



## Review of the Costa Rican *Saltagenes* Diller, 1995 (Hymenoptera: Ichneumonidae: Ichneumoninae: Phaeogenini) with descriptions of seven new species

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### Abstract

The parasitoid wasp genus *Saltagenes* Diller, 1995 is known only from the original description of a single species from Argentina. However, undescribed *Saltagenes* species occur throughout the Neotropical region and into the southern Nearctic. Here, I review the *Saltagenes* species of Costa Rica and describe seven new species: *Saltagenes alboannulatus* sp. nov., *S. atosomus* sp. nov., *S. escazuensis* sp. nov., *S. gauldi* sp. nov., *S. modicum* sp. nov., *S. pseudatosomus* sp. nov., and *S. rotundiceps* sp. nov. The generic diagnosis is revised to account for hitherto unknown morphological diversity of *Saltagenes*. An illustrated key and specimen images are provided to aid in identification. *Saltagenes* is now represented by eight described species though more than double that figure remain undescribed from outside of Costa Rica. More broadly, this study highlights the paucity of our knowledge of Costa Rican Ichneumoninae.

**Key words:** Neotropical region, parasitoid wasp, biodiversity, morphology

### Introduction

The Costa Rican ichneumonid fauna stands out as the best documented of any country or region in the Neotropics, primarily due to the efforts of Ian Gauld and colleagues. Thanks to their work, the Costa Rican species in the following subfamilies have been revised: Acaenitinae, Anomaloninae, Brachycyrtinae, Cremastinae, Ctenopelmatinae, Cylloceriinae, Diplazontinae, Labeninae, Lycorininae, Oxytorinae, Phrudinae, Pimplinae, Poemeniinae, Rhyssinae, Tryphoninae, and Xordinae (Gauld 1988, Gauld 1991, Gauld 2000, Gauld *et al.* 1997, Gauld *et al.* 2002). More recently, Khalaim and Broad (2012, 2013) added Tersilochinae to the list of revised subfamilies.

The Mesochorinae were revised by Sharkey *et al.* (2023). However, that study along with other “minimalist revisions” (e.g., Mierotto *et al.* 2019 and Sharkey *et al.* 2021) has only exacerbated the “superficial description impediment” (Meier *et al.* 2021) due to serious methodological flaws and the flagrant disregard for well-established taxonomic practices (Meier *et al.* 2021, Zamani *et al.* 2021, Zamani *et al.* 2022). Hence, the Mesochorinae have not been ‘revised’ in the same sense as the subfamilies mentioned above. Unless the mesochorine names are found to be unavailable by the International Commission on Zoological Nomenclature, it will fall on subsequent revisors to properly delimit and describe the Costa Rican mesochorines species ostensibly described by Sharkey *et al.* (2023).

In addition to Mesochorinae, the Costa Rican fauna of several other major subfamilies remains almost entirely unknown, the largest of which is Ichneumoninae (Santos 2017, Yu *et al.* 2016). Currently, only 28 ichneumonines are known from Costa Rica. For comparison, in the United Kingdom, the country for which the ichneumonid fauna is arguably the best known in the world, ichneumonine diversity is over three times that of Pimplinae (Broad *et al.* 2018), and in Costa Rica there are 189 described pimpline species (Gaston & Gauld 1993, Yu *et al.* 2016). It is unknown whether this ratio obtains in the Neotropics, but there are undoubtedly hundreds of undescribed ichneumonines in Costa Rica. Gauld (1991) estimated that there are three to four hundred Costa Rican ichneumonines and sorted material at the Utah State University Insect Collection supports that figure as well. This significant gap in our knowledge of ichneumonid diversity underscores the need for increased taxonomic efforts on the ichneumonine

fauna of Costa Rica and the broader Neotropical region. A more complete inventory will not only enrich our understanding of Costa Rican biodiversity but may also yield insights into the purported inverse, or at least shallow, latitudinal diversity gradient of Ichneumonidae (Gauld 1987, Gauld *et al.* 1992, Janzen 1981, Janzen & Pond 2009, Owen & Owen 1974; contrary opinions: Quicke *et al.* 2012, Sääksjarvi *et al.* 2004, Veijalainen *et al.* 2013).

The present study is a review of the genus *Saltagenes* Diller, 1995 (Ichneumoninae: Phaeogenini) of Costa Rica and illustrates the potential for undiscovered ichneumonines in Costa Rica and the Neotropics more generally. *Saltagenes* was formerly known only from a single species in Argentina, represented by two female specimens (Diller 1995). The hosts of *Saltagenes* are unknown, but like nearly all Phaeogenini, *Saltagenes* species almost certainly attack microlepidoptera and emerge from the host pupa (Diller & Shaw 2014). However, the morphology of the metasomal apex varies from strongly oxygygous (Fig. 1G) to semi-amblygygous (Fig. 11G), with a thin, needle-like ovipositor suggesting that both larval and pupal host stages are attacked depending on the species.

Here, I describe and illustrate seven new species of Costa Rican *Saltagenes* and provide a species key. The generic diagnosis is also revised to account for newly discovered morphological diversity within the genus and to distinguish *Saltagenes* from other Neotropical phaeogenin genera, including several that are undescribed.

## Methods

Morphological terminology follows Bennett *et al.* (2019). Surface sculpture terminology follows Harris (1979). “T1”, “T2”, etc. refer to the corresponding metasomal tergites. The “median field” of the supraclypeal area refers to the medial, usually convex area of the supra-antennal area that is delimited ventrally by the hypostomal suture, dorsally by the transverse ridge ventral to the antennal insertions, and laterally by weak, vertical impressions (Heinrich 1960). For species in which sexual dimorphism is minimal, females are described in full while only deviations in morphology and color are noted for males. For sexually dimorphic species, males and females are described separately.

Specimen images were taken with a Canon 1200D body, a Canon EF-S 60mm macro lens for habitus images and a Venus Optics Laowa 25mm Ultra-Macro lens for higher magnification images. Image stacking was performed with Helicon Focus 7 and further processed in the web-based photo editor Photopea (photopea.com). Figures were assembled in LibreOffice Draw 5.4.4.2.

Specimens examined were deposited in the following collections:

NHMUK	The Natural History Museum: London, United Kingdom
CNCI	Canadian National Collection of Insects, Agriculture Canada: Ottawa, Ontario, Canada
EMUS	Entomology Museum, Utah State University: Logan, Utah, U.S.A.
ZSM	Zoologische Staatssammlung München: Munich, Bavaria, Germany

## Taxonomy

### *Saltagenes* Diller, 1995

*Saltagenes* Diller, 1995: 454. Type species: *Saltagenes osteni* Schönitzer. Monotypic and original designation.

**Generic diagnosis.** *Saltagenes* was originally recognized as a distinct genus based on a combination of the following characters: propodeum elongated with distinct dorsal and posterior faces, carinae on dorsal face of propodeum absent, and metasomal tergites elongated (Diller 1995). Most undescribed species conform to this diagnosis, including most Costa Rican species, but several deviate in one or more characters. Specifically, *S. pseudatrosomus* has a short propodeum and moderate-length metasomal tergites, *S. gauldi* has a posteriorly sloping propodeum without distinct dorsal and posterior faces, and the propodeal carination in *S. alboannulatus* is complete in most specimens. Along with the original diagnosis and considering the above exceptions, the combination of the following characters will separate *Saltagenes* from other Neotropical Phaeogenini genera: mandible bidentate with subequal teeth (ventral

tooth slightly shorter); clypeus narrow with a nearly straight ventral margin; basal flagellomeres elgonate (first flagellomere length  $> 3.0 \times$  width); fore wing with 3rs-m present (areolet pentagonal); juxtacoxal carina entirely absent or only present on anterior 0.3 of ventral division of metapleuron; thyridium well developed and wider than interthyridial width; female hind coxa without ventral tooth; and males with distinct tyloids.

**Distribution and diversity.** *Saltagenes* is primarily Neotropical, but its range also extends into the southern Nearctic. The type species, *S. osteni* Schönlitzer, occurs in western Argentina. In addition to the seven newly described species in the current study, undescribed *Saltagenes* species also occur in Brazil, Colombia, Guatemala, Honduras, Mexico, Peru, Venezuela and in southern Arizona and California in the U.S.A. Judging by the available material, species richness is highest in Mexico, where at least ten species occur. *Saltagenes* are typically collected at mid to high elevations (1800–2850 m based on specimens with reliable elevation data).

**Comments.** Sexual dimorphism and dichromatism are minimal in the majority of *Saltagenes* species. The exceptions are *S. alboannulatus* and *S. gauldi*, in which males and females exhibit entirely different color patterns and minor morphological differences. Otherwise, *Saltagenes* males and females are similar, except that males often have more yellowish-white areas on the head and the metasoma is more densely punctate.

*Tycherus tenuicinctus* (Cresson) largely matches the above diagnosis; however, it is here excluded from *Saltagenes* due to several morphological differences (i.e., the short propodeum, complete propodeal carination, and well-developed juxtacoxal carina) and unpublished Ultra-Conserved Elements phylogenomic results showing that it is not included within nor sister to *Saltagenes*. This species has only been recorded from Mexico, but EMUS specimens show that it occurs in Costa Rica as well.

#### Key to the Costa Rican species of *Saltagenes* (males of *S. modicus* and *S. pseudatrosomus* are unknown)

1. Propodeum sloping without distinct dorsal and posterior faces (Figs 7D, 8D) . . . . . *Saltagenes gauldi* sp. nov.
- Propodeum not sloping and with distinct dorsal and posterior faces (e.g., Figs 2D, 3D) . . . . . 2
2. Propodeal carinae on dorsal face well developed (Figs 1D, 2D). Female flagellum with yellowish-white banding on flagellomeres 7–12 (Fig. 1A) . . . . . *Saltagenes alboannulatus* sp. nov.
- Propodeal carinae on dorsal face obsolete (e.g., Figs 3D, 11E). Female flagellum either uniformly brown or dark brown, or at most with incomplete yellowish-white banding on flagellomeres 8–11 (e.g., Figs 3A, 11A) . . . . . 4
4. Primarily black with yellowish-white markings on mesosoma (Figs 3A, 10A) . . . . . 5
- Tricolored with black, yellowish-white and brownish-red areas (e.g., Figs 5A, 6A) . . . . . 6
5. Propodeum long (Fig. 3D). Metasoma granulate and impunctate or with shallow punctation (Fig. 3E) . . . . . *Saltagenes atrosomus* sp. nov.
- Propodeum short (Fig. 10D). Metasoma smooth with shallow punctation (Fig. 10E) . . . . . *Saltagenes pseudatrosomus* sp. nov.
6. Clypeus entirely yellowish-white in both males and females (Figs 11B, 12B). Female metasoma semi-amblypygous with short, stout ovipositor sheaths (Fig. 11G). Supra-antennal area smooth with only ventral 0.1 transversely rugulose and remainder finely, sparsely punctate . . . . . *Saltagenes rotundiceps* sp. nov.
- Clypeus dark brown in females and in males either entirely dark brown or dark brown with ventral margin yellowish-white (Figs 5B, 6B, 9B). Female metasomal apex oxypygous with moderately long ovipositor sheaths (Figs 5G, 9G). Supra-antennal area rugulose or punctate-rugulose . . . . . 7
7. Body length 7.4–7.5. Female flagellum uniformly brown to dark brown with at most flagellomeres 10–11 light brownish dorsomedially (Fig. 9A). Mesopleuron brownish-red with small yellowish-white mark at posteroventral corner . . . . . *Saltagenes modicus* sp. nov.
- Body length 5.5–5.8. Female flagellum brown with incomplete yellowish-white banding on flagellomeres 8–11 (Fig. 5A). Mesopleuron entirely brownish-red . . . . . *Saltagenes escazuensis* sp. nov.

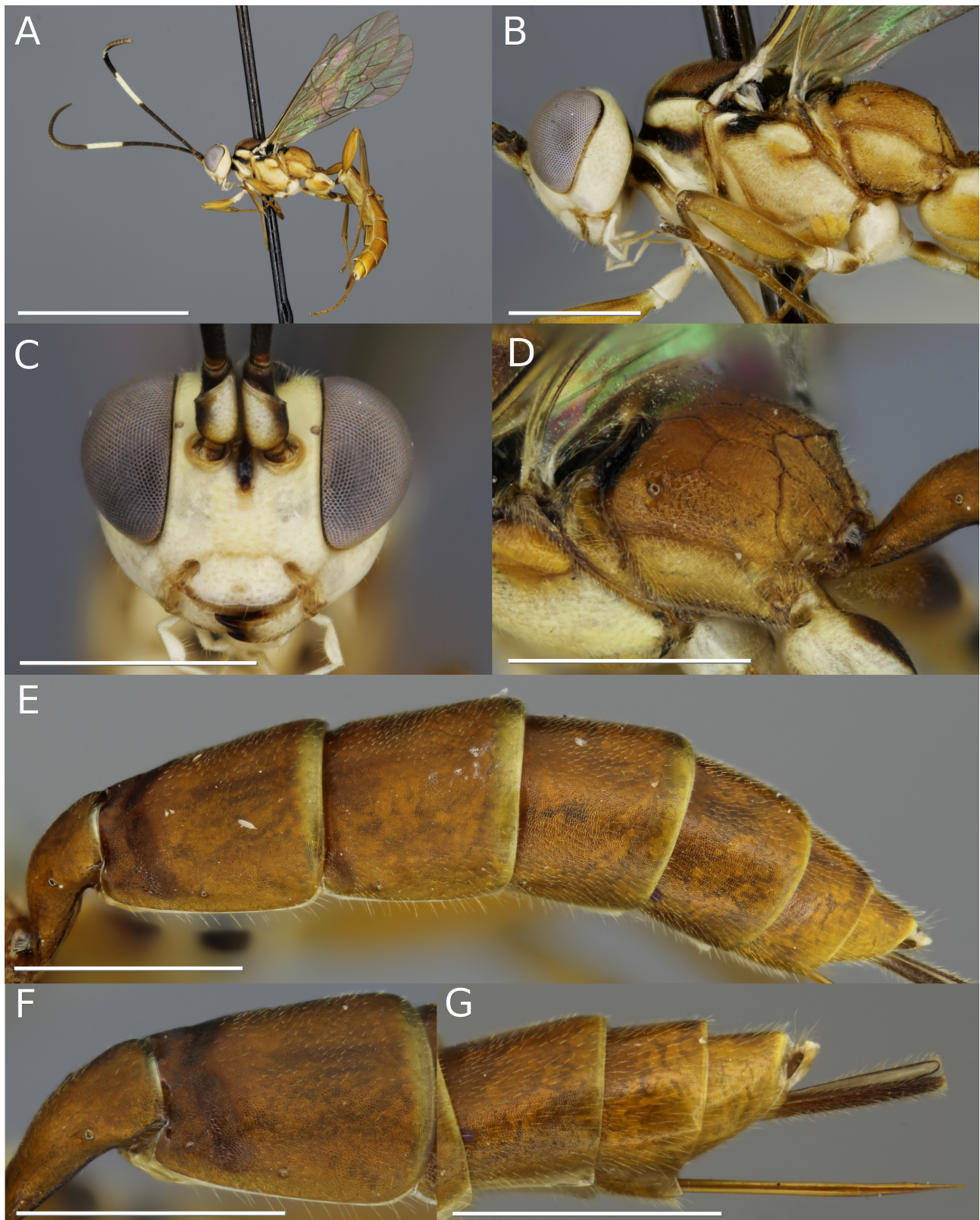
#### *Saltagenes alboannulatus* sp. nov.

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Figs 1–2

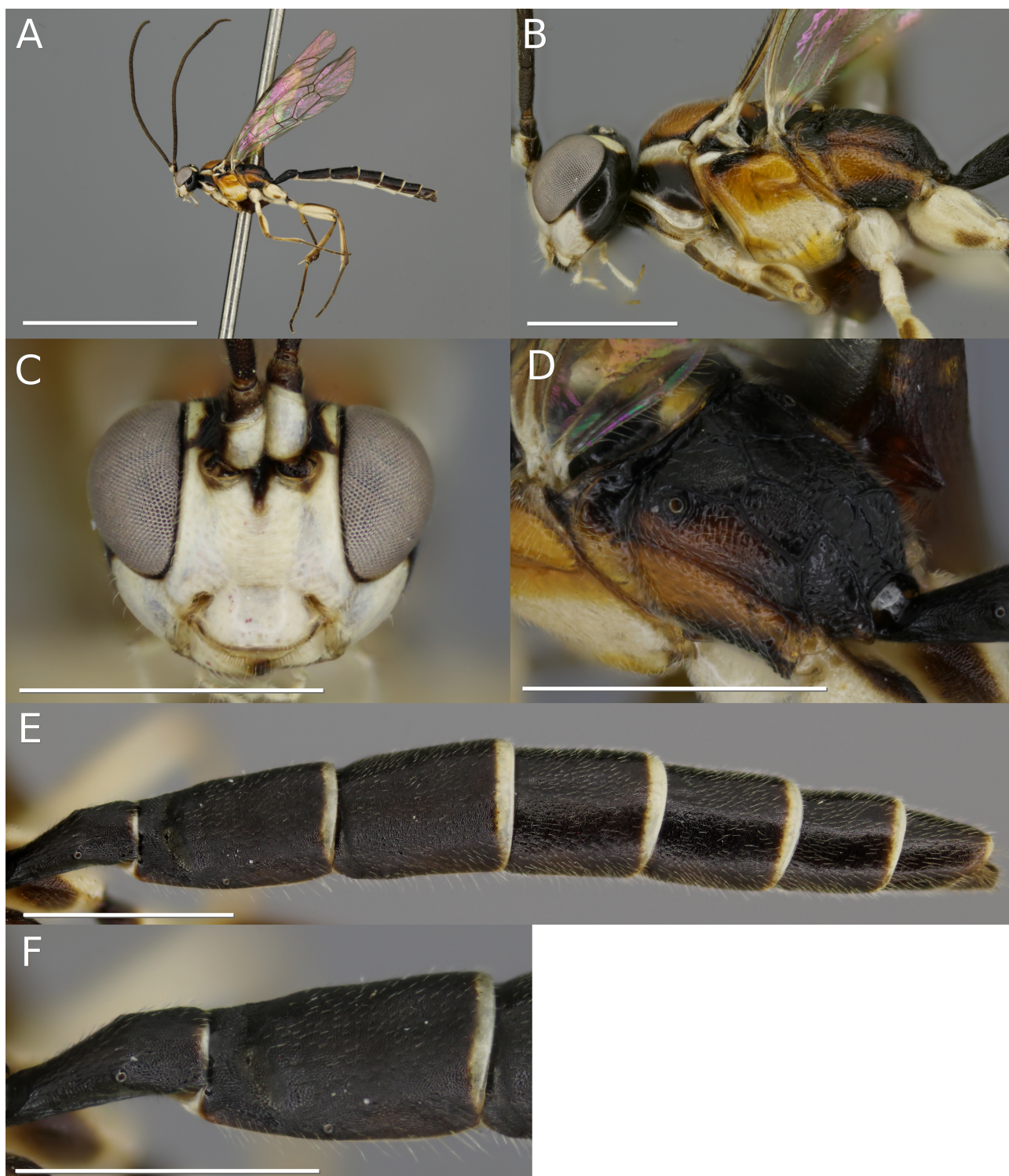
**Diagnosis.** *Saltagenes alboannulatus* is immediately recognizable among congeners by the unique color pattern of each sex. Females are overall lighter in color than other species, being predominantly light brownish-red, and the yellowish-white antennal banding on flagellomeres 7–12 is greater than that of other Costa Rican *Saltagenes*. Males are diagnosed by the combination of the entirely yellowish-white clypeus, supraclypeal area, and ventral 0.5 of the gena and the presence of brownish-red areas on the mesosoma. *Saltagenes alboannulatus* is also unique due to the presence of well-developed carinae on the dorsal face of the propodeum.





**FIGURE 1.** *Saltagenes alboannulatus* sp. nov. holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsolateral view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).





**FIGURE 2.** *Saltagenes alboannulatus* **sp. nov.** paratype male. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsolateral view; F. First and second metasomal segments, dorsolateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–F).

**Description. Female** (Fig. 1A–G). Body length: 5.0–8.2 mm; fore wing length: 3.9–5.3 mm.

**Color.** Predominantly yellowish-white and light reddish brown with restricted black areas. Head primarily yellowish-white becoming more yellow dorsally except: mandibular apex dark brown; median longitudinal black area beginning at narrow dorsomedial mark on supra-clypeal area, widening dorsally on supra-antennal area and vertex before narrowing near occiput; dorsal 0.6–0.7 of occiput dark brown to black. Scape yellowish-white ventrally and

dark brown laterally and dorsally. Pedicel dark brown. Flagellum dark brown except yellowish-white banding on flagellomeres 7–12. Mesosoma tricolored with yellowish-white, black and brownish-red areas. Pronotum primarily yellowish-white with medial black longitudinal stripe. Prosternum yellowish-white becoming dark brown to black at anterior margin. Mesonotum brownish-red with narrow, sublateral yellowish-white longitudinal stripes, anterior and lateral margins black, usually medial semicircular black to dark brown mark on anterior 0.3–0.5, and medial, semicircular black mark at posterior margin. Scutellum varying from brownish-red with yellowish-white lateral margins to primarily yellowish-white with light brownish-red medial mark. Tegula and subalar ridge yellowish-white. Mesopleuron primarily yellowish-white with dorsal 0.1 black anteriorly. Speculum varying from yellowish-white to light brownish-red. Ventral division of metapleuron varying from yellowish-white to brownish-yellow. Propodeum light brownish-red with black anterior margin. Fore and mid legs with coxae, trochanters and trochantelli yellowish-white; femora brownish-yellow to brownish-red, brownish dorsally in one specimen; tibiae brownish dorsally, brownish-yellow ventrally; tarsi light reddish-brown except tarsomere 5 dark brown. Hind leg with coxa brownish-yellow except small anteroapical and large posteroapical brown to dark brown marks, dorsally yellowish-white; trochanter dark brown except apex yellowish-white; trochantellus yellowish-white; femur brownish-yellow to reddish-brown; tibia brownish-yellow dorsally, brownish-yellow ventrally; tarsus reddish-brown except tarsomere 5 dark brown. Metasoma brownish-red except T2–7 with posterior margins yellowish.

**Head.** Clypeus smooth and punctate with punctures separated by 0.5–1.5× their diameter; nearly flat in lateral view. Supraclypeal area nearly smooth to weakly granulate with fine, scattered, nearly indistinct punctures; nearly flat in lateral view; median field indistinct. Gena smooth and impunctate except for a few scattered, subobsolete punctures. Occiput granulate and impunctate. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 31–33 flagellomeres.

**Mesosoma.** Pronotum smooth and impunctate. Epomia well developed. Mesonotum granulate becoming smoother laterally. Scutellum varying from smooth to finely granulate with a few scattered, subobsolete punctures laterally. Mesopleuron granulate-rugulose. Speculum smooth and impunctate. Ventral division of metapleuron varying from rugulose to rugulose-punctate. Propodeum: not sloping, dorsal and posterior faces distinct; carinae well developed except lateral longitudinal carina obsolete; pleural area rugulose-punctate; first lateral area granulate; areola and second lateral area rugulose-granulate; posterior face rugulose.

**Metasoma.** T1–7 granulate and impunctate. Gastrocoelus shallow. Thyridium wide and subadjacent medially. Metasomal apex strongly oxygygous with ovipositor projecting past apex by 0.3–0.4× length of hind tibia.

**Male** (Figs 2A–F). Body length: 5.9–7.4 mm; fore wing length: 3.7–4.9 mm.

**Color.** Primarily black and yellowish-white with reddish-brown areas on mesosoma. Head with the following areas yellowish-white: mandible (except dark reddish-brown apex), clypeus, supraclypeal area except linear black dorsomedial mark and ventral 0.4–0.5 of gena, ventral 0.7 of medial paraocular area, and posterodorsal paraocular area varying from mainly black with a small ovoid yellowish-white mark to broadly yellowish-white and connected to yellowish-white region on medial paraocular area; remainder black. Mesosoma tricolored with yellowish-white, black and brownish-red areas. Pronotum black with anterior margin and posterior 0.8 of dorsal margin yellowish-white. Anterior 0.3–0.5 of propleuron black, remainder yellowish-white. Mesonotum varying from brownish-red with black margins to almost entirely black with faint, sublateral brownish-red marks. Scutellum light brownish-red to brownish-red medially, anterolaterally yellowish-white. Tegula and subalar ridge yellowish-white. Mesopleuron light brownish-red to brownish-red except anterodorsal corner black and longitudinal yellowish-white stripe, brownish-red color lighter ventrally. Speculum brownish-red. Ventral division of metapleuron with dorsal 0.6–0.7 brownish-red, remainder black. Propodeum varying from entirely black to black and partially brownish-red laterally. Fore and mid legs with coxae, trochanters and trochantelli yellowish-white; femora yellowish-white with splotchy light brownish area dorsally; tibiae brownish dorsally, yellowish-white ventrally; fore tarsus with tarsomeres 1–4 reddish-brown and tarsomere 5 dark brown; mid tarsus dark brown. Hind leg with coxa yellowish-white except small for light brown mark anterolaterally and large medial dark brown mark; trochanter dark brown except apical margin yellowish-white dorsally; trochantellus yellowish-white; femur yellowish-white ventrally and brown to dark brown dorsally except yellowish-white base; tibia dark brown except ventral area whitish; tarsus dark brown. Wing: membrane clear; basal 0.1–0.2 of wing with veins white, remaining sections brown. Metasoma black except for tergite posterior margins yellowish-white.

**Head.** Clypeus smooth and several fine, scattered punctures; nearly flat in lateral view. Supraclypeal area smooth with fine, scattered punctures (medially rugulose in 25% of specimens); median field indistinct. Gena



smooth with a few, scattered punctures. Supra-antennal area varying weakly granulate to transversely rugulose, predominantly impunctate except for a few, scattered punctures dorsally and laterally. Occiput smooth with a few, scattered punctures. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 29–31 flagellomeres. Flagellomeres 7/8–16/17 with tyloids.

**Mesosoma.** Pronotum smooth and impunctate. Epomia well developed. Mesonotum varying from smooth to finely granulate, smoother at anterior and lateral margins, posterior 0.5 with shallow punctures, irregular punctures forming longitudinal rugulae in 50% of specimens. Scutellum varying from entirely smooth to smooth and finely punctate. Mesopleuron primarily smooth and varying from sparsely, finely punctate to moderately punctate, punctation denser ventrally; anterodorsal corner longitudinally rugulose. Ventral division of metapleuron varying from smooth and punctate dorsally and rugulose ventrally to entirely rugulose. Propodeum: not sloping, dorsal and posterior faces distinct; slightly longer than wide; carinae well developed; dorsal face varying from nearly smooth to granulate, posterior face smooth and transversely rugulose.

**Metasoma.** Postpetiole granulate and impunctate. Gastrocoelus well developed. Thyridia wide and subadjacent medially. T2–7 granulate becoming smoother posteriorly and with sparse, shallow, indistinct punctures becoming obsolete posteriorly.

**Material examined. Holotype:** GUATEMALA • ♀; Quetzaltenango, Zunil; 2200 m; 7.ix.1987; M. J. Sharkey; EMUSENT00005016. **Paratypes:** COSTARICA • ♂, ♀; Heredia Province; Vara Blanca; Finca Georgina; 2100 m; iii–iv.1990; EMUSENT00005507, EMUSENT00003690 • ♀; same data as preceding; v–vi.1990; EMUSENT00005114 • ♂; San José Province, Cerro de la Muerte, 16 km S Empalme; 2600 m; xii.1988; Gauld; EMUSENT00004800 • ♂; San José Province, 26 km N San Isidro; 2100 m; iii.1991; I. D. Gauld & P. Hanson; EMUSENT00005452 • ♂; same data as preceding; iii–iv.1992; EMUSENT00000279 • ♂; San José Province, Zurquí de Moravia, nr. to Braulio Carrillo N. P.; 1600 m; Gauld; EMUSENT00004982. GUATEMALA • ♀; Huehuetzango, 20 km NE Todos Santos, Cuchumatán; 31.viii.1987; Sharkey; EMUSENT00005244 • ♀; Guatemala, San José Pinalá; 1800 m; 29.viii.1987; M. J. Sharkey; EMUSENT00005274. HONDURAS • ♀; Cerro Monserrat; 1800 m; 30.v.1994; H. & A. Howden; EMUSENT00005155 • 3♂♂; Francisco Morazán; 30 km E Tegucigalpa, Cerro Uyuca; 1800 m; 6.vi.1994; H&A Howden; EMUSENT00000114; EMUSENT00000100, EMUSENT00000064 • 3♂♂; same collection data as preceding; 27.v.1994; EMUSENT00000144, EMUSENT00000757, EMUSENT00000276. PANAMA • ♀; Chiriquí, Cerro Punta; 01.vi.1977; H. & A. Howden; EMUSENT00005211. **Nontypes:** MEXICO • ♀; Guadalajara, Jalisco; “^^.^^.1989”; H. W. Fittkau; ZSM • ♀; Sinaloa, 15 mi. W. El Palmito; 5000’; 25.vii.1964; W. R. M. Mason; CNCI • ♀; same collection data as preceding; 08.viii.1964 • ♂, 2♀♀; Durango, 30 mi W. La Cuicdad; 6500 ft.; 4.viii.1964; W. R. M. Mason; CNCI • ♂; Durango, 24 mi. W. La Cuidad; 7000 ft.; 4.vii.1964; W.R.M. Mason; CNCI • ♂; same collection data as preceding; 12.vii.1964 • ♂; same collection data as preceding; 30.vii.1964 • ♂; same collection data as preceding; 4.viii.1964 • ♀; same collection data as preceding; 20.vii.1964 • ♀; Chipas, San Cristóbal de las Casas; 7200 ft.; 24.vi.1969; Malaise Trap; CNCI.

**Etymology.** Named for the distinctive broad, yellowish-white antennal banding of the females. Derived from *albo-* (Latin) and *annulatus* (ringed).

**Comments.** The sex association was made based on the concurrence of males and females at multiple sites and the well-developed carinae on the dorsal face of the propodeum, a unique character in *Saltagenes*. Although *S. alboannulatus* is strongly sexually dichromatic, there are only minor morphological differences between the sexes.

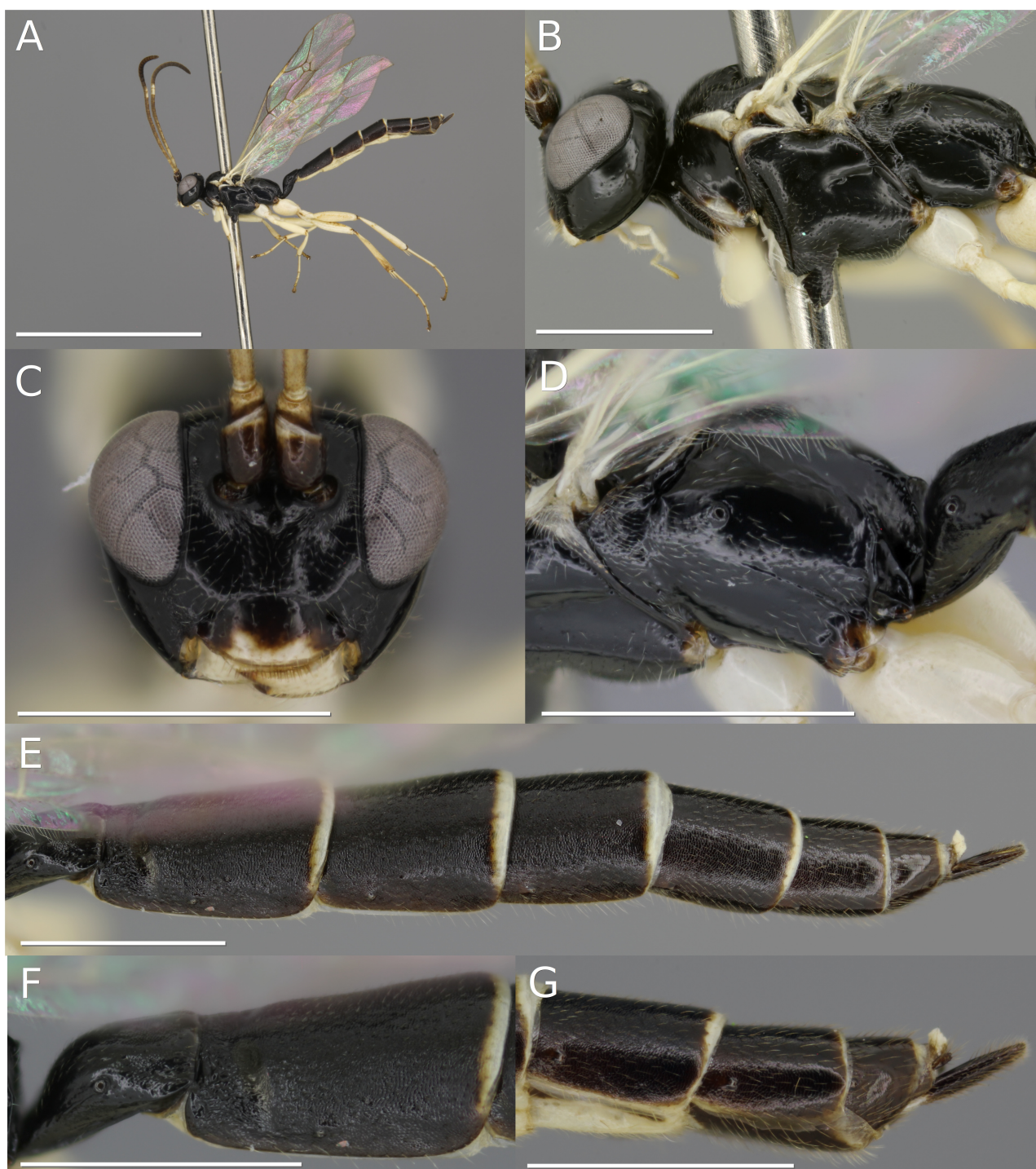
### *Saltagenes atosomus* sp. nov.

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Figs 3–4

**Diagnosis.** Similar to *S. pseudatosomus* and males of *Saltagenes gauldi*, *Saltagenes atosomus* is black and yellowish-white without brownish-red areas, unlike the remainder of *Saltagenes* species, which have at least some brownish-red areas. *Saltagenes atosomus* is distinguished from *S. gauldi* males by the black mesopleuron with a small posteroventral yellowish-white mark and the propodeum with distinct dorsal and posterior faces in *S. atosomus*, while in *S. gauldi* the mesopleuron is black with a longitudinal yellowish-white stripe and the propodeum slopes posteriorly (without posterior and dorsal faces). *Saltagenes atosomus* and *S. pseudatosomus* can be separated based on the longer propodeum, well-developed epomia, and granulate metasoma in *S. atosomus*, whereas *S. pseudatosomus* has a shorter propodeum, weakly-developed to obsolete epomia, and a smooth metasoma.



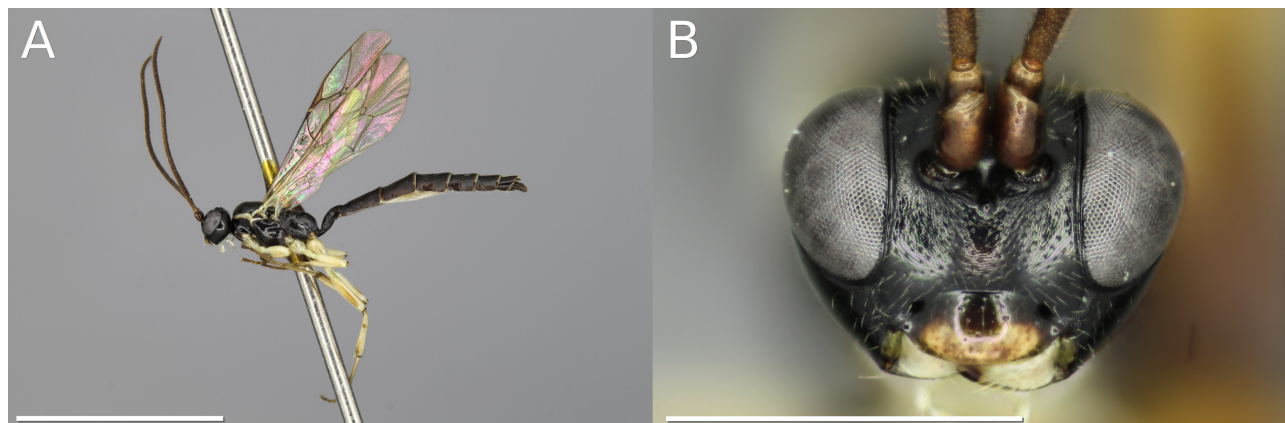


**FIGURE 3.** *Saltagenes atrosomus* **sp. nov.** holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsolateral view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).

**Description. Female** (Fig. 3A–G). Body length: 7.4–7.9 mm; fore wing length: 5.0–5.3 mm.

**Color.** Overall black with yellowish-white legs and restricted yellowish-white areas. Head black except mandible yellowish-white (excluding dark brown apex) and clypeus with ventral margin to 0.2–0.4 yellowish-white; one specimen with clypeus ventrally dark brown. Scape and pedicel dark brown. Flagellum brown becoming dark brown apically with incomplete yellowish-white banding on flagellomeres 10–11. Mesosoma black except the following areas yellowish-white: venterolateral corner of propleuron, posterior 0.6–0.7 of dorsal margin of pronotum, ventral

mark on posteroventral margin of pronotum, tegula, subalar ridge, anterolateral marks on scutellum; one specimen with yellowish-white, posteroventral mark on mesopleuron. Legs primarily yellowish-white except: tarsomere 5 of fore and mid legs brown; tarsomeres 4–5 of hind leg brown; hind femur with faint, splotchy brown marks anteriorly and posteriorly; hind tibia and tarsomeres splotchy brown ventrally; one specimen with more extensive brownish coloration on hind leg and a similar but fainter pattern on fore and mid legs. Wing: membrane clear; basal 0.1–0.2 of wing with veins white, remaining sections brown. Metasoma black with posterior margins of T2–6 yellowish-white.



**FIGURE 4.** *Saltagenes atrosomus* sp. nov. paratype male. A. Habitus; B. Head, frontal view. Scale bars: 5.0 mm (A); 1.0 mm (B).

**Head.** Clypeus smooth and sparsely punctate with punctures separated by  $3.0\text{--}6.0\times$  their diameter; nearly flat in lateral view. Supraclypeal area smooth and finely punctate with punctures separated by  $0.5\text{--}4.0\times$  their diameter, sparser laterally, one specimen with median field finely coriaceous; weakly convex in lateral view; median field varying from indistinct to weakly delimited. Gena smooth and impunctate except for a few scattered punctures. Ventral 0.2–0.4 of supra-antennal area transversely rugulose, remainder varying from smooth and nearly impunctate to moderately punctate with punctures separated by  $0.5\text{--}1.5\times$  their diameter. Vertex smooth and impunctate except for a few scattered punctures. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 23 flagellomeres.

**Mesosoma.** Pronotum smooth and impunctate. Epomia varying from weakly-developed to obsolete. Mesonotum smooth and finely punctate with punctures separated by  $3.0\text{--}5.0\times$  their diameter. Scutellum smooth and impunctate. Mesopleuron smooth, anterior and ventral 0.4 finely punctate with punctures separated by  $1.5\text{--}4.0\times$  their diameter. Speculum smooth and impunctate. Ventral division of metapleuron varying from smooth with a few scattered fine punctures to finely punctate with punctures separated by  $0.5\text{--}1.5\times$  their diameter, denser ventrally. Propodeum: not sloping, dorsal and posterior faces distinct; carinae obsolete except posterior transverse carina well developed; dorsal face smooth and impunctate medially, finely punctate laterally; posterior face smooth and transversely rugulose in 50% of specimens.

**Metasoma.** Postpetiole smooth and postpetiole varying from smooth to finely granulate, laterally with a few shallow, scattered punctures. Gastrocoelus well developed. Thyridia wide and subadjacent medially. T2–7 granulate becoming smoother posteriorly, punctation varying from obsolete to T2 densely, shallowly punctate becoming indistinct posteriorly. Metasomal apex oxypygous with ovipositor projecting beyond apex by  $\sim 0.2\times$  length of hind tibia.

**Male.** (Fig 4A–F). Body length: 7.8 mm; fore wing length: 5.0 mm. As in female except: propodeum shorter and hind tarsomeres 2–4 brown. Antenna with 27 flagellomeres. Flagellomeres 6–15 with tyloids.

**Material examined.** *Holotype*: COSTA RICA • ♀; San José Province, Cerro de la Muerte, 20 km south of Empalme; 2800m; vii–viii.1988; I. D. Gauld; EMUSENT00000745. *Paratypes*: COSTA RICA • ♀; Cartago Province, Cerro de la Muerte, Villa Mills; 3000m; xi.1988–i.1989; Gauld; EMUSENT00000069 • ♂; San José Province; Cerro de la Muerte, 3 km W–16 km S Empalme; 2600m; iv–v.1993; Gauld; EMUSENT00004996 • ♀; San José Province, Cerro de la muerte, 16 km S Empalme; 2600m; i–ii.1989; Gauld; EMUSENT00000337.

**Etymology.** Named for the overall black coloration and derived from the Latin *atro-* (black) and *soma* (body).



***Saltagenes escazuensis* sp. nov.**

urn:lsid:zoobank.org:act:6211B602-0317-49FF-8180-709FB0389AEF

Figs 5–6

**Diagnosis.** *Saltagenes escazuensis* is diagnosed by a combination of the following characters: female clypeus dark brown; female flagellum brown with incomplete yellowish-white banding on flagellomeres 8–11; dorsal margin of pronotum with anterior 0.4 black and remainder brownish-red except small yellowish-white area at posterodorsal margin; clypeus and supraclypeal area weakly convex; propodeal carinae on dorsal face of propodeum obsolete; propodeum not sloping posteriorly (with distinct dorsal and posterior faces); female oxygygous; and body length 5.5–5.8 mm. *Saltagenes escazuensis* species is most similar to *Saltagenes modicus* but is easily distinguished by the significantly smaller body size, dorsal margin of pronotum with anterior 0.4 black and remainder brownish-red except for a small yellowish-white area at posterodorsal margin (dorsal margin of pronotum predominantly yellowish-white in *S. modicus*), and female flagellum brown with incomplete yellowish-white banding on flagellomeres 8–11 (female flagellum in *S. modicus* without antennal banding or at most flagellomeres 8–11 faintly lighter dorsomedially).

**Description. Female** (Fig. 5A–G). Body length: 5.5–5.8 mm; fore wing length: 3.4–3.7 mm.

**Color.** Head and metasoma primarily black, metasoma brownish-red with restricted yellowish-white areas and legs yellowish-white. Head primarily black becoming dark reddish-brown ventrally except clypeus dark brown and mandible yellowish-white (except dark brown apex). Scape and pedicel yellowish-white anteriorly and posteriorly brown to dark brown. Flagellum brown except flagellomeres 8–11 with incomplete yellowish-white banding and apical 1/3<sup>rd</sup> dark brown dorsally. Mesosoma brownish-red except: posterior 0.2 of dorsal margin of pronotum and subalar ridge yellowish-white; anterior 0.4 of pronotum and medial 0.5 of propodeum black. Fore and mid legs with coxae, trochanters and trochantelli yellowish-white; femur yellowish-white with large splotchy light brown marks anteriorly and posteriorly tibiae dorsally splotch brown except basal 0.1–0.2 yellowish-white, ventrally yellowish-white; tarsomeres 1–4 brown and tarsomere 5 dark brown. Hind leg with coxa dark brown anteroventrally becoming yellowish-white posterodorsally; trochanter basal 0.5 dark brown, apical 0.5 yellowish-white; femur yellowish-white with large splotchy light brown marks anteriorly and posteriorly; tibia dorsally splotchy brown except basal 0.1–0.2 yellowish-white, ventrally yellowish-white; tarsi brown except tarsomere 5 dark brown. Metasoma black except posterior margins of T2–6 yellowish-white.

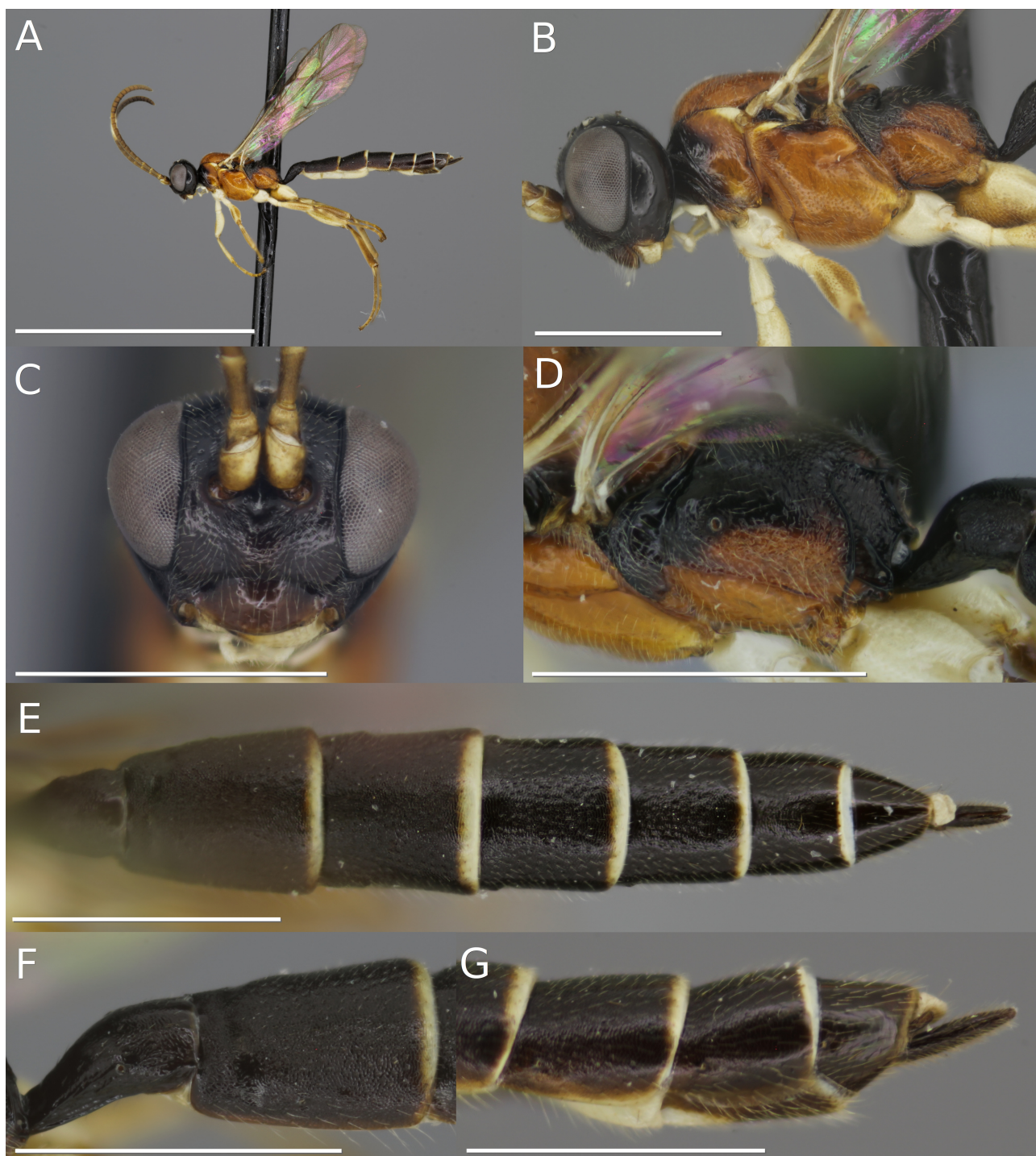
**Head.** Clypeus smooth with a few scattered punctures; moderately convex in lateral view. Supraclypeal area smooth and sparsely, finely punctate laterally with punctures separated by 1.5–3.0× their diameter, punctuation becoming denser medially; moderately convex in lateral view; median field distinct and convex. Gena smooth with a few scattered punctures. Supra-antennal area predominantly smooth to partially granulate with irregular punctuation, ventral 0.1–0.2 transversely rugulose. Vertex smooth with a few scattered punctures. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 23 flagellomeres

**Mesosoma.** Pronotum smooth and impunctate. Epomia well developed. Mesonotum smooth and finely, shallowly punctate with punctures separated by 2.0–5.0× their diameter. Scutellum smooth with a few indistinct punctures. Mesopleuron smooth and finely, shallowly punctate with punctures separated by 2.0–4.0× their diameter. Speculum smooth and impunctate. Ventral division of metapleuron smooth and finely, shallowly punctate, ventral 0.3 irregularly rugulose-punctate. Propodeum: not sloping, dorsal and posterior faces distinct; carinae obsolete on dorsal face and well developed on posterior face; dorsal face finely rugulose-punctate laterally becoming smooth anteromedially; posterior face rugulose.

**Metasoma.** Postpetiole smooth anteriorly becoming granulate at postpetiole and impunctate. Gastrocoelus shallow. Thyridia wide and subadjacent medially. T2–7 granulate becoming smoother posteriorly, shallowly punctate with punctures separated by 1.0–1.5×. Metasomal apex weakly oxygygous with ovipositor projecting beyond apex by ~0.2× length of hind tibia.

**Male** (Fig. 6A–B). Body length: 5.4–5.7 mm; fore wing length: 3.4–3.6 mm. Antenna with 23 flagellomeres. Flagellomeres 5–13 with tyloids.

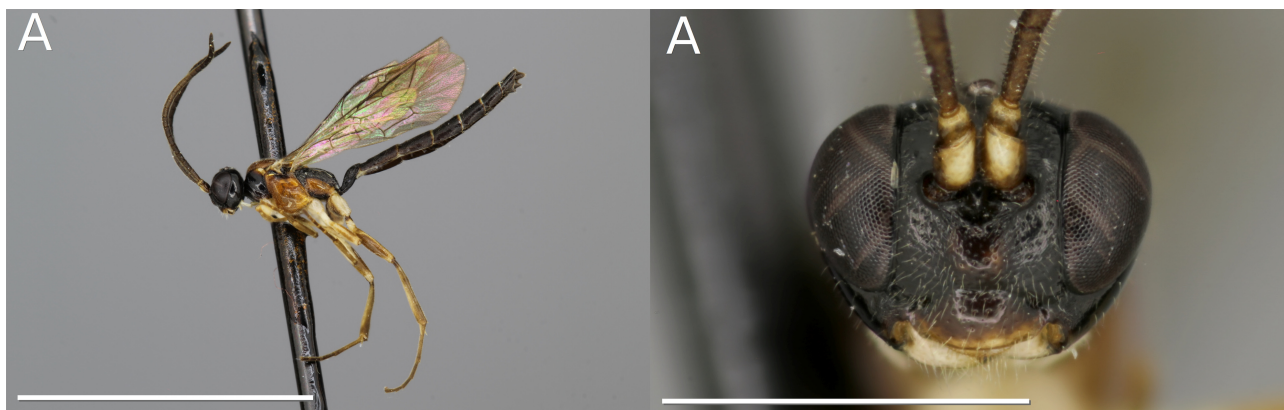




**FIGURE 5.** *Saltagenes escazuensis* **sp. nov.** holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsal view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).

**Material examined.** *Holotype*: COSTA RICA • ♀; Escazú; 20.v.1987; H. & M. Townes; EMUSENT00005020. *Paratypes*: COSTA RICA • 3♂♂; San José Province, San Antonio de Escazu; 25.iii.–09.iv.1984; Sydney A. Cameron; by malaise trap; EMUSENT00005363, EMUSENT00005129, EMUSENT00005088 • 1♂; same data as preceding; 10.iv.1984; EMUSENT00004731 • 1♂; same data as preceding; 15–25.iii.1984; EMUSENT00005259.

**Etymology.** Named for the type locality.



**FIGURE 6.** *Saltagenes escazuensis* **sp. nov.** paratype male. A. Habitus; B. Head, frontal view. Scale bars: 5.0 mm (A); 1.0 mm (B).

***Saltagenes gauldi* sp. nov.**

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Figs 7–8

**Diagnosis.** The evenly sloping propodeum without distinct dorsal and posterior faces is sufficient to differentiate *Saltagenes gauldi* from congeners, as does the unique color pattern of each sex.

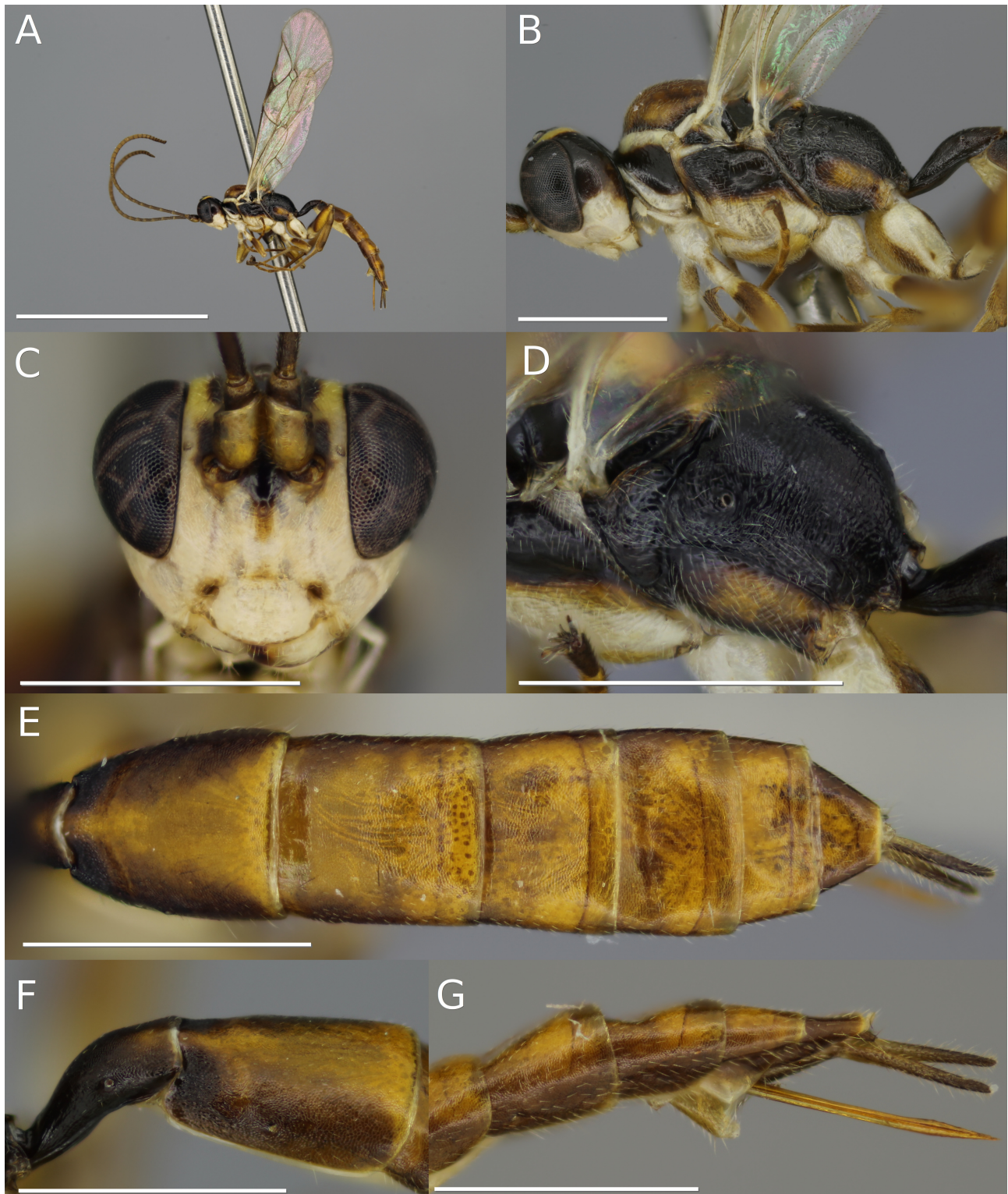
**Description. Female** (Fig. 7A–G). Body length: 5.0–7.7 mm; fore wing length: 4.6–5.8 mm.

**Color.** Primarily light brownish-red to reddish-brown with extensive yellowish-white and black areas. Head yellowish-white becoming more yellow dorsally except: mandibular apex dark brown; epistomal suture faintly light brown medially; dorsal 0.2–0.3 of supraclypeal area with narrow longitudinal dark brown to black mark; supra-antennal area and vertex black except paraocular area broadly yellowish-white and extending posteromedially on vertex except posterior margin of vertex narrowly black medially; dorsal 0.5 of gena black; occiput dark brown to black. Scape light brown anteriorly, dark brown posteriorly. Pedicel dark brown. Flagellum dark brown basally becoming light brown apically. Mesosoma tricolored with extensive yellowish-white, black and brownish-red areas. Propleuron yellowish-white becoming dark brown to black at anterior margin. Pronotum black except ventral and posterior margins yellowish-white. Mesonotum brownish-red. Scutellum brownish-red with anterolateral yellowish-white marks. Tegula and subalar ridge yellowish-white. Mesopleuron with dorsal 0.1–0.3 and speculum black, narrowly light brownish-red ventral to black area, broadly yellowish-white medially except small light brownish-red mark at anterior end of sternaulus, ventrally light brownish-red except black ventral margin. Ventral division of metapleuron varying from black to brownish-red. Propodeum varying from entirely black to primarily black or dark reddish-brown with lighter reddish-brown areas, particularly anterolaterally and posteromedially. Fore and mid legs with coxae and trochanters yellowish-white; trochantelli yellowish-white with brownish ventral marks, occasionally with anterodorsal brownish markings; femora primarily brownish-yellow except basal 0.1 yellowish-white and anterodorsally dark brown becoming lighter apically; tibiae reddish-brown dorsally and brownish-yellow to yellowish-brown ventrally; tarsi reddish-brown except tarsomere 5 dark brown. Hind leg with coxa yellowish-white with basal 0.4–0.5 of anterior and posterior faces brownish-yellow and apical 0.4–0.5 dark brown except apex yellowish-white; trochanter dark brown except apex yellowish-white; trochantellus yellowish-white; femur brownish-yellow except base yellowish-white and dorsally brown to dark brown; tibia brown dorsally except whitish mark at basal 0.2, ventral face brownish-yellow; tarsus reddish-brown to dark brown and tarsomere 5 dark brown. Wing: membrane clear; 0.1–0.2 of wing with veins white, remaining sections brown. T1 anteriorly black, postpetiole varying from entirely black to light brownish-red. T2 light brownish-red to brownish-red except area anterior to thyridium black and laterally brown to dark brown. T3–7 varying from almost entirely light brownish-red to brown and medially light brownish-red.

**Head.** Clypeus smooth and punctate with punctures separated by 0.5–1.0× their diameter; weakly convex in lateral view. Supraclypeal area varying from entirely smooth to finely granulate medially, impunctate medially with sparse, shallow punctures laterally; nearly flat in lateral view; median field indistinct. Gena smooth and impunctate



except for a few fine, scattered punctures. Supra-antennal area with minute transverse rugulae. Vertex varying from smooth to finely granulate, impunctate. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 28–32 flagellomeres.



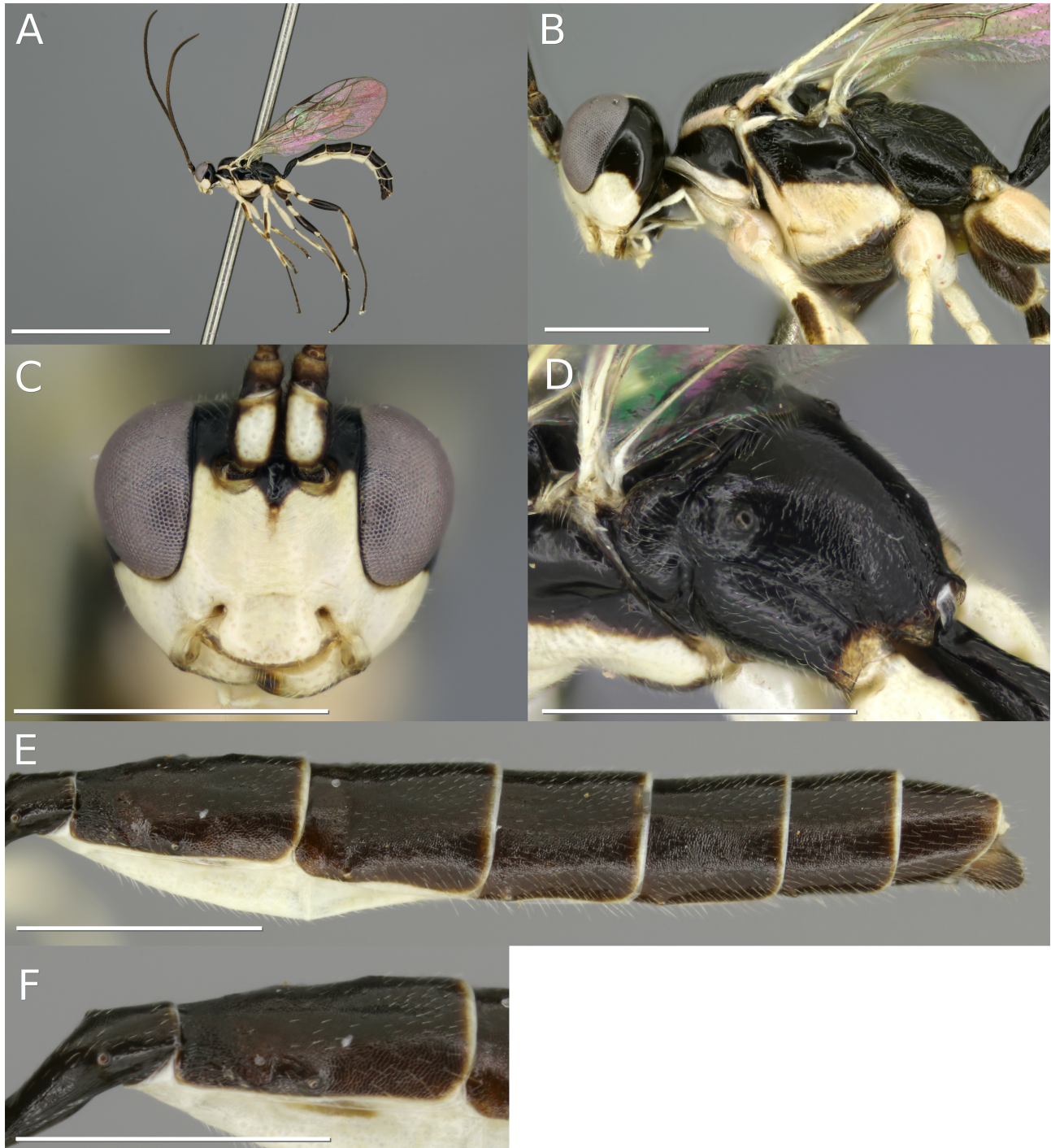
**FIGURE 7.** *Saltagenes gauldi* **sp. nov.** holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsal view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).



**Mesosoma.** Pronotum smooth and impunctate. Epomia well developed. Mesonotum granulate, impunctate. Scutellum smooth, impunctate except for a few shallow, subobsolete punctures. Mesopleuron punctate becoming longitudinally punctate-rugulose posteriorly, anterodorsal corner longitudinally rugulose. Speculum smooth and impunctate. Ventral division of metapleuron varying from smooth with irregularly punctate to finely punctate-rugulose. Propodeum: sloping, without dorsal and posterior faces; carinae obsolete except median longitudinal carina subobsolete posteriorly; surface sculpture transversely rugulose.

**Metasoma.** Postpetiole granulate and impunctate. Gastrocoelus shallow. Thyridia wide, medially separated by 0.2–0.3 thyridium width. T2–7 granulate and impunctate becoming smoother posteriorly.

**Male.** (Fig 8A–F). Body length: 7.0–7.4 mm; fore wing length: 4.7–5.0 mm.



**FIGURE 8.** *Saltagenes gauldi* **sp. nov.** paratype male. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsolateral view; F. First and second metasomal segments; dorsolateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–F).

**Color.** Primarily black with extensive yellowish-white markings. Head with mandibles, clypeus, supraclypeal area, ventral 0.4 of gena, and small, paraocular marks at vertex yellowish-white; apex of mandible dark brown; dorsal 0.2 of supraclypeal area with ventrally tapering medial black mark; remainder of head black. Scape yellowish-white anteriorly, black posteriorly. Pedicel and flagellum brown anteriorly, black posteriorly. Mesosoma black except the following areas yellowish-white: dorsal 0.6–0.8 of propleuron, dorsal and ventral margins of pronotum, tegula, subalar ridge, epicnecium, posteriorly tapering mark on ventral 0.2–0.5 of mesopleuron, anterolateral marks on scutellum. Fore and mid legs with coxae, trochanters and trochantelli yellowish-white; femora yellowish-white except apical 0.8–0.9 light brown anterodorsally; fore tibia yellowish-white except dorsal face predominantly splotchy dark brown; middle tibia primarily yellowish-white except apical 0.3–0.6 splotchy light brown anterodorsally; fore tarsus with tarsomeres 1–4 light brown and tarsomere 5 dark brown; middle tarsus dark brown. Hind leg with coxa predominantly yellowish-white except anteromedially brown to dark brown; trochanter dark brown except yellowish-white apex; femur dark brown except yellowish-white apex; tibia brown to dark brown except ventrally yellowish-white except at apex; tarsus black. Wing: membrane clear; basal 0.1–0.2 of wing with veins white, remaining sections brown. Metasoma black except posterior margin of T2–7 yellowish-white and thyridium dark brown.

**Head.** Clypeus smooth and finely, sparsely punctate with punctures separated by 1.0–4.0× their diameter; weakly convex in lateral view. Supraclypeal area smooth and finely, sparsely punctate with punctures separated by 1.0–4.0× their diameter; nearly flat in lateral view; median field indistinct. Gena smooth and impunctate except for a few scattered punctures. Supra-antennal area with ventral 0.5 transversely coreaceous-rugulose, dorsal 0.5 finely coriaceous. Vertex smooth and impunctate except for a few scattered punctures. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 29–30 flagellomeres. Flagellomeres 7/8–19 with tyloids.

**Mesosoma.** Pronotum smooth and impunctate. Epomia absent. Mesonotum granulate, smoother laterally, posterior 0.4 with minute longitudinal rugosity medially. Scutellum smooth and impunctate. Mesopleuron with anterodorsal corner varying from smooth to longitudinally rugulose, remainder smooth and finely punctate with punctures becoming denser ventrally. Speculum smooth and impunctate. Ventral division of metapleuron smooth and finely punctate, denser near margins. Propodeum: sloping, without distinct dorsal and posterior faces; carinae obsolete except posterior 0.2 of median longitudinal carinae subobsolete; anterior 0.7 transversely minutely rugulose, posterior 0.3 irregularly rugulose.

**Metasoma.** Postpetiole finely granulate. T2 granulate and posterior 0.3–0.5 with indistinct, shallow punctation. T3–7 granulate becoming smoother posteriorly. Gastrocoelus shallow. Thyridia wide and subadjacent medially. Metasoma apex strongly oxygygous with ovipositor sheaths projecting beyond apex by ~0.2× length of hind tibia.

**Material examined. Holotype:** Costa Rica • ♀; Cartago Province, Cerro de la Muerte Villa Mills; 3000m; xi–xii.1989; Gauld; EMUSENT00005530. **Paratypes:** COSTA RICA • 2♂♂1♀; San José Province, 20 km south of Empalme, Cerro de la Muerte; 2800m; iii–iv.1990; I. Gauld; EMUSENT00004934, EMUSENT00004930, EMUSENT00004713 • 2♂♂1♀; same data as preceding, vii–viii.1990; EMUSENT00000131, EMUSENT00000260, EMUSENT00004944 • 2♀♀; San José Province, 20 km south of Empalme; ix.1989; I. D. Gauld; EMUSENT00005515, EMUSENT00004813 • 2♂♂; San José Province, Cerro de la Muerte; 2700m; v–vi. 1989; Gauld & Mitchell; *Quercus* forest; EMUSENT00000697, EMUSENT00000161 • 1♀; same data as preceding; vii.1988; EMUSENT00003742 • 2♀♀; San José Province, Cerro de la Muerte, 16 km south of Empalme; 2600m; iii–iv.1989; Gauld; EMUSENT00004890, EMUSENT00004793.

**Etymology.** Named in honor of the Ian Gauld whose collecting efforts in Costa Rica made this study possible.

**Comments.** Although males and females differ considerably in color, their association is evidenced by the unique sloping propodeum and co-occurrence at high elevation sites near Cerro de la Muerte in central Costa Rica.

### *Saltagenes modicus* sp. nov.

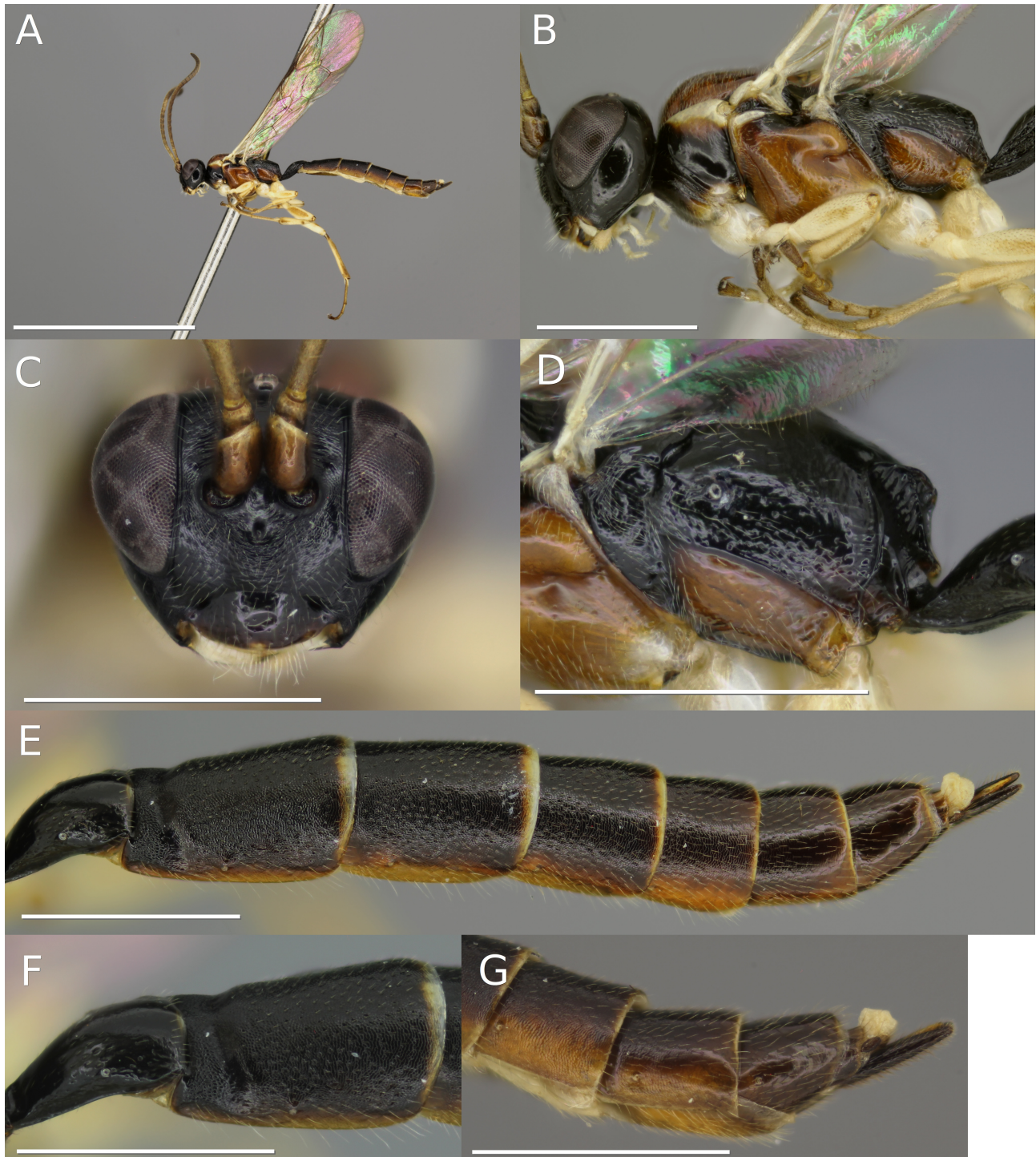
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Fig. 9

**Diagnosis.** *Saltagenes modicus* diagnosed by a combination of the following characters: female clypeus black to dark brown; clypeus and supraclypeal area weakly convex; propodeal carinae on dorsal face of propodeum



obsolete; propodeum not sloping posteriorly (i.e., with distinct dorsal and posterior faces); female oxygygous; female flagellum varying from entirely brown to brown with flagellomeres 8–11 lighter dorsomedially; mesopleuron brownish-red with small yellowish-white spot at posteroventral corner; ventral division of metapleuron smooth and finely punctate; postpetiole smooth and rugulose-punctate laterally; and body length 7.4–7.5 mm. Among Costa Rican *Saltagenes*, *S. modicus* is most similar to *S. escazuensis* but is easily distinguished by the larger body size and differences in color, as noted in the diagnosis of *S. escazuensis*.



**FIGURE 9.** *Saltagenes modicus* **sp. nov.** holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsolateral view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).



**Description. Female** (Fig. 9A–G). Body length: 7.4–7.5 mm; fore wing length: 4.9–5.1 mm.

**Color.** Primarily black and brownish-red with restricted yellowish-white marks and yellowish-white legs. Head black except mandible yellowish-white (except dark brown apex) and clypeus becoming dark brown ventrally. Scape and pedicel brown. Flagellum brown with apical 1/3<sup>rd</sup> dark brown; one specimen with flagellomeres 10–11 light brown dorsomedially. Mesosoma primarily brownish-red except: center of pronotum, dorsal division of metapleuron, propodeum except partially brownish-red area laterally, and sulci black; venterolateral corner propleuron, anterior 0.9 of dorsal margin and venteroposterior corner of pronotum, subalar ridge and tegula yellowish-white. Fore and mid legs yellowish-white except: tibia with faint splotchy brownish marks on apical 0.5 of anterior face surface; tarsomeres 3–4 light brown; tarsomere 5 dark brown. Hind leg with coxa, trochanter, and trochantellus yellowish-white; femur splotchy light brown on anterior and posterior faces; tibia with base dark brown ventrally, anterior and posterior surfaces splotchy light brown and more distinct brown mark at 0.3–0.4 from base; tarsomeres 1–2 yellowish-white dorsally and splotchy brown ventrally; tarsomeres 3–4 brown; tarsomere 5 dark brown. Metasoma primarily dark brown black except T2–7 laterally reddish-brown and posterior margins of T2–7 yellowish-white.

**Head.** Clypeus smooth and impunctate except for a few scattered punctures; weakly convex in lateral view. Supraclypeal area with median field rugulose-punctate, laterally smooth and moderately punctate with punctures separated by 0.5–2.0× their diameter; weakly convex in lateral view; median field well-defined. Gena smooth and impunctate except for a few scattered punctures. Ventral 0.3 of supra-antennal area transversely striate, dorsal 0.7 smooth and punctate with punctures separated by 0.3–1.5× their diameter becoming sparser dorsally. Occiput smooth and impunctate except for a few scattered punctures. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 25–26 flagellomeres.

**Mesosoma.** Pronotum smooth and impunctate except for a few scattered punctures. Epomia well developed. Mesonotum smooth and finely punctate with punctures separated by 1.0–4.0× their diameter. Scutellum smooth and impunctate except for a few scattered punctures. Mesopleuron smooth and finely punctate with punctures separated by 2.0–4.0× their diameter. Speculum smooth and impunctate. Ventral division of metapleuron smooth and finely punctate with punctures separated by 1.0–3.0× their diameter. Propodeum: not sloping, dorsal and posterior faces distinct; dorsal face with carinae obsolete, posterior face with carinae well developed; medial 0.5 of dorsal face smooth and impunctate, lateral 0.5 smooth and densely punctate with punctures separated by 0.2–0.5× their diameter, posterior face transversely rugulose.

**Metasoma.** Postpetiole smooth and rugulose-punctate laterally. Gastrocoelus well developed. Thyridia wide and subadjacent medially. T2–7 granulate becoming smoother posteriorly and shallowly punctate with punctures separated by 1.0–2.0× their diameter on T2 and becoming obsolete posteriorly. Metasoma weakly oxypygous with ovipositor sheaths projecting beyond apex by ~0.2× length of hind tibia.

**Male.** Unknown.

**Material examined. Holotype:** COSTA RICA • ♀; Cartago Province, Cerro de la Muerte, Villa Mills; 3000m; iii–vi.1990; Gauld; EMUSENT00000348. **Paratypes:** COSTA RICA • 1♀; same data as holotype; viii–ix.1990; EMUSENT00000473 • 1♀; Cartago Province, Linda Vista, Dulce Nombre; 1300m; vi–vii.1993; P. Hanson; EMUSENT00000130.

**Etymology.** From the Latin *modicus* (ordinary) in reference to the typical morphology and coloration with respect to most *Saltagenes* species.

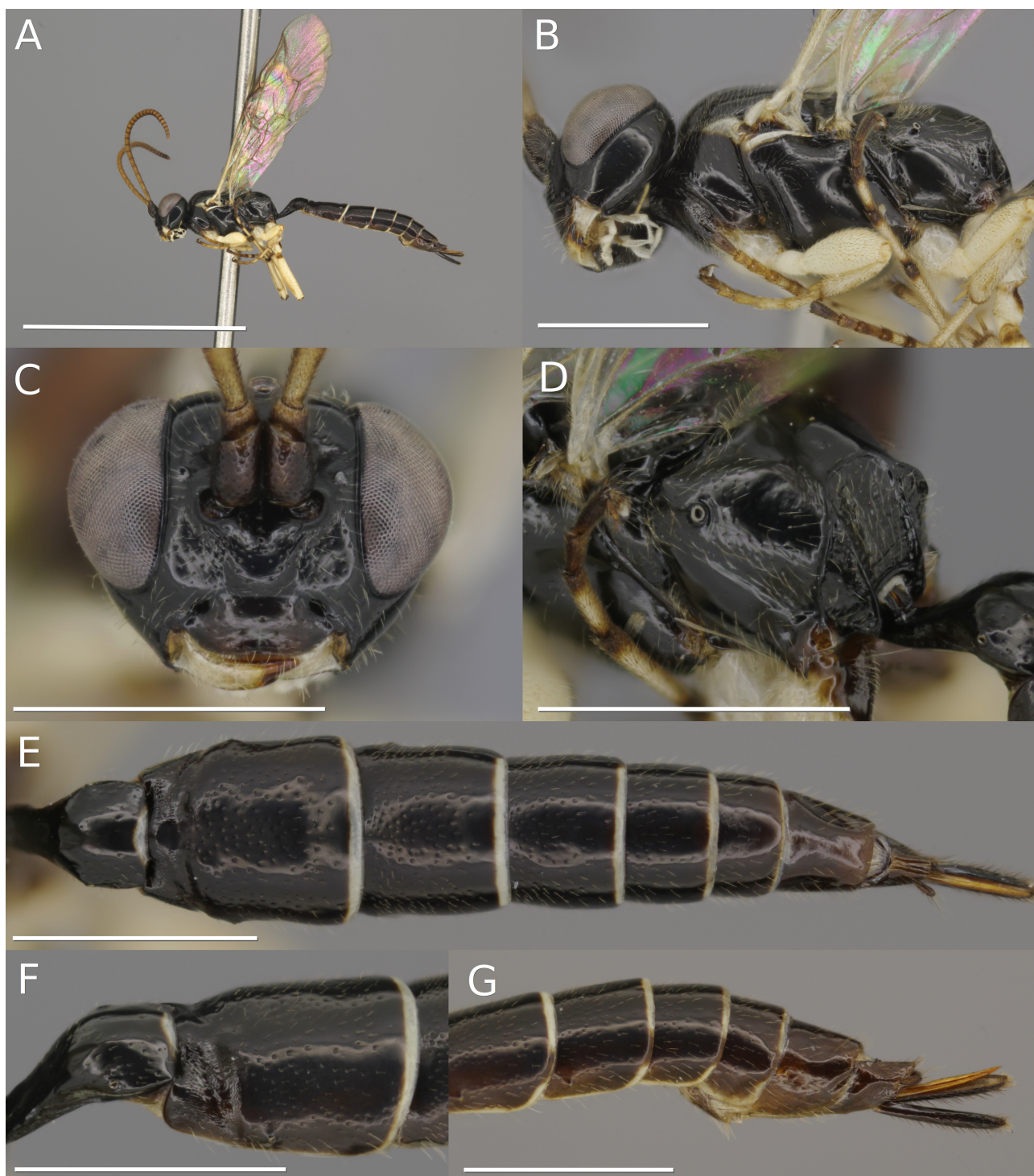
### *Saltagenes pseudatrosomus* sp. nov.

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Fig. 10

**Diagnosis.** *Saltagenes pseudatrosomus* is easily distinguished from congeners by the smooth and finely, sparsely punctate metasoma, in contrast to the usual granulate metasoma with or without punctures in other *Saltagenes* species. *Saltagenes atrosomus* is nearly identical in color to *S. pseudatrosomus*, but the two can easily be separated based on the difference in metasomal surface sculpture. *Saltagenes pseudatrosomus* can also be distinguished from *S. atrosomus* by the lack of an epomia, the hypostomal and occipital carinae meeting before the mandibular base, and the shorter propodeum.

**Description. Female** (Fig. 10A–G). Body length: 6.4 mm; fore wing length: 4.4 mm.



**FIGURE 10.** *Saltagenes pseudatromus* **sp. nov.** holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Propodeum, dorsolateral view; E. Metasoma, dorsal view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).

**Color.** Overall black with restricted yellowish-white markings. Head black except mandible yellowish-white with dark brown apex. Scape and pedicel dark brown. Flagellum brown. Mesosoma black except following areas yellowish-white: posterior 0.4 of dorsal margin of pronotum, tegula, and subalar prominence. Fore and mid legs yellowish-white except: tibia apically light reddish-brown and splotchy light reddish-brown mark dorsally; tarsomere 1 apically light-reddish-brown; tarsomere 2 basally and apically light reddish-brown; tarsomeres 3–4 light reddish-brown; tarsomere 5 dark brown. Hind leg with basal 0.6 of coxa brown medially, basal 0.6 of trochanter brown

posterolaterally; femur and tibia basally and apically light brown; tibia anteriorly marked brown at 0.2 from base and with faint brown mark at 0.6–0.9 from base; tarsomeres 1–3 dark brown apically; tarsomeres 4–5 dark brown. Wing: membrane clear; basal 0.2 of wing with veins white, remaining sections brown. T1 black except posterior margin with medial 0.6 yellowish-white. T2–7 black except posterior margins yellowish-white.

**Head.** Clypeus smooth with a few scattered, fine punctures; nearly flat in lateral view. Supraclypeal area smooth and sparsely, finely punctate laterally with punctures separated by 1.5–3.0× their diameter; nearly flat in lateral view; median field distinct. Gena smooth and minutely punctate. Supra-antennal area predominantly smooth and finely, sparsely punctate with punctures separated by 1.0–4.0× their diameter. Vertex smooth and impunctate. Hypostomal and occipital carinae meeting before mandibular base. Antenna with 26 flagellomeres.

**Mesosoma.** Surface sculpture overall smooth with fine, sparse, subobsolete punctation. Epomia obsolete. Propodeum: not sloping, dorsal and posterior faces distinct; carinae obsolete on dorsal face, well-developed on posterior face; dorsal face smooth and impunctate medially, laterally with a few scattered punctures, posterior face smooth and impunctate.

**Metasoma.** Postpetiole smooth except for a few fine punctures posterolaterally. Gastrocoelus well developed. Thyridia wide with interthyridial width 0.3× thyridium width. T2–7 smooth and sparsely, finely punctate with punctures 1.5–3.0× their diameter. Metasomal apex strongly oxygygous with ovipositor sheaths projecting beyond apex by ~0.2× length of hind tibia.

**Male.** Unknown.

**Material examined.** *Holotype*: COSTA RICA • ♀; Cartago Province, Cerro de la Muerte, Villa Mills; ix–xi.1989; Gauld; EMUSENT00004825.

**Etymology.** The species name refers to the apparent similarity between this species and *S. atosomus*. Derived from the Greek *pseud-* (false) and the species name *atosomus*.

**Comments.** The male of *S. pseudatosomus* is unknown but could presumably be easily associated based on the predominantly smooth and finely punctate metasoma, although *Saltagenes* species do tend to have a greater degree of punctation than corresponding females.

### *Saltagenes rotundiceps* sp. nov.

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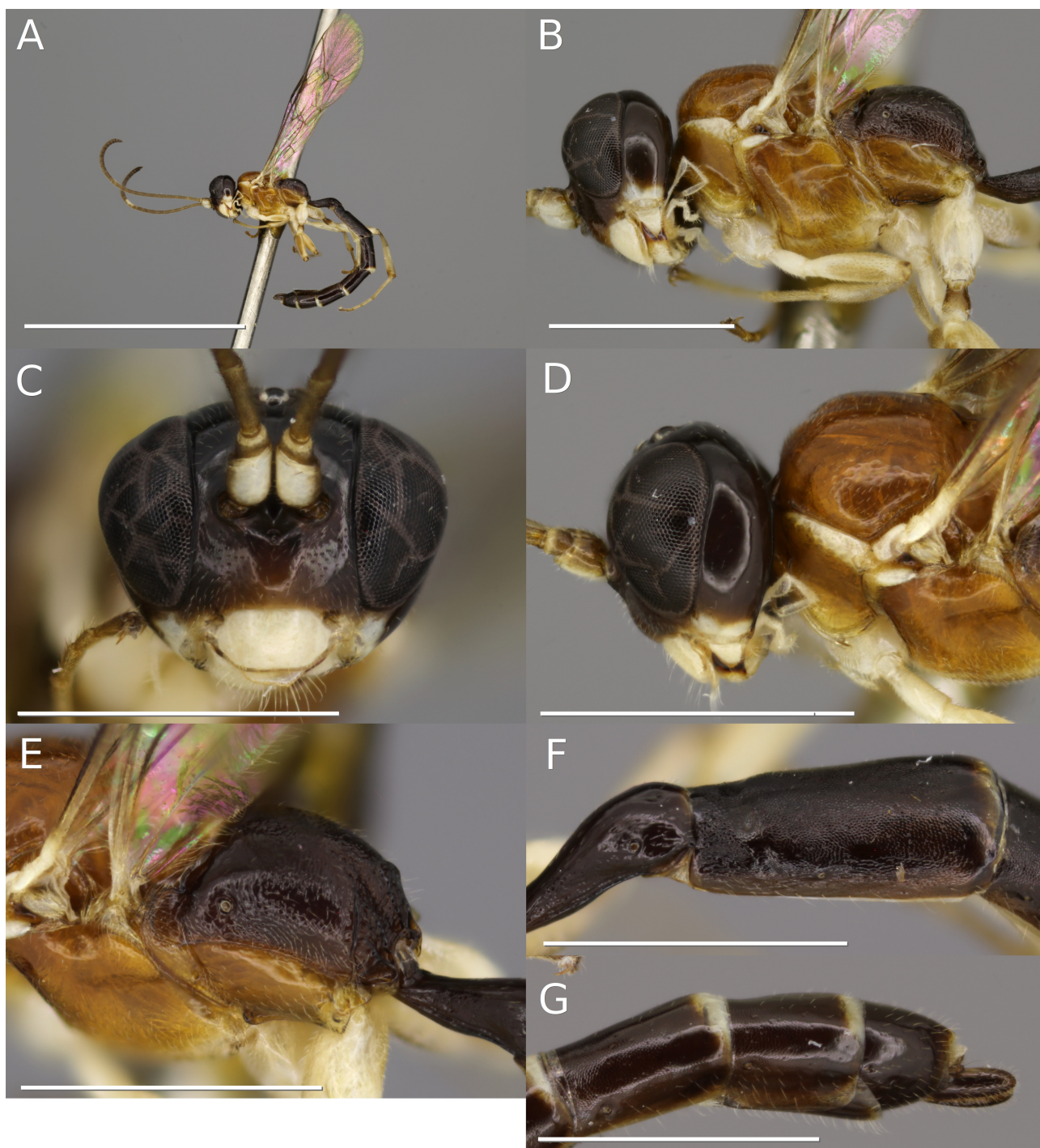
Figs 11–12

**Diagnosis.** *Saltagenes rotundiceps* is distinguished by a combination of the following characters: clypeus and supraclypeal area strongly convex; propodeum dark reddish-brown; female metasoma granulate and impunctate; female semi-amblypygous; male with supraclypeal area yellowish-white except for variable sublateral or lateral longitudinal brownish marks.

**Description. Female** (Figs 11A–G). Body length: 6.3–6.4 mm; fore wing length: 3.8–3.9 mm.

**Color.** Primarily dark reddish-brown to black and brownish-red with yellowish-white legs. Head primarily dark brown becoming black dorsally except following areas yellowish-white: mandible (except dark brown apex), clypeus, and ventral margin of gena. Scape yellowish-white anteriorly, brown posteriorly. Pedicel brown. Flagellum brown becoming dark brown apically except flagellomeres 9/10–11 with incomplete yellowish-white banding. Mesosoma light brownish-red except: ventral 0.3–0.4 of propleuron, posterior 0.7 of dorsal margin of pronotum, subalar ridge and tegula yellowish-white; remainder of pronotum varying from light brownish-red to dark reddish-brown; ventral division of metapleuron varying from light brownish-red to dark brown; propodeum dark brown. Fore and mid legs yellowish-white except tibiae and femora slightly splotchy brown, greatest extent on anterior face of middle femur; tarsi with tarsomere 1 yellowish-white and splotchy brown; tarsomeres 2–4 light brown and tarsomere 5 brown to dark brown. Hind leg with coxa yellowish-white except anteroventrally brown; trochanter brown except apex yellowish-white; femur yellowish-white except anterior face light brown except at base and apex; tibia predominantly yellowish-white except for base dark brown, ventral face and apical 0.2 splotchy brown; tarsomeres 1–2 yellowish-white and splotchy brown, particularly at apex, tarsomeres 3–4 light brown, and tarsomere 5 dark brown. Metasoma black except posterior margins of T2–6 yellowish-white.





**FIGURE 11.** *Saltagenes rotundiceps* sp. nov. holotype female. A. Habitus; B. Mesosoma, lateral view; C. Head, frontal view; D. Head, lateral view; E. Propodeum, dorsolateral view; F. First and second metasomal segments, dorsolateral view; G. Metasomal apex, lateral view. Scale bars: 5.0 mm (A); 1.0 mm (B–G).

**Head.** Clypeus smooth and impunctate; strongly convex in lateral view. Supraclypeal area smooth and finely, sparsely punctate with punctures separated by 3.0–5.0× their diameter; strongly convex in lateral view; median field indistinct. Gena smooth and impunctate except for a few fine, scattered punctures. Supra-antennal area smooth, ventral 0.1 transversely rugulose and remainder finely, sparsely punctate with punctures separated by 2.0–4.0× their diameter. Vertex smooth and impunctate. Hypostomal and occipital carinae meeting at mandibular base. Antenna with 22–23 flagellomeres.

**Mesosoma.** Pronotum smooth and impunctate. Epomia well developed. Mesonotum smooth and finely, sparsely punctate with punctures separated by 2.0–5.0× their diameter. Scutellum smooth and impunctate. Mesopleuron smooth with fine, subobsolete punctation. Ventral division of metapleuron smooth with fine, scattered, subobsolete punctation. Propodeum: slightly longer than wide; not sloping, dorsal and posterior faces distinct; dorsal face with carinae obsolete; posterior face with carinae well developed except median longitudinal carinae obsolete medially; dorsal face transversely rugulose medially, rugulose-punctate laterally; posterior face rugulose.

**Metasoma.** Postpetiole smooth and impunctate except petiole with a few scattered punctures laterally. Gastrocoelus well developed. Thyridia wide and subadjacent medially. T2–7 granulate becoming smoother posteriorly.

**Male** (Fig. 12) Body length: 6.1–6.3 mm; fore wing length: 3.8–3.9 mm. As in female except: supraclypeal area yellowish-white except variable sublateral or lateral longitudinal brownish marks; ventral 1.0–2.0 of gena yellowish-white. Antenna with 23–25 flagellomeres. Flagellomeres 8–13/14 with tyloids.



**FIGURE 12.** *Saltagenes rotundiceps* sp. nov. paratype male. A. Habitus; B. Head, frontal view. Scale bars: 5.0 mm (A); 1.0 mm (B).

**Material examined.** *Holotype*: COSTA RICA • ♀; Puntarenas Province, San Vito, Las Cruces; 9–23.xii.1990; J. S. Noyes; EMUSENT00004816. *Paratypes*: COSTA RICA • ♀; San José Province, San Vito, Las Alturas; 1500m; xii.1991; K. Gaston; EMUSENT00000248 • ♂; San José Province, San Antonio de Escazu; 15–25.iii.1984; Sydney A. Cameron; EMUSENT00005567 • 4♂♂; same collecting data as preceding; 25.iii–09.iv.1984; EMUSENT00004826, EMUSENT00004568, EMUSENT00005220, EMUSENT00004767.

**Etymology.** The species name refers to the convex clypeus and supraclypeal area and is derived from the Latin *rotundi-* (rounded) and *ceps* (head).

**Comments.** Given the short, thick ovipositor sheaths and the generally semi-amblypygous appearance of the metasomal apex, *S. rotundiceps* is likely a larval-pupal parasitoid. There are at least three other undescribed species share a similar morphology in the metasomal apex.

## Discussion

*Saltagenes* is now comprised of eight species: *Saltagenes osteni* from Argentina (Diller 1995) and the seven Costa Rican species described here. Among the Costa Rican species, only *S. alboannulatus* is recorded from elsewhere in Central America. It is unclear which species, if any, are truly endemic to Costa Rica due to a lack of Central American material from other countries. However, unlike tropical Ophioninae and Pimpliformes which tend to have wide ranges in tropical regions (Gaston & Gauld 1993, Gauld 1984, Gauld & Mitchell 1978, Gauld & Mitchell 1981, Porter 1978), ichneumonines do not appear to be particularly widespread. On the contrary, sorted specimens at EMUS (pers. obs.) and a recent revision of the New World genus *Jethsura* (Claridge 2021) indicate that neotropical ichneumonines have relatively narrow ranges, at least those that occur at mid- to high elevations such as *Saltagenes*. Consequently, the Costa Rican *Saltagenes* may occur elsewhere in Central America but are unlikely to be present in South America.



Despite the current progress, the diversity of *Saltagenes* is still poorly known. Males of *S. modicus*, *S. osteni*, and *S. pseudatrosomus* are unknown. More broadly, less than half of the sorted species of *Saltagenes* at EMUS have been described, and additional collecting will likely yield even more. Also, the hosts of *Saltagenes* and any other biological information are completely unknown.

The current study increased the documented Costa Rican ichneumonine fauna from 28 to 35 recorded species, such that *Saltagenes* presently represents a fifth of the total species. However, this figure is highly artificial as the vast majority of Costa Rican ichneumonines remain undiscovered, with potentially less than 10% formally described (Gauld 1991). Clearly, Costa Rican and Neotropical ichneumonines are woefully understudied, and continued taxonomic exploration is needed to uncover their diversity and shed light on species richness patterns of tropical ichneumonids.

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