

## A Review of the *Sphaerophthalma uro* Species-group (Hymenoptera: Mutillidae), with Taxonomic Changes

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**ABSTRACT:** The subgenera *Micromutilla* Ashmead, 1899, *Photopsioides* Schuster, 1958, *Photopsis* Blake, 1886, *Physetapsis* Schuster, 1958, and *Xenophotopsis* Schuster, 1958 are junior synonyms of *Sphaerophthalma* Blake 1871. The single species previously placed in the subgenus *Xenophotopsis* is placed into the *Sphaerophthalma orestes* species-group. Species previously placed in the subgenus *Physetapsis* are placed into the *Sphaerophthalma clara* species-group. Species previously placed in the subgenera *Sphaerophthalma* and *Photopsioides* are placed into the *Sphaerophthalma pensylvanica* species-group and *Sphaerophthalma uro* species-group, respectively. A review of the males of *Sphaerophthalma uro* species-group is given. The females of *Sphaerophthalma abdominalis* (Blake) and *S. amphion* (Fox) are described. Forty-seven new host records and current distributional data are presented for the species of the *Sphaerophthalma uro* species-group. A key and illustrations are given for the males and known females of the *Sphaerophthalma uro* species-group.

**KEY WORDS:** Sphaerophthalminae, wasp, velvet ant

The family Mutillidae (Hymenoptera) is found worldwide, but is predominantly tropical, and contains over 8000 species in 230 genera (Brothers, 1975). Velvet ant species are most commonly collected in open, sandy areas. Because the family is parasitic, and dependent upon other species for survival, velvet ants are usually found in areas where their hosts are abundant. This is particularly true of host nesting areas (Evans and Eberhard, 1970). For at least some species of hosts, it has been found that the preferred nesting areas are relatively permanent dunes, devoid of much vegetation (Bohart and MacSwain, 1939; Ferguson, 1963). In these areas many genera, such as *Sphaerophthalma*, can be found.

The males of *Sphaerophthalma* are nocturnal and readily collected with light-traps. Little more is known about the natural history of *Sphaerophthalma* species, other than host records, although some life history information is known for *Sphaerophthalma blakeii* (Fox), *S. orestes* (Fox), and *S. unicolor* (Cresson) (Ferguson, 1962). Most of the females of *Sphaerophthalma* are unknown, but are presumed to be active only at night along with males (Ferguson, 1963). Currently, *Sphaerophthalma* has 66 spp. known from males only, 20 spp. known from females only, and 5 spp. known from both sexes.

Schuster (1958) split *Sphaerophthalma* into six subgenera—*Micromutilla* Ashmead, *Photopsioides* Schuster, *Photopsis* Blake, *Physetapsis* Schuster, *Sphaerophthalma* Blake, and *Xenophotopsis* Schuster—based on male characteristics. The subgenus *Photopsioides* was described to include several species of Nearctic nocturnal wasps, namely *Photopsis abdominalis* Blake, *Mutilla amphion amphion* Fox, *Photopsis amphion abstrusa* Baker, *Agama contract* Blake, *Agama uro uro* Blake and *Photopsis uro melanderi* Baker. Schuster also placed two newly described subspecies, *S. amphion ignacio* and *S. uro stenognatha*, into *Photopsioides*.

Subsequent work with *Photopsioides* species has shown that all of the subspecies were dubious or were valid species belonging to another subgenus. Ferguson (1967) synonymized *S. amphion amphion* and *S. amphion abstrusa*. Krombein (1967, 1979)

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synonymized *S. uro uro*, *S. uro melanderi*, and *S. uro stenognatha*. Mickel transferred *S. amphion ignacio* as the species *S. ignacio* to the subgenus *Photopsis* based on wing venation and morphology of the genitalia, which is very similar to *S. (Photopsis) bisetosa* Schuster (Krombein, 1979; Mickel, unpubl. notes).

Until Pitts and Manley (2002) described the female of *S. uro*, this subgenus was known only from males. Material acquired by F.D. Parker over the last 30 years from rearing wasps from twig and trap nests has provided clear association of two more of the females, *S. abdominalis* and *S. amphion*, with their male counterparts. These females are described, illustrated and discussed below.

Lastly, it is evident that some characters, such as those of the male mouthparts and genitalia, have been overlooked or ignored by previous authors. In order to help identify males of these commonly collected, but notoriously difficult species, a review is given for the males of *S. (Photopsioides)*. Comparison of these characters with the other *Sphaerophthalma* subgenera has led to the taxonomic changes discussed below.

### Materials and Methods

We have used the term “simple pubescence” for setae that are smooth and do not have barbed surfaces. “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. “Plumose pubescence” is used for setae that have longer barbs. We have used the abbreviations T2, T3, etc., to denote the second, third, etc., metasomal tergites while S2, S3, etc., denote the second, third, etc., metasomal sternites. Lastly, punctures can sometimes be elongate and their posterior edge indistinct. We have used the term “puncture width” to indicate the transverse measurement of the width of a puncture. At times, this measure equals the diameter. This is the only way to accurately and reproducibly measure an elongate puncture.

Only new locality data are reported in detail. For completeness, the state of previously published locality data is also presented. Many of the new locality records were obtained from specimens reared from hosts. In the early spring, stick traps and blocks were placed throughout the Southwestern United States over a period of 30 years, resulting in over 100,000 nests of many bee and wasp species. The traps were collected in late fall and winter, and brought into the laboratory (see Parker and Bohart, 1966 for details). Each nest was X-rayed, then opened and all cells were placed into an individual gelatin capsule and labeled according to site, nest number and position in the nest. All specimens were then reared to adulthood and identified. This enabled us to associate any mutillid with its host, either by directly identifying an adult host from the same nest or by identifying the cocoon or puparium from which the mutillid was reared. F.D. Parker collected and reared the material unless otherwise noted.

Host records from Parker and Bohart (1966) and Krombein (1979) are given along with new host records. Matthews (1997) has reported that the sexes of *Sphaerophthalma pensylvanica* (Lepeletier) develop on different hosts as larvae; only males are reared from *Trypoxylon politum* (Say). The host(s) of the females is unknown. Matthews (1997) stated that this could arise either by obligatory heteronymous heterotrophy, differential mortality, or facultative size-dependant sex allocation. A similar situation may occur for *Photopsioides* species as well, for at least some hosts. In order to help with future investigations along these lines, the sexes and numbers of *Photopsioides* specimens reared from each host are noted after the host's name.

All reared specimens are deposited into the USDA-ARS Bee Biology and Systematics Laboratory Collection (BBSL) in Logan, UT.

### *Sphaerophthalma* Blake

*Sphaerophthalma* Blake, 1871. Trans. Amer. Ent. Soc. 3: 232. Type species. *Mutilla* (*Sphaerophthalma*) *scaeva* Blake. Automatic designation by Ashmead, 1899 (= *Sphaerophthalma pensylvanica scaeva* (Blake)).

*Agama* Blake, 1871. Trans. Amer. Ent. Soc. 3: 258. Preoccupied. Type species. *Agama imperialis* Blake. Automatic designation by Ashmead, 1899. **NEW SYNONYMY.**

*Photopsis* Blake, 1886. Trans. Amer. Ent. Soc. 13: 179. New Name. Type species. *Agama imperialis* Blake. Automatic designation by Ashmead, 1899. **NEW SYNONYMY.**

*Sphaerophthalma* (!) Blake, 1886. Trans. Amer. Ent. Soc. 13: 179. Type species. *Mutilla* (*Sphaerophthalma*) *scaeva* Blake. Designation by Ashmead, 1899 (= *Sphaerophthalma pensylvanica scaeva* (Blake)).

*Pyrrhomutilla* Ashmead, 1899. Jour. N. Y. Ent. Soc. 7: 56. Type species. *Sphaerophthalma* (!) *anthophorae* Ashmead. Original designation. **NEW SYNONYMY.**

*Micromutilla* Ashmead, 1899. Jour. N. Y. Ent. Soc. 7: 59. Type species. *Photopsis nanus* Ashmead. Original designation. **NEW SYNONYMY.**

*Neophotopsis* Ashmead, 1903. Canad. Ent. 35: 306. Type species. *Mutilla pluto* Fox. Original designation. **NEW SYNONYMY.**

*Sphaerophthalma* subgen. *Xenophotopsis* Schuster, 1958. Ent. Amer. (n. s.) 37: 9 (in key), 14. Type species. *Sphaerophthalma* (*Xenophotopsis*) *isolatrix* Schuster. Original designation. **NEW SYNONYMY.**

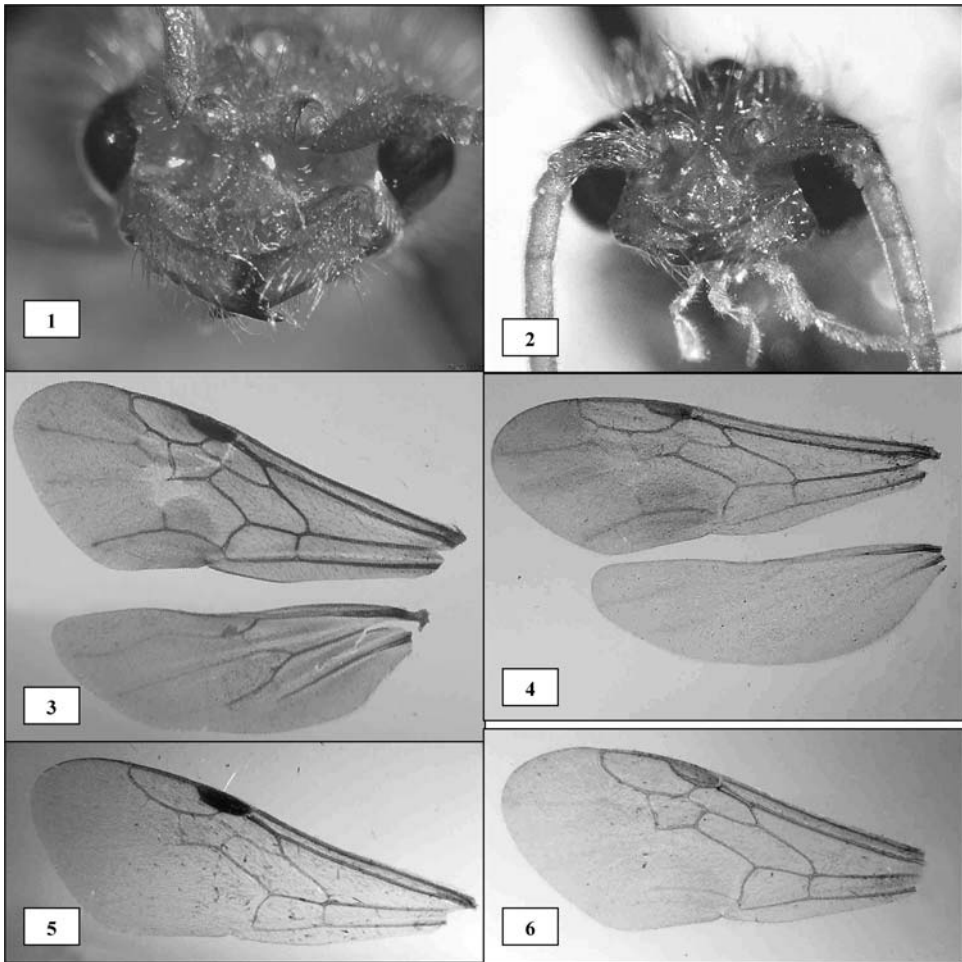
*Sphaerophthalma* subgen. *Physetapsis* Schuster, 1958. Ent. Amer. (n. s.) 37: 9 (in key), 20. Type species. *Sphaerophthalma* (*Physetapsis*) *papaga* Schuster. Original designation. **NEW SYNONYMY.**

*Sphaerophthalma* subgen. *Photopsioides* Schuster, 1958. Ent. Amer. (n. s.) 37: 10 (in key), 36. Type species. *Agama uro* Blake. Original designation. **NEW SYNONYMY.**

*Comments.* Comparison of characters used by Schuster to define the *Sphaerophthalma* subgenera has led to several conclusions. The subgenus *Micromutilla* lacks diagnostic characters justifying its separation as a valid subgenus. Furthermore, *S. isolatrix* in the monotypic subgenus *Xenophotopsis* belongs in the *S. (Photopsis) orestes* species-group. Species in the subgenus *Physetapsis* belong in the *S. (Photopsis) clara* species-group. The subgenera *Sphaerophthalma* and *Photopsioides* are closely related to the *S. (Photopsis) albicinta* species-group (discussed below). Thus, the subgenus *Photopsis* is paraphyletic with respect to the remaining four subgenera. We believe it is best at this time to abandon the subgeneric classification of *Sphaerophthalma* and opt for use of previously defined species-groups (Schuster, 1958), which gives a better indication of phylogenetic relationships.

### *Sphaerophthalma uro* Species-group

*Diagnosis of Male.* Head slightly wider than mesosoma. Eye subovate, margins entire (Figs. 1, 2); eye and ocelli large, bulging, compound eye touching base of mandible, posterior margin of eye less than greatest diameter of eye from posterolateral angle of head. Ventral tooth of mandible small, ventral margin weakly emarginate (Figs. 1, 2). Notali complete. Mesosternum unmodified. Marginal cell length equal to or shorter than stigma, truncate apically (Fig. 3). Metasomal segment 1 petiolate with segment 2. Felt line present



Figs. 1–6. 1. *Sphaerophthalma contracta*, 1. head, frontal view; 2. *S. amphion*, head, frontal view. 3. *S. contracta*, fore and hind wings; 4. *S. bisetosa*, fore and hind wings; 5. *S. nokomis*, forewing; 6. *S. ignacio*, forewing.

on T2, absent on S2. Pygidium and hypopygidium short, transverse, truncate. Cuspis spatulate, weakly to strongly dilated distally, bearing plumose setae with 5 or more branches at least apically (e.g., Figs. 10, 11). Body with conspicuous plumose setae, setae white or golden throughout.

*Diagnosis of Female.* Antennal scrobes with dorsal carinae. Mandible with slightly developed ventral basal tooth. Flagellomere 1 almost 2× as long as the pedicel. Propodeum length in lateral view subequal to 0.5× maximum height. Metasomal segments with sparse to dense plumose pubescence apically. Pygidium undefined laterally by carinae. Pubescence plumose.

*Distribution.* Throughout the Western United States.

*Hosts.* Diptera: Sarcophagidae; Hymenoptera: Chrysididae, Megachilidae, Crabronidae, and Vespidae.

*Comments.* This species-group includes species previously placed in the subgenus *Photopsioides*: *Sphaerophthalma abdominalis*, *S. amphion*, *S. contracta*, and *S. uro*.

The subgeneric description for the females of *S. uro* species-group (as *Photopsioides*) given by Pitts and Manley (2002) agrees with the descriptions of the females here and does not need to be altered. For a more thorough treatment of female characters see Pitts and Manley (2002).

Host data suggests that species of the *S. uro* species-group are opportunistic parasitoids. Rearing parasitoids from twig and trap nests provided 46 new host records for the species-group, which more than triples the known hosts. Host data suggests that the species may be limited to cavity nesting hosts. It is noteworthy that the females of the species-group lack a distinct pygidium, as do many twig nesting sphecoid wasps and bees. The *S. uro* species-group uses a vast array of hosts ranging from *Ashmeadiella* (Megachilidae) to *Ancistrocerus* (Vespidae: Eumeninae) and including other parasitoids of cavity nesters, such as sarcophagid flies. Specific hosts are listed under each *Sphaerophthalma* species.

*Phylogenetic Affinities.* Males of *S. uro* species-group are exceedingly similar to those of the *S. pensylvanica* species-group. Both have the pygidium and hypopygium short and truncate, lack sternal felt lines, and the cuspis dilated and covered with plumose tipped setae. Males of the *S. uro* species-group differ from those of the *S. pensylvanica* species-group by being nocturnal (having larger ocelli and compound eyes, and lacking coloration), having weaker sculpture and having sparse pubescence on the ventral margin of the parameres.

The males of *S. uro* species-group superficially resemble males of other *Sphaerophthalma* species in appearance, especially those in the *S. albicinta* species-group (comprised of *S. bisetosa* Schuster, *S. coaequalis* Cameron, *S. helicaon* (Fox), *S. ignacio* Schuster, *S. nokomis* (Blake), *S. pinales* Schuster, and three undescribed species). The genitalia of the *S. uro* species-group and *S. ignacio* are especially similar; the cuspis bears branched setae, to a greater or lesser degree, in both. This condition is also seen in *S. bisetosa* and three undescribed species in the *albicinta* species-group. The wing venation of the *S. albicinta* species-group, however, differs from the condition in the *S. uro* species-group by having the marginal cell longer than the stigma and subtruncate. Species of the *S. uro* species-group have a marginal cell that is truncate and as short or shorter than the stigma. Lastly, the mandibles of the *S. albicinta* species-group resemble those of *S. amphion*. This leads us to believe that the *S. uro* species-group and the *S. pensylvanica* species-group are closely related to the *S. albicinta* species-group.

The genitalia of the remaining *Sphaerophthalma* species drastically differ from those of the *S. uro* species-group. There are four exceptions, which have plumose setae on the cuspis similar to that of the *S. uro* species-group: *S. ferruginea* (Blake) in the *S. orestes* species-group, *S. danaus* (Blake) in the *S. baboquivari* species-group, and an undescribed species from Costa Rica and Guatemala, respectively, in the *S. rustica* species-group.

Schuster presented only four characters to separate *S. uro* species-group (as *Photopsioides*) and the *S. pensylvanica* species-group (as *Sphaerophthalma*) from the remaining *Sphaerophthalma* species, but these characters may cause confusion and need elaboration. First, Schuster stated that branched setae are never present on the cuspis of other *Sphaerophthalma* species, which has been thoroughly discussed and dismissed above. Second, Schuster stated that males of the *S. uro* species-group and the *S. pensylvanica* species-group have a distinctly quadrate pygidium and hypopygium contrary to the elongate shape of remaining *Sphaerophthalma* species. This is also not completely accurate as some species in the *S. ceyx* species-group have a quadrate pygidium and hypopygium as well. (The *S. ceyx* species-group have modified hind coxae, and the morphology of their genitalia drastically differ from that of the *S. uro* and the *S. pensylvanica* species-groups.)

Schuster's last two characters, absence of a ventral felt line and unarmed coxae in the *S. uro* and the *S. pennsylvanica* species-groups, are variable throughout the genus, sometimes even within a species, and may represent the plesiomorphic condition of the genus. This contributes further evidence pointing to the paraphyly of Schuster's subgenera.

Key to the Males of the *Sphaerophthalma uro* Species-group

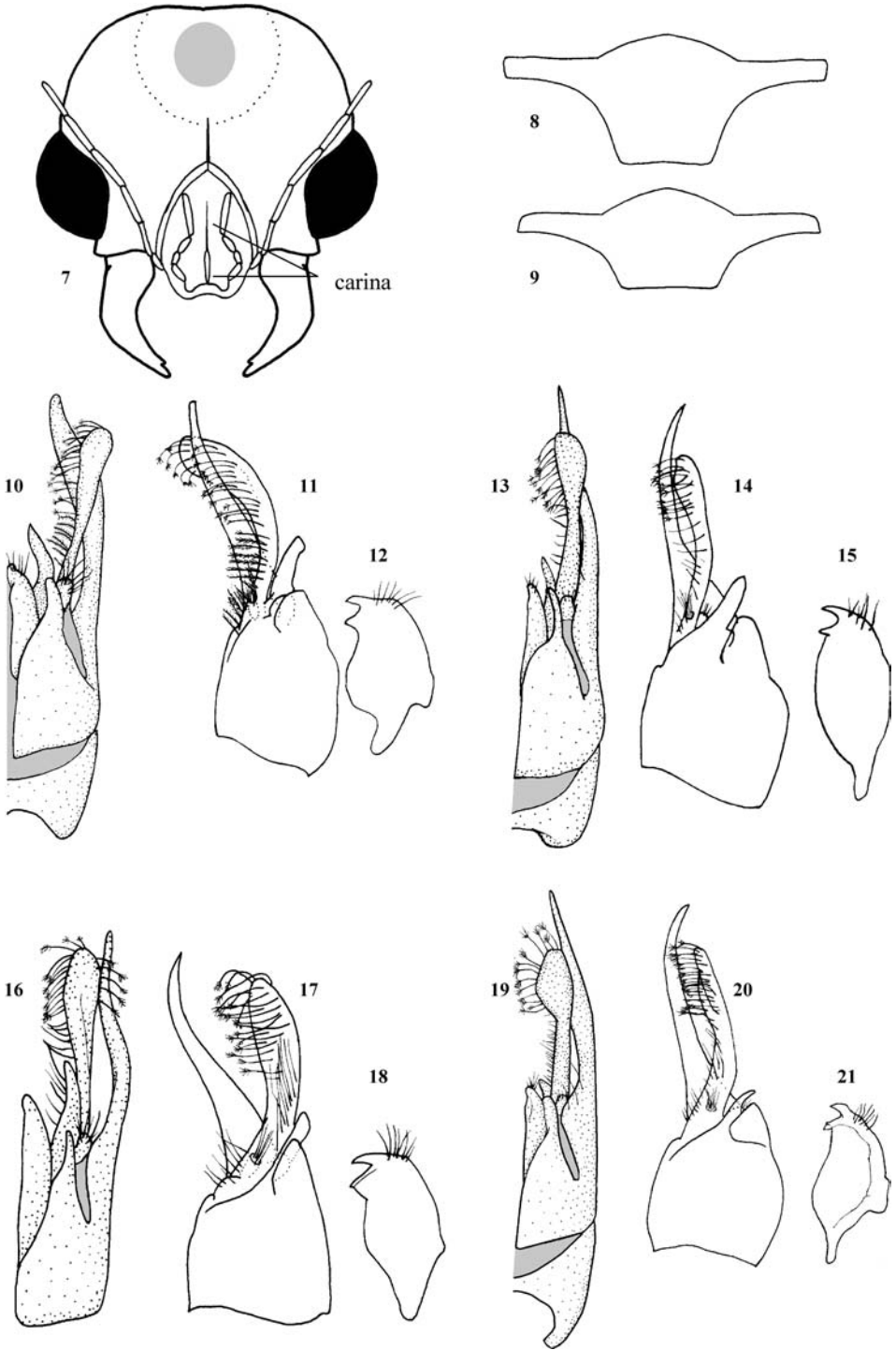
- 1. Mandibles with dorsal carina sharp, blade-like to apex of mandible, mandible vertical throughout (Fig. 1); length of clypeal apical truncation greater than 0.6× width (Fig. 8) . . . . . 2
- Mandibles with dorsal carina becoming obsolete distally, distal portion of mandible oblique (Fig. 2); length of clypeal apical truncation less than 0.5× width (Fig. 9) . . . . . *amphion* (Fox)
- 2. Ocelli small, largest diameter less than 0.4× the ocellocular distance; metasomal vestiture golden or yellow; paramere cylindrical, spine-like, not flattened (Figs. 16, 17) . . . . . *contracta* (Blake)
- Ocelli large, largest diameter over 0.6× the ocellocular distance; metasomal vestiture white; paramere somewhat dorsoventrally flattened, blade-like (Figs. 10, 11, 19, 20) . . . . . 3
- 3. Mentum conspicuously, sharply longitudinally carinulate (Fig. 7); mandible slender, narrowest medially (just distad of ventral angulation), ventral excision 0.5–0.65× the width of anterior ocellus; clypeus forming a somewhat concave broadly truncate, strongly produced plate, scarcely depressed . . . . . *abdominalis* (Blake)
- Mentum ecarinate; mandible broadly dilated not perceptibly narrower medially than at inner dorsal tooth, at ventral excision 0.85–1.0× as wide as anterior ocellus; clypeus forming a strongly depressed, its anterior margin hidden below mandibular rims . . . . . *uro* (Blake)

Key to the Females of the *Sphaerophthalma uro* Species-group  
(Female of *S. contracta* remains unknown)

- 1. Legs black, much darker than mesosoma; apical margin of T2 to metasomal apex dark red to almost black, darker than basal metasomal segment . . . . . *abdominalis* (Blake)
- Legs concolorous with mesosoma, at most slightly infuscated or lighter than mesosoma; metasoma yellow to light red, apex not darker than basal segments . . . . . 2
- 2. T2 coarsely, punctate throughout, interstitial length less than puncture width . . . . . *uro* (Blake)
- T2 coarsely confluent punctate laterally and on basal ~2/3, median apical ~1/3 with sparse indiscernible punctures . . . . . *amphion* (Fox)

***Sphaerophthalma abdominalis* (Blake)**  
(Figs. 7, 10–12)

*Photopsis abdominalis* Blake, 1886. Amer. Ent. Soc., Trans. 13: 275, male, Colorado, Philadelphia Academy of Science. Not *Mutilla abdominalis* Westwood.  
*Mutilla coloradensis* Dalla Torre, 1897. Cat. Hym., v. 8, p. 25. Replacement name for *Photopsis abdominalis* Blake.



*Diagnosis of Male.* Mandible slender, narrowest medially (just distad of ventral angulation), ventral excision  $0.5\text{--}0.65\times$  width of anterior ocellus, with dorsal carina sharp, blade-like to apex of mandible, mandible thus vertical throughout (e.g., Fig. 1). Ocelli large, largest diameter over  $0.6\times$  ocellocular distance. Clypeus with slightly concave, broadly truncate, strongly produced plate, scarcely depressed. Mentum conspicuously, sharply longitudinally carinulate (Fig. 7). Length of stigma  $1.0\text{--}1.3\times$  length of marginal cell. Vestiture of metasoma white. *Genitalia.* Paramere arcuate, stout at base, dorsoventrally flattened toward apex, widening before apex, slightly curved inwardly, tip truncate (Figs. 10, 11). Cuspid elongate,  $0.7\text{--}0.9\times$  free length of paramere, basal portion cylindrical, dilated towards apex, distal portion and inner margin with long dense setae, tips of setae plumose, basal portion with plumose setae, basal pit present with long simple setae, dorsomedial area sparsely, minutely pubescent (Figs. 10, 11). Basal lobe present on cuspid (Figs. 10, 11). Digitus cylindrical, elongate, minutely pubescent (Figs. 10, 11). Aedeagus bidentate ventrally, angulate dorsally (Fig. 12).

*Diagnosis of Female.* Legs black, much darker than mesosoma; apical metasomal segments ferruginous, darker than basal metasomal segments. T2 coarsely confluent punctate throughout.

*Description of Female. Head.* Head orangish-brown, clothed with sparse, erect, pale white brachyplumose pubescence. Malar space  $0.9\times$  maximum eye width. First flagellomere  $1.8\times$  length of pedicel. Second flagellomere  $\sim 1\times$  length of pedicel. Scape orangish-brown, flagellum darker than head, brown. Frons and vertex with small dense punctures. Mandible reddish-black apically.

*Mesosoma.* Mesosoma orange brown. Legs darker than mesosoma, dark brown to black, except tarsi orange brown. Pubescence of pronotum, mesonotum and metanotum pale golden-brown, brachyplumose. Propodeum with white brachyplumose pubescence, which becomes plumose posteriorly. Humerus angulate. Propleuron punctate, with sparse erect pale white pubescence. Mesopleuron punctate, with erect pale white pubescence. Metapleuron glabrous. Propodeum punctate laterally, coarsely punctate dorsally, narrowly reticulate posteriorly.

*Metasoma.* First metasomal segment and T2 on basal  $\sim 0.80$  orangish-brown. T2 laterally and on apical fifth and metasomal segments 3–6 ferruginous. T1 with erect brachyplumose pubescence and shorter erect white plumose pubescence. T1 with sparse white plumose pubescence, fringe sparse. T2 felt line  $0.3\times$  length of T2, ovate. T2 with brown semi-erect brachyplumose pubescence, white on apical margin. T2 with dense white plumose fringe apically. T3–T5 with white pubescence. T2–T3 and S2–S3 with dense white plumose apical fringe. S1 with erect white plumose pubescence. S2–5 with brachyplumose white pubescence. T2 surface reticulate anteriorly, coarsely punctate posteriorly, sometimes less coarsely punctate anteromedially. T3–T6 finely punctate. S1 coarsely punctate. S2 with median longitudinal tumid region on anterior fifth, coarsely punctate. S3–S6 finely punctate. Pygidium nitid.

*Length.* 4.5–9.2 mm.

←

Figs. 7–21. 7. *Sphaerophthalma abdominalis*, head, ventral view; 8. *S. contracta*, clypeus; 9. *S. amphion*, clypeus; 10–12. *S. abdominalis*, 10. left half of genitalia, dorsal view, 11. left half of genitalia, lateral view, aedeagus removed, 12. aedeagus, lateral view; 13–15. *S. amphion*, 13. left half of genitalia, dorsal view, 14. left half of genitalia, lateral view, aedeagus removed, 15. aedeagus, lateral view; 16–18. *S. contracta*, 16. left half of genitalia, dorsal view, 17. left half of genitalia, lateral view, aedeagus removed, 18. aedeagus, lateral view; 19–21. *S. uro*, 19. left half of genitalia, dorsal view, 20. left half of genitalia, lateral view, aedeagus removed, 21. aedeagus, lateral view.



*Distribution.* Found from the Chihuahuan Desert of Texas, north to Kansas, west into Colorado, eastern Arizona, Utah and Wyoming.

*Activity.* June–August, with outliers in May and November.

*Hosts.* *Ashmeadiella aridula* Cockerell (3♀), *A. gillettei* Titus (1♂2♀), *A. meliloti* (Cockerell) (6♀), *A. timberlakei* Michener (2♀), *Ceratochrysis enhuycki* (Cooper) (2♀), *Hoplitis hypocrita* (Cockerell) (1♂), *H. producta* (Cresson) (1♀), *Leptochilus* sp. (1♀), *Megachile montivaga* Cresson (3♂), *Microdynerus bakerianus* (Cameron) (1♀), *Sapyga pumila* Cresson (9♀), *Stelis lateralis?* Cresson (1♀), *Stelis* sp. on *Ashmeadiella gillettei* (1♀), *Stelis* sp. on *Hoplitis grinnelli* (Cockerell) (1♀), *Stelis* sp. (1♂1♀), *Trypargilum t. tridentatum* (Packard), *Trypargilum* sp. (2♂).

*Material Examined.* 18♂ 1♀ Arizona, 7♂ Colorado, 2♂ Kansas, 1♂ New Mexico, 4♂ Texas, 1♂ Utah. *Material reared by FDP:* **Arizona:** Cochise Co., 16 mi NE Douglas 1♂; Gila Co., 12 mi S Punkin Center 1♂; Mohave Co., Kingman 1♂; **Nevada:** Clark Co., Searchlight, 16 mi W 1♂; **New Mexico:** Dona Ana Co.: Las Cruces Airport 1♂; 8 mi N Las Cruces 1♂; Organ Pipe Mnts 1♀; Socorro Co.: 2 mi E San Antonio 3♀; 3 mi NW Socorro 4♂3♀; Lincoln Co., Valley of Fires 2♀; Sierra Co., Kingston 1♀; Valencia Co., 15 mi N Fence Lake 1♀; **Utah:** Duchesne Co., Myton 33♀; Emery Co., San Rafael Desert, 3 mi SSE Temple Mt 1♂; Garfield Co., Dry Lake Swell, 29 rd mi S Hanksville 1♂; **Wyoming:** Albany Co., 9 mi SE Laramie 1♂4♀.

### *Sphaerophthalma amphion* (Fox)

(Figs. 2, 9, 13–15)

*Mutilla amphion* Fox, 1899. Amer. Ent. Soc., Trans. 25: 263, male, Nevada, Philadelphia Academy of Science.

*Photopsis abstrusa* Baker, 1905. Invertebrata Pacifica 1: 113, male, California, Cornell University.

*Photopsis nudata* Baker, 1905. Invertebrata Pacifica 1: 114, male, California, Cornell University.

*Diagnosis of Male.* Mandible not dilated apically, somewhat tapered, with dorsal carina becoming obsolete distally, distal portion of mandible thus oblique (Fig. 2). Ocelli large, largest diameter over 0.6× the ocellocular distance. Clypeus slightly depressed, its anterior margin just below dorsal mandibular rims. Mentum ecarinate. Stigma length 1.1–1.7× length of marginal cell. Vestiture of metasoma white. *Genitalia.* Paramere arcuate, cylindrical, spine-like, tapering towards apex, slightly curved inwardly (Figs. 13, 14). Cuspis elongate, 0.7–0.8× free length of paramere, basal portion cylindrical, dilated towards apex, slightly wider than paramere, distal portion and inner margin with long dense setae, tips of setae plumose, basal portion with simple setae, basal pit present with long simple setae, dorsomedial area sparsely, minutely pubescent (Figs. 13, 14). Basal lobe present on cuspis (Figs. 13, 14). Digitus cylindrical, lobe-like, minutely pubescent (Figs. 13, 14). Aedeagus bidentate ventrally, smoothly curved dorsally (Fig. 15).

*Diagnosis of Female.* Legs concolorous with mesosoma, at most slightly darker or lighter than mesosoma; apical metasomal segments concolorous with basal segments. T2 coarsely confluent punctate laterally and on basal ~0.66, apical ~0.33 with sparse indiscernible punctures.

*Description of Female. Head.* Head orangish-brown, clothed with sparse erect pale white brachyplumose pubescence. Malar space 0.8× maximum eye width. First flagellomere

1.6× length of pedicel. Second flagellomere subequal to length of pedicel. Antenna orangish-brown. Front and vertex with small dense punctures. Mandible reddish-black apically.

*Mesosoma.* Mesosoma orangish-brown. Legs concolorous to slightly lighter than mesosoma. Pubescence of pronotum, mesonotum and metanotum pale golden-brown. Propodeum with white brachyplumose pubescence, plumose posteriorly. Humerus angulate. Propleuron punctate with sparse erect pale white pubescence. Mesopleuron punctate with erect pale white pubescence. Metapleuron glabrous. Propodeum punctate laterally, coarsely punctate dorsally, narrowly reticulate posteriorly.

*Metasoma.* Orangish-brown. T3–T6 slightly darker than T1 and T2. Disk of T1 with erect brachyplumose pubescence and shorter erect white plumose pubescence. T1 sparsely punctate medially. T2 felt line 0.3× length of T2, ovate, almost circular in outline. T2 with brown erect brachyplumose pubescence, white on apical margin. T3–T5 with white pubescence. T1–T4 and S2–S5 with dense white plumose apical fringe. S1 with erect white plumose pubescence. S2–5 with simple white pubescence. T2 surface coarsely confluent punctate on anterior half and laterally, apical half with sparse shallow punctures (distance between punctures >1–2× puncture width; not confluent). T3–T6 finely punctate. S1 coarsely punctate. S2 with median longitudinal tumid region on anterior fifth, coarsely punctate. S3–S6 finely punctate.

*Length.* 4.2–9.5 mm.

*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 (1♂), *Ancistrocerus* sp. (3♂1♀), *Anthocopa copelandica* (Cockerell) (1♀), *Ashmeadiella bigeloviae* (Cockerell) (2♂), *A. gillettei* Titus (1♀), *A. meliloti* (Cockerell), *Ashmeadiella* sp. (1♂1♀), *Atoposmia hypostomalis* Michener (6♂), *Chrysis derivata* du Buysson (1♂1♀), *Hoplitis bullifacies* (Michener) (4♂11♀), *Hoplitis f. fulgida* (Cresson), *H. g. grinnelli* (Cockerell), *H. sambuci* Titus (1♀), *Leptochilus chiricahua* Parker, *L. rufinodus* (Cresson) (1♂), *Leptochilus* sp. (5♂), *Osmia marginata* Michener (3♀), *Pisonopsis birkmanni* Rohwer (1♀), *Pisonopsis* sp. (1♀), *Sapyga aculeata* Cresson on *Hoplitis sambuci* (3♀), *Sapyga elegans* Cresson on *Hoplitis fulgida* (1♂4♀), *Sarcophagidae* sp. (Diptera) (1♂), *Stelis* sp. on *Hoplitis bullifacies* (3♀), *Stelis* spp. (1♂5♀), *Trypargilum t. tridentatum* (Packard), *Trypargilum* sp. (2♂1♀).

*Material Examined.* Arizona 7♂; California 77♂, Oregon 1♂, Baja California 9♂. *Material reared by FDP:* **Arizona:** Coconino Co., 11 mi S Jacob's Lake 1♀; Mohave Co., Kingman 1♀; **California:** Fresno Co.: Whites Water Stream, 10 mi W Coalinga 1♀; Whites Creek, 12 mi W Coalinga 1♂; Inyo Co.: 8 mi NE Big Pine 5♂1♀; 11 mi NE Big Pine 1♂; 5 mi N Bishop 1♂; 3 mi W Lone Pine 2♂; Kern Co.: 3 mi W Brown, Sand Canyon 2♀; Short Canyon, 7 m W Inyokern 2♂2♀; 15 mi W Johannesburg 1♂; Riverside Co.: Banning 2♂8♀; 3 mi W Banning 1♀; 9 mi W Banning 1♀; Deep Canyon 2♂; 7 mi S Palm Springs 2♂; 1 mi W Yucca Valley 1♂1♀; San Bernardino Co.: 1 mi S Morongo Valley 8♀; 3 mi W Morongo Valley 1♀; San Diego Co., Borrego Valley 2♂; **Nevada:** Humboldt Co., Winnemucca Dunes 2♀; Washoe Co., Nixon 9♂18♀; **Utah:** Duchesne Co., Myton 1♀; Emery Co.: 4 air mi W Gibson Butte 1♀; Hwy 24 2♂1♀; San Rafael Desert, 3 mi SSE Temple Mt 3♀; Wild Horse Canyon, N of Goblin Valley 2♀; Garfield Co., Dry Lake Swell, 29 rd mi S Hanksville 1♀; Washington Co.: 10 mi SW Santa Clara 1♀; 2 mi W Santa Clara 3♀; Snow Canyon 3♂; *Material reared by T. L. Griswold:* **California:** San Bernardino Co.: Kelso Sand Dunes 1♂.

*Activity.* This species is collected throughout the year in the southern limits of its range. In the northern limits of its range, this species is mainly active from April to August.

*Comments.* Initially, Schuster (1958) published *S. abstrusa* as a subspecies of *amphion* based on the width of the stigma versus the width of the marginal cell. Ferguson (1967) determined that these characters were continuous, not geographically distinct, and synonymized the two subspecies. We agree with Ferguson's determination.

***Sphaerophthalma contracta* (Blake)**

(Figs. 1, 3, 8, 16–18)

*Agama contracta* Blake, 1879. Amer. Ent. Soc., Trans. 7: 253, male, Nevada, Philadelphia Academy of Science. Not *Mutilla contracta* Say

*Mutilla contrahenda* Dalla Torre, 1897. Cat. Hym., v. 7, p. 27. Replacement name for *Agama contracta* Blake.

*Diagnosis of Male.* Mandible very broadly dilated, not perceptibly narrower medially than at inner dorsal tooth, at ventral excision 1.1–1.3× as wide as anterior ocellus, with dorsal carina sharp, blade-like to apex of mandible, mandible thus vertical throughout (Fig. 1). Ocelli small, largest diameter less than 0.4× ocellocular distance. Clypeus strongly depressed, anterior margin hidden below dorsal mandibular rims. Mentum ecarinate. Length of stigma 0.8–1.0× length of marginal cell (Fig. 3). Vestiture of metasoma golden or yellow. *Genitalia.* Paramere arcuate, cylindrical, spine-like, tapering towards apex, slightly inwardly curved (Figs. 16, 17). Cuspis elongate, 0.8–0.9× free length of paramere, much wider than paramere, basal portion cylindrical, dilated towards apex, distal portion and inner margin with long dense setae, tips of setae plumose, basal portion with simple setae, basal pit present with long simple setae, dorsomedial area sparsely, minutely pubescent (Figs. 16, 17). Basal lobe present on cuspis (Figs. 16, 17). Digitus cylindrical, lobe-like, minutely pubescent (Figs. 16, 17). Aedeagus bidentate ventrally, gently curved dorsally (Fig. 18).

*Female.* Unknown.

*Distribution.* Found throughout the Columbia Basin of Oregon, Washington and northern Nevada. Also found in the Snake River Plain of Idaho into southern Montana and Northern Utah. It has not been recorded from western Wyoming, but may be found there.

*Activity.* June–August.

*Hosts.* Unknown.

*Material Examined.* 1♂ Montana; 5♂ Oregon; 7♂ Utah, Cache County, Black Smith Fork Canyon, June–July; and 1♂ Washington.

*Comments.* This species may not use cavity-nesting Hymenoptera as hosts. Many cavity traps have been placed in the canyons east of Logan, Utah and have never produced any specimens of *contracta*, even though males have been collected in malaise traps in these same areas. Thus, it is likely that this species uses ground nesting Hymenoptera as hosts.

***Sphaerophthalma uro* (Blake)**

(Figs. 19–21)

*Agama uro* Blake, 1879. Amer. Ent. Soc., Trans. 7: 253, male, Texas, Philadelphia Academy of Science.

*Photopsis melanderi* Baker, 1905. Invertebrata Pacifica 1: 112, male, Texas, Cornell University.

*Sphaerophthalma* (*Photopsioides*) *uro stenognatha* Schuster, 1958. Ent. Amer. (n. s.) 37: 38, male, University of Minnesota.

*Diagnosis of Male.* Mandible slightly to very broadly dilated, not perceptibly narrower medially than at inner dorsal tooth, at ventral excision 0.85–1.0× as wide as anterior ocellus, with dorsal carina sharp, blade-like to apex of mandible, mandible thus vertical throughout (as in Fig. 1). Ocelli large, largest diameter over 0.6× ocellocular distance. Clypeus strongly depressed, anterior margin hidden below dorsal mandibular rims. Mentum ecarinate. Length of stigma 1.0–1.3× length of marginal cell. Vestiture of metasoma white. *Genitalia.* Paramere arcuate, stout at base and dorsoventrally flattened toward apex, slightly widening medially, slightly curved inwardly, tip truncate (Figs. 19, 20). Cuspis elongate, ~0.75× free length of paramere, basal portion cylindrical, apex dorsoventrally flattened and lobate, distal portion and inner margin with long dense setae, tips of setae plumose, basal portion with plumose setae, basal pit present with long simple setae, dorsomedial area sparsely, minutely pubescent (Figs. 19, 20). Basal lobe present on cuspis (Figs. 19, 20). Digitus reduced in size, cylindrical basally, minutely pubescent (Figs. 19, 20). Aedeagus bidentate ventrally, angulate dorsally (Fig. 21).

*Diagnosis of Female.* Legs concolorous with mesosoma, at most slightly infuscated or lighter than mesosoma; apical metasomal segments concolorous with basal metasomal segments. T2 coarsely punctate throughout.

*Distribution.* Found throughout the Western United States.

*Activity.* April–August, with outliers in March, September and October.

*Hosts.* *Ancistrocerus* sp. (1♂), *A. gillettei* Titus (1♀), *Ashmeadiella* sp. (2♂), *Chrysis derivata* du Buysson (1♂), *Chrysis* sp. on *Parancistrocerus* sp. (1♀), *Chrysis* spp. (4♀), *Dianthidium curvatum sayi* Cockerell, *Hoplitis biscutellae* (Cockerell) (1♀), *Leptochilus* sp. (2♀), *Osmia* sp. (2♀), *Pachodynerus astraesus* (Cameron), *Pisonopsis* sp. (1♂), *Sapyga pumila* Cresson (2♀), *Stelis* spp. (3♀), *Trypargilum t. tridentatum* (Packard) (13♂8♀), *Trypargilum* sp. (2♂1♀).

*Material Examined.* 99♂ Arizona, 1♂ California, 1♂ Kansas, 2♂ New Mexico, 1♂ Oklahoma, 42♂ Texas; Mexico, 1♂ Sonora. *Material reared by FDP:* **Arizona:** Cochise Co.: Portal 1♂; Tombstone 1♀; Coconino Co., 11 mi S Jacob's Lake 4♂1♀; 3 mi S Sedona 1♀; Gila Co.: 8 mi S Punkin 1♀; 1 mi S Jakes Corner 2♀; Yavapai Co.: E Camp Verde 1♂2♀; Clarkdale 1♂1♀; 3 mi E Congress 1♂; **Nevada:** Clark Co., 16 mi W Searchlight 1♀; 5 mi E Searchlight 1♂; **New Mexico:** Dona Ana Co., 8 mi N Las Cruces 3♂; Socorro Co., 2 mi E San Antonio 1♀; **Utah:** Emery Co., San Rafael Desert, 3 mi SSE Temple Mt. 1♀; Washington Co., Snow Canyon 1♂; *Material reared by T. L. Griswold:* **California:** San Bernardino Co.: Cedar Canyon 3♀; Colton Hills 1♂5♀; 6.2 mi S Kelso 1♀; 10 mi S Kelso 2♂2♀; 13.6 mi S Kelso 2♀; 14.0 mi S Kelso 1♀; 10.1 mi NE Kelso 5♂; Providence Mnt 2♂2♀.

*Comments.* Krombein (1979) synonymized the three subspecies of *uro* (*melanderi*, *stenognatha*, and *uro*). Evidence was not presented legitimizing this stance. The three subspecies were based on coarseness of sculpture, width of the mandible at the ventral excision, and coloration of the antennae and legs. Coarseness of sculpture has been shown to be directly related to size of the individual and indirectly related to the size of the host (Ferguson, 1962). Males, as well as females, show considerable differences in size and thus coarseness of sculpture. After measuring the width of the mandibles and noting the coloration of the antennae and legs, and sculpture of the propodeum, we have concluded that no diagnostic populations exist and agree with Krombein in placing the subspecies in synonymy.

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