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FROM THE NEW WORLD, WITH REMARKS ON
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CHALCIDOIDEA: EUPELMIDAE).

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The symbols changed (published paper → corrected PDF/as in original manuscript) are:

B	→	–	(en-dash)
C	→	—	(em-dash)
&	→	♀	(female)
%	→	♂	(male)
=	→	°	(degree)
l-shaped	→	n-shaped	

SPECIES OF *AUSTRALOODERA* GIRAULT
FROM THE NEW WORLD, WITH REMARKS
ON WORLD SPECIES (HYMENOPTERA:
CHALCIDOIDEA: EUPELMIDAE)

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ABSTRACT

Australoodera albolata **new species** and *A. narendrani* **new species** are described from Belize, Brazil, Costa Rica and Trinidad, representing the first described species of the genus from the New World. *Australoodera quilonica* Narendran, from India, is transferred to *Reikosiella* as *R. (Hirticauda) quilonica* (Narendran) **new combination**. A key is provided to distinguish females of the four currently described world species of *Australoodera*.

INTRODUCTION

Australoodera was established by Girault (1922) for a single species from Australia, *A. varicornis* Girault. Girault (1923) subsequently described a second Australian species as *Eupelmus bicinctipilum*, which was transferred to *Australoodera* by Bouček (1988). Bouček (1988) stated that the genus was circumtropical in distribution and estimated at least 12 species comprise the genus. Subsequently, Narendran (1996) described *A. quilonica* from India and Gibson (1995) noted the presence of two undescribed species in Central and South America. The purpose of this paper is to differentiate the two New World species of *Australoodera* from other world species and to clarify the generic identity of the species described from India.

MATERIALS AND METHODS

This study is based on specimens from the Natural History Museum, London, England (BMNH), Canadian National Collection of Insects, Ottawa, ON, Canada (CNCI), and University of California, Davis, CA, United States (UCDC). Paratypes of the newly described species are also deposited in the Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica (INBIO) and Museo de Insectos, Universidad de Costa Rica, San José, Costa Rica (MUCR). All paratypes are in the CNCI unless stated otherwise. I examined the type material of *A. bicinctipilum* and *A. varicornis* in 1998; the holotype of *A. quilonica* Narendran is on permanent loan to the CNCI from the Department of Zoology, Calicut University, Calicut, India (DZCU).

Descriptions of the two new species are based on the primary types; illustrations are from paratypes. Features described include those that differentiate the two species from each other and from other known world species. Terminology follows Gibson (1995, 1997) except measurement of length of the costal cell and terms used for basal regions of the forewing follows Gibson (2004). Character observation and measurements were taken with a Nikon SMZ-U microscope fitted with an ocular grid having 100 divisions. All measurements except body length are relative; wing and antennal measurements of *A. albolata* and *A. narendrani* are comparable based on the length of the costal cell of *A. narendrani* assigned a base measurement of 10.

***Australoodera* Girault**

Australoodera Girault, 1922: 207. Type species: *Australoodera varicornis* Girault, by monotypy.

Diagnosis. Female largely yellowish to dark brown with limited metallic luster; male with head and mesosoma yellow to uniformly metallic green. Scrobal depression (Figs. 5, 6, 15) with lateral margin carinate and differentiating subequally wide parascrobal region along inner orbit for at least two-thirds distance to anterior ocellus, without distinct dorsal margin but ventrally with margin usually at least obscurely recurved toward lower inner orbit. Lower face often transversely reticulate to imbricate (Figs. 5, 6, 15). Mandible tridentate. Scape bicolored with longitudinal or oblique white streak over inner and outer surfaces, at least in female. Male antenna (Fig. 17) with pedicel more than twice as long as api-

cal width, without line of long setae ventrally; flagellum with Fl₁ and often Fl₂ subequally short and narrow compared to Fl₃, with subsequent segments having short setae and usually a single row of sensilla, and clava more than twice as long as wide with micropilose sensory region ventrally. Propodeum of female with foramen broadly and evenly incurved to apex of anteromedian emargination, hence plical region sublinear medially but with small, triangular, flat to slightly concave paramedial regions relative to convex callus (Figs. 7-9). Forewing of female without linea calva (Figs. 1, 2, 12); forewing of male with speculum behind base of parastigma, but region not extending obliquely behind apex of parastigma and base of marginal vein (Fig. 18). Mesotibia of female without oblique apical groove, with or without row or small patch of apical pegs, but any pegs light-colored and inconspicuous; mesotarsus ventrally with single row of light-colored pegs along each side of tarsal segments. Gaster of female with Gt₆ (penultimate tergum) sometimes divided medially by fine suture (Fig. 13) or white line; syntergum (Gt₇ + Gt₈) omega-like emarginate, with dorsal surface sublinear anterior to deep emargination. Ovipositor sheaths filamentous, usually curved up over gaster or coiled but extending for distance at least equal to half length of gaster (Figs. 3, 4).

Recognition. The sexually dimorphic females and males of *Australoodera* can be differentiated from those of other eupelmid genera using the keys provided for each sex by Gibson (1995). Because of tergal telescoping in females, Gt₅ sometimes overlies both Gt₆ and the syntergum. In such instances neither the deep emargination nor the sublinear dorsal surface of the syntergum anterior to the emargination (Gibson 1995, figs. 317, 318) are visible. The short, almost linear dorsal surface of the syntergum is an important feature to differentiate *Australoodera* females from those of *Reikosiella* Yoshimoto, which have the syntergum extensive dorsally anterior to the emargination (Gibson 1995, figs. 311, 312, 314), though sometimes superficially appearing very short dorsally if overlain by Gt₆ (Gibson 1995, fig. 313). Because of the problem of tergal telescoping, I used two other features in couplet 10 of my 1995 key to females to differentiate *Reikosiella* from *Australoodera* and *Phlebopenes* Perty. Females of *Reikosiella* were stated to have a shallow, oval or \cap -shaped scrobal depression delineating ecarinate parascrobal regions (Gibson 1995, figs. 75-78); the forewing was also described as distinctively narrow (at least three times as long as wide) with the marginal vein at least as long as and usually dis-

tinctly longer than the costal cell or maximum width of the wing. However, forewing structures of *Reikosiella* and *Australoodera* females intergrade because some female *Australoodera* have a conspicuously long marginal vein that is almost as long as the costal cell and sometimes is even slightly longer than the maximum width of the forewing. The features I subsequently used in couplet 14 to differentiate *Australoodera* from *Phlebopenes* also apply to many species of *Reikosiella*, except for the irregular, longitudinal white color pattern of the scape, which was said to be unique for *Australoodera* (Gibson 1995, p. 152). It is this latter feature that likely led Narendran (1996) to describe a female eupelmine from India as *Australoodera quilonica*. Though less conspicuous than for most *Australoodera* females, the scape of this female has a definite longitudinal white pattern because the ventral margin is brown basally, there is a brown mark on the dorsal margin medially, and the inner surface is white compared with a more yellowish outer surface. This pattern is similar to the characteristic scapal color pattern of *Australoodera*, but structure of the upper face (Fig. 14) and syntergum as well as relative measurements of forewing length: forewing width: marginal vein length: costal cell length (10.0: 3.0: 3.7: 2.8) all support classifying this species in *Reikosiella*. I classify the species as *Reikosiella (Hirticauda) quilonica* **new combination** based on the flagellum having Fl₄-Fl₈ white, the presence of mesotibial apical pegs, a sinuate acropleural sulcus, and a short plical region.

Although males of *Australoodera* were known previously from the Old World, *A. albolata* is the first described species to have the sexes associated and described.

Biology. The long ovipositors of females suggest hosts in concealed situations. Bouček (1988) recorded *A. bicinctipilum* as reared from *Hylurgops* (= *Hyleops*) *glabratus* (Zetterstedt) (Coleoptera: Scolytidae) in the logs of *Xanthophyllum* and *Sygium*, and stated that other, unnamed species had been reared as ectoparasitoids of caterpillars. Host relationships of the two newly described species are unknown, but collection of several specimens of *A. narendrani* on dead trees suggests a wood-boring beetle or an aculeate wasp nesting in holes as possible hosts.

***Australoodera albolata* n. sp.**

(Figs. 1, 3, 7, 11*b*, 15-18)

Type material. *Holotype* (♀) — BELIZE: Las Cuevas, XI.1994, T. King, A. Howe (CNCI Type No. 22870). *Allotype* (♂) — same data as holotype except collected VI. 1996 (CNCI). *Paratypes* — COSTA RICA: Guanacaste Prov., Guanacaste Nat. Pk., 27.IV–11.V.1985, BH-9-0 (1♀), 27.IV–11.V.1985, BH-11-0 (1♀), 13.VII–3.VIII.1985, BH-9-0 (1♀), 28.XII.85–18.I.86, BH-12-C (1♀, BMNH), 23.III–13.IV.1986, BH-10-0 (1♀, MUCR), 13.IV–4.V.1986, BH-11-0 (1♀, INBIO), D. Janzen & I. Gauld / Bosque Humedo [spelled Humido on some labels], mature, partially evergreen forest, clearing. San José, Ciudad Colón, 800 m, II.1990, Luis Fournier (1♀).

Etymology. From the Latin words, *albus*, white, and *latus*, side, in reference to the body color pattern of females, which is unique among known species of the genus.

Description. Female. Length of body excluding ovipositor sheaths = 1.4 mm. Head (*cf.* Figs. 5, 6) yellowish-brown, shiny with very slight metallic green sheen under some angles of light; lower face, interantennal region and lower parascrobal region to near level of apex of interantennal region transversely reticulate-imbricate; scrobes finely coriaceous and scrobal channel smooth and shiny; upper parascrobal region and vertex smooth and shiny except for sparse setiferous punctures. Eye very sparsely and inconspicuously setose, superficially glabrous. Palpi white. Antenna (Fig. 11*b*) with length of scape (excluding radicle): pedicel: funicular segments: clava = 2.8: 1.2: 0.3: 0.4: 0.6: 0.6: 0.6: 0.6: 0.6: 0.6: 2.1; scape brown dorsally and ventrobasally but with longitudinal white stripe on inner and outer surfaces, the stripes merging apically on ventral surface; pedicel yellowish-brown; flagellum brownish-yellow with Fl₆–Fl₈ slightly lighter in color. Mesosoma primarily yellowish-brown dorsally and ventrally but white laterally, including the following: pronotal panel, propleuron, prepectus, acropleuron, mesopleurosternum between acropleural sulcus and transepisternal sulcus anteriorly, metapleuron, and propodeal callus. Mesoscutum very finely coriaceous with light-colored, inconspicuous setae; scutellum low convex with fine coriaceous sculpture forming concentric circle pattern and with somewhat longer, more spine-like setae than on mesoscutum (Fig. 7). Forewing hyaline except for extremely faint infuscate region extending behind stigma; length of cc: mv: pmv: stv = 5.6: 2.8: 2.8: 1.2; submarginal vein with single row of setae along most of length, but in two rows basally and apically; disc with lunate bare region beyond basal cell; cubital and

vannal areas both setose (Fig. 1). Legs white; mesotibia with stronger spines apically but without distinct pegs. Gaster dorsally yellowish over about basal half and brown over about apical half, more extensively yellowish to white laterally but with Mt_6 , syntergum and outer plate of ovipositor brown, and with hypopygium brownish but all other sterna white; terga shiny; Gt_5 angulate posteromedially (cf. Fig. 13); Gt_6 without mediolongitudinal line. Ovipositor sheaths yellowish, curved above gaster but length about equal to that of gaster (Fig. 3).

Male. Length of body = 1.4 mm. Head (Fig. 15) similar in structure, sculpture, setal pattern and color as described for female except frontovertex dark brown with metallic green luster under some angles of light. Antenna (Fig. 17) with length of scape (excluding radicle): pedicel: funicular segments: clava = 3.0: 1.4: 0.5: 0.5: 0.8: 0.7: 0.7: 0.7: 0.7: 0.7: 2.0; Fl_1 and Fl_2 tubular without multiporous plate sensilla (Fig. 17, insert), subsequent segments increasing in width towards clava; color pattern of scape similar to female but flagellum dark brown. Mesosoma in dorsal view primarily dark brown, the ridges forming sculpture of mesonotum dark but cuticle otherwise more orange-brown; prepectus and tegula white and the following yellowish-brown: lateral surface of pronotum, mesepisternum, acropleuron, and upper mesepimeron dorsally. Mesonotum with strong sculpture, mesoscutum more or less reticulate but axilla obliquely strigose to strigose-cristate posteriorly and scutellum strigose-cristate in concentric circle pattern (Fig. 16); scutellum highly convex with dark brown setae over about anterior third forming inconspicuous setal tuft. Metanotum with dorsellum smooth and shiny, vertical, hemispherical surface behind scutellum; metapleuron bare. Propodeum smooth and shiny, without median carina (Fig. 16). Forewing hyaline; length of cc: mv: pmv: stv = 5.2: 2.0: 3.0: 1.3; costal cell with ventral surface setose but dorsal surface bare except for line of setae near anterior margin; basal cell with dorsal surface setose, but cubital and vannal areas bare; disc with speculum closed posteriorly by two lines of setae on vannal area that extend to level of basal fold (Fig. 18). Front leg with coxa, trochanter, trochantellus and about basal third of femur white, remainder of femur brown; tibia yellowish-white on inner and dorsal surfaces but outer surface brown; tarsus yellowish-white. Middle leg with coxa and all but about apical third of femur white, with trochanter and trochantellus yellowish-brown and apical third of femur dark brown; tibia with

dorsal and apical margins white, otherwise brown; tarsus white except distal segment brownish. Hind leg with coxa brownish basally but white apically; trochanter, trochantellus and femur yellowish-orange except for brown region on outer surface basally and most of inner surface except basally; tibia compressed with dorsal margin white, ventral margin orange and outer and inner surfaces dark brown; tarsus white except distal segment brownish. Gaster dark brown; Gt_1 extending about half length of gaster.

Variation. The holotype is the smallest and lightest-colored female. Other females are about 2.5 mm in length and though the laterally white mesosomal color pattern is constant, many of the yellowish areas of the holotype are darker brown in other females. The interantennal region, lower parascrobal region and lower face are often darker brown with quite a distinct metallic green luster under different angles of light and the vertex is variably extensively dark. The flagellum usually is dark brown with Fl_5 - Fl_8 yellowish-white. The mesonotum is also bicolored in all paratype females, the mesoscutum being dark brown medially between the longitudinal ridges of the lateral lobes but the outer convex portion of the lateral lobes and the scutellar-axillar complex being more orange. The gaster usually is also more extensively dark brown dorsobasally. Paratype females also always have a variably conspicuous though always quite faint brownish region widening posteriorly from the stigma, and often a longitudinal brownish streak on the bare part of the cubital fold extending at most to a level about equal with the base of the marginal vein (Fig. 1). The stigma is also often quite large and subquadrate, and the submarginal vein usually is quite densely setose with the setae scattered in two or more irregular rows (Fig. 1). The apex of the postmarginal vein is often difficult to discern, but the marginal vein appears to be about equal in length or slightly longer than the postmarginal vein (Fig. 1) in all specimens. Larger specimens have more distinct sculpture and often conspicuous dark setae on the vertex, scutellum and legs that contrast distinctly with the whitish to yellowish cuticle. The ovipositor sheaths are variably distinctly tricolored, with about the basal half brownish-white and apical quarter dark brown, the two regions separated by a subapical white band. I consider all the differences among specimens included in the type series as intraspecific variation resulting primarily from size differences.

Remarks. Females of *A. albolata* differ conspicuously from those of *A. narendrani* by color pattern of the mesosoma and by

more subtle features detailed in the descriptions. Males of *A. narendrani* are unknown; they likely resemble *A. albolata* males but probably have the prepectus brown and they may have a different leg color pattern.

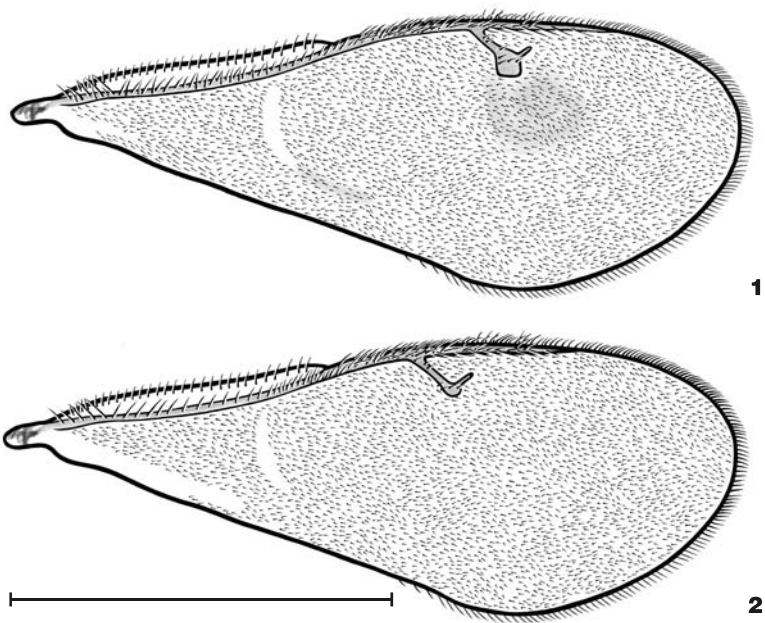
***Australoodera narendrani* n. sp.**

(Figs. 2, 4-6, 8-11*a*, 12, 13)

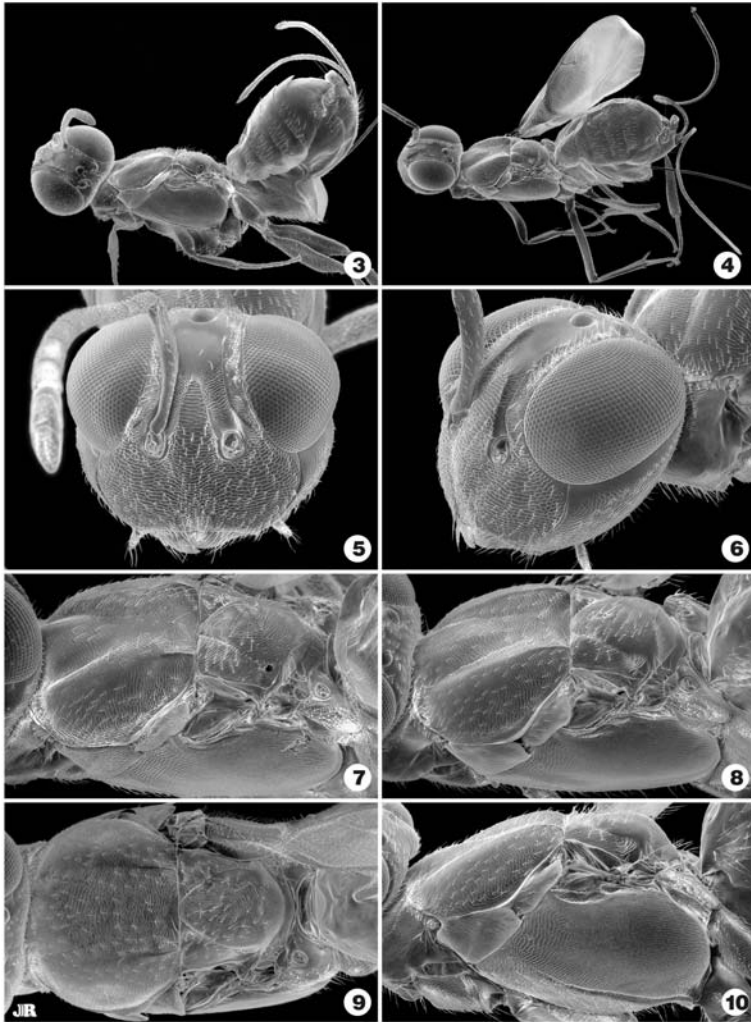
Type material. *Holotype* (♀) — COSTA RICA: Heredia Pr.: La Selva Biol. Sta., 3 km. S. Pto. Viejo, 10E26°N 84E01°W / 16.V.1990, H.A. Hespeneheide, on dead Citrus (CNCI Type No. 22871). *Paratypes* — BRAZIL: Sta. Cat. [Santa Catarina], Nova Teutonia, 29.X.1956, F. Plaumann, B.M. 1957-341 (1♀, BMNH). Rondonia, Fazenda Rancho Grande, 62 km. S. Ariquemes, 165 m., S10,32 W62,48, 12-22.XI.1991, R.M. Fisher (1♀, UCDC). COSTA RICA: 5♀♀ with same data as holotype except one specimen each collected 25.VI.1986 (dead tree), 28.VI.1986 (dead tree), 31.III.1987 (*Ficus* TF) (INBIO), 4.IV.1987 and 11.V.1990 (dead tree trunk); 1♀ (MUCR) with same data as for first label of holotype, but with second label: 3-8.VIII.1992, G. Wright, Malaise Trap, second growth, SOC 1000. TRINIDAD: Simla nr. Arima, 250 m., 25.XI-2.XII.1977, W.R.M. Mason (1♀).

Etymology. Named in honor of Dr. T.C. Narendran in recognition of his 35 years studying chalcid parasitic wasps and his extensive contributions toward the description and resolution of the Indian and Oriental faunas.

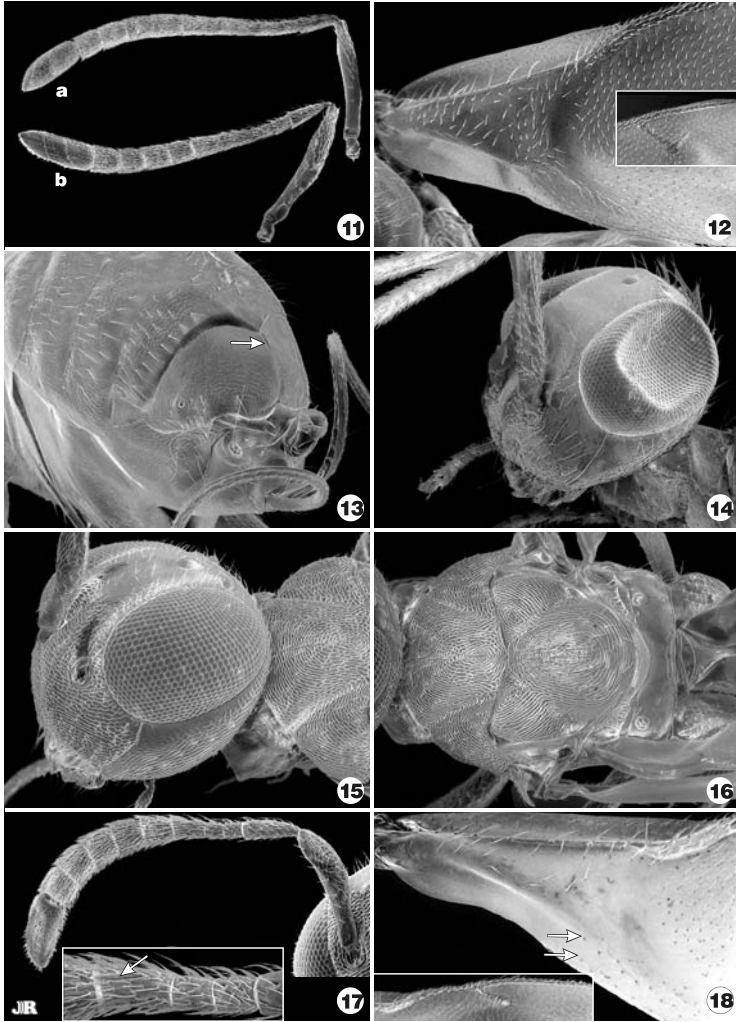
Description. FEMALE. Length of body excluding ovipositor sheaths about 2.5 mm (body contorted). Head (Figs. 5, 6) yellowish-orange except lower parascrobal region slightly darker under some angles of light and with dark band between anterior ocellus and each posterior ocellus; lower face, interantennal region, and lower parascrobal region to level of apex of interantennal region transversely reticulate-imbricate; scrobes finely coriaceous and scrobal channel smooth and shiny; upper parascrobal region and vertex finely coriaceous with scattered setiferous punctures. Eye very sparsely and inconspicuously setose, superficially glabrous. Palpi yellowish-white except apical two segments of maxillary palpus darker brown. Antenna (Fig. 11*a*) with length of scape (excluding radicle): pedicel: funicular segments: clava = 5.7: 1.9: 0.8: 1.2: 1.7: 1.6: 1.3: 1.2: 1.2: 2.9; scape dark brown dorsally and ventrobasally but with longitudinal white stripe on inner and outer



Figs. 1, 2. Forewing (♀): 1, *Australoodera albolata*; 2, *A. narendrani*.



Figs. 3–10. 3 and 4, lateral habitus (♀): 3, *Australoodera albolata*; 4, *A. narendrani*. 5 and 6, *A. narendrani*, head (♀): 5, frontal; 6, frontolateral. 7, *A. albolata*, mesosoma, dorsolateral (♀). 8–10, *A. narendrani*, mesosoma (♀): 8, dorsolateral; 9, dorsal; 10, lateral.



Figs. 11–18. 11, antenna (♀): 11a, *A. narendrani*; 11b, *A. albolata*. 12 and 13, *A. narendrani* (♀): 12, basal half of forewing plus (insert) stigmatal and postmarginal veins; 13, posterior gastral terga (arrow points to mediolongitudinal sulcus on Gt_6). 14, *Reikosiella quilonica*, head (♀). 15–18, *A. albolata* (♂): 15, head, frontolateral; 16, mesosoma, dorsal; 17, antenna plus (insert) apex of pedicel to base of Fl_4 (mps = multiporous plate sensilla); 18, basal half of forewing (arrows point to lines of setae closing speculum) plus (insert) marginal, stigmatal and postmarginal veins.

surfaces, the stripes merging apically on ventral surface; pedicel dark brown; flagellum dark brown with Fl₅-Fl₈ yellowish-orange. Mesosoma yellowish-orange except medial concave portion of mesoscutum, scutellum medially, and mesepisternum ventrally between transepisternal sulci brown. Mesonotum distinctly coriaceous with orange-brown setae not distinctly contrasting with color of cuticle; scutellar-axillar complex low convex, with fine coriaceous sculpture forming concentric circle pattern and with hairlike setae (Figs. 8, 9). Forewing hyaline; length of cc: mv: pmv: stv = 10: 4.4: 6.5: 2.1; submarginal vein with single row of setae in straight line basal to more densely setose parastigma; stigma with posterior margin convex but not distinctly capitate (Figs. 2, 12); disc with lunate bare region beyond basal cell; cubital and vannal areas bare except apically (Fig. 2). Legs orange-brown with setae not contrasting with cuticular color; mesotibia with stronger spines apically but without distinct pegs. Gaster orange-brown; terga very finely and inconspicuously coriaceous; Gt₅ angulate posteromedially (Fig. 13); structure of Gt₆ not visible because concealed under Gt₅ (in one paratype with Gt₆ exposed a fine medial suture is visible over about its basal half, Fig. 13). Ovipositor sheaths distinctly tricolored, about basal 0.7 yellowish-brown and with subapical whitish band slightly shorter than apical brown band; sheaths curved above gaster, about equal in length to combined length of mesosoma and gaster.

Male. Unknown.

Variation. Some females have only a dark spot adjacent to each ocellus, Fl₅ brown rather than yellowish-orange or Fl₄ and sometimes Fl₃ only slightly darker than Fl₅-Fl₈, and the mesosoma and gaster almost uniformly orange. Color pattern of the ovipositor sheaths is also variable, particularly how distinct is the subbasal white band and its relative length, which varies from slightly longer to shorter than the apical brown band. The postmarginal vein is always distinctly longer than the marginal vein and the cubital and vannal areas are bare over at least their basal half. One female from Brazil and the single female from Trinidad have the ovipositor sheaths looped (Fig. 4) rather than upcurved (*cf.* Fig. 3). These two specimens appear to have been critical-point dried rather than air dried and the difference may result from the different method of preservation.

Key to females of described world species

- 1. Flagellum dark; head with face entirely reticulate; forewing infusate between about base of parastigma and apex of postmarginal vein except for more hyaline band behind about apical half of marginal vein, but hyaline region with dark setae *A. bicinctiplum* (Girault)
- Flagellum partly light colored; head with scrobal channel and parascrobal region above level of apex of interantennal region smooth and shiny or at most very finely and inconspicuously coriaceous, much smoother than lower face (Figs. 5, 6); forewing color pattern varied, but if similar to above then hyaline region behind marginal vein with white setae 2
- 2(1) Forewing with basal cell bare, with marginal vein only slightly shorter than length of costal cell and at least 2.5 times as long as postmarginal vein, and with disc conspicuously infusate from about base of parastigma to apex of postmarginal vein except for hyaline cross-band having white setae behind marginal vein, the band narrowed toward middle where very narrow or with a few dark setae; prepectus vertically striate and white in contrast to color of acropleuron; mesotibia with obliquely angled medial white streak bordered above and below by brown mark; funicle dark apically, with Fl₈ and usually Fl₇ brown compared to white Fl₄-Fl₇ *A. varicornis* Girault
- Forewing with basal cell setose (Fig. 12), with marginal vein at most about 0.5 length of costal cell and subequal in length or shorter than postmarginal vein, and with disc hyaline or at most with very faint, small infusate regions and without white setae (Figs. 1, 2); prepectus reticulate (Fig. 10) and if white then same color as acropleuron; mesotibia uniformly yellowish to orange; funicle white apically, with at least Fl₆-Fl₈ light colored 3
- 3(2) Mesosoma yellowish to dark brown dorsally and ventrally, but sides white *A. albolata* Gibson
- Mesosoma yellowish-orange though venter and dorsum usually somewhat darker brown *A. narendrani* Gibson

Remarks:

A revision of the world species of *Australoodera* is required prior to proposing rigorous hypotheses of species relationships, but the similar color pattern of the funicle and very similar structure and sculpture of *A. albolata* and *A. narendrani* females suggest these are sister species. Females of *A. bicinctipilum* resemble *A. albolata* and *A. narendrani* because they have a setose basal cell, long postmarginal vein, and a reticulate prepectus similar in color to the acropleuron, but differ from the two New World species in several features other than those given in the key. These features include a yellowish-brown to dark brown body color pattern and a distinctly reticulate mesonotum having slight metallic luster under some angles of light. The comparatively long marginal and short postmarginal vein as well as some or all of the other features given in the key to differentiate *A. varicornis* are characteristic of females of several species known from throughout the Old World. The given combination of features is sufficient to differentiate females of *A. varicornis* from other known Australian species, but a revision is required to establish species limits relative to similar females seen from other areas.

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