



## ***Cornugon* (Hymenoptera: Eulophidae: Entedoninae) a new genus from tropical America including ten new species**

CHRISTER HANSSON

*Entomology Department, the Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom.*

*E-mail: christerdennis@gmail.com*

### **Abstract**

*Cornugon* **gen. nov.** (Hymenoptera: Eulophidae: Entedoninae) is described from the Neotropical region, including ten new species from Costa Rica, Ecuador, Honduras and Mexico: *C. albicoxa*, *C. anais*, *C. bicornis*, *C. diabolos*, *C. diceros*, *C. gibberum*, *C. leios*, *C. petiolatum*, *C. reticulatum*, and *C. unicornis* **spp. nov.** The monophyly of the genus is demonstrated through two putative morphological autapomorphies. One of the autapomorphies is in a recently discovered character system, wing interference colour patterns (WIPs). WIPs are used here for the first time at the generic level for the classification of insects. *Cornugon* is compared to *Pediobius* Walker with which it shares the most apomorphies.

**Key words:** Neotropical, *Pediobius*, taxonomy, wing interference patterns, WIP

### **Introduction**

The knowledge of the fauna of Eulophidae in tropical America has increased considerably during the last decade, both through large monographs, e.g. Hansson (2009), and smaller contributions, e.g. Hansson (2010) and Schauff & Janzen (2001). In spite of these contributions even the most basic knowledge of what species occur in the neotropics and how to identify or classify them is still very incomplete. This is a contribution to this knowledge, adding a new genus and new species with new morphological information.

Wing interference colour patterns (WIPs) were recently introduced as a potential new character system of extremely thin insect wings (Shevtsova *et al.* 2011), i.e. of the wings of very small insects. The functional use of the patterns for the insects and for those studying insects was speculated upon in the article, but very little was actually known at the time of publication. Taxonomy was mentioned as one of the fields of research that would benefit from the discovery. The only known concrete case was indeed in taxonomy, in the genus *Achrysocharoides* Girault, where males of some species showed species-specific wing patterns. Consequently, WIPs have been proven useful for the separation of species. Here, WIPs are shown for the first time to be also advantageous for generic classification in insects.

### **Material and methods**

Methods how to view and document interference colour patterns in thin membranous wings are explained in Shevtsova *et al.* (2011). The following is in addition to that account. Images 52–69 were made with a Nikon SMZ 1000 stereomicroscope, a halogen ring light Ø 55 mm, and a Nikon DS-Fi1 camera. As long as the optics is of high quality the brand of the microscope is not important — what is important is the angle between lines of observation and incident light beams. Using another stereomicroscope (Nikon SMZ 1500) with the same light source the colour patterns were the same as for the SMZ 1000, but appeared distinctly less bright (compare Figs 89, 90). The main difference between these microscopes is the working distance (WD) and thus the angle between lines of observation and light beams. In the SMZ 1000 this angle is 25° (WD = 60 mm) and in SMZ 1500 it is 40° (WD = 30 mm).

The interference colour patterns, as viewed through a microscope with a ring light, thus appear brighter and more distinct the smaller is the angle between lines of observation and light beams. Under natural conditions where light is more dispersed, the interference patterns always appear bright, which can be seen when observing wings through a microscope with the sun or daylight as the only light source. More interference colour patterns of wings of Eulophidae can be viewed on the following websites: <http://neotropicaleulophidae.com/> and <http://wipbarcode.com/>.

Abbreviations of morphological terms used are: HE= height of eye; HW= height of wing, measured across the widest part of wing; LG= length of gaster; LM= length of marginal vein; LW= length of wing, measured from base of marginal vein to the apical margin of wing; MM= length of mesosoma; MO= mouth opening; MS= malar space, i.e. the distance between lower margin of eye and mouth opening; OOL= the distance between eye and posterior ocellus; PM= length of postmarginal vein; POL= the distance between posterior ocelli; POO= the distance between posterior ocelli and occipital margin; ST= length of stigmal vein; WH= width of head; WT= width of thorax, measured across widest part which is usually just in front of attachment point of forewing.

Ratios between different body parts among the species are summarized in Table 1 based on the holotype and one of the paratypes (if present) of the other sex.

**TABLE 1.** Ratios between different body parts. For an explanation of the morphological abbreviations see “Materials and methods”.

	HE/MS/WM	POL/OOL/POO	WH/WT	LW/LM/HW	PM/ST	MM/LG
<i>C. albicoxa</i> <b>sp. nov.</b> female	7.9/1.0/3.1	3.7/4.7/1.0	1.3	2.0/1.0/1.4	1.0	1.1
<i>C. anais</i> <b>sp. nov.</b> female	18.1/1.0/7.4	1.6/1.0/1.2	1.2	1.8/1.0/1.3	0.3	1.2
<i>C. bicornis</i> <b>sp. nov.</b> female	9.3/1.0/3.8	1.2/1.0/1.0	1.0	2.1/1.0/1.4	0.5	1.4
<i>C. bicornis</i> <b>sp. nov.</b> male	12.4/1.0/6.1	–	–	–	–	1.2
<i>C. diabolos</i> <b>sp. nov.</b> female	10.4/1.0/3.3	1.0/1.1/1.7	1.2	1.9/1.0/1.3	0.7	1.5
<i>C. diabolos</i> <b>sp. nov.</b> male	14.5/1.0/5.5	–	–	–	–	1.3
<i>C. diceros</i> <b>sp. nov.</b> female	22.8/1.0/9.2	1.2/1.0/1.2	1.2	2.1/1.0/1.4	0.5	1.1–1.2
<i>C. diceros</i> <b>sp. nov.</b> male	18.8/1.0/7.8	–	–	–	–	1.1–1.2
<i>C. gibberum</i> <b>sp. nov.</b> female	9.1/1.0/3.2	2.5/2.1/1.0	1.2	1.9/1.0/1.4	0.5	1.2
<i>C. leios</i> <b>sp. nov.</b> female	3.9/1.0/1.5	1.3/1.1/1.0	1.3	1.8/1.0/1.2	0.5	1.1–1.2
<i>C. leios</i> <b>sp. nov.</b> male	2.6/1.0/1.2	–	–	–	–	1.4
<i>C. petiolatum</i> <b>sp. nov.</b> female	21.3/1.0/6.0	1.3/1.3/1.0	1.1	1.9/1.0/1.3	0.5	1.2
<i>C. reticulatum</i> <b>sp. nov.</b> female	16.6/1.0/5.3	1.0/1.2/1.2	1.2	1.8/1.0/1.4	0.5	1.2–1.4
<i>C. reticulatum</i> <b>sp. nov.</b> male	2.8/1.0/1.1	–	–	–	–	1.3
<i>C. unicornis</i> <b>sp. nov.</b> female	4.1/1.0/1.9	2.6/1.8/1.0	1.1	1.8/1.0/1.2	0.3	1.2–1.3

The terminology used here follows Gibson (1997) with one addition. The term “frontal speculum” is newly introduced. This is the more or less rhomboid area just above the frontal suture that is distinctly delimited from the remaining upper part of the frons. The frontal speculum is delimited ventrally by the frontal suture and dorsally by an edge or a carina, or is distinct from remaining upper part of the frons through absence of reticulation. The concept of “upper part of frons” is here meant as the part of the frons above the frontal suture up to where the vertex begins. For illustrations of this and other morphological terms used see <http://www.neotropicaleulophidae.com/>.

Acronyms of museums used in the text: BMNH = The Natural History Museum, London; CH = collection of Christer Hansson; CNC = Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa; INBio = Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica; LUZM = Lund University Zoological Museum, Sweden; MIUCR = Museo de Insectos, Universidad de Costa Rica, San Pedro; TAMU = Texas A&M University, College Station, U.S.A.; USNM = United States Museum of Natural History, Washington, D.C.

## ***Cornugon* Hansson gen. nov.**

**Type species:** *Cornugon diabolos* sp. nov., designated here.

**Etymology.** Name emanating from the game “dungeons and dragons” where the character “cornugon” is a creature with two horns on the forehead and with wings, much like some of the species in this new genus, e.g. the type species. The name is from the Latin *cornu* = horn, and with a suitable suffix. The gender is neuter.

**Diagnosis.** Eyes large and hairy (e.g. Figs 4, 8, 14); mouth opening small; frontal speculum usually present (e.g. Figs 2, 18, 28); vertex with a median groove reaching from occipital margin to anterior ocellus (e.g. Figs 15, 20, 25) (missing from *C. albicoxa* (Fig. 4) and *C. anais* (Fig. 10)); with a fovea in below anterior ocellus (e.g. Figs 8, 18, 28, 34); frons with a second short row of setae inside row of setae along inner margin of eye (e.g. Figs 8, 13, 18); pronotum with a transverse carina close to hind margin (e.g. Figs 3, 9, 21); notauli distinct, in anterior 1/3 as a narrow groove (e.g. Figs 3, 9, 21) and in posterior 2/3 triangular, smooth and deeply impressed; prepectus smooth and shiny with 2 or 3 foveae (Figs 6, 12, 32, 46); propodeal plicae usually present and complete (e.g. Figs 17, 22, 27, 31) (missing in *C. anais* (Fig. 11)); hindwing colour interference pattern with a bright blue spot apically (Figs 52–57); petiole with an anterodorsal protrusion covering upper petiolar foramen (Figs 31, 37, 40).

**Description.** Head and body bright metallic and shiny (Figs 70–73). Flagellum in both sexes with a 2- (e.g. Figs 78, 79) or 3-segmented clava (e.g. Figs 74, 75), or males with all flagellomeres separated from one another, i.e. not fused (Fig. 86); sensilla ampullacea globular, symmetric (type I sensu Hansson (1990)), present on all flagellomeres. Antenna with small, discoid anelli. Scape narrow in female and of same width or slightly wider in male (Figs 74–88), reaching above frontal suture; in male with ventral sensory area extending along the major length of scape. Mandibles with 3 or 4 large teeth (Figs 13, 14) or with 2 large ventroapical teeth and several small teeth above these (Fig. 7). Clypeus not delimited. Tentorial pits distinct (e.g. Figs 13, 14). Malar sulcus present or absent. Antennal scrobes unite at V-shaped frontal suture (e.g. Figs 18, 48) or slightly below frontal suture (e.g. Figs 2, 8); frons dorsally subdivided by a rounded edge or through different sculpture, with ventral portion forming a smooth and shiny frontal speculum (e.g. Figs 2, 18, 28). Border between vertex and occiput convex without edge or carina (e.g. Figs 20, 25, 29); occiput without groove or fold between occipital margin and occipital foramen. Frons between upper border of frontal speculum, level of toruli, and eye margins smooth and shiny without any reticulation (e.g. Figs 18, 23, 28), and usually also with frons between upper border of frontal speculum and vertex smooth, but this part with strong reticulation in *C. reticulatum* (Figs 42–44). Vertex smooth and shiny (e.g. Figs 4, 15, 20) except with engraved or raised reticulation inside ocellar triangle in some species (Figs 10, 44); usually with a groove between occipital margin and anterior ocellus (e.g. Figs 15, 20, 25), occasionally without such a groove (Figs 4, 10).

Pronotum with a transverse carina close to posterior margin (e.g. Figs 9, 16, 21). Mesoscutum predominantly reticulate (e.g. Fig. 9) to predominantly smooth (e.g. Fig. 16); notauli as narrow grooves in anterior part and as distinctly delimited, more or less triangular, smooth foveae in posterior part (e.g. Figs 36, 45); midlobe with two pairs of setae; with a narrow slit medially between mesoscutum and scutellum (e.g. Figs 9, 16) or with a round to quadrangular fovea in same location (e.g. Figs 21, 26). Scutellum predominantly reticulate (Fig. 9) to predominantly smooth except along posterior margin (Fig. 16); without (e.g. Fig. 30) or with a median groove in anterior 1/2 (e.g. Fig. 9) or extending most of length (e.g. Fig. 49); anteromedian part projecting into posteromedian part of midlobe of mesoscutum (e.g. Figs 16, 21, 26); with one pair of setae in posterior 1/2 of scutellum. Pleurae smooth and shiny (Figs 12, 46); transepimeral sulcus (i.e. sulcus separating upper and lower mesepimeron) straight or weakly curved (Fig. 46). Propodeum smooth except usually with lateral plicae (absent from *C. anais* (Fig. 11)) and then plicae either converging strongly posteriorly (e.g. Fig. 37) or parallel (e.g. Fig. 17) and with (e.g. Fig. 37) or without (e.g. Fig. 17) a median carina; propodeal callus with two setae. Forewing rounded; costal cell narrow, as wide as submarginal vein; speculum closed below; postmarginal vein 0.3–1.0x as long as stigmal vein.

Petiole 1–3.5X as long as wide, dorsal surface with reticulation (e.g. Fig. 37) or with transverse carinae (e.g. Fig. 22), and with an anterodorsal protrusion that covers upper part of petiolar foramen (e.g. Figs 22, 27, 31). Male genitalia as in most Entedoninae, i.e. with two digital spines and with volsellar setae short and thin (see Hansson 1996).

**Distribution.** Neotropical region (Costa Rica, Ecuador, Honduras, and Mexico).

**Biology.** Unknown.

**Identification.** *Cornugon* runs to couplet 114 in the key to Nearctic genera of Eulophidae by Schauff *et al.* (1997), where the first alternative fits best (with complete notauli), but with posterior part of notauli as shallow, smooth and distinctly delimited foveae (i.e. not as narrow grooves). Another option for identification is to use the matrix key to the Neotropical genera of Entedoninae on the website <http://www.neotropicaleulophidae.com/>.

**Monophyly.** *Cornugon* possess several apomorphies, two putative autapomorphies and ten apomorphies shared with other entedonine genera, mainly with *Pediobius* Walker. *Cornugon* thus has unique apomorphies and can be defined as a distinct, monophyletic group. Furthermore, *Pediobius*, the genus *Cornugon* shares most apomorphies with, is previously defined as monophyletic (Hansson 2002) through the medioposterior part of the propodeum being extended to form a nucha and the anterior part of petiole being concave to embrace the protruding nucha; and propodeum having submedian carinae. However, most apomorphic features shared by *Cornugon* and *Pediobius* are also present in other genera of Entedoninae. Furthermore, those apomorphic features present only in *Cornugon* and *Pediobius* are present in just a few species of *Pediobius*. Therefore, a sister-group relationship is not certain. The apomorphic features shared with other genera possibly delimit larger sets of genera or are homoplasies, whereas the apomorphies shared with a few species of *Pediobius*, which is represented by 217 species on a world basis (Noyes 2009), very likely evolved independently in the two genera, i.e. are homoplasies.

Putative autapomorphies:

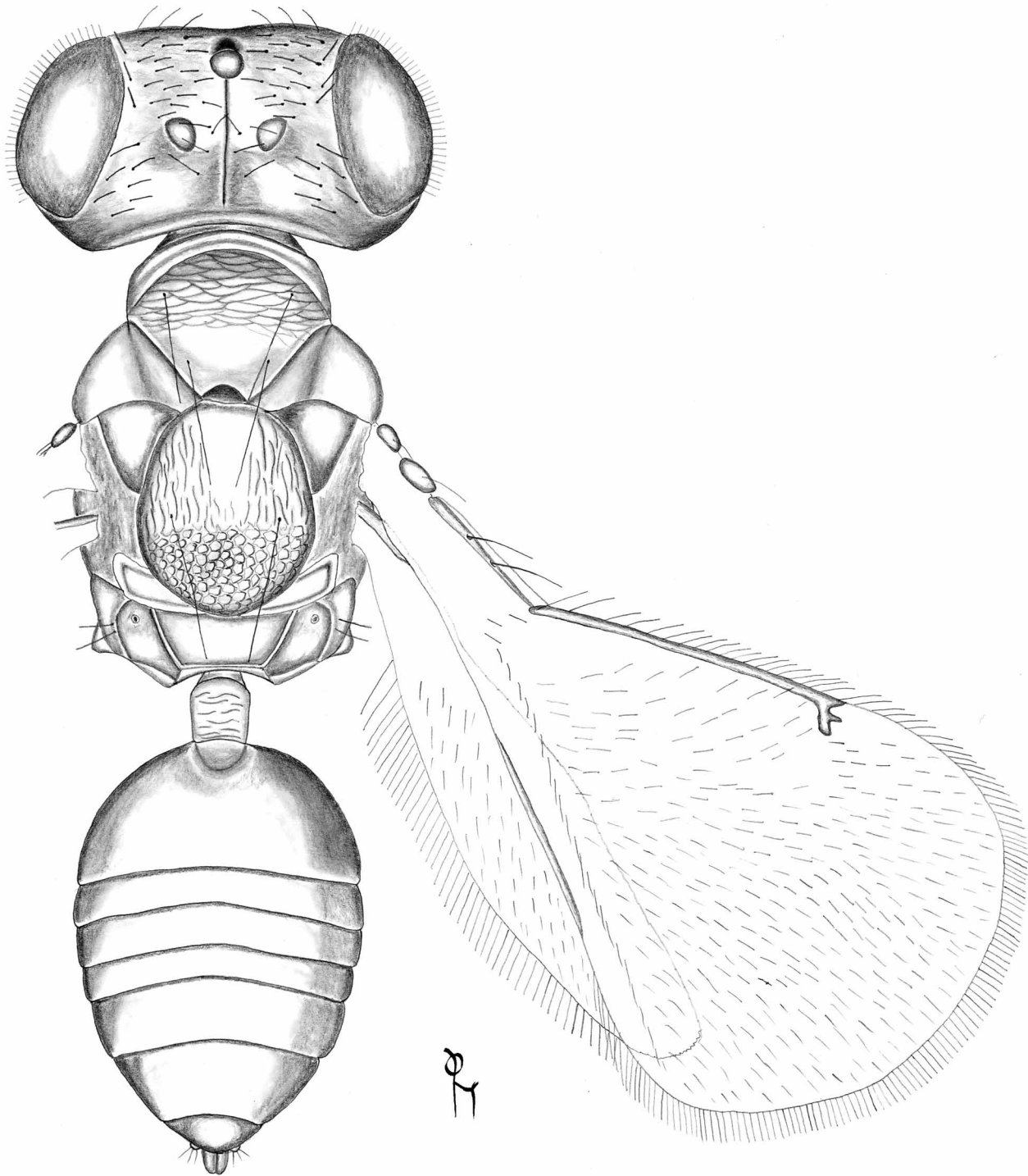
- Prepectus smooth and shiny with 2 or 3 shallow, indistinct foveae (Figs 6, 12, 32, 46).
- Hindwing apically with a bright blue spot in the interference colour pattern (Figs 52–57).

Apomorphies shared with *Pediobius*

- Head with a frontal speculum (e.g. Figs 2, 28, 33). The frontal speculum is a new character introduced here, though it is not confined to *Cornugon* and *Pediobius*; for example, it is also present in *Proacrias* Ihering and some species of *Closterocerus* Westwood. The character is thus either an autapomorphy for a larger set of genera or a homoplasy; further investigations must be done to establish this.
- Antennal scrobes as narrow, distinct grooves (e.g. Figs 2, 8, 19). This feature is also present in several other entedonine genera, e.g. *Emersonella* Girault, *Horismenus* Walker and *Paracrias* Ashmead.
- Pronotum with a carina close to posterior margin (e.g. Figs 9, 16, 21). This feature is also present in several other entedonine genera, e.g. *Horismenus*, some *Chrysocharis* Förster, and some *Achrysocharoides* Girault.
- Notauli complete with anterior 1/3 to 1/2 as a distinct narrow groove and posterior 1/2 to 2/3 as a shallow, smooth, distinctly delimited and more or less triangular fovea (e.g. Figs 3, 9, 21). This feature is also present in some species of *Pediobius*, e.g. *P. foveolatus* (Crawford).
- Mesonotum with a distinct fovea medially between mesoscutum and scutellum (e.g. Figs 9, 16, 21, 26). This feature is also present in some species of *Pediobius*, e.g. *P. aphidiphagus* (Ashmead) and *P. crassicornis* (Thomson).
- Anteromedian part of scutellum protruding into posteromedian part of mesoscutum (e.g. Figs 3, 16, 21). This feature is also present in some species of *Pediobius*, e.g. *P. aspidomorphae* (Girault) and *P. anomalus* (Gahan).
- Anterior part of mesepisternum protruding into posterior part of prepectus (Figs 32, 46). This feature is also present in *Horismenus*, *Inti* Hansson, and some species of *Pediobius*.
- Propodeum with plicae (e.g. Figs 17, 22, 27). This is a characteristic feature for *Pediobius*, but it is also present in several other entedonine genera, e.g. *Apleurotropis* Girault and *Pediobomyia* Girault.

Apomorphies shared with other entedonine genera but not with *Pediobius*:

- Head with a fovea just below anterior ocellus (Figs 2, 4, 18, 28). This feature is also present in several other genera e.g. *Apleurotropis*, *Platocharis* Kerrich, *Schizocharis* Kerrich and some species of *Achrysocharoides*.
- Petiole with an anterodorsal protrusion covering upper part of petiolar foramen (Figs 31, 37, 40). This feature is also present in some other genera: *Pediobomyia*, *Tropicharis* Hansson, and in some species of *Chrysocharis* Förster and *Omphale* Haliday.



**FIGURE 1.** *Cornugon gibberum* sp. nov., female paratype, body length 1.0 mm.

### **WIPs as a taxonomic character**

The recently reported character system consisting of interference colours in wings (WIPs) (Shevtsova *et al.* 2011) is useful in defining *Cornugon* as a monophyletic group. The bright small blue spot at the apex of the hindwings (Figs 52–57) is a distinctive feature of *Cornugon* that is absent from the hindwings of, or smaller than other genera that *Cornugon* shares apomorphies with (Figs 58–69), and from other genera of the subfamily. WIPs may perhaps

also be of some use for distinguishing species of *Cornugon*. However, the differences between the species are small and, as with other morphological characters, WIPs probably are subject to intraspecific variation. The material included here is the result of more than 25 years of collecting efforts in Costa Rica (Hansson 2009, Noyes 2010), but yet most species of *Cornugon* are represented by a single or just a few specimens. Because the group is very rare and few specimens are available for studies of intraspecific variation, analysis of WIPs for species delineation must wait more material becoming available. The usefulness of WIPs for the separation of species has been demonstrated for some species of *Achrysocharoides* (Shevtsova *et al.* 2011). The species also displayed distinct sexual dimorphism in this character, males having species-specific and distinct WIPs, whereas the colour patterns of females were similar among the species. The colour patterns of females and males in species of *Cornugon* treated here are similar.

### Key to species of *Cornugon*

1. Upper part of frons with two pointed protrusions resembling "horns" (Figs 14, 15, 19, 23) ..... 2
- Upper part of frons either with one pointed protrusion medially (Fig. 48), without protrusions (e.g. Figs 2, 33) or with rounded protrusions (Fig. 38) ..... 4
2. Mesonotum with a small, transverse fovea between midlobe of mesoscutum and scutellum (Fig. 16); scape, femora and tibiae dark brown with metallic tinges ..... *C. bicornis* **sp. nov.** (female, male)
- Mesonotum with a large, more or less quadrangular or round fovea between midlobe of mesoscutum and scutellum (Figs 21, 26); scape, femora and tibiae white. .... 3
3. Petiole widest and with irregular transverse carinae in anterior half, and with a constriction posteriorly (Fig. 22) ..... *C. diabolos* **sp. nov.** (female, male)
- Petiole narrowest anteriorly and gradually increasing in width posteriorly, and dorsally reticulate with small meshes (Fig. 27). .... *C. diceros* **sp. nov.** (female, male)
4. Upper part of frons with one pointed protrusion medially (Fig. 48). .... *C. unicornis* **sp. nov.** (female)
- Upper part of frons without pointed protrusions (e.g. Figs 2, 33) or with rounded protrusions (Fig. 38) ..... 5
5. Coxae white to yellowish-white ..... 6
- Coxae dark brown ..... 7
6. Scutellum with a median groove extending entire length, and posterior ½ with weak reticulation (Fig. 3); propodeum 0.4X as long as wide measured between spiracles, and without groove along anterior margin (Fig. 5) . . . *C. albicoxa* **sp. nov.** (female)
- Scutellum with a median groove in anterior ½ only, and predominantly with strong reticulation (Fig. 9); propodeum 0.2X as long as wide measured between spiracles, and with a wide groove along anterior margin (Fig. 11) . . *C. anais* **sp. nov.** (female)
7. Scutellum with a strong median groove in anterior 2/3 (Figs 36, 39); propodeum with a median carina (Figs 37, 40) ..... 8
- Scutellum without median groove (Figs 30, 45); propodeum without median carina (Figs 31, 47) ..... 9
8. Mesoscutum predominantly reticulate (Fig. 39); propodeal plicae parallel (Fig. 40). .... *C. petiolatum* **sp. nov.** (female)
- Mesoscutum predominantly smooth and shiny (Fig. 36); propodeal plicae converging posteriorly (Fig. 37). .... *C. leios* **sp. nov.** (female, male)
9. Vertex anteriorly and upper part of frons with strong reticulation (Figs 42–44); upper posterior surface of hind coxa with more than 10 long hairs ..... *C. reticulatum* **sp. nov.** (female, male)
- Vertex entirely and upper part of frons smooth and shiny (Figs 28, 29); upper posterior surface of hind coxa with less than 5 long hairs. .... *C. gibberum* **sp. nov.** (female)

### Species treatments

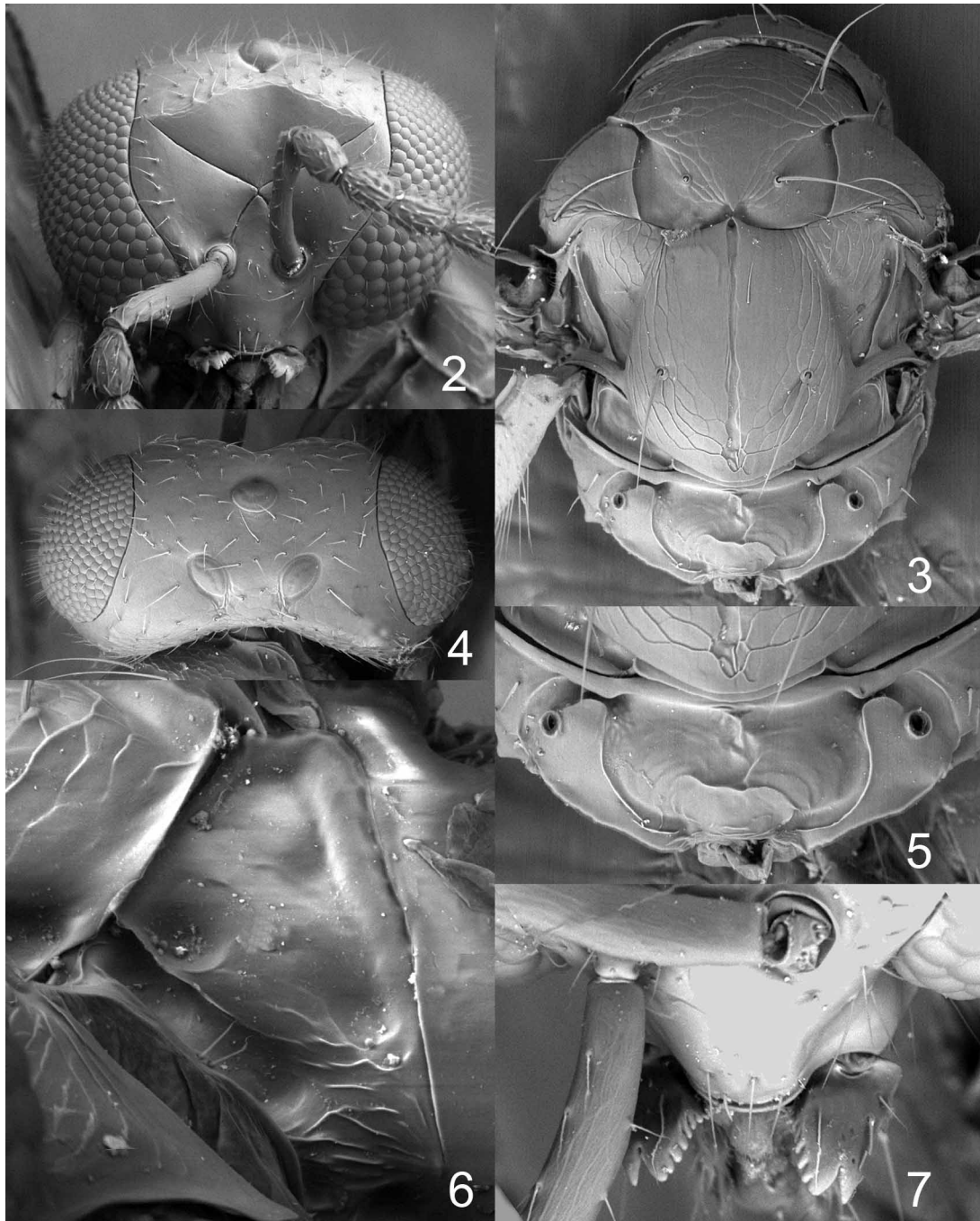
#### *Cornugon albicoxa* **sp. nov.**

(Figs 2–7, 74)

**Diagnosis.** Vertex without median groove (Fig. 4); pronotal collar carina very weak (Fig. 3); scutellum with a deep and distinct median groove extending along entire length (Fig. 3); propodeum without median carina (Fig. 5); coxae white; petiole about as long as wide; first gastral tergite covering about 1/3 of gaster.

Similar to *C. anais*, but differing in having a complete median groove on scutellum, and longer propodeum with plicae.

**Description.** FEMALE. Length 1.0 mm. Antenna dark brown except scape white. Frons metallic purple. Vertex metallic greenish-blue. Mesoscutum, scutellum and propodeum golden-green. Legs white. Wings hyaline. Petiole golden-green. Gaster weak golden-green.



**FIGURES 2–7.** *Cornugon albicoxa* sp. nov., female. 2. Head frontal. 3. Mesosoma dorsal. 4. Vertex. 5. Propodeum dorsal. 6. Prepectus. 7. Lower part of head with mandibles.

Antenna as in Fig. 74. Frons and vertex smooth and shiny (Figs 2, 4), upper part of frons concave, otherwise almost flat; vertex without median groove. Tentorial pits indistinct (Fig. 2).

Mesonotum with a more or less triangular fovea medially between mesoscutum and scutellum (Fig. 3). Pronotal collar with transverse carina very weak (Fig. 3). Midlobe of mesoscutum anteriorly with weak transverse striae (Fig. 3), posterior part of midlobe with very weak engraved reticulation, sidelobes with very weak engraved reticulation posteriorly, otherwise smooth and shiny. Scutellum smooth and shiny medially (Fig. 3), laterally and posteriorly with weak reticulation; with a deep and distinct median groove extending along entire length. Dorsellum very short, almost hidden under scutellum with only very posterior parts visible in dorsal view (Fig. 5). Propodeum with very weak sculpture and shiny between plicae (Fig. 5).

Petiole about as long as wide. Gaster ovate with first tergite covering about 1/3 length.

MALE. Unknown.

**Type material.** Holotype female (TAMU) labelled “Mexico, Oaxaca, 9 miles west of Tehuantepec, 13.vii.1987, 87/039, G. Zolnerowich”.

**Etymology.** Name referring to the white coxae, from the Latin *albus* = white, and coxa.

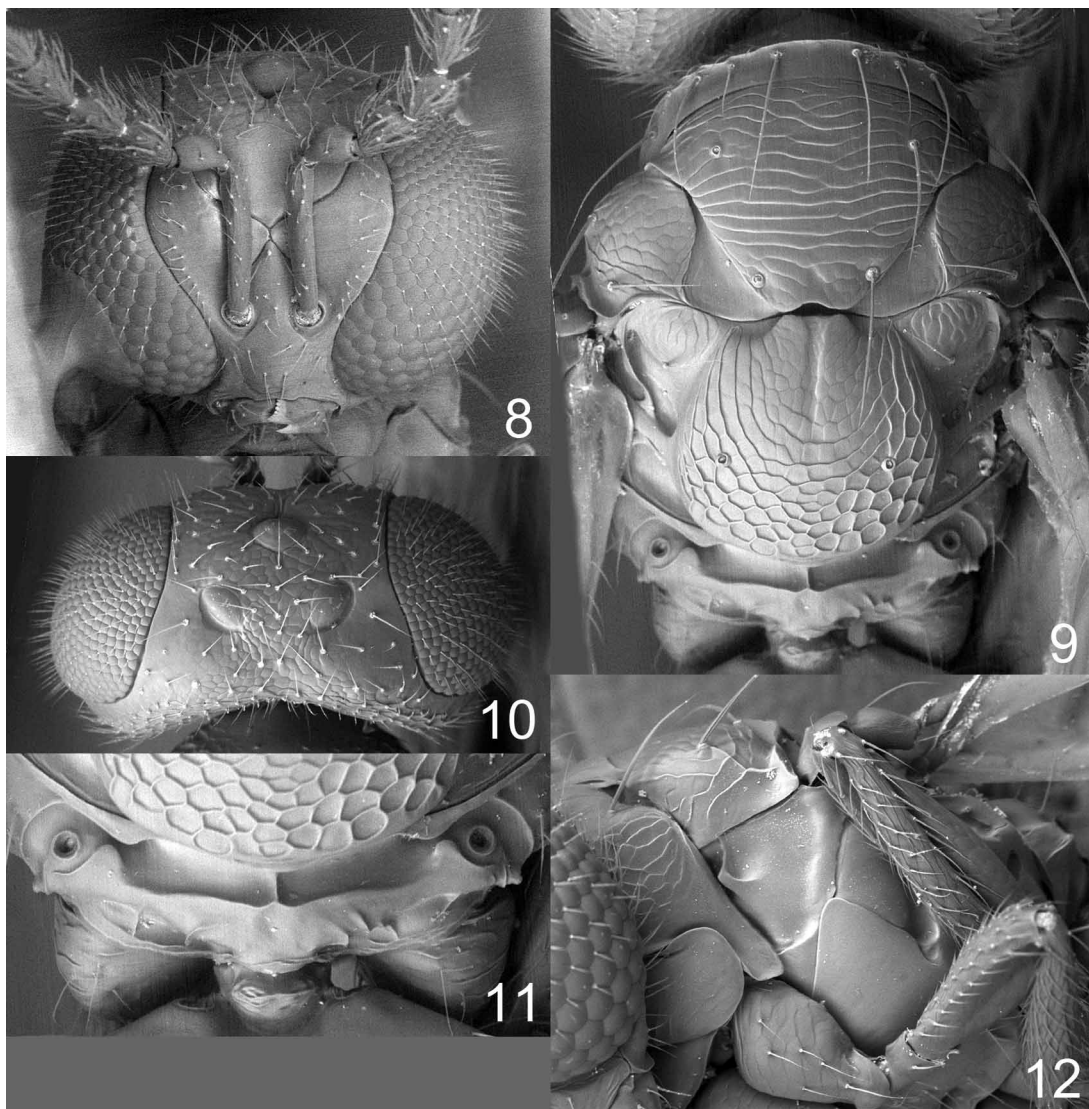
**Distribution.** Mexico.

**Remarks.** The single specimen is broken, but with all parts glued to same card.

***Cornugon anais* sp. nov.**

(Figs 8–12, 75)

**Diagnosis.** Eyes large and malar space narrow (Fig. 8), HE/MS = 18.1; vertex without median groove (Fig. 10); mesoscutum and scutellum completely reticulate, scutellum with a median groove in anterior 1/3 (Fig. 9); propodeum short, without median carina and plicae but with a wide groove anteriorly (Fig. 11); coxae white; petiole about as long as wide; first gastral tergite covering about 1/3 of gaster.



**FIGURES 8–12.** *Cornugon anais* sp. nov., female. 8. Head frontal. 9. Mesosoma dorsal. 10. Vertex. 11. Propodeum dorsal. 12. Mesosoma lateral.

Similar to *C. albicoxa*, but differing in scutellum having an incomplete median groove, and propodeum shorter and without plicae.

**Description.** FEMALE. Length 1.0 mm. Antenna dark brown except scape white. Frons metallic dark purple. Vertex metallic greenish-blue. Mesoscutum metallic greenish-blue with purple tinges. Scutellum metallic greenish-



blue in anterior ½, metallic dark purple in posterior ½. Propodeum metallic greenish-blue. Legs, including coxae, white. Wings hyaline. Petiole metallic purple. Gaster weak metallic greenish-blue.

Antenna as in Fig. 75. Frons smooth and shiny (Fig. 8); frontal suture incomplete, terminating at a distance equal to diameter of torulus; antennal scrobes uniting below frontal suture. Tentorial pits distinct (Fig. 8). Vertex smooth and shiny except for engraved reticulation inside ocellar triangle (Fig. 10).

Mesonotum with an ovate fovea medially between mesoscutum and scutellum (Fig. 9). Midlobe of mesoscutum with raised reticulation, the meshes transverse (Fig. 9); sidelobes with engraved reticulation, the meshes isodiametric. Scutellum with raised, strong reticulation except anteromedian 1/2 with engraved, weak reticulation (Fig. 9); with a shallow, indistinct median groove in anterior 1/3. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 9). Propodeum smooth and shiny, without median carina and plicae but with a wide groove along anterior margin (Fig. 11).

Petiole about as long as wide and smooth. Gaster ovate with first tergite shiny and large, covering 1/3 of length.

MALE. Unknown.

**Type material. Holotype** female (INBio) labelled "Costa Rica, Puntarenas, Parque Nacional Corcovado, Estación Leona, 15.ii.2002, J. Azofoifa".

**Etymology.** No specific meaning intended.

**Distribution.** Costa Rica.

### ***Cornugon bicornis* sp. nov.**

(Figs 13–17, 52, 76–77)

**Diagnosis.** Upper part of frons with two "horns" and with frontal suture continuing up into apex of horns (Figs 13–15); scape, femora and tibiae dark brown with metallic tinges; mesoscutum smooth and shiny (Fig. 16); scutellum with a deep and distinct median groove extending from anterior margin along 3/4 length (Fig. 16); propodeum without median carina (Fig. 17); hind coxa conspicuously hairy on posterior surface; petiole about 1.5X as long as wide, reticulate with small meshes and hence dull (Fig. 17); first gastral tergite shiny and large, covering 4/5 of gaster.

Similar to *C. diabolos*, but differing in having scape, femora and tibiae dark brown and with a narrow fovea medially between the mesoscutum and scutellum (Fig. 16).

**Description.** FEMALE. Length 1.0 mm. Antenna dark. Frons dark purple. Vertex golden-green. Mesoscutum golden-green with blue tinges anteriorly. Scutellum golden-purple, metallic greenish-blue laterally. Propodeum golden-green. Coxae, femora and tibiae dark and metallic with knees pale; tarsi pale brown. Wings hyaline. Gaster and petiole dark metallic purple.

Antenna as in Fig. 76. Frons and vertex smooth and shiny (Figs 13–15), frons concave; upper part of frons with two "horns"; tentorial pits distinct (Fig. 13); frontal suture incomplete, ending just below frontal horns; frontal speculum small.

Mesonotum with a narrow slit medially between mesoscutum and scutellum (Fig. 16). Mesoscutum smooth and shiny (Fig. 16). Scutellum with anterior 4/5 smooth and shiny, posterior 1/5 with strong reticulation (Fig. 16); with a distinct median groove extending from anterior margin along 3/4 length. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 16). Propodeum with irregular sculpture medially, otherwise smooth and shiny between plicae (Fig. 17).

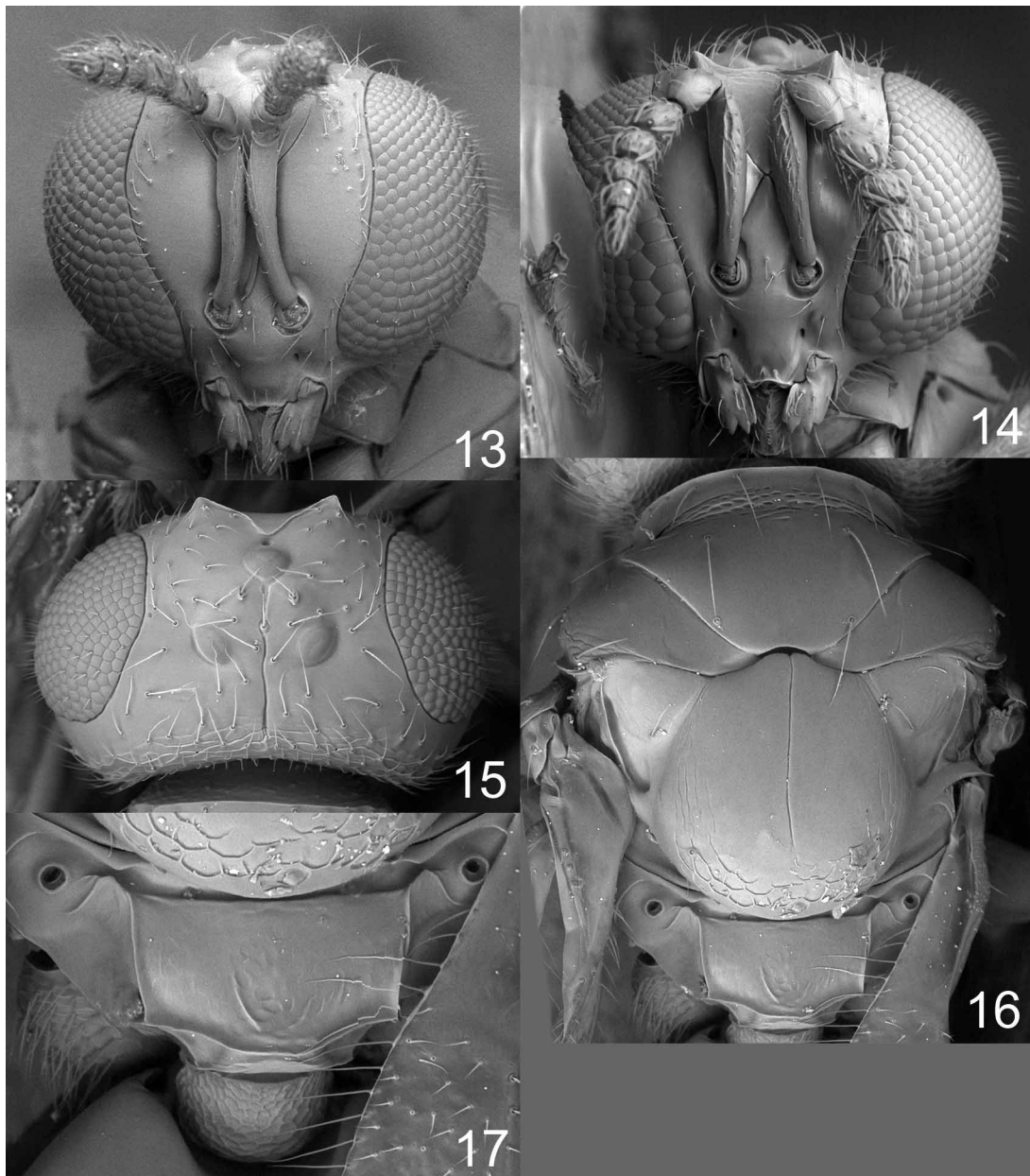
Petiole about 1.5X as long as wide, reticulate with small meshes and hence dull (Fig. 17). Gaster ovate with first tergite shiny and large, covering 4/5 length.

MALE. Length 1.2 mm. Colour as in female except frons black with metallic shine, vertex golden-red, and mesoscutum golden-red. Antenna as in Fig. 77. Structure as for female except petiole 1.8X as long as wide and first gastral tergite covering 2/3 length of gaster.

**Type material. Holotype** female (BMNH) labelled "Costa Rica, Guanacaste, Guanacaste National Park, near headquarter, 5.iii.1990, J.S. Noyes". **Paratypes.** 1♀ 1♂ on cards. COSTA RICA. **Guanacaste:** Bagaces, Parque Nacional Palo Verde, Estación Pale Verde, 10 m, 10.x–10.xi.2000, LN 259050/388400, I. Jiménez, #60220 (1♀, INBio); Bagaces, Parque Nacional Palo Verde, Sector Palo Verde, Cerro Guyacán, 212 m, 8.xii.1999–10.i.2000, LN 259350/389600, I. Jiménez, #54958 (1♂, BMNH).

**Etymology.** Named after the two hornlike protrusions on upper part of frons, from the Latin *bi* = two, and *cornu* = horn.

**Distribution.** Costa Rica.

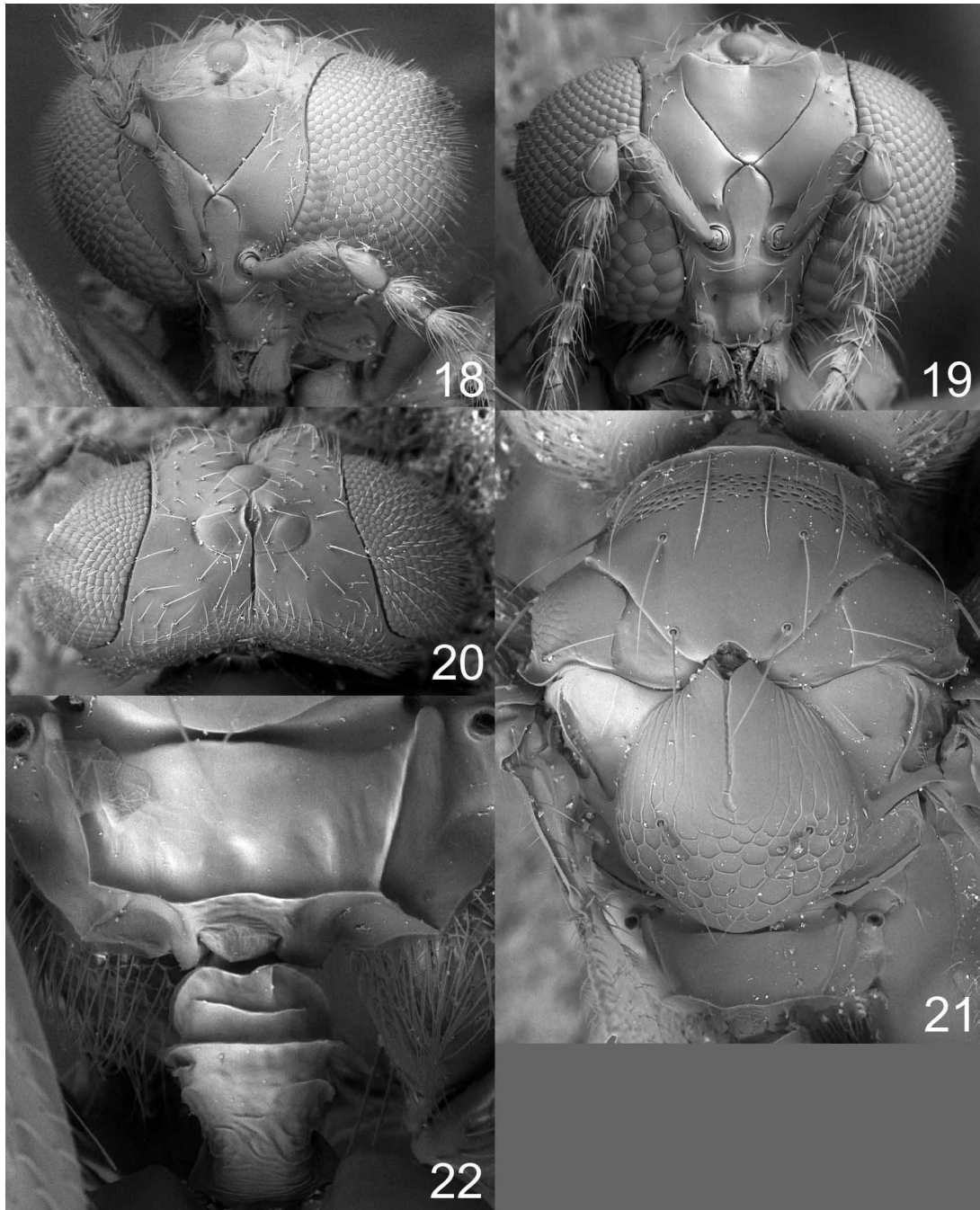


**FIGURES 13–17.** *Cornugon bicornis* sp. nov. 13. Head frontal, female. 14. Head frontal, male. 15. Vertex, female. 16. Mesosoma dorsal, female. 17. Propodeum dorsal, female.

***Cornugon diabolos* sp. nov.**

(Figs 18–22, 78, 79)

**Diagnosis.** Upper part of frons with two "horns" and with frontal suture continuing up into apex of horns (Figs 18, 19); scape, femora and tibiae white; scutellum with a deep and distinct median groove extending from anterior margin along  $\frac{1}{2}$  length (Fig. 21); hind coxa conspicuously hairy on posterior surface; propodeum without median carina (Fig. 22); petiole 1.5X as long as wide, widest and with irregular transverse carinae in anterior half, and with a constriction posteriorly (Fig. 22); first gastral tergite covering about  $\frac{1}{3}$  of gaster.



**FIGURES 18–22.** *Cornugon diabolos* sp. nov. 18. Head frontal, female. 19. Head frontal, male. 20. Vertex, female. 21. Mesosoma dorsal, female. 22. Propodeum dorsal, female.

Similar to *C. diceros*, but differing in the shape of petiole, and vertex with an ovate pit inside ocellar triangle; also similar to *C. bicornis*, but differing in having scape, femora and tibiae white and a large fovea medially between mesoscutum and scutellum (Fig. 21).

**Description.** FEMALE. Length 1.3 mm. Antenna dark brown except scape white. Frons golden-green. Vertex, mesoscutum, scutellum and propodeum metallic bluish-green. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline. Petiole metallic bluish-green. Gaster dark brown with metallic bluish-purple tinges.

Antenna as in Fig. 78. Frons smooth and shiny (Figs 18, 19); upper part of frons with two "horns"; tentorial pits distinct (Fig. 19); frontal suture incomplete, ending just below frontal horns and not reaching eyes. Vertex smooth and shiny (Fig. 20), medially with a groove between occipital margin and anterior ocellus, the groove extending into an ovate pit inside ocellar triangle.

Mesonotum with a more or less round fovea medially between mesoscutum and scutellum (Fig. 21). Mesoscutum predominantly smooth and shiny (Fig. 21), anterior margin with rows of strong foveae and sidelobes with engraved and very weak reticulation. Scutellum smooth and shiny over anteromedian ½ except for a distinct median groove, and with engraved reticulation of elongate meshes over anterolateral ½ (Fig. 21) and raised, strong, isodiametric meshlike reticulation over posterior ½. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 21). Propodeum smooth and shiny between plicae (Fig. 22).

Petiole 1.5X as long as wide, with irregular transverse carinae (Fig. 22). Gaster ovate with first tergite covering about ½.

**MALE.** Length 1.2–1.3 mm. Scape yellowish-brown or white. Frons metallic dark purple, golden-green along eyes. Vertex golden-red or metallic red. Midlobe of mesoscutum golden-red or metallic red, sidelobes metallic dark purple. Scutellum with anterior ½ metallic dark purple with golden-red tinges or metallic red, posterior ½ metallic dark purple with bluish-green tinges. Propodeum golden-green or golden-red. Legs with femora and hind tibia pale brown, fore and mid tibiae yellowish-brown, tarsi white. Petiole black with metallic bluish-green tinges. Gaster dark brown with metallic purple tinges and with a large white spot in anteromedian 1/3. Antenna as in Fig. 79. Structure otherwise as in female.

**Type material.** **Holotype** female (BMNH) labelled “Costa Rica, Heredia, Estación Biológica La Selva, 75 m, 10°26'N 84°01'W, 27–28.ii.2003, J.S. Noyes”. **Paratypes.** 1♀ 2♂ on cards. **COSTA RICA.** **Alajuela:** Parque Nacional Volcan Tenorio, Sector El Pilón, 700–800 m, LN 298212/427913, 10.iii.2003, J. Azofeifa, #73794 (1♂, INBio); **Heredia:** Estación Biológica La Selva, 75 m, 10°26'N 84°01'W, 30–31.iii.2002 (1♂, BMNH); **Puntarenas:** Reserva Abs. Cabo Blanco, 09°35'N 85°06'W, 30 m, 16–17.ii.2009, J.S. Noyes (1♀, BMNH).

**Etymology.** Named after the two horns on upper part of frons, on the “forehead”, a character allegedly shared with the devil, from the Greek with *diabolos* = devil.

**Distribution.** Costa Rica.

### ***Cornugon diceros* sp. nov.**

(Figs 23–27, 53, 76–79, 80, 81)

**Diagnosis.** Upper part of frons with two “horns” and with frontal suture continuing up into apex of horns (Figs 23–25); scape, femora and tibiae white; scutellum with a deep and distinct median groove in anterior 2/3 (Fig. 26); hind coxa conspicuously hairy on posterior surface; propodeum without median carina (Fig. 27); petiole 2X as long as wide, narrow anteriorly and becoming wider posteriorly, and reticulate with isodiametric meshes (Fig. 27); first gastral tergite 0.4X as long as gaster.

Similar to *C. diabolos*, but differing in shape of petiole; also similar to *C. bicornis*, but differing in having scape, femora and tibiae white and a large fovea medially between mesoscutum and scutellum (Fig. 26).

**Description.** **FEMALE.** Length 0.9–1.2 mm. Antenna dark brown except scape white. Frons weakly metallic purple, golden-green along eyes. Vertex, mesoscutum, scutellum, propodeum and gaster metallic bluish-purple or bluish-green. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline.

Antenna as in Fig. 80. Frons smooth and shiny, upper part of frons with two “horns” (Figs 23–25); tentorial pits distinct (Fig. 24); frontal suture incomplete, ending just below frontal horns. Vertex smooth and shiny (Fig. 25); medially with a groove between occipital margin and anterior ocellus.

Mesonotum medially with a more or less round fovea between mesoscutum and scutellum (Fig. 26). Mesoscutum smooth and shiny (Fig. 26). Scutellum with engraved, weak reticulation of elongate meshes and with a distinct median groove in anterior 2/3 (Fig. 26), and, posterior 1/3 with raised, strong, isodiametric meshlike reticulation. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 26). Propodeum smooth and shiny between plicae (Fig. 27).

Petiole 2X as long as wide, reticulate with small isodiametric meshes (Fig. 27). Gaster ovate with first tergite covering 0.4X length.

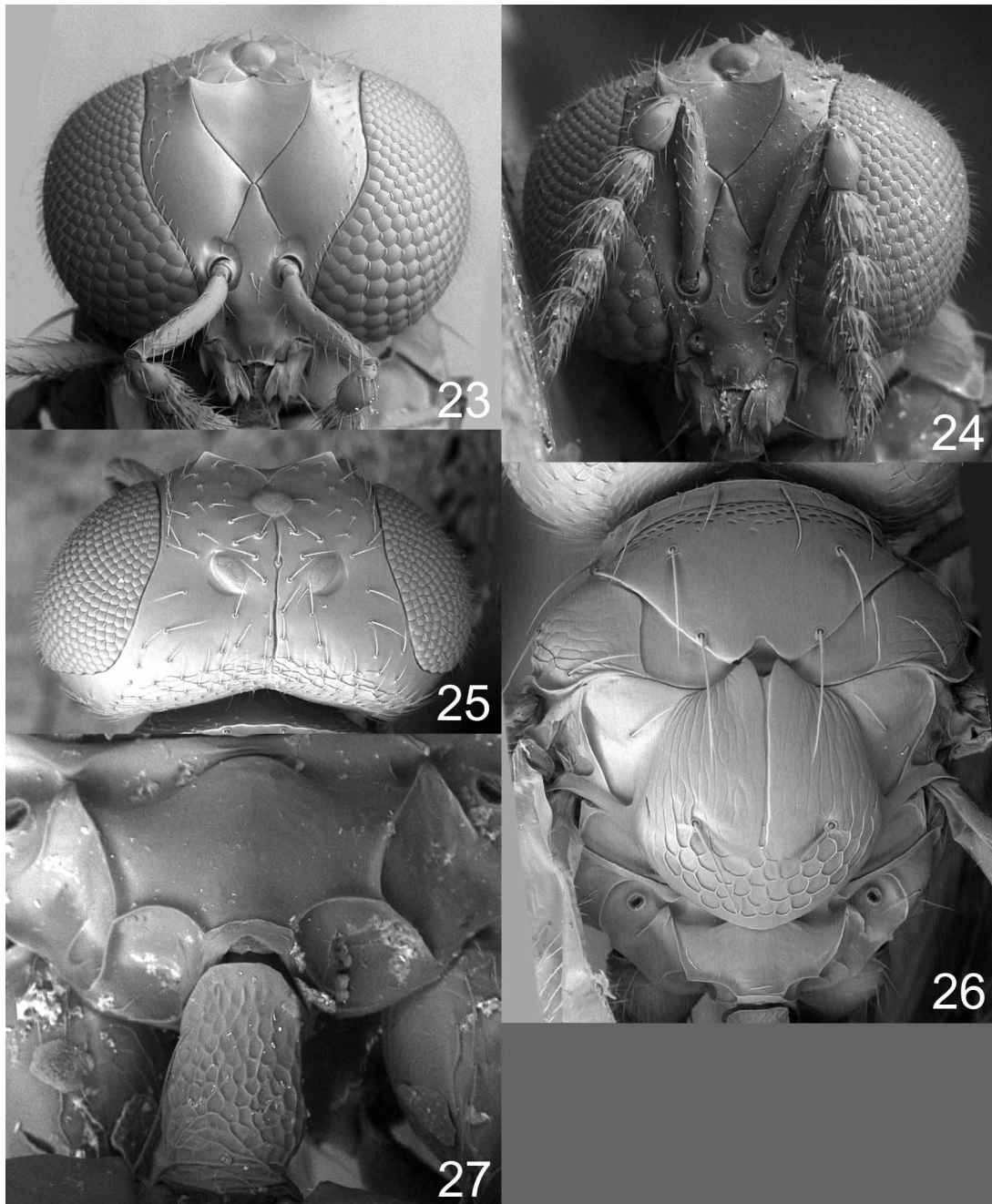
**MALE.** Length 1.1 mm. Frons metallic dark purple. Vertex golden or metallic red. Mesoscutum golden or metallic purple. Scutellum with anterior 2/3 golden and posterior 1/3 metallic dark purple, or completely metallic red. Propodeum golden-green or metallic purple. Fore femur completely white or with basal 2/3 pale brown with apical 1/3 white, remaining parts of legs distal to coxae white. Petiole black with metallic purple and blue tinges.

Gaster dark brown with metallic purple tinges and with a white spot in anteromedian  $\frac{1}{2}$  or  $\frac{1}{5}$ . Antenna as in Fig. 81. Structure otherwise as in female.

**Type material.** **Holotype** female (INBio) labelled “Costa Rica, Guanacaste, Bosque Nacional Diria, Retallano, alrededor Torre Control de Incendio, 600–700 m, 14.viii–18.ix.2001, LN 238550/358650, I. Jiménez, #64578” (INBio). **Paratypes.** 4♀ 2♂ on cards. COSTA RICA. **Guanacaste:** Parque Nacional Palo Verde, Sector Palo Verde, 250 m, 10–18.viii.2000, LN 385020/260952, I. Jiménez, #57716 (1♂, INBio); **Heredia:** 16 km SSE La Virgen, 450–550 m, 14.ii–22.iii.2003 (1♀, INBio); **Puntarenas:** Reserva Privada Karen Mogensen, 09°52'N 85°03'W, 300 m, 11–21.ii.2005, C. Hansson (1♀, CH); from same locality as previous but collected 24.ii.2007 (1♀, BMNH). MEXICO. **Guerrero:** 6.2 miles southwest of Xochipala, 6.vii.1987, 87/017, J.B. Woolley (1♀ 1♂, TAMU).

**Etymology.** Named after the two “horns” on upper part of frons, from the Greek *dikeros* = “two-horned”.

**Distribution.** Costa Rica, Mexico.



**FIGURES 23–27.** *Cornugon diceros* sp. nov. 23. Head frontal, female. 24. Head frontal, male. 25. Vertex, female. 26. Mesosoma dorsal, female. 27. Propodeum dorsal, female.

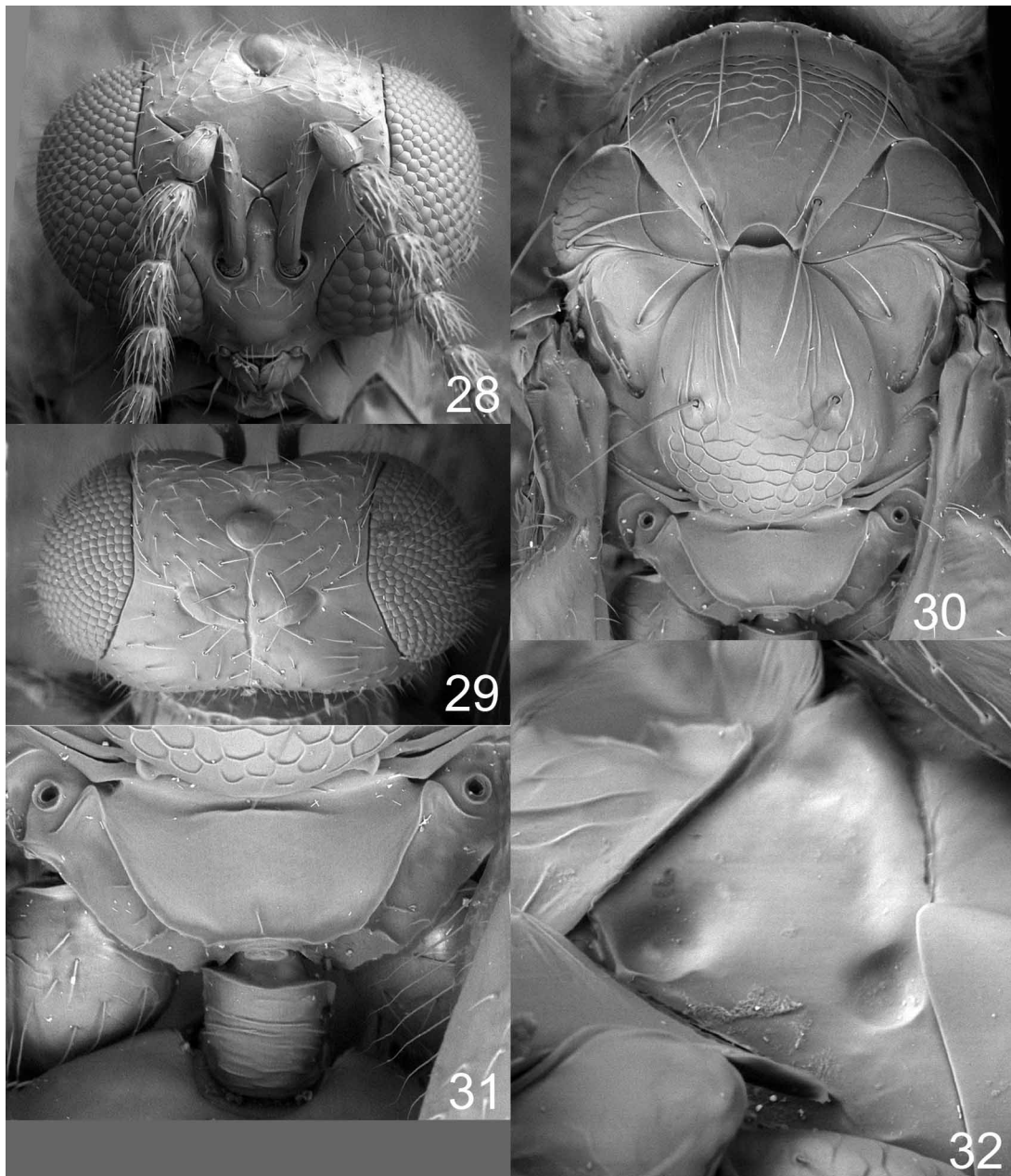
**Remarks.** There are colour differences between the male from Costa Rica (mentioned first in the description)

and the male from Mexico. This might indicate two different species, or intraspecific variation. The two specimens are otherwise very similar and until more material becomes available I regard the colour differences as variation within the species.

***Cornugon gibberum* sp. nov.**

(Figs 1, 28–32, 54, 82)

**Diagnosis.** Vertex with two weak humps, one behind each posterior ocellus, and medially with a groove between occipital margin and anterior ocellus (Fig. 29); scutellum without median groove (Fig. 30); propodeum without median carina (Fig. 31); petiole 1.0–1.5X as long as wide, transversely striate and shiny (Fig. 31); first gastral tergite covering about 1/3 of gaster.



**FIGURES 28–32.** *Cornugon gibberum* sp. nov., female. 28. Head frontal. 29. Vertex. 30. Mesosoma dorsal. 31. Propodeum dorsal. 32. Prepectus.

Similar to *C. reticulatum*, but differing in having upper part of frons and vertex smooth.

**Description.** FEMALE. Length 1.0–1.1 mm. Antenna dark brown except scape white. Frons metallic dark purple, golden-green along eyes. Vertex, mesoscutum, scutellum and propodeum golden-green. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline. Petiole golden-green. Gaster weak golden-green.

Antenna as in Fig. 82. Frons and vertex smooth and shiny (Figs 28, 29), frons almost flat; tentorial pits distinct (Fig. 28); vertex with two humps, one behind each posterior ocellus.

Mesonotum with a more or less round fovea medially between mesoscutum and scutellum (Fig. 30). Mesoscutum with weak reticulation, the meshes transverse, anteriorly on midlobe, and posterior of midlobe and sidelobes smooth and shiny (Fig. 30). Scutellum with anterior ½ smooth and shiny except for weak elongate striae, and posterior ½ with strong reticulation (Fig. 30). Dorsellum very short, almost hidden under scutellum with only very posterior parts visible in dorsal view (Fig. 30). Propodeum smooth and shiny between plicae (Fig. 31).

Petiole 1.0–1.5X as long as wide, with transverse carinae and shiny (Fig. 31). Gaster ovate with first tergite covering about 1/3 length.

MALE. Unknown.

**Type material.** **Holotype** female (BMNH) labelled "Costa Rica, Guanacaste, Santa Rosa National Park, Hacienda 10, 2–23.iii.1986, D.H. Janzen & I.D. Gauld". **Paratypes.** 8♀ on cards. COSTA RICA. **Alajuela:** Parque Nacional Arenal, 600 m, 10°28'N 84°45'W, 21–28.ii.2005, C. Hansson" (1♀, CH); **Guanacaste:** with same label data as holotype (2♀, CNC, INBio); from same locality as holotype but collected 8.ii–2.iii.1986 (1♀, USNM), and 23.iii–12.iv.1986 (1♀, BMNH), and 4–25.iv.1987 (1♀, CH); Bosque Nacional Diria, Retallano, alrededor Torre Control de Incendio, 600–700 m, 14.viii–18.ix.2001, LN 238550/358650, I. Jiménez (1♀, INBio); **Heredia:** Santo Domingo, INBio-Parque, 11–25.ii.2006, J.S. Noyes" (1♀, BMNH).

**Etymology.** Named after the humps on the vertex, from the Latin *gibbus* = humped.

**Distribution.** Costa Rica.

### *Cornugon leios* sp. nov.

(Figs 33–37, 55, 83, 84)

**Diagnosis.** Vertex with a complete median groove and with a groove delimiting posterior part of ocellar triangle (Fig. 35); scutellum with a deep and distinct median groove in anterior 2/3 (Fig. 36); propodeum with a complete median carina (Fig. 37); hind coxa conspicuously hairy on posterior surface; petiole 2X as long as wide and reticulate with small meshes; first gastral tergite shiny and large, covering 2/3 the length of gaster.

Similar to *C. petiolatum* and *C. unicornis*, but differing from the former in having a shorter petiole and from the latter in lacking a horn on the upper-median frons.

**Description.** FEMALE. Length 1.2–1.4 mm. Antenna dark brown except scape usually white (specimen from Altamira with basal 2/3 dark brown). Frons metallic dark purple. Vertex metallic bluish-purple or bluish-green. Mesoscutum metallic bluish-purple or bluish-green. Scutellum with anterior 2/3 metallic bluish-purple or bluish-green, posterior 1/3 metallic dark purple. Propodeum metallic bluish-green. Coxae dark and metallic; femora, tibiae and tarsi white (specimen from Altamira with femora predominantly dark brown). Wings hyaline. Petiole metallic dark purple. Gaster with first tergite metallic bluish-purple, remaining tergites metallic purple.

Antenna as in Fig. 83. Frons smooth and shiny (Figs 33, 34); antennal scrobes uniting below frontal suture; frontal suture incomplete, terminating at the distance equal to one ocellus from each eye; tentorial pits missing (Fig. 33). Vertex smooth and shiny (Fig. 35), medially with a groove between occipital margin and anterior ocellus.

Mesonotum with a more or less round fovea medially between mesoscutum and scutellum (Fig. 36). Mesoscutum smooth and shiny (Fig. 36) except midlobe with strong pitlike reticulation along anterior margin. Scutellum with anterior 2/3 smooth and shiny except for distinct median groove (Fig. 36), posterior 1/3 with raised, strong reticulation. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 36). Propodeum with a complete, strong median carina, smooth and shiny between plicae (Fig. 37).

Petiole 2X as long as wide and reticulate with small meshes, hence dull (Fig. 37). Gaster ovate with first gastral tergite shiny and large, covering 2/3 length.

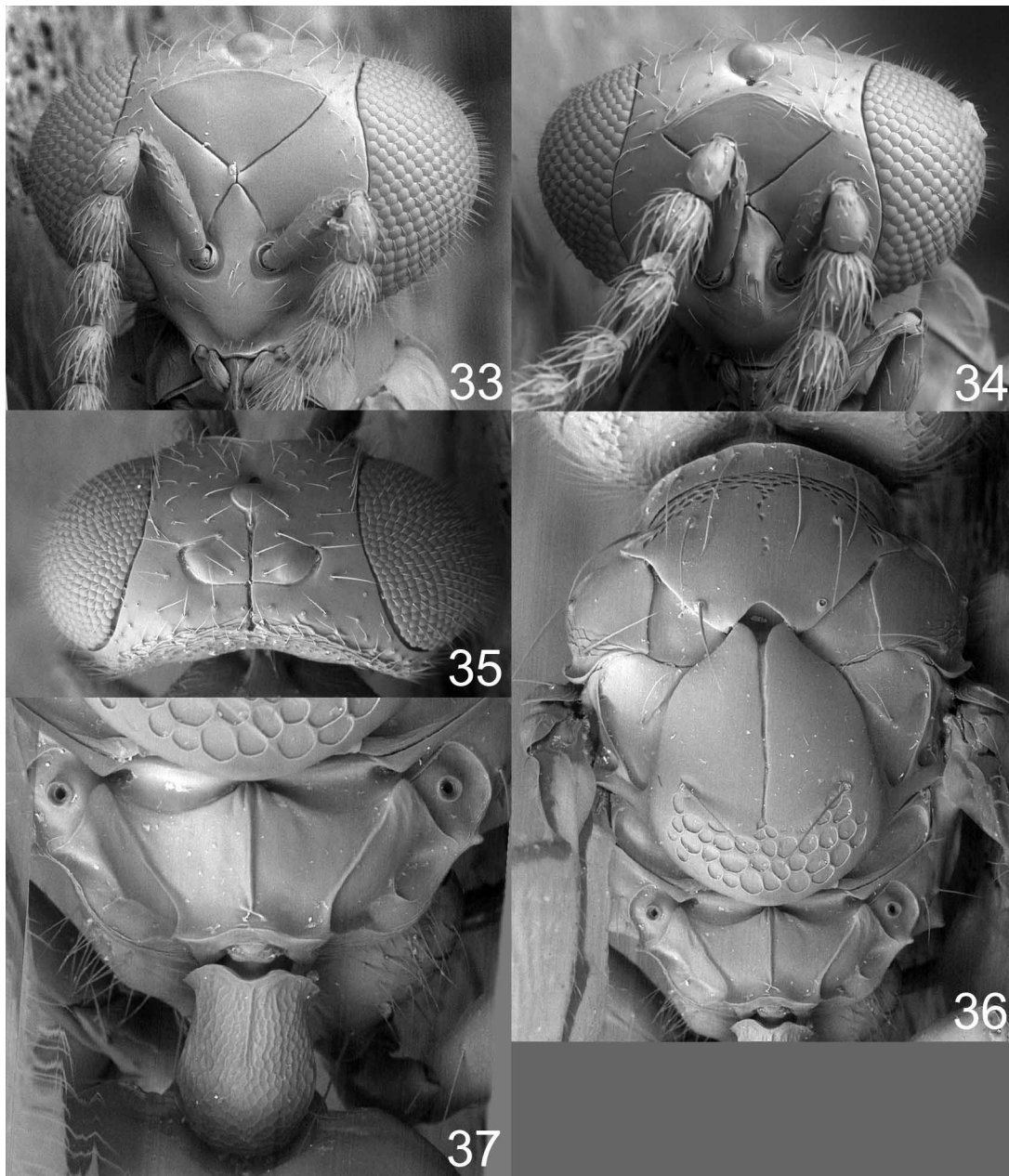
MALE. Length 1.1 mm. Colour as in female. Antenna as in Fig. 84. Structure otherwise as in female.

**Type material.** **Holotype** female (INBio) labelled "Costa Rica, Guanacaste, Parque Nacional Diria, Retallano,

alred. Torre Control de Incendio, 600–700 m, LN 238550/358650, 16.xii.2000–16.i.2001, I. Jiménez, #66659".  
**Paratypes.** 3♀ 1♂ on cards. COSTA RICA. **Guanacaste:** with same label data as holotype (1♀, BMNH); Baga-  
ces, Parque Nacional Palo Verde, Sector Palo Verde, Extremo E. Campo Aterrizaje, 10 m, LN 388400/259050,  
10.i–9.ii.2001, I. Jiménez (1♂, INBio); **Puntarenas:** San Vito, Las Cruces, Wilson Botanical Garden, 1000–1300  
m, 8°47'N 82°58'W, 7–19.ii.2007, C. Hansson (1♀, BMNH); Estacion Altamira, Sendero Los Gigantes, 9°02'N  
83°00'W, 1460 m, 13.iii–13.iv.2001, D. Rubí, #62126 (1♀, INBio).

**Etymology.** Name referring to the predominantly smooth frons, vertex and thoracic dorsum, from the Greek  
*leios* = smooth.

**Distribution.** Costa Rica.



**FIGURES 33–37.** *Cornugon leios* sp. nov. 33. Head frontal, female. 34. Head frontal, male. 35. Vertex, female. 36. Mesosoma dorsal, female. 37. Propodeum dorsal, female.

***Cornugon petiolatum* sp. nov.**

(Figs 38–41, 88)

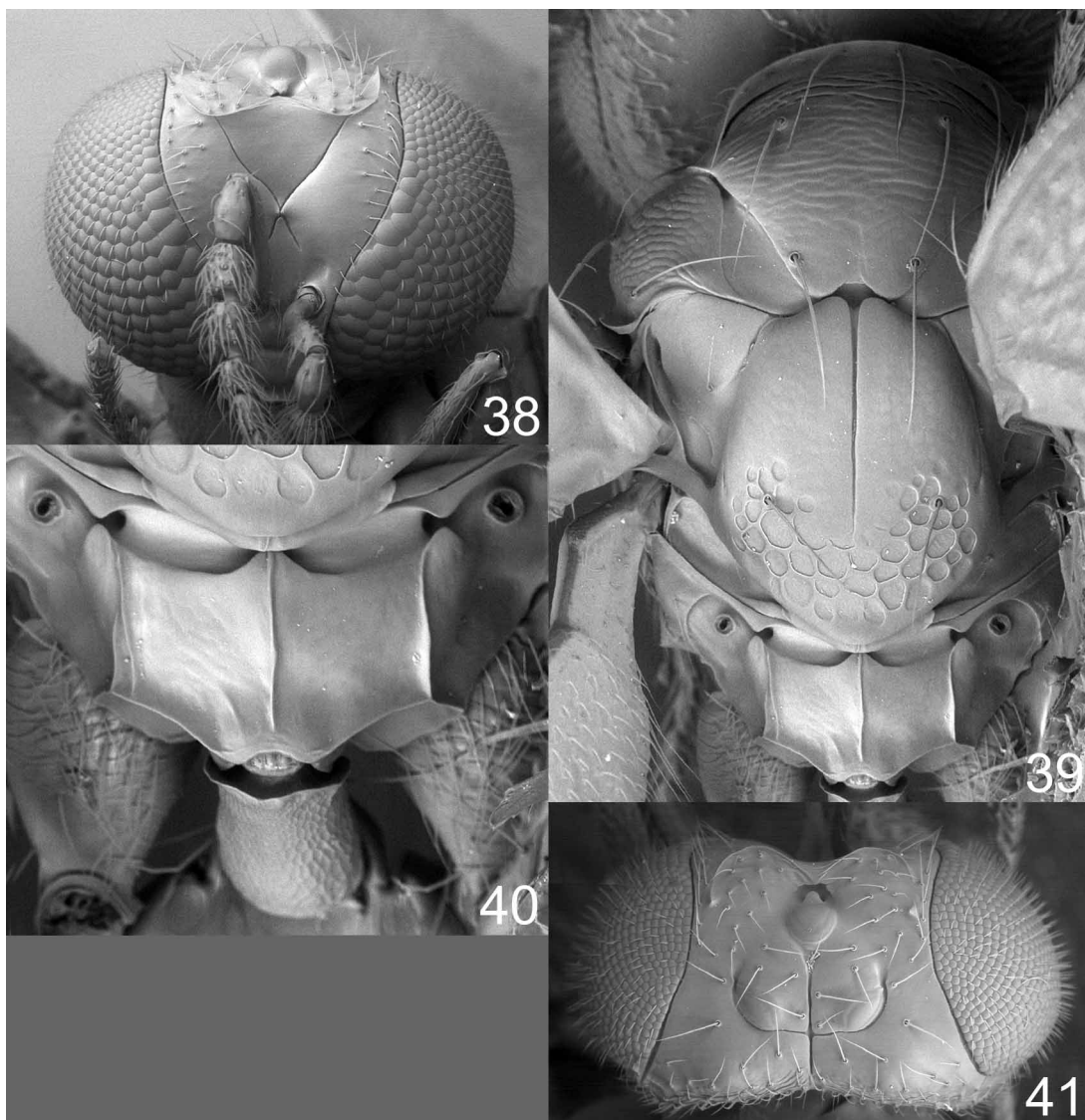


**Diagnosis.** Vertex with two humps, one behind each posterior ocellus, with a complete median groove and with a groove delimiting posterior part of ocellar triangle (Fig. 41); scutellum with a deep and distinct median groove extending from anterior margin along  $\frac{3}{4}$  of length (Fig. 39); hind coxa conspicuously hairy on posterior surface; propodeum with a complete and strong median carina (Fig. 40); petiole about 3.5X as long as wide and reticulate with small meshes (Fig. 40); first gastral tergite shiny and large, covering  $\frac{2}{3}$  length of gaster.

Similar to *C. leios* and *C. unicornis*, but differing from both in having a very long petiole, and from the latter also in not having a horn on the upper-median frons.

**Description.** FEMALE. Length 1.4 mm. Antenna dark brown except scape white. Frons metallic dark purple, golden-green along eyes. Vertex metallic greenish-blue. Mesoscutum golden-green anteriorly, metallic greenish-blue posteriorly. Scutellum metallic greenish-blue with metallic purple tinges posteriorly. Propodeum golden-green. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline. Petiole metallic purple. Gaster weak metallic greenish-blue.

Antenna as in Fig. 88. Frons and vertex smooth and shiny (Figs 38, 41), frons concave; frontal suture reaching eyes at level of anterior ocellus; tentorial pits missing; vertex with two humps, one behind each ocellus.



**FIGURES 38–41.** *Cornugon petiolatum* sp. nov., female. 38. Head frontal. 39. Mesosoma dorsal. 40. Propodeum dorsal. 41. Vertex.

Mesonotum with a more or less round fovea medially between mesoscutum and scutellum (Fig. 39). Midlobe of mesoscutum with weak reticulation, the meshes transverse, and sidelobes with engraved transverse reticulation

(Fig. 39). Scutellum with anterior 1/2 smooth and shiny and posterior 1/2 with raised, strong reticulation (Fig. 39), but with a deep, distinct median groove extending from anterior margin along 3/4 length. Dorsellum short, with posterior parts visible in dorsal view (Fig. 39). Propodeum with a complete and strong median carina (Fig. 40), smooth and shiny between plicae.

Petiole about 3.5X as long as wide and reticulate with small meshes, hence dull (Fig. 40). Gaster ovate with first tergite shiny and large, covering 2/3 length.

MALE. Unknown.

**Type material.** **Holotype** female (LUZM) labelled "Honduras, Cortez, Parque Nacional San Cusuco, 5 km north of Buenos Aires, 15°29'N 88°13'W, 15.ix.1995, R. Cave, malaise trap in oak/pine cloud forest".

**Etymology.** Name referring to elongate petiole.

**Distribution.** Honduras.

### ***Cornugon reticulatum* sp. nov.**

(Figs 42–47, 56, 86, 87)

**Diagnosis.** Vertex anteriorly and upper part of frons with raised, very strong reticulation (Figs 42–44); vertex with a weak median groove (Fig. 44); male flagellomeres strongly pedunculate (Fig. 86); scutellum without median groove (Fig. 45); propodeum without median carina (Fig. 47); petiole 1.5X as long as wide, widest anteriorly and narrowing posteriorly (as in Fig. 22), with transverse carinae and shiny; first gastral tergite covering about 1/3 of gaster.

Similar to *C. gibberum*, but differing in having upper part of frons and vertex strongly reticulate.

**Description.** FEMALE. Length 1.1–1.5 mm. Antenna black with metallic green tinges except scape white. Frons black with metallic green tinges. Vertex metallic bluish-green. Mesoscutum metallic bluish-green. Scutellum with anterior 1/2 (striate part) metallic bluish-green, posterior 1/2 (reticulate part) golden-green. Propodeum metallic bluish-green. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline. Petiole golden-green. Gaster metallic bluish-purple or metallic bluish-green.

Antenna as in Fig. 87. Frons smooth and shiny except with raised, very strong reticulation above frontal speculum (Fig. 42); antennal scrobes uniting below frontal suture; frontal suture incomplete, terminating at a distance equal to 1/3 diameter of anterior ocellus from each eye margin; tentorial pits distinct (Fig. 42). Vertex with raised, very strong reticulation inside, lateral to, and in front of ocellar triangle (Fig. 44), but smooth and shiny behind ocellar triangle; medially with a groove extending from occipital margin to ocellar triangle.

Mesonotum with a triangular fovea medially between mesoscutum and scutellum (Fig. 45). Mesoscutum with raised, weak reticulation, the meshes transverse (Fig. 45). Scutellum with strong longitudinal striae to smooth medially in anterior 1/2, and with raised, strong reticulation in posterior 1/2 (Fig. 45). Dorsellum mostly hidden under scutellum in dorsal view, with just lateral parts extending out from under scutellum (Fig. 45). Propodeum smooth and shiny between plicae (Fig. 47).

Petiole 1.4X as long as wide, with transverse carinae and shiny (Fig. 47). Gaster ovate with first gastral tergite covering about 1/3 length.

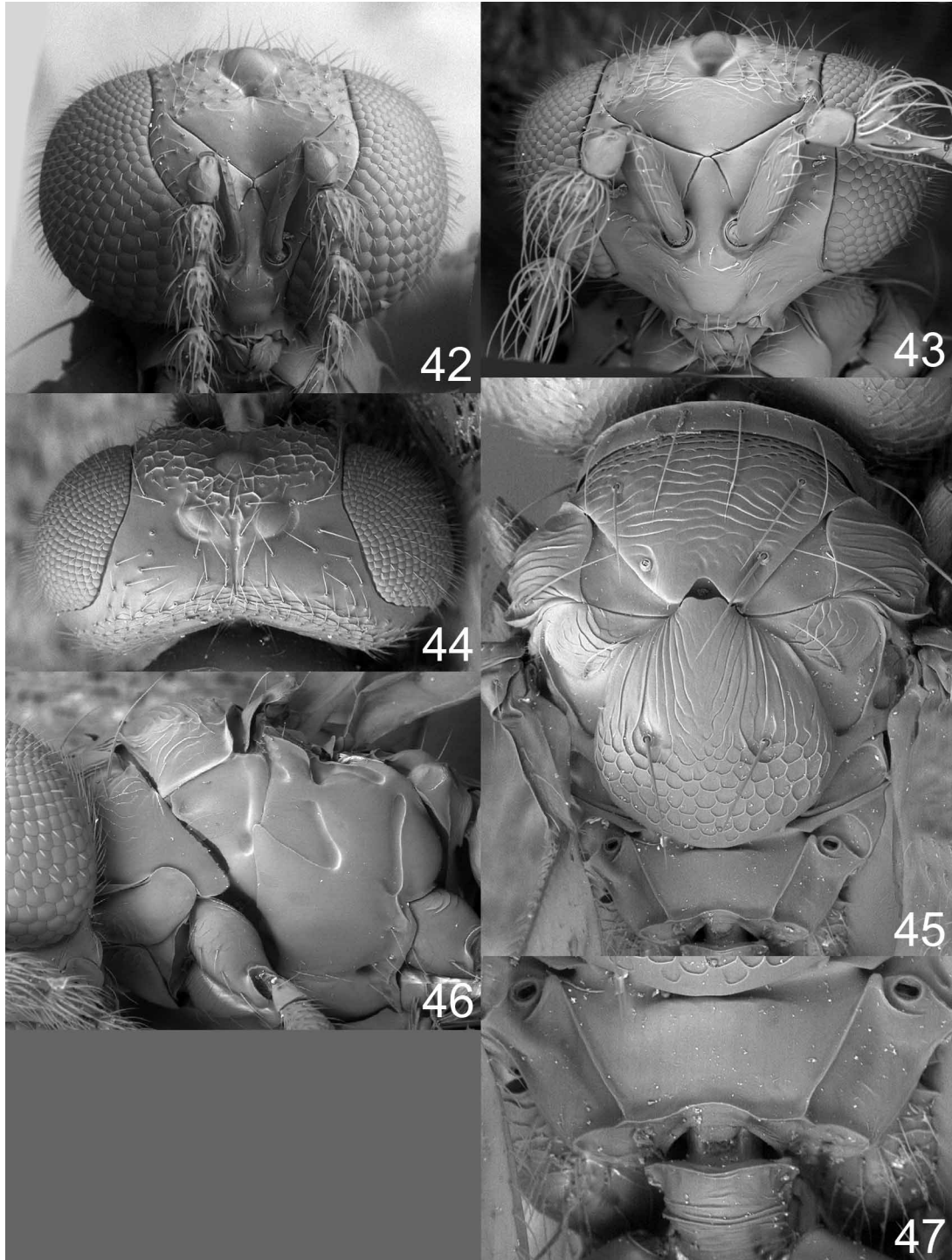
MALE. Length 1.3–1.5 mm. Scape pale brown to white. Smooth part of vertex golden or golden-green. Mesoscutum golden or metallic dark purple. Scutellum with anterior 1/2 golden, golden-green or metallic dark purple. Femora and hind tibia dark brown or white. Gaster dark brown with metallic tinges, with a large white spot in anteromedian 1/2. Antenna as in Fig. 86. Structure otherwise similar to female except eyes smaller and malar space larger, and antennal scrobes uniting on frontal suture (Fig. 43).

**Type material.** **Holotype** female (BMNH) labelled "Costa Rica, Heredia, Santo Domingo, INBio-Parque, 11–25.ii.2006, J.S. Noyes". **Paratypes.** 9♀ 4♂ on cards. COSTA RICA. **Alajuela:** A.C.A., San Carlos, Parque Nacional Arenal, Sendero Pilón, 600 m, 10°27'N 84°43'W, 16.viii–8.ix.1999, G. Carballo (1♀, INBio), and 26.ii.2003 (1♀, BMNH); **Cartago:** Paraiso, Parque Nacional Tapanti-Macizo de la Muerte, Torre cerca de Estación, 1200 m, LN 560050/193800, 15.ix–19.x.200, D. Rubí (1♂, BMNH); **Guanacaste:** Estación Maritza, 10°58'N 85°29'W, 700 m, 23.ii.2003, J.S. Noyes (1♀, BMNH); Zona Protectora Nosara, Sendero Las Qrquideas, 500 m, LN 221650/382750, 7–8.ii.2002, I. Jiménez (1♀, CH); Zona Protectora Nosara, Sendero La Ceiba, 600 m, LN 221100/382950, 20.iii.2002, I. Jiménez (1♂, INBio); **Heredia:** with same label data as holotype (2♂, BMNH, INBio); 3 km S

Puerto Viejo, OTS – La Selva, 100 m, 30.iii. 2001, M. Gates (1♀, USNM); **Puntarenas**: Golfito, Estación Agujas, 300 m, LS 526550/2767501, 1–14.x.2000, J. Azofeifa (1♀, INBio); Reserva Abs. Cabo Blanco, 09°35'N 85°06'W, 30 m, 16–17.ii.2009, J.S. Noyes (2♀, BMNH, CH). ECUADOR. Manta, Monte Cristi, 400 m, 6.ii.1983, L. Huggert (1♀, LUZM).

**Etymology.** Name referring to the strongly reticulate upper part of frons and vertex.

**Distribution.** Costa Rica, Ecuador.



**FIGURES 42–47.** *Cornugon reticulatum* sp. nov. 42. Head frontal, female. 43. Head frontal, male. 44. Vertex, female. 45. Mesosoma dorsal, female. 46. Mesosoma lateral, female. 47. Propodeum dorsal, female.

***Cornugon unicornis* sp. nov.**

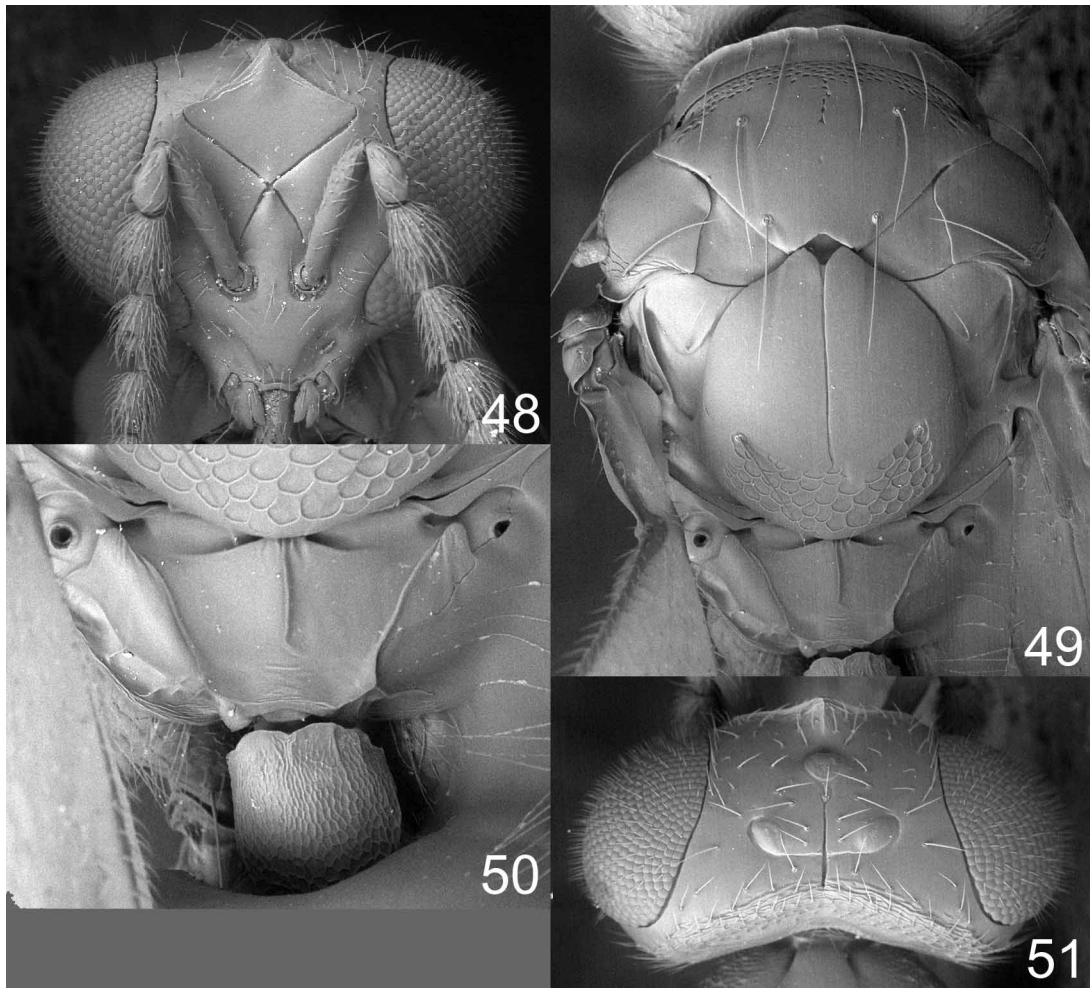
(Figs 48–51, 57, 85)

**Diagnosis.** Frons with upper-median part with a single pointed “horn” (Fig. 48); vertex with a complete median groove and with a groove delimiting posterior part of ocellar triangle (Fig. 51); scutellum with a deep and distinct median groove in anterior 2/3 (Fig. 49); propodeum with a median carina in anterior 1/2 (Fig. 50); hind coxa conspicuously hairy on posterior surface; petiole 1.4X as long as wide and reticulate with small meshes, hence dull (Fig. 50); first gastral tergite shiny and large, covering 2/3 length of gaster.

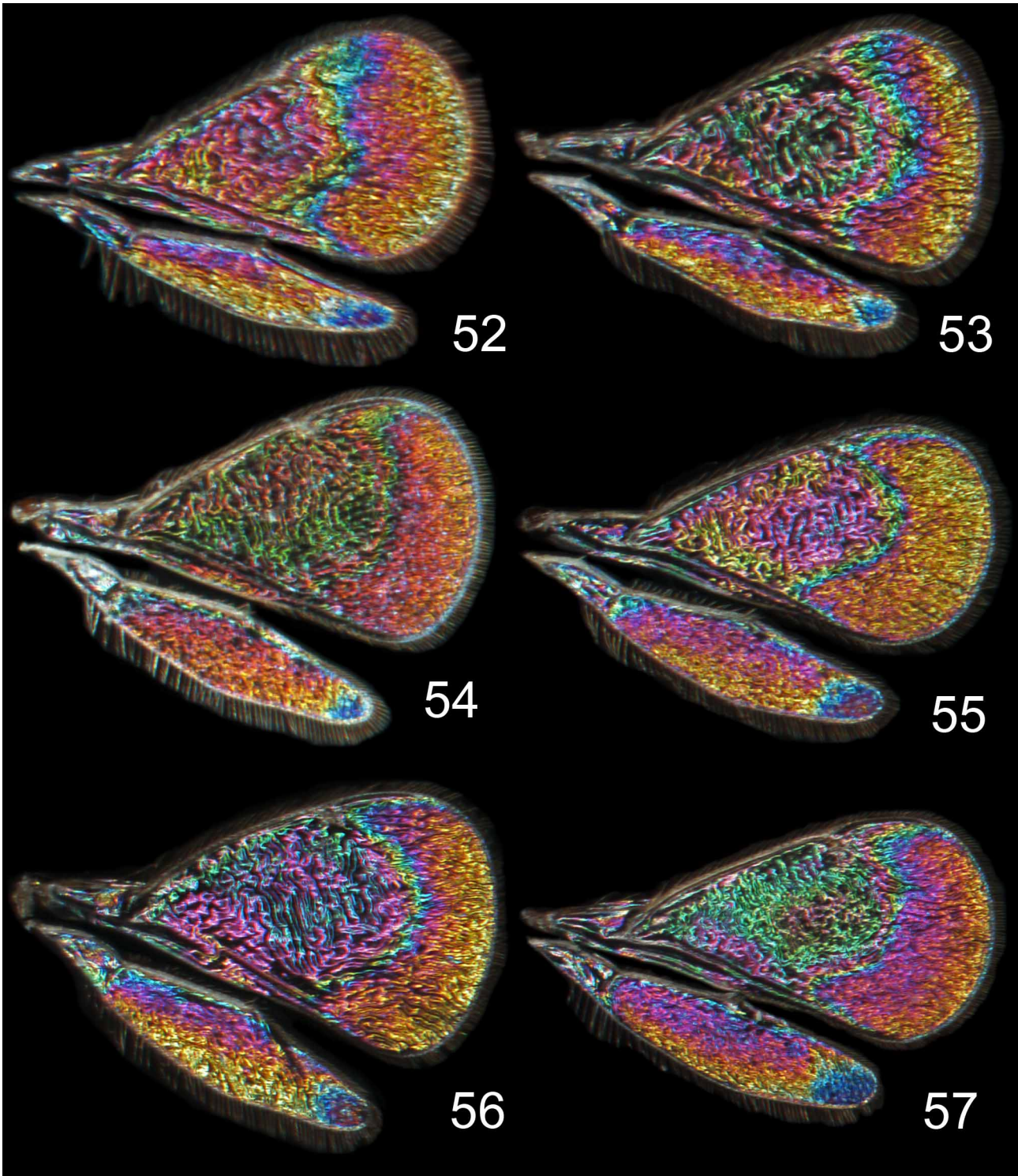
Similar to *C. leios* and *C. petiolatum*, but differing from both in having a single horn medially on the upper part of frons.

**Description.** FEMALE. Length 1.4–1.6 mm. Scape white, remaining antenna dark brown. Frons metallic dark purple. Vertex metallic greenish-blue. Mesoscutum metallic greenish-blue. Scutellum with smooth anterior part metallic greenish-blue, reticulate posterior part metallic dark purple. Propodeum metallic greenish-blue. Coxae dark and metallic; femora, tibiae and tarsi white. Wings hyaline. Petiole metallic dark purple. Gaster with first tergite metallic greenish-blue in anterior 3/4, and posterior 1/4 and remaining tergites metallic dark purple.

Antenna as in Fig. 85. Frons smooth and shiny (Fig. 48); upper-median part with a pointed “horn”; lower part of frons close to mouth opening drawn out, and with mandibles pointing downwards; frontal suture incomplete, terminating at a distance equal to diameter of torulus from each eye margin; antennal scrobes uniting on frontal suture; tentorial pits missing (Fig. 48). Vertex smooth and shiny (Fig. 51), with a complete median groove between occipital margin and anterior ocellus.

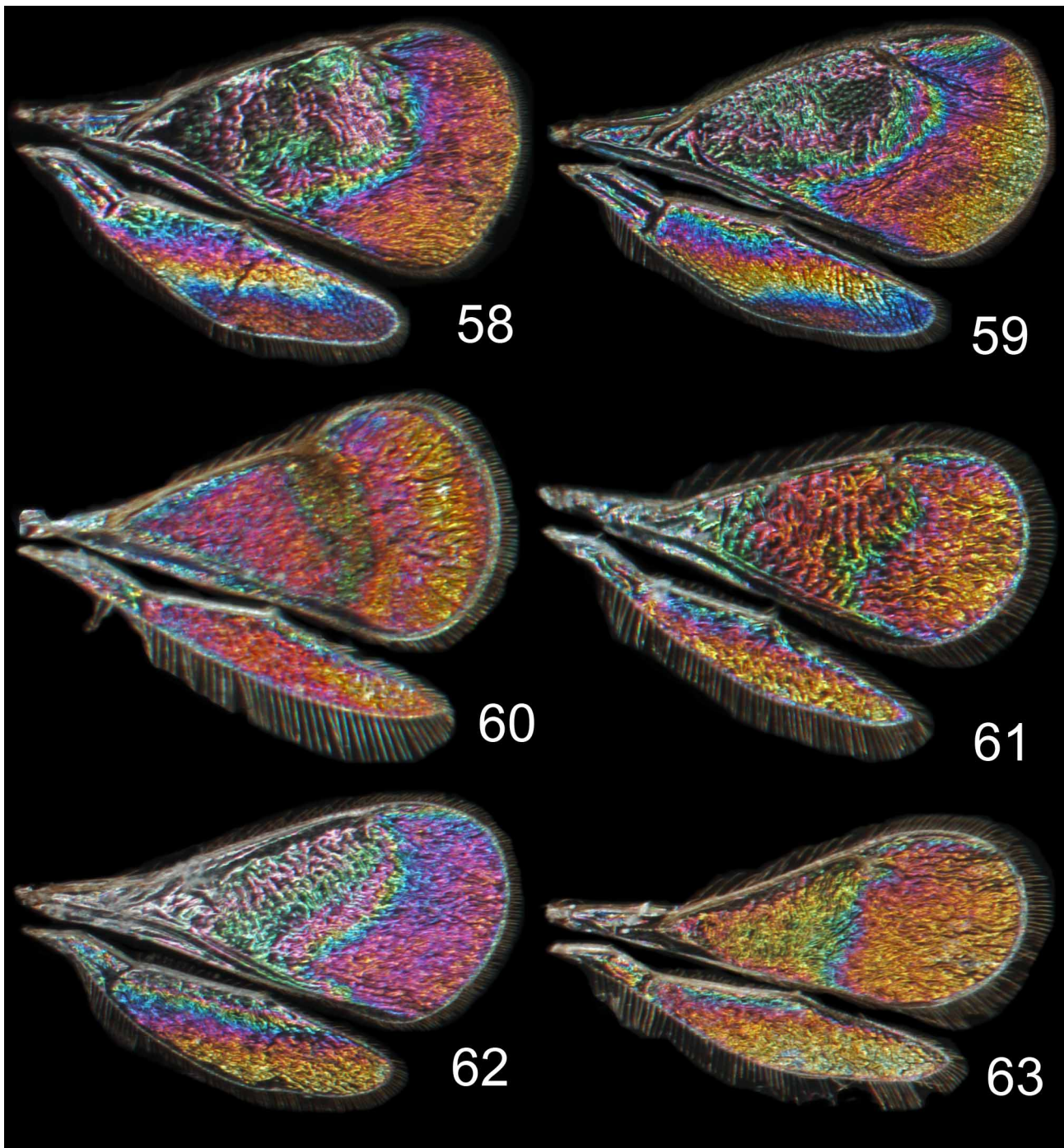


**FIGURES 48–51.** *Cornugon unicornis* sp. nov., female. 48. Head frontal. 49. Mesosoma dorsal. 50. Propodeum dorsal. 51. Vertex.



**FIGURES 52–57.** *Cornugon* spp. nov. females, wing interference patterns (WIPs) of right pair of wings. 52. *C. bicornis*, length of forewing 0.7 mm. 53. *C. dicerus*, length of forewing 0.8 mm. 54. *C. gibberum*, length of forewing 0.9 mm. 55. *C. leios*, length of forewing 1.0 mm. 56. *C. reticulatum*, length of forewing 1.0 mm. 57. *C. unicornis*, length of forewing 1.2 mm.

Mesonotum with a more or less quadratic fovea medially between mesoscutum and scutellum (Fig. 49). Mesoscutum smooth and shiny except for strong pit-like reticulation on very anterior part close to pronotum (Fig. 49). Scutellum with anterior 2/3 smooth and shiny with distinct median groove, posterior 1/3 with raised, strong reticulation (Fig. 49); anteromedian part protruding into posteromedian mesoscutum and with a quadrangular pit in front of protrusion. Dorsellum hidden under scutellum, not visible in dorsal view (Fig. 49). Propodeum smooth and shiny, with a median carina in anterior 1/2 and with complete plicae (Fig. 50).



**FIGURES 58–63.** Wing interference patterns (WIPs) of right pair of wings. 58. *Achrysocharoides atys* (Walker) female, length of forewing 1.1 mm. 59. *Chrysocharis pubicornis* (Zetterstedt) female, length of forewing 1.5 mm. 60. *Closterocerus cinctipennis* Ashmead female, length of forewing 0.8 mm. 61. *Emersonella niveipes* Girault female, length of forewing 1.0 mm. 62. *Horismenus cyaneoviridis* Girault female, length of forewing 1.4 mm. 63. *Omphale erginnus* (Walker) female, length of forewing 1.3 mm.

Petiole about 1.4X as long as wide and reticulate with small meshes, hence dull (Fig. 50). Gaster ovate with first gastral tergite shiny and large, covering 2/3 length.

MALE. Unknown.

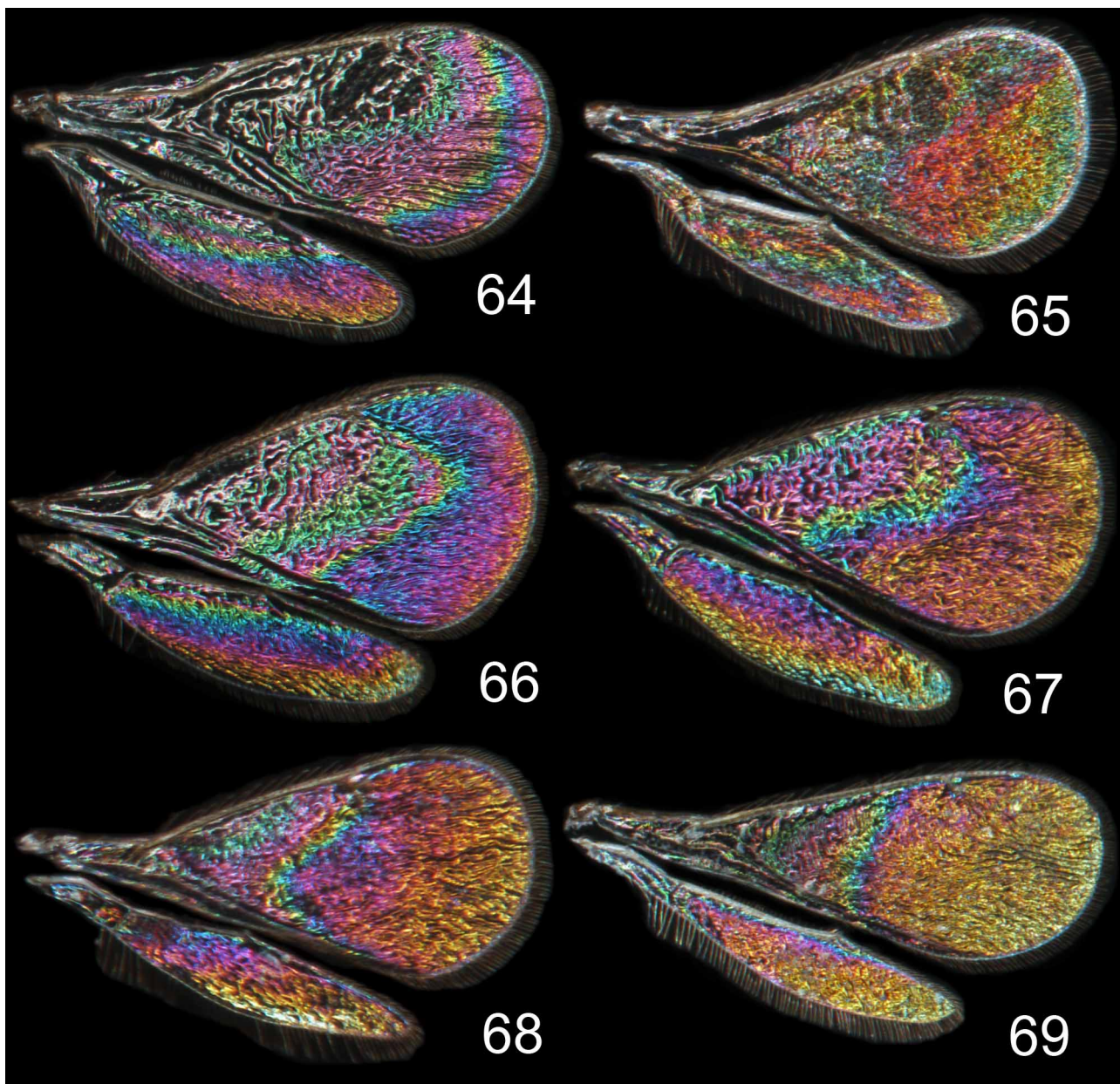
**Type material.** **Holotype** female (INBio) labelled "Costa Rica, Heredia, Santo Domingo, INBio-Parque, iii.2002, J.S. Noyes & J.A. Azofeifa". **Paratypes.** 2♀ on cards. COSTA RICA. **Heredia:** with same label data as holotype (BMNH, MIUCR).

**Etymology.** Named referring to the single hornlike protrusion on median frons, from the Latin *unus* = one, and *cornu* = horn.

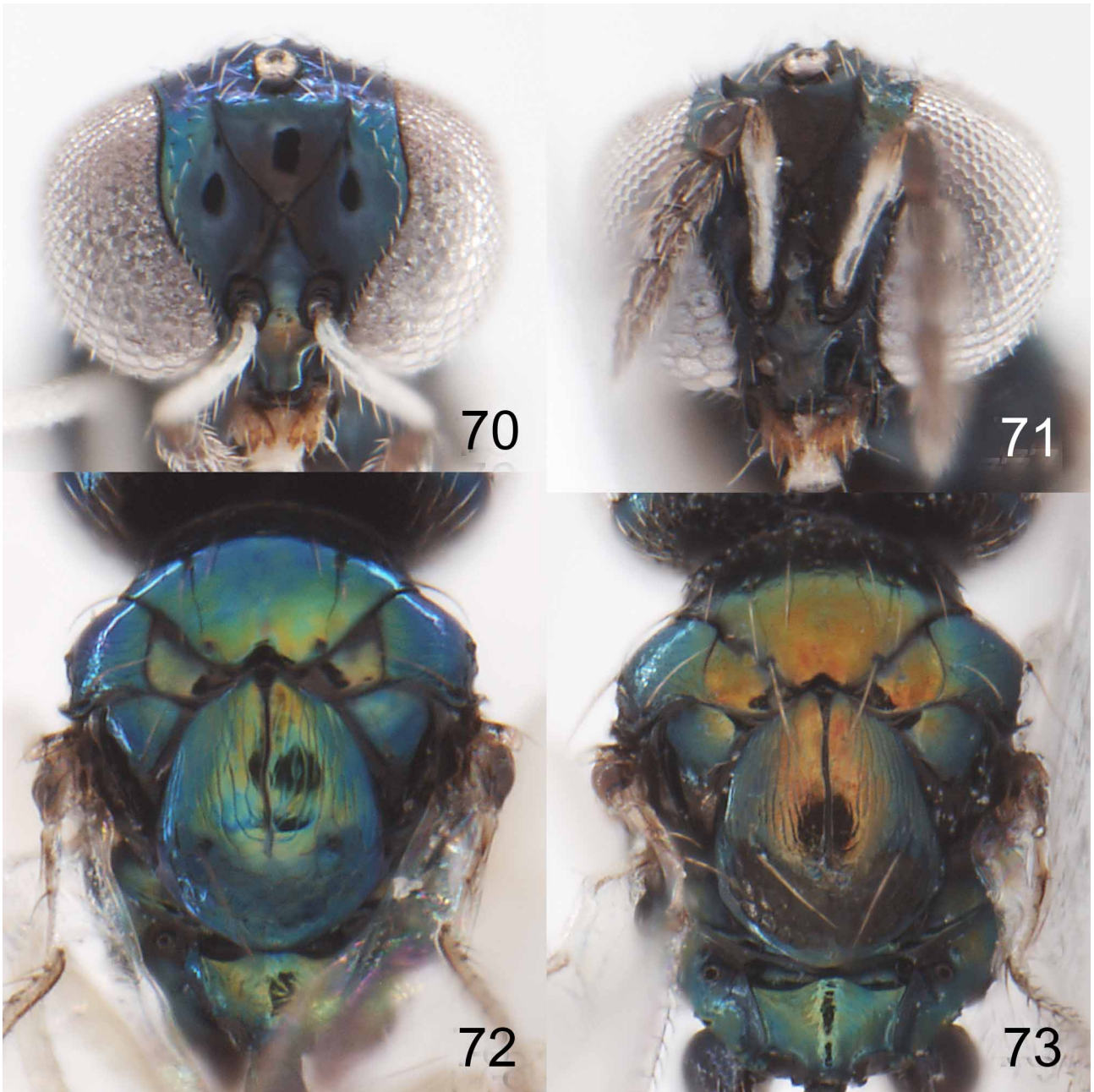
**Distribution.** Costa Rica.

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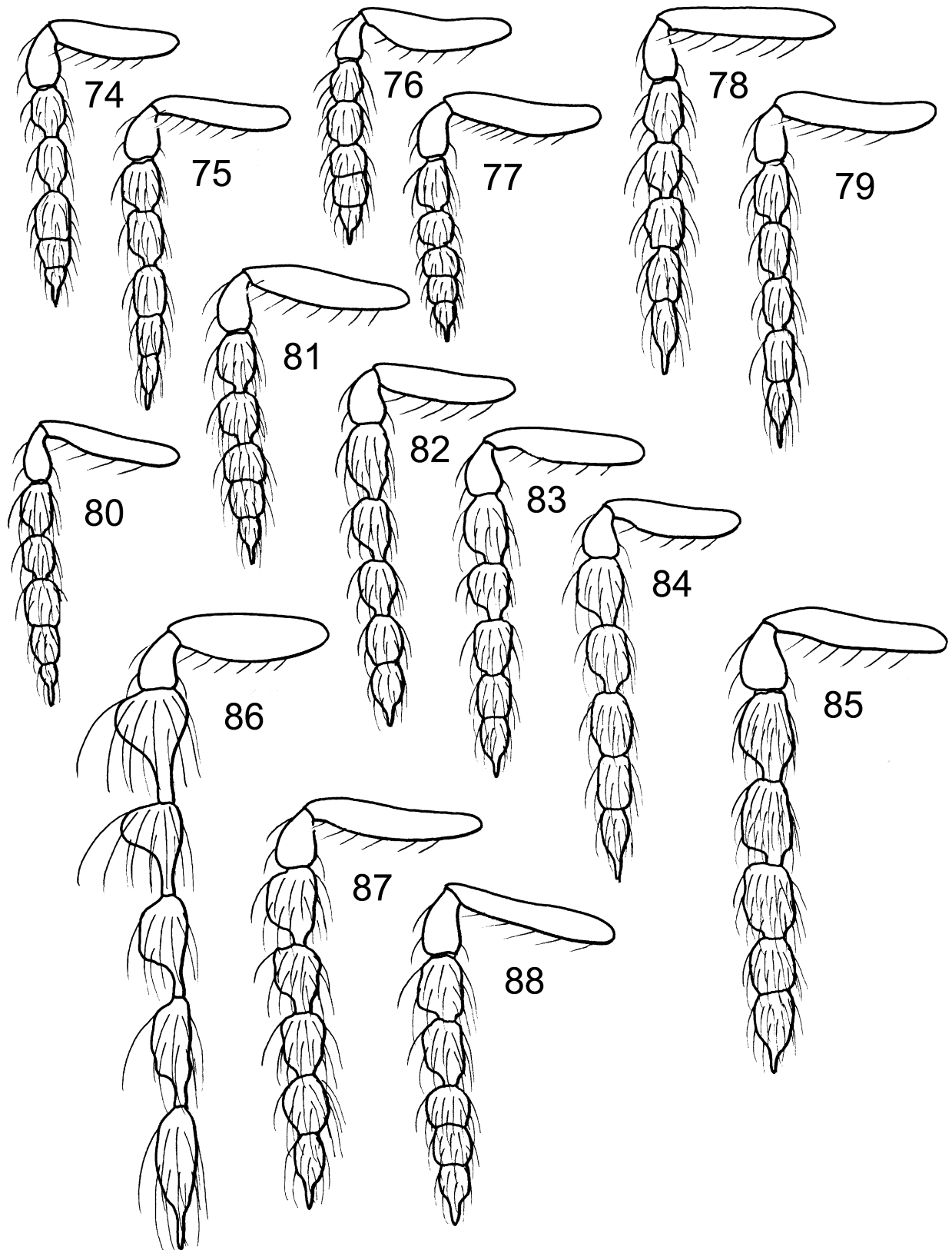


**FIGURES 64–69.** Wing interference patterns (WIPs) of right pair of wings. 64. *Paracrias laticeps* Ashmead female, length of forewing 1.6 mm. 65. *Pediobomyia brevicaulis* Hansson female, length of forewing 1.4 mm. 66. *Pediobius crassicornis* (Thomson) female, length of forewing 1.3 mm. 67. *Pediobius metallicus* (Nees) female, length of forewing 1.3 mm. 68. *Proacrias* sp. female, length of forewing 1.0 mm. 69. *Tropicharis cecivora* Hansson female, length of forewing 1.6 mm.

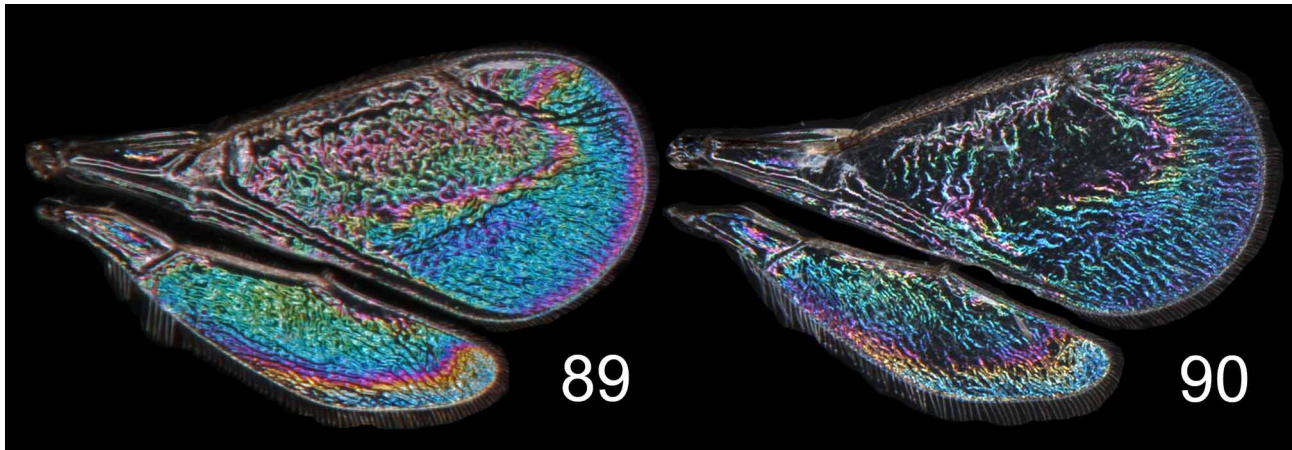


**FIGURES 70–73.** *Cornugon diceros* sp.nov. 70. Head frontal, female. 71. Head frontal, male. 72. Thoracic dorsum, female. 73. Thoracic dorsum, male.





**FIGURES 74–88.** *Cornugon* spp. nov., antenna lateral. 74. *C. albicoxa*, female. 75. *C. anais*, female. 76. *C. bicornis*, female. 77. *C. bicornis*, male. 78. *C. diabolos*, female. 79. *C. diabolos*, male. 80. *C. diceros*, female. 81. *C. diceros*, male. 82. *C. gibberum*, female. 83. *C. leios*, female. 84. *C. leios*, male. 85. *C. unicornis*, female. 86. *C. reticulatum*, male. 87. *C. reticulatum*, female. 88. *C. petiolatum*, female.



**FIGURES 89–90.** Wing interference patterns (WIPs) of right pair of wings of *Pediobius saulius* (Walker) female, length of forewing 1.4 mm. 89. Photo taken with microscope Nikon SMZ 1000. 90. Photo taken with microscope Nikon SMZ 1500.

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