



Nocturnal velvet ant males (Hymenoptera: Mutillidae) of Deep Canyon, California including four new species and a fifth new species from Owens Lake Valley, California

JAMES P. PITTS¹, JOSEPH S. WILSON, KEVIN A. WILLIAMS & NICOLE F. BOEHME

Department of Biology, Utah State University, 5305 Old Main Hill, Logan, UT 84322

¹Corresponding author. E-mail: jpitts@biology.usu.edu

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Abstract

The diversity of nocturnal velvet ants (Hymenoptera: Mutillidae) at the Philip L. Boyd Deep Canyon Desert Research Center of southern California is investigated. Thirty-five species are found to inhabit areas on and around the canyon. *Odontophotopsis hammetti*, *Sphaerophthalma chandleri*, *S. fergusonii*, and *S. mankelli* are described as **new species**. *Odontophotopsis hammetti* and *S. mankelli* are only known from Deep Canyon. *Sphaerophthalma chandleri* and *S. fergusonii* also are known from Painted Canyon located in the Mecca Hills on east the side of the Coachella Valley and from Corn Springs located east of the Coachella Valley in the Chuckwalla Mountains, respectively. The females of too few of the species are known, so only the males are treated. A key is provided for the males. A new species-group, the *S. fergusonii* species-group is described to house *S. fergusonii* and the **new species** *S. arnalduri*, which is an apterous male described from Owens Lake Valley. Similarities between the fauna of Deep Canyon and the Algodones Sand Dunes are discussed.

Key words: ITS1, ITS2, Sphaerophthalminae, solitary wasp

Introduction

Philip L. Boyd Deep Canyon Desert Research Center, University of California, Riverside, is a 6,100 acre desert canyon and flood plain 25 miles southeast of Palm Springs, California, located in the Coachella Valley of the western Sonoran Desert (Wheeler & Wheeler 1973). This research center is home to nine amphibians, 45 reptiles, 48 mammals, more than 650 species of plants, and countless numbers of insect species. A study of ants alone reviewed 59 species (Wheeler & Wheeler 1973).

A cursory study of specimens of nocturnal velvet ants (Hymenoptera: Mutillidae) from Deep Canyon on loan from the UCR Entomological Teaching and Research Collection, University of California, Riverside, California, revealed 35 species of which four were new to science. The purpose of this study is to describe these new species and to provide a means for future entomologists to identify the nocturnal velvet ants of Deep Canyon. One of the new species is likely the sister species of another undescribed species only known from Owens Lake Valley, California. This Owens Lake Valley species also is described here and a new species-group is designated for these two species.

Lastly, Pitts *et al.* (2009) treated the nocturnal velvet ants species that are found on the Algodones Sand Dunes near Glamis, California. The Algodones Sand Dunes are approximately 90 miles southeast of Deep Canyon and are also in the Coachella Valley of the western Sonoran Desert. We compare the nocturnal mutillid fauna found at each of these sites.

Material and methods

During the summers of 2005–2008, field studies were conducted throughout the Southwestern US to collect fresh specimens of both sexes of nocturnal velvet ants to associate using molecular techniques in the lab. Male and female nocturnal mutillids were collected at 60 field sites, including Owens Lake Valley and Boyd Deep Canyon Desert Research Center near Palm Springs, California, which we will refer to as Deep Canyon throughout this study.

Our collecting was limited to a few locations on two separate dates, the latter half of May and the last week of July 2007. Specimens were collected using black light traps, fluorescent lantern traps, and by hand. Specimens collected with light traps were captured in soapy water and were transferred into 95% ethanol, while all hand-collected specimens were placed directly into 95% ethanol for any subsequent molecular studies. A total of 292 specimens were collected.

To make sure we had an adequate sampling, museum specimens collected at Deep Canyon were borrowed from UCR Entomological Teaching and Research Collection, University of California, Riverside, California. For Owens Lake Valley, we borrowed specimens from the California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento, California.

Taxonomic methods. In the descriptions, we have used the term “simple pubescence for setae that are smooth and do not have barbed surfaces visible at 50X magnification. “Brachyplumose pubescence refers to setae with barbs that are less than or equal to the diameter of the shaft at the attachment of the barb and, for this publication, are typically longer than the following setal type; they are sparse and erect, unless otherwise stated. Plumose pubescence is used for setae that have longer barbs, and are typically short and dense. Also, we have used the acronyms T2, T3, etc., to denote the second, third, etc., metasomal terga, and S2, S3, etc., to denote the second, third, etc., metasomal sterna.

Collector names are not given in many cases for specific specimens in the Materials Examined sections, except for the holotypes of the new species. This is because few individuals were involved in the collecting and are easily identified by date alone, as follows. Collections made during 1963 and 1964 were by E. Schlinger. Collections made from 1969 to 1974 were by S. Frommer, L. LaPré, A. Tabet, R. Worley, and B. Worley. Collections made in July 2007 were by J. Wilson, K. Williams and J. Pitts. Any exceptions to the cases will have the collectors names annotated as usual in the appropriate Materials Examined sections. All specimens are housed in UCR Entomological Teaching and Research Collection, University of California, Riverside, California, USA (UCRC) unless otherwise indicated.

Institutions:

ANSP	Department of Entomology, Academy of Natural Sciences, Philadelphia, Pennsylvania, USA.
BMNH	British Museum of Natural History, London, United Kingdom.
CASC	Department of Entomology, California Academy of Sciences, San Francisco, California, USA.
CDFA	California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento, California, USA.
CISC	Essig Museum of Entomology, Department of Entomological Sciences, University of California, Berkeley, California, USA.
CUIC	Cornell University Insect Collection, Department of Entomology, Cornell University, Ithaca, New York, USA.
DGMC	Donald G. Manley Personal Collection, Pee Dee Research and Education Center, Florence, South Carolina, USA.
LACM	Insect Collection, Los Angeles County Museum of Natural History, Los Angeles, California, USA.
EMUS	Entomological Museum, Department of Biology, Utah State University, Logan, Utah, USA.
MNHN	National Collection of Insects, Muséum National d’Histoire Naturelle, Paris, France.
NMNH	National Museum of Natural History, Smithsonian, Washington D.C., USA.
SEMC	Snow Entomological Museum, University of Kansas, Lawrence, Kansas, USA.
UCDC	The Bohart Museum of Entomology, University of California, Davis, California, USA.
UCRC	UCR Entomological Teaching and Research Collection, University of California, Riverside, California, USA.
UMSP	University of Minnesota Insect Collection, Department of Entomology, St. Paul, Minnesota, USA.

Acanthophtopsis falciformis Schuster

Acanthophtopsis falciformis falciformis Schuster, 1958. Ent. Amer. 37: 13. Male. Holotype data: Palm Springs, California, male, fall, 1932, T. Zschokke (UMSP).

Acanthophtopsis falciformis fuscisterna Schuster, 1958. Ent. Amer. 37: 14. Male. Holotype data: Tucson, Arizona, 5.Oct.1935, O. Bryant (UMSP).

Diagnosis of male. The male of this species can be recognized by unique quadridentate mandibles (Fig. 1; also see Figs 6 & 12 of Tanner *et al.* 2009). The mandibles have three apical teeth, plus a fourth tooth that projects posteriorly over the clypeus (Fig. 1). Also, the males have the posterior head margin elongate posteriorly, large conical mesosternal processes, only a single spur on the tibia of the middle leg, a paramere of the genitalia that is squat, and a cuspis that is curled apically (Fig. 49).

Female. Unknown, possibly it will be mistaken as a species of *Sphaerophthalma* near *Sphaerophthalma blakeii*.

Material examined. California, Riverside Co.: Deep Canyon, 5 males, 2.May.1963, 2 males, 3.May.1963, 3 males, 16.May.1963, 1 male, 30.May.1963, 2 males, 8.Oct.1963, coll. M.E. Irwin and E.I. Schlinger, 12 males, 9.Oct.1963, coll. M.E. Irwin and E.I. Schlinger (UCRC, EMUS); 2 males, 18.May. 1969, coll. M.E. Erwin; 2 males, 21–29.May. 1973 2 males, 27.May–1.Jun.1970, 2 males, 18.May.1969, coll. M.E. Erwin; 1 male, 24.May.1969, coll. M.E. Erwin and S. Frommer, 3 males, 13–18.Jun.1969, 1 males, 15.Jun.1969, 3 males, 18–19.Jun.1969, 4 males, 20–24.Jun.1969, 3 males, 2–3.Jul.1969, 1 male, 30–31.Jul.2007.

Distribution. Nevada and southern Utah south into California, Arizona, and as far southwest as Zacatecas, Mexico.

Remarks. This species is rarely collected and is not limited to Deep Canyon. This genus was recently revised by Tanner *et al.* (2009).

Acrophotopsis campylognatha Schuster

Acrophotopsis campylognathus Schuster, 1958. Ent. Amer. 37:69. Male. Holotype data, MEXICO, Baja California, Arroyo Rosarito, 29.III.1935, C.M. Brown (CASC).

Diagnosis of male. The male of *A. campylognatha* has greatly dilated mandibles that are deeply excised ventrally (Fig. 2), lacks mesosternal processes, has a flattened hypopygidium that is carinate anterolaterally and has genitalia that are distinctive in having the paramere and cuspis dorsoventrally flattened and the cuspis straight (Figs 47, 48).

Female. Described in Pitts and Wilson (2009).

Material examined. California, Riverside Co.: Deep Canyon, 1 male, 16.May.1973, coll. J. Pinto, 1 male, 19–21.Jul.1969.

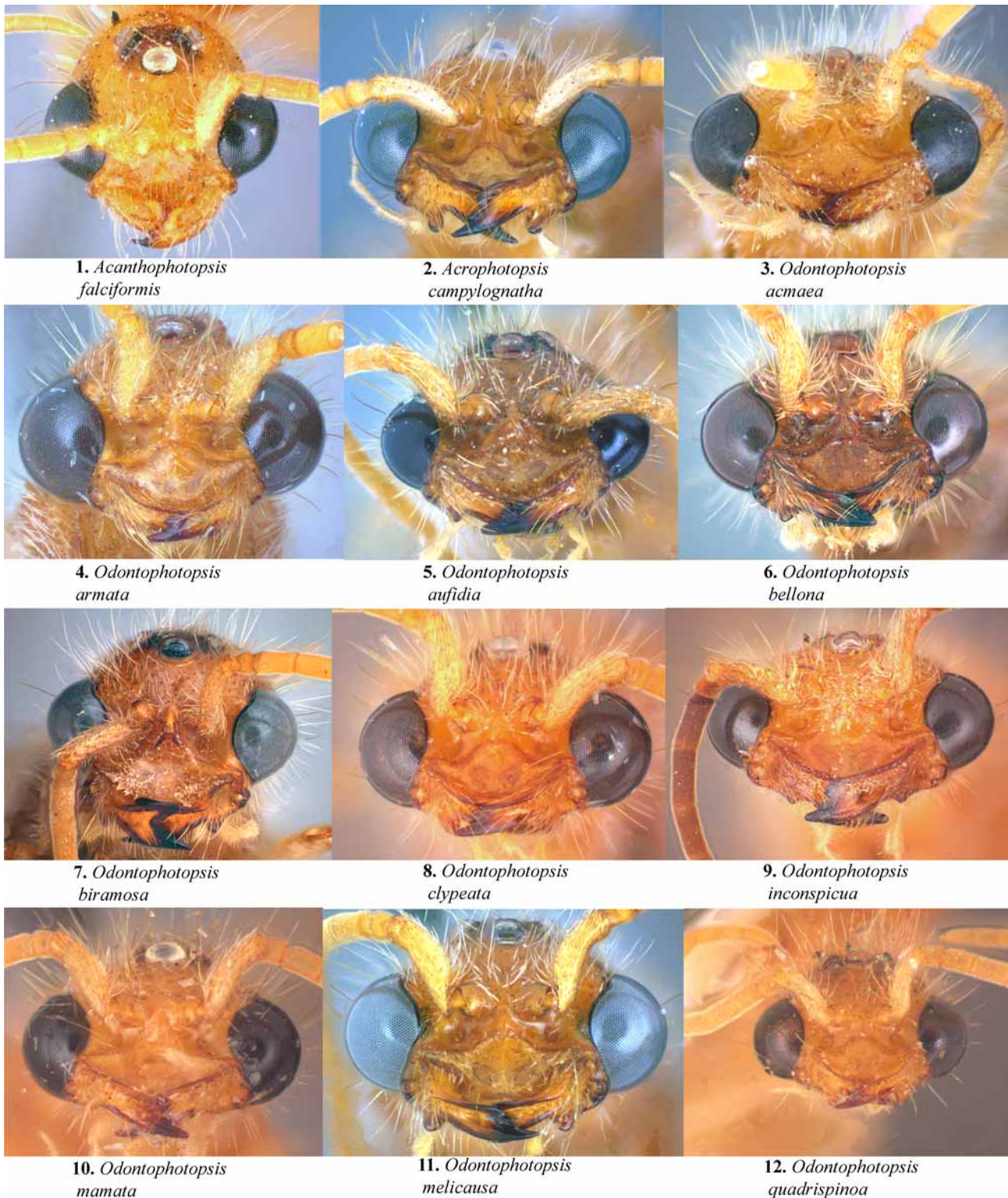
Distribution. southern regions of the Mojave Desert of California and south into the Sonoran Desert of Baja California.

Remarks. Pitts and McHugh (2002) reviewed this genus. Recent morphological studies (Pitts & McHugh 2002; Pitts 2003; Wilson & Pitts 2008; Pitts & Wilson 2009) all concurred in suggesting that *Acrophotopsis* is closely related to *Dilophotopsis* based on morphology; this conclusion has been confirmed by Pitts *et al.* (2010). Along with many characters shared by the males (Pitts 2003; Pitts & McHugh 2002), the females of *Acrophotopsis* and *Dilophotopsis* are morphologically very similar, sharing several notable characters of the mandibles and pygidium. In addition, the females of these genera share many characteristics with females of the *Sphaerophthalma orestes* species-group (Pitts & Wilson 2009), a relationship also confirmed by Pitts *et al.* (2010).

Dilophotopsis paron (Cameron)

Sphaerophthalma (sic) *paron* Cameron, 1896. Biol. Cent.-Amer. 37: 88. Male. Holotype data: Mexico, Northern Sonora, Morrison (BMNH).

Dilophotopsis concolor sonorensis Schuster, 1958. Ent. Amer. 37: 88. Male. Holotype data: Arizona, Gila Bend, 24.Apr.1935, F.H. Parker (UMSP).



FIGURES 1–12. Head, anterior view. 1. *Acanthophotopsis falciformis*; 2. *Acrophotopsis campylognatha*; 3. *Odontophotopsis acmaea*; 4. *O. armata*; 5. *O. aufidia*; 6. *O. bellona*; 7. *O. biramosa*; 8. *O. clypeata*; 9. *O. inconspicua*; 10. *O. mamata*; 11. *O. melicausa*; and 12. *O. quadrispinoa*.

Diagnosis of male. The male of this species has greatly dilated mandibles that are deeply excised ventrally (e.g., Fig. 2), has mesosternal processes in the form of tubercles (Fig. 51) that are relatively wide and shagreened on their apex, has a flattened hypopygidium that is carinate anterolaterally and has distinctive genitalia with the paramere, and cuspis dorsoventrally flattened and the cuspis elbowed (Fig. 50).

Female. Unknown.

Materials examined. California, *Riverside Co.*: Deep Canyon, 3 males, 16.May.63.

Distribution. Restricted to the Mojave and western Sonoran Deserts of Arizona, California, and Nevada, and the deserts of Baja California, and Baja California Sur, Mexico.

Remarks. This genus was reviewed by Wilson and Pitts (2008).

***Odontophotopsis acmaea* Viereck**

Odontophotopsis acmaeus Viereck, 1904. Amer. Ent. Soc., Trans. 30: 84. Male. Holotype data: Arizona, type no. 2304 (NMNH).

Odontophotopsis (Odontophotopsis) adonis acmaeus Schuster, 1958. Ent. Amer. 37: 54. Male.

Odontophotopsis (Odontophotopsis) grata Schuster (nec Melander, nec Schuster 1958 p. 53, 57, 58), 1958. Ent. Amer. 37: 55. Male.

Diagnosis of male. This species is recognized by having the following combination of characters: the mandible is excised ventrally forming an angle (Fig. 3), but does not taper towards the apex; the apex of the mandible is slightly dilated; the mesosternum has only one pair of large distinct spines that have a posterior face that is longitudinally sulcate and have an apex that is bifid; the metasternum is bidentate; and the pygidium is granulate, but not defined laterally by carinae. The genitalia of this species are similar to those of *O. aufidia* (see Fig. 9 of Pitts *et al.* 2009).

Female. Unknown.

Material examined. California, *Riverside Co.*: Deep Canyon, 2 males, 13.Apr.1968, coll. P. Rauch, 1 male, 16.May.1963.

Distribution. The Sonoran Desert of southern California and southwestern Arizona.

Remarks. This species is rare, but is found throughout southern California and extends into southern Arizona and northern Mexico. Schuster (1958) created some problems with this species in combination with *O. grata* (Pitts *et al.* 2009).

Schuster (1958) placed this species as a subspecies of *O. adonis*. Mickel (Krombein 1979) established this was not conspecific with *O. adonis*. This species clearly belongs in the *O. parva* species-group due to the weak ventral mandibular tooth, overall mandibular shape, the bidentate metasternum, the well developed sternal felt line, and the granulate pygidium. This species differs from all other species of the *O. parva* species-group due to the shape of the mesosternal processes, which are high, oblique, anteroposteriorly compressed, rectangular in outline, bidentate at the apex and separated by a 'U' shaped sinus. Only three other species, *O. bellona*, *O. parva* and an undescribed species, have similar, but not identical mesosternal processes. Of these, only *O. bellona* has been collected at Deep Canyon thus far; it has a large, rounded, ventral tooth on the mandible (Fig. 6; see Fig. 17 in Mickel & Clausen 1983). *Odontophotopsis parva* has the apex of the mandibles parallel, the pygidium distinctly margined, while *O. acmaea* has the apex of the mandibles dilated, the pygidium not margined. Furthermore the mesosternal processes are rounded at the apex and are separated by a 'V' shaped sinus. The undescribed species also has a margined pygidium, but the shape of the mandible, which could be described as dilated, is unique in having a dorsally directed lamella at the apex of the tridentate mandible that is similar in shape and size to normal tooth.

***Odontophotopsis armata* Schuster**

Odontophotopsis (Odontophotopsis) armata Schuster, 1958. Ent. Amer. (n. s.) 37: 60. Male. Neotype data: California, *Riverside Co.*: Deep Canyon, 15 males, 23–24.May.2007, Coll. Wilson, Williams and Pitts (EMUS).

Diagnosis of male. This species can be recognized by the presence of mesosternal processes, a deeply emarginate, tridentate, mandible that is slightly oblique apically (Fig. 4), and a distinct tubercle located medial on the posterior margin of the clypeus, while usually lacking a sternal felt line. In many of the specimens from

Deep Canyon a trace of a sternal felt line is present, but it is defined by little more than a small cluster of micropunctures.

Female. Unknown.

Material examined. **California, Riverside Co.:** Deep Canyon, 15 males, 22–23.May.2007, 45 males, 23–24.May.2007, 1 male, 11.Jul.1971, 1 male, 13–18.Jul.1969, 1 male, 19–20.Jul.1969, 1 male, 24.Aug.1969, 1 male, 9–11.Sep.1969, 8 males, 26.Sep–6.Oct.1969, 1 male, 6–8.Oct.1969, 3 male, 9.Oct.1963, 1 male, 11.Nov.1963.

Distribution. The western Sonoran Desert of California and Baja California, Mexico and the Mojave Desert.

Remarks. This species can be sometimes confused with *O. serca*, from which it only can be separated by the presence of the clypeal tubercle. These two species are genetically distinct, however (e.g., Pitts *et al.* 2010). This species often has a trace of sternal felt line made up of short, dense, plumose setae and occasionally associated micropunctures.

Schuster (1958) validated this species in a key, but did not designate a holotype or type locality (Ferguson 1967). As such, we are designating a Neotype for this species. Schuster (1958) placed this species in the *O. serca* species-group due to the deeply emarginate ventral margin of the mandible and the absence of sternal felt lines. This species differs from *O. serca* in having a tuberculate clypeus, which is lacking in *O. serca*, and mandibles that are oblique apically. Also, the apices of the mandibles are vertical in *O. serca*. Both of these characters should be used together, because the tuberculate aspect of the clypeus is sometimes difficult to see. Pitts *et al.* (2010) established that *O. armata* and *O. serca* are not closely related. A species-group housing *O. armata* should be delineated, but this is best left for a future revision of *Odontophotopsis*.

***Odontophotopsis aufidia* Mickel**

Odontophotopsis (Odontophotopsis) aufidia Mickel, 1983. Ann. Amer. Ent. Soc. 76: 541. Male. Holotype data: Taft, California, 12 Jun 1942, W.C. Cook (UMSP).

Diagnosis of male. This species is recognized by the following combination of characters: the mandible is excised ventrally forming an angle and tapering towards the vertical apex (Fig. 5; see Fig. 43 in Pitts *et al.* 2009), the mesosternum only has one pair of distinct spines, the metasternum is bidentate, and the pygidium is granulate, but is not defined laterally by carinae. The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 9.

Female. Unknown.

Material examined. **California, Riverside Co.:** Deep Canyon, 1 male, 7–14.Sep.1973, coll. A. Tabet.

Distribution. Southern California northward into the Californian Central Valley.

Remarks. This species is abundant in the Central Valley of California, but is rare at Deep Canyon and in southern California. This species is a member of the *O. parva* species-group.

***Odontophotopsis bellona* Mickel**

Odontophotopsis (Odontophotopsis) bellona Mickel, 1983. Ann. Amer. Ent. Soc. 76: 541. Holotype data: Cortaro, Pima Co., Arizona, 2100 ft, 5 Jun 1969, J. Burger (UMSP).

Diagnosis of male. This species is differentiated by the tridentate mandible that is vertical at the apex, but the large basal tooth on the ventral margin of the mandible (Fig. 6; see Fig. 17 in Mickel & Clausen 1983) and by the pygidium defined laterally by carinae and with the surface distinctly granulate sculptured. This species has a characteristic apically bifid mesosternal process (see Fig. 106 of Mickel & Clausen 1983 and Fig. 25 of Pitts *et al.* 2009). The genitalia are illustrated by Mickel & Clausen (1983) in Fig. 4.

Female. Unknown.

Material examined. California, *Riverside Co.*: Deep Canyon, 1 male, 15–18.May.1970, 1 male, 19.May.1973, coll. Wilson, 22 males, 22–23.May.2007, 36 males, 23–24.May.2007, 1 male, 24.May.1969, 1 male, 24.Jun.1970, coll. W. McKay, 2 males, 3–7.Jul.1969, 1 male, 24–26.Jul.1969.

Distribution. Sonoran and Mojave deserts.

Remarks. This species is rare in some regions, but can be found in larger numbers elsewhere, including Deep Canyon.

This species is a member of the *O. parva* species-group and is the only member with large ventral teeth on the mandibles. This species could be confused with *O. parva* (see remarks for that species).

***Odontophotopsis biramosa* Schuster**

Odontophotopsis (Odontophotopsis) biramosa Schuster, 1952. Brooklyn Ent. Soc., 47: 43–47. Male. Holotype data: California, Imperial Co., Holtville, 2 Jul 1929, P.W. Owens (NMNH).

Odontophotopsis (Odontophotopsis) biramosa Schuster, 1958. Ent. Amer. (n. s.) 37: 56. Male.

Diagnosis of male. This species is recognized by having a tridentate mandible with an large dorsal tooth separated from the lower portion of the mandibular apex by a deep, wide, sinus, which makes the mandibular apices appear biramose (Fig. 7), and by the clypeus, which has a horseshoe-shaped tubercle posteromedially that overhangs the clypeus as a slight hood-like or nasutiform process (Fig. 7). Also, this species has a single mesosternal process on each side of the midline, and its cuspis is approximately half the free length of the paramere. The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 10.

Female. Unknown.

Material examined (abbreviated). Arizona, *Yuma Co.*, *Maricopa Co.*, *Mohave Co.* California, *Imperial Co.*, *Riverside Co.*, *San Bernardino Co.* Nevada, *Clark Co.*, *Nye Co.*

Distribution. The western Sonoran Desert of California and southwestern Arizona northward into Mojave Desert including southern Nevada.

Remarks. This species is rare, and has not been collected at Deep Canyon. It has been found in the Coachella Valley at Palm Springs, however, and included here because it is likely to be found here in the future. A more thorough discussion of this species can be found in Pitts (2007) and Pitts *et al.* (2009).

Schuster (1958) placed this species along with *O. setifera* in the *O. setifera* species-group. This group presumably was based heavily on similarities in mandibular morphology. Pitts (2007) studied the genitalia of these two species and suggested that they may not be closely related. Pitts *et al.* (2010) has confirmed this; *O. biramosa* seems to be closely related to *O. melicausa* while *O. setifera* seems to be closely related to, but not a member of, the *O. parva* species-group.

***Odontophotopsis clypeata* Schuster**

Odontophotopsis (Odontophotopsis) clypeata Schuster, 1958. Ent. Amer. (n. s.) 37: 59. Male. Holotype data: Tucson, Arizona, 26 Aug 1939, O. Bryant (UMSP).

Diagnosis of male. This species has a head that is rounded posteriorly, deeply excised mandibles that are slightly dilated apically (Fig. 8), has a transverse clypeus that is slightly depressed below mandibular margins (Fig. 8), but lacks a tubercle situated posteromedially on the clypeus, has a pair of denticulate mesosternal processes, and has a shiny glabrous pygidium. Also, the second metasomal segment is normally castaneous compared to the lightly ferruginous remainder of the metasoma, head and mesosoma. The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 11.

Female. Unknown.

Material examined. California, *Riverside Co.*, Deep Canyon, 2 males, 30–31.Jul.2007.

Distribution. Southwestern USA.

Remarks. This species is widespread and common throughout much of the Southwest including Deep Canyon. This species is currently placed in the *O. melicausa* species-group, which is paraphyletic (Pitts *et al.* 2010). The paraphyly of this species-group will need to be dealt within a future revision.

Odontophotopsis hammetti Pitts, NEW SPECIES

Diagnosis of male. This species can be recognized by the hind coxae with longitudinal hirsute carinae along their inner margin, and also having the mandible (Fig. 32) tridentate apically, weakly excised ventrally with the angle of excision obtusely angulate, the dorsal carina complete terminating at moderate tooth, and the apex vertical. Also, this species has a flattened to slightly concave mesosternum similar to other species of *Odontophotopsis*, but lacks the associated mesosternal processes and has dense plumose setal fringes on the metasoma (Fig. 33).

Description of male. *Coloration* (Figs 32, 33). Body testaceous; flagellum and legs stramineous. Body clothed with dense, erect, brachyplumose, yellowish-white setae. T1 with sparse plumose fringe at distal margin. T2 and S2 with dense fringe of whitish plumose setae. T3–5 and S3–5 each with sparser, but conspicuous fringes of whitish plumose setae.

Head. Head rounded to slightly quadrate posteriorly. Mandible (Fig. 32) tridentate, weakly excised beneath, excision obtuse, ventral tooth angulate; dorsal carina complete terminating at moderate tooth; apex vertical; mandible dilated ventrally beyond excision; mandible slightly curving ventrally towards apex. Clypeus depressed below margin of mandible, median area concave; surface of clypeus polished, impunctate, with few erect setae; apex truncate, not bidentate. F1 approximately 0.75X length of F2. Ocelli moderate in size, ocellocular distance approximately 1.25X greatest width of lateral ocellus. Head weakly sculptured with punctures slightly wider than setal bases; interstitial regions glabrous.

Mesosoma. Sides and dorsum of pronotum coarsely punctate, dorsum with moderate, shallow punctures, sides with somewhat larger, contiguous punctures. Mesonotum with moderate, contiguous, shallow punctures. Notaulus obsolete on anterior 0.3 of mesonotum. Scutellum coarsely, confluent punctate. Axillae not projecting posteriorly. Dorsum and posterior face of propodeum conspicuously, shallow reticulate, reticulations extending on to sides of propodeum, either remaining reticulate laterally or becoming coarse, punctate-reticulate. Anterolateral area of mesopleuron with moderate, shallow, separated punctures; remainder of mesopleuron with deeper, contiguous to confluent punctures; interstitial areas micropunctate. Metapleuron polished. Mesosternal processes absent, but mesosternum flattened, impunctate; area narrow anteriorly just at midline, widening to mid coxal width posteriorly. Mid coxa edentate. Hind coxa with distinct hirsute carina running longitudinally along inner margin. Metasternum bidentate. Mid femur not swollen. Marginal cell on costa short, 1.25–1.5X length of stigma.

Metasoma. First metasomal segment broad, nodose. Pygidium elongate and ovate, polished to weakly granulate along posterior margin, not strongly margined; S2 with felt line tuft-like, 0.2X length of tergal felt line. Hypopygium elongate and ovate. Genitalia (Fig. 64) with paramere acicular; cuspis elongate, approximately 0.5X free length of paramere, and cylindrical in lateral view, with moderate basal pit.

Female. Unknown.

Length. 11–13 mm.

Material examined. Holotype: **California**, *Riverside Co.*, Deep Canyon, 11.Nov.1963, coll. E. Schlinger (UCRC). Paratypes: **California**, *Riverside Co.*, Deep Canyon: 1 male, 25.Sep.1969, 1 male, 26.Sep–6.Oct.1969, 1 male, 9.Oct.1963, 2 males, 11.Nov.1963 (UCRC, EMUS).

Distribution. Currently known only from Deep Canyon, but will presumably be found throughout at least the western Sonoran Desert.

Etymology. Named after Samuel Dashiell Hammett (1894–1961), who was a well-known American author of hardboiled detective novels and short stories, and creator of the famous protagonist, Sam Spade.

Remarks. Although this species lacks mesosternal processes, it clearly belongs in *Odontophotopsis* due the characteristic genitalia and overall appearance of the species (i.e., density of plumose setae, weakly

punctate head, etc.). Furthermore, the species has the mesosternum broadly, but weakly concave and impunctate similar to other *Odontophotopsis* having mesosternal processes, but unlike *Sphaerophthalma*, which have the mesosternum punctate and convex on either side of the midline. The species belongs in the *O. parva* species-group, based on mandibular morphology and the bidentate metasternum. This is the only species in this species-group that lacks a densely granulate pygidium. However, recent phylogenetic analyses of *Odontophotopsis* (Pitts *et al.* 2010) suggest this species-group is paraphyletic with respect to the *O. tapajos* species-group. Some of these species lack developed mesosternal processes and all lack a granulate pygidium.

***Odontophotopsis inconspicua* (Blake)**

Photopsis inconspicuus Blake, 1886. Amer. Ent. Soc., Trans. 13: 272. Male. Holotype data: California (ANSP).

Mutilla infelix Dalla Torre, 1897. Cat. Hym. 50. New name for *Photopsis inconspicuus* Blake not *Mutilla inconspicuus* Smith.

Diagnosis of male. This species is recognized by the following combination of characters: the mandible is excised ventrally forming a slight tooth that is dilated towards the vertical apex (Fig. 9), the mesosternum only has one pair of large distinct spines that are flattened to slightly concave on the posterior side, the metasternum is tridentate, and the pygidium is granulate and is defined laterally by carinae. The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 12.

Diagnosis of female. The female of this species is diagnosed in Pitts *et al.* (2009).

Material examined. California, Riverside Co., Deep Canyon: 10 males, 2.May.1963, 5 males, 3.May.1963, 10 males, 16.May.1963, 1 male, 18.May.1964, 1 male, 22–23.May.2007, 3 males, 23–24.May.2007, 1 male, 24.May.1964, 2 males, 30.May.1963.

Distribution. The Sonoran desert of southern California and southwestern Arizona and the Mojave Desert being found as far north as southern Nevada.

Remarks. Pitts *et al.* (2009) associated the female with this species based on morphological, distributional data, and specimens collected by W.E. Ferguson (1967). This species is widespread throughout the most of the Southwest and is normally abundant.

***Odontophotopsis mamata* Schuster**

Odontophotopsis (*Periphotopsis*) *mamata* Schuster, 1958. Ent. Amer. (n. s.) 37: 60. Male. Holotype data: Arizona, Ehrenberg, 12.Jun.1935, F.H. Parker (UMSP).

Diagnosis of male. This species can be easily recognized by the distinct mesosternal processes, which are made up of large glabrous longitudinal swellings located on either side of the midline. It also has typical *O. parva* species-group mandibles (Fig. 10).

Female. Unknown.

Material examined. California, Riverside Co.: Deep Canyon: 5 males, 22–23.May.2007, 20 males, 23–24.May.2007, 1 male, 25.May.1953, coll. R. Flock, 2 males, 6–13.Jun.1969, 1 male, 13–15.Aug.1969, 1 male, 26–28.Aug.1969, 1 male, 26.Sep–6.Oct.1963; Palm Springs: 2 males, 27.May–6.Jun.1932, coll. T. Zachokke, 1 male, 10–12.Jul.1969.

Distribution. Widespread throughout the Mojave and western Sonoran Deserts.

Remarks. Schuster (1958) placed this species into its own subgenus *Periphotopsis* due to its unique mesosternal processes. Pitts (2007) recognized that this species shares many characteristics with the *O. parva* species-group, and, as such, synonymized *Periphotopsis* with *Odontophotopsis* and moved *O. mamata* to the *O. parva* species-group. This placement is confirmed in Pitts *et al.* (2010).

***Odontophotopsis melicausa* (Blake)**

Agama melicausa Blake, 1871. Amer. Ent. Soc., Trans. 3: 261. Male. Holotype data: Texas, Belfrage (ANSP).

Mutilla brevicornis Fox, 1899. Amer. Ent. Soc., Trans. 25: 255. Male. Holotype data: Texas (ANSP).

Odontophotopsis mellicornis Baker, 1905. Invertebrata Pacifica 1: 96. Male. Holotype data: Ormsby Co., Nevada (CUIC).

Diagnosis of male. This species has a head that is quadrate posteriorly, deeply excised mandibles that are distinctly dilated towards the vertical apex (Fig. 11; see Fig. 44 in Pitts *et al.* 2009)), lacks a tubercle situated posteromedially on the clypeus, has a pair of denticulate mesosternal processes, and has a shiny glabrous pygidium. The genitalia are illustrated in Fig. 13 of Pitts *et al.* (2009).

Diagnosis of female. A diagnosis of this female is provided in Pitts *et al.* (2007).

Material examined. California, Riverside Co., Deep Canyon: 1 male, 1–4.Jun.1970, 1 male, 28.Jul–17.Aug.1973, 1 male, 17–30.Jul.1973, 1 male, 9.Oct.1963, 2 males, 25.Oct.1969.

Distribution. Central and Western USA into northern Mexico.

Remarks. This species ranges throughout the Great Plains and the western USA. It usually makes up a major portion of the fauna, but seems to be rare at Deep Canyon, although this could be a function of timing of collections given that in southern Nevada it is more prevalent later in the summer and fall.

***Odontophotopsis quadrispinosa* Schuster**

Odontophotopsis quadrispinosa Schuster, 1958. Ent. Amer. 37: 51. Male. Neotype data: Palm Springs, California, 1 May 1933, at light, Theo. Zschokke (UMSP).

Diagnosis of male. The male of this species can be recognized by having the marginal cell much shorter than the stigma as measured along the costal vein and two pair of mesosternal processes forming a square, with the anterior pair much more obvious than the posterior pair. Also, the mandibles are deeply emarginate along the ventral margin, but the mandible narrows towards the vertical apex (Fig. 12). The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 18.

Female. Unknown, but the likely female was described in Pitts *et al.* (2009).

Material examined. California, Riverside Co.: 12 males, 2.May.1963, 2 males, 16.May.1963, 3 males, 30.May.1963, 1 male, 25.Sep.1969.

Distribution. Sonoran and Mojave deserts.

Remarks. This species is rare throughout its range and is not endemic to Deep Canyon. The mesosternal processes are weak and sometimes difficult to observe. This species was placed by Schuster (1958) into a monotypic species-group. It shares several morphological characteristics, but most especially similarities in the genitalia, with *Sphaerophthalma difficilis*, *S. django*, *Photomorphus californicus* and *Odontophotopsis grata*, which is a grouping suggested by Pitts *et al.* (2010).

***Odontophotopsis serca* Viereck**

Odontophotopsis sercus Viereck, 1904. Amer. Ent. Soc., Trans 30: 87. Male. Holotype data: Mexico, Lower California, type no. 4979 (ANSP).

Diagnosis of male. This species can be recognized by the lack of a clypeal tubercle, by having deeply excised mandibles with a vertical apex (Fig. 13), by having simple but prominent mesosternal processes, and by lacking a sternal felt line.

Female. Unknown.

Material examined. California, Riverside Co., Deep Canyon: 1 male, 18.May.1969, 30 males, 22–23.May.2007, 1 male, 24.May.1969, 1 male, 1–4.Jun.1970, 1 male, 5–13.Jun.1973, 1 male, 6–13.Jun.1969, 3

males, 13–18.Jun.1969, 1 male, 20–24.Jun.1969, 3 males, 3–7.Jul.1969, 1 male, 10–12, Jul.1969, 1 male, 16–17.Aug.1969, 3 males, 5–9.Sep.1969, 1 male, 9–11.Sep.1969, 51 males, 26.Sep–6.Oct.1969, 5 males, 6–8.Oct.1969, 2 males, 16–17.Oct.1969, 1 male, 17–20.Oct.1969.

Distribution. The Sonoran Desert including Baja California, Mexico and the Mojave Desert.

Remarks. This species unlike *O. armata* never develops anything that resembles a felt line on the second metasomal sternite. This species, along with *O. melicausa*, has a tendency to develop a slight secondary mesosternal tubercle posterior to the primary one. Sometimes this can be unilateral (Ferguson 1967).

Odontophotopsis setifera Schuster

Odontophotopsis (Odontophotopsis) setifera Schuster, 1952. Brooklyn Ent. Soc., 47: 47–49, male. Holotype data: California, Riverside Co., Palms to Pines Highway, 28.May.1940, R.M. Bohart (UMSP).

Odontophotopsis (Odontophotopsis) setifera Schuster, 1958. Ent. Amer. (n. s.) 37: 56, male.

Diagnosis of male. This species can be recognized by its unique mandibular morphology (Fig. 14). The mandible has the apex vertical and has four teeth with the dorsal tooth is separated from the remaining teeth by a deep sinus similar to the mandibles of *O. biramosa* (see Fig. 27 of Pitts 2007). Other potentially useful characters are listed in Pitts (2007) and Pitts *et al.* (2009).

Female. Unknown.

Material examined. California, Riverside Co., Deep Canyon: 1 male, 16.May.1963.

Distribution. The western Sonoran and Mojave Deserts of Arizona, California, Nevada, and Baja California, Mexico.

Remarks. This species is found throughout the Mojave and western Sonoran Deserts. It was placed into the *O. setifera* species-group along with *O. biramosa*. See the remarks for *O. biramosa* for a discussion of the validity of the species-group.

Sphaerophthalma amphion (Fox)

Mutilla amphion Fox, 1899. Amer. Ent. Soc., Trans. 25: 263, male. Holotype data: Nevada (ANSP).

Photopsis abstrusa Baker, 1905. Invertebrata Pacifica 1: 113, male. Holotype data: California (CUIC).

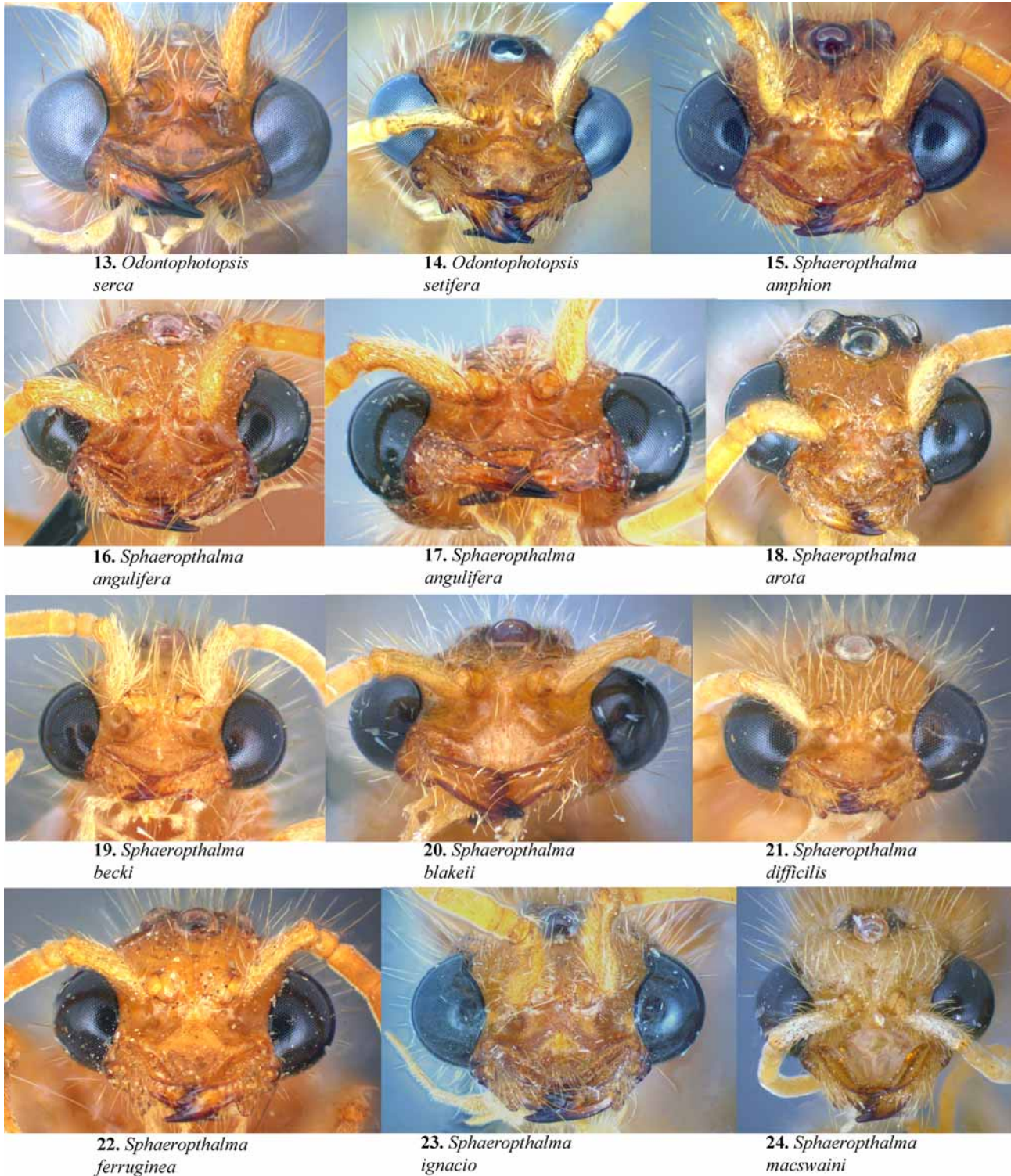
Photopsis nudata Baker, 1905. Invertebrata Pacifica 1: 114, male. Holotype data: California (CUIC).

Diagnosis of male. The male of this species can be recognized by having the mandible with a somewhat tapered apex and with the dorsal carina becoming obsolete distally such that the distal portion of mandible is oblique (Fig. 15). Also, the marginal cell length is short being 0.5–0.9X length of stigma, and this species lacks a sternal felt line. In addition to the mandibular morphology, the genitalia are diagnostic (Fig. 52). The cuspis is elongate (0.7–0.8X free length of paramere) and is dilated towards its apex and has the ventral portion, especially at the apex and inner margin, clothed with long dense setae that have their apices plumose. *Diagnosis of female.* Pitts *et al.* (2004) associated and described the female of this species.

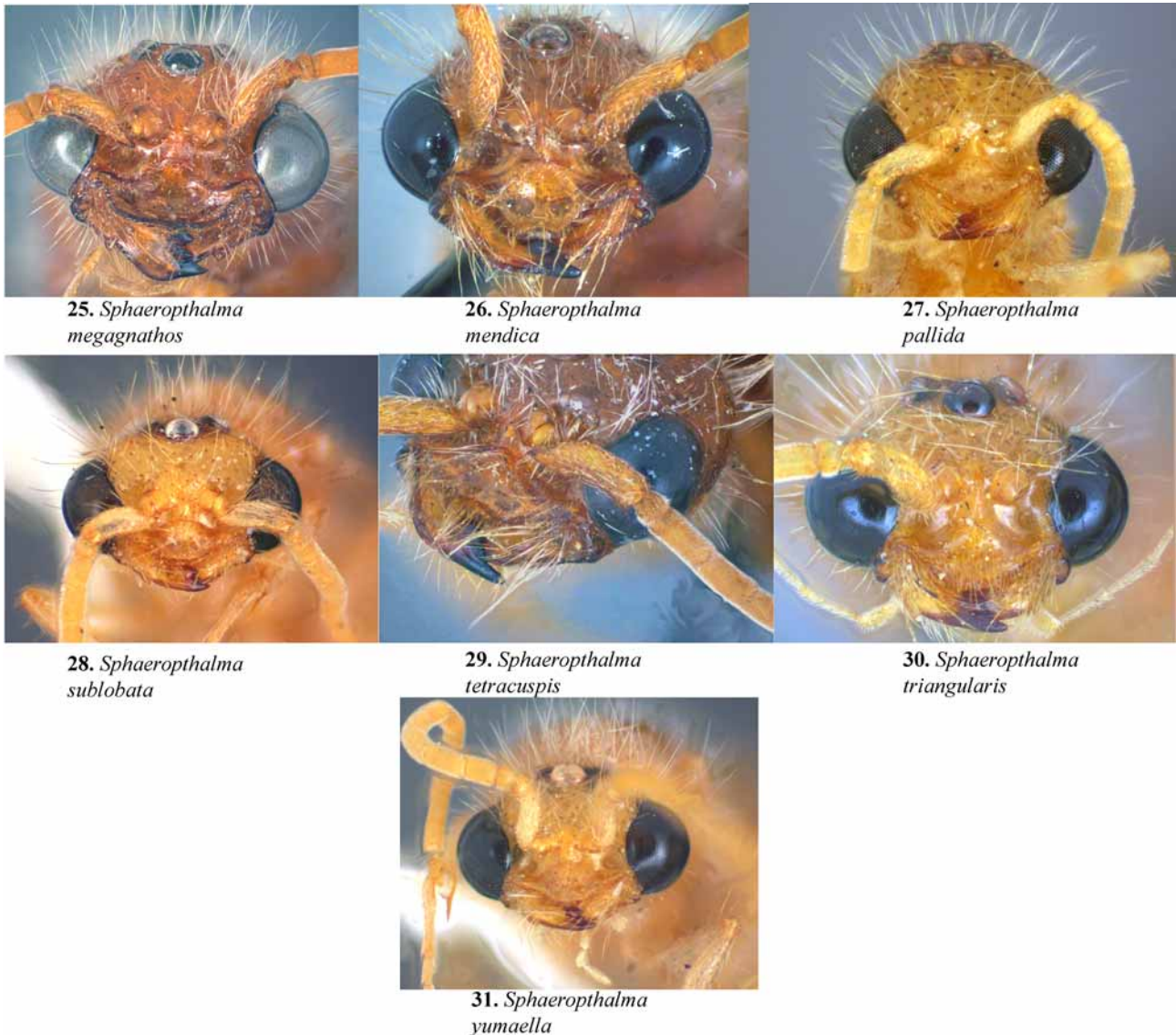
Distribution. Found in the xeric regions of Arizona, California, Nevada, Baja California, Mexico, Nevada and Utah, including the Sonoran Desert, Great Basin Desert, Mojave Desert, Colorado Plateau, and San Joaquin Valley.

Hosts. *Ancistrocerus c. catskill* (Saussure), *A. simulator* Cameron, *Ancistrocerus* sp., *Anthocopa copelandica* (Cockerell), *Ashmeadiella bigeloviae* (Cockerell), *A. gillettei* Titus, *A. meliloti* (Cockerell), *Ashmeadiella* sp., *Atoposmia hypostomalis* Michener, *Chrysis derivata* du Buysson, *Hoplitis bullifacies* (Michener), *Hoplitis f. fulgida* (Cresson), *H. g. grinnelli* (Cockerell), *H. sambuci* Titus, *Leptochilus chiricahua* Parker, *L. rufinodus* (Cresson), *Leptochilus* sp., *Osmia marginata* Michener, *Pisonopsis birkmanni* Rohwer, *Pisonopsis* sp., *Sapyga aculeata* Cresson on *Hoplitis sambuci*, *Sapyga elegans* Cresson on *Hoplitis fulgida*, Sarcophagidae sp. (Diptera), *Stelis* sp. on *Hoplitis bullifacies*, *Stelis* spp., *Trypargilum t. tridentatum* (Packard), *Trypargilum* sp.

Material examined. California, Riverside Co., Deep Canyon: 4 males, 15.Mar.2007, 1 male, 12.Apr.1975, 1 male, 15.May.1969, 1 male, 19.May.1973, 7 males, 22–23.May.2007, 5 males, 23–24.May.2007, 1 male, 24–26.Jun.1969, 2 males, 23.Jul.1969, 1 male, 3–7.Aug.1969, 1 male, 25–26.Aug.1969, 1 male, 25.Sep.1969, 20 males, 26.Sep–6.Oct.1969, 1 male, 6–8.Oct.1969, 1 male, 15–16.Oct.1969, 1 male, 18–20.Oct.1969, 1 male, 11.Nov.1969.



FIGURES 13–24. Head, anterior view; except ventral view 17. 13. *Odontophotopsis serca*; 14. *O. setifera*; 15. *Sphaerophthalma amphion*; 16. *S. angulifera*; 17. *S. angulifera*; 18. *S. arota*; 19. *S. becki*; 20. *S. blakeii*; 21. *S. difficilis*; 22. *S. ferruginea*; 23. *S. ignacio*; and 24. *S. macswaini*.



FIGURES 25–31. Head, anterior view. 25. *Sphaerophthalma megagnathos*; 26. *S. mendica*; 27. *S. pallida*; 28. *S. sublobata*; 29. *S. tetracuspis*; 30. *S. triangularis*; and 31. *S. yumaella*.

Remarks. Pitts *et al.* (2004) placed this species in the *S. uro* species-group and discovered the female. This species is widespread throughout much of the western United States. It is similar to *S. ignacio*, especially the shape of the cuspis of the genitalia, and can be separated from this species by differences in the marginal cell and type of setae on the cuspis. The marginal cell of *S. amphion* is shorter than the stigma and the cuspis bears plumose tipped setae, while the marginal cell of *S. ignacio* is at least 1.75X the length of the stigma and the cuspis bears setae with bifid tips.

Sphaerophthalma angulifera Schuster

Sphaerophthalma (Photopsis) angulifera Schuster, 1958. Ent. Amer. 37: 32. Male. Holotype data: California, Kern Co., Bakersfield (CASC).

Diagnosis of male. The male of this species can be recognized by having mandibles that are weakly excised ventrally with a distinct angulate basal tooth (Figs 16, 54) and an apex that is tridentate and oblique (Figs 15, 54), but most importantly the dorsal carina of the mandible is angulate at the midpoint of the mandible

coinciding with the ventral tooth (Figs 16, 54), the posterior margin of the head is quadrate, the mesosternum lacks processes, the second metasomal sternite has a distinct felt line, and the pygidium is granulate. The genitalia also help to diagnose this species (Fig. 53); the cuspis is a uniform diameter from the base to the apex.

Diagnosis of female. Wilson & Pitts (2009) diagnosed the female based on associations made from similarities of the female to that of *S. mendica* and distributional data.

Material examined. California, Riverside Co.: Deep Canyon, 1 male, 13–18.Jul.1973, 1 male, 18–19.Jul.1969.

Distribution. This species is found in the Mojave and Western Sonoran deserts.

Remarks. *Sphaerophthalma angulifera* is morphologically similar to *S. unicolor* and *S. mendica*, but can be differentiated from these two species by mandibular morphology (Wilson & Pitts 2009). Although this species is found throughout the Mojave and western Sonoran Deserts, it is extremely rare.

Sphaerophthalma arota (Cresson)

Mutilla Arota Cresson, 1875. Amer. Ent. Soc., Trans. 5: 120. Female. Holotype data: San Diego, California, G.R. Crotch, Type no. 1873 (UMSP).

Mutilla helicaon Fox, 1899. Amer. Ent. Soc., Trans. 25: 254. Male. Holotype data: Nevada, Type no. 4642 (UMSP).

Photopsis lingulatus Viereck, 1903. Acad. Nat. Sci. Phil., Proc. 54: 737. Male. Holotype data: La Jolla, San Diego Co., California (UMSP).

Sphaerophthalma (*Photopsis*) *carinata* Schuster, 1958. Ent. Amer. 37: 34. Male. Holotype data: Purissima, Baja California (NMNH).

Sphaerophthalma (*Photopsis*) *helicaon coahuilae* Schuster, 1958. Ent. Amer. 37: 34. Male. Holotype lost.

Sphaerophthalma (*Photopsis*) *helicaon diegueno* Schuster, 1958. Ent. Amer. 37: 35. Male. Holotype data: S. Carlos, Arizona, 12–13 May 1918, J. Ch. Bradley (CUIC).

Diagnosis of male. This species is easily recognized by the weak excision and slight angulate tooth on the ventral margin of the mandible (Fig. 18), which is oblique apically, the clypeus carinate at base, but sometimes delicately so or gibbous (Fig. 18), the lack of mesosternal processes or a sternal felt line, and the ventral margin of the paramere with dense setae that are directed inward toward the cuspis (see Fig. 100 in Pitts *et al.* 2009).

Diagnosis of female. Pitts *et al.* (2009) diagnosed the female of this species.

Material examined. California, Riverside Co., Deep Canyon: 1 male, 23–24.May.2007, 4 males, 3–7.Jul.1969, 1 male, 21.Jul.1970, coll. W. MacKay.

Distribution. From the Chihuahuan Desert of Texas west to the Sonoran Desert of California and north into the Mojave Desert.

Remarks. Preliminary molecular data, which will be published elsewhere, suggests that this species may actually be a group of four sibling species.

Sphaerophthalma becki Ferguson

Sphaerophthalma (*Micromutilla*) *becki* Ferguson, 1967. Brigham Young Univ. Sci. Bull. Biol. Ser. 8: 9. Male. Holotype data: Hillside, 0.85 mi NNW Mercury, Nye Co., Nevada, 23 Aug 1964, W.E. Ferguson (NMNH).

Diagnosis of male. This species is recognized by its small body size, the deeply excised mandible with the ventral tooth forming an oblique angle (Fig. 19; see also Fig. 45 in Pitts *et al.* 2009) while the dorsal carina is complete and the apex of the mandible is slightly oblique, the absence of mesosternal processes, the marginal cell which is shorter than the stigma, the first segment of the metasoma which is petiolate with the second segment, and the genitalia with a short cylindrical cuspis (see Pitts *et al.* 2009: Fig. 2).

Female. Unknown.



32. *Odontophotopsis hammetti*, sp. nov.



33. *Odontophotopsis hammetti*, sp. nov.



34. *Sphaerophthalma arnalduri*, sp. nov.



35. *Sphaerophthalma arnalduri*, sp. nov.



36. *Sphaerophthalma arnalduri*, sp. nov.



37. *Sphaerophthalma arnalduri*, sp. nov.

FIGURES 32–37. *Odontophotopsis hammetti*, sp. nov.: 32. Head, anterior view; and 33. Habitus. *Sphaerophthalma arnalduri*, sp. nov.: 34. Head, dorsal view; 35. Head oblique lateral view; 36. Mesosoma, lateral view; and 37. Habitus.



38. *Sphaerophthama chandleri*, sp. nov.



39. *Sphaerophthama chandleri*, sp. nov.



40. *Sphaerophthama chandleri*, sp. nov.



41. *Sphaerophthama fergusonii*, sp. nov.



42. *Sphaerophthama fergusonii*, sp. nov.



43. *Sphaerophthama fergusonii*, sp. nov.

FIGURES 38–43. *Sphaerophthama chandleri*, sp. nov.: 38. Head, anterior view; and 39. Habitus. *Sphaerophthama fergusonii*, sp. nov.: 40. Pygidium, dorsal view; 41. Head anterior view; 42. Head, dorsal view; and 43. Habitus.



44. *Sphaerophthalma munkelli*, sp. nov.



45. *Sphaerophthalma munkelli*, sp. nov.



46. *Sphaerophthalma munkelli*, sp. nov.



47. *Acrophotopsis campylognatha*



48. *Acrophotopsis campylognatha*

FIGURES 44–48. *Sphaerophthalma munkelli*, **sp. nov.**: 44. Head, anterior view; 45. Habitus; and 46. Apex of wing. *Acrophotopsis campylognatha*: 47. genitalia, dorsal view (scale 0.5 mm) and 48. Close up of cuspis (scale 0.2 mm) (Fig. 47. from Pitts & McHugh 2002).

Material examined. California, *Riverside Co.*, Deep Canyon: 1 male, 2.May.1963, 2 males, 23–25.May.1970, 1 male, 24.May.1969, 2 males, 21–29.May.1973, 34 males, 22–23.May.2007, 2 males, 27.May–1.Jun.1970, 2 males, 5–13.Jun.1973, 4 males, 13–18.Jun.1969, 1 male, 18–19.Jun.1969, 1 male, 27–28.Jun.1969, 1 male, 1–2.Jul.1969, 4 males, 2–3.Jul.1969, 1 male, 10–12.Jul.1969, 1 male, 13–14.Jul.1969, 1 male, 13–20.Jul.1973, 1 male, 19–21.Jul.1969, 55 males, 30–31.Jul.2007, 2 males, 4–5.Aug.1969, 4 males, 5–7.Aug.1969, 2 males, 7–9.Aug.1969, 2 males, 9–11.Aug.1969, 2 males, 17–30.Aug.1973, 1 male, 25–26.Aug.1969, 1 male, 28–30.Aug.1969, 1 male, 30.Aug.–7.Sep.1973, 2 males, 26.Sep–6.Oct.1969, 2 males, 6.Oct.1969, 1 male, 6–8.Oct.1969.

Distribution. California and southwestern Arizona northward into southern Nevada.

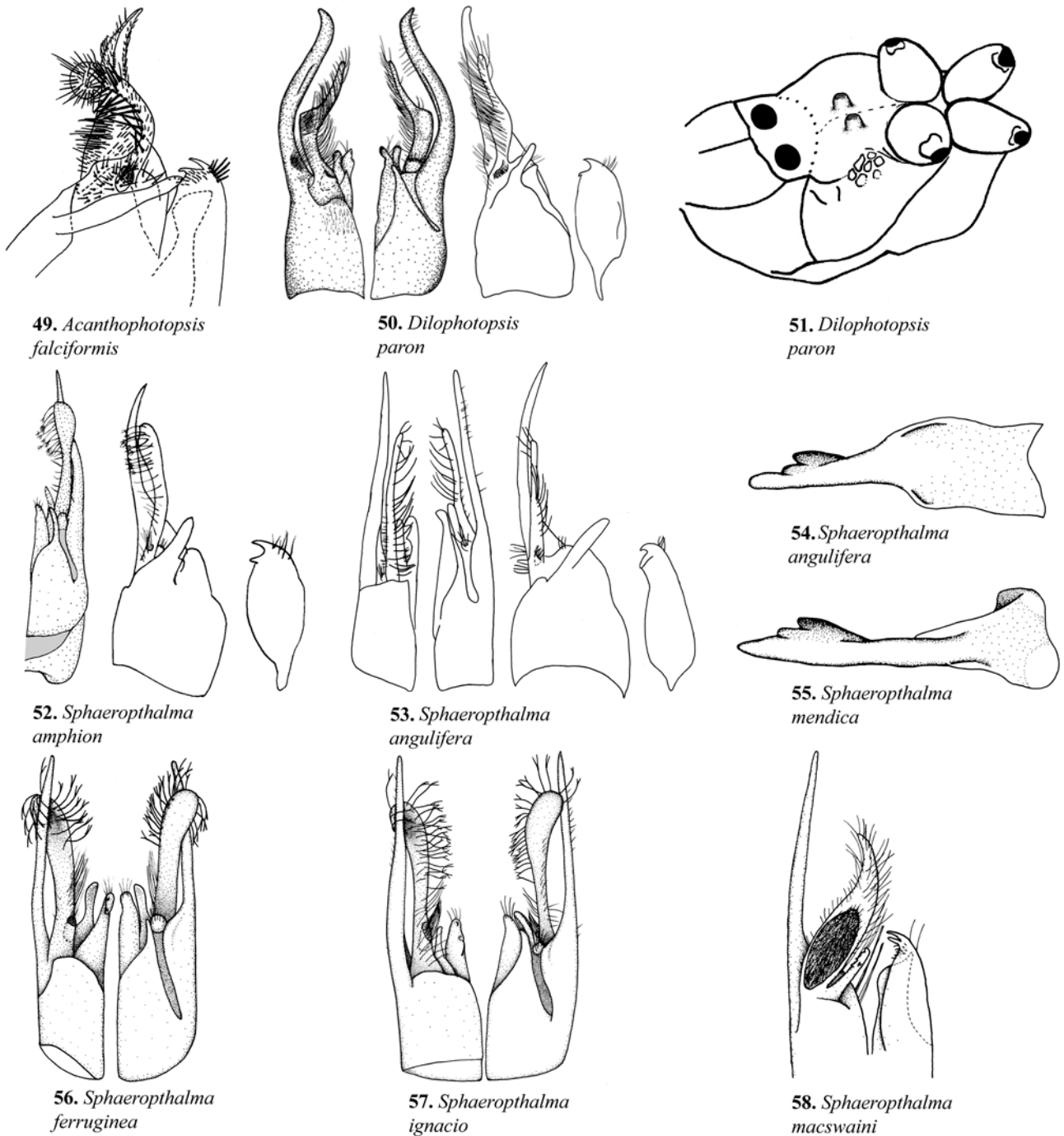
Remarks. This species is not endemic to Deep Canyon, but is among the smallest mutillids that occur here. Ferguson (1967) gives a complete discussion of this species.

Sphaerophthalma blakeii (Fox)

Photopsis Blakeii Fox, 1893. Calif. Acad. Sci., Proc. 4: 6. Male. Lectotype data: San Jose del Cabo, Baja California (ANSP).

Mutilla Gautschii Dalla Torre, 1897. Cat. Hym. 50. N. name erroneously proposed for *Photopsis Blakeii* Fox, thought to be preoccupied by Cameron, 1894.

Mutilla ceyx Fox, 1899. Amer. Ent. Soc., Trans. 25: 262. Male. Lectotype data: Calmili Mines, Apr (ANSP).



FIGURES 49–58. *Acanthophotopsis falciformis*: 49. Genitalia, lateral view (from Tanner & Pitts 2009). *Dilophotopsis paron*: 50. Genitalia, ventral, dorsal, inner lateral view, and lateral view of penis valve; and 51. Mesosoma, oblique ventral view (from Wilson & Pitts 2008). *Sphaerophthalma amphion*: 52. Genitalia, dorsal, inner lateral view, and lateral view of penis valve (from Pitts *et al.* 2004). *Sphaerophthalma angulifera*: 53. Genitalia, dorsal, inner lateral view, and lateral view of penis valve (from Wilson & Pitts 2009). Mandible, anterior view: 54. *Sphaerophthalma angulifera*; and 55. *Sphaerophthalma mendica* (from Wilson & Pitts 2009). *Sphaerophthalma ferruginea*: 56. Genitalia, ventral view left, dorsal view right. *Sphaerophthalma ignacio*: 57. Genitalia, ventral view left, dorsal view right. *Sphaerophthalma macswaini*: 58. Genitalia, inner lateral view left.

Diagnosis of male. This species can be recognized by the posterior margin of the head, by the weakly excised mandible that is dilated towards the vertical apex (Fig. 20), by the large stigma that is slightly longer than the marginal cell, by the denticles on the internal margin of the hind coxa, by the lack of mesosternal processes, by the quadrate pygidium, and most especially by the lobate dorsoventrally flattened condition of the cuspis (see Fig. 23 in Pitts *et al.* 2009), which has long setae along the internal margin that coalesce apically.

Diagnosis of female. Pitts *et al.* (2009) associated and diagnosed the female.

Material examined. California, Riverside Co., Deep Canyon: 2 males, 1.May.1973, 5 males, 22–23.May.2007, 1 male, 1–4.Jun.1970, 1 male, 6–13.Nov.1969.

Distribution. This species is widespread in the Mojave and Sonoran deserts in Arizona, California, Nevada, Utah and Mexico.

Remarks. This species is widespread and not endemic to Deep Canyon. It is currently placed in the *S. blakeii* species-group along with *S. arenicola*, *S. ceyxoides*, and *S. tuberculifera*. *Sphaerophthalma blakeii* is sister to *S. ceyxoides* with which it shares similarities in genitalic morphology, but is not closely related to *S. arenicola* which makes this species-group paraphyletic (Pitts *et al.* 2010).

Sphaerophthalma chandleri Pitts, NEW SPECIES

Diagnosis of male. This species can be diagnosed by the mandible having a moderate ventral tooth (Fig. 38) with an oblique apex, the marginal cell being 0.75X the length of the stigma, the lobed hind coxa and the granulate pygidium (Fig. 40).

Description of male. Coloration (Figs 38–40). Body testaceous; flagellum and legs stramineous. Ocellular triangle infuscated. Body clothed with sparse, erect, brachyplumose, whitish setae. T1 lacking plumose fringe at distal margin. T2 and S2 with sparse fringe of whitish plumose setae. T3–5 and S3–5 each with sparser, less conspicuous fringe of whitish plumose setae. Setae sometimes tinged yellow.

Head. Head distinctly rounded posteriorly. Mandible (Fig. 38) tridentate, moderately excised beneath, angle of ventral tooth oblique; dorsal carina incomplete; apex oblique; mandible slightly tapered beyond excision. Clypeus depressed slightly below margin of mandible, median area concave; surface of clypeus polished, almost impunctate, with few erect setae; apex moderately bidentate. F1 approximately 0.66X length of F2. Ocelli moderate in size, ocellocular distance 1.25–1.5X greatest width of lateral ocellus.

Mesosoma. Sides and dorsum of pronotum glabrous, dorsum with small, shallow punctures. Mesonotum with small, sparse, shallow punctures, surface mostly glabrous. Notaulus incomplete on anterior 0.3 of mesonotum. Scutellum weakly punctate. Axillae not projecting posteriorly. Dorsum and posterior face of propodeum indistinctly reticulate, reticulations extending on to sides of propodeum, either remaining reticulate laterally or becoming coarse, punctate-reticulate. Anterolateral area of mesopleuron glabrous; remainder of mesopleuron with weak, sparse punctures only visible at certain angles; interstitial areas glabrous. Metapleuron polished. Mesosternal processes absent. Metasternum bidentate. Mid femur not swollen. Marginal cell on costa short, 0.75–0.8X length of stigma.

Metasoma. First metasomal segment sessile, slightly nodose when viewed laterally. Pygidium quadrate, strongly granulate (Fig. 40), but not strongly margined; S2 with sternal felt line 0.3–0.5X length of tergal felt line. Hypopygium quadrate. Genitalia (Fig. 66) with paramere acicular; cuspis elongate, >0.75X free length of paramere, and cylindrical basally, laterally flattened, densely setose along the ventral and inner margins.

Length. 6.0–7.5 mm.

Female. Unknown.

Material examined. Holotype: California, Riverside Co., Deep Canyon, 3.May.1963 (UCRC). Paratypes: California, Riverside Co.: Deep Canyon, 2 males, 2.May.1963, 1 males 15–18.May.1970, 1 male, 30.May.1963, 1 male, 22.Jun.1963 (UCRC, EMUS); Painted Canyon, near Mecca, 4 males, 14.Apr.1974, coll. M. Wasbauer (CDFA).

Distribution. Known only from Deep Canyon and Painted Canyon.

Etymology. Named after Raymond Thornton Chandler (1888–1959), who was an American crime writer that greatly influenced the modern private eye story and created the famous protagonist, Philip Marlowe.

Remarks. This species currently should be placed into the *S. noctivaga* species-group based on presence of plumose setal fringes on the metasoma, T1 broadly attaching to T2 on the metasoma, and the forewing with a short marginal cell. However, differences in mandibular and genitalic morphology make this placement doubtful without the aid of molecular data.

This species could be confused with *S. sublobata*, because the lobes on the hind coxae are quite similar. However, the pygidium of *S. sublobata* is glabrous, not granulate, and there are noticeable differences in the mandible, especially in the narrower size and shallower depth of the ventral excision in *S. sublobata*.

Sphaerophthalma difficilis (Baker)

Photopsis difficilis Baker, 1905. Invertebrata Pacifica 1: 114. Male. Holotype data: Claremont, California (CUIC).

Sphaerophthalma (*Micromutilla*) *maricopella purismella* Schuster, 1958. Ent. Amer. 37: 17. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *maricopella maricopella* Schuster, 1958. Ent. Amer. 37: 17. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *maricopella castanea* Schuster, 1958. Ent. Amer. 37: 17. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *californiense californiense* Schuster, 1958. Ent. Amer. 37: 18. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *californiense fuscata* Schuster, 1958. Ent. Amer. 37: 18. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *quijotoa quijotoa* Schuster, 1958. Ent. Amer. 37: 18. Male. Holotype data: Lost.

Sphaerophthalma (*Micromutilla*) *quijotoa parrasia* Schuster, 1958. Ent. Amer. 37: 18. Male. Holotype data: Lost.

Diagnosis of male. This species is recognized by the deeply excised mandible (Fig. 21) with the tooth forming an acute angle and having a vertical apex, the lack of mesosternal processes, the marginal cell shorter (approximately 0.75X) than the stigma, the first segment of the metasoma petiolate with the second segment and densely punctate, the second sternite with an anteromedial tumid region, and the genitalia with a long cylindrical cuspis that is setose ventrally with the apex having longer denser setae and parameres with dense setae located medially, but internally directed, along the internal margin (see Fig. 3 in Pitts *et al.* 2009).

Diagnosis of female. Pitts *et al.* (2009) associated the female.

Material examined. California, Riverside Co., Deep Canyon: 1 male, 3.May.1963, 2 males, 16.May.1963, 1 male, 18.May.1969, 1 male, 24.May.1969, 15 males, 23–24.May.2007, 1 male, 30.May.1964, coll. M. Irwin, 2 males, 1–4.Jun.1970, 3 males, 5–13.Jun.1973, 1 male, 13–18.Jun.1969, 1 male, 18.Jun.1969, 1 male, 13–20.Jun.1973, 1 male, 20.Jun.1963, 1 male, 29.Jun–6.Jul.1973, 3 males, 24–26.Jul.1969, 1 male, 28.Jul–17.Aug.1973, 1 male, 5–7.Aug.1969, 1 male, 11.Sep.1969, 1 male, 26.Sep–6.Oct.1969, 1 male, 6–8.Oct.1969, 1 male, 29.Oct–2.Nov.1969.

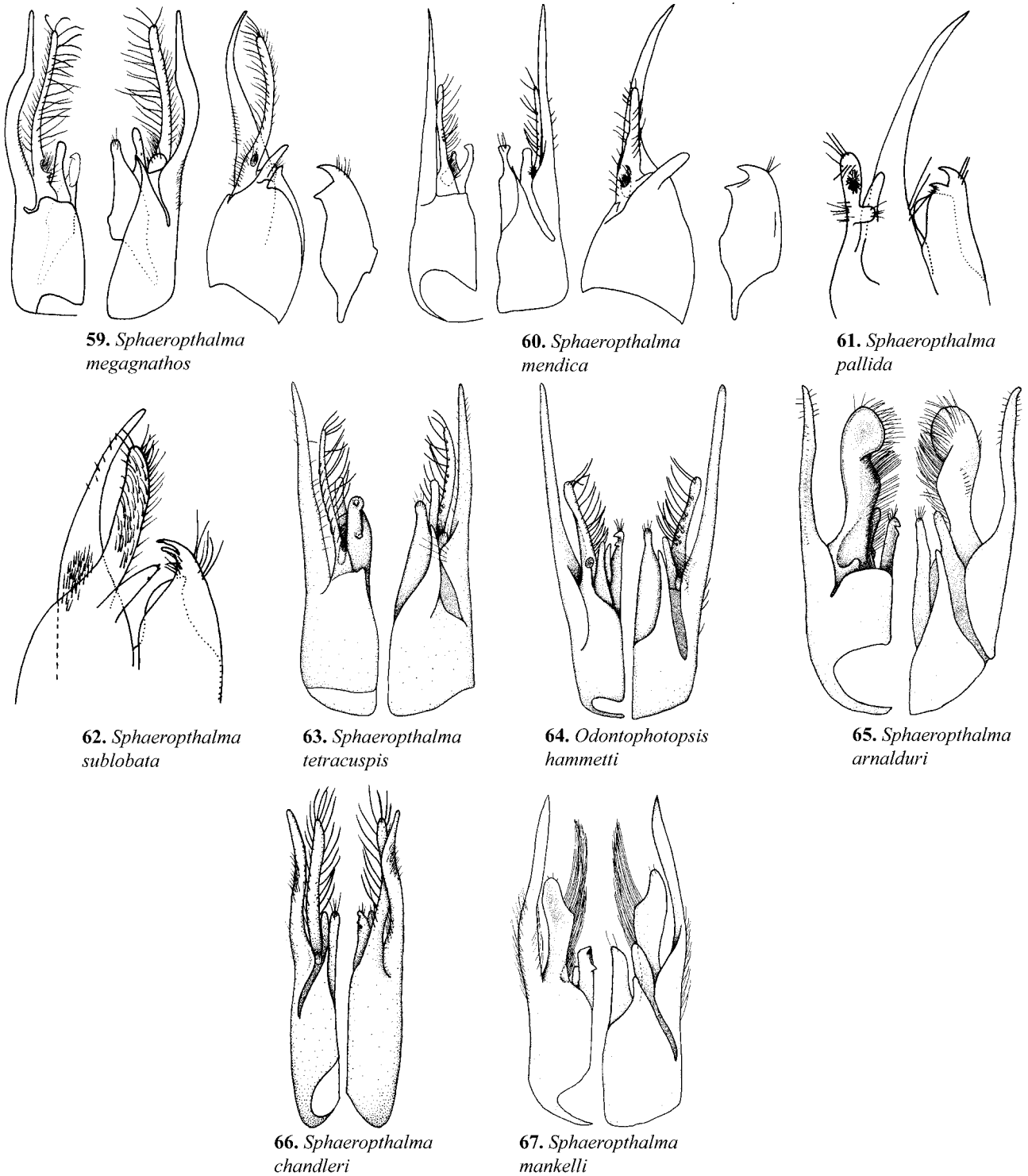
Distribution. Found throughout most of the southwestern USA.

Remarks. The males of this species are difficult to separate from *S. django* Pitts and Wilson and it is currently impossible to separate the females of *S. difficilis* and *S. django* based on morphology alone. *Sphaerophthalma django* is known only from the Algodones Sand Dunes and should not cause any problems with identification of Deep Canyon specimens.

Sphaerophthalma fergusonii Pitts, NEW SPECIES

Diagnosis of male. This species is can be recognized by its quadrate head, the thickened apex of the clypeus (Fig. 41), the mid coxa with a median denticle present on the inner margin and diagnostic genitalia with which it shares features only with *S. arnalduri*, **sp. nov.** (Fig. 65), while lacking any mesosternal processes.

Description of male. *Coloration* (Figs 41–43). Body testaceous; flagellum and legs stramineous to concolorous with body, sometime femur infuscated; metasoma varies from stramineous to testaceous. Body clothed with sparse, erect, brachyplumose, whitish setae. T1 with sparse plumose fringe at distal margin. T2 and S2 with sparse fringes of whitish plumose setae. T3–5 and S3–5 each with sparser, less conspicuous fringe of whitish plumose setae. Setae somewhat yellow tinged.



Figs. 59-67: *Sphaerophthalma megagnathos*: 59. Genitalia, ventral, dorsal, inner lateral view, and lateral view of penis valve (from Pitts 2006). *Sphaerophthalma mendica*: 60. Genitalia, dorsal, inner lateral view, and lateral view of penis valve (from Wilson & Pitts 2009). *Sphaerophthalma pallida*: 61. Genitalia, lateral view. *Sphaerophthalma sublobata*: 62. Genitalia, lateral view. Figs. 63-67, Genitalia, ventral view left, dorsal view right: 63. *Sphaerophthalma tetracuspis*; 64. *Odontophotopsis hammetti*, sp. nov.; 65. *Sphaerophthalma arnalduri*, sp. nov.; 66. *Sphaerophthalma chandleri*, sp. nov.; and 67. *Sphaerophthalma mankelli*, sp. nov.

Head. Head distinctly quadrate posteriorly. Mandible (Fig. 41) tridentate, with weak rounded ventral tooth, lacking excision apical to tooth; dorsal carina incomplete forming slight dorsal lamella towards

termination; apex oblique; mandible appearing tapered beyond excision in strict frontal view. Clypeus depressed slightly below margin of mandible, median area concave; surface of clypeus polished, almost impunctate, with few erect setae; apex truncate and distinctly thickened (Fig. 41). F1 approximately 1X length of F2. Ocelli moderate in size, ocellular distance 1.1–1.2X greatest width of lateral ocellus (Fig. 42). Head weakly punctate.

Mesosoma. Sides and dorsum of pronotum coarsely punctate, dorsum with moderate, shallow punctures, sides with somewhat larger, shallower punctures. Mesonotum with weak, separated, shallow punctures. Notaulus distinct, complete. Scutellum coarsely, confluent punctate. Axillae not projecting posteriorly. Dorsum and posterior face of propodeum conspicuously, shallow reticulate, reticulations extending on to sides of propodeum, either remaining reticulate laterally or becoming coarse, punctate-reticulate. Anterolateral area of mesopleuron mostly glabrous; remainder of mesopleuron with deeper, contiguous to confluent punctures; interstitial areas sometimes micropunctate. Metapleuron polished. Mesosternal processes absent. Metasternum bidentate. Mid femur not swollen. Mid coxa with distinct to indistinct denticle located medially on inner margin. Marginal cell on costa long, 1.75–2X length of stigma.

Metasoma. First metasomal segment petiolate. Pygidium shortened, quadrate, polished, not strongly margined; S2 with sternal felt line 0.3–0.5X length of tergal felt line. Hypopygium quadrate. Posterior margin slightly dentate medially. Genitalia with paramere acicular, only extreme apex curving dorsally; cuspis elongate, >0.9X free length of paramere, and cylindrical basally, dorsal face with central longitudinal swelling, apex spatulate, ventral face slightly concave, with basal pit, inner margin with shallow ventral notch anterior to spatulate area.

Female. Unknown.

Length. 11.5–13 mm.

Material examined. Holotype: **California**, *Riverside Co.*, Corn Springs, 24.Jun.2004, coll. K. Williams (EMUS). Paratypes: **California**, *Riverside Co.*, Deep Canyon: 1 male, 2.May.1936, 1 male, 15.May.1969, 3 males, 16.May.1963, 1 male, 19.May.1973, 2 males, 6–13.Jun.1969, 1 male, 13.Jun.1963, 1 male, 20–24.Jun.1969, 2 males, 24–26.Jun.1969, 1 male, 1.2.Jul.1969, 1 male, 3–7.Jul.1969, 3 males, 10–12.Jul.1969, 2 males, 19–21.Jul.1969, 1 male, 23–24.Jul.1969, 1 male, 26–28.Jul.1969, 1 male, 30–31.Jul.2007, 1 male, 7–9.Aug.1969, 1 male, 9–11.Aug.1969, 2 male, 11–13.Aug.1969, 1 male, 16–17.Aug.1969, 1 male, 5–9.Sep.1969 (UCRC, EMUS).

Distribution. Known only from Corn Springs and Deep Canyon.

Etymology. Named after W.E. Ferguson who surveyed the mutillids of the Nevada Test Site in 1967 and published several critical papers on nocturnal mutillids.

Remarks. This species belongs in a new *S. fergusonii* species-group, which also includes *S. arnalduri*, **sp. nov.**, which is described later in this paper. The genitalia of *S. arnalduri* (Fig. 65) are quite similar to *S. fergusonii*, which were not illustrated. There are, however, other characters that are distinct between these species making the distinction of the two species credible.

This species has tubercles on the hind coxae similar to those of *S. blakeii*. They are difficult to see in most cases being obscured by setae. The morphology of the mandibles coupled with that of the clypeus make this species distinctive enough to be identified.

In Fig. 43, the black coloration of the gena is caused by some kind of oily substance that leaks out of older specimens; under natural circumstances, the gena should be the same color as the remainder of the head and actually is on the other side of the head of this individual.

Sphaerophthalma ferruginea (Blake)

Agama ferruginea Blake, 1879. Amer. Ent. Soc., Trans. 7: 254. Male. Holotype data: Nevada (ANSP).

Mutilla ferruginosa Dalla Torre, 1897. Cat. Hym. V. 8, p. 40. N. name for *Agama ferruginea* Blake not *Mutilla ferruginea* Smith.

Diagnosis of male. This species has a deeply excised tridentate mandible that has a complete dorsal carina and a vertical apex (Fig. 22), has sternal felt lines that are mere tufts, lacks mesosternal and coxal processes,

and the genitalia have a clavate cuspis that has bifid-tipped setae located ventrally towards the apex (Fig. 56).
Female. Unknown.

Material examined. California, Riverside Co.: Deep Canyon, 2 males, 16.May.1975, coll. J. Trucker.

Distribution. The western Sonoran Desert, Mojave Desert and northern California into Oregon and Washington.

Remarks. This species is placed in the *S. orestes* species-group. Members of this group can be recognized by their deeply emarginate mandibles, the weak sternal felt line and clavate to spatulate cuspis of the genitalia. *Sphaerophthalma ferruginea* is the only species in this group that has setae on the cuspis that are bifid tipped. All other species have simple setae on the cuspis.

Sphaerophthalma militaris is another species in the *S. orestes* species-group that possibly be collected at Deep Canyon in the future. It would key out to couple 25 and could be recognized by the rows of inner directed setae present on toward the apices of the parameres of the genitalia (see Fig. 25 in Pitts *et al.* 2009).

Sphaerophthalma ignacio Schuster

Sphaerophthalma (Photopsis) ignacio Schuster, 1958. Ent. Amer. (n. s.) 37: 38. Male. Holotype data: 15 mi. N., San Ignacio, Lower California, Mexico, 24.Jun.1938, Michelbacher and Ross (CASC).

Diagnosis of male. This species is recognized by the weakly excised mandibles that have weak a ventral tooth (Fig. 23), by an elongate marginal cell that is at least 1.75X the length of the stigma, and by the genitalia with a spatulate cuspis bearing bifid-tipped setae apically (Fig. 57), while lacking mesosternal processes, coxal processes, and a sternal felt line.

Female. Unknown.

Material examined. California, Riverside Co.: 1 male, 26.Sep–6.Oct.1969, 1 male, 16–17.Oct.1969.

Distribution. Western Sonoran Desert into Baja California, Mexico.

Remarks. This species could be confused with *S. amphion* (see the discussion of *S. amphion*). *Sphaerophthalma ignacio* was placed by Schuster (1958) in the *S. albicincta* species-group with *S. arota* (as *S. helicaon* and many synonyms), *S. coaequalis*, *S. nokomis*, *S. pinales* and *S. bisetosa*. Based on morphology, similarities in genitalia and Pitts *et al.* (2010), the *S. albicincta* species-group should be split into two separate groups. *Sphaerophthalma ignacio* should be placed in the newly designated *S. lamyrus* species-group along with *S. jacala*, which was previously placed in its own species group (Pitts and Parker, 2005), *S. lamyrus*, *S. pinales* and *S. bisetosa*. *Sphaerophthalma arota*, *S. coaequalis*, and *S. nokomis* should be placed into the *S. arota* species-group.

Sphaerophthalma macswaini Ferguson

Sphaerophthalma (Micromutilla) macswaini Ferguson, 1967. Brigham Young Univ. Sci. Bul., Biol. Ser. 8, no. 4: 12. Male. Holotype data: 2.1 mi NE Mercury, Nye Co., Nevada, 24.Aug.1964, W.E. Ferguson (NMNH).

Diagnosis of male. This species has distinctive tridentate mandibles that are deeply excised ventrally and the apex is vertical and greatly dilated, which is similar to species of *Acrophotopsis* and *Dilophotopsis*, but more so that other species at Deep Canyon. Additionally, the clypeus is distinctly elongate and projects anteriorly (Fig. 24) and the genitalia have a distinctively shaped curved cuspis that bears a large seta filled pit (Fig. 58). This species sometimes has weak mesosternal processes located anteromedially.

Female. Unknown.

Material examined. California, Riverside Co.: Deep Canyon, 1 male, 2.May.1963, 1 male, 4–6.May.1970, 1 male, 15.May.1969, 1 male, 15–18.May.1970, 2 males, 15–23.May.1970, 5 males, 22–23.May.2007, 15 males, 23–24.May.2007, 2 males, 1–4.Jun.1970, 1 male, 6–13.Jun.1969, 7 males, 13–18.Jun.1969, 5 males, 18–19.Jun.1969, 1 male, 27–28.Jun.1969, 1 male, 30.Jun.1964, 1 male, 29.Jun–

6.Jul.1973, 2 males, 5–13.Jul.1973, 4 males, 13–14.Jul.1969, 5 males, 30–31.Jul.2007, 2 males, 26.Jul–3.Aug.1969, 10 males, 3–7.Aug. 1969, 2 males, 7–9.Aug.1969, 2 males, 9–11.Aug.1969, 5 males, 10–12.Aug.1969, 3 males, 12–13.Aug.1969, 7 males, 16–17.Aug.1969, 3 males, 23–24.Aug.1969, 2 males, 26–28.Aug.1969, 1 male, 28–30.Aug.1969, 5 males, 26.Sep–6.Oct.1969, 2 males, 5–9.Oct.1969, 1 male, 6–8.Oct.1969, 1 male, 9.Oct.1963.

Distribution. Sonoran and Mojave Deserts.

Remarks. Pitts (2007) erroneously stated in the key to the nocturnal genera that the clypeus of *S. macswaini* covered the mandibles. The clypeus of this species is diagnostic. However, it is elongate and the extreme apex overlies the greatly dilated and deeply excised mandibles, but does not obscure them.

Sphaerophthalma mankelli Pitts, NEW SPECIES

Diagnosis of male. This species has distinctive bidentate mandibles (Fig. 44) that drastically taper towards their apices and are deeply excised ventrally. Also, this species lacks mesosternal and coxal processes, but has a very small marginal cell (Fig. 46: approximately 0.5X the length of the stigma), which is unusual for species having a relatively large body. The genitalia are distinctive as well (Fig. 67).

Description of male. *Coloration* (Figs 44, 45). Body testaceous; flagellum and legs stramineous; ocellular triangle infuscated. Body clothed with sparse, erect, brachyplumose, whitish setae. T1 lacking plumose fringe at distal margin. T2 and S2 with sparse fringe of whitish plumose setae. T3–5 and S3–5 each with sparser, less conspicuous fringe of whitish plumose setae. Setae tinged with yellow.

Head. Head distinctly rounded posteriorly. Mandible (Fig. 44) bidentate, deeply excised ventrally, angle of excision rounded; dorsal carina incomplete; apex oblique; mandible strongly tapered beyond excision, acuminate. Clypeus depressed slightly below margin of mandible, median area concave; surface of clypeus polished, almost impunctate, with few erect setae; apex truncate. F1 approximately 0.8X length of F2. Ocelli large in size, ocellular distance approximately 1.1X greatest width of lateral ocellus. Head only punctate at base of setae, punctures only slightly larger in width than base of setae; interstitial region glabrous; overall appearance glabrous.

Mesosoma. Sides and dorsum of pronotum coarsely punctate. Mesonotum mostly glabrous with some shallow punctures. Notaulus distinct, complete. Scutellum with small, confluent punctures. Axillae not projecting posteriorly. Dorsum and posterior face of propodeum conspicuously, shallowly reticulate, reticulations extending on to sides of propodeum, either remaining reticulate laterally or becoming coarse, punctate-reticulate. Anterolateral area of mesopleuron with moderate, shallow, separated punctures; remainder of mesopleuron with deeper, contiguous to reticulate; interstitial areas glabrous. Metapleuron polished. Mesosternal processes absent. Metasternum bidentate. Mid femur not swollen. Coxae unmodified. Marginal cell on costa extremely short, approximately 0.5X length of stigma (Fig. 46).

Metasoma. First metasomal segment elongate, petiolate (Fig. 45). Pygidium elongate and ovate, polished, not strongly margined; S2 with sternal felt line 0.3–0.5X length of tergal felt line. Hypopygium elongate and ovate. Genitalia (Fig. 67) with paramere acicular. Cuspis 0.5X free length of paramere; dorsoventrally flattened, spatulate, inner margin with lateral swelling at mid length; swelling with dense tuft of setae that coalesce into single point directed posteriorly.

Female. Unknown.

Length. 12 mm.

Material examined. Holotype: Deep Canyon, Riverside Co., 24.Dec.1963, at light, coll. E. Schlinger (UCRC).

Distribution. Only known from Deep Canyon.

Etymology. Named in honor of Henning Mankell (1948–present), who is a renowned Swedish crime writer that is best known for his detective novels involving Inspector Kurt Wallander.

Remarks. This species is placed into the *S. papaga* species-group based on similarities in mandibular morphology (i.e., the mandible is acuminate towards the apex) and genitalia. This species group currently

contains *S. papaga*, *S. subcarinata*, and *S. borealis*. The genitalia are similar to the first two species but differ from the latter. *Sphaerophthalma mankelli* can be separated from *S. papaga* and *S. subcarinata* by the lack of armature on the hind coxa, which the latter two species possess.

In Fig. 45, the black substance on the posterior portion of the metasoma of the specimen is some kind of oily substance that leaks out of older specimens; this portion of the metasoma is actually the same color as the remainder of the metasoma. The holotype also has dermestid damage, which has destroyed one side of the mesosternum and the mid and hind coxae on one side. Also, the holotype is missing one pair of wings.

Sphaerophthalma megagnathos Schuster

Sphaerophthalma (Photopsis) megagnathos megagnathos Schuster, 1958. Ent. Amer. (n. s.) 37: 36. Male. Holotype: Arizona, Ehrenberg, 27.Apr.1939, coll. F.H. Parker (UMSP).

Sphaerophthalma (Photopsis) megagnathos aurifera Schuster, 1958. Ent. Amer. (n. s.) 37: 36. Male. Holotype: Arizona, Tinajas Atlas Mountains, 1905, coll. W.J. McGee (UMSP).

Diagnosis of male. The male of this species can be recognized by mandibular morphology (Fig. 25; see Fig. 7 in Pitts, 2006). The mandibles are broadly dilated, especially the ventral portion apically, and is much wider distally than its width at the ventral angulation, the ventral basal tooth of the mandible is small, and the apex is vertical. Additionally, the head is long and parallel posteriorly, the clypeus is deeply depressed below the dorsal mandibular margin, the mesosternum lacks tubercles, the wings are yellowish-hyaline and a sternal felt line is absent. The genitalic morphology also is diagnostic (Fig. 59).

Female. Unknown.

Material examined. USA: California, Riverside Co.: Deep Canyon, 1 male, 19.May.1973, coll. M. Quillman, 1 male, 22–23.May.2007, 1 male, 23.Jul.1969.

Distribution. The western Sonoran and Mojave deserts.

Remarks. In some specimens the coloration of the setae is bright orange, although setal coloration varies from orange to white (see Fig. 29 in Pitts, 2006). The orangish specimens of *S. megagnathos* could easily be confused with *S. luiseno* or *S. contracta* based on coloration. They do not occur in Deep Canyon; *S. luiseno* has large projections bearing long, curved setae on the middle and hind coxae, while *S. contracta* has much smaller ocelli and different genitalic morphology (see Pitts *et al.* 2004).

Sphaerophthalma mendica (Blake)

Agama mendica Blake, 1871. Amer. Ent. Soc., Trans. 3: 259. Male. Holotype data: Nevada, type no. 4551 (ANSP).

Mutilla aspasia Blake, 1879. Amer. Ent. Soc., Trans. 7: 250. Female. Holotype data: Nevada, type no. 4574 (ANSP).

Photopsis nebulosus Blake, 1886. Amer. Ent. Soc., Trans. 13: 275. Male. Holotype data: Nevada, type no. 4549 (ANSP).

Diagnosis of male. The male of this species can be recognized by having mandibles that are weakly excised ventrally with a indistinct basal tooth and an apex that is tridentate and oblique (Fig. 26), the posterior margin of the head is quadrate, the mesosternum lacks processes, the second metasomal sternite has a distinct felt line, and the pygidium is granulate. The genitalia of this species (Fig. 60) are quite similar to those of *S. angulifera* (Fig. 53)

Diagnosis of female. The female of this species was diagnosed by Wilson and Pitts (2009).

Materials examined. California, Riverside Co.: Deep Canyon, 1 male, 2–5.Jun.2002, M.E. Irwin and F.D. Parker (EMUS), 1 male, 13.Jun.1963, 1 male, 11.Nov.1963.

Distribution. This species is widespread in the Mojave and Sonoran deserts. It is also present in the Great Basin Desert, the Colorado Plateau and the Snake River Plain.

Remarks. This species was recently resurrected from synonymy with *S. unicolor* (Wilson & Pitts 2009). This species occurs throughout the Coachella Valley and was referred to as *S. unicolor* in Pitts *et al.* (2009).

There is a wide array of integumental coloration in this species. Specimens range from nearly black integument to a more reddish-brown color characteristic of most nocturnal mutillids. Female integumental coloration has a similar range as the males. The setal coloration rarely varies among *S. mendica* specimens. Some individuals have pale orange setae on their mesosoma, but the majority has entirely white setae. All specimens have dense fringes of white plumose setae on the apical margins of the tergites. Only the light forms have been collected at Deep Canyon.

Sphaerophthalma pallida (Blake)

Agama pallida Blake, 1871. Amer. Ent. Soc., Trans. 3: 263. Male. Holotype data: Texas, type no. 4552 (ANSP).

Sphaerophthalma (Micromutilla) arizonae Schuster, 1958. Ent. Amer. (n. s.) 37: 16. Male. Holotype data: Tucson, Arizona, 5.Jun.1935, Bryant (UMSP).

Diagnosis of male. This small species can be recognized by the deeply excised mandibles that are oblique apically (Fig. 27), a marginal cell that is approximate the same length as the stigma, the mesosternum lacks processes, the first metasomal segment is sessile with the second, plumose setal fringes are absent on the metasoma, and the cuspis of the genitalia is very short just barely surpassing the free length of the penis valve (Fig. 61).

Female. Unknown.

Material examined. California, Riverside Co., Deep Canyon: 1 male, 4.May.1974, 1 male, 4–6.May.1970, 2 males, 15–23.May.1970, 5 males, 16.May.1963, 1 male, 1–4.Jun.1970, 2 males, 6–13.Jun.1969, 1 male, 13–18.Jun.1969, 1 male, 27–28.Jun.1969, 1 male, 20.Jun–1.Jul.1969, 1 male, 13–14.Jul.1969, 1 male, 7–9.Aug.1969, 1 male, 30.Aug–7.Sep.1973, 2 males, 11.Sep.1969, 1 male, 25.Sep.1969.

Distribution. Widespread throughout the Southwest from Texas and Oklahoma to Mojave and Sonoran deserts.

Remarks. Ferguson (1967) synonymized *S. pallida* and *S. arizonae*. We agree with this conclusion. This species could be confused with *S. difficilis* from which it can be separated by differences in the length of the genitalic cuspis. In *S. pallida* the cuspis (Fig. 61) barely surpasses the penis valve while in *S. difficilis* the cuspis is elongate (see Fig. 3 in Pitts *et al.* 2009).

Sphaerophthalma sublobata Schuster

Sphaerophthalma (Micromutilla) sublobata Schuster, 1958. Ent. Amer. (n. s.) 37: 16. Male. Holotype data: Mt. Home, Idaho, 7.Jul.1951, J. Nottingham (SEMC).

Diagnosis of male. This small species can be recognized by the weakly excised mandibles that are oblique apically (Fig. 28), a marginal cell that is approximately 0.75X the length of the stigma, the mesosternum lacks processes, the first metasomal segment is sessile with the second, plumose setal fringes are present on the metasoma, the hind coxa has large lobes, the pygidium glabrous, and the cuspis of the genitalia is thickened, densely setose, and long being approximately 0.75X the free length of the paramere (Fig. 62).

Female. Unknown.

Material examined. California, Riverside Co., Deep Canyon: 3 males, 13Apr.1969, 1 male, 15.May.1969, 3 males, 18.May.1969, 2 males, 21–29.May.1973, 2 males, 27.May–1.Jun.1970, 1 male, 4–12.Jun.1973, 1 male, 6–13.Jun.1969, 10 males, 13–18.Jun.1969, 1 male, 1–2.Jul.1969, 1 male, 2–3.Jul.1969, 1 male, 10–12.Jul.1969, 1 male, 19–21.Jul.1969, 1 male, 30.Sep–3.Oct.1973.

Distribution. Snake River Valley and Great Basin, Mojave and western Sonoran deserts.

Remarks. Schuster designated a holotype from Mt. Home, Idaho. He also designated a holotype from Ehrenberg, Arizona located in UMSP. This second holotype is not conspecific with the first holotype and does not match the characters Schuster (1958) listed for this species in his key.

This species has been rarely collected and, although no specimens currently exist from these regions, it is presumed to be found in the Great Basin and Mojave deserts, given that it has been found in Idaho and southern California.

This species is placed into the *S. noctivaga* species-group that also contains *S. brachyptera*, *S. chandleri*, *S. noctivaga*, and *S. yumaella*.

***Sphaerophthalma tetracuspis* Schuster**

Sphaerophthalma (Photopsis) tetracuspis Schuster, 1958. Ent. Amer. (n. s.) 37: 31. Male. Holotype data: San Fernando, Lower California, Mexico, 31.Jul.1938, Michelbacher and Ross (CASC).

Diagnosis of male. It can be recognized by having mandibles that are weakly excised ventrally with an indistinct basal tooth and an apex that is tetridentate and oblique (Fig. 29) and is similar in shape to that of *S. mendica* (Fig. 55), the posterior margin of the head is quadrate, the mesosternal lacks processes, the second metasomal sternite has a distinct felt line, and the pygidium is granulate. The genitalia (Fig. 63) are similar to those of *S. angulifera* (Fig. 53) and *S. mendica* (Fig. 60).

Female. Unknown.

Material examined. California, Riverside Co., Deep Canyon: 2 males, 13.May.1963, 1 male, 16.May.1963, 1 male, 24.May.1963, coll. M. Irwin.

Distribution. The western Sonoran Desert into Baja California, Mexico.

Remarks. This species is in the *S. unicolor* species-group along with *S. angulifera*, *S. mendica*, *S. pinalea*, *S. subtriangularis* and *S. unicolor*.

This species is similar to *S. mendica* and differences in their genitalia are difficult to distinguish, although the cuspis of *S. tetracuspis* seems to be longer. Besides the differences in the mandibles of these two species, the clypeus of *S. tetracuspis* is distinctive, the posterior portion pushed forward and the anterior portion shortened. Laterally the clypeus looks curved almost in a 'C' shape. The clypeus of the other members of this group is flat anteriorly and gently curved posteriorly.

***Sphaerophthalma triangularis* (Blake)**

Agama triangularis Blake, 1871. Amer. Ent. Soc., Trans. 3: 262. Male. Holotype data: Nevada (ANSP).

Diagnosis of male. The male of this species is easily recognized by the triangular shaped posterior margin of the head, the weakly excised mandibles that are oblique apically (Fig. 30), the lack of mesosternal processes, the lobe-like projections on the hind coxae, and the triangulate posterior projection of the apex of the hind tibia. The genitalia are illustrated by Pitts *et al.* (2009) in Fig. 26.

Diagnosis of female. The female of this species was described in Pitts *et al.* (2009).

Material examined. California, Imperial Co.: Algodones dunes 7 mi. SE Glamis, 32°55'20"N 114°59'14"W, 1 female, 19.Mar.1979–24.Mar.1979 (CDFA).

Distribution. Southwestern USA.

Remarks. *Sphaerophthalma triangularis* is widespread and not endemic to Deep Canyon. This species previously placed in its own species-group and was moved to Schuster's *S. rustica* species-group by Pitts *et al.* (2009). Given that the addition of this species-group differs from that of Schuster (1958) with the addition of *S. triangularis* and exclusion of *S. pluto* and *S. juxta*, we chose to rename this the *S. unicolor* species-group. This species-group is further discussed in the remarks section of *S. tetracuspis*.

Sphaerophthalma yumaella Schuster

Sphaerophthalma (Micromutilla) yumaella Schuster, 1958. Ent. Amer. 37: 19. Male. Holotype data: Wellton, Yuma Co., Arizona (CUIC).

Diagnosis of male. This species is recognized by the strongly excised mandible (Fig. 31), the lack of mesosternal processes, the marginal cell that is shorter than the stigma, the first segment of the metasoma that is sessile with the second segment, and the genitalia that have a long thick cylindrical cuspis that tapers apically and has a large basal pit on the internal margin (see Pitts *et al.* 2009: Fig. 6).

Female. Unknown, but see Pitts *et al.* (2009).

Material examined. California, Riverside Co., Deep Canyon: 1 male, 5–17.Apr.1970, 4 males, 2.May.1963, 1 male, 15.May.1969, 1 male, 15–23.May.1970, 1 male, 16.May.1962, 4 males, 16.May.1963, 1 male, 18.May.1969, 1 male, 19.May.1973, 28 males, 22–23.May.2007, 1 male, 24.May.1969, 1 male, 5–13.Jun.1973, 3 males, 6–13.Jun.1969, 1 male, 13.Jun.1963, 2 male, 20.Jun.1963, 2 males, 13–18.Jun.1969, 1 male, 18–19.Jun.1969, 1 male, 24–26.Jun.1969, 1 male, 30.Jun.1964, 1 male, 29.Jun–6.Jul.1973, 2 males, 3–7.Jul.1969, 4 males, 7.Jul.1964, 3 males, 10.Jul.1963, 3 males, 10–12.Jul.1969, 1 male, 11–13.Jul.1969, 1 male, 13–20.Jul.1973, 1 male, 19–21.Jul.1969, 2 males, 23.Jul.1969, 1 male, 23–24.Jul.1969, 12 males, 30–31.Jul.2007, 1 male, 4–5.Aug.1969, 4 males, 5–7.Aug.1969, 1 male, 5–9.Sep.1969, 2 males, 9–11.Aug.1969, 3 males, 16–17.Aug.1969, 1 male, 24.Aug.1969, 2 males, 25–26.Aug.1969, 1 male, 11.Sep.1969, 2 males, 23.Sep.1963, 1 male, 25.Sep.1969, 5 males, 26.Sep–6.Oct.1969, 3 males, 6–8.Sep.1969, 1 male, 9.Oct.1963, 1 male, 11.Nov.1963, 1 male, 10–22.Dec.1969.

Distribution. Mojave Desert from Southern Nevada southward throughout the Sonoran Desert of Arizona and southern California into Baja California, Mexico.

Remarks. This species is widespread and not endemic to Deep Canyon. This species is placed into the *S. noctivaga* species-group that also contains *S. brachyptera*, *S. chandleri*, *sp. nov.*, *S. noctivaga*, and *S. yumaella*.

Key to the male nocturnal mutillids of Deep Canyon

1. Integument from black to ferruginous; axillae spinose or triangulate Diurnal Mutillidae
- Integument from brown to testaceous; axillae indistinct 2
2. Mesosternum with large glabrous longitudinal swellings located on either side of the midline
..... *Odontophotopsis mamata* Schuster
- Mesosternum with spine-like processes, ridges or lacking processes 3
3. Metasoma with dense fringes of plumose setae along apical margins of terga (Fig. 33), AND mesosternum impunctate and concave medially, AND mesosternum lacking anterior mesosternal processes, AND hind coxae with longitudinal setose carinae *Odontophotopsis hammetti* Pitts, **sp. nov.**
- Metasoma without dense fringes of plumose setae along apical margins of terga OR mesosternum punctate and convex medially OR mesosternal processes present OR hind coxae without longitudinal setose carinae 4
4. Hind coxae with lobes or denticles 5
- Hind coxae unmodified 9
5. Hind coxae with denticles 6
- Hind coxae with lobes 7
6. Mandibular apex vertical; clypeus with apex not thickened (Fig. 20) *Sphaerophthlamma blakeii* (Fox)
- Mandibular apex horizontal; clypeus with apex thickened (Fig. 41) *Sphaerophthlamma fergusonii* Pitts, **sp. nov.**
7. Hind tibia with lateral expansion; marginal cell longer than stigma as measured along costal vein
..... *Sphaerophthalma triangularis* (Blake)
- Hind tibia without lateral expansion; marginal cell shorter (approximately 0.75X) than stigma as measured along costal vein 8
8. Pygidium granulate *Sphaerophthalma chandleri* Pitts, **sp. nov.**
- Pygidium glabrous *Sphaerophthalma sublobata* Schuster
9. Clypeus elongate; mandible greatly dilated apically and ventrally excised (Fig. 24)
..... *Sphaerophthalma macswaini* Ferguson

-.	Clypeus not elongate; mandible moderately dilated to not dilated apically	10
10.	Hypopygidium flattened; lateral margins with longitudinal carinae basally	11
-.	Hypopygidium convex; lateral margins without longitudinal carinae.....	12
11.	Mesososternum without processes	<i>Acrophotopsis campylognatha</i> Schuster
-.	Mesososternum with rounded, conical processes (Fig. 51).....	<i>Dilophotopsis paron</i> (Cameron)
12.	Mesososternum armed with spines or ridges	13
-.	Mesososternum unarmed, lacking spines or ridges	24
13.	Mandible quadridentate, with three apical teeth and a fourth tooth along internal margin that overhangs clypeus (Fig. 1); cuspis of genitalia knobbed apically (Fig. 49)	<i>Acanthophotopsis falciformis</i> Schuster
-.	Mandible apex bidentate, tridentate, or quadridentate, but without a fourth tooth along internal margin that overhangs clypeus; cuspis of genitalia tapering apically	14
14.	Mandible greatly dilated with large dorsal tooth separated from other teeth by a deep, wide sinus (Figs 7, 14)	15
-.	Mandible moderately dilated or not dilated, but without a deep, wide sinus (e.g., Figs 8–12).....	16
15.	Clypeus with dense, short, even-length brush of stiff, subclavate setae; clypeus without horseshoe-shaped tubercle posteromedially process; mandibles quadridentate distally (Fig. 14).....	<i>Odontophotopsis setifera</i> Schuster
-.	Clypeus virtually glabrous; clypeus with horseshoe-shaped tubercle posteromedially that overhangs the clypeus as a slight hood-like or nasutiform process; mandibles tridentate distally (Fig. 7)	<i>Odontophotopsis biramosa</i> Schuster
16.	Ventral margin of mandible with deep excision subtended by a large rounded tooth	17
-.	Ventral margin of mandible with weak excision subtended by angulation or small rounded tooth	22
17.	Pygidium granulate; mesosternal processes bifid.....	<i>Odontophotopsis bellona</i> Mickel
-.	Pygidium glabrous; mesosternum with either only a single tooth on each side of the midline, or with two teeth on each side of the midline separated by a distance greater than their height and forming a square	18
18.	Marginal cell approximately 0.5X length of stigma; mesosternum with two teeth on each side of the midline separated by a distance greater than their height and forming a square.....	<i>Odontophotopsis quadrispinosa</i> Schuster
-.	Marginal cell approximately equal to or longer than, the length of stigma; mesosternum with only a single tooth on each side of the midline	19
19.	Clypeus posteromedially tuberculate (Fig. 4).....	<i>Odontophotopsis armata</i> Mickel
-.	Clypeus lacking posteromedial tubercle	20
20.	Second sternite lacking a felt line	<i>Odontophotopsis serca</i> Viereck
-.	Second sternite with a felt line	21
21.	Posterior margin of head quadrate; clypeus depressed below dorsal margin of mandible, appearing concave (Fig. 11) ...	<i>Odontophotopsis melicausa</i> (Blake)
-.	Posterior margin of head rounded; clypeus level with dorsal margin of mandible or slightly below it (Fig. 8)	<i>Odontophotopsis clypeata</i> Schuster
22.	Mandible broadly dilated apical to ventral excision (Fig. 9); metasternum tridentate; sternal felt lines absent; head with posterior margin quadrate	<i>Odontophotopsis inconspicua</i> (Blake)
-.	Mandible parallel to slightly dilated apical to ventral excision; metasternum bidentate; sternal felt lines present; head with posterior margin rounded	23
23.	Mesosternal processes tall and conspicuous; distal third of mandible dilated (Fig. 3)	<i>Odontophotopsis acmaea</i> Viereck
-.	Mesosternal processes low and indistinct; distal third of mandible attenuated (Fig. 5).....	<i>Odontophotopsis aufidia</i> Mickel
24.	Second sternite lacking felt line	25
-.	Second sternite with distinct felt line.....	28
25.	Cuspis of the genitalia spatulate, apex with ventral setae bearing plumose tips	26
-.	Cuspis of the genitalia cylindrical, apex with simple setae	27
26.	Marginal cell equal to only slightly longer than stigma	<i>Sphaerophthalma amphion</i> (Fox)
-.	Marginal cell at least 1.5X longer than stigma	<i>Sphaerophthalma ignacio</i> Schuster
27.	Clypeus lacking medial raised area or longitudinal carina posteriorly; mandibles broadly dilated, especially ventral portion apically, distally much wider than width at ventral angulation, apex vertical (Fig. 25, also see Pitts 2006: Fig. 7); clypeus deeply depressed below mandibular rims; parameres lacking inward directed setae along ventral margin at base of paramere (see Pitts 2006: Fig. 19); head quadrate posteriorly	<i>Sphaerophthalma megagnathos</i> Schuster
-.	Clypeus with medial raised area or longitudinal carina present posteriorly; mandibles not dilated apically, apex oblique (Fig. 18); clypeus not depressed below mandibular rims; parameres with inward directed setae along ventral margin at base of paramere; head rounded posteriorly	<i>Sphaerophthalma arota</i> (Cresson)
28.	Marginal cell longer than stigma as measured along costal margin	29
-.	Marginal cell is equal to or shorter than stigma as measured along costal margin	32
29.	Mandibles deeply excised ventrally; apex of mandible vertical (Fig. 22); cuspis of genitalia slightly spatulate with plumose tipped setae located ventrally at apex (Fig. 56)	<i>Sphaerophthalma ferruginea</i> (Blake)

- . Mandibles weakly excised ventrally; apex of mandible oblique; cuspis of genitalia cylindrical bearing simple setae 30
- 30. Pygidium granulate; dorsal carina of mandible does not form a lamella or tooth (Figs 26, 29, 55) 31
- . Pygidium glabrous; dorsal carina of mandible forms a lamella terminating at mid length of mandible in an angulate tooth (Figs 16, 54) *Sphaerophthalma angulifera* Schuster
- 31. Mandibular apex tridentate (Figs 26, 55)..... *Sphaerophthalma mendica* (Blake)
- . Mandibular apex quadridentate (Fig. 29) *Sphaerophthalma tetracuspis* Schuster
- 32. Angle formed by ventral mandibular excision (obtuse) greater than 90 degrees (Fig. 19); cuspis of genitalia approximately 0.5X free length of paramere *Sphaerophthalma becki* Ferguson
- . Angle formed by ventral mandibular excision (acute) less than 90 degrees; cuspis of genitalia much longer or much shorter 33
- 33. Mandible acuminate towards apex; apex bidentate (Fig. 44) *Sphaerophthalma mankelli* Pitts, **sp. nov.**
- . Mandible dilated or parallel towards apex; apex tridentate 34
- 34. Metasoma lacking fringes made of plumose setae; cuspis of genitalia in lateral view slightly surpassing the apex of the penal valve (cuspis less than 0.25X the free length of the paramere; Fig. 61) ... *Sphaerophthalma pallida* (Blake)
- . Metasoma with fringes of plumose setae; cuspis of genitalia in lateral view greatly surpassing the apex of the penal valve (cuspis approximately 0.75X the free length of the paramere) 35
- 35. First segment of metasoma sessile with second segment; setae of cuspis of similar length throughout (Fig. 6 of Pitts *et al.* 2009) *Sphaerophthalma yumaella* Schuster
- . First segment of metasoma petiolate with second segment; apex of cuspis with a ventral tuft of setae that is longer than at the base of the cuspis (Fig. 4 of Pitts *et al.* 2009) *Sphaerophthalma difficilis* (Blake)

The *Sphaerophthalma fergusonii* species-group

Diagnosis. Members of this species-group can be recognized by mandibular morphology in which the apex of the mandible is tridentate and almost horizontal, and the ventral margin is not excised and has a weak angulate tooth. This species group also has the apical margin of the clypeus thickened and for one species dorsally bent forming a flange. Lastly, the genitalia are distinctive with the cuspis being elongate, cylindrical basally but spatulate apically, the dorsal face has a central longitudinal swelling, while the ventral face is slightly concave, and the inner margin has a deep ventral notch anterior to spatulate area making the apex of the cuspis appear mitten-shaped when viewed dorsally.

Included species. *Sphaerophthalma arnalduri* Pitts and *S. fergusonii* Pitts.

Remarks. Due to the quadrate condition of the head, the weak tooth on the ventral margin of the mandible, the fact that one species has dentate hind coxae, and similarities in genitalia, this species-group is likely most closely related to *S. blakeii* and *S. cexyoides*.

Sphaerophthalma arnalduri Pitts, NEW SPECIES

Diagnosis of male. The male of this species can be recognized by the clypeus, which is thickened and upturned apically (Figs 34, 35), by the genitalic characters (Fig. 63) that it shares only with *S. fergusonii*, **sp. nov.**, and fact that it is apterous (Fig. 36, 37). Apterous in this case includes complete fusion of the mesosoma (Fig. 36), except for the pronotum, such that scutellum is unrecognizable and the tegulae are absent.

Description of male. *Coloration* (Figs 34–37). Body testaceous; flagellum and legs slightly lighter than the body. Body clothed with sparse, erect, brachyplumose, whitish-orange-brown setae. T1 with sparse plumose fringe at distal margin. T2 and S2 with sparse fringe of whitish plumose setae. T3–5 and S3–5 each without conspicuous fringe of whitish plumose setae.

Head. Head distinctly quadrate and elongate posteriorly (Fig. 34). Mandible tridentate (Fig. 35), with very weak angulate ventral tooth, lacking excision apical to ventral tooth; dorsal carina incomplete, appearing on slightly lamellate; apex oblique; mandible parallel beyond excision in frontal view. Clypeus not depressed below margin of mandible, median area concave; surface of clypeus polished, almost impunctate, with few erect setae; apex truncate, greatly thickened and dorsally bent (Figs 34, 35). F1 approximately 0.75X length of

F2. Ocelli miniscule in size (Fig. 34), ocellocular distance approximately 4X or greater than greatest width of lateral ocellus. Head coarsely punctate.

Mesosoma. Mesothorax, metathorax and propodeum fused (Fig. 36). Dorsum of mesosoma coarsely punctate (Fig. 36), Notaulus absent. Scutellum and axillae indiscernible (Fig. 36). Dorsum of propodeal area coarsely punctate becoming conspicuously, shallow reticulate, reticulations extending on to sides of propodeum posteriorly. Anterolateral area of mesopleuron with moderate, shallow, separated punctures; remainder of mesopleuron with deeper, contiguous to confluent punctures; interstitial areas glabrous. Metapleuron polished. Mesosternal processes absent. Metasternum bidentate. Mid femur not swollen. Apterous (Figs 36, 37).

Metasoma. First metasomal segment sessile (Fig. 37). Pygidium quadrate, polished, not strongly margined; S2 with sternal felt line 0.3–0.5X length of tergal felt line. Hypopygium quadrate. Genitalia (Fig. 65) with paramere acicular, only extreme apex curving dorsally; cuspis elongate, >0.9X free length of paramere, and cylindrical basally, dorsal face with central longitudinal swelling, apex spatulate, ventral face slightly concave, with basal pit, inner margin with deep ventral notch anterior to spatulate area.

Length. 10–14.5 mm.

Female. Unknown.

Material examined. Holotype: **California**, *Inyo Co.*, Owens Lake Valley, mid May–mid June, coll. Andrews and Hardy (CDFA). Paratypes: **California**, *Inyo Co.*, Owens Lake Valley: 3 males, mid May–mid June, coll. Andrews, Hardy and Giuliani; 5 males, Jun–Jul, coll. Andrews, Hardy and Giuliani; 3 males, mid Jul–mid Aug, coll. Andrews, Hardy and Giuliani (CDFA; EMUS).

Distribution. Known only from Owens Lake Valley.

Etymology. Named after Arnaldur Indriðason (1961 to present) who is an Icelandic writer of crime fiction and is currently best known for his detective novels involving Detective Erlender Sveinsson.

Remarks. This species belongs in the new *S. fergusonii* species-group (described above), which also includes *S. fergusonii*, **sp. nov.**, described earlier in this paper. The defining characteristics of this species-group are given in the remarks section for *S. fergusonii*.

Similarity of the nocturnal mutillid fauna at Deep Canyon and the Algodones Sand Dunes

The Algodones Sand Dunes, the largest dune system in North America, are located in Imperial County, California at the southern end of the Coachella Valley and extending southwards into northern Mexico. The system covers more than 250 square miles. The Algodones Sand Dunes are approximately 90 miles from Deep Canyon. Given the size and uniqueness of the Algodones Sand Dunes, one may expect that there would be a high degree of endemism and a unique dune fauna. Of the 29 nocturnal mutillid species (Table 1) that have been collected at the Algodones Sand Dunes thus far (Pitts *et al.* 2009), only one species, *Sphaerophthalma django*, is thought to be endemic. All of the other species have wide distributions and have been collected at many sites, most of which are not sand dunes.

Deep Canyon (Table 1), on the other hand, seems to have a more species-rich nocturnal fauna. This is based in the fact that only limited collecting at Deep Canyon has revealed 34 species, while the Algodones Sand Dunes data are based on a large number of specimens derived from many years of collecting by multiple collectors and on over one year's worth of continuous collecting by UCDC. Deep Canyon shares only 15 species with the Algodones Sand Dunes (Sørensen's similarity = 0.485). *Odontophotopsis hammetti*, **sp. nov.**, and *S. mankelli*, **sp. nov.**, are known only from Deep Canyon. However, it is unlikely that these species are actually endemic to Deep Canyon. Their distribution are likely similar to that *S. chandleri*, **sp. nov.**, and *S. fergusonii*, **sp. nov.**, which have been collected in various canyons in southern California, and these species are likely endemic to the canyons around the Coachella Valley.

TABLE 1. List of the velvet ant species collected at each site. X means present.

Species	Deep Canyon	Glamis	Species	Deep Canyon	Glamis
<i>Acrophotopsis campylognatha</i>	X	-	<i>Sphaerophthalma angulifera</i>	X	-
<i>Dilophotopsis paron</i>	X	-	<i>Sphaerophthalma arota</i>	X	X
<i>Odontophotopsis acmaea</i>	X	X	<i>Sphaerophthalma becki</i>	X	X
<i>Odontophotopsis arcuata</i>	-	X	<i>Sphaerophthalma blakeii</i>	X	X
<i>Odontophotopsis armata</i>	X	-	<i>Sphaerophthalma chandleri</i> , sp. nov.	X	-
<i>Odontophotopsis aufidia</i>	X	X	<i>Sphaerophthalma difficilis</i>	X	X
<i>Odontophotopsis bellona</i>	X	-	<i>Sphaerophthalma django</i>	-	X
<i>Odontophotopsis biramosa</i>	-	X	<i>Sphaerophthalma ecarinata</i>	-	X
<i>Odontophotopsis clypeata</i>	X	X	<i>Sphaerophthalma fergusonii</i> , sp. nov.	X	-
<i>Odontophotopsis hammetti</i> , sp. nov.	X	-	<i>Sphaerophthalma ferruginea</i>	X	-
<i>Odontophotopsis inconspicua</i>	X	X	<i>Sphaerophthalma ignacio</i>	X	-
<i>Odontophotopsis mamata</i>	X	-	<i>Sphaerophthalma macswaini</i>	X	X
<i>Odontophotopsis melicausa</i>	X	X	<i>Sphaerophthalma mankelli</i> , sp. nov.	X	-
<i>Odontophotopsis obscura</i>	-	X	<i>Sphaerophthalma marpesia</i>	-	X
<i>Odontophotopsis quadrispinosa</i>	X	X	<i>Sphaerophthalma megagnathos</i>	X	X
<i>Odontophotopsis serca</i>	X	-	<i>Sphaerophthalma mendica</i>	X	X
<i>Odontophotopsis setifera</i>	X	-	<i>Sphaerophthalma mesillensis</i>	-	X
<i>Odontophotopsis sonora</i>	-	X	<i>Sphaerophthalma militaris</i>	-	X
<i>Odontophotopsis unicornis</i>	-	X	<i>Sphaerophthalma pallida</i>	X	-
<i>Odontophotopsis villosa</i>	-	X	<i>Sphaerophthalma sublobata</i>	X	-
<i>Photomorphus bicolor</i>	-	X	<i>Sphaerophthalma tetracuspis</i>	X	-
<i>Photomorphus clandestina</i>	-	X	<i>Sphaerophthalma triangularis</i>	X	X
<i>Sphaerophthalma acontia</i>	-	X	<i>Sphaerophthalma yumaella</i>	X	X

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