usta (Grissell and Schauff)
Invreia usta Grissell and Schauff 1981:6
(Figs. 5g, 8, 12)

Type locality.—Texas, Comanche Co., 3 mi W DeLeon, 14 Aug 1978.

Diagnosis.—Distinguished by the following: (1) lateral panel of pronotum polished, ventral strip reticulate; (2) female—mesoscutellum punctate except for median area polished, interstices polished; (3) ovipositor sheath apically rounded (Fig. 12).

Comments.—*Psilochalcis usta* comes nearest to *P. minuta*, with both having tergum 1 reticulate dorsally and a wide polished posterior band, but differs from it as aforementioned under *P. minuta*.

Material examined.—**Texas:** *Comanche Co.*: 3 mi W DeLeon, 14 Aug 1978, R.L. Sams (♀, holotype no.76488, USNM); same data except 20 Jul 1978 (♀ paratype); 17 Aug 1978 (♂ allotype).

Distribution. *Psilochalcis usta* is known only from cultured material collected from cultivated peanut crop from Texas, Comanche Co. (Fig. 8). It is not known whether this species occurs naturally in the United States.

Key to *Psilochalcis* Species of the Western United States

1a. Male, antennal pedicel 1–2× longer than wide; scape outer margin usually with projecting denticle (Figs. 5a–c, e–g) 2

1b. Female, antennal pedicel 3–5× longer than wide; scape without projecting denticle (Fig. 5d) 9

Male

2a. Scape elongate, at least 3× longer than wide; pedicel nearly equal in length and width 3

2b. Scape triangular, 2× longer than wide at apex (Fig. 5f); pedicel 1.5× wider than 1st funicular antennomere, forming a rounded medial flap. . . . . *P. hespenheidei* (Bouček)

3a. Scape with denticle produced on outer margin (Figs. 5b, c, e, g) 4

3b. Scape without protruding denticle (Fig. 5a) . . . . . *P. adenticulata* Petersen, new species

4a. Point of denticle projecting toward apex of scape (Fig. 5e) 5

4b. Point of denticle projecting outward (Figs. 5b, c, g) 6

5a. Tergum 1 dorsally reticulate, laterally polished without sculpture . . . . . *P. brevialata* Grissell and Johnson

5b. Tergum 1 dorsally and laterally polished without sculpture . . . . . *P. deceptor* (Grissell and Schauff)

6a. Tergum 1 dorsally and laterally reticulate . . . . . *P. threa* (Grissell and Schauff)

6b. Tergum 1 dorsally reticulate, laterally polished or dull with faint sculpture 7

7a. Lateral panel of pronotum punctate dorsally, median area to ventral carina highly polished without punctures, ventral strip reticulate . . . . . *P. usta* (Grissell and Schauff)

7b. Lateral panel of pronotum entirely punctate including ventral strip 8

8a. Scape 3× longer than width at denticle; denticle 1.3× wider than width of scape at apex; tergum 1 reticulate to posterior margin . . . . . *P. quadratis* Petersen, new species

8b. Scape 6× longer than width at denticle; denticle equal to or slightly wider than width of scape at apex; tergum 1 reticulate, wide polished band at posterior margin . . . . . *P. minuta* Petersen, new species

Female

9a. Ovipositor sheath in lateral view reaching and/or exceeding apex of gaster 10

9b. Ovipositor sheath in lateral view positioned anteroventrally, not reaching apex of gaster. . . . . *P. hespenheidei* (Bouček)

10a. Gaster apex acuminate; tergum 6 acutely inclined; ovipositor sheath extending beyond gaster apex (Figs. 11, 12) 11

10b. Gaster apex truncate; tergum 6 vertical or nearly so; ovipositor sheath usually reaching or exceeding gaster apex (Fig. 13) . . . . . *P. quadratis* Petersen, new species

11a. Upper face with evenly to irregularly spaced punctures, flat interstices either polished or with sculpture; forewing usually reaching or exceeding apex of gaster 12

11b. Upper face with evenly spaced punctures separated by carinate walls; forewing barely reaching dorsal posterior margin of tergum 3. . . . . *P. brevialata* Grissell and Johnson

12a. Tergum 1 laterally polished, without sculpture, dorsally either polished or with reticulate sculpture 13

12b. Tergum 1 laterally and dorsally reticulate . . . . . *P. threa* (Grissell and Schauff)

13a. Tergum 1 dorsally three-fourths reticulate with polished posterior band 14

13b. Tergum 1 dorsally and laterally polished, without sculpture . . . . . *P. deceptor* (Grissell and Schauff)

14a. Scutellum with irregularly spaced punctures, median polished without punctures, interstices polished; apex of ovipositor sheath rounded (Fig. 12) . . . . . *P. usta* (Grissell and Schauff)

14b. Scutellum with irregularly spaced punctures throughout, interstices reticulate/aciculate (Fig. 6b); apex of ovipositor sheath truncate (Fig. 11) . . . . . *P. minuta* Petersen, new species

SUMMARY

With the addition of *P. adenticulata*, *P. minuta*, and *P. quadratis*, 8 species of *Psilochalcis* are known to occur in the United States, and *P. hespenheidei* is reported for the first time as occurring in Mexico. *Psilochalcis adenticulata* is unique among them, being the first species known to have males lacking a protruding denticle on the antennal scape. This morphological trait has previously only been documented in a few species known from the Old World. It is expected that other undescribed *Psilochalcis* species have yet to be discovered in North America, particularly in the western deserts. Expanding the extent of Malaise trapping to these areas will likely be rewarded with new discoveries. The use of Malaise traps for collecting is a highly effective method of obtaining specimens of *Psilochalcis* and other chalcidoids.

ACKNOWLEDGMENTS

The authors wish to thank Mallory K. Sanders for creating the *Psilochalcis* illustrations and figures; Shawn M. Clark for taxonomic suggestions for this paper and support of this project; Teresa Gomez for help in producing the distribution maps; Steven L. Petersen and Tom Smith for their advice and support of this project; and *Western North American Naturalist*, Brigham Young University, for awarding a natural history grant to fund equipment purchases and travel to visit other collections. Thank you also to the following institutions for providing specimen loans: University of Idaho (WFBM), Colorado State University (CSUC), Washington State

University (WSU), California Academy of Sciences (CAS), Utah State University (EMUS), Texas A&M University (TAMU).

Literature Cited

Bouček, Z. 1951. The first revision of the European species of the family Chalcididae (Hymenoptera). Acta Entomologica Musei Nationalis Pragae 27 (Supplement No. 1):1–124).

Bouček, Z. 1974. A revision of the Leucospidae (Hymenoptera: Chalcidoidea) of the world. Bulletin of the British Museum (Natural History), Entomology 23:1–241.

Bouček, Z. 1984. On *Schwarzella*, *Invreia* and some other Hybothoracini (Hym. Chalcididae). Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri" Portici 41:53–64.

Bouček, Z. 1992. The new world genera of Chalcididae. On the New World Chalcididae (Hymenoptera). Memoirs of the American Entomological Institute 53:49–117.

Bouček, Z. 1997. Leucospidae. Pages 496–498 *in* G.A. Gibson, J.T. Huber, and J.B. Woolley, editors, Annotated Keys to the genera of Nearctic Chalcidoidea (Hymenoptera). Research Press, National Research Council of Canada, Ottawa, Ontario.

Bouček, Z., and J. Halstead. 1997. Chalcididae. Pages 151–164 *in* G.A. Gibson, J.T. Huber, and J.B. Woolley, editors, Annotated keys to the genera of Nearctic Chalcidoidea (Hymenoptera). Research Press, National Research Council of Canada, Ottawa, Ontario, Canada.

Delvare, G. 2017. Order Hymenoptera, family Chalcididae. Pages 225–274 *in* A. van Harten, editor, Arthropod fauna of the UAE. Volume 6. Dar Al Ummah Printing, Publishing, Distribution & Advertising, Abu Dhabi, United Arab Emirates.

Delvare, G., L. Talaee, and S.H. Goldansaz. 2011. New Chalcididae (Hymenoptera: Chalcidoidea) of economic importance from Iran. Annales Zoologici 61:789–801.

Evenhuis, N.L. 2021. The insect and spider collections of the world website. [Accessed 1 February 2022]. http://hbs.bishopmuseum.org/codens/

Gibson, G.A. 1997. Morphology and terminology. Pages 16–44 *in* G.A. Gibson, J.T. Huber, and J.B. Woolley, editors, Annotated keys to the genera of Nearctic Chalcidoidea (Hymenoptera). Research Press, National Research Council of Canada, Ottawa, Ontario, Canada.

Grissell, E.E., and M.E. Schauff. 1981. New Nearctic *Invreia* (Hymenoptera: Chalcididae) from lepidopterous pests of peanut. Proceedings of the Entomological Society of Washington 81:1–12.

Johnson, J.A., E.E. Grissell, V.E. Gokhman, and K.A. Valero. 2001. Description, biology, and karyotype of a new *Psilochalcis* Kieffer (Hymenoptera: Chalcididae) from Indianmeal moth pupae (Lepidoptera: Pyralidae) associated with culled figs. Proceedings of the Entomological Society of Washington 103: 777–787.

Johnson, R.L., V.J. Anderson, and S.M. Clark. 2008. Impact of habitat alterations to bee diversity in sagebrush and pinyon/juniper communities of the eastern Great Basin. Pages 1–51 *in* R.L. Johnson, author, Impacts of habitat alterations and predispersal seed predation on the reproductive success of Great Basin forbs. Doctoral dissertation, Brigham Young University, Provo, UT.

Kieffer, J.J. 1905. New Eucharinae and Chalcidinae. Berliner Entomologischer Verein 49:240–265.

Malaise, R. 1937. A new insect trap. Entomologisk Tidskrift 58:148–160.

Masi, L. 1929. Sopra un nuovo genere di Haltichellini e sulle diverse forme attribute al genere Euchalcis Duf. (Hymen. Chalcididae). Memorie della Società Entomologica Italiana 6:208–222.

Narendran, T.C., and F.R. Khan. 2011. Two new species of Chalcididae (Hymenoptera: Chalcidoidea) from India. Journal of Threatened Taxa 3:1506–1513.

Narendran, T.C., and C. Van Achterberg. 2016. Revision of the family Chalcididae (Hymenoptera, Chalcidoidea) from Vietnam, with the description of 13 new species. ZooKeys 576:1–202.

Nikol'skaya, M.N. 1960. Chalcididae and Leucospidae in Central Asia (Hymenoptera, Chalcidoidea). Trudy Zoologicheskogo Instituta, Akademiya Nauk SSSR, Leningrad 27:220–246.

Noyes, J.S. 2019. Universal Chalcidoidea database. [Accessed 18 June 2022]. http://www.nhm.ac.uk/chalcidoids

Skvarla, M.J., J.L. Larson, J.R. Fisher, and A.P. Dowling. 2021. A review of terrestrial and canopy Malaise traps. Annals of the Entomological Society of America 114:27–47.

Stringer, D., S. Mantel, J. Jennings, and A. Austin. 2012. Family Chalcididae. Australian Centre for Evolutionary Biology and Biodiversity, and the School of Earth and Environmental Science, The University of Adelaide, South Australia, Australia; [accessed 3 August 2022]. https://www.researchgate.net/publication/268212136_Family_CHALCIDIDAE

Townes, H. 1962. Design for a Malaise trap. Proceedings of the Entomological Society of Washington 64: 253–262.

van Achterberg, C. 2009. Can Townes type Malaise traps be improved? Some recent developments. Entomologische Berichten 69:129–135.

Wall, R., and R.C. Berberet. 1975. Parasitoids associated with lepidopterous pests on peanuts; Oklahoma fauna. Environmental Entomology 4:877–882.

Received 24 February 2022
Revised 11 August 2022
Accepted 31 August 2022
Published online 18 November 2022