Zootaxa 137: 1-10 (2003)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

137

Description of the female and larval stage of *Odontophotopsis succinea* Viereck (Hymenoptera: Mutillidae), with new synonymy and notes

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Abstract

Four specimens of *Odontophotopsis succinea* Viereck eclosed from cocoons of *Oxybelus uniglumis* (L.) (Hymenoptera: Crabronidae) collected in Davis, California. One specimen is a female and is described below. The larval stage is also described based on a larval exuvium. This record represents the second host record and the first descriptions of the female and the larva for *Odontophotopsis*. After study of the holotypes of several *Odontophotopsis* species by JPP, *O. annulata* Baker is synonymized with *O. succinea* Viereck.

Key words: *Oxybelus uniglumis*, Crabronidae, parasitoid, velvet ant

Introduction

Nocturnal mutillids of the southwestern United States are quite diverse, with 206 known species (Krombein et al. 1979) and several undescribed species (pers. obs.). However, most females of nocturnal southwestern Mutillidae remain unknown. Females of only seven species have been associated with their conspecific males. Currently, some genera and subgenera are represented only by males, such as *Acanthophotopsis* Schuster, *Acrophotopsis* Schuster, and *Odontophotopsis* Viereck. During the summer and autumn in the southwestern United States, great numbers of mutillids are attracted to black lights. Unfortunately, these mutillids are usually only males.

Determination of the hosts of these nocturnal mutillids would facilitate the association of males and females. To date, hosts for only 10 nocturnal species are known (Krombein et al. 1979). Known hosts include several different families of solitary aculeate Hymenoptera, including Sphecidae, Apidae, Megachilidae, Sapgyidae, Pompilidae and

Accepted: 17 January 2003; published: 24 January 2003

Vespidae (Eumeninae) (Krombein et al. 1979). For the nocturnal genus *Odontophotopsis*, which includes 59 species (Krombein et al. 1979, Mickel and Clausen 1983), the host of only *O. eubule* (Cameron) is known. This species was reared from an ootheca of a Blattaria, *Arenivaga genitalis* Caudell (Polyphagidae). *Evaniella neomexicana* (Ashmead) (Hymenoptera: Evaniidae) also emerged from the same ootheca. Thus, it is unclear whether the mutillid's host was the cockroach or the ensign wasp (Mickel 1974). Compared to hosts of the other mutillids, use of either Evaniidae or Polyphagidae as a host seems unusual.

In California during October of 1964, FDP collected several cocoons of *Oxybelus uniglumis* (L.) (Hymenoptera: Crabronidae) during excavations of *Dryudella* Spinola nests (Parker 1969). These cocoons yielded several important details about the genus *Odontophotopsis.* First, four of the cocoons had been parasitized a mutillid that yielded three males and one female. The males were determined to be *Odontophotopsis succinea* Viereck and the female of this species is here described. Second, a host of *O. succinea* is now confirmed. Last, the larval remains of *O. succinea* were found in a cocoon and are described below. This is the seventh known larva for the family and the first for *Odontophotopsis* (Pitts and Matthews 1999).

In order to determine the identity of the *Odontophotopsis* males, several holotypes were studied by JPP. Consequently, a new synonymy is determined at this time. This synonymy is discussed below.

Materials and methods

The following are acronyms for collections that were studied: ANSP: Department of Entomology, Academy of Natural Science, Philadelphia, PA; BBSL: U.S. National Pollinating Insect Collection, Bee Biology and Systematics Laboratory, Utah State University, Logan, Utah; CUIC: Cornell University Insect Collection, Department of Entomology, Cornell University, Ithaca, NY; NMNH: U.S. National Entomological Collection, Department of Entomology, U.S. National Museum of Natural History, Washington, DC; JPPC: James P. Pitts collection; UAIC: Department of Entomology Collection, University of Arizona, Tucson, Arizona; UMSP: University of Minnesota Insect Collection, Department of Entomology, St. Paul, Minnesota.

After Ferguson (1967), we are adopting the following notation for punctures in the order of decreasing coarseness: reticulate, coarse, moderate, small, fine and micropunctate. “Micropunctate” refers to punctures that are extremely shallow, and do not have vertical walls or sharp margins. We have used the term "simple pubescence" for hairs that are smooth and do not have barbed surfaces. “Brachyplumose pubescence” refers to hairs with barbs that are less than or equal to the diameter of the shaft at the attachment of the barb. “Plumose pubescence” is used for hairs that have longer barbs.

T2, T3, etc., are used to denote the second, third, etc., metasomal tergites while S2, S3, etc., denote the second, third, etc., metasomal sternites.

For the exuvium, the head capsule and integument were cleared with a solution of hot potassium hydroxide. The exuvium was neutralized in water and placed in a deep-well slide filled with hot glycerin jelly. Descriptive terminology follows Evans (1987).

Odontophotopsis Viereck

Type species. Odontophotopsis exogyrus Viereck, orig. desig.

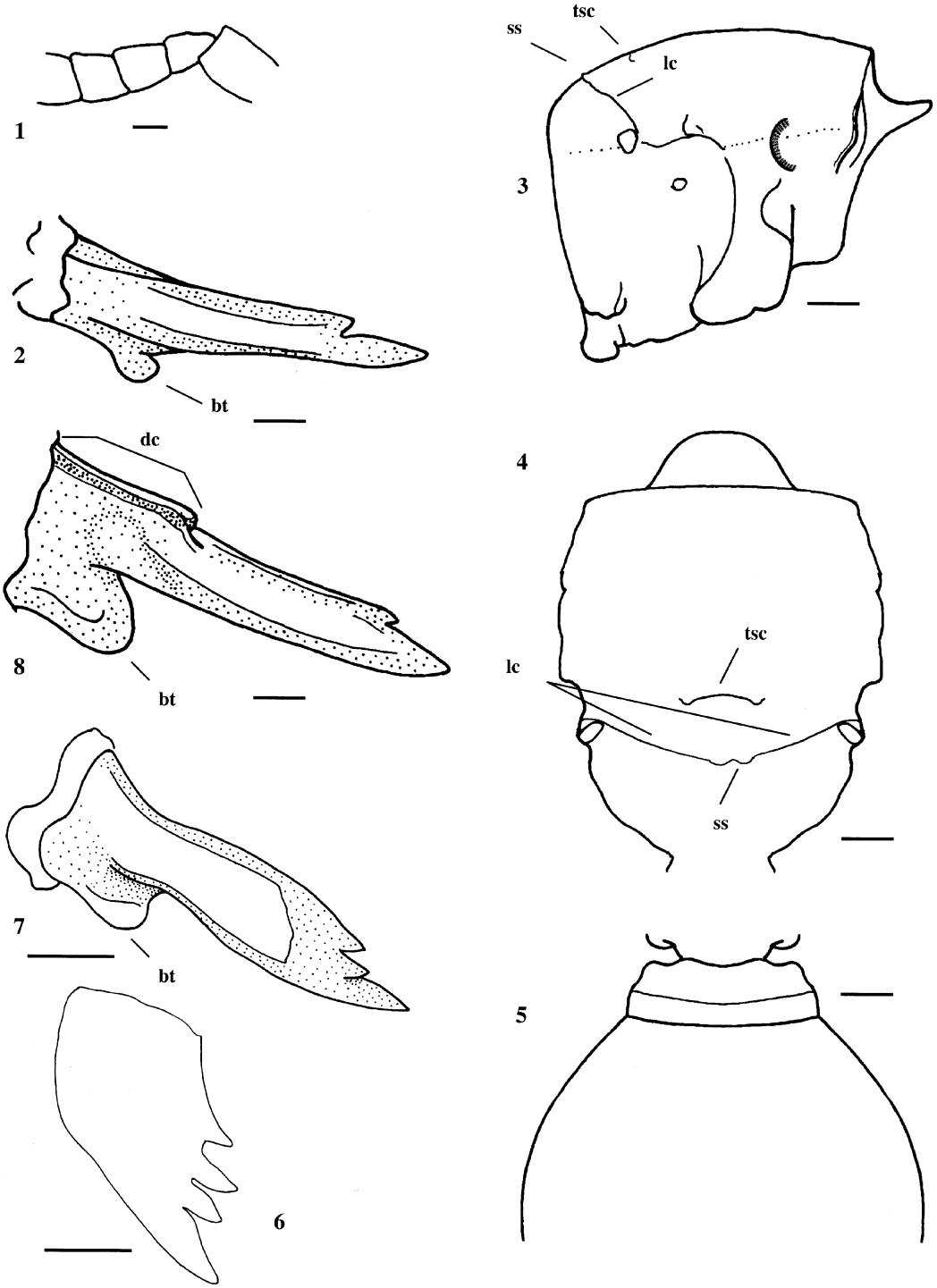
Female. Head. As wide as thorax. Eyes slightly projecting, oval, finely but clearly faceted. Clypeus anterior edge emarginate medially, base swollen medially. Antennal scrobe lacking dorsal carina. Antennal tubercle well developed, separated by distance equal to width of single tubercle, transversely rugose. Antenna 12-segmented. Pedicel and flagellomere II subequal in length, flagellomere I slightly longer than pedicel (Fig. 1). Mandible bidentate apically (Fig. 2). Dorsal margin of mandible lacking prominent carina (Fig. 2). Ventral margin of mandible emarginate on basal third with distinct basal tooth (Fig. 2). Genal carina absent. Maxillary palpus 6-segmented, labial palpus 4-segmented. Decumbent plumose pubescence present on frons and vertex.

Mesosoma. Pyriform, slightly longer than wide, widest medially (Fig. 4). Anterolateral margin of pronotum slightly angulate with vertical carina (Fig. 3). Scutellar scale present with lateral carina connecting scale to propodeal spiracle tubercles (Figs. 3, 4). Propodeum with distinct disk and declivity regions (Fig. 3). Decumbent plumose pubescence present on metasomal dorsum. Femora of all legs rounded apically. Tibial spurs pectinate.

Metasoma. First segment subsessile with respect to second, slightly disciform posteriorly (Fig. 5). T2 with lateral felt line. S2 flattened medially, without lateral felt line. T6 with pygidial area defined laterally by carinae. Plumose pubescence present both on surface of tergites and as dense apical fringes.

Distribution. Western North America, east to Arkansas, from B.C. Canada south into Central America (Northern Costa Rica).

Comments. The genus *Odontophotopsis* is in the subfamily Sphaeropthalminae (Sphaeropthalmini). Males of *Odontophotopsis* can be separated from other Sphaeropthalmini by the presence of large ocelli, simple spine-like sternal processes (absent in *O. mamata* Schuster and in some specimens of species in the *O. tapajos* species-group), usually with weak sculpturing and the integumental surface polished, presence of incomplete parapsidal furrows (complete in *O. fallax* Viereck and *O. pudica* (Melander)), absence of or very short felt lines on the second sternite, presence of well-developed plumose pubescence (especially on the abdomen), and presence of three or four mandibular teeth (mandibles bidentate in the *O. unicornis* species-group) (Schuster 1958).



FIGURES 1-8. *Odontophotopsis succinea* female: 1, antenna (scape and first 4 flagellomeres), scale = 0.1 mm; 2, right mandible, lateral view, scale = 0.1 mm; 3, mesosoma, lateral view, scale = 0.4 mm; 4, mesosoma, dorsal view, scale = 0.4 mm; 5, metasoma (T1-2), dorsal view, scale = 0.4 mm; *O. succinea* larva: 6, right mandible, lateral view, scale = 0.04 mm; *O. succinea* male: 7, right mandible, lateral view, scale = 0.4 mm; *Dilophotopsis stenognatha* female: 8, right mandible, lateral view, scale = 0.4 mm (bt, basal tooth; dc, dorsal carina; lc, lateral carina; ss, scutellar scale; tsc, transverse sinuate carina).

The female of *Odontophotopsis* can be distinguished from females of other sphaeropthalmine genera by the following combination of characters: presence of plumose pubescence, absence of dorsal carina on the antennal scrobe, antennal flagellomere I being only slightly longer than the pedicel, absence of genal carina, presence of a scutellar scale connected to a transverse carina, first metasomal segment subsessile and slightly disciform, and presence of lateral carinae defining pygidium. These characters are thought to be of generic importance and were chosen after a survey of approximately ten other undescribed probable *Odontophotopsis* females. Because the female of only one of 59 species has been described, it is unclear which characters are autapomorphic, if any, for the females and it is anticipated that the generic description will need to be modified as more females are described.

Several described female species currently placed in *Sphaeropthalma (Photopsis)* Blake but not associated with males may be *Odontophotopsis* species, such as *S.* (*P.*) *arota* (Cresson), *S. (P.) ceres* (Fox) and *S.* (*P.*) *zenobia* (Blake), as well as several others. However, these species do not completely match the above generic description. As such, we feel that we should attain a better understanding of the generic characters for *Odontophotopsis* females by studying females from definitive sex associations before placing described species into *Odontophotopsis.*

In the key to the mutillids of the United States (Manley and Pitts 2002), the *Odontophotopsis* female will terminate at couplet 16 with a choice between *Dilophotopsis* Schuster and *Sphaeropthalma (Photopsis). Dilophotopsis* females are much larger in size, have a transverse carina on the antennal tubercle, have a dorsal carina abruptly terminating at a distinct denticle on the basal third of the mandible (Fig. 8), have a granulate pygidium, and exhibit differences in plumose pubescence and the shape of the first metasomal segment. *Photopsis* females that could be confused with *Odontophotopsis,* such as *S. (P.) orestes* (Fox) or *S. (P.) marpesia* (Blake) have a dorsal carina on the antennal scrobe, have a granulate or coarsely rugose pygidium, and lack a scutellar scale. This last character may not be a reliable generic character because it is known to vary within other genera, such as *Dasymutilla* Ashmead.

Odontophotopsis (Odontophotopsis) succinea Viereck

Odontophotopsis succinea Viereck, *Proc. Acad. Nat. Sci., Phila*., 54:741-743, male, 1902.
Odontophotopsis annulatus Baker, *Invertebrata Pacifica*, 1:94-96, male, 1905. **NEW SYNONYMY**.

Female. Head. Head brown orange, clothed with sparse erect white brachyplumose pubescence, also clothed with dense decumbent white plumose pubescence. Clypeus clothed with erect white brachyplumose pubescence. Eye width 0.44 mm, distance to occipital margin from posterior eye margin 0.26 mm. Eyes convergent ventrally. Malar space 0.7X maximum eye width. Pedicel length 0.10 mm (Fig. 1). Flagellomere I slightly longer than pedicel (Fig. 1). Flagellomere II slightly shorter than I, equal in length to pedicel (Fig. 1). Antenna concolorous with head. Antennal scrobe not carinate dorsally. Front with small confluent punctures. Mandible orange, red brown distally. Dorsomedial portion of head with inconspicuous transverse tumid region just anterior to occipital carina, only visible at certain angles.

Mesosoma. Mesosoma and coxae brown orange, femora and tibiae dark brown. Mesosoma with erect orange brown brachyplumose pubescence. Metanotal area and propodeal dorsum also with decumbent orange white plumose pubescence, denser posteriorly. Propodeum with only erect white brachyplumose pubescence posteriorly. Legs with both erect white brachyplumose and decumbent white plumose pubescence. Anterolateral margins of pronotum angulate with vertical carina (Fig. 3). Transverse sinuate carina present anterior to scutellar scale, similar in size to scale. Scutellar scale broadly bidentate. Lateral area of pronotum sparsely punctate with decumbent white plumose pubescence. Mesopleura with posterior half punctate with erect white brachyplumose pubescence; anterior half sparsely punctate with decumbent white plumose pubescence. Propodeum laterally sparsely punctate with decumbent white plumose pubescence. Mesosomal dorsum punctures similar to head, closely spaced. Punctures of vertical portion of propodeum small and sparsely spaced, distance apart at least 2X -width of puncture. Declivity of propodeum flattened medially.

Metasoma. Brown orange. T1 with sparse long erect white brachyplumose and short plumose pubescence. T1 flattened medially with small widely spaced punctures, distance apart at least 2X width of puncture. Anterior margin of T2 with moderate punctures, distance between punctures equal to width of puncture. Surface of T2 with denser punctures, some confluent, and with erect orange brachyplumose pubescence. T2 felt line 0.36X length of T2. T2-T5 and S2-S5 with dense orange white plumose pubescence fringe that obscures following tergite, and with sparse erect orange white brachyplumose pubescence. S2 with median tumid region on anterior sixth, flattened medially. T6 finely longitudinally rugose.

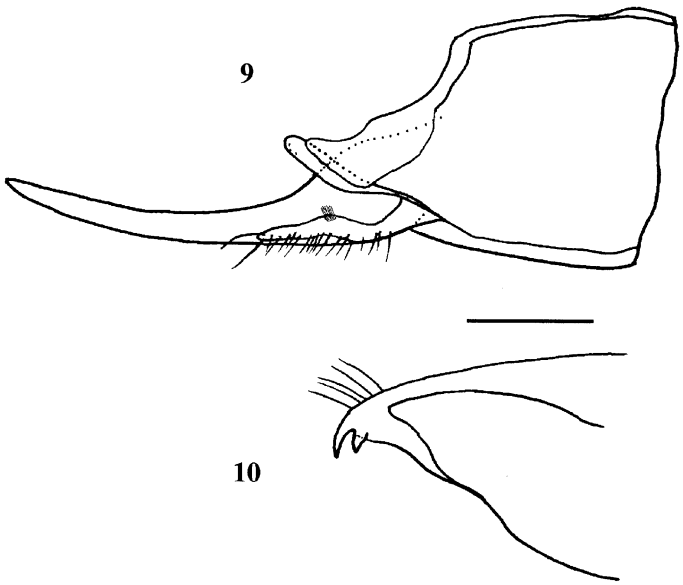
Length. 5.25 mm.

Male Larva. *Body.* Ten pairs of spiracles, second thoracic pair minute. Spiracles small,

spiracular atria unarmed, subatria elongate. Integument lacking setae, clothed densely in spinules separated by 0.5-1.0X their own length.

Head: 1 .2X as wide as high, height measured to apex of clypeus, unpigmented except for apical half of mandible. Side of head more convex than vertex. Parietal bands elongate, faintly pigmented. Antennal orbit below middle of head capsule, located on large, circular elevated area; each with three sensilla. Head with several scattered setae. Mandible more than 2.0X as long as wide at base, without setae, terminating in four teeth in same plane, basal tooth much smaller, two preapical teeth subequal in size, smaller than apical tooth, length of second tooth from apex ~0.5X length of apical tooth (Fig. 6). Labrum bilobed, each lobe with 14-15 sensilla, some bearing minute setae, apical median margin spinulose. Maxilla with several setae laterally, minutely spinulose mesally. Maxillary palpus much wider than long, with three apical sensilla. Galea smaller than palpus, similarly formed, each with two sensilla. Labium broad, with a few small apical setae. Labial palpus much broader than long, with 4 sensilla. Spinneret a transverse slit, widened medially.

Length. 4-6 mm.



FIGURES 9-10. *Odontophotopsis succinea* male: 9, genitalia with aedeagus removed, internal view; 10, aedeagus; scale =0.3 mm (same for Figs. 9-10).

Type Material Examined. Odontophotopsis succinea, Holotype male, CA, La Jolla, Aug., Cockerell, ANSP. *Odontophotopsis annulata,* Holotype male, CA, Claremont, CUIC.

Material Examined. USA: CA: Davis, 1 female, 3 males X. 1964, rearing no.3102, F.D. Parker (BBSL, JPPC); Monterey Co., Big Sur, 1 male, 7.VII. 1938, M. Cazier (UMC); San Diego Co.: Jacumba, 1 male, 20.VII. 1949 (UMSP), D.J. and J.N. Kissell;

Live Oak Springs, 1 male, 11.VII.1923 (UMSP); Mission Dam, 3 males, 21.VI (UMSP); Pine Valley, F.W. Kelsey: 1 male, 25.Vl-4.VII.1927, (UMC); 1 male, 18.VII.1927, 1 male, 20.VII.1927, 1 male, 19.VIII.1927, 1 male, 11.IX.1927, 1 male, 21.IX.1927, 1 male, 26.IX.1927, 1 male, 28.VIII.1927, (UMSP); 1 male, 19.VIII.1927, (UMC); San Diego, 5 males, C.E. Ricksecker (NMNH, UMSP); Vallecitos, 1 male, 27.IX. 1936 (UMSP); Santa Cruz Co.: Santa Rosa Mts., 1 male, 15.VI.1946, D.J. and J.N. Kissell (UMC).

Host. Three males and one female reared from *Oxybelus uniglumis* (L.).

Discussion. The male holotypes of *O. annulata* Baker and *O. succinea* Viereck were studied and found to be conspecific. Both are characterized by deeply excised mandibles that are dilated beyond the excision, infuscated flagellomeres, posteromedian margins of clypeus produced into a weak transverse ridge, a nitid pygidium that is not defined laterally by carinae, weakly infuscated tarsi, and a marginal cell length along the costa that is equal to the length of the pterostigma. The genitalia of both types were studied and found to be identical (Figs. 9, 10). The holotype of *O. annulata* has a weak tubercle a short distance from each mesosternal process. These tubercles were found to be present in a few of the specimens studied, but absent in most. No other differences could be found between specimens with tubercles versus those without tubercles.

There is some variation in the male *O. succinea* specimens that were studied. Length ranged from 7 to 11 mm. The infuscated coloration of the flagellum, legs and tarsi varies in intensity from very dark to almost absent. The infuscated coloration, however, is dark in both of the holotypes.

Several problems were found in Schuster (1958) in relation to *O. succinea.* Firstly, Schuster placed *O. succinea* in the *melicausa* species-group and keyed it out there, but he also keyed this species out as *O. annulata* in the *O. parva* species-group. Schuster stated that the species *O. annulata* (now *O. succinea)* and *O. viereckii* Baker appear to be close to or identical with *O. cookii* Baker (Schuster 1958*)* and that “all three forms perhaps should be treated as members of the [*melicausa* species-group]." After studying the holotype of *O. cookii* (CUCI: Claremont, California), it was found that this is not the case. *Odontophotopsis cookii* clearly belongs in the *O. parva* species-group. It differs markedly from the other two species by having the sculpture of the pygidium granulate and having only a slight excision, but not a distinct basal tooth, on the ventral margin of the mandible, as opposed to *O. succinea* (Fig. 7).

Secondly, after studying the holotype of *O. viereckii* (CUCI: Ormsby Co., Nevada), it was found that it does belong in the *O. melicausa* species-group, but was left out of Schuster’s key. It will key to *O. succinea. Odontophotopsis viereckii* has the legs completely honey-colored. In *O. succinea*, at least the distal portions of the femora and tibiae are infuscated, but ranges from almost completely stramineous to completely black. The genitalia differ from *O. succinea* by the cuspis being slightly longer and spatulate apically. Also, the length of the aedeagus of *O. viereckii* is much more than 2X its basal height (as opposed to Figs. 9, 10).

We were able to base our larval description on an exuvium of a larva. The resolution obtained by clearing the exuvium was comparable to that of a freshly prepared larva, except that we were unable to study the natural shape of the larva or the form of the tenth abdominal segment.

The description of the larva of *O. succinea* generally agrees with the description of the Mutillidae larval stage as given by Evans (1987). The head capsule and integument of *O. succinea* is very similar to *Sphaeropthalma pensylvanica* (Lep.). It differs from *S. pensylvanica,* however, in having spinules more densely clothing the body and in having a larger first mandibular tooth that is approximately equal to 2X length of second tooth (for *S. pensylvanica,* the first mandibular tooth is length is <1.5X length of second tooth).

Acknowledgements

We are indebted to James L. Liebherr (CUIC), Jason D. Weintraub (ANSP), Carl A. Olsen (UAIC), Terry Griswold (BBSL), Ted Shultz (NMNH) and Philip Clausen (UMSP) for loan of material. Wilford Hanson (Utah State University, Logan) is hereby acknowledged for funding (JPP) to travel to their museum for study of their collection. We thank Donald G. Manley (Clemson University), Joseph McHugh (University of Georgia, Athens, GA) and Theresa Pitts-Singer (USDA-ARS Bee Biology and Systematics Laboratory, Logan, UT) for critically reviewing the manuscript.

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