



## Revision of the *Orasema festiva* species group (Hymenoptera: Chalcidoidea: Eucharitidae)

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### Abstract

The Neotropical *Orasema festiva* species group is revised, retaining *O. festiva* (Fabricius) and *O. delicatula* (Walker) as valid species, and describing four new species: *O. alvarengai* n. sp., *O. caesariata* n. sp., *O. erwini* n. sp., and *O. reburra* n. sp. The *festiva*-group is characterized by features that are unusual or unique in *Orasema*, including the presence of 8–11 labral digits, a smooth face, and a lateral petiolar carina. The egg of *O. caesariata* and the first-instar larva of *O. delicatula* are newly described and found to be similar to other species of *Orasema*.

**Key words:** parasitoid, Neotropical, Formicidae

### Introduction

*Orasema* Cameron (Eucharitidae) are a diverse group of parasitoids that likely all attack the brood of myrmicine ants. Adults insert their eggs into plant tissue, and the active first-instar larvae (planidia) gain access to the ant nest by some form of phoretic transfer by using foraging ant workers (Heraty 2000; Carey *et al.* 2012). The planidium initially attacks the ant larva, with the first and later instars completing development on the ant pupa (Wheeler 1907; Clausen 1940; Heraty *et al.* 1993). Confirmed ant hosts in the New World include *Pheidole* Westwood, *Solenopsis* Westwood, *Temnothorax* Mayr, *Tetramorium* Mayr and *Wasmannia* Forel (Myrmicinae) (Heraty 2002; Lachaud & Perez-Lachaud 2012). More than 200 species of *Orasema* are estimated worldwide, but only 57 species have been described, and the majority of these have been poorly characterized (Heraty 1994, 2002).

The *Orasema festiva*-group was initially defined (Heraty 2000) based on two species, *Orasema delicatula* (Walker) and *Orasema festiva* (Fabricius). The *festiva*-group is known from South America and Panama (Fig. 1), but possesses characters that initially placed it in a monophyletic group with similar species known from Madagascar (*communis*-group) and southeastern Asia (*uichancoi*-group) (Heraty 2000). The *festiva*-group is readily defined by the presence of a pronounced lateral petiolar carina, distinctly flattened and smooth face, labrum with 8–11 marginal digits, densely setose wings, and postmarginal vein reaching the apex of the fore wing. The lateral petiolar carina is the only character that is unique within *Orasema*.

A grouping of the *festiva*-group with the *communis* and *uichancoi*-groups based on morphological analyses (Heraty 2000) suggested that most of the defining features of the *festiva*-group are symplesiomorphies, and remnants of a hypothetical primitive morphology that is either lost or highly modified in most other *Orasema*. Recent molecular investigations (Mottern & Heraty in prep.) instead indicate that these groups are unrelated and that the *festiva*-group is part of a monophyletic New World group. These new results further suggest that the defining features of the *festiva*-group are instead apomorphic within the New World group, signifying an increase or expansion in several features (more labral digits, longer and more setose wings, longer antenna with more

preclaval flagellomeres, more extensive petiolar carinae), but with a reduction in facial and coxal surface sculpture (from reticulate to smooth), and an increased variety in mesosomal surface sculpture topology (areolate-rugose or transversely carinate instead of reticulate or smooth). These features are not necessarily correlated with an increased body size in these species of *Orasema*, since other New World species, such as *Orasema tolteca* Mann, are large-bodied without possessing any of the characteristic features of the *festiva*-group. Likewise, an increased funicular count and similarly long and densely setose wings can be found in relatively small-bodied species such as *Orasema susanae* Gemignani. The stalked egg and planidium larva described herein are similar to other *Orasema*, suggesting a similar life history. These highly convergent patterns in morphology between both Old and New World species is a mystery that can be resolved only through a better phylogenetic hypothesis (in progress) and better knowledge of their life history. Herein we revise the *festiva*-species group and better circumscribe their unique morphology, and facilitate study of these fascinating species.

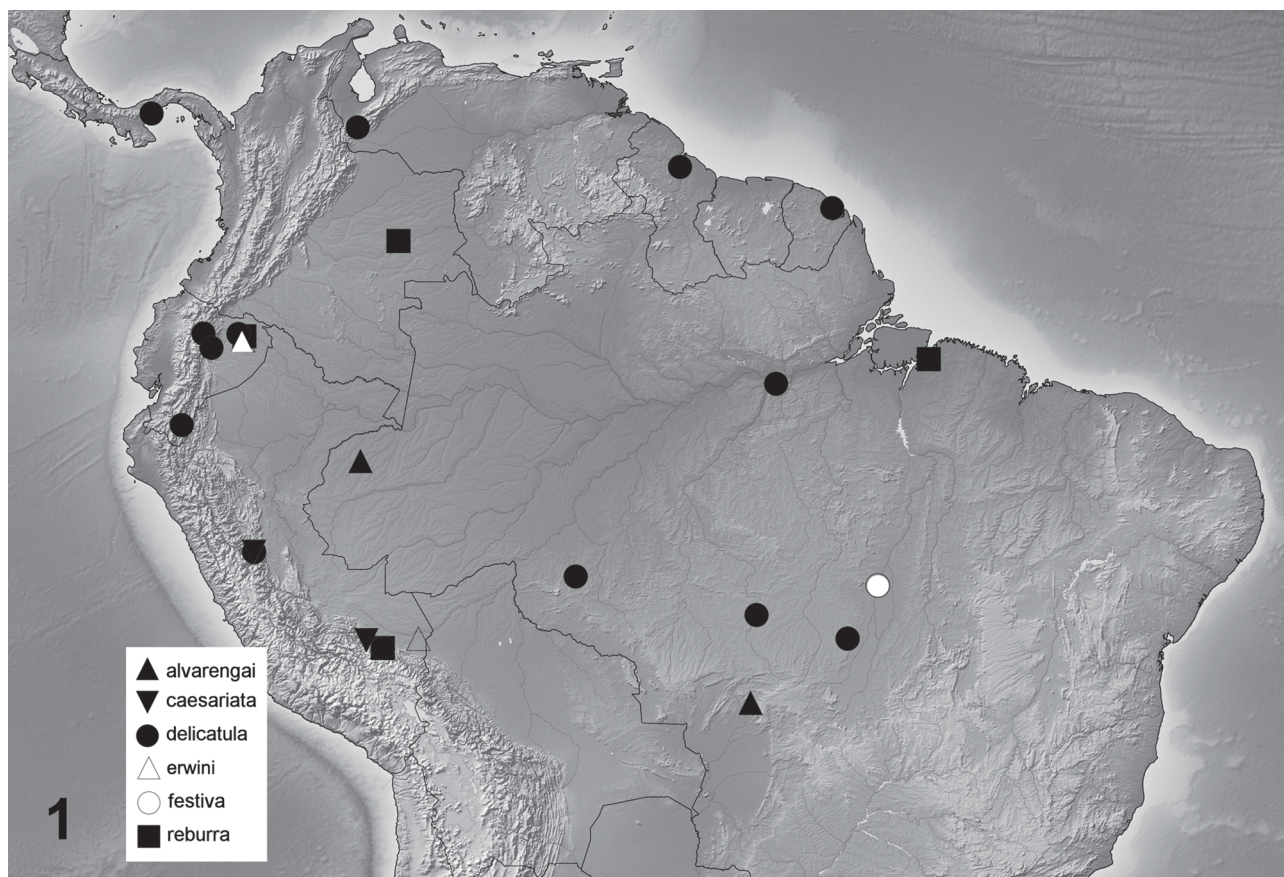


FIGURE 1. Geographic distribution of the *Orasema festiva* species group.

## Material and methods

Material was examined from the AEIC: American Entomological Institute, Gainesville, USA; AMNH: American Natural History Museum, New York, USA; BMNH: Natural History Museum, London, UK; CASC: California Academy of Sciences, San Francisco, USA; CNC: Canadian National Collection of Insects, Arachnids & Nematodes, Ottawa, Canada; FSCA: Florida State Collection of Arthropods, Gainesville, USA; MCZ: Museum of Comparative Zoology, Cambridge, USA; IAVH: Instituto Alexander von Humboldt, Bogotá, Colombia; UCRC: UCR Entomology Research Museum, Riverside, USA; USNM: National Museum of Natural History, Washington, USA; ZMUC: University of Copenhagen Zoological Museum, Copenhagen, Denmark. All specimens are labeled with a UCRCENT barcode label indicating the museum of deposition and a unique specimen identification number. Georeferenced points for specimens estimated from Google Earth are italicized. Photographs were taken using a Leica Imaging System with a Z16 APO A microscope, and stacked using Zerene Stacker (version 1.04, ©

Zerene Systems, LLC). Images from this manuscript, including additional images of holotype labels, are present in a Morphbank collection: <http://www.morphbank.net/853548>.

Morphological terms follow Heraty *et al.* (2013). All terms were verified using the Hymenoptera Anatomy Ontology (<http://portal.hymao.org/>) when they are represented in that resource, and variations from their preferred terms are discussed here: “torulus” is used as it was originally defined (Kirby & Spence 1826), which corresponds to HAO\_0001022. The first and second valvulae of the ovipositor may have subsegments that have been called annuli (Smith 1972), but in *Orasema* there are tooth-like projections on the first (ventral) valvula that we prefer to call ovipositor teeth (Figs 15, 16: tvv), to highlight their difference in shape versus the annuli of the second (dorsal) valvula, which are more carina-like (Figs 15, 16: adv). Palpomere formula follows a maxillary:labial format. Mandibular tooth count follows a right:left format. Surface sculptural terms follow illustrations provided by Harris (1979).

### ***Orasema festiva* species group**

**Diagnosis.** Recognized from all other *Orasema* species by having 8 funiculars (Fig. 2: F2–F9), smooth face, labrum with 8–11 digits (Fig. 3: lbr), densely setose, elongate fore wing with a long postmarginal vein reaching near to apex of wing (Figs 2, 6: pmv), and lateral margins of petiole with a single strong carina confluent with a broadened ventral surface (Fig. 5: lpc). Additional descriptive features include: scape and legs (beyond coxae) yellow; face smooth; vertex posteriorly sharp; mandibular formula 3:2; wings slightly infusate, at least 2.3× as long as broad; fore wing with bare basal cell and small specular area; hind wing costal cell densely setose; mesoscutum and mesoscutellum with areolate-rugose or transverse sculpture, never reticulate; transverse antecostal sulcus on Ms<sub>2</sub> smooth (Fig. 25: acs).

**Biology.** Unknown. Immature stages of *O. caesariata* (egg) and *O. delicatula* (first instar) are described herein.

**Distribution.** Northern South America and Panama (Fig. 1), with a range in elevation from 150–1280 meters.

**Phylogenetics.** Six species are recognized. As part of a separate study, we have sequences including 18S (783bp), 28S D2–D5 (1120bp), COI (1041bp) available for four species, *O. caesariata*, *O. delicatula*, *O. reburra* and *O. erwini* (Mottern & Heraty in prep). In those results (likelihood and parsimony using PAUP and RAxML), the *festiva*-group is monophyletic, with two species pairs: *O. caesariata* + *O. reburra* and *O. delicatula* + *O. erwini*. These results are reinforced by morphological differences. Both *O. caesariata* and *O. reburra* have long setae on the head, mesosoma and petiole, which in *Orasema* is otherwise known only in the *Orasema coloradensis*-group. The longitudinal groove between the torulus and eye is shallow, hardly visible, and not surrounded by a depression in *O. reburra*, and is absent from *O. caesariata*, but is deeply impressed and surrounded by a depression in the other species. This feature does not occur in a similar form in any other *Orasema* and would support the monophyly of *O. alvarengai*, *O. delicatula*, *O. erwini* and *O. festiva*. No other characters appear to delineate groupings within this complex.

### **Key to species of the *Orasema festiva* group**

Males are unknown for *O. alvarengai*, *O. festiva*, and *O. reburra*, but based on the other species features appear to be valid for both sexes.

1. Eye with long setae (Fig. 7) ..... *Orasema caesariata* n. sp.
- Eye without visible setae at 50× magnification (Figs 3, 11, 18, 22, 27). ..... 2
2. Coxae dark brown (Figs 26, 29). Petiole with many (>10) long setae (Fig. 29). ..... *Orasema reburra* n. sp.
- Coxae yellow (Figs 2, 5, 12, 21, 24). Petiole bare (Figs 5, 14, 21, 24), or with few (<5) very tiny decumbent setae are not easily visible at 50× magnification (Fig. 5). ..... 3
3. Petiole parallel-sided in dorsal view, smooth and without a dorsal longitudinal carina (Fig. 24). . . . *Orasema festiva* (Fabricius)
- Petiole laterally expanded near midlength, with some dorsal sculpture and/or dorsal longitudinal carina (Figs 5, 14, 21). . . . 4
4. Petiole only slightly laterally expanded near midlength: at least 3.5× as long as broad in both sexes (Fig. 21) .....  
..... *Orasema erwini* n. sp.
- Petiole more strongly laterally expanded near midlength: not more than 2.8× as long as broad in females (Figs 5, 14), 3.27× as long as broad in males. .... 5



5. Petiole without dorsal longitudinal carina (Fig. 5) ..... *Orasema alvarengai* n. sp.  
 - Petiole with dorsal longitudinal carina (Fig. 14: dpc) ..... *Orasema delicatula* (Walker)

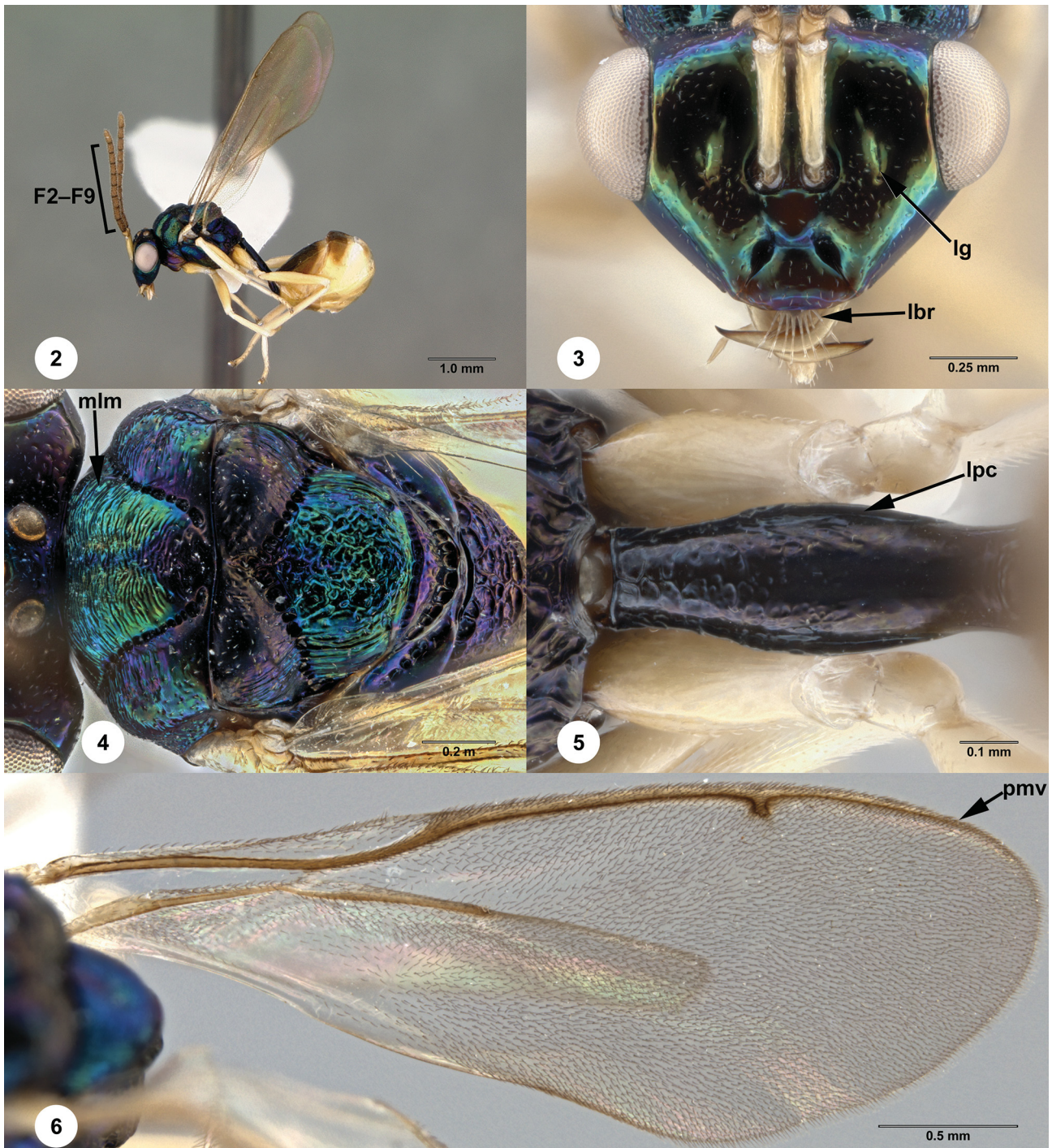
***Orasema alvarengai* n. sp.**

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(Figs 2–6)

**Diagnosis.** Face flattened and smooth, with very short setae, and with a strongly impressed longitudinal groove between torulus and eye (Fig. 3: lg). Mesoscutal midlobe transversely strigate (Fig. 4: mlm). Petiole without a dorsal longitudinal carina, very weakly sculptured dorsally, and expanded laterally near midlength (Fig. 5: lpc).

Most similar to *O. festiva*, which has a more coarsely strigate midlobe and a parallel-sided petiole.



**FIGURES 2–6.** *Orasema alvarengai*. Holotype female (UCRCENT00320756): 2, habitus, lateral; 3, head, anterior; 4, mesosoma, dorsal; 5, petiole, dorsal; 6, wings, dorsal. lbr = labrum, lg = longitudinal groove, lpc = lateral petiolar carina, mlm = mesoscutal midlobe, pmv = postmarginal vein.



**Female.** Length, 3.7–4.1 mm. Head and mesosoma metallic bluish green to purple; pedicel and anellus yellowish brown, flagellum dark brown; coxae and metatrochanters yellow; petiole metallic blue to purple; gaster dark brown anterodorsally, pale brown apically, ventrally dark brown, except anterior region of  $Ms_2$  black with metallic luster.

*Head* subquadrate, width/length 1.5. Face with broad depression surrounding longitudinal groove (Fig. 3: lg) lateral to torulus; scrobal depression medially with a broad flat carina bordered laterally by narrow foveate furrow. Eye bare. Labrum with 8 or 9 digits (Fig. 3: lbr). Palpal formula 2-2 or 2-1. Pedicel slightly broader than F2; flagellum 2.0–2.1× height of head; F2 1.9–2.8× as long as broad, F2 1.0–1.2× as long as F3.

*Mesosoma.* Mesoscutum transversely strigate (Fig. 4), lateral lobe with finely sculptured depression medially; dorsally with minute setae. Axilla smooth or with some weak carinae; mesoscutellar disc rugulose, as long as broad, broadly separated from transscutal articulation at base by deep fovea; frenum shallowly sculptured. Propodeal disc areolate-rugose, median carina difficult to distinguish from surrounding sculpture, irregular when distinguishable; callus smooth, with a few setae. Metafemur densely setose dorsoapically, bare ventroapically. Fore wing 2.5–2.8× as long as broad; stigmal vein 1.5–2.0× as long as broad, perpendicular to anterior margin (Fig. 6).

*Metasoma.* Petiole 1.6× as long as metacoxa, 2.5–2.7× as long as broad, laterally expanded near midlength, weakly rugose dorsally, with a few (<5) tiny setae, dorsal longitudinal carina absent (Fig. 5). Hypopygium with few minute setae apically. Ovipositor not visible in available specimens.

**Male.** Unknown.

**Material examined. Holotype. Brazil: Amazonas:** Estirer do Ecuador Rio Javari, ix.1979, M. Alvarenga 5°35'30"S, 71°38'54"W [1♀, CNC: UCRCENT00320756]. **Paratypes. Brazil: Amazonas:** same data as holotype [2♀, CNC: UCRCENT00320757, CNC: UCRCENT00320758]. **Mato Grosso:** Chapada dos Guimarães, 800m, 15°27'11"S, 55°44'22"W, vii.1983, M. Alvarenga [1♀, AEIC: UCRCENT00251351].

**Etymology.** Named in honor of the collector.

### ***Orasema caesariata* n. sp.**

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(Figs 7–10)

**Diagnosis.** Face flattened and smooth, lacking a groove or depression between torulus and eye (Fig. 7). Head triangular in frontal view with prominent bulging eyes, and body including eyes with long setae. Petiole laterally expanded near midlength, with one or two dorsal irregular longitudinal carinae (Fig. 10).

Similar to *O. reburra* based on the setation of the head and body, rugose mesoscutum, and presence of irregular dorsal carinae on the petiole. However, *O. reburra* has at most minute setae on the eyes, the head is more distinctly subtriangular (Fig. 27), and the petiole is more nearly parallel-sided.

**Female.** Length, 3.4–3.6 mm. Head and mesosoma metallic bluish green to purple or red; pedicel and anellus pale brown, flagellum dark brown; procoxa yellow, base of meso- and metacoxae dark brown and apex yellow, metatrochanter dark brown medially; petiole metallic blue to purple; gaster brown dorsally with purplish reflections, ventrally pale brown, except anterior region of  $Ms_2$  black with metallic luster.

*Head* triangular with prominent bulging eyes (Fig. 7), 1.5–1.6× as broad as high. Face without depression or groove between torulus and eye, sparsely covered with long hairs; scrobal depression medially with irregular carina bordered laterally by foveate furrow. Eye with long setae. Labrum with 8–10 digits. Palpal formula 2-1. Pedicel as broad as F2; flagellum 2.3× height of head; F2 2.6–3.0× as long as broad, F2 1.1–1.2× as long as F3.

*Mesosoma* with long setae (Figs 8, 9); mesoscutum with irregular transverse carinae but becoming areolate-rugose posteromedially, lateral lobe evenly sculptured. Axilla with oblique carinae; mesoscutellar disc coarsely areolate-rugose, slightly longer than broad, narrowly separated from transscutal articulation by deep fovea; frenum areolate-rugose. Propodeal disc areolate-rugose, median carina lacking; callus smooth, with a few long setae. Metafemur with sparse semi-erect setae. Fore wing 2.6–2.8× as long as broad; stigmal vein 2.0–2.5× as long as broad, perpendicular to anterior margin.

*Metasoma* with petiole 1.4–1.5× as long as metacoxa (Fig. 10), 2.4–2.6× as long as broad, laterally expanded near midlength, weakly rugose with one or two dorsal longitudinal carinae (sometimes a single longitudinal carina is split, as in Fig. 10). Hypopygium with few setae apically. Ovipositor strongly curved cephalad; ventral (1st)

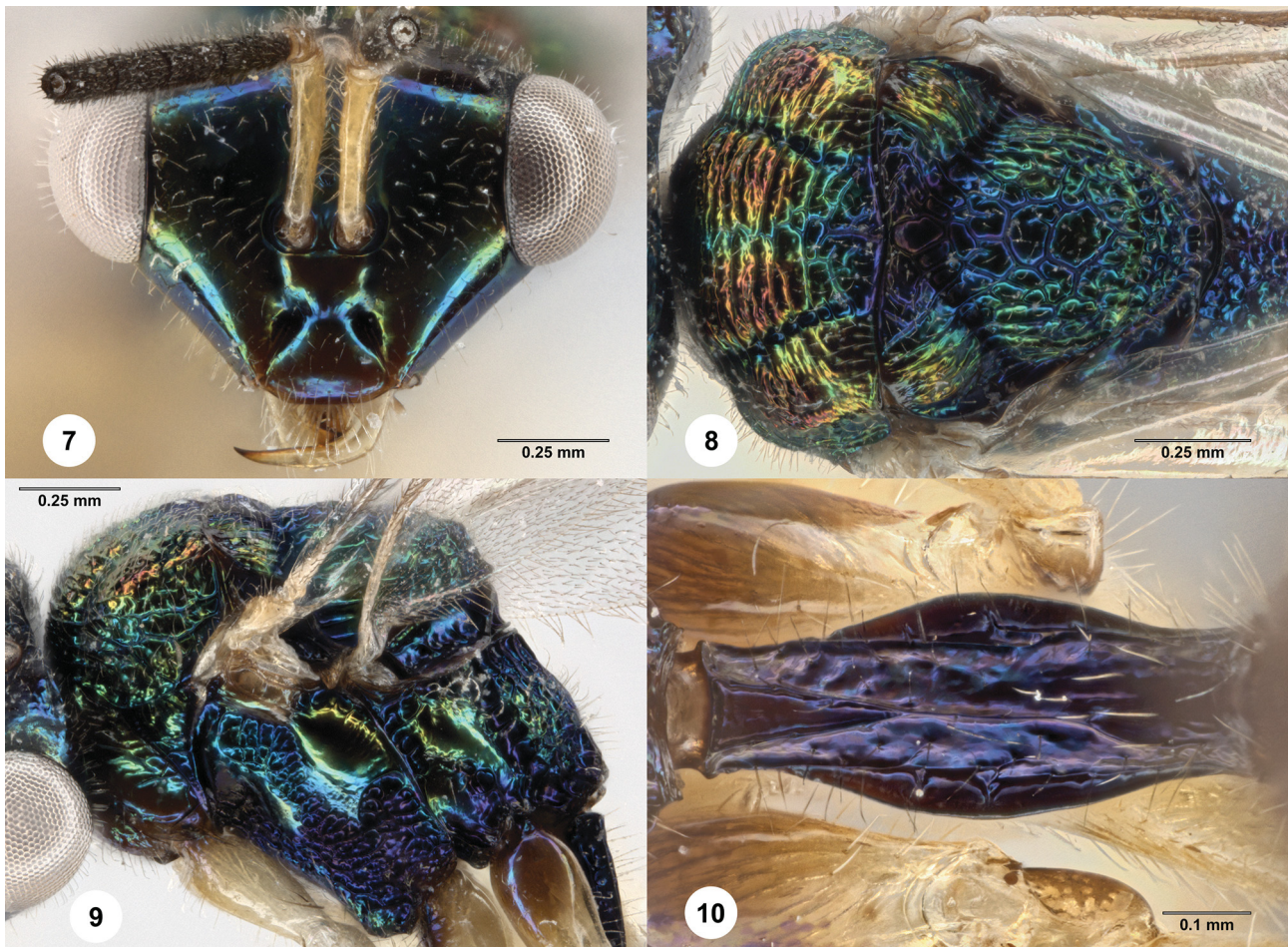
valvula with subapical lateral line of 6–8 narrowly spaced blunt teeth; dorsal (2nd) valvula with 8–12 rasp-like annuli meeting along midline.

**Male.** Length, 3.1–3.3 mm. Similar to female except for following character states: antenna with flagellum 3.5–3.8× head height; F2 3.2–3.9× as long as broad; metasoma with petiole 1.8–1.9× as long as metacoxa, 3.5–3.9× as long as broad. Genitalia: parameres long and narrow, digitus with 5 broadly spaced marginal teeth.

**Description of egg.** Information from ovarian eggs exposed in gaster of paratype (UCRCENT322671). Similar in form to other *Orasema*, length of egg body 0.10–0.12 mm, length of egg stalk 0.10–0.11 mm.

**Material examined. Holotype. Peru: Huánuco:** Monson Valley, Tingo Maria, 750m, 9°17'59"S, 75°59'05"W, 10.x.1954, E.I. Schlinger & E.S. Ross [1♀, CASC: UCRCENT00417462]. **Paratypes. Peru: Huánuco:** same data as holotype [2♀, CASC: UCRCENT00417461, CASC: UCRCENT00417463]. Huannes, Tingo Maria, 670m, 9°17'43"S, 75°59'51"W, 10.x.1946, J.C. Pallister [1♂, AMNH: UCRCENT00238127]. Monson Valley, Tingo Maria, 620m, 9°17'59"S, 75°59'05"W, 5–12.x.1964, C.C. Porter [1♂ 1♀, CASC: UCRCENT00322671, MCZ: UCRCENT00318633]. **Cusco:** Villa Carmen Biological Station, trail 8, 560m, 12°54'01.3"S, 71°24'25.6"W, 2.viii.2014, J. Mottern, rainforest, sweep [1♂, UCRC: UCRCENT00434574].

**Etymology.** From the Latin *caesariatus* meaning “covered with hair”; referring to the complete covering of the face and eyes with long setae.



**FIGURES 7–10.** *Orasema caesariata*. 7–9, paratype female (UCRCENT00322671): 7, head, anterior; 8, mesosoma, dorsal; 9, mesosoma, lateral. 10, holotype female (UCRCENT00417462): petiole, dorsal.

***Orasema delicatula* (Walker)**

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(Figs 11–17)

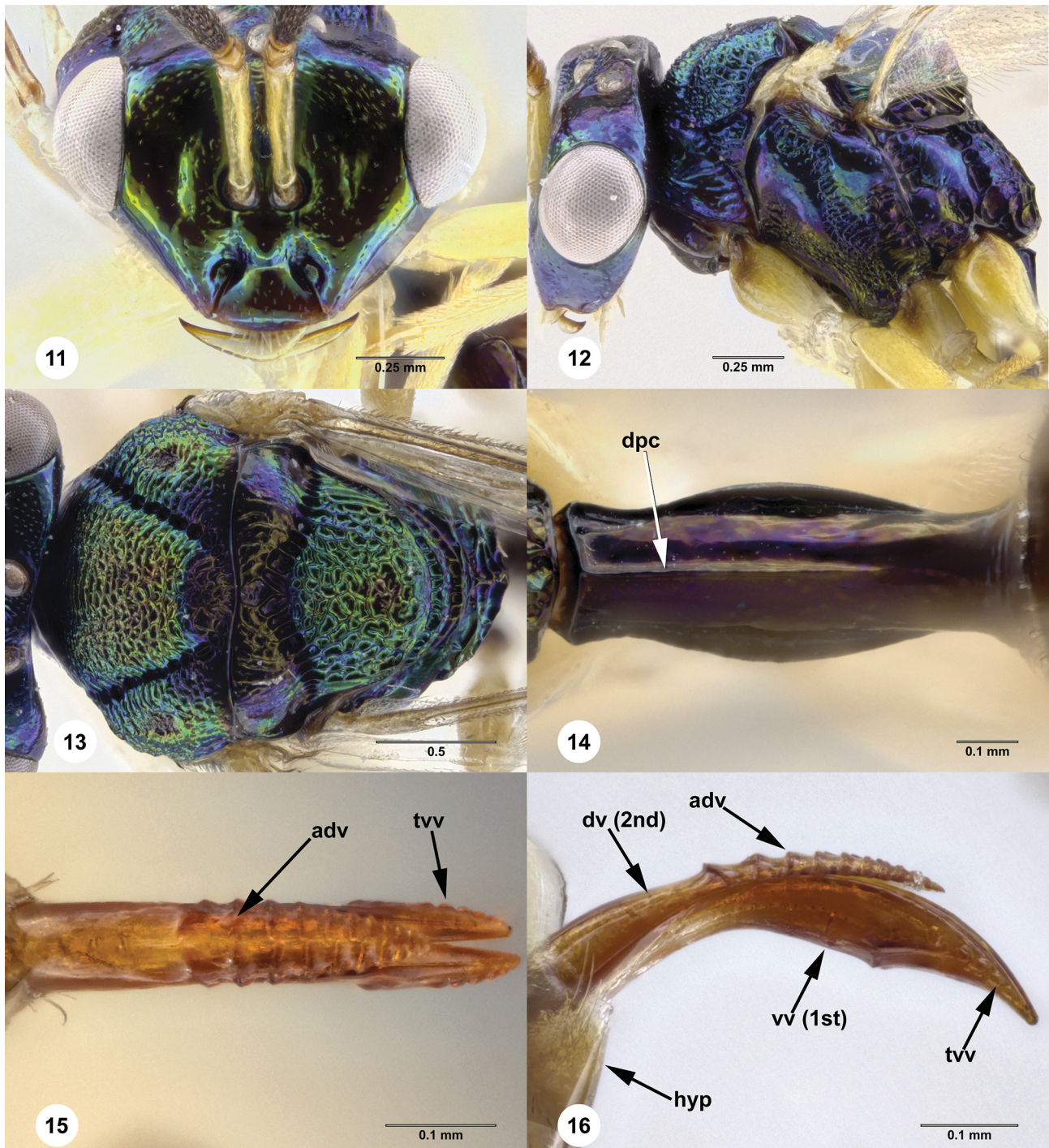
*Eucharis delicatula* Walker, 1862: 377.



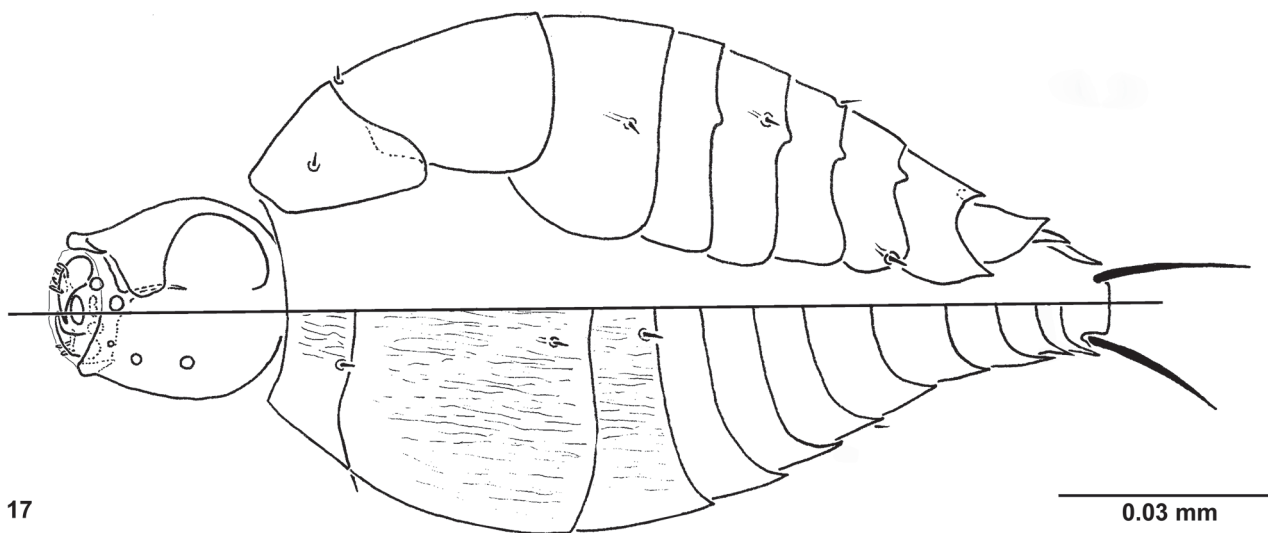
*Stilbula delicatula*; combination by Walker, 1871: 66.

*Orasema delicatula*; combination by Bouček, 1988: 520; Heraty, 1994: 54 (discussion of distribution); Heraty 2002: 51 (taxonomy).

**Diagnosis.** Face flattened and smooth, with very short setae, and with a strongly impressed longitudinal groove between torulus and eye. Petiole strongly expanded laterally near midlength, dorsally smooth or nearly so, and with a single dorsal longitudinal carina (Fig. 14: dpc).



**FIGURES 11–16.** *Orasema delicatula*. 11 and 12, female (UCRCENT00320759): 11, head, anterior; 12, mesosoma, lateral. 13, female (UCRCENT00239436): mesosoma, dorsal. 14, female (UCRCENT00408490): petiole, dorsal. 15 and 16, female (UCRCENT00239436): 15, ovipositor, dorsal. 16: ovipositor, lateral. adv = annuli of dorsal valvula, dpc = dorsal longitudinal petiolar carina, dv = dorsal (2nd) valvula, hyp = hypopygium, tvv = ovipositor teeth of ventral valvula, vv = ventral (1st) valvula.



17

0.03 mm

**FIGURE 17.** *Orasema delicatula*. 1st instar (planidium) larva (UCRCENT00412681); lateral setae indicated in both views. Top half: ventral view; surface sculpture indicated on TI–TIII. Lower half: dorsal view.

Similar to *O. erwini*, but differs by the median petiolar carina and the prominent lateral expansions of the petiole (Fig. 14).

**Female.** Length, 4.5–4.7 mm. Head and mesosoma metallic bluish green to purple; pedicel and anellus pale brown, flagellum dark brown; coxae yellow, metatrochanters black medially; petiole metallic purplish black; gaster dark brown dorsally with purplish luster, ventrally pale brown, except anterior region of  $Ms_2$  black with metallic luster and some areas near ovipositor dark brown.

**Head** subtriangular (Fig. 11), 1.5× as long as broad. Face flat with broad depression enclosing longitudinal groove between torulus and eye; scrobal depression with a broad flat median carina bordered laterally by broad foveate furrow. Eye bare. Labrum with 8–10 digits. Palpal formula 3-2. Pedicel as broad as F2; flagellum length 2× height of head; F2 2.5× as long as broad, F2 1.2× as long as F3.

**Mesosoma.** Mesoscutum with variable sculpture ranging from rugulose-areolate, approaching reticulate (Fig. 13) to transversely carinate, lateral lobe with finely sculptured medial depression; dorsally with minute setae. Axilla with oblique carinae or with very weak sculpture; mesoscutellar disc areolate-rugose with ovate depression just anterior to frenal line, as long as broad, broadly separated from transscutal articulation at base by deep fovea; frenum areolate-rugose. Propodeal disc areolate-rugose with irregular median carina; callus nearly smooth, with a few minute setae. Metafemur sparsely setose ventroapically. Fore wing 2.7–3.3× as long as broad; stigmal vein 1.5–2.0× as long as broad, slightly angled to anterior margin.

**Metasoma** with petiole 1.5–1.6× as long as metacoxa, 2.1–2.4× as long as broad, laterally expanded near midlength, smooth or nearly so, with strong dorsal longitudinal carina (Fig. 14). Hypopygium with few minute setae apically. Ovipositor (Figs 15, 16) curved cephalad, ventral (1st) valvula (Fig. 16: vv) with subapical lateral line of 6–8 narrowly spaced blunt teeth (Figs 15, 16: tvv); dorsal (2nd) valvula (Fig. 16: dv) with 8–11 annuli that are carina-like and meet along midline (Figs 15, 16: adv).

**Male.** Length, 3.5 mm. Similar to female except for following character states: face reddish; metasoma with petiole 1.9× as long as metacoxa, 3.27× as long as broad. Parameres long and narrow, digitus with 6 broadly spaced teeth.

**Planidium first instar larva** (USNM: UCRCENT00412681, Fig. 17). Length 0.17 mm. Antenna absent. Labial plates absent. Tergopleural line absent. Tergites I and II (TI, TII) separate. TI, TII, TIII with dorsal seta and with wrinkle-like longitudinal sculpture dorsally. TII, TVI with very short lateral seta. TI, TIII, TV, TVII with ventral seta. TIX with separated leaflike ventral plate having a uniformly curved posterior margin. Caudal pad present; caudal cerci present and relatively long, about as long as apical 4 tergites.

Found on metacoxa of adult female from Panama: El Valle. Planidia can be found on adults that may have visited oviposition sites frequented by other females. While common in some groups of Eucharitinae, this is the first case recorded for a member of the Oraseminae. The planidium very closely matches with *Orasema* planidia (Heraty 1994, 2000), and we feel confident of the association.



**Type material Examined. Lectotype.** “Lecto-type, Type, *Psilogaster delicatula* Walker, B.M. Type HYM. 5.612, *Orasema delicatula* (Walk.) det. Z. Bouček, 1978” [♀, BMNH: UCRCENT00310030]. **Note:** The specimen locality was reported as “Australia (?)” by Walker (1862) but this is certainly incorrect, and this specimen must have been collected from South America or Panama (Heraty 1992).

**Additional material examined. Brazil: Mato Grosso:** [no locality] 7.iii.1968, O.W. Richards, R.S. & R.G.S. Exped., gallery forest [1♀, BMNH: UCRCENT00239436]. **Pará:** Santarem, 30m, 2°26'22"S, 54°41'55"W, H.H. Smith [1♀, USNM: UCRCENT00161421]. **Rondônia:** Faz. Rancho Grande, 62 km S Ariquemes, 10°17'57"S, 62°52'12"W, 12–22.xi.1991, E. Fischer [1♀, UCRC: UCRCENT00408490]. **Ecuador: Napo:** Napo & Coca rivers, 0°23'46"S, 78°03'00"W, 2–10.v.1965, L. Peña [1♀, AEIC: UCRCENT00251354]; Limoncocha, on Rio Napo, 0°24'42"S, 76°37'31"W, 26.vii.1974, B.A. Drummond, malaise trap [2♀, FSCA: UCRCENT00322523, FSCA: UCRCENT00322524]; Limoncocha, 250m, 0°24'41"S, 76°37'31"W, 15–28.vi.1976, S. & J. Peck [1♂ 4♀, CNC: UCRCENT00320759—CNC: UCRCENT00320763]; 10 km NE Tena, Bio Hollin, 400m, 0°58'28"S, 77°43'38"W, 19.ii.1983, L. Masner [1♀, CNC: UCRCENT00415262]. **Zamora-Chinchipe:** Zamora, Rio Jumboé, 4°07'29"S, 78°56'23"W, 1.iv.1965, L. Peña [1♀, AEIC: UCRCENT00251355]. **French Guiana:** Montagne des chevaux, 4°43'22"N, 52°24'44"W, 4.x.2011, SEAG [2♀, UCRC: UCRCENT00412210, UCRC: UCRCENT00412211]. **Guyana:** Kartabo, Bartica Dist., 8m, 6°24'00"N, 58°37'00"W, 29.iii.1924 [1♀, AMNH: UCRCENT00238126]. **Panama:** El Valle, 8°34'48"N, 80°10'12"W, xi.1946, N.L.H. Krauss [3♀, USNM: UCRCENT00247752—USNM: UCRCENT00247754]. **Peru: Huánuco:** Monson Valley, Tingo Maria, 620m, 9°17'43"S, 75°59'51"W, 20.i.1927, A. Garcia & C. Porter [1♀, MCZ: UCRCENT00318635]; Monson Valley, Tingo Maria, 750m, 9°17'59"S, 75°59'05"W, 18.ix.1954, E.I. Schlinger & E.S. Ross [1♀, CASC: UCRCENT00417472]. **Cusco:** Quince Mil, 750m, 13°13'00"S, 70°44'00"W, 16.x.1962, Pena [1♀, MCZ: UCRCENT00318634]. Quince Mil, 750m, 13°13'03"S, 70°44'27"W, 15–30.x.1962, L. Peña [1♂, CNC: UCRCENT00320765]. Quince Mil, nr Marcapata, 750m, 13°13'03"S, 70°44'27"W, 20–30.x.1962, L. Peña [2♀, AEIC: UCRCENT00251356–57]. **Venezuela: Táchira:** Pregonero, Camp. Siberia, Hospital, 1280m, 8°00'56"N, 71°45'48"W, 10–31.vii.1989, S. & J. Peck [1♀, UCRC: UCRCENT00434757].

### *Orasema erwini* n. sp.

urn:lsid:zoobank.org:act:F2C98814-442B-417C-A13B-43BB19174B15

(Figs 18–21)

**Diagnosis.** Face with longitudinal groove between torulus and eye. Petiole slightly expanded laterally near midlength, but at least 3.6× as long as broad, and with dorsal sculpture including irregular longitudinal carinae (Fig. 21).

Similar to *O. delicatula* and *O. festiva*, but recognized by the dorsal petiolar sculpture and intermediate lateral expansion of the petiole.

**Female.** Length, 3.5 mm. Head and mesosoma metallic bluish green to black; pedicel and anellus yellowish brown, flagellum dark brown; coxae yellow, metatrochanters with small brown area medially; petiole metallic blue to purple; gaster dark brown dorsally, ventrally pale brown, except anterior region of Ms<sub>2</sub>, black with metallic luster.

*Head* subquadrate, 1.5× as long as broad (Fig. 18). Face with broad depression enclosing a longitudinal groove between torulus and eye; scrobal depression medially with a broad flat carina bordered laterally by narrow foveate furrow. Eye bare. Labrum with 8 digits. Palpal formula 3-2. Pedicel as broad as F2; flagellum 2.1× height of head, F2 2.5× as long as broad, F2 1.3× as long as F3.

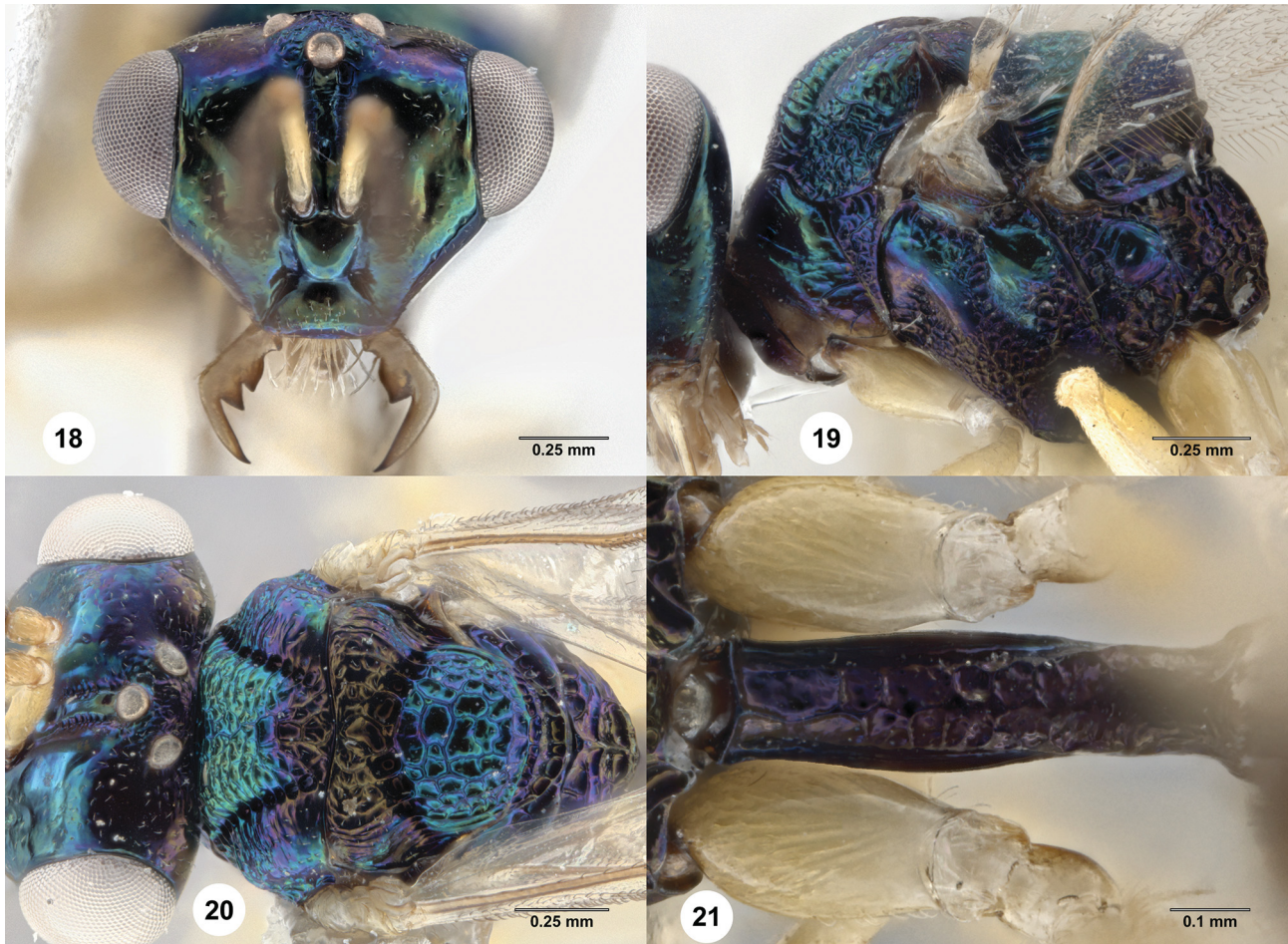
*Mesosoma* (Figs 19, 20) with mid lobe coarsely areolate-rugose, bare; lateral lobe nearly smooth posteriorly, with finely sculptured area near center. Axilla with oblique carinae; mesoscutellar disc coarsely areolate-rugose, as long as broad, broadly separated from transscutal articulation at base by deep fovea; frenum coarsely areolate-rugose. Propodeal disc areolate-rugose with irregular median carina; callus smooth, with a few setae. Metafemur with short dense setae dorsoapically. Fore wing 2.8× as long as broad; stigmal vein 2.0–2.5× as long as broad, perpendicular to anterior margin.

*Metasoma* with petiole 1.7× as long as metacoxa, 3.6× as long as broad, laterally weakly expanded near midlength, weakly rugose with irregular median dorsal carina that is weak or absent posteriorly (Fig. 21). Hypopygium with few minute setae apically. Ovipositor curved cephalad, ventral (first) valvula with subapical lateral line of 6 blunt teeth; dorsal (2nd) valvula with 10 rasp-like annuli meeting along midline.

**Male.** Length, 3.25–3.58 mm. Similar to female except for following character states: antenna with flagellum 2.5–2.9× height of head; F2 length/width = 2.5–3.4; metasoma with petiole 1.7–2.3× as long as metacoxa, 3.5–4.7× as long as broad. Genitalia: parameres long and narrow, digitus with 5 broadly spaced teeth.

**Type material. Holotype. Brazil: Mato Grosso:** Sinop, 11°52'14"S, 55°29'46"W, x.1974, M. Alvarenga, Malaise [1♀, CNC: UCRCENT00320683]. **Paratypes. Ecuador: Napo:** Reserva Etnica Waorani 1 km S. Onkone Gare Camp, 220m, 0°39'10"S, 76°26'00"W, 2.x.1999, T.L. Erwin *et al.* [4♂ 1♀, UCRC: UCRCENT00092062, USNM: UCRCENT00092063, USNM: UCRCENT00092209, USNM: UCRCENT00092061, USNM: UCRCENT00092064]. **Peru: Madre de Dios:** 30 km (air) SW Ptp. Maldonado, 290m, 12°50'00"S, 69°17'00"W, 9.iii.1984, T.L. Erwin [2♂, UCRC: UCRCENT00436386, UCRC: UCRCENT00436387].

**Etymology.** Named in honor of Terry L. Erwin of the Smithsonian Institution, a champion of tropical biodiversity who has opened our eyes to what might be possible.



**FIGURES 18–21.** *Orasema erwini*. 18 and 19, paratype female (UCRCENT00092209): 18, head, anterior; 19, mesosoma, lateral. 20 and 21, holotype female (UCRCENT00320683): 20, mesosoma, dorsal; 21, petiole, dorsal.

***Orasema festiva* (Fabricius)**

urn:lsid:zoobank.org:act:9158E6C1-5171-4A6C-BBC1-2DC2DF6156AD

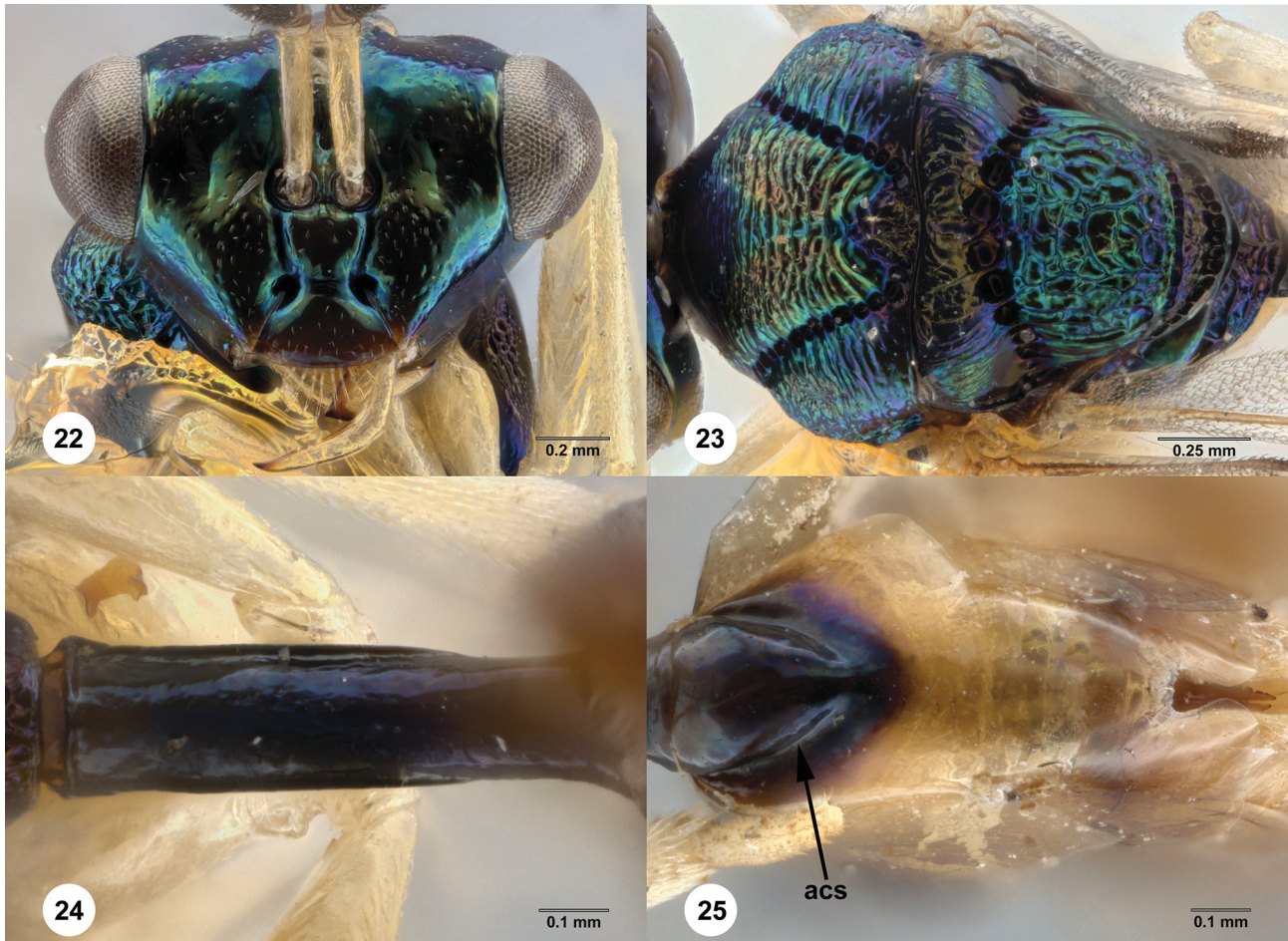
(Figs 22–25)

*Eucharis festiva* Fabricius, 1804: 157.

*Orasema festiva*; combination by Kirby 1886: 29; Heraty 2002: 52 (taxonomy).

**Diagnosis.** Face flattened and smooth, with very short setae, and with a strongly impressed longitudinal groove between torulus and eye. Mesoscutal midlobe transversely costate, lateral lobe strigate (Fig. 23). Petiole without a dorsal carina, smooth and parallel-sided (Fig. 24).





**FIGURES 22–25.** *Orasema festiva*. Female (UCRCENT00417464): 22, head, anterior; 23, mesosoma, dorsal; 24, petiole, dorsal; 25, metasoma, ventral, acs = antecostal sulcus.

Similar to *O. alvarengai*, which has a more finely strigate midlobe and a laterally expanded petiole.

**Female.** Length, 3.4–4.5 mm. Head and mesosoma metallic bluish green to purple; pedicel and anellus pale brown, flagellum dark brown; coxae yellow, metatrochanters dark brown medially; petiole black with metallic luster; gaster dorsally dark brown with metallic luster, ventrally pale brown without metallic luster, except anterior region of  $Ms_2$ , black with metallic luster.

*Head* triangular, 1.5× as long as broad (Fig. 22). Face with broad depression enclosing longitudinal groove lateral to torulus, smooth and glossy with sparse setae; scrobal depression medially with a broad flat median carina bordered laterally by narrow foveate furrow. Eye bare. Labrum with 8 digits. Palpal formula 3-2. Pedicel as broad as  $F_2$ ; flagellum 2.0–2.1× height of head;  $F_2$  2.2–2.4× as long as broad,  $F_2$  1.1–1.2× as long as  $F_3$ .

*Mesosoma* (Fig. 23). Mesoscutum with midlobe transversely costate and lateral lobe strigate with patch of fine sculpture near its center, dorsally with minute setae. Axilla obliquely strigate; mesoscutellar disc areolate-rugose, as long as broad, broadly separated from transscutal articulation at base by deep fovea; frenum areolate-rugose anteriorly. Propodeal disc areolate-rugose with irregular median longitudinal carina; callus smooth, with a few tiny setae. Fore wing 2.6× as long as broad; stigmal vein 2.0–2.5× as long as broad, slightly angled to anterior margin.

*Metasoma* with petiole 1.5–1.6× as long as metacoxa, 4.0× as long as broad, parallel-sided in dorsal view, dorsally smooth, without longitudinal dorsal carina (Fig. 24). Hypopygium with few minute setae apically. Ovipositor weakly curved cephalad; ventral (1st) valvula with subapical lateral line of 6–8 blunt teeth; dorsal (2nd) valvula with 8–11 rasp-like annuli meeting along midline.

**Male.** Unknown.

**Type material examined. Lectotype.** “TYPE, E: festiva, ex Am: mer: Schmidt. LECTOTYPE, Eucharis festiva, Fabricius, 1804, Det: Heraty” [♀, ZMUC: zmuc00241186, images of specimen and labels available from ZMUC online database].



**Additional material examined. BRAZIL: Mato Grosso:** [no locality], 7.iii.1968, O.W. Richards, R.S.& R.G.S. Exped., gallery forest [1♀, BMNH: UCRCENT00239435; homotype established by Heraty]; Barra do Tapirapé, 180m, 10°40'00"S, 50°33'00"W, 10.xii.1962, B. Malkin [1♀, CASC: UCRCENT00417464].

***Orasema reburra* n. sp.**

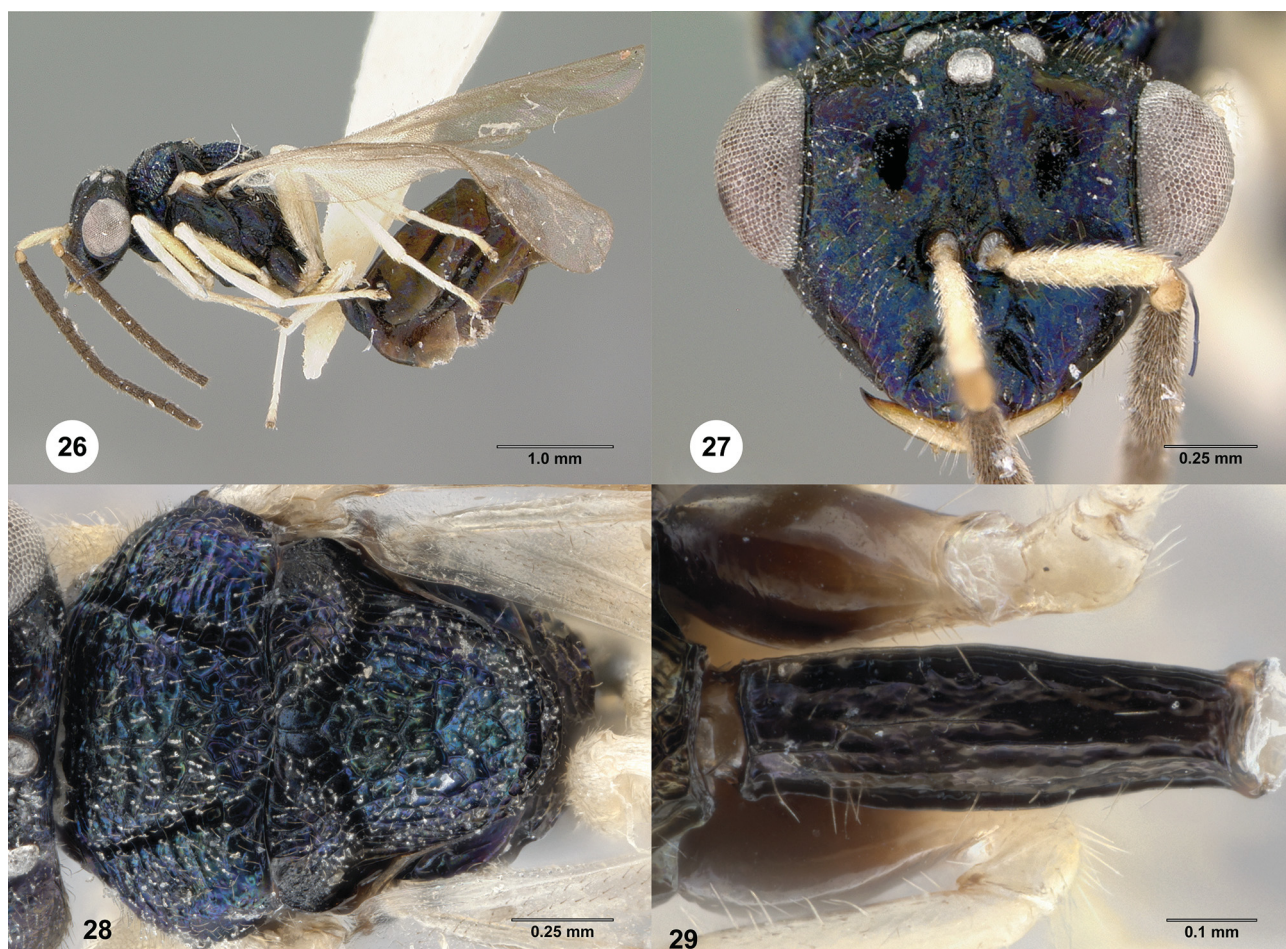
urn:lsid:zoobank.org:act:2E0FE42B-5AFA-4772-A21F-81BAA2852D3B

(Figs 26–29)

**Diagnosis.** Most of body, including petiole but not eyes, with long setae (Figs 26, 28). Petiole slightly expanded laterally near midlength, with one or two dorsal longitudinal carinae (Fig. 29).

*Orasema reburra* is the only known species with a dark brown metacoxa (Figs 26, 29). Distinguished from *O. caesariata*, the only other species with long setae, by absence of setae from the eye, and by the more rounded head in frontal view (Fig. 27).

**Female.** Length, 3.4–4.2 mm. Head and mesosoma metallic blue to purple; pedicel and anellus pale brown, flagellum dark brown; coxae dark brown, metatrochanters yellow; petiole dark metallic purple to black, gaster dark brown to black.



**FIGURES 26–29.** *Orasema reburra*. 26–28, holotype female (UCRCENT00316397): 26, habitus, lateral; 27, head, anterior; 28, mesosoma, dorsal. 29, paratype female (UCRCENT00092181): petiole, dorsal.

*Head* subtriangular, 1.4× as long as broad (Fig. 27). Face with very shallow longitudinal groove between torulus and eye but lacking surrounding depression; scrobal depression with median carina bordered laterally by broad foveate furrow. Eye bare. Labrum with 9–11 digits. Palpal formula 2-2. Pedicel as broad as F2; flagellum 1.5–1.7× height of head; F2 2.5× as long as broad, F2 1.1× as long as F3.



*Mesosoma* (Fig. 28) with mesoscutum coarsely areolate-rugose and densely setose, lateral lobe with irregular transverse carinae and finely sculptured area near center. Axilla areolate-rugose; mesoscutellar disc coarsely areolate-rugose, slightly longer than broad, broadly separated from transscutal articulation basally by deep fovea; frenum areolate-rugose. Propodeal disc coarsely areolate-rugose, median carina lacking; callus smooth, with a few long setae. Metafemur with semi-erect long setae, setae denser and decumbent apically. Fore wing 2.3–2.6× as long as broad; stigmal vein 2.0–2.5× as long as broad, perpendicular to anterior margin.

*Metasoma* with petiole 1.3–1.4× as long as metacoxa, 2.5–2.6× as long as broad, laterally expanded near midlength, smooth, with 1 or 2 dorsal longitudinal carinae (Fig. 29). Hypopygium with few minute setae apically. Ovipositor not visible in available specimens.

**Male.** Unknown.

**Type material. Holotype. Ecuador: Napo:** Anangu, 240m, 0°30'22"S, 76°23'04"W, 25–30.xi.1987, Mike Huybenz [1♀, MCZ: UCRCENT00316397]. **Paratypes. Brazil:** Belen, Duret (leg.), viii.1951 [1♀, UCRC: UCRCENT00434661]. **Colombia: Amazonas:** PNN Amacayacu San Martin, 150m, 3°23'00"N, 70°06'00"W, 10–18.x.2000, B. Amado, malaise trap [1♀, IAVH: UCRCENT00092181]; PNN Amacayacu San Martin, 150m, 3°23'00"N, 70°06'00"W, 8–16.ix.2000, B. Amado, malaise trap [1♀, UCRC: UCRCENT00091402]. **Peru: Cusco:** Quince Mil, 750m, 13°13'03"S, 70°44'27"W, 15–30.x.1962, L. Peña [1♀, CNC: UCRCENT00320755].

**Etymology.** From the Latin *reburrus* meaning “with bristling hair”.

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We thank Lars Vilhelmsen (ZMUC) for providing images of the type of *Eucharis festiva*. Funding was provided by NSF DEB-1257733. Helpful comments on the manuscript were provided by Petr Janšta, an anonymous reviewer, Austin Baker, Judith Herreid, and Adena Why (UCRC).

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