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A new species and key for *Rhaphiomidas* Osten Sacken (Diptera: Mydidae)

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Abstract

This paper describes one new species, *Rhaphiomidas ballmeri* **sp. nov.** from Sonora state, Mexico. A new key is provided for males of this genus to aid in their identification.

Key words: Diptera, Mydidae, *Rhaphiomidas*, Sonora, Baja California

Introduction

The genus *Rhaphiomidas* Osten Sacken, 1877 consists of 23 species and 5 subspecies. Since Cazier's (1985) revision there have been five additions to the genus including the species described here (Rogers 1993; Rogers & Van Dam 2007). This paper describes one new species *Rhaphiomidas ballmeri* **sp. nov.** from Sonora state, Mexico. A key is provided for males of this genus to aid in their identification.

Material and methods

The terminology of the description follows that of Sinclair *et al.* (1993) and Dikow (2009). The change in terminology from Cazier (1985) is made to recognize homologous structures across the lower Brachycera (Sinclair *et al.* 1993). One of the most noticeable changes is the use of epandrium for hemitergites in the male terminalia. The museum abbreviations are as follows: University of California Berkeley, Essig Museum of Entomology (EMEC), California Academy of Sciences (CAS). Digital photos were taken with a Canon EOS-1D Mark II camera using a Microptics Digital Imaging System. Lenses used were 2x teleconverter and HDF-2 Pro lens. CombineZM (Hadley 2006) was used to montage images for increased depth of field. Abbreviations for U.S. and Mexican states are as follows: USA; Arizona (AZ), California (CA), Nevada (NV), New Mexico (NM), Texas (TX). Mexico; Baja California (BCN), Baja California Sur (BCS), Nuevo Leon (NL), Sonora (SON).

Taxonomy

Rhaphiomidas ballmeri sp. nov.

Diagnosis. A medium sized species (length overall ~28 mm, mesonotal width ~7 mm), easily recognized by the combination of the elongate non-overlapping epandrium, recurved aedeagus subequal in length to the gonocoxites, hind and middle tibia and tarsi possessing short, dark brown spines, abdominal tergites with a central dark maculation, anterior margin with same dark coloration expanding to form a dark triangle at anterior margin. Epandrium elongate (5.5 mm in length by 2.45 mm in width), dark brown, bordered in light

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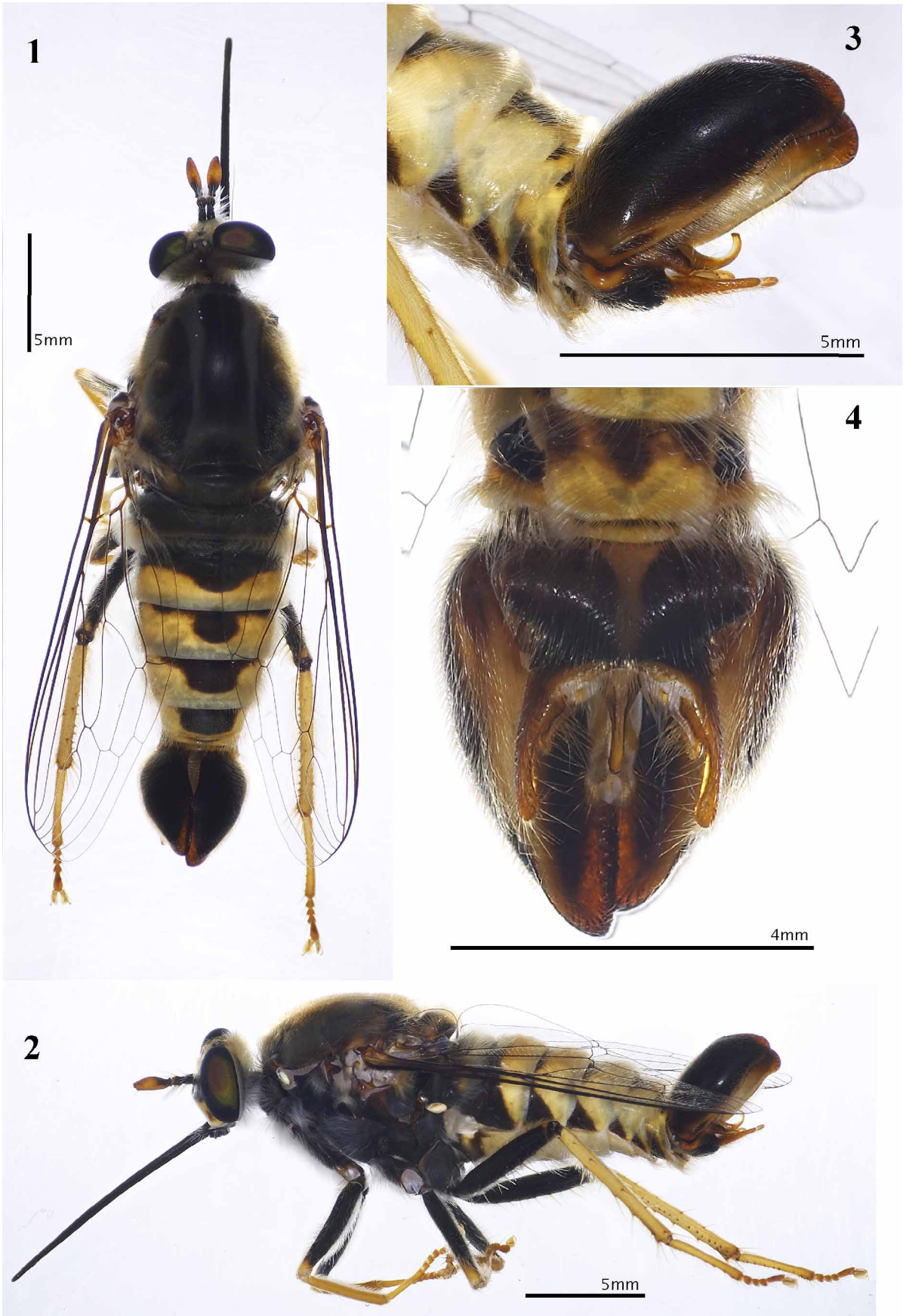
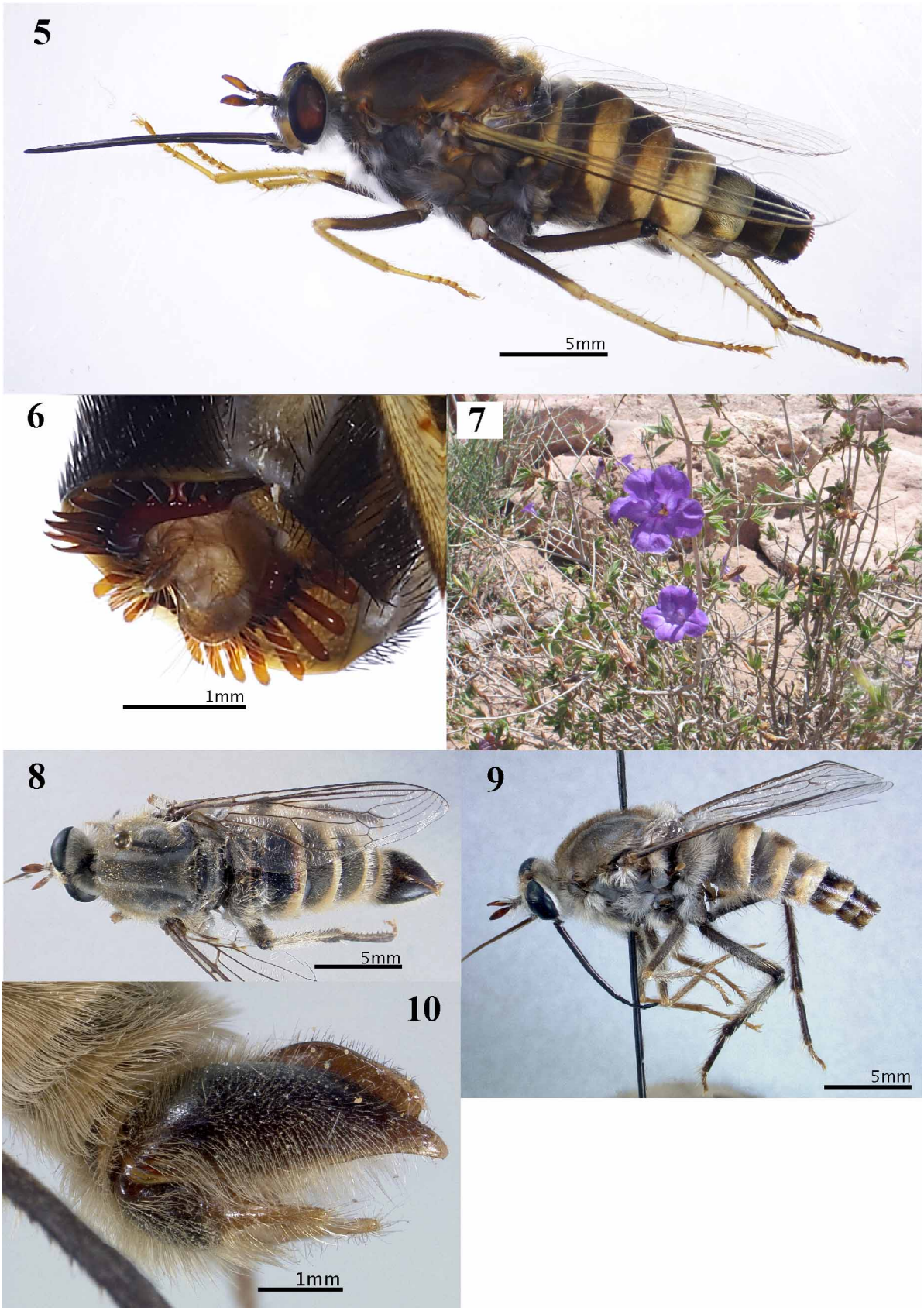
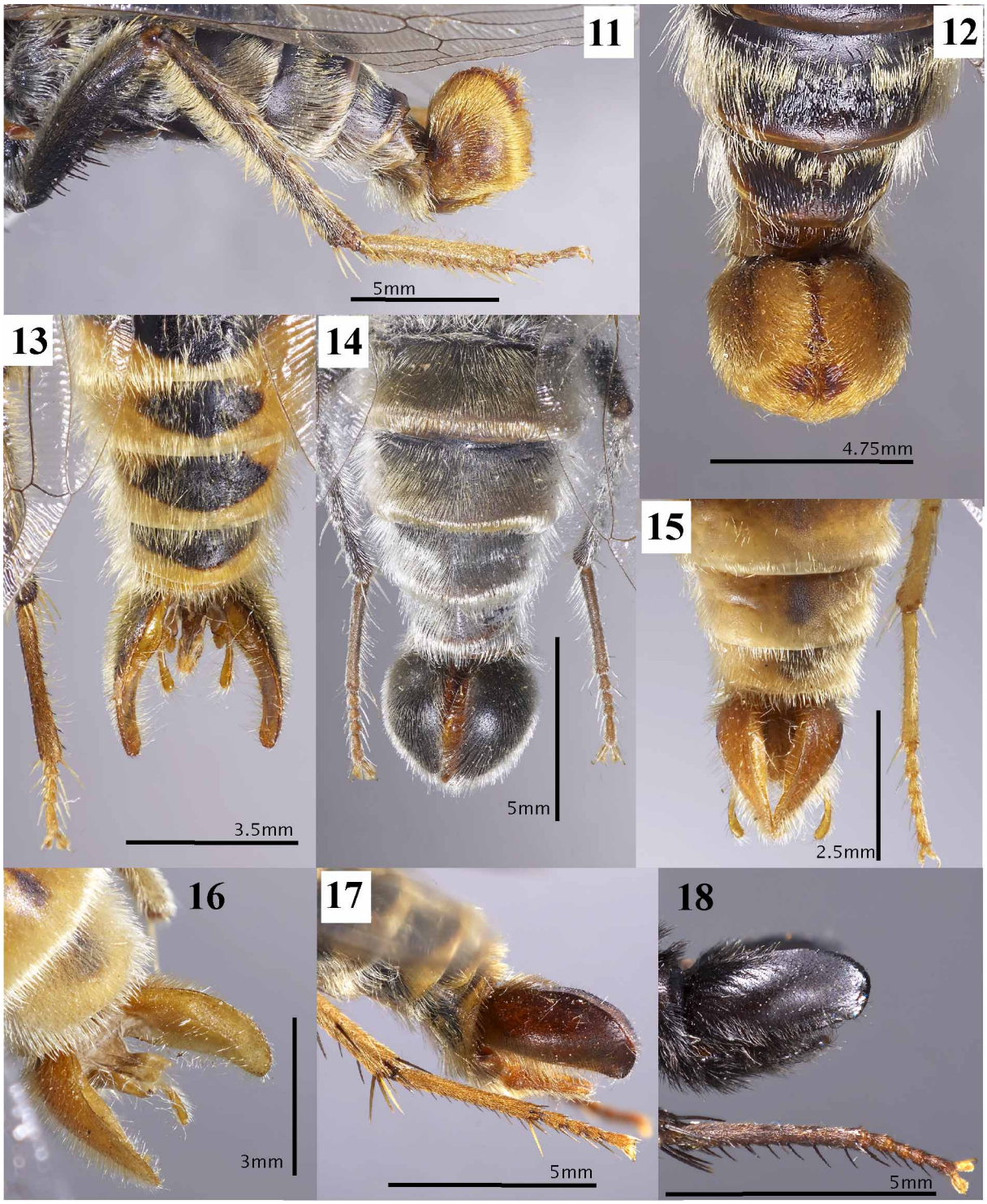


FIGURES 1–4. *Rhaphiomidas ballmeri* **sp. nov.**, male. **(1)** dorsal habitus; **(2)** lateral habitus; **(3)** terminalia lateral; **(4)** terminalia ventral.



FIGURES 5–10. *Rhaphiomidas ballmeri* **sp. nov.** and *R. forficatus*. **(5)** *Rhaphiomidas ballmeri* **sp. nov.** female, lateral habitus; **(6)** *R.ballmeri* **sp. nov.** female, acanthophorites; **(7)** *Ruellia californica* (Rose) known nectar source for *R.ballmeri* **sp. nov.** photo taken in type locality; **(8)** *R. forficatus* male, dorsal habitus; **(9)** *R. forficatus* female, lateral habitus; **(10)** *R. forficatus* male terminalia, lateral view.



FIGURES 11–18. *Rhaphiomidas* male terminalia. **(11)** *R. hirsuticaudus*, lateral view; **(12)** *R. hirsuticaudus*, dorsal view; **(13)** *R. socorroae* terminalia open, dorsal view; **(14)** *R. parkeri*, dorsal view; **(15)** *R. hasbroucki*, dorsal view; **(16)** *R. hasbroucki* terminalia open, dorsal view; **(17)** *R. terminatus terminatus*, lateral view; **(18)** *R. episcopus episcopus*, lateral view.

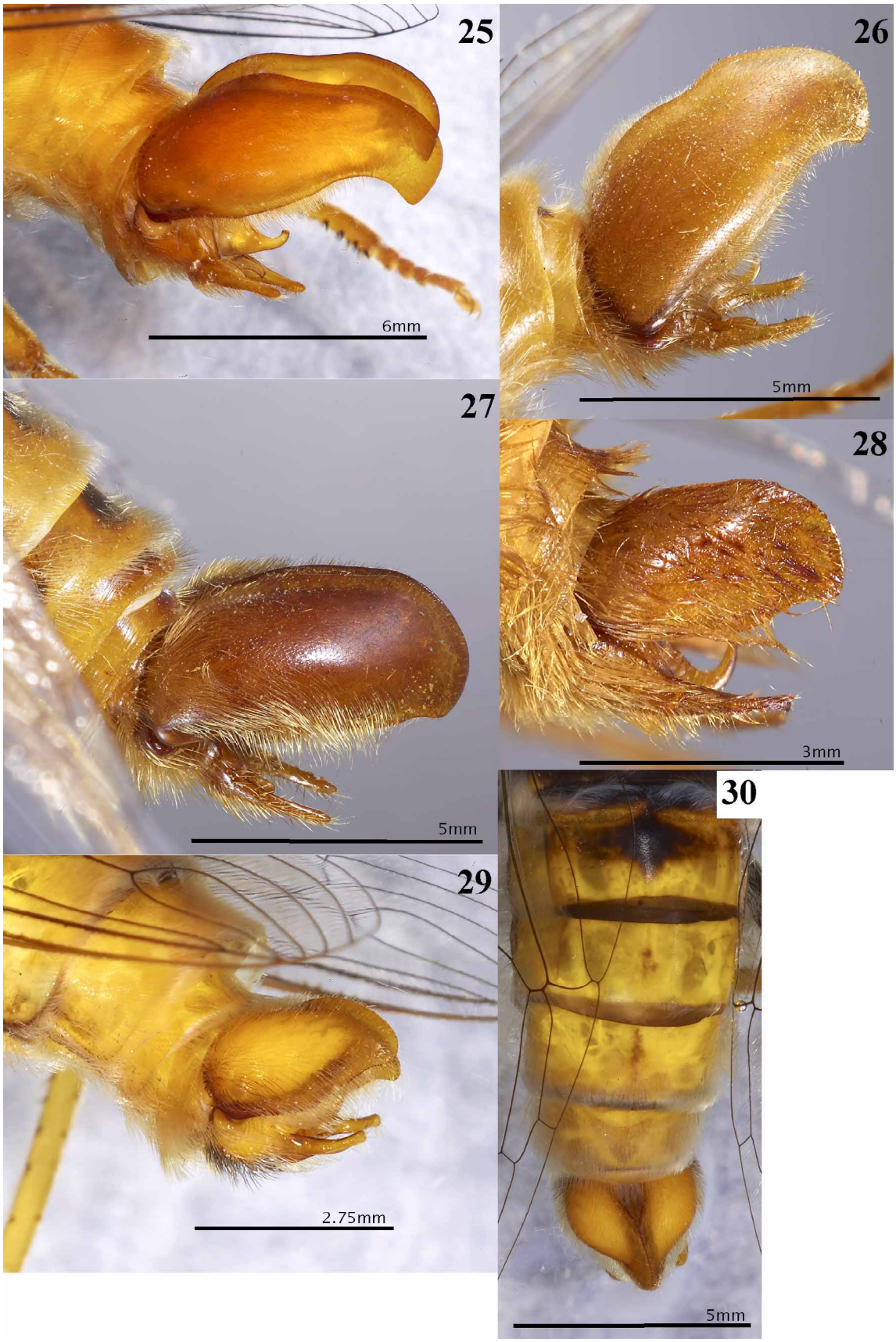
brown, cordate-shaped in dorsal view, gonocoxite extending posteriorly less than half the length of epandrium. The aedeagus is strongly curved dorsally in distal third (Fig. 3).

Description of holotype. Male (Figs. 1–4). **Head**: vertex, frons and face white pruinose, face pilose with long white setae, lower frons pilose with long, white setae fading to golden brown on vertex, vertex between lateral ocelli and compound eye deeply impressed, compound eye separated from lateral ocelli by the lateral

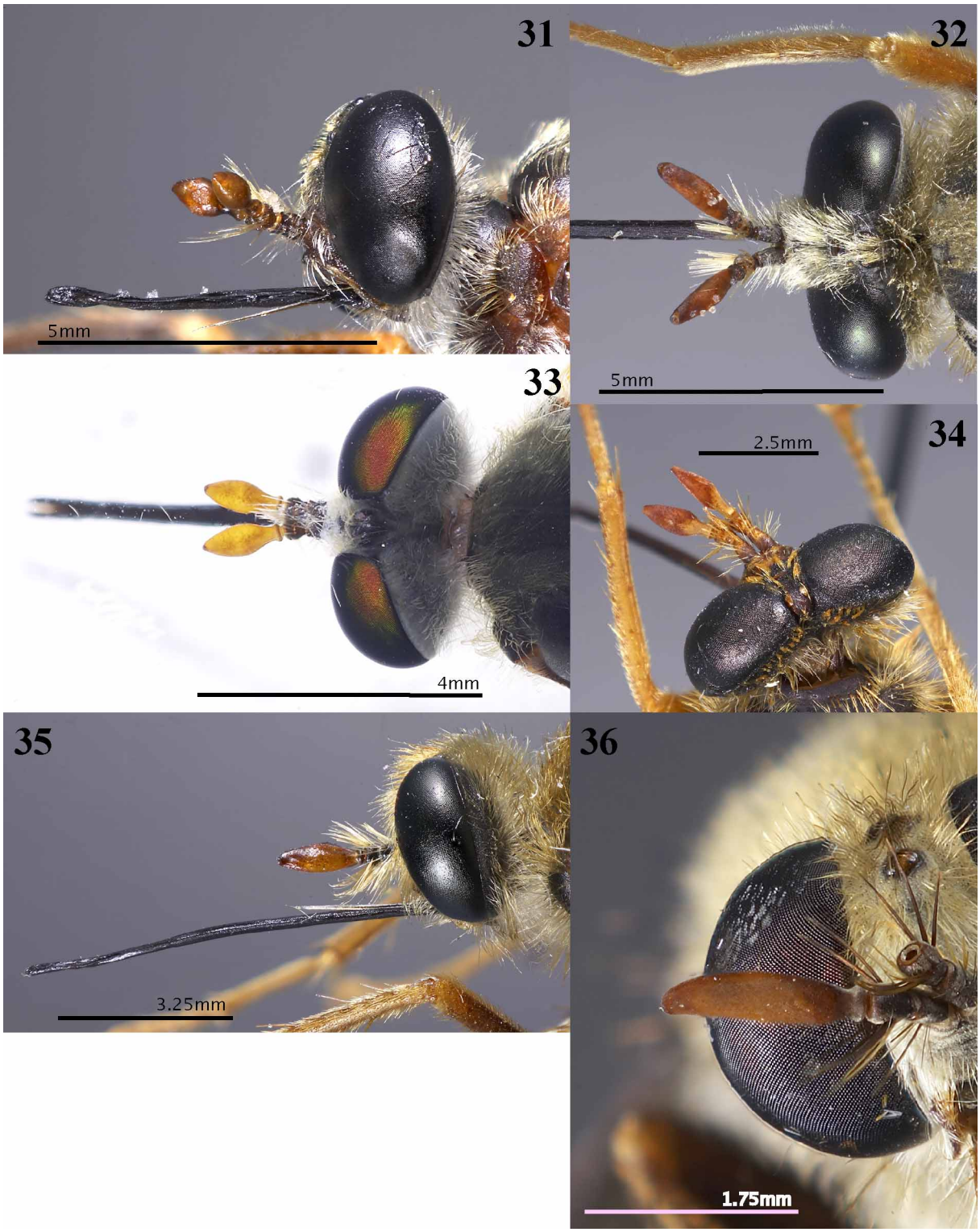
ocellus width; occiput darker gray pruinose, pilosity same as face. Antennae: scape dark gray sparsely pruinose with central ring of long white setae followed by a constriction, pedicel width greatest medially with central ring of white setae, distal apex red-orange in color, postpedicel with swollen ring at base width broadest in middle tapering to a blunt point at apex, black basally fading towards red-orange, apex black (Fig. 1). Proboscis: long [ca. 20 mm], palpus with long white setae. **Thorax**: postpronotal lobe deeply incised posteriorly, moderately pilose with long golden setae; mesonotum, with single median dark longitudinal vitta, wide lateral gray vitta with two pale yellow macrosetae posteriorly clothed in golden brown pile progressively longer towards ventral surface, six macrosetae just posterior to transverse suture along lateral margin, two just anterior to transverse suture, postalar callus with six long, pale yellow macrosetae, anterior ventral surface with long white pile. Scutellum deeply divided from posterior mesonotal margin, similar in color and pilosity to mesonotum. Lateral thoracic sclerites black, weakly shining, with tufts of white pile; katatergite large, cone-shaped, weakly shining, bare; halter with stalk light brown, club tan in color. **Wing**: costal vein base golden brown abruptly fading to black pile in basal third, the remaining portion short, black pilose. **Legs**: coxae black, weakly shining, densely clothed with white pile, anterior margin with 6-8 white macrosetae. Trochanters piceous, nitid; fore and mid trochanter densely clothed with white pile ventrally, dorsally with small tuft of tan pile, hind trochanter with same pilosity as proceeding but with four white macrosetae. Femora piceous, nitid, weakly wrinkled, shallowly grooved longitudinally along most of the length, apical area of fore and mid femur orange, apex of hind femora glossy black; fore femur ventral surface with long white pilosity and a single row of white macrosetae, dorsal surface with long golden pilosity; mid femur with more uniform pale, gold setae with double row of pale tan macrosetae; hind femur with golden pile, ventral surface with slightly longer pile, ventral surface with three rows of white macrosetae. Fore tibia with pale tan pile on dorsal and median surface, ventral and lateral surface covered in dense long pale tan pile with macrosetae; mid tibia same as above, but dorsal surface with tan macrosetae in a zigzag formation, ventral lateral surface with a single row of macrosetae and ventral surface with a double row of irregularly spaced short, stout, cone-shaped macrosetae; hind tibia same as middle but ventral interior surface with a row of irregularly spaced short, stout, cone-shaped macrosetae. Fore tarsus pale orange, dorsal surface with short pale tan pile, lateral and ventral surfaces with long pale tan pile on first tarsomere; mid tarsus pale tan with much shorter pale yellow pile, and a double row of short, stout, cone-shaped macrosetae ventrally; hind tarsus pale tan, dorsally with short porrect pale tan pile, ventral surface with long hairs on first tasomere, pale tan macrosetae present on dorsal and lateral apex and a double row of eleven to thirteen short black spines on the ventral surface of the first tarsomere; pulvilli and claws of all tarsi pale tan, pulvilli large, greatly expanded apically. **Abdomen**: Tergite I black, apical margin dark yellow densely clothed with long white pile, tergite II basal half black with maculation expanding into center ending near apex, surface covered in long golden setae progressively shorter towards distal margin, black markings expanded on anterior margin forming dark triangle reaching distal apex, tergites III-VI with a central dark maculation, lateral margin with same dark coloration but hidden by preceding segment, expanding to form a dark triangle at anterior corner, pile golden reclinate dorsally becoming longer and more sinuous, erect towards lateral margin, VII-VIII hidden except for distal margin; sternite I pale tan with long erect white setae one quarter the length of sternite II, sternite II same color as sternite I except for anterior margin black and faint dark maculation in center, sternites III-VI same as sternite II but lacking maculation in anterior margin, sternite V-VI anterior maculation expanded into center, sternites VII maculation expanded forming a M shape, sternite VIII largely hidden by sternite VII. **Terminalia**: epandrium cordate-shaped dorsally (Fig. 1), black, weakly shining, tawny border encircling the entire edge, apex weakly falcate, epandrium elongate (5.5 mm length by 2.45 mm width) surface covered in golden setae, setae longest ventrally; interior surface of epandrium lacking prominent carina, surface with weak convex ridge dorsally expanding until absent in distal third, distal interior margin weakly scalloped, surface covered with sparse golden pile. Aedeagus dorsal and ventral surfaces dark brown, center light brown, base laterally compressed, remainder of length (distal third) recurved so that tip points dorsally (Fig. 3). Gonocoxite black covered in long golden setae; gonostylus subequal in length to aedeagus, shiny brown, covered in long golden setae, basal projections dorsal surface with strong basal sulcus, ventral surface with callus along interior face.

FIGURES 19–24. *Rhaphiomidas* male terminalia. **(19)** *R. nigricaudis*, lateral view; **(20)** *R. trochilus*, lateral view; **(21)** *R. aitkeni*, lateral view; **(22)** *R. aitkeni*, dorsal view; **(23)** *R. auratus*, lateral view; **(24)** *R. acton acton*, dorsal view.

Female. Similar to male except in the following ways; legs lacking short, stout, cone-shaped macrosetae, hind femur covered with black setae. Abdominal tergites with dark brown coloration expanded forming into a point on segments IV and V, setae brown, segment V pale tan with reclinate black setae, segments VI and VII black with black proclinate setae (Fig. 5); sternites II-IV lacking central maculation, segments V-VII same as tergites; acanthophorites (Fig. 6) 12 robust acanthophorite spurs, first three dorsal spurs recurved.

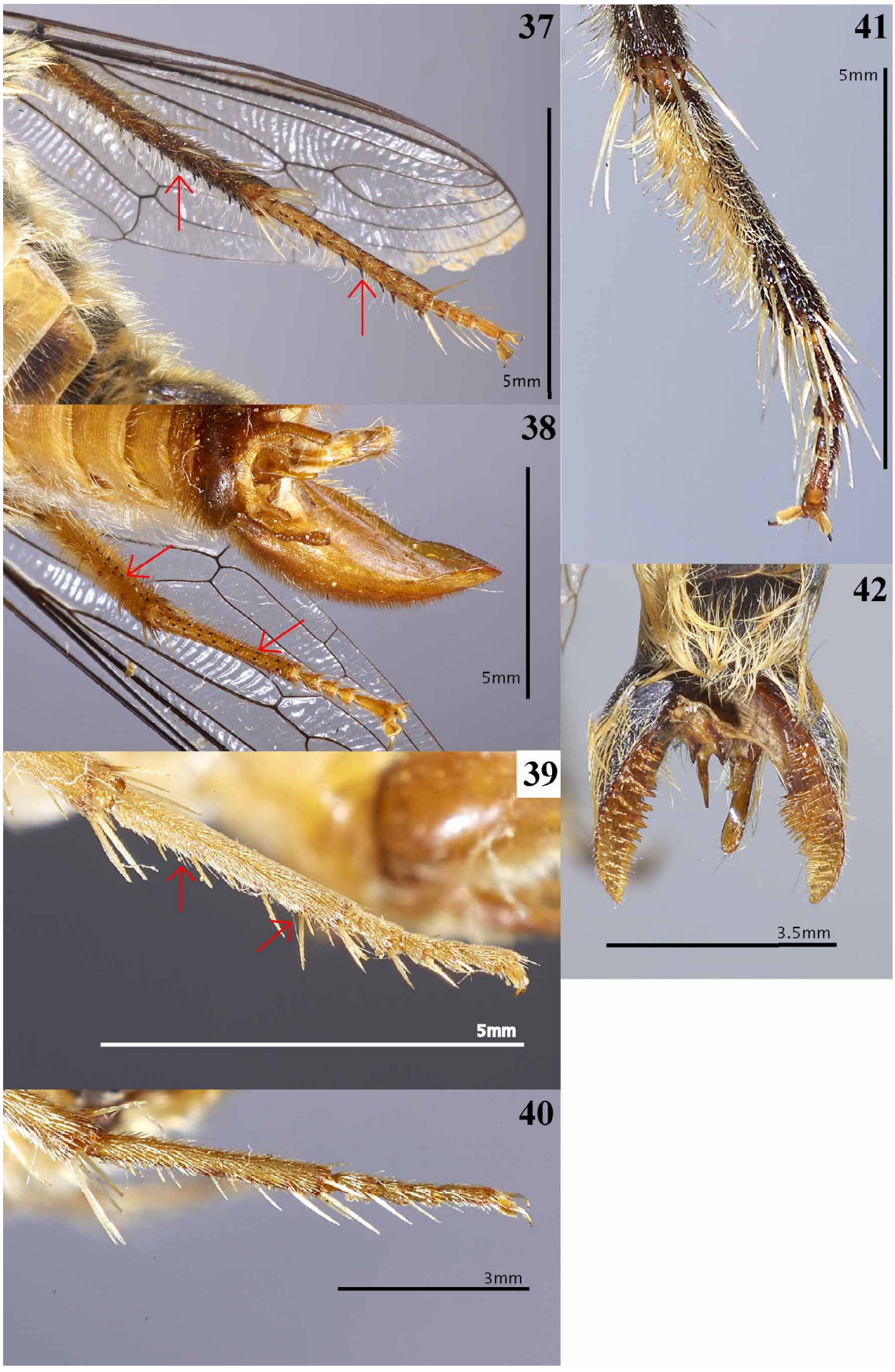


FIGURES 25–30. *Rhaphiomidas* male terminalia. **(25)** *R. undulatus*, lateral view; **(26)** *R. acton maehleri*, lateral view; **(27)** *R. acton acton*, lateral view; **(28)** *R. xanthos xanthos*, lateral view; **(29)** *R. painteri*, lateral view; **(30)** *R. painteri*, dorsal view.



FIGURES 31–36. *Rhaphiomidas* male heads. **(31)** *R. hirsuticaudus*, lateral view; **(32)** *R. acton acton*, dorsal view; **(33)** *R. painteri*, dorsal view; **(34)** *R. xanthos xanthos*, dorsal view; **(35)** *R. terminatus terminatus*, lateral view; **(36)** *R. episcopus episcopus*, anterior view.

Material examined. Holotype: (male) Mexico: Sonora: vic. San Carlos. 0.5mi N 0.25mi E of Palo Ferro Ranch, in large dry wash, 0.4 mi N of San Carlos Rd. 10 iv 2009 coll. M Van Dam, 27˚58’54”N 111˚05’42”W 68ft. (EMEC)



FIGURES 37–42. *Rhaphiomidas* hind tarsus. **(37)** *R. socorroae*, ventral view; **(38)** *R. acton maehleri*, ventral view; **(39)** *R. tarsalis*, lateral view, arrows denote long hair-like setae which separate the species from *R. hasbroucki;* **(40)** *R. hasbroucki*, lateral view; **(41)** *R. spinicaudus*, tibia ventral view; **(42)** *R. spinicaudus*, epandrium dorsal view.

Paratypes: (3 males, 1 female) Mexico: Sonora: vic. San Carlos. 0.5mi N 0.25mi E of Palo Ferro Ranch, in large dry wash, 0.4 mi N of San Carlos Rd. 10 iv 2009 coll. M Van Dam, L.L. Cardenas & Y. Gadar 27˚58'54"N 111˚05'42"W 68ft. (EMEC), (1 male) same data as holotype but collected on 11 iv 2009 (EMEC), (1 female) Mexico: Sonora: 9 km NW San Carlos SW side Sierra Aguaje, malaise in Alarcan wash; ME Irwin, FD Parker, 30 iii- 5 iv 2008; 68m, 28˚00.64'N 11'05.69'W (CAS).

Etymology. This species in named in honor of Greg R. Ballmer. Greg has contributed thousands of specimens to the UC Riverside Entomology Research Museum over the course of 30 years. In addition he is largely responsible for the listing of *Rhaphiomidas terminatus abdominalis* Cazier, 1941, as a federally listed endangered species (Federal Register 58 FR 49881). This not only preserved vital habitat for this species but many other endemic arthropods. He also has great enthusiasm for collecting *Rhaphiomidas* and Apioceridae.

Ecology. Specimens of *Rhaphiomidas ballmeri* were collected in a dry rocky wash. Specimens were collected as they perched on rounded boulders. One specimen was collected while feeding on floral nectar of *Ruellia californica* (Rose) I.M. Johnston (Acanthaceae) (Fig. 7). Specimens were also seen and taken atop the banks of the wash.

Comments. *Rhaphiomidas ballmeri* shares several distinctive characters with *R. forficatus* Cazier, 1985: the recurved aedeagus, the triangular profile and short length of the gonocoxites in proportion to the length of the epandrium and the coloration of the epandrium (Figs. 8, 10). *R. ballmeri* does not key out readily in Cazier's (1985) key, in addition the key is lacking the five species described after its publication. I have included a key below for males of *Rhaphiomidas* for those reasons. The female of *R. ballmeri* does key out in Cazier's (1985) key to *R. forficatus* but has much less dark maculation on the abdominal tergites (Fig. 9). In a search for *Rhaphiomidas forficatus* conducted in mid April 2009 in Baja California Sur, *Ruellia californica* was also seen in flower, in documented locations of *Rhaphiomidas forficatus*. On inspection of the type specimen of *Rhaphiomidas forficatus*, pollen grains are present on the face and thorax. Indicating that this species also feeds on floral nectar.

K**ey to males of *Rhaphiomidas***

1. Proboscis less than twice the length of antenna (Fig. 31); postpedicel rounded, spherical (Fig. 31); epandrial lobes rounded in lateral view (Figs. 11, 12, 14) 2
- Proboscis more than twice the length of the antenna (Fig. 1); postpedicel not spherical (Fig. 32–36); epandrial lobes variable 4
2. Epandrial lobes clothed in white setae, black in color bordered in pale yellow (USA: AZ, vic. Yuma, Mexico: SON) ..... *brevirostris* Cazier
- Epandrial lobes clothed in pale orange setae 3
3. Body clothed in pale orange setae; epandrial lobes overlapping (USA: TX, Laredo) ..... *hoguei* Rogers
- Body clothed in white setae (Fig. 11, 12, 31); epandrial lobes not overlapping (Figs. 11–12) (USA: CA, AZ) ..... *hirsuticaudus* Cazier
4. Interior surface of epandrial lobes clothed with short spines in distal half (Fig. 41); pulvillus reduced to small narrow pad (Fig. 42) (Mexico: BCN, dunes vic. Guerrero Negro) ..... *spinicaudus* Cazier
- Interior surface of epandrial lobes absent of spines, setae present fine hair-like; pulvillus broad, expanded apically (Figs. 18, 37, 38) 5
5. Hind first tarsomere and apex of hind tibia with a double row of short, stout, cone-shaped macrosetae present on interior surface of tibia, with at least a single row extending to base; with combination of epandrial lobes dark brown to black (Fig. 37) 6
- Hind first tarsomere and apex of hind tibia usually with elongate macrochaetae, (Figs. 19–20); if double row of short, stout, cone-shaped macrosetae present on interior surface of hind tibia with combination of orange epandrial lobes (Fig. 38) 10
6. Epandrial lobes narrowing towards apex, to form a point (Fig. 10), apices overlapping (Figs. 8, 10) (Mexico: BCS). ..... *forficatus* Cazier
- Epandrial lobes not narrow at apex and not overlapping 7
7. Interior base of epandrial lobes with distinct carina; aedeagus with dorsal projections (Fig. 13) (Mexico: BCN, vic. San Quitin) ..... *socorroae* Cazier
- Interior surface of epandrial lobes absent of basal carina; aedeagus lacking dorsal projections 8

8. Aedeagus weakly curved dorsally; abdominal tergites gray bordered in cream color (USA: NV, Moapa Valley) ..... *moapa* Rogers & Van Dam
- Aedeagus distinctly recurved; abdominal tergites not gray 9
9. Bullae-like structures distinctly present on latero-posterior margin of second abdominal tergite; epandrium basal half clothed in long setae, distal half bare (Mexico: NL) ..... *pachyrhynchus* Rogers & Van Dam
- Bullae-like structures absent on latero-posterior margin of second abdominal tergite; epandrial lobes with fine pale setae (Mexico: SON, vic San Carlos) ..... *ballmeri* **sp. nov.**
10. First hind tarsomere distinctly bow-like with fine long hairs (Mexico: BCS, dune 5 mi S Mulege) ..... *scopaflexus* Rogers
- First hind tarsomere not bow-like 11
11. Epandrial lobes overlapping; abdominal tergites gray with narrow border of pale tan (Fig. 14) (USA: AZ, CA) ..... *parkeri* Cazier
- Epandrial lobes not overlapping; abdominal tergites not fitting above description 12
12. Epandrial lobes when closed gonocoxites partially visible from above (Fig. 15) and carina present on interior surface of epandrial lobes (Fig. 16) 13
- Lacking combination of epandrial lobes when closed gonocoxites visible from above and presence of carina on interior surface (Figs. 22, 24); carina if present then epandrial lobes highly falcate (Fig. 25), or if gonocoxites visible from above lacking interior carina (Fig. 30) 14
13. First hind tarsomere with long fine setae (Fig. 39) (USA: CA, vic. Kelso sand dune) ..... *tarsalis* Cazier
- First hind tarsomere without long fine setae (Fig. 40) (USA: AZ, CA) ..... *hasbroucki* Cazier
14. Epandrial lobes entirely black or brown, no bands of color (Figs. 17–18) 15
- Epandrial lobes if dark bordered in tan (Figs. 19–20) or entirely light brown or entirely orange (Figs. 21–30) 16
15. Postpedicel elongate (Fig. 36) ..... 15(A.)

15(A.)Abdominal tergites entirely black (Mexico: BCS, East side of Sierra La Lagunas) ..... *episcopus episcopus* Osten Sacken
- Abdominal tergites orange and black maculated (Mexico: BCS, West side of Sierra La Lagunas) ..... *episcopus michelbacheri* Cazier
- Postpedicel not elongate, widest in middle (Fig. 35) ..... 15(B.)

15(B.)Abdominal tergite III black in basal half, abdominal markings continuous along sides (USA: CA, vic. Palos Verdes Peninsula) ..... *terminatus terminatus* Cazier
- Abdominal tergite III with large isolated dark maculation, abdominal marking narrowly connected at most along sides (USA: CA, vic. Colton) ..... *terminatus abdominalis* Cazier
16. Epandrial lobes black bordered in pale tan or light brown (Figs. 19–20) 17
- Epandrial lobes orange or light brown in color (Figs. 21–30) 18
17. Abdominal tergites mostly orange, some with dark dorsal maculation (USA: AZ, CA) ..... *nigricaudis* Cazier
- Abdominal tergites dark with narrow pale tan vitta at posterior margins (USA: CA, Central Valley) ..... *trochilus* (Coquillett)
18. Postpedicel elongate, roughly twice as long as scape and pedicel combined (Fig. 32); epandrial lobes twice the length of fifth abdominal tergite (Figs. 21–27) 19
- Postpedicel more rounded, roughly length of scape and pedicel combined (Figs. 33–34); epandrial lobes less than twice the length of fifth abdominal tergite (Figs. 28–30) 24
19. Epandrium narrow, roughly width of fifth abdominal tergite (Fig. 22), length of the first hind tarsomere 20
- Epandrium distinctly wider than fifth abdominal tergite (Fig. 24), longer than first hind tarsomere 21
20. Setae on lateral surface of first abdominal segment white (Fig. 21) (USA: CA, NV) ..... *aitkeni* Cazier
- Setae on lateral surface of first abdominal segment orange (Fig. 23) (USA: AZ, NV) ..... *auratus* Cazier
21. Epandrial lobes with dorsal undulation, interior surface with obtuse subdorsal carina, distal third highly falcate (Fig. 25) (USA: CA) ..... *undulatus* Cazier
- Not fitting above description 22
22. Epandrial lobes with weak dorsal undulation, apex falcate (Fig. 26) (USA: AZ, CA) ..... *acton maehleri* Cazier
- Epandrial lobes dorsal surface smooth, apex only weekly falcate (Fig. 27) 23
23. Abdominal middorsal markings usually large; pile usually deep golden and long; mid and hind femora dark (USA: CA, Mexico: BCN) ..... *acton maculatus* Cazier
- Abdominal middorsal markings reduced to line of dots becoming larger at segment five; pile white or golden; mid and hind femora usually orange (USA: CA) ..... *acton acton* Coquillett
24. Lateral ocellus separated from compound eye by more than half its width (Fig. 33); epandrial lobes with a narrow rounded point at apex (Figs. 29–30) (USA: NM, TX) ..... *painteri* Cazier
- Lateral ocellus separated from compound eye by half its width (Fig. 34); epandrial lobes with a broad round point at apex (Fig. 28) ..... 24(A.)

24(A.)Body pile white; abdominal tergites with broad black vitta covering most of basal half; fore and mid femora dark

(Mexico: BCS) ..... *xanthos vittatus* Cazier

- Body pile golden or yellowish; abdominal tergites two through five with at most middorsal black spots; fore and mid femora golden or testaceous (Mexico: BCS) ..... *xanthos xanthos* Townsend

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