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Andesipolis, a puzzling new genus of cyclostome Braconidae (Hymenoptera) from the Chilean Andes, with descriptions of three new species

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ABSTRACT

A new genus of braconid wasp, *Andesipolis* Whitfield & Choi, n. g., is described from the Andean region of Chile. It clearly belongs to the cyclostome lineage of Braconidae but otherwise is difficult to assign definitively to tribe or subfamily, as it has some morphological features typical of Rhysipolini, others typical of Rhyssalini, and a few unique features. Three species, *A. whartoni* n. sp., *A. masoni*, n. sp. and *A. framea* n. sp. are described to represent the range of morphological variation encompassed by the new generic concept; other species are known to exist in collections but await a full-scale revision of this locally abundant genus.

Key words: parasitoids, Rhyipolini, Rhyssalini, Hormiini

INTRODUCTION

The cyclostome braconid wasps loosely known as "Hormiinae" and Exothecinae" have long posed problems for classification (Hedquist , 1963; Shaw, 1983; Belokobylskij, 1984; Whitfield & Achterberg, 1987; Whitfield, 1988, 1992; Shaw and Huddleston, 1991; Belokobylskij 1992, 1993a, b; Quicke, 1993; Wharton, 1993; Achterberg, 1995; Whitfield & Wharton, 1997; Quicke and Belshaw, 1999; Spencer & Whitfield, 1999; Scatolini *et al*., 2002). Three large subfamilies (Braconinae, Doryctinae and Rogadinae), as well as several smaller ones, are clearly closely related to the hormiine and exothecine genera, yet the subfamilies are currently defined in such a way as to exclude these genera. "Hormiines" and "exothecines" are thus often assigned to small subfamilies or tribes of their own with varying composition. It is likely that a complete overhaul of the cyclostome groups will be required to produce a more stable and accurate long-term subfamily- and tribal-level classification, most likely with fewer subfamilies than are currently recognized, and

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more structure at the tribal level. The problem is discussed in more detail elsewhere (especially Whitfield, 1992; Wharton, 1993; Belokobylskij, 1992, 1993a, b; Achterberg, 1995; Whitfield & Wharton, 1997; Wharton, 2000), but seems to be exemplified by the new genus we describe below from South America.

For several decades, the existence of this unusual genus in the Andean region of Chile has been known to braconid systematists. The late W. R. M. Mason had planned to revise the new group based on the material in the Canadian National Insect Collection, but his tragic death in late 1991 ended this plan. Nevertheless, his abortive efforts on the group provided subsequent workers with partially sorted specimens and some notes as to significant characters for recognizing the new genus. During preparations for the identification manual to the New World genera of Braconidae (Wharton *et al.*, 1997), Masons specimens were placed in the key to "hormiine" genera (Whitfield & Wharton, 1997), tentatively as "undescribed genus 2". Since neither Whitfield nor Wharton were able to describe the genus before the manual itself appeared, the "undescribed genus 2" retained this name in the manual. We proceed to provide a formal description for this genus below, and describe three species to provide an indication of the morphological variation to be found within it. We are already aware of additional undescribed species represented by single specimens or short series or males only; it is also likely that a number of specimens of this genus can be found in other collections, probably misplaced. Perhaps the description of this genus will encourage a full revision of the genus and groups related to it in the near future. We acknowledge the contributions of Bob Wharton and the late Bill Mason to our recognition of the uniqueness of this new taxon.

MATERIALS AND METHODS

All the specimens for this study were assembled from the material assembled by W. R. M. Mason at the Canadian National Collection in Ottawa (CNC). Terms for wing venation and general morphology follow Sharkey & Wharton (1997). Specimens for scanning electron microscopy were dried under room conditions, and mounted on carbon-based SEM stubs. Specimens were coated in a Denton Desk II TSC turbo-pumped sputter coater with 40 nm of gold/palladium for 90 seconds and examined under a Philips XL30 field emission environmental scanning electron microscope with Hi-Vac mode. Specimens for environmental scanning electron microscopy were left mounted on card-points and examined uncoated under the same electron microscope using "wet mode".

DESCRIPTIVE TAXONOMY

Key to females of the genus *Andesipolis*

(Note: the species appear to be somewhat sexually dimorphic in metasomal and propodeal sculpturing and shape, as well as minor aspects of wing venation, and are difficult to associate unless series are obtained from the same time and place. Thus we have not attempted to place the males, but illustrations of one species (quite possibly males of *A. masoni* based on collection data) are shown in Figs. 10–13.

1. Ovipositor straight (Fig. 9, 22); propodeal areola present (Fig. 7, 21); hind tarsal claw simple (Fig. 8) 2
- Ovipositor curved upward (Fig. 14); propodeal areola absent (Fig. 15); hind tarsal claw with prominent basal lobe (Fig.19).....*A. whartoni* n. sp
2. Forewing maculate (Fig. 3); stigma broadly rounded, 2.4X longer than broad (Fig. 3); ovipositor 1.0 1.2X as long as hind tibia (Fig. 22) ..... *A. framea* n. sp.
- Forewing hyaline (Fig. 1); stigma elongate, 4.2X longer than broad (Fig. 1); ovipositor 0.8 0.9X as long as hind tibia (Fig. 9) ..... *A. masoni* n. sp.

Andesipolis Whitfield & Choi, New Genus

Type species: *Andesipolis masoni* Choi & Suh, n. sp. (described below).

Etymology: The generic name comes from the superficial resemblance to *Rhysipolis*, and from the Andean distribution of the genus.

Diagnosis: Antennae 27–34 segmented, slightly longer than fore wing (Fig. 26). Malar suture present (Fig.18, 23). Ocelli in equilateral triangle, occipital carina complete, remaining separate from hypostomal carina to mandibular base (Fig. 12, 23). Maxillary palps 6 (sometimes appearing7)-segmented; labial palps 3-segmented. Pronope absent. Notauli short, covering only anterior part of mesonotum (Fig 6, 13, 14), shallow and narrowly elliptical midpit present (Fig 6, 13, 14). Epicnemial carina present (Fig. 5, 16, 20). Sternaulus present as a short groove on the posterior portion of mesopleuron (Fig. 5, 16, 20. Fore wing 2a vein present (Fig. 1- 3). Hind tibia without a fringe (comb) of spines on inner side of apex, or with a very poorly developed group of spines. Propodeum with (Figs. 7, 13, 21) or without (Fig. 15) well-defined areola, but when well-defined, usually elongate with a transverse carina dividing it into anterior and posterior portions. First tergite with distinct dorsope; dorsal carinae converging posteriorly (Fig. 7, 11, 15, 21). Ovipositor sheaths long and setose (Fig. 9, 17, 22).

Distribution: Chile (Neotropical).

Biology: Unknown.

Comments: The new genus superficially resembles some species of *Rhysipolis* Förster in habitus (hence the name we have given it), and in addition in many details of the

mesopleuron, wing venation and metasomal tergites. Unlike *Rhysipolis*, the forewing (Figs. 1-3) has a distinctly visible vein 2a (not common within Braconidae yet found more basally within Hymenoptera). In addition the mesonotum has a longitudinal posterior groove as in many Hormiini and Rhyssalini (perhaps represented in an often less well-demarcated form in *Pseudorhysipolis* Scatilini, Penteado-Dias and Achterberg), while the propodeum has a "double areola" pattern of carinae resembling especially Rhyssalini (figs. 7, 13, 21). The latter character has been proposed as likely to be plesiomorphic within Braconidae (Whitfield, 1988); some Rhysipolini also have a double areola, but of a different form (Spencer & Whitfield, 1999). Unlike typical Hormiini and Rhyssalini vein m-cu meets RS + M before RS splits from M (in this respect resembling *Rhysipolis*, Exothecini and Rogadinae). Thus, the new genus *Andesipolis* has a unique combination of features that make it difficult to place to tribe or subfamily. This difficulty is largely due to the tribes and subfamilies not being very well defined in the first place. Its biology is unknown, but the typically long ovipositor (Figs. 9, 17, 22) resembles that of groups that attack hosts within shelters of leaf (*Rhysipolis* Shaw, 1983; Whitfield, 1992; Spencer & Whitfield, 1999) or stem tissue (Doryctine- Marsh, 1997, or plant galls (Hydrangeocolini Oda et al., 2001; Belshaw et al., 2003).

***Andesipolis masoni* Choi & Suh, n. sp.** (Fig. 1, 4–9)

Female. Body length 2.6–2.9 mm; forewing length 3.5 mm.

Head 1.1–1.2X wider than mesoscutum. Face 1.6X as broad at midheight as long medially, smooth and polished with scattered setae. Clypeus 2.6X as broad as its height. Malar space 0.4X eye height in frontal view. Eyes 1.2–1.3X higher than width; eyes 1.6–1.8X longer than temple in lateral view. Vertex smooth and polished, with scattered setae. Occipital and hypostomal carinae remaining separate to mandibular base. Antennae slightly longer than forewing; 27–29 segmented. Maxillary and labial palps 6 and 3-segmented respectively.

Mesosoma 1.8 1.9X longer than high; 2.2–2.3X longer than width between tegulae. Pronotum rugose dorsally; mostly polished laterally. Mesonotum weakly punctate with scattered setae; Notauli short, presenting only anterior one-third of mesonotum; midpit shallow and long, 0.4 0.6X as long as mesonotum. Scutellum 1.2X as long as width, smooth to weakly punctate and polished; scutellar sulcus 0.3X as long as width. Propodeum with roughly pentagonal shape areola and distinct areolar cross-bridge with irregular ridges arising inside of areola; median carina present; with irregular ridges around median carina and transverse carinae; polished anterior-laterally. Hind coxa 2.0X as long as width, slightly shorter than first abdominal tergum, smooth and polished; hind tibial spur short, 0.24X as long as basitarsus; hind tarsal claw simple.

Wing Forewing: Stigma about 4.3X longer than broad; vein r arising from middle of

stigma; Vein r 0.5X as long as vein 3RSa. Vein 2RS 0.8X as long as vein 3RSa. Vein 3RSa 0.5X as long as vein 3RSb. Vein r-m spectral, 0.6X as long as vein 3RSa. Vein 1CUb 1.9X as long as vein 1CUa. Vein (RS+M)b present, short and spectral. Vein 1-1AC 0.4X as long as vein 2-1A. Hindwing: Vein M+CU 1.9X as long as vein 1M. Vein cu-a 0.5X as long as vein 1M, slightly curved. Vein r-m 0.6X as long as vein 1M.

Metasoma Length of tergite I 0.8X its apical width, distinctly sclerotized, reticulate-rugose except granulate posterior-dorsolateral portion; dorsal carinae converging but not jointed; dorsope rather large and deep. Tergite II and III smooth to granulate and polished, tergite II 1.9X as long as tergite III. Hypopigium small. Ovipositor 0.8–0.9X shorter than hind tibia, straight; ovipositor sheath 0.6X shorter than ovipositor.

Color Body generally orange-brown or brown; maxillary and labial palps pale yellow; antenna brown; mesosoma yellowish brown except brown scutellar sulcus; propodeum brown; legs orange-brown to brown.

Male Unknown.

Biology Unknown.

Diagnosis This species can be distinguished from other *Andesipolis* species by the relatively short and straight ovipositor (the ovipositor is always shorter than the hind tibia).

Material examined. Holotype. Female: Chile: Carelmapu, Llonquihue, 21–28.ii.1957, L. E. Pena (CNC) Paratypes: 1 female, Chile: Pucotrihue, Valdivia, 11–13.iii.1955, L. E. Pena (CNC); 1 female, Chepu, I. De Chiloé, 3.ii.1952, Peña (CNC).

Etymology. This species is named for the late W.R. M. Mason, who contributed a great deal to this work, as detailed above.

***Andesipolis whartoni*, Whitfield & Choi, n. sp. (Fig. 2, 14–19, 26)**

Female Body length 2.8–2.9 mm; forewing length 4.0–4.1 mm.

Head 1.0–1.1X wider than mesoscutum. Face 1.5–1.7X as broad at midheight as long medially, smooth and polished with scattered setae. Clypeus 2.1–3.0X as broad as its height. Malar space 0.3–0.4X eye height in frontal view. Eye 1.4X higher than width; eye 1.5X longer than temple in lateral view. Vertex smooth and polished with scattered setae. Occipital and hypostomal carinae remaining separate to mandibular base. Antennae slightly longer than forewing; 33–34 segmented; first flagellomere about 6.0X longer than mid-width. Maxillary palps 6-segmented; labial palps 3-segmented.

Mesosoma 1.5X longer than high; 2.1–2.2X longer than width between tegulae. Pronotum small; rugose dorsally; largely polished laterally except weakly rugulose anterior portion. Mesonotum weakly punctate with scattered setae; notauli short and shallow, presenting only anterior half of mesonotum; midpit shallow and narrowly elliptical, 0.4X as long as mesonotum. Scutellum 1.1–1.2X as long as width, smooth to weakly punctate and polished; scutellar sulcus 0.4X as long as width, with one longitudinal carina. Mesopleuron mostly smooth and polished. Propodeum with weak but distinct irregular

median carina; without distinct areola; mostly polished, smooth to granulate. Hind coxa 2.0X as long as width, smooth to granulate, 1.0X as long as tergite I; hind femur 4.6X as long as width; hind tibia 10.3X as long as width; hind tibial spur short, 0.26X as long as basitarsus; hind tarsal claw with prominent basal lobe.

Wings Forewing: Stigma 4.2X longer than broad. Vein r arising from middle of stigma; vein r 0.5–0.6X as long as vein 3RSa. Vein 2RS 1.0–11X as long as vein 3RSa. Vein 3RSa 0.4X as long as vein 3RSb. Vein 3RSa 1.5X as long as vein r-m. Vein 1Cub 2.2X as long as vein 1CUa. Vein (RS+M)b present. Vein 1-1AC 0.4X as long as vein 2-1A. Hindwing: Vein M+CU 1.9–2.0X as long as vein 1M. Vein cu-a 0.7X as long as vein 1M, slightly curved. Vein r-m 0.5X as long as vein 1M.

Metasoma Length of tergite I 1.1X its apical width, sclerotized, striate-rugose except smooth to granulate posterior-lateral margin; dorsal carina converging and jointed; dorsope rather large and deep. Tergite II and III smooth and polished, tergite II 1.2X as long as tergite III. Hypopigium small. Ovipositor 2.0X longer than hind tibia, curved upward; ovipositor sheath 0.7X shorter than ovipositor.

Color Body generally brown; legs orange-yellow; maxillary palps, labial palps, lateral pronotum, scutellum and mesopleuron orange-brown except slightly darker apex of tibia and tarsus; metasoma orange-brown except brown tergite I; ovipositor sheath dark brown.

Male Unknown.

Biology Unknown.

Diagnosis This species differs from *Andesipolis masoni* and *A. framea* due to the long and curved ovipositor and the indistinct areola on the propodeum.

Material examined. Holotype. Female: Chile: Pichinahuel, Cord, Nahuelbuta Arauco, 12.ii.1953, 11–1400m, L. Peña (CNC). Paratypes. 3 females, same data as holotype (CNC).

Etymology This species is named for R. A. Wharton, who originally planned to describe this genus and helped characterize it.

Andesipolis framea Whitfield & Choi, n. sp. (Fig. 3, 20–25)

Female. Body length 2.2–2.9 mm; forewing length 3.0–3.9 mm.

Head 1.1X wider than mesoscutum. Face 1.9X as broad at midheight as long medially, smooth and polished with scattered setae. Clypeus 2.4X as broad as its height. Malar space 0.4X eye height in frontal view. Eyes 1.2–1.3X higher than width; eyes 1.7–1.8X longer than temple in lateral view. Vertex smooth and polished with scattered setae. Occipital and hypostomal carinae remaining separate to mandibular base. Antennae slightly longer than forewing; 27–30 segmented. Maxillary and labial palps 6 and 3- segmented respectively.

Mesosoma 1.8 1.9X longer than high. Pronotum rugose dorsally; mostly polished laterally. Mesonotum 0.9X longer than width between tegulae, weakly punctate with scat-

tered setae; notauli short, presenting only anterior one-third of mesonotum; midpit shallow and long, 0.5X as long as mesonotum. Scutellum 1.1X as long as width, smooth and polished; scutellar sulcus 0.3X as long as width. Propodeum with roughly pentagonal shape areola and distinct areolar cross-bridge with irregular ridges arising inside of areola; median carina present; with short irregular ridges around median carina and transverse carinae; polished anterior-laterally. Hind coxa 1.6X as long as width, slightly shorter than first abdominal tergum, smooth and polished; hind tibial spur short, 0.3X as long as basitarsus; hind tarsal claw simple.

Wing Forewing: Stigma about 2.4X longer than broad; vein r arising from middle of stigma; Vein r 0.4X as long as vein 3RSa. Vein 2RS 0.9X as long as vein 3RSa. Vein 3RSa 0.4X as long as vein 3RSb. Vein r-m spectral, 0.5X as long as vein 3RSa. Vein 1CUb 2.0X as long as vein 1CUa. Vein (RS+M)b present, short and spectral. Vein 1-1AC 0.4X as long as vein 2-1A. Hindwing: Vein M+CU 1.9X as long as vein 1M. Vein cu-a 0.5X as long as vein 1M, slightly curved. Vein r-m 0.6X as long as vein 1M.

Metasoma Length of tergite I 1.1X its apical width, distinctly sclerotized, strongly convex dorsally, reticulate-rugose to striate; dorsal carinae converging but not jointed; dorsope rather large and deep. Tergite II and III smooth to granulate and polished, tergite II 1.6X as long as tergite III. Hypopigium small. Ovipositor 1.0–1.2X longer than hind tibia, straight; ovipositor sheath 0.5 0.6X shorter than ovipositor.

Color Body generally brown to dark brown; maxillary and labial palps pale yellow; antenna brown except dark brown scape and pedicel; mesonotum brown except dark brown notauli; scutellum, metanotum, propodeum, tergite I, anterior 1/3 of tergite II, Tergite IV to VIII, and ovipositor sheath dark brown; legs generally yellowish brown; hind tibia pale yellow except dark brown apex.

Male Unknown.

Biology Unknown.

Diagnosis This species is similar to *Andesipolis masoni* in its straight ovipositor and presence of pentagonal areola and distinct areolar cross-bridge (forming a “double areola”) on the propodeum, but differs from *A. masoni* in its relatively longer ovipositor and maculate forewing.

Material examined. Holotype female: Chile: Carelmapu, Llonquihue, 21–28.ii.1957, L. E. Pena (CNC). Paratype: 4 females, same data as holotype (CNC).

Etymology. “Framea” is a little-known Latin word that refers to long spears carried by the Germans of their day. We use this name in reference to the spearlike ovipositor.

ACKNOWLEDGMENTS

This study owes a great deal to earlier efforts by the late W. R. M. Mason of the Canadian National Insect Collection, and by the fortunately still very much alive Bob Wharton of Texas A&M University, to make some taxonomic sense out of these unusual animals. Two

of the species are named after, and dedicated to, them. Sydney Cameron (University of Illinois) suggested the genus name. Although this manuscript was finished some years after the grant finished, the support of NSF grant DEB9300517, which supported production of the identification manual to the New World braconid genera, really made this study possible, and prompted the original examination of the material accumulated by Mason. We thank Scott Robinson, of the Imaging Technology Group, Beckman Institute, University of Illinois, for aid in producing the SEM and ESEM photos.

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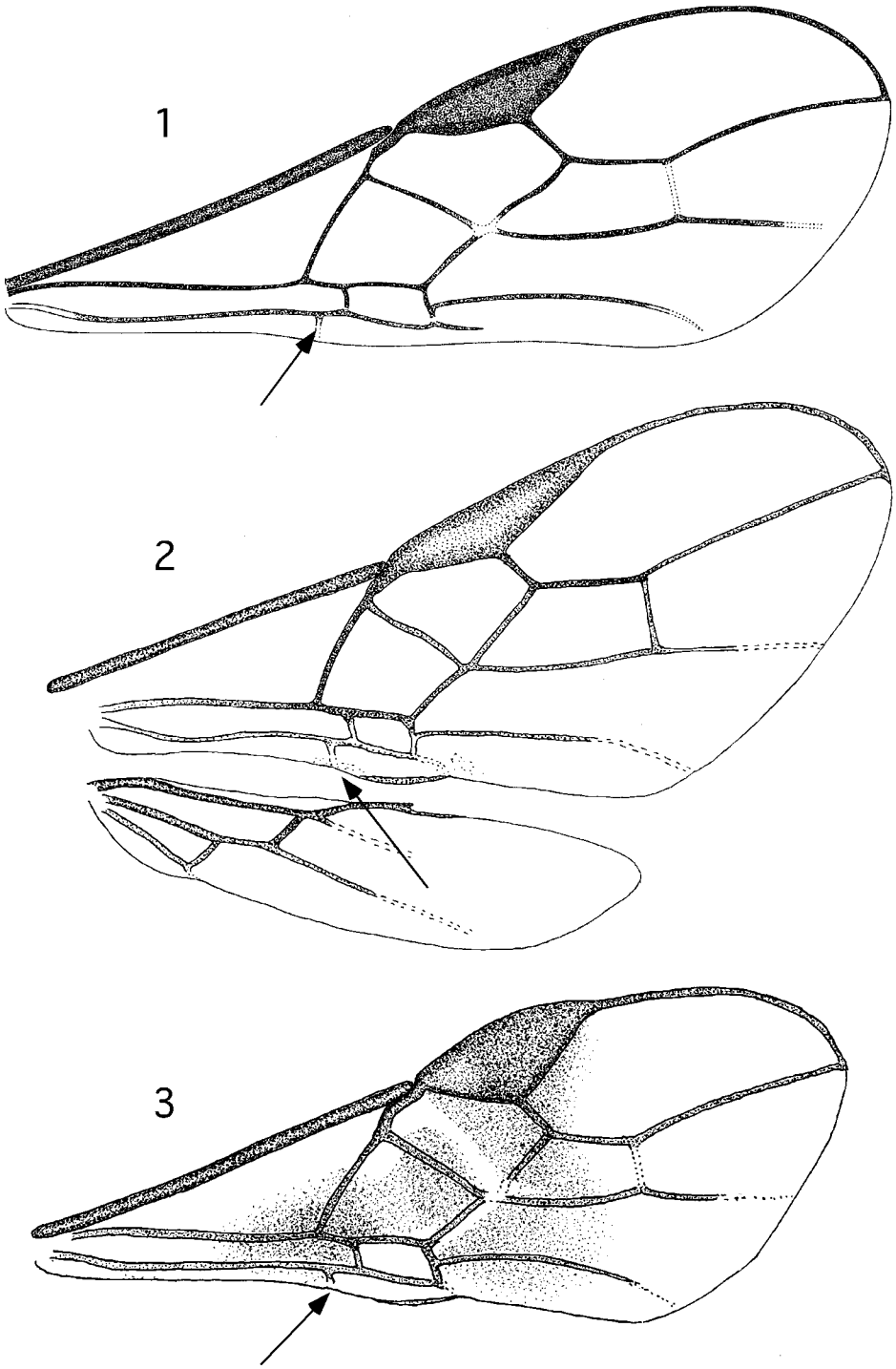
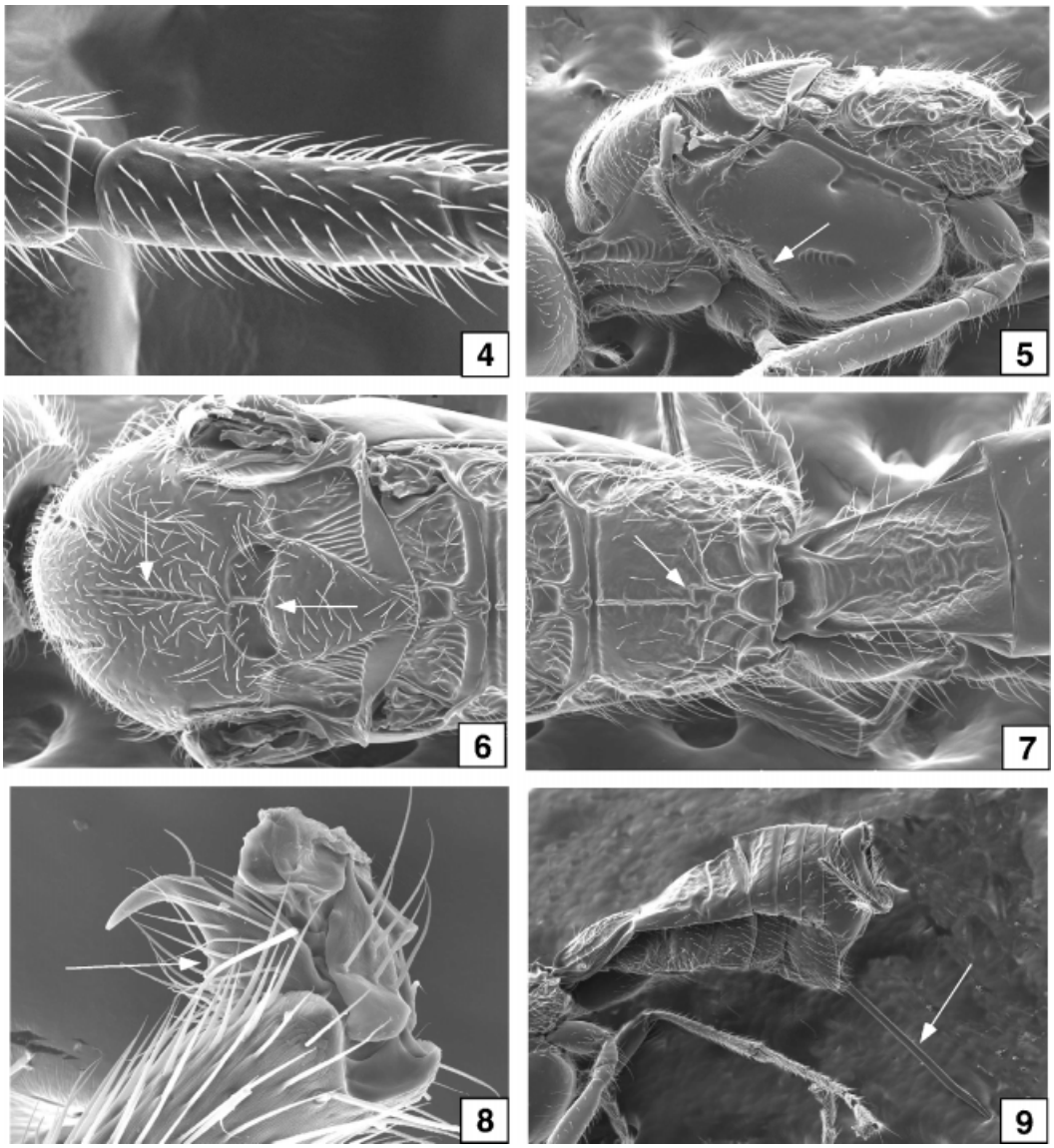
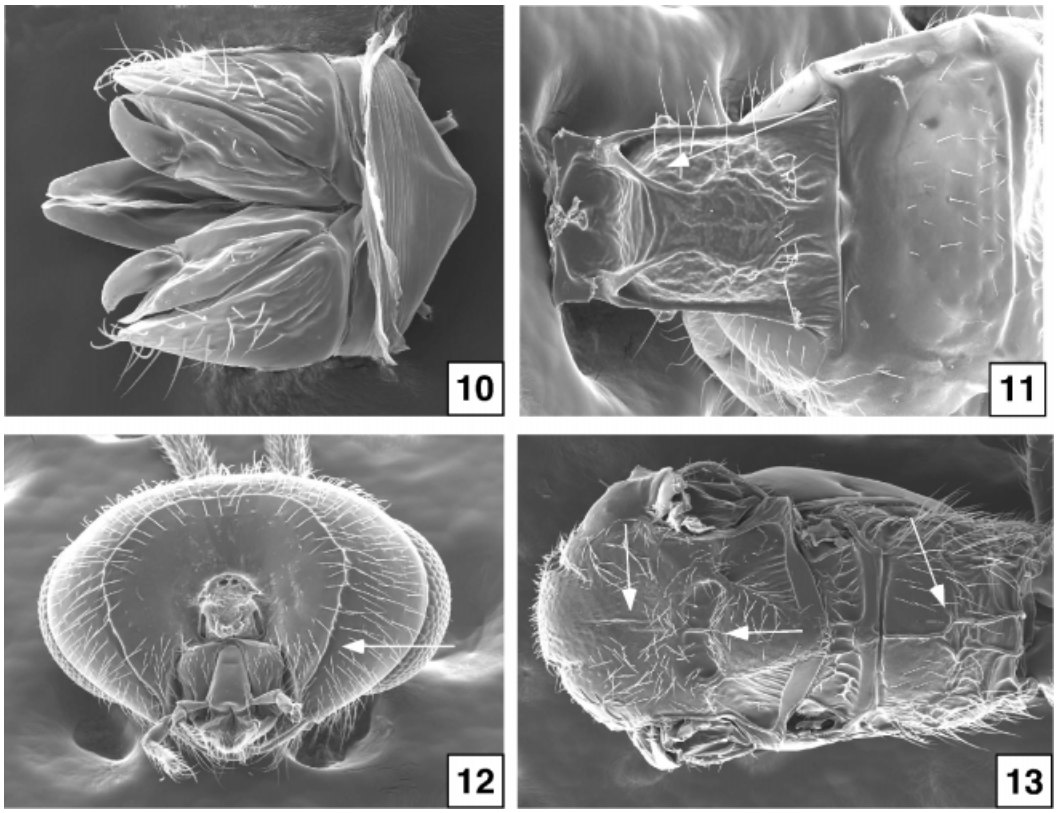


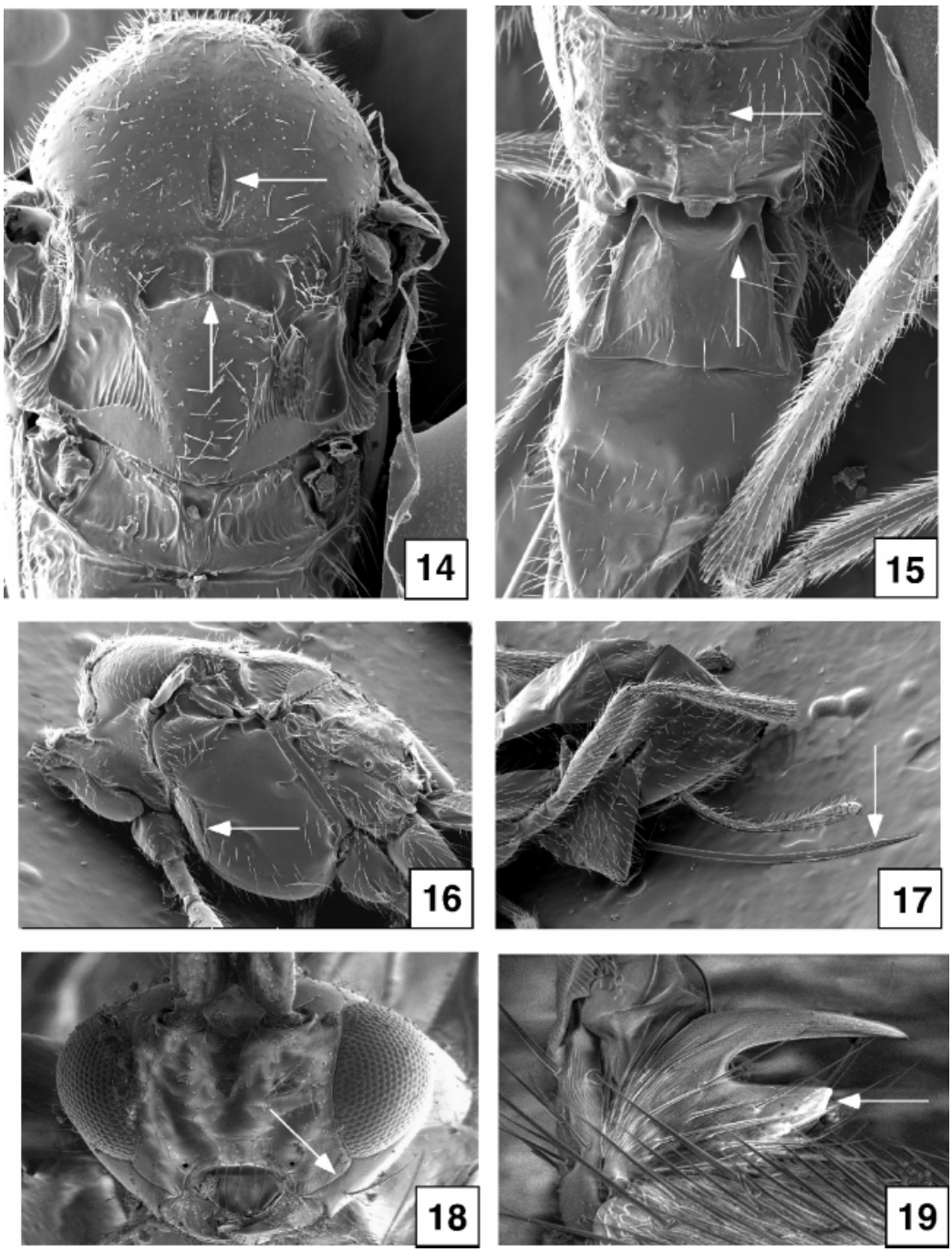
FIGURES 1–3. 1: *Andesipolis masoni* Whitfield and Choi, n. sp., fore wing. 2: *A. whartoni* Whitfield and Choi, n. sp., fore and hind wing. 3: *A. framea* Whitfield and Choi, n. sp., fore wing. Unusual anal vein indicated by arrow.



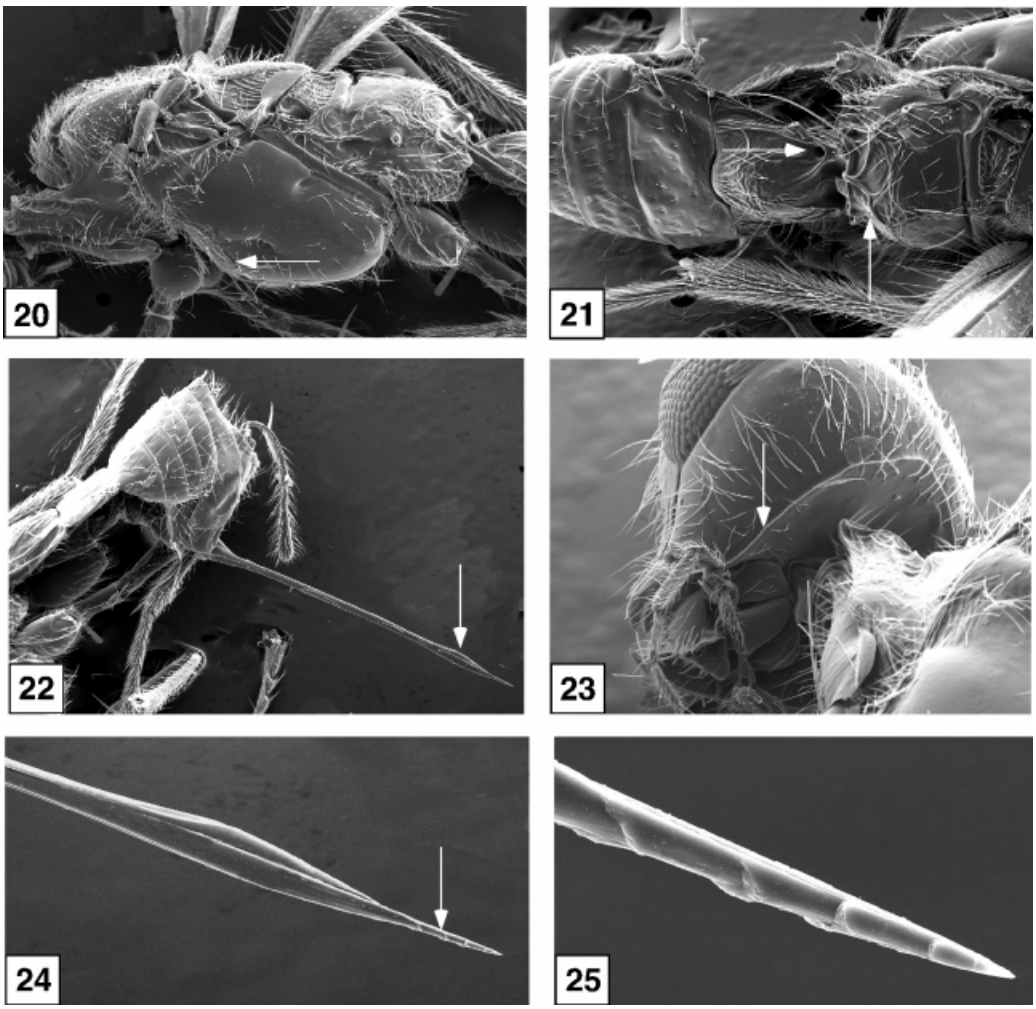
FIGURES 4–9. *A. masoni*, n. sp. 4: third antennal segment, dorsal view. 5: mesosoma, lateral view, with epicnemial carina indicated by arrow. 6: mesoscutum through metanotum, dorsal view, with mesonotal midpit and sutoscutellar scrobe indicated by arrows. 7: propodeum and anterior metasomal tergites, dorsal view, with obsolescent anterior portions of propodeal areola indicated by arrows. 8: hind tarsal claw, simple type indicated by arrow. 9: metasoma and ovipositor mechanism, lateral view, with straight ovipositor highlighted by arrow.



FIGURES 10–13. *A.* sp., male. 10: genitalia capsule, ventral view. 11: metasoma, dorsal view, with distinct dorsope and dorsal carinae indicated by arrow. 12: head, posterior view, complete occipital carinae indicated by arrow. 13: mesosoma through propodeum, dorsal view, with mesonotal midpit, sutoscutellar scrobe and pentagonal propodeal areola indicated by arrows.



FIGURES 14–19. *A. whartoni*, n. sp. 14: mesoscutum through metanotum, dorsal view, with mesonotal midpit and sutoscutellar scrobe indicated by arrows. 15: propodeum and anterior metasomal tergites, dorsal view, with obsolescent anterior portions of propodeal areola and dorsal carina of first metasomal tergite indicated by arrows. 16: mesosoma, lateral view, with epicnemial carina indicated by arrow. 17: metasoma and ovipositor mechanism, lateral view, with upturned ovipositor highlighted by arrow. 18: head, anterior view, with strong malar suture indicated by arrow. 19: hind tarsal claw, with prominent basal lobe indicated by arrow.



FIGURES 20–25. *A. framea*, n. sp. 20: mesosoma, lateral view, with epicnemial carina indicated by arrow. 21: propodeum and anterior metasomal tergites, nearly dorsal view, with areolar "cross-bridge" indicated by arrow. 22: metasoma and ovipositor mechanism, lateral view, with straight ovipositor highlighted by arrow. 23: Head, posterolateral view, showing occipital carina meeting mandibular socket without meeting any obvious hypostomal carina. 24: close-up of ovipositor tip. 25: even closer-up of ovipositor tip.

FIGURE 26. Lateral habitus photo of *A. whartoni*, n. sp.

