



***Apleurotropis* Girault (Hymenoptera: Eulophidae) new to tropical America, including six new species and biological records**

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Abstract

The genus *Apleurotropis* Girault is here reported for the first time from tropical America. The genus is diagnosed and compared to *Achrysocharoides* Girault with which it shares important characters. Changes are suggested in two existing keys to Neotropical/Nearctic genera of Eulophidae to include *Apleurotropis*. Included in *Apleurotropis* are also six newly described species: *A. albicaulis*, *A. albiscapus*, *A. anemia*, *A. assis*, *A. ficaria*, and *A. strix*, **spp. nov.**, all of which are included in an identification key, diagnosed, described and illustrated. Four of the species have host records: three are parasitoids on leafminers and the fourth species is associated with galls. These new biological records are in accordance with the known host spectrum for this genus.

Key words: neotropical, parasitoid, leafminers, galls, gallmakers, identification key, Entedoninae

Introduction

The genus *Apleurotropis* Girault is mainly a tropical group previously known only from the Old World. Originally described from Australian species, the morphological concept and distribution of *Apleurotropis* have been expanded to include additional species from Australia (Girault 1915, 1934, 1935, 1937), India (Surekha & Narendran 1992), Japan (Kamijo 1977, 1990), Madagascar (Risbec 1952), New Zealand (Bouček 1988), Papua New Guinea (Girault 1938; Kerrich 1974) and Tanzania (Kerrich 1969). Prior to this publication 21 species of *Apleurotropis* were known, with the majority of species (13) from Australia. Available biological information indicates that the species are mainly primary parasitoids on leafminers belonging to Coleoptera, Diptera, Hymenoptera and Lepidoptera, but some species are associated with galls (for host compilation see Noyes 2001).

Here six new species of *Apleurotropis* are described from several countries in tropical America, from Mexico to Brazil. These represent the first records of the genus from the Neotropical region. The new Neotropical species fit well into the morphological framework for *Apleurotropis* put forward by Bouček (1988) and Kamijo (1990) — see diagnosis below. Four of the six species have host records: three of the species have been reared from leafminers and one has been reared from a gallmaker. These records are in accordance with the host range for *Apleurotropis*.

Morphological abbreviations and acronyms

HE = height of eye; HW = height of forewing; LG = length of gaster; LM = length of marginal vein; LW = length of forewing, measured from base of marginal vein to apex of wing; MM = length of mesosoma; MS = malar space; OOL = distance between one posterior ocellus and eye; PM = length of postmarginal vein; POL = distance between posterior ocelli; POO = distance between posterior ocelli and occipital margin; ST =

length of stigmal vein; WH = width of head; WM = width of mouth; WT = width of thorax. For illustrations of the morphological terms see www.neotropicaeulophidae.com.

Collection acronyms used are: BMNH = Natural History Museum, London, England; CH = collection of Christer Hansson; INBio = Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica; CNC = Canadian National Collection of Insects, Ottawa, Canada; IAvH = Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Colombia; LUZM = Lund University Zoological Museum, Lund, Sweden; MIUCR = Museo de Insectos, Universidad de Costa Rica, San Pedro, Costa Rica; MZSP = Museu de Zoologia da Universidade de São Paulo, Brazil; TAMU = Texas A & M University, College Station, U.S.A.; USNM = United States National Museum of Natural History, Washington, D.C., U.S.A.

The ratios, summarized in Table 1, are 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 “Morphological abbreviations and acronyms” above.

	<i>A. albicaulis</i>	<i>A. albiscapus</i>	<i>A. anemia</i>	<i>A. assis</i>	<i>A. ficaria</i>	<i>A. strix</i>
HE/MS/WM female	11.9/1.0/5.1	5.1/1.0/2.7	6.9/1.0/3.7	11.0/1.0/5.0	6.7/1.0/3.8	4.8/1.0/2.1
HE/MS/WM male	4.7/1.0/2.3	4.0/1.0/2.0	4.0/1.0/2.2	2.9/1.0/1.3	4.1/1.0/2.2	—
POL/OOL/POO female	1.6/1.0/1.3	1.4/1.0/1.1	2.0/1.0/1.5	2.2/1.0/1.3	1.9/1.0/1.4	2.0/1.0/1.6
WH/WT female	1.2	1.2	1.3	1.2	1.1	1.2
LW/LM/HW female	1.8/1.1/1.0	1.9/1.3/1.0	1.9/1.3/1.0	1.9/1.3/1.0	1.7/1.2/1.0	1.8/1.2/1.0
PM/ST female	2.4	2.9	3.7	3.4	4.0	3.3
MM/LG female	0.8	0.9	0.8–0.9	0.9	0.8	0.9–1.0
MM/LG male	1.0	0.8–0.9	1.1–1.3	1.0–1.2	1.0	—

Apleurotropis Girault

Apleurotropis Girault, 1913: 77–78. Type species: *Apleurotropis viridis* Girault, by original designation.

Apleurotropopseus Girault, 1913: 146. Type species: *Apleurotropopseus albipes* Girault, by original designation. Synonymized by Bouček, 1988: 711.

Epentedon Girault, 1915: 186. Type species: *Epentedon unnotipennis* Girault, by original designation. Synonymized by Bouček, 1988: 711.

Horismenella Girault, 1915: 189. Type species: *Horismenella clariviridis* Girault, by original designation. Synonymized by Bouček, 1988: 711.

Pleurotropomyia Girault, 1913: 145. Type species: *Pleurotropomyia grotiusi* Girault, by original designation. Synonymized by Bouček, 1988: 711.

Propleurotropis Girault, 1937: 1–2. Type species: *Propleurotropis minii* Girault, by original designation. Synonymized by Bouček, 1988: 711.

Diagnosis. Eyes with dense long hairs (e.g. Figs 7, 12); vertex with a pit or a short groove in front of anterior ocellus (e.g. Figs 4, 9); frons just above frontal suture raised to form a carina, V-shaped, straight or slightly down-curved laterally (e.g. Figs 2, 17, 22); pronotum with a transverse carina close to posterior margin (e.g. Figs 5, 10), laterally also with a complete longitudinal carina (Fig. 31); mesoscutum usually with a median groove in posterior 1/3–1/2 (e.g. Figs 5, 15); mesoscutum and scutellum with engraved and strong reticulation (e.g. Figs 10, 20); postmarginal vein long, 2.4–3.7X as long as stigmal vein; propodeum with complete and more or less parallel plicae and with a complete median carina (e.g. Figs 6, 11, 16).

Description. Flagellum with a two-segmented clava in both sexes; male flagellomeres with scattered setae; male scape enlarged, ventral sense area present along entire scape; sensilla ampullacea symmetric and short, present on all flagellomeres. Antenna with discoid anelli. Mandibles with two large teeth at apex and

with one small tooth above large teeth. Clypeus not delimited. Malar sulcus present. Upper frons just above frontal suture as a raised carina, straight or slightly down-curved laterally; antennal scrobes reach frontal suture separately. Occipital margin rounded; occiput without median groove or fold above foramen magnum.

Pronotum with a transverse carina close to posterior margin. Midlobe of mesoscutum with two pairs of setae; mesoscutum and scutellum with engraved reticulation; mesoscutum with a shallow median groove in posterior 1/3–1/2; notauli distinct in anterior 1/2, in posterior 1/2 present as weakly delimited notaular depressions that are usually smooth. Scutellum with or without lateral grooves in anterior 1/2–2/3; with one pair of setae. Transepimeral sulcus weakly curved. Dorsellum visible in dorsal view. Postmarginal vein 2.4–3.7X as long as stigmal vein. Propodeum smooth and shiny with complete median carina and parallel and complete plicae.

Petiole 0.5–2.0X as long as wide, smooth and shiny or with irregular carinae, with or without a spine medially to either side of the petiole, ventral surface smooth. The male genitalia are similar to the majority of Entedoninae, i.e. with two digital spines and with volsellar setae thin and narrow (see e.g. Hansson 1996).

Biology. Primary parasitoids on leaf-mining larvae of sawflies (Hymenoptera), Agromyzidae (Diptera), Hispinae (Coleoptera, Chrysomelidae), and various Lepidoptera groups (Bouček 1988). Hosts for the species described here are mainly from leaf-mining Lepidoptera, with one record from a leaf-mining Diptera and one from an unidentified gall (all **new records**): *Bucculatrix* sp. (Lepidoptera: Bucculatricidae) on *Forsteronia spicata* (Apocyanaceae); *Elachista* sp. (Lepidoptera: Elachistidae) on *Olyra latifolia* (Poaceae); *Marmara* sp. (Lepidoptera: Gracillariidae) on *Heliconia* sp. (Heliconiaceae); *Phyllocnistis* sp. (Lepidoptera: Gracillariidae) on *Trichilia havanensis* (Meliaceae); *Tischeria* spp. (Lepidoptera: Tischeriidae) on *Coussapoa villosa* (Moraceae) and *Gouania polygama* (Rhamnaceae); unidentified Elachistidae (Lepidoptera) mining leaves of *Bambusa* (= *Guadua*) *angustifolia* (Poaceae); unidentified lepidopteran leafminers on *Saurauia* sp. (Actinidiaceae), *Trichilia havanensis*, *Peperomia peltata* (Piperaceae), unidentified Asteraceae, Heliconiaceae and Melastomataceae; Agromyzidae indet. (Diptera) on *Tradescantia* sp. (Commelinaceae); from a leaf pustule gall on *Ficus hartwegii* (Moraceae).

Distribution. Australia, India, Japan, Madagascar, New Zealand, Papua New Guinea, Tanzania. Tropical America (all **new records**): Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Peru.

Remarks. *Apleurotropis* shares some characters with *Achrysocharoides* Girault: hairy eyes, frons just above frontal suture raised and forming a carina, lateral downsloping part of pronotum with a longitudinal carina. This latter character is somewhat different in the two genera, in *Achrysocharoides* it is incomplete, present only in posterior 1/2, whereas it is complete in *Apleurotropis*. The two latter characters are as far as is known present only in these two genera, hence indicating a possible relationship. These genera differ as follows. *Apleurotropis* has antennal scrobes in females joining frontal suture separately, mesoscutum and scutellum with engraved reticulation, postmarginal vein 2.4–3.7X as long as stigmal vein, propodeum with a distinct and strong median carina; *Achrysocharoides* with antennal scrobes in females joining below frontal suture, mesoscutum and scutellum with raised reticulation or partly smooth — sometimes with pits, postmarginal vein 0.5–1.5X (usually about 1X) as long as stigmal vein, and propodeum without strong median carina.

Identification. In the key to the Nearctic genera of Eulophidae by Schauff *et al.* (1997) *Apleurotropis* runs to couplet 119 where the genera *Entedon* and *Pediobius* are keyed out. *Apleurotropis* differs from both in having engraved reticulation on midlobe of mesoscutum and scutellum (mesoscutum and scutellum with raised reticulation in both *Entedon* and *Pediobius*), and in having a very long postmarginal vein (2.4–3.7X as long as stigmal vein), in *Entedon* and *Pediobius* the postmarginal vein is at most 1.7X as long as stigmal vein but usually these two veins are subequal in length. It differs from *Entedon* in having distinct propodeal plicae and from *Pediobius* in having medioposterior part of propodeum short and anterior part of petiole narrow — in *Pediobius* the medioposterior part of propodeum is extended backwards to varying degrees to form a nucha, and anterior part of petiole is wide and concave to embrace the extended medioposterior part of propodeum. Another option for identification is to use the multiple entry key to the Neotropical genera of Entedoninae on the website www.neotropicaleulophidae.com.

Key to Neotropical species of *Apleurotropis*

1. Petiole with dorsal part white (Fig. 33) 2
- Petiole with dorsal part dark and usually metallic (Fig. 32)..... 4
2. Female..... *A. albicaulis* **sp. nov.**
- Male 3
3. Scape white; setae on flagellomeres short and more dense (Fig. 39).....*A. albiscapus* **sp. nov.**
- Scape yellowish-brown; setae on flagellomeres long and more sparse (Fig. 37)..... *A. albicaulis* **sp. nov.**
4. Hind coxa white to yellowish-brown..... 5
- Hind coxa dark and metallic 6
5. Costal cell with ventral surface bare or with setae only in basal ½ (Fig. 34); median carina on propodeum narrow throughout (Fig. 16).....*A. anemia* **sp. nov.** (female, male)
- Costal cell with ventral surface with a complete row of setae (as in Fig. 35); median carina on propodeum with anterior part wide, posterior part narrow (Fig. 11)..... *A. albiscapus* **sp. nov.** (female)
6. Female petiole with dorsal surface smooth and shiny, without carinae (Fig. 21). Both sexes: dorsellum without two large foveae anteriorly (Fig. 21); scape predominantly dark brown, pale only at base
.....*A. assis* **sp. nov.** (female, male)
- Female petiole with a median carina (Fig. 30) or with irregular carinae (Fig. 26). Both sexes: dorsellum with two large foveae anteriorly (Figs 26, 30); scape yellowish-brown to pale brown..... 7
7. Female eyes small (Figs 22, 24), width of head/width of frons at level of anterior ocellus = 2.1
.....*A. ficaria* **sp. nov.** (female, male)
- Female eyes large (Figs 27, 28), width of head/width of frons at level of anterior ocellus = 2.6
..... *A. strix* **sp. nov.** (female, male unknown)

Species treatments

Apleurotropis albicaulis **sp. nov.**

(Figs 2–6, 33, 36, 37)

Diagnosis. Costal cell with ventral surface bare (as in Fig. 34); frontal suture down-curved laterally (Fig. 2); fore coxa dark brown, mid and hind coxae white; postmarginal vein 2.4X as long as stigmal vein; petiole white (Fig. 33), 0.6X as long as wide in female and 1.2X as long as wide in male.

Description. FEMALE. Length 1.4 mm.

Scape yellowish-brown, remaining antenna pale brown. Frons below frontal suture golden-green, above suture metallic bluish-purple. Vertex metallic bluish-green. Mesoscutum, scutellum and propodeum metallic bluish-green. Fore coxa dark brown, mid and hind coxae white; fore and mid femora pale brown, hind femur dark brown; tibiae white; tarsi yellowish-brown. Forewing hyaline with a weak infusate spot medially. Petiole white (Fig. 33). Gaster with tergites 1–2 metallic bluish-green, remaining tergites metallic dark purple.

Antenna as in Fig. 36. Frons with raised and strong reticulation (Fig. 2). Vertex with engraved and weak reticulation (Fig. 4).

Mesoscutum with engraved and strong reticulation, posterior 1/3 with weak median groove (Fig. 5); notaular depressions smooth and shiny. Scutellum with engraved reticulation, laterally and posteriorly smooth (Fig. 5). Axillae with engraved and very weak reticulation (Fig. 5). Dorsellum smooth with two large foveae anterolaterally (Fig. 6). Propodeal callus with two setae (Fig. 6). Forewing rounded, speculum closed below. Petiolar foramen triangular.

Petiole dorsally smooth, 0.6X as long as wide, mediolaterally with a spine (Fig. 6). Gaster ovate with pointed apex.

MALE. Length 1.0–1.4 mm.

Scape pale brown. Entire frons metallic bluish-green. Vertex golden-green. Mesoscutum with midlobe with anterior ½ golden-red. Propodeum metallic dark purple. Colour otherwise as in female.

Antenna as in Fig. 37. Head otherwise as in female.

Petiole dorsally smooth and shiny, 1.2X as long as wide. Mesosoma and metasoma otherwise as in female.

Distribution. Costa Rica.

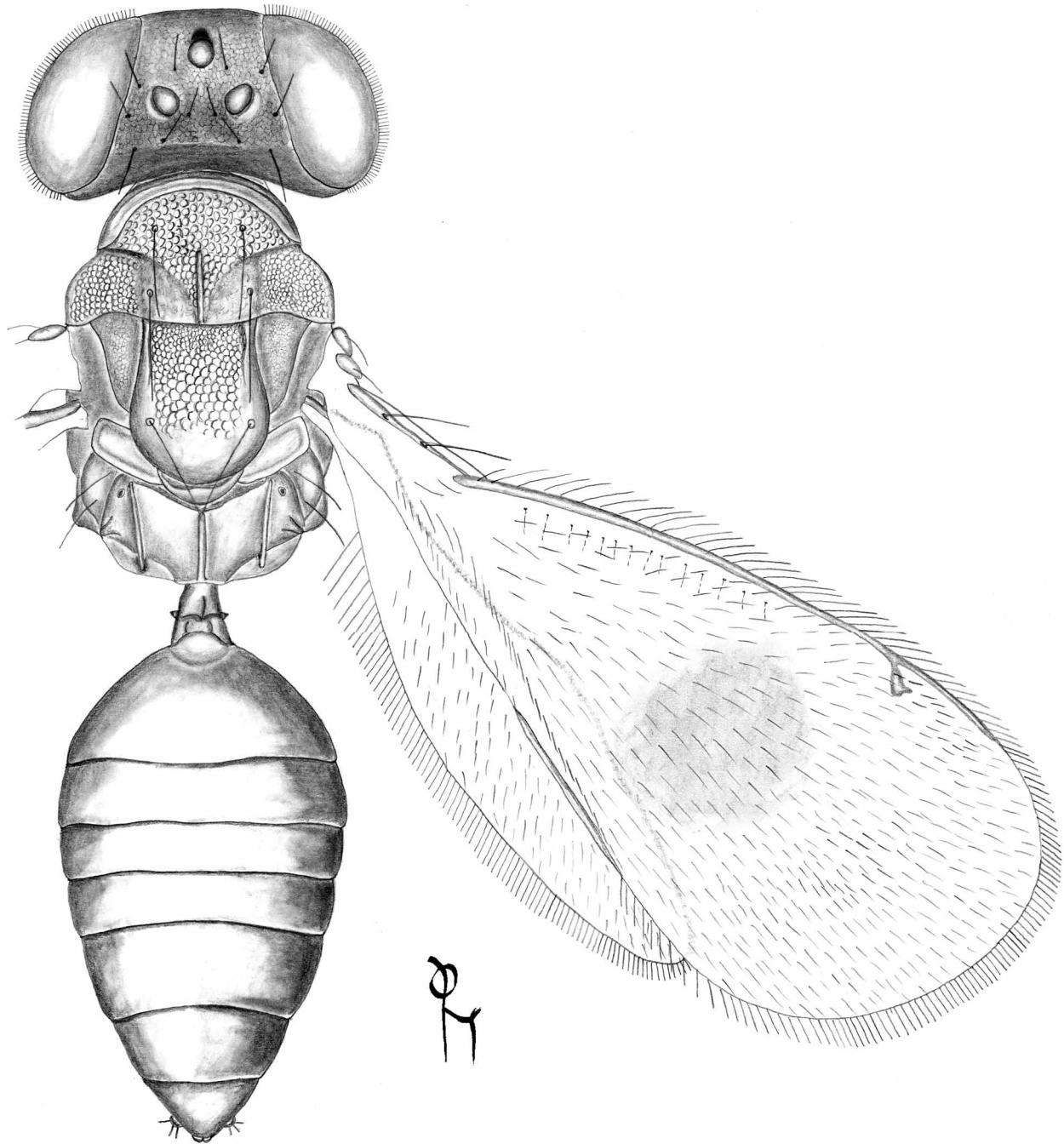


FIGURE 1. *Apleurotropis anemia* sp. nov., female paratype, body length 2.0 mm.

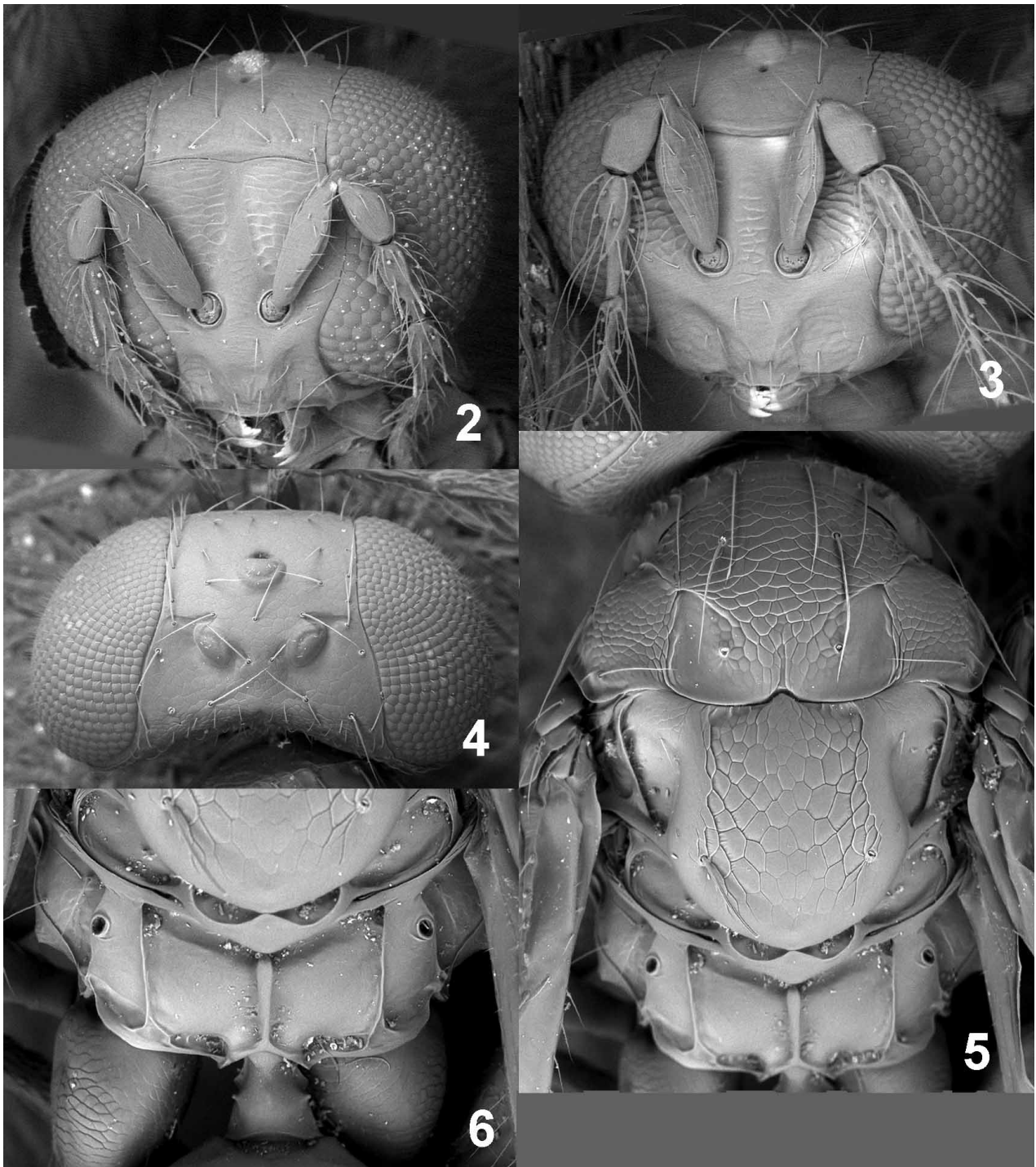
Biology. Unknown.

Material examined. Holotype female (INBio) labelled "Costa Rica: Puntarenas, Parque Nacional Corcovado, Estación Los Patos, 200 m, LS 281600/517900, 20.ii.2002, J.A. Azofeifa".

Paratypes. 10♀ and 19♂ on cards. COSTA RICA. **Puntarenas:** Golfo Dulce, 3 km SW Rincón, 10 m, xii.1992, P. Hanson (1♂, BMNH); Parque Nacional Carara, 09°46'N 84°57'W, 41 m, 1–7.iii.2005, C. Hansson (1♂, INBio); Parque Nacional Corcovado, Estación Los Patos, 200 m, LS 281600/517900, 20.ii.2002, J.A. Azofeifa (1♂, INBio) and ii.2000 (2♂, BMNH, INBio); Parque Nacional Corcovado, Quebrada La Bonanza, 500 m, 15.iii–28.iv.2001, LS 524800/275700, J. Azofeifa (1♂, CH) and 20.iv.2002 (1♀ 1♂, BMNH, INBio); Parque Nacional Corcovado, Sirena, 08°29'N 83°35'W, 5 m, 19–20.ii.2004, J.S. Noyes (1♀ 4♂, BMNH, INBio); Peninsula Osa, 8 km South puente Río Rincón, Coopemarti, 30 m, 08°38'N 83°28'W, ii.1991, P. Hanson (1♂, MIUCR); Reserva Privada Karen Mogensen, 09°52'N 85°03'W, 300 m, 11–21.ii.2005, C.

Hansson (5♀ 3♂, CH, INBio) and 14–15.ii.2005 (3♀ 2♂, BMNH, CNC).

Etymology. Named for the white petiole in both sexes (Latin *albus* = white, *caulis* = stem).



FIGURES 2–6. *Apleurotropis albicaulis* sp. nov. 2, head frontal, female. 3, head frontal, male. 4, vertex, female. 5, mesosoma dorsal, female. 6, propodeum, female.

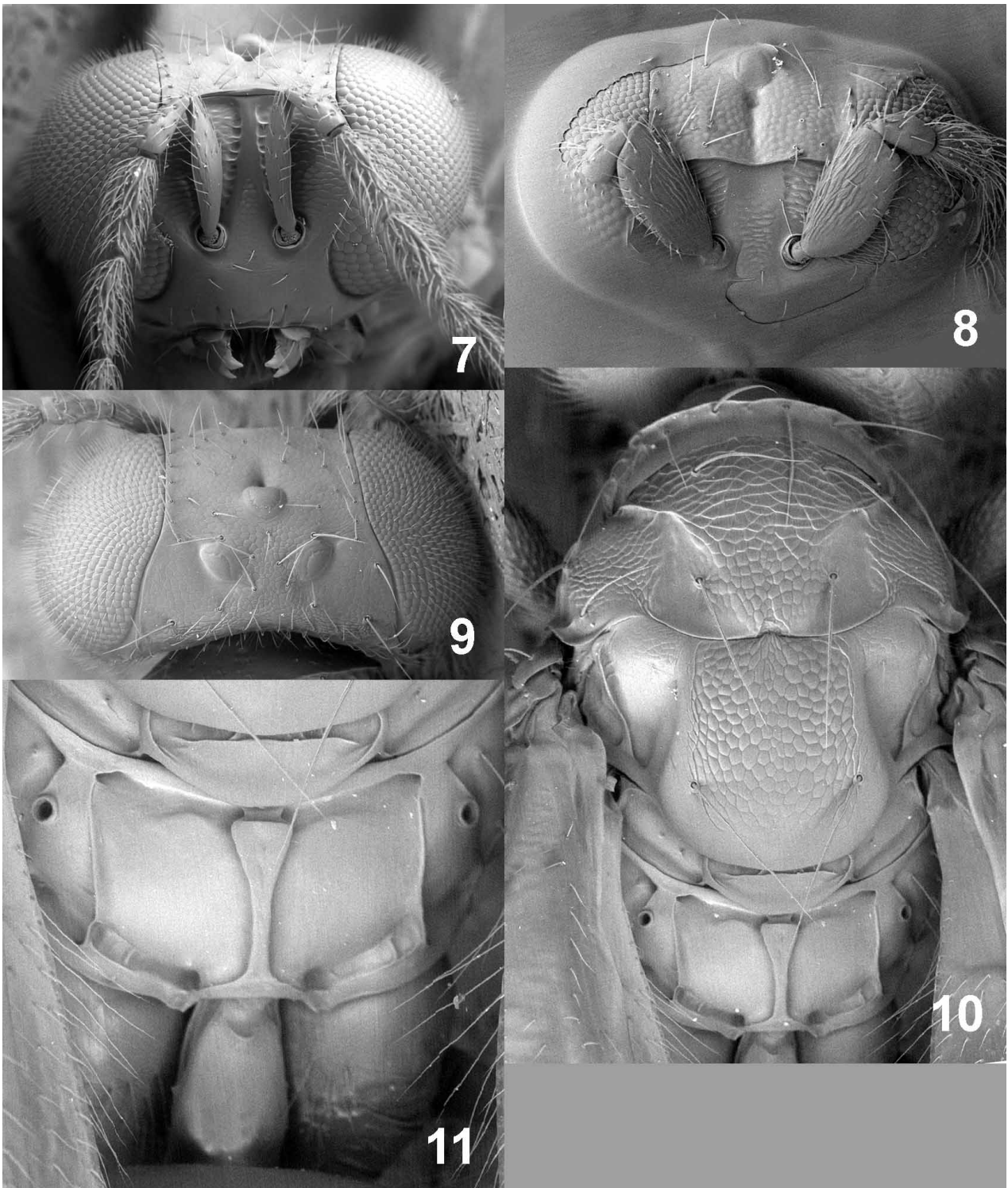
***Apleurotropis albiscapus* sp. nov.**

(Figs 7–11, 38, 39)

Diagnosis. Ventral surface of costal cell with a complete row of setae (as in Fig. 35); frontal suture down-curved laterally (Figs 7, 8); female scape yellowish-brown, male scape white; propodeal callus with 4–5 setae;

coxae yellowish-brown in female, white in male; postmarginal vein 2.9X as long as stigmal vein; petiole 1.5X as long as wide in female, 2.0X as long as wide in male, dark brown with metallic tinges in female, yellowish-white to pale brown in male.

Description. FEMALE. Length 2.1–2.2 mm.



FIGURES 7–11. *Apleurotropis albiscapus* sp. nov. 7, head frontal, female. 8, head frontal, male. 9, vertex, female. 10, mesosoma dorsal, female. 11, propodeum, female.

Scape yellowish-brown, remaining antenna dark brown. Frons below frontal suture golden-green with or without red tinges, above suture metallic bluish-purple. Vertex metallic bluish-green or golden-green. Mesoscutum, scutellum and propodeum metallic bluish-green. Coxae yellowish-brown, hind coxa sometimes pale brown; femora yellowish-brown with apex pale brown to dark brown; tibiae and tarsi yellowish-brown. Forewing hyaline with an infuscate spot medially. Petiole dark brown with metallic tinges. Gaster with tergites 1–3 metallic bluish-green, remaining tergites metallic dark purple.

Antenna as in Fig. 38. Frons with raised and weak reticulation (Fig. 7). Vertex with engraved and weak small-meshed reticulation (Fig. 9).

Mesoscutum with engraved and strong reticulation, reticulation weaker on sidelobes, posterior 1/3 with weak median groove (Fig. 10); notaular depressions smooth and shiny. Scutellum with engraved and strong reticulation, laterally and posteriorly smooth (Fig. 10). Axillae with engraved and very weak reticulation (Fig. 10). Dorsellum smooth with two large foveae anterolaterally (Fig. 11). Propodeal callus with 4–5 setae (Fig. 11). Forewing rounded, speculum closed below. Petiolar foramen rounded.

Petiole dorsally smooth and shiny, 1.5X as long as wide, with a spine mediolaterally (Fig. 11). Gaster ovate with apex pointed.

MALE. Length 1.5 mm.

Scape white. Entire frons metallic bluish-green. Vertex golden-purple. Scutellum golden-green. Legs predominantly white, hind femur and all tarsi pale brown. Petiole yellowish-white to pale brown. Colour otherwise as in female.

Antenna as in Fig. 39. Head otherwise as in female.

Petiole 2.0X as long as wide, without spine mediolaterally. Mesosoma and metasoma otherwise as in female.

Distribution. Costa Rica.

Biology. Reared from an unidentified Elachistidae (Lepidoptera) mining leaves of *Bambusa* (= *Guadua*) *angustifolia* (Poaceae).

Material examined. Holotype female (BMNH) labelled "Costa Rica: San José, Zurqui de Moravia, 1600 m, 10°3'N 84°0'W, v.1995, P. Hanson".

Paratypes. 8♀ 3♂ on cards. COSTA RICA. **Puntarenas:** San Vito, Las Tablas, 1600 m, 10.iii.1989, P. Hanson (1♂, MIUCR). **San José:** San Pedro, Reserva Ecología Leonel Oviedo, University of Costa Rica, 1150 m, 15.v.2000, ex Elachistidae larva mining leaf of *Guadua angustifolia*, K. Nishida (1♂, INBio); Zurqui de Moravia, 1600 m, 10°3'N 84°0'W, v.1995, P. Hanson (2♀ 1♂, BMNH, MIUCR), iv.1992 (2♀, MIUCR), iv.1995 (3♀, CH, INBio), vii.1996 (1♀, INBio)

Etymology. Named for the white scape in males.

Apleurotropis anemia sp. nov.

(Figs 1, 12–16, 31, 32, 34, 40, 41)

Diagnosis. Costal cell with ventral surface bare or with setae in basal ½ only (Fig. 34); frontal suture down-curved laterally (Fig. 12); fore coxa white to dark brown, mid and hind coxae white to yellowish-white; postmarginal vein 3.7X as long as stigmal vein; petiole 0.5–1.0X as long as wide in female and 1.0–1.5X as long as wide in male, in both sexes with a spine mediolaterally (Fig. 16), completely metallic bluish-green in female (Fig. 32), metallic bluish-green dorsally and yellowish-white ventrally in male.

Description. FEMALE. Length 1.5–2.2 mm.

Scape yellowish-white to yellowish-brown, remaining antenna dark brown. Frons below frontal suture golden-green or golden-red, above suture metallic bluish-purple. Vertex metallic bluish-purple. Mesoscutum, scutellum and propodeum metallic bluish-green — sometimes with purple tinges, or golden-green. Fore coxa white to dark brown, mid and hind coxae white to yellowish-white; fore femur white to pale brown, mid and hind femora pale brown to dark brown; tibiae and tarsi white to yellowish-white. Forewing hyaline with an infuscate spot medially. Petiole completely dark. Gaster with tergites 1–3 metallic bluish-purple, remaining tergites metallic dark purple.

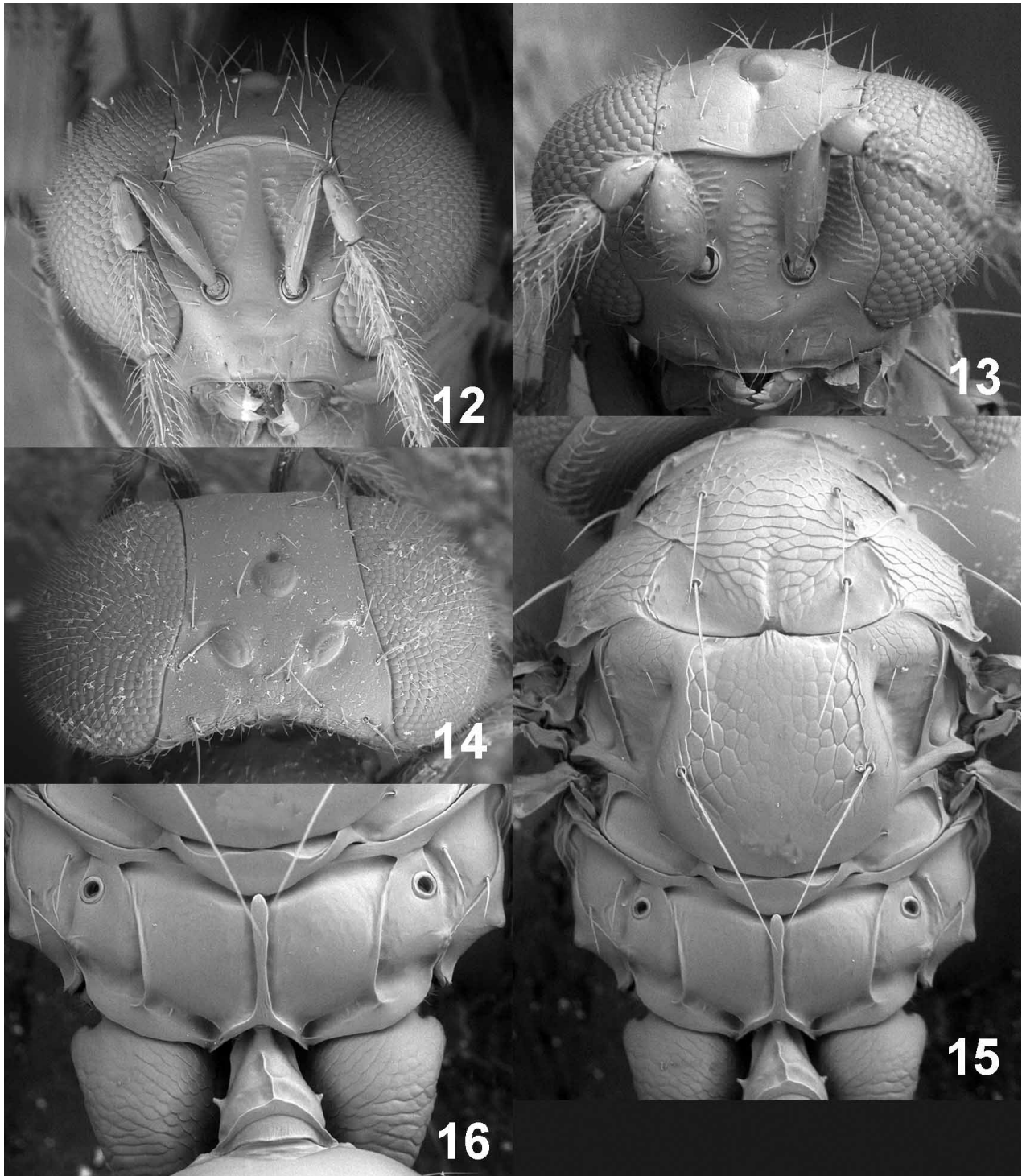
Antenna as in Fig. 40. Frons with raised and weak small-meshed reticulation (Fig. 12). Vertex with engraved and weak small-meshed reticulation (Fig. 14).

Mesoscutum with engraved and strong reticulation, posterior 1/3 with weak median groove (Fig. 15);

notaular depressions smooth and shiny. Scutellum with engraved reticulation, medially more or less smooth, laterally and posteriorly always smooth (Fig. 15). Axillae with engraved and very weak reticulation (Fig. 15). Dorsellum smooth with two large foveae anterolaterally (Fig. 16). Propodeal callus with two setae (Fig. 16). Forewing rounded, speculum closed below. Petiolar foramen triangular.

Petiole dorsally smooth and shiny, 0.5–1X as long as wide, mediolaterally with a spine (Fig. 16). Gaster ovate with pointed apex.

MALE. Length 1.0–1.5 mm.



FIGURES 12–16. *Apleurotropis anemia* sp. nov. 12, head frontal, female. 13, head frontal, male. 14, vertex, female. 15, mesosoma dorsal, female. 16, propodeum, female.

Scape yellowish-brown to pale brown. Entire frons metallic bluish-purple to bluish-green. Vertex golden-green. Fore coxa pale brown to dark brown, fore femur yellowish-brown to dark brown; hind tibia yellowish-white to dark brown. Petiole dark dorsally and pale ventrally. Colour otherwise as in female.

Antenna as in Fig. 41. Head otherwise as in female.

Petiole 1.0–1.5X as long as wide. Mesosoma and metasoma otherwise as in female.

Distribution. Brazil, Costa Rica, Ecuador, Honduras, Peru.

Biology. Primary parasitoid on *Bucculatrix* sp. (Lepidoptera: Bucculatricidae) on *Forsteronia spicata* (Apocyanaceae); *Elachista* sp. (Lepidoptera: Elachistidae) on *Olyra latifolia* (Poaceae); *Marmara* sp. (Lepidoptera: Gracillariidae) on *Heliconia* sp. (Heliconiaceae); *Phyllocnistis* sp. (Lepidoptera: Gracillariidae) on *Trichilia havanensis* (Meliaceae); lepidopterous leafminer on *Trichilia havanensis* and *Peperomia peltata* (Piperaceae), and Melastomataceae; Agromyzidae indet. (Diptera) on *Tradescantia* sp. (Commelinaceae).

Material examined. Holotype female (INBio) labelled “Costa Rica: Cartago, Parque Nacional Tapantí, 09°45'N 83°47'W, 1200–1550 m, iv.1999, C. Hansson, from agromyzid leafminer on *Tradescantia* sp.”.

Paratypes. 64♀ 45♂ on cards. COSTA RICA. **Alajuela:** Northern slope Volcan Cacao, 650 m, 17.iii.1986, C. Hansson (3♀, CH, USNM); Estacion Biologica San Ramón, 900 m, 10°13'N 84°37'W, x–xii.1995, P. Hanson (2♀, MIUCR) and iv.1999, from Lepidoptera leafminer on *Peperomia peltata* (3♀, CH, MIUCR); Parque Nacional Arenal, 600 m, 10°28'N 84°45'W, 21–28.ii.2005, C. Hansson (2♀ 1♂, CH); Parque Nacional Arenal, La Peninsula, 600 m, 10°27'N 84°45'W, 25.ii.2003, J.S. Noyes (1♀, BMNH); Parque Nacional Arenal, Sendero Pilón, 600 m, 10°27'N 84°43'W 26.ii.2003, J.S. Noyes (1♀ 2♂, BMNH), and 17–18.v.1999 (1♀, INBio), 9.iii–7.iv.2000 (1♂, INBio), 5.iii–20.iv.2001 (1♂, INBio); Reserva Forestal Rincón, Estacion Caribe, 10°53'N 83°18'W, 400 m, 19–20.ii.2003, J.S. Noyes (1♀, BMNH). **Cartago:** Humo, El Copal, 9°47'N 83°45'W, 1050–1250 m, 29.ii–6.iii.2008, C. Hansson (5♀ 4♂, CH, INBio, USNM); Parque Nacional Tapantí, 09°45'N 83°47'W, 1200–1550 m, iv.1999, C. Hansson, from agromyzid leafminer on *Tradescantia* sp. (3♀, BMNH, CH, MIUCR), and 20.iii–10.iv.2000 (2♀, CH, INBio); Turrialba, CATIE, Reventazon, 4.ix.1986, L. Masner (1♀, CNC) and 14–15.iii.1990 (1♂, BMNH). **Guanacaste:** Estacion Cacao, 10°55'N 85°30'W, 1100 m, 22.ii.2003, J.S. Noyes (1♀, BMNH); Guanacaste National Park, below Volcan Cacao, 400–500 m, 3.iii.1990, J.S. Noyes (2♀ 1♂, BMNH); Parque Nacional Guanacaste, 9 km South Santa Cecilia, 700 m, Estacion Pitilla, ix.1991, P. Rios (1♂, INBio), and iv.1994 (1♀, INBio); Parque Nacional Guanacaste, Santa Rosa, 22.x.1990, J. Memmott, ex *Bucculatrix* sp. 1 on *Forsteronia spicata* (1♂, BMNH), and reared from *Elachista* sp. on *Olyra latifolia* (2♂, BMNH); Reserva Privada Karen Mogensen, 09°52'N 85°03'W, 300 m, 14–15.ii.2005, J.S. Noyes (2♂, BMNH, INBio); Zona Protectorada Miravalles, Cabro Muco, 9.ix.2004, J.A. Azofeifa, LN 299151/410000 (1♀, INBio), and 11–21.ii.2005 (1♀ 1♂, CH). **Heredia:** Braulio Carrillo National Park, 25.iii.1990, J.S. Noyes (1♂, MIUCR); La Selva, 50 m, 22.i–2.ii.1991, J.S. Noyes (2♀ 2♂, BMNH, INBio), and ii.2000 from lepidoptera leafminer on Heliconiaceae (3♂, BMNH, CNC), ii.2000 from lepidoptera leafminer on Melastomataceae (3♂, INBio, USNM), 27–28.ii.2001 (1♀ 1♂, BMNH), 30–31.iii.2002 (2♀, INBio, MIUCR), 27–28.ii.2003 (5♂, BMNH, CH, INBio), 22.iv.2004 from *Marmara* sp. on *Heliconia* leaf (1♀, USNM), 23–24.ii.2005 (1♀, INBio); Reserva Privada Selva Verde, 10°27'N 84°04'W, 75 m, 13.iii.2005, C. Hansson (1♀, CH). **Limón:** Hitoy-Cerere Biological Reserve, Headquarters, 14–18.i.1991, 100 m, J.S. Noyes (1♀, INBio), and 24–25.ii.2004 (1♀, CNC). **Puntarenas:** Estacion Altamira, 9°02'N 83°00'W, 1450–1700 m, 7.ii–5.iii.2002, C. Hansson & Parataxonomos (4♀ 3♂, CH, INBio); Parque Nacional Corcovado, Estación Sirena, 8°29'N 83°35'W, 5 m, 19–20.ii.2004, J.S. Noyes (1♀, BMNH); San Vito, Las Cruces, Wilson Botanical Garden, 1150 m, 22.iii.1990, J.S. Noyes (2♀ 1♂, BMNH, CH), and 15–16.ii.2006 (2♀, INBio), 7–19.ii.2007 (1♀ 3♂, BMNH, INBio), 19–29.ii.2008 (1♀ 1♂, CH). **San José:** San Pedro, UCR campus, 1200 m, vii.1996, Roberto, ex lep leafminer on *Trichilia havanensis* (1♀, MIUCR), and 8.i.2003 ex *Phyllocnistis* sp. leafminer on *Trichilia havanensis* (1♂, MIUCR). BRAZIL. Bahia Fazenda, Matiapa Camara, 14.x.1978, F. Benton (1♀, BMNH); Bahia, Mata de São João, Reserva de Sapiranga, 12°33'42.1”S 38°02'43.8”W, Varredura veg. – Am. 5, 21.vii.2001, M.T. Tavares e eq., col. (1♀, MZSP); Caruaru, P.E., 900 m, iv.1972, M. Alvarenga (1♀, CNC); Espirito Santo, Linhares, Res. Biol. Sooretama, 19°19'11”S 40°07'08.1”W, Varredura veg. – Am. 23, 06.iv.2002, C.O. Azevedo e eq., col (1♀, MZSP); Guanabara, Represa Rio Grande, ix.1972, M. Alvarenga (1♀, CNC); Rio de Janeiro, Nova Iguaçu, Res. Biol. Tinguá,

22°34'38"S 43°26'09"W, Varredura Veg. – Am. 14, 07.iii.2002, S.T. Amarante e eq., col. (1♀, MZSP); Santa Catarina, São Francisco do Sul, CEPA Vila da Glória, 26°13'40.0S 48°40'49.1"W, Varredura Veg. – Am. 30, 17.x.2001, A.M. Penteado-Dias e eq., col. (1♀, MZSP). ECUADOR. Napo, 5 km S Sacha, cultivated forest, 7.iii.1983, Lars Huggert (1♀, LUZM). HONDURAS. Copán, Copán Ruinas, 23.x.1988, R. Cave (1♂, LUZM). PERU. Huanuco, Tingo Maria, Cueva de las Pavas, 30.i.1984, Lars Huggert (1♂, LUZM); **Loreto**: Iquitos, Barillal, 10.ii.1984, Lars Huggert (1♀, LUZM); Iquitos, Rio Nanay, 4–6.ii.1984, Lars Huggert (1♂, LUZM); Iquitos, Quisto Cocha, 5.ii.1984, Lars Huggert (1♀, LUZM). **Junin**: Satipo, 19.i.1984, Lars Huggert (1♀, LUZM).

Etymology. Named for the predominantly bare costal cell (Greek *aneimon* = naked, unclad).

Remarks. In the material from the inventory project of the Mata Atlantica project in Brazil there is one damaged female from Bahia, Ilhéus, and one damaged male from Pernambuco, Recife that are not included in the type material because of their incomplete states (female without petiole and damaged gaster, male without head). These two specimens are kept in MZSP.

***Apleurotropis assis* sp. nov.**

(Figs 17–21, 43, 44)

Diagnosis. Scutellum close to anterior margin with longitudinal lateral grooves (Fig. 20); costal cell with ventral surface with a complete row of setae (Fig. 35); frontal suture straight (Fig. 17); all coxae and femora dark and metallic; postmarginal vein 3.4X as long as stigmal vein; petiole 0.7–0.8X as long as wide in female and 1.0–1.4X as long as wide in male, in female without median carina (Fig. 21); dorsellum smooth and shiny without 2 large foveae anteriorly (Fig. 21). Similar to *A. strix* but dorsellum smooth without large anterolateral foveae, and female petiole smooth (*A. strix* with dorsellum with 2 foveae anterolaterally (Fig. 30) and female petiole with median carina (Fig. 30)).

Description. FEMALE. Length 2.0–2.1 mm.

Antenna dark brown, scape pale at very base. Frons below frontal suture golden-green, above suture metallic bluish-purple. Vertex golden-green. Mesoscutum, scutellum and propodeum metallic bluish-green with purple tinges, or golden-green with blue tinges. Coxae golden-green; femora dark brown; tibiae and tarsi white. Forewing hyaline with a weak infuscate spot medially. Petiole golden-red or golden-green. Gaster with tergites 1–3 metallic bluish-purple or bluish-green, remaining tergites metallic dark purple.

Antenna as in Fig. 43. Frons below frontal suture with raised and strong reticulation, above suture with engraved and weak reticulation (Fig. 17). Vertex with engraved and weak small-meshed reticulation (Fig. 19).

Mesoscutum with engraved and strong reticulation, posterior 1/3 with a weak median groove (Fig. 20); notaular depressions smooth and shiny. Scutellum slightly convex with engraved and strong reticulation, laterally and posteriorly smooth (Fig. 20). Axillae with engraved and very weak reticulation (Fig. 20). Dorsellum smooth without two large foveae anterolaterally (Fig. 21). Propodeal callus with two setae (Fig. 21). Forewing rounded, speculum closed below. Petiolar foramen triangular.

Petiole dorsally smooth and shiny, 0.7–0.8X as long as wide, mediolaterally without a spine (Fig. 21). Gaster ovate with apex pointed.

MALE. Length 1.3–1.5 mm.

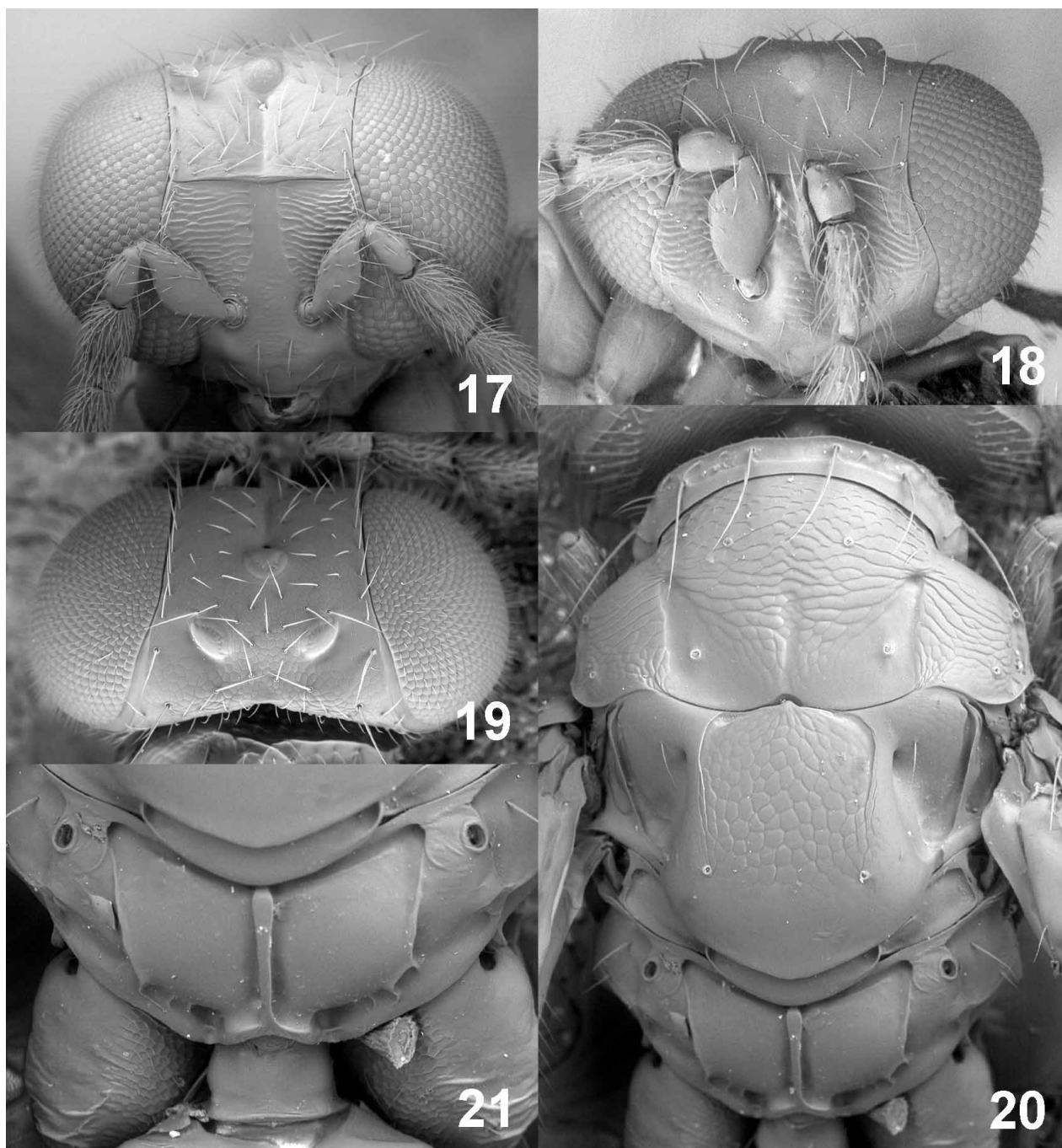
Scape usually dark brown as in female, one specimen with scape pale with apical ¼ dark. Entire frons metallic bluish-green. Scutellum golden-green, metallic bluish-green, or metallic dark purple. Colour otherwise as in female.

Antenna as in Fig. 44. Head otherwise as in female.

Petiole 1.0–1.4X as long as wide, with or without mediolateral spine. Scutellum frequently flat. Mesosoma and metasoma otherwise as in female.

Distribution. Costa Rica, Dominican Republic, Mexico.

Biology. Parasitoid on *Tischeria* spp. (Lepidoptera: Tischeriidae) on *Coussapoa villosa* (Moraceae) and *Gouania polygama* (Rhamnaceae), and from unidentified lepidopteran leafminers on unidentified Asteraceae.



FIGURES 17–21. *Apleurotropis assis* sp. nov. 17, head frontal, female. 18, head frontal, male. 19, vertex, female. 20, mesosoma dorsal, female. 21, propodeum, female.

Material examined. Holotype female (CNC) labeled “Dominican Republic: Barahona, 7 km NW Paraiso, 200 m, 27.xi–4.xii.1991, L. Masner & S.B. Peck”.

Paratypes. 5♀ 7♂ on cards. **COSTA RICA.** **Alajuela:** Parque Nacional Arenal, Sendero Pilón, 600 m, 10°28'N 84°45'W, 21–28.ii.2005, C. Hansson (1♀, CH). **Guanacaste:** Parque Nacional Guanacaste, Santa Rosa, 5.x.1990, J. Memmott, ex *Lepidoptera* sp4 on *Compositae* (1♀ 1♂, BMNH) and 18.x–8.xi.1986 (1♂, BMNH), 22.viii.1989 (1♀, INBio); Parque Nacional Guanacaste, Sector Santa Rosa, 3.ix.1989, J. Memmott, ex *Tischeria* sp. on *Gouania polygama* (1♂, BMNH); Zona Protectorada Nosara, Fila Maravilla, 800 m, LN 221350/381700, 24.xi–21.xii.2001, I. Jimenez (1♀, INBio). **Heredia:** Estacion Biologica La Selva, 50–150 m, 10°25'N 84°01'W, 26.v.1998, L.M. LaPierre, ex *Tischeria* sp. on *Coussapoa villosa* (3♂, INBio, USNM) and

17.viii.1998 (1♂, BMNH). MEXICO. **Chiapas:** Ocozacoautla, 8.viii.1990, 1800–2200', J.B. Woolley (1♀, TAMU).

Etymology. No specific meaning intended.

***Apleurotropis ficaria* sp. nov.**

(Figs 22–26, 45, 46)

Diagnosis. Costal cell with ventral surface with a complete row of setae (as in Fig. 35); frontal suture slightly V-shaped (Fig. 22); female with fore and mid coxae pale brown with metallic tinges, hind coxa dark and metallic, male with fore and mid coxae dark brown and metallic, hind coxa dark and metallic; postmarginal vein 4.0X as long as stigmal vein; petiole 1.1X as long as wide in female and 1.3X as long as wide in male. Similar to *A. strix* but with smaller eyes.

Description. FEMALE. Length 2.0 mm.

Scape pale brown, remaining antenna dark brown. Frons below frontal suture golden-green, above suture metallic bluish-purple. Vertex golden-red. Mesoscutum, scutellum and propodeum metallic bluish-green. Fore and mid coxae pale brown with metallic tinges; femora dark brown; fore tibia with basal ½ dark brown and apical ½ white, mid and hind tibiae white; tarsi white. Forewing hyaline with an infuscate spot medially. Petiole completely dark. Gaster with tergites 1–3 metallic bluish-green, remaining tergites metallic dark purple.

Antenna as in Fig. 45. Frons with raised and strong reticulation (Fig. 22). Vertex predominantly smooth, inside ocellar triangle with engraved and very weak reticulation (Fig. 24).

Mesoscutum with engraved and strong reticulation, posterior 1/3 with weak median groove (Fig. 25); notaular depressions smooth and shiny. Scutellum with engraved reticulation, laterally and posteriorly smooth (Fig. 25). Axillae with engraved and very weak reticulation (Fig. 25). Dorsellum smooth with two large foveae anterolaterally (fig. 26). Propodeal callus with two setae (Fig. 26). Forewing rounded, speculum closed below. Petiolar foramen rounded.

Petiole dorsally with strong longitudinal and irregular carinae, 1.1X as long as wide, mediolaterally without a spine (Fig. 26). Gaster ovate with pointed apex.

MALE. Length 1.8 mm.

Scape dark and metallic. Entire frons metallic bluish-purple. Vertex golden-red inside ocellar triangle, metallic bluish-purple outside. Fore and mid coxae dark brown with metallic tinges, fore tibia entirely white. Colour otherwise as in female.

Antenna as in Fig. 46. Head otherwise as in female.

Petiole dorsally smooth and shiny, 1.3X as long as wide, with a spine mediolaterally. Meso- and metasoma otherwise as in female.

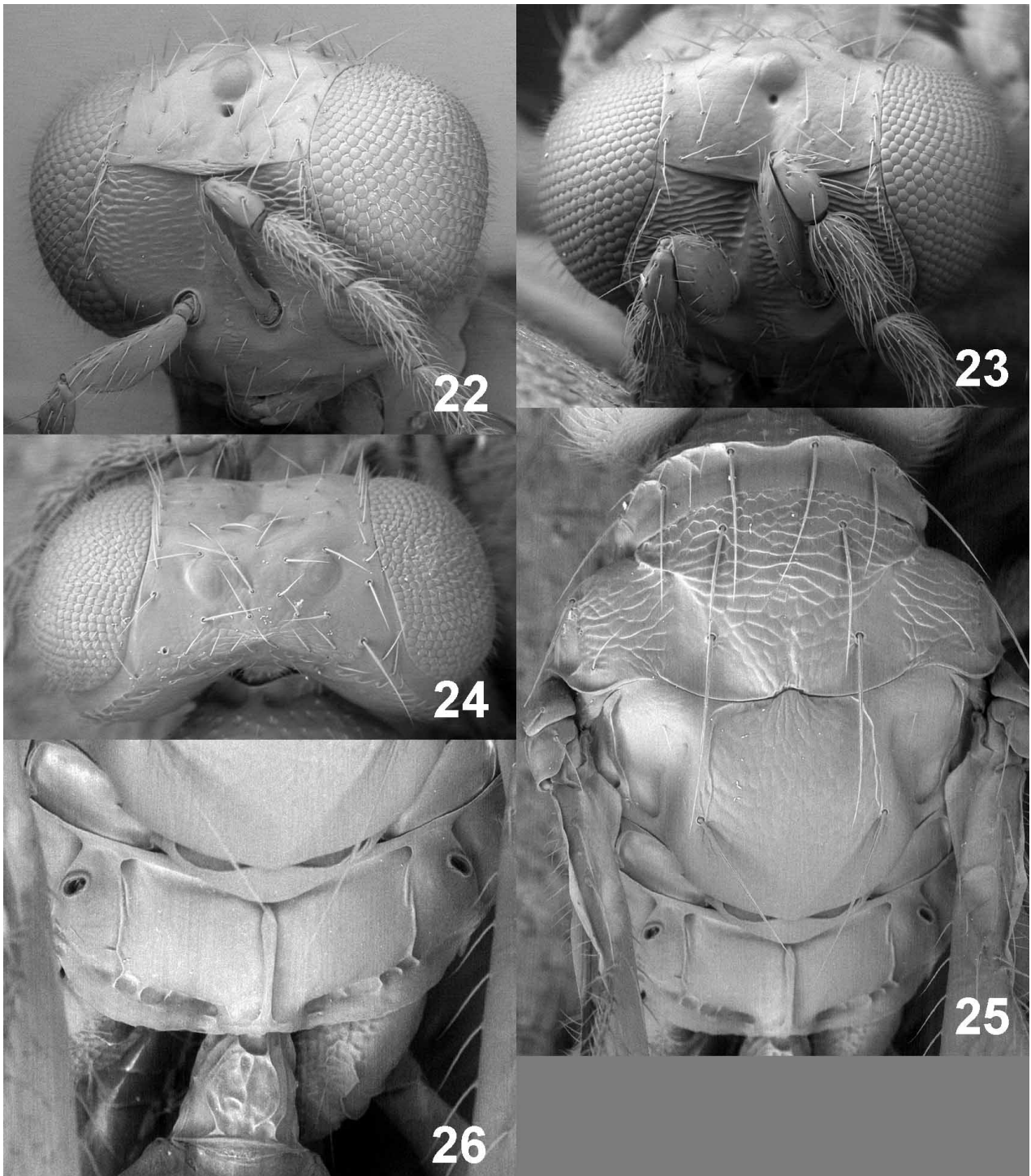
Distribution. Costa Rica.

Biology. Reared from a leaf pustule gall on *Ficus hartwegii* (Moraceae).

Material examined. Holotype female (BMNH) labeled "Costa Rica: San José, Zurqui de Moravia, 1600 m, 10°3'N 84°0'W, xi.1997, from leaf pustule gall on *Ficus hartwegii*, P. Hanson" (BMNH).

Paratype. 1♂ on card with same label data as holotype (BMNH).

Etymology. Named for its host-plant association (Latin *ficaria* = of figs).



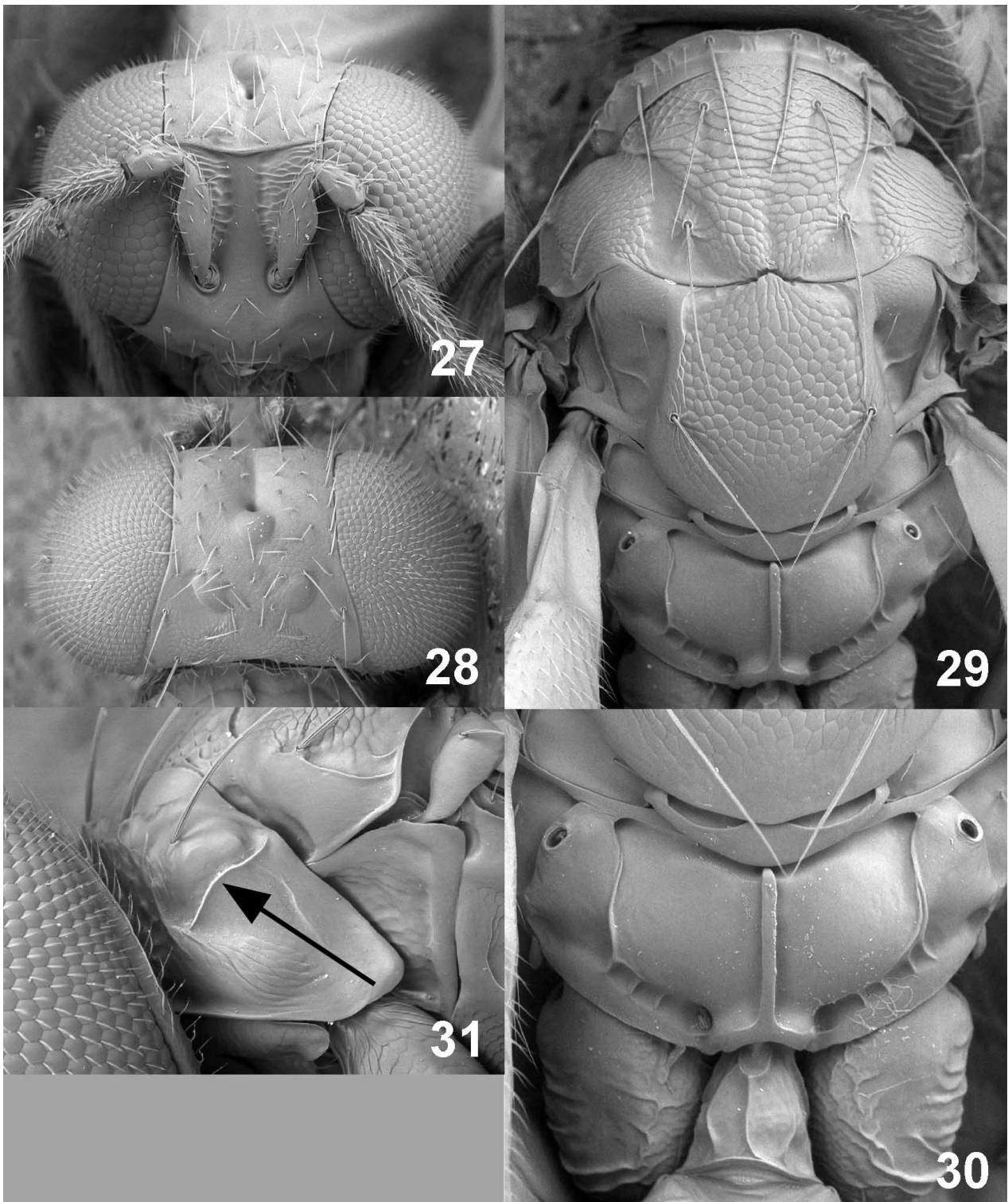
FIGURES 22–26. *Apleurotropis ficaria* sp. nov. 22, head frontal, female. 23, head frontal, male. 24, vertex, female. 25, mesosoma dorsal, female. 26, propodeum, female.

***Apleurotropis strix* sp. nov.**

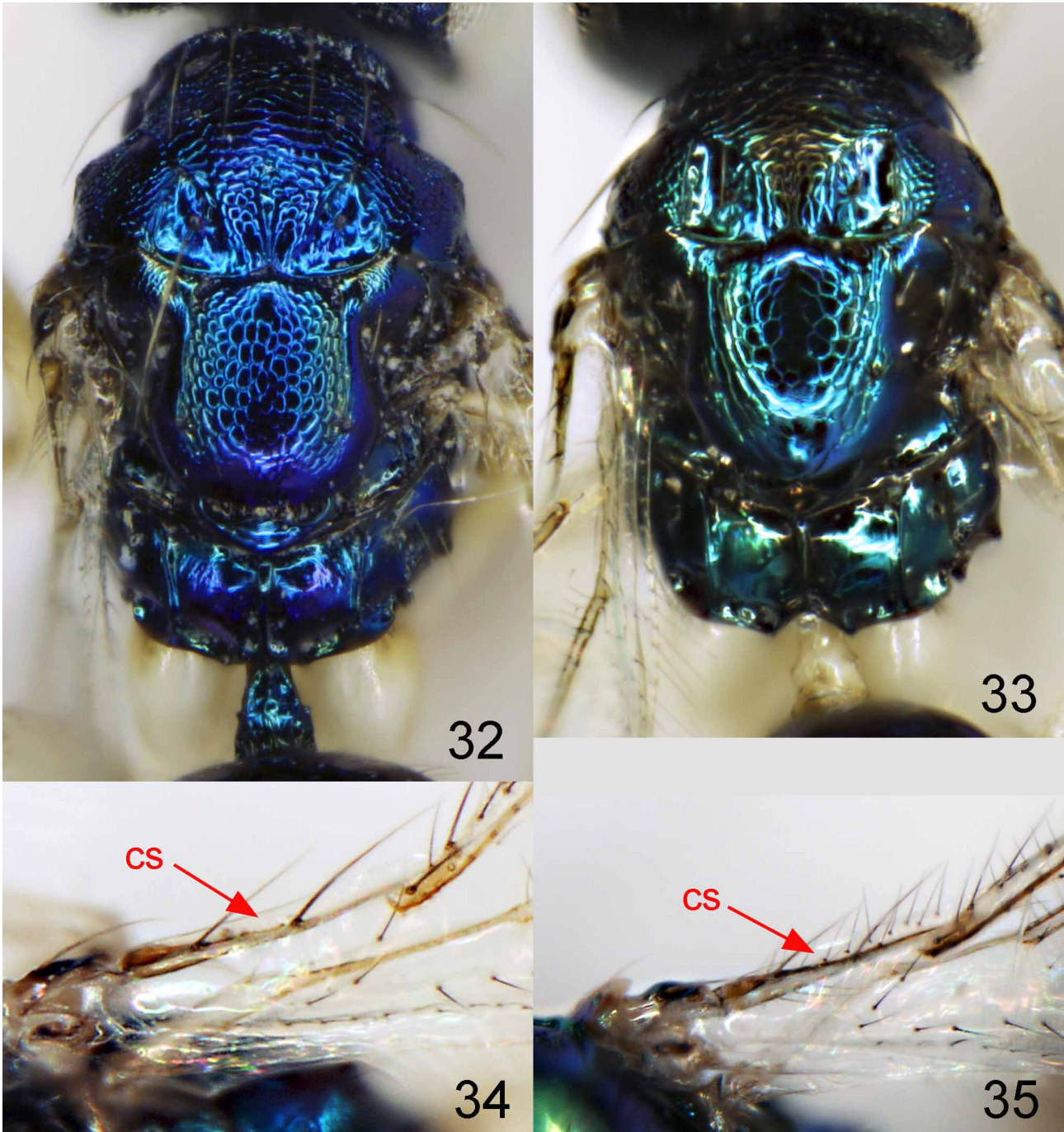
(Figs 27–30, 42)

Diagnosis. Scutellum close to anterior margin with longitudinal lateral grooves (Fig. 29); costal cell with ventral surface with a complete row of setae (as in Fig. 35); frontal suture v-shaped (Fig. 27); all coxae and femora dark and metallic; postmarginal vein 3.3X as long as stigmal vein; petiole 0.5–0.7X as long as wide

and with a median carina. Similar to *A. assis* but dorsellum with two foveae anterolaterally (Fig. 30), and female petiole with a median carina (Fig. 30) (dorsellum in *A. assis* without foveae (Fig. 21) and female petiole smooth dorsally (Fig. 21)).



FIGURES 27–31. 27–30. *Apleurotropis strix* sp. nov. 27, head frontal, female. 28, vertex, female. 29, mesosoma dorsal, female. 30, propodeum, female. 31, *A. anemia* sp. nov., pronotum lateral, female, arrow points at longitudinal carina.

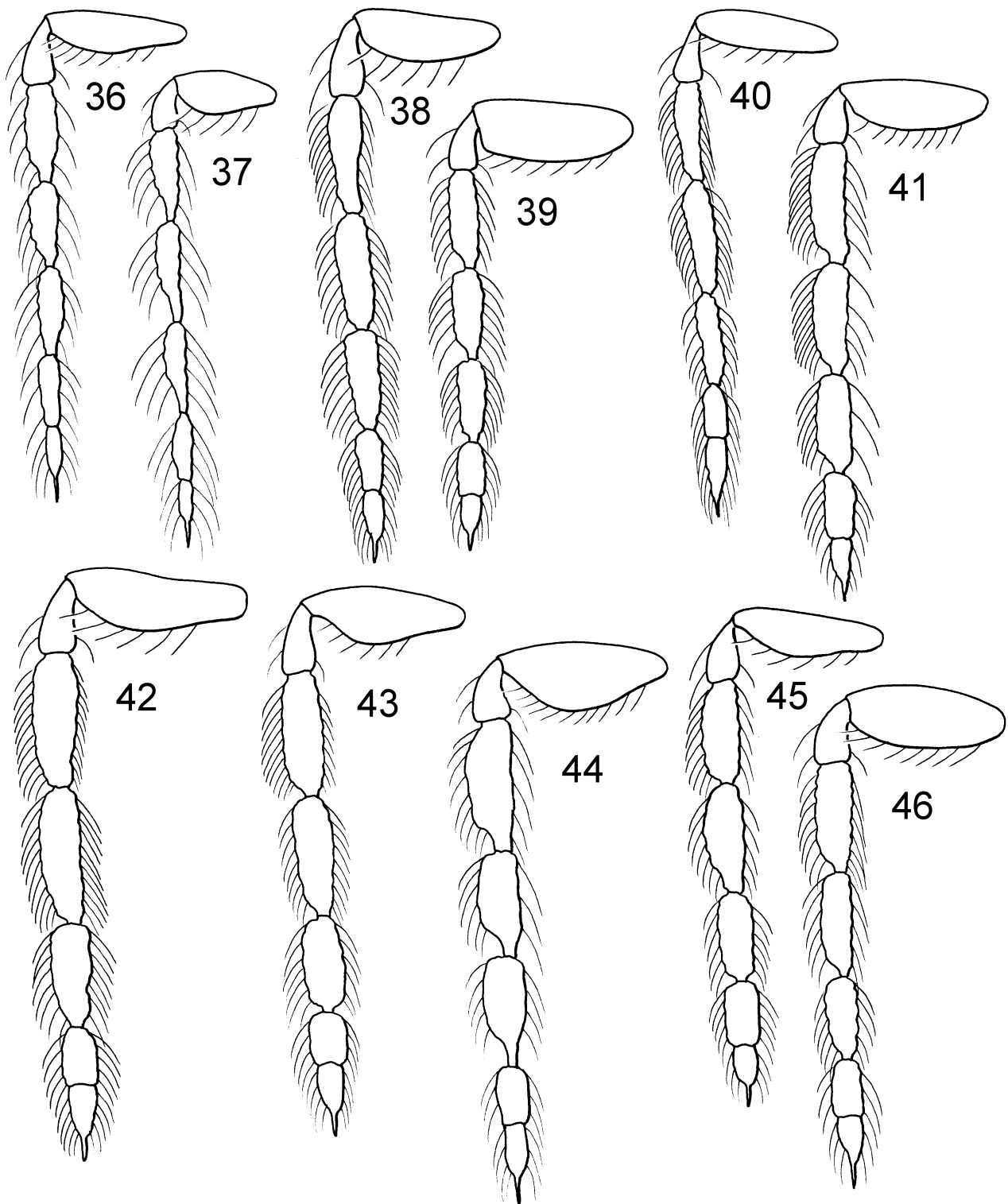


FIGURES 32–35. *Apleurotropis* spp. nov. 32, *A. anemia*, mesosoma and petiole, female. 33, *A. albicaulis*, mesosoma and petiole, female. 34, *A. anemia*, base of forewing, cs = costal cell. 35, *A. assis*, base of forewing, cs = costal cell.

Description. FEMALE. Length 1.7–2.6 mm.

Scape yellowish-brown to pale brown, remaining antenna dark brown. Frons below frontal suture golden to golden-green, above suture metallic bluish-purple. Vertex metallic bluish-purple, bluish-green, or golden-green. Mesoscutum, scutellum and propodeum metallic bluish-purple, bluish-green with purple tinges, or golden-green with blue tinges. Coxae metallic bluish-green; femora dark brown with metallic tinges; tibiae and tarsi yellowish-white. Forewing hyaline with an infusate spot medially, or with entire forewing hyaline. Petiole golden-green. Gaster with tergites 1–2 metallic bluish-purple or golden-green, remaining tergites metallic dark purple.

Antenna as in Fig. 42. Frons below frontal suture with raised and strong reticulation, above suture with engraved and weak reticulation (Fig. 27). Vertex with engraved and weak small-meshed reticulation (Fig. 28).



FIGURES 36–46. *Apleurotropis* spp. nov., antenna lateral. 36, *A. albicaulis*, female. 37, *A. albicaulis*, male. 38, *A. albiscapus*, female. 39, *A. albiscapus*, male. 40, *A. anemia*, female. 41, *A. anemia*, male. 42, *A. strix*, female. 43, *A. assis*, female. 44, *A. assis*, male. 45, *A. ficaria*, female. 46, *A. ficaria*, male.

Mesoscutum with engraved and strong reticulation, posterior 1/3 with or without a weak median groove (Fig. 29); notaular depressions smooth and shiny. Scutellum slightly convex to flat with engraved and strong reticulation, laterally and posteriorly smooth (Fig. 29). Axillae with engraved and very weak reticulation (Fig. 29). Dorsellum smooth with two large foveae anterolaterally (Fig. 30). Propodeal callus with two setae (Fig. 30). Forewing rounded, speculum closed below. Petiolar foramen triangular.

Petiole dorsally smooth and shiny, 0.5–0.7X as long as wide, mediolaterally with a spine (Fig. 30). Gaster elongate with apex pointed.

MALE. Unknown.

Distribution. Brazil, Colombia, Costa Rica.

Biology. Parasitoid on unidentified lepidopteran leafminers on *Saurauia* sp. (Actinidiaceae).

Material examined. Holotype female “Costa Rica: Cartago, Parque Nacional Tapantí, 09°45'N 83°47'W, 1200–1550 m, 20.iii–10.iv.2000, ex lepidopteran leafminer on *Saurauia* sp., C. Hansson & D. Rubí” (INBio).

Paratypes. 5♀ on cards. COSTA RICA. **Alajuela:** San Carlos, Parque Nacional Arenal, Sendero Pilón, 600 m, 10°27'N 84°43'W, 17–18.v.1999, G. Carballo” (1♀, CH). **Guanacaste:** Guanacaste National Park, below Pitilla, 500 m, 7–8.iii.1990, J.S. Noyes” (1♀, BMNH). **Puntarenas:** Golfo Dulce, 24 km W Piedras Blancas, 200 m, 08°46'N 83°24'W, ii.1992, P. Hanson” (1♀, MIUCR). BRAZIL. BA, Mata de São João, Reserva de Sapiranga, 12°33'42.1”S 38°02'43.8”W, Varredura veg. – Am. 13, 24.vii.2001, M.T. Tavares e eq., col.” (1♀, MZSP). COLOMBIA. **Amazonas,** PNN Amacayacu, San Martín, 03°23'N 70°06'W, 150 m, 24.iv–5.v.2000, A. Parente (1♀, IAvH).

Etymology. Named for the two lateral grooves on anterior part of scutellum (Latin *strix* = furrow, groove).

Acknowledgements

Special thanks to Valmir Antonio Costa (Instituto Biológico, Campinas, Sao Paulo, Brazil) for checking the material collected in the inventory project (Biota-FAPESP) of Mata Atlantica in Brazil, and to Marcelo Teixeira Tavares (Universidade Federal do Espírito Santo) and Carlos Roberto Ferreira Brandão (MZSP) for making this material available. In connection with the Mata Atlantica material I am also greatly indebted to FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) for funding my stay in Brazil in 2008 to examine this material. Thanks are also due to Roy Danielsson (LUZM), Paul Hanson (MIUCR), Gary A.P. Gibson and John T. Huber (CNC), Louis LaPierre, Kenji Nishida (MIUCR), John S. Noyes (BMNH), James B. Woolley (TAMU), and staff at IAvH and INBio, for loan of material; and to the electron microscopy unit at Department of Biology, Lund University, for the use of their facilities.

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