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The circumscription of the generic concept of *Aximopsis* Ashmead (Hymenoptera: Chalcidoidea: Eurytomidae) with the description of seven new species

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Abstract

The genus *Aximopsis* is redefined, an hypothesis of its phylogenetic placement within Eurytominae is presented, and seven species are described as new: *A. anubis* Gates, *A. arietinis* Gates, *A. hespenheidei* Gates, *A. hippolytis* Gates, *A. lanceolepis* Gates, *A. pythmenis* Gates, and *A. vogti* Gates. Three new combinations are proposed: *Philolema javensis* (Girault), 1917, **n. comb**., *Philolema tephrosiae* Girault, 1917, **n. comb**., and *Eurytoma tricolor* **n. comb**. *Aximopsis elegans* Masi (1917) is placed *incertae sedis*. *Aximopsis ovi* Girault and *A. tumidiscapi* Girault are *nomina nuda*.

Key words: *Aximopsis*, Chalcidoidea, Eurytomidae, systematics, leafminers, Buprestidae

Introduction

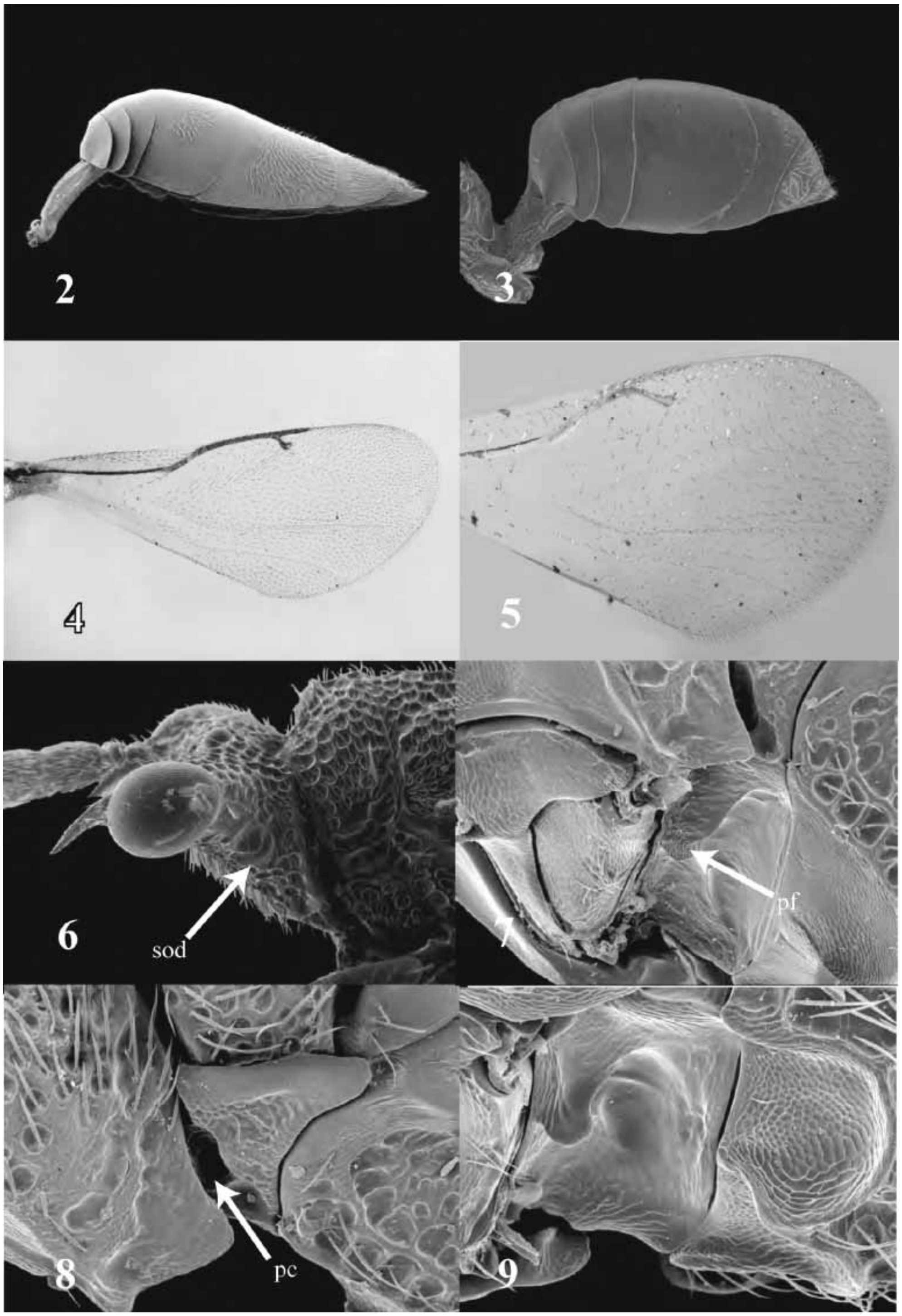
This is the second in a series of papers in which we describe new chalcidoid taxa from the Nearctic and Neotropical regions collected by George B. Vogt. Vogt was an avid student of the biology of leaf-mining Coleoptera and leaf-rolling attelabids (Anderson et al. 1991). He traveled extensively from 1960 until his death in 1991 in the area between the eastern United States and Panama and to Brazil, amassing a collection of thousands of rearing records from a variety of host plants. Vogt was described as being eccentric in his record keeping (Anderson et al. 1991) and he left behind a trail of cryptic notes, but organizational failings aside, his insect collection and associated writings represent a heretofore untapped wealth of biological information, particularly for poorly known insect groups from the Neotropics such as the genus *Aximopsis* Ashmead, 1904.

The genus *Aximopsis* (Fig. 1) was based on a single species, *Aximopsis morio* Ashmead, 1904, described from a single female from Santarem, Brazil that Ashmead found in the H. H. Smith collection. Ashmead named the genus for its assumed tribal relationship with *Axima* Walker, 1862 (-*opsis* = like), but he proposed a new genus for the species based mainly on the difference in the shape of the gaster, elongate and tapered in *Axima* versus shorter and truncate apically in *Aximopsis* (Figs. 2, 3), and the much shorter marginal vein relative to the stigmal vein (Figs. 4, 5). Additional species subsequently described in *Aximopsis* belong in related genera or are *nomina nuda* (see below). Apparently, these species were originally described without reference to the type species, *A. morio* Ashmead. *Philolema javensis* (Girault 1917), **n. comb**., *Philolema tephrosiae* (Girault 1917), **n. comb**., and *Eurytoma tricolor* **(**Girault 1913), **n. comb**., are proposed as new combinations. *Aximopsis ovi* Girault and *A. tumidiscapi* Girault previously have been reported as *nomina nuda* (Farooqi & Subba Rao 1986; Noyes 2003). The type of the final species, *Aximopsis elegans* Masi 1917, was lost and is considered *incertae sedis* (see below).

A hypothesis for the synapomorphies that support *Aximopsis* has never been proposed. Ashmead compared *Aximopsis* to *Axima*, as indicated above, but features purported to define *Aximopsis*, such as marginal vein length hardly twice stigmal vein and the nonlanceolate abdomen, are not unique to *Aximopsis*. Previous authors (Girault 1913, 1917; Masi 1917) apparently placed new species in *Aximopsis* based on reference to Ashmead's original description as they made no mention of having examined the type species for comparative purposes. Ashmead's 1904 publication served as the basis for the tribal name Aximini, containing *Axima* and *Aximopsis*, but the only characters offered to support this taxon were found in the "Table of Tribes" as "Head cornuted, much wider than the thorax; eyes round..." (p. 258, Ashmead 1904). Depending on a particular author's viewpoint, genera placed in Aximini/Aximinae may or may not possess horns on the head. Ashmead's (1904) classification was followed by subsequent authors (Schmiedeknecht 1909; Bugbee 1936) whereupon four of Ashmead's tribes were elevated to subfamily status (Ferrière 1950) and subsequently maintained (Claridge 1961). Most authors since have at least maintained Eurytominae and Rileyinae (Peck 1963, Peck et al. 1964, Riek 1970, Burks 1971, Subba Rao 1978, Stage & Snelling 1986, Zerova 1995), with Aximinae occasionally afforded subfamily status (Burks 1979, Zerova 1988, Mani 1989). However, only the classifications of Zerova (1988) and Ashmead (1904) provide any morphological features to diagnose or identify the taxon.

FIGURE 1. *Aximopsis hespenheidei*, female, habitus.

In this paper, we circumscribe the species most closely related to *A. morio* Ashmead, 1904 using modern morphological cladistic methodology, thus clarifying the monophyly of the genus. We also provide morphological synapomorphies relative to its sister taxon



FIGURES 2–9. 2. *Axima zabriskiei*, female gaster, lateral. 3. *Aximopsis lanceolepis*, female gaster, lateral. 4. *Ax. zabriskiei* female, forewing. 5. *Aximopsis* female, forewing. 6. *Aplatoides diabolus*, female head, lateral. 7–8. *Ax. zabriskiei*, female: 7. ventrolateral prepectus, 8. prepectus, lateral. 9. *A. vogti*, female, ventrolateral prepectus.

and describe seven new species. We discuss character evolution based on hypothesized relationships and their potential use for further analyses within Eurytomidae and discuss the biology of the group.

Methods

Specimens collected by Vogt were presumably placed in alcohol of an unknown concentration shortly after emergence and left relatively untended until the present whereupon they were discovered either dry in vials or in severely degraded ethanol. Specimens still in ethanol were dehydrated through ethanol and HMDS (Heraty & Hawks 1998) before point or card mounting. Specimens were labeled with an identification number (Vogt coll. #) when Vogt placed them into vials. Vogt collection numbers were formulated as a two-digit year followed by a number indicating the site (i.e., 63-1055 for site 1055 in 1963). Certain years (e.g., 1960, 1981) lack field notes and associated documentation; these documents apparently were never discovered after Vogt's death. Specimens provided by other collectors was mounted and labeled previously.

The imaging of specimens was done by scanning electron microscopy (SEM), environmental SEM (E-SEM) and AutoMontage. A Nikon SMZ1500 stereomicroscope with 10X (Nikon C-W10X/22) and Chiu Technical Corp. Lumina 1 FO-150 fiber optic light source were used for card- and point-mounted specimen observation. Mylar film was placed over the ends of the light source to reduce glare from the specimen. Scanning electron microscope (SEM) images were taken with an Amray 1810 (LaB_6 source). Specimens were cleaned of external debris with bleach and distilled water after Bolte (1996) and affixed to 12.7 X 3.2 mm Leica/Cambridge aluminum SEM stubs with carbon adhesive tabs (Electron Microscopy Sciences, #77825-12). Stub-mounted specimens were sputter coated using a Cressington Scientific 108 Auto with a gold-palladium mixture from at least three different angles to ensure complete coverage (~20–30nm coating). Unique, rare and type specimens were visualized uncoated with a Philips XL30 ESEM utilizing water vapor and a LaB_6 filament. Wing and habitus images were prepared using an AutoMontage image capture system (Microbiology International, Synchroscopy). With this system, digital images were captured from a stereoscope (Leica M400) by using a JVC 3-CCD Color Video Camera (Model No. KY-F55B) affixed to the microscope phototube and connected to the AutoMontage computer system.

Terminology for surface sculpturing follows Harris (1979) and for morphology follows Gibson (1997). Morphological terms and their abbreviations that deviate from or are not used by Gibson (1997) follow: Figs. 6, *Subocular Depression*, **sod**; 7, *Prepectal Flange*, **pf**; 8, *Prepectal Concavity*, **pc**; 9, *Mesosternal Carina*, **mec**; 10, *Longitudinal Scutellar Keel*, **lsk**; 11, 39, *Nuchal Pocket*, **np**; 12, 38–39, *Posterior Propodeal Panel*, **ppp**; 13, *Male Petiolar Process*, **mpp**. Body lengths were measured in lateral view from the anterior projection of the face to the tip of the gaster. Head width was measured through an imaginary line from gena to gena bisecting both toruli. Head height was measured through an imaginary line from the vertex to the clypeal margin bisecting the median ocellus and the distance between the toruli. Partial head height in lateral view was measured between the dorsal eye margin and lateral margin of the oral fossa (HTE). The malar space (msp) was measured in lateral view between the ventral margin of the eye and lateral margin of the oral fossa. Posterior ocellar line (POL) was measured as the shortest distance between the posterior ocelli. Ocular ocellar line (OOL) was measured as the shortest distance between the lateral margin of the posterior ocellus and the eye orbit. The marginal vein was measured as the length coincident with the leading forewing edge to the base of the stigmal vein; the stigmal vein was measured between its base on the marginal vein and its apex; the postmarginal vein was measured from the base of the stigmal vein to its apex on the leading forewing edge. Petiole length was measured from the base of the anterior condyle to the junction of the petiole with Gt_1. Petiole width was measured at the midlength. Antennae of both sexes were dissected and macerated in KOH to determine segmentation. All specimens were labeled with a USNM matrix code number to facilitate data entry and specimen identification. Specimen numbers are indicated in parentheses after specimens in the format “USNM ENTO 99999999.

Specimens used in this study are the property of the National Museum of Natural History (NMNH), Smithsonian Institution, Washington, D.C., USA (USNM). Additional holotype material examined was borrowed from The Natural History Museum, London, UK (BMNH) and the Museum für Naturkunde der Humboldt-UniversitŠt, Berlin (ZMHB).

We initially explored the tree space defined by the data matrix utilizing the Nixon Ratchet (Nixon 1999a) as implemented by NONA ver. 2.0 (Goloboff 1998) in Winclada ver. 0.9.99m24 (Nixon 1999b) (5,000 repetitions, hold = 5, character sample = 10%). We then used the number of steps of the shortest trees from the Winclada search to limit a heuristic search in PAUP* ver. 4.0b10 (Swofford 2002) (1,000 random repetitions, hold = 1, branch swapping = TBR). We attempted to increase resolution of tree nodes using successive reweighting of the maximum value of the rescaled consistency index in PAUP*. Bootstrap values were calculated in Winclada, and both these and character changes on the tree were mapped using Winclada. Bremer support values were calculated using TreeRot (Sorenson 1999). Character polarities as coded were based upon hypotheses presented in previous cladistic works within Chalcidoidea in which those characters (or characters similar to them) were demonstrated to have (Wijesekara 1997; Grissell 1995) or hypothesized to have certain polarity (Bouček 1988, Zerova 1988; Bugbee 1936).

Exemplar taxa sampled, representing the morphological diversity within Eurytominae, sought to provide the basis for hypothesizing the placement of *Aximopsis* within the subfamily. However, the sampling and coding were not exhaustive given the primary goal of circumscribing generic limits of *Aximopsis*. Outgroup taxa consisted of two species, *Heimbra opaca* Ashmead and *H. bicolor* Subba Rao, representing the eurytomid subfamily Heimbrinae. The 29 ingroup taxa include all species of *Aximopsis* as defined herein and representatives of genera putatively closely related to *Aximopsis* (e.g., *Conoaxima*, *Axima*, *Philolema*, *Mesoeurytoma*) to assess generic concepts and hypothesize relationships among these taxa.

Character analysis

1. Flagellomere 1

0, transverse and ringlike, >2x as broad as long without longitudinal sensilla.
1, subtransverse to quadrate, <2x as broad as long without longitudinal sensilla.

2. Flagellomere 2

0, “normally” sized, at least as broad as long with longitudinal sensilla.
1, transverse and ringlike, >2x as broad as long without longitudinal sensilla.
2, subtransverse to subquadrate, <2x as broad as long without longitudinal sensilla.

3. Flagellomere 3

0, “normally” sized, at least as broad as long with longitudinal sensilla.
1, subtransverse to quadrate, <2x as broad as long without longitudinal sensilla.

The single distinct anellus of most Chalcidoidea is considered to be the groundplan condition (Schauff 1986; Gibson 1986). Grissell (1995) operationally defined an anellus as, "a greatly reduced (i.e. "ringlike") flagellomere without ridgelike, multiporous plate sensilla (MPS)". He indicated that many Torymidae have "flagellar" segments that are not ringlike yet lack sensilla whereas others possess "anelli" that are ringlike and possess sensilla. This clearly causes problems in deciding when to designate an anellus (Grissell 1995, Schauff 1986). Most eurytomid taxa have anelli fitting this operational definition. However certain taxa in this analysis (*Macrorileya*, *Archirileya*) have “anelli” that are not ringlike and are almost the size of subsequent flagellomeres, but lack MPS. The current coding attempts to homologize the first three segments of the flagellum as independent characters by separating each based upon relative size, shape and the possession of MPS rather than statements about the presence or absence of anelli perse.

4. Antennal segments

0, 13-segmented.
1, 11-segmented.

The larger number of funicular segments is presumed to be plesiomorphic (Bouček & Heydon 1997). Most Eurytominae are variable in the number of antennal segments, ranging from 9–13 segments, though 11 is typical. Heimbrinae always possess 13 segments.

5. Position of torulus

0, below lower eye margin.
1, at or above lower eye margin.

This character has been used in the past (Habu 1960; Wijesekara 1997; Delvare 1992) and the toruli below the lower eye margin is presumed to be the plesiomorphic condition based upon outgroup comparison. Grissell (1995) attempted to use this character by subdividing it into five states based upon ratios of the toruli from the vertex and clypeus, but could not recognize discontinuities in the states.

6. Parascrobal carina

0, absent.

1, present.

This character is indicated by the presence of a carina extending along the lateral edges of the scrobal depression (Fig. 18). Only three taxa in this analysis lack a parascrobal carina: *Macrorileya*, *Archirileya*, *Buresium*.

7. Clypeus

0, recessed below level of rest of face, lateral margin of oral fossa expanded and ventrally convex (Fig. 16).

1, flush with rest of face, medial margin produced ventrally (Fig. 17).

2, flush with rest of face, truncate or slightly emarginated (Fig. 18).

The plesiomorphic condition is present in both species of *Heimbra*, which demonstrates a completely different morphology from the remaining taxa in the analysis. Most of the taxa have a clypeus that is continuous with the rest of the head and flush with the surface of the face and corners of the oral fossa. Although this may represent a plesiomorphic condition in an analysis of a larger scope, it is here considered apomorphic with the median portion of the clypeus either produced ventrally (state 1) or straight (2).

8. Face with a carina between parascrobal carina and clypeus

0, absent (Fig. 17).

1, present (Fig. 18).

Ashmead (1904) noted in his description of *Aximopsis* that the single specimen possessed a carina that connected the parascrobal carina with the clypeus. This structure is a distinctly elevated tract of cuticle independent of the radiating striae dorsad the clypeal margin commonly observed among species of Eurytominae. We consider the presence of this carina apomorphic within the limits of this analysis and found it present in all species of *Aximopsis*, *Mesoeurytoma*, and *Philolema*. The sister taxa of *Aximopsis*, *Conaxima+Axima+Aplatoides*, lack this carina and we consider this a reversal or subsequent loss.

9. Postgenal lamella

0, absent (Fig. 19).

1, present (Fig. 20).

This character occurs as a flattened lobe, directed laterally or ventrolaterally, in the postgenal region of the head below the occipital foramen (Fig. 19). It is produced in conjunction with the presence of a groove extending from the foramen magnum toward the posterolateral region of the head. It appears to function in tongue-and-groove fashion with a corresponding groove on the procoxae. This character was initially observed by Thomson (1878) and defined by Claridge (1958) as a hypostomal lamella, an apparent development of the hypostomal carina (Richards, 1956). Claridge (1961) later termed the same structure "postgenal lamella" when it became apparent that it probably was not an extension of the hypostomal carina. Delvare (1988) termed it as the "lamina postgénal" in differentiating species of African Eurytomidae described by Risbec (1951, 1952, 1953, 1956ab, 1957). This character appears to occur primarily in Eurytominae, and is found in *Mesoeurytoma*, *Philolema*, *Aximopsis*, *Conoaxima*, *Axima*, *Eudoxinna*, *Eurytoma*, *Chryseida*, *Aplatoides*, and *Bephratelloides*. Its absence (e.g., *Heimbra*, *Tetramesa*, *Systole*, *Macrorileya*, *Archirileya*, *Buresium*) is considered plesiomorphic.

10. Hypostomal/postgenal bridge

0, postgenal bridge present, with postgenae narrowly uniting below occipital foramen, hypostomal bridge slightly exposed (Fig. 19).

1, postgenal bridge present and complete, postgenae broadly uniting hypostomal bridge obscured (Fig. 20).

11. Hypostomal carina

0, hypostomal carina distinct, complete, not approaching occipital foramen, uniting below occipital foramen (Fig. 19).

1, hypostomal carina distinct, incomplete, approaching one another below occipital foramen (Fig. 20).

Wijesekara (1997) used characters 10 and 11 as a single character that might needlessly eliminate phylogenetic signal. Separating the single character into two characters is justified because the hypostomal carina cannot necessarily be correlated with character state changes in genal bridge production/hypostomal bridge exposure. The genal bridge, when present, is formed by the fusion of the genae (postgenae) between the occipital foramen and the ventral mouthparts and typically obscures the hypostomal bridge (Wijesekara 1997). The hypostomal carina proceeds dorsoventrally along the lateral margin of the oral fossa and either turns medially at the base of the ventral mouthparts or continues dorsally to approach/encircle the occipital foramen. Most taxa in this analysis possess state 1 with the outgroup and some of the eurytomines (*Archirileya*, *Macrorileya*, *Tetramesa*, etc.) at the base of the hypothesized phylogeny with state 0.

12. Preorbital carina

0, absent (Fig. 17).

1, present (Fig. 18).

Preorbital carinae parallel the anterior eye margin, often either continuing over the vertex or turning mesad to bisect the ocellar triangle (e.g., *Philolema carinigena*, *Mesoeurytoma cariniceps*). The presence of preorbital carinae has been used historically to define, at least partially, genera such as *Aximopsis*, *Conoaxima*, *Axima*, *Philolema*, *Mesoeurytoma* (Ashmead 1904, Cameron 1908, Brues 1922). This character, both in this analysis and within Chalcidoidea, is homoplastic as it is present in some extralimital species of *Chryseida* and *Eurytoma*.

13. Vertex horns

0, absent (Fig. 21).

1, present (Fig. 22).

Vertex horns are extensions of the preorbital carina. As such, they are laterally flattened and broadly to narrowly triangular in lateral view. Species of *Aximopsis* (reduced in *A. hippolytis*) all possess vertex horns as defined here. *Axima brasiliensis*, *Ax. zabriskiei* and *Aplatoides diabolus* possess positionally homologous horns on the vertex. However, *Ap. diabolus* lacks the preorbital carina always associated with vertex horns in *Aximopsis*. Those taxa possessing preorbital carinae but lacking vertex horns include *Mesoeurytoma*, *Philolema*, *Chryseida*, *Eurytoma nodularis*, *Eu.* **n. sp.** “euglossa”.

14. Vertex anterior to lateral ocelli

0, not elevated significantly above level of vertex (Fig. 18).

1, carinate continuation of preorbital carina (Fig. 23).

Two species in the analysis, *Ph. carinigena* and *M. cariniceps*, have a preorbital carina that continues dorsally and medially and is almost continuous across the vertex. This tract of cuticle is distinctly elevated above the level of the surface of the vertex and carinate such that it obscures the lateral ocellus from frontal view. Some species in the analysis have a general expansion of the surface of the vertex or, in the case of *C. affinis* a cuticular spine, that also obscures the lateral ocellus from frontal view, but these are neither distinctly carinate nor continuous with the preorbital carina. We consider the possession of such a distinct carina on the vertex apomorphic, but it seems not to be stable among the taxa in the analysis and does not support a monophyletic grouping.

15. Ocellar horns

0, absent (Figs. 17, 21).

1, present (Figs. 24, 25).

This character is autapomorphic for *C. affinis* in this analysis. As far as is known, all species within *Conoaxima* share this character.

16. Dense patch of smaller umbilicae on vertex and ocellar triangle

0, absent (Fig. 26).

1, sparse, but flattened setae present (Fig. 27).

2, extremely dense (Figs. 20, 30).

Most species in the study group are heavily sculptured with punctae and/or umbilicae of varying size. Among *Aximopsis* species the head is mostly covered uniformly by large, deep umbilicae with filiform setation and alveolate interstices, but the dorsal portions of the head have distinct continuous areas where the umbilicae are smaller and more densely packed, the interstices reduced, and the setae distinctly flattened. The size and distribution of the umbilicae vary among the *Aximopsis* species (both *A. arietinis* **n. sp.** and *A. hippolytis* **n. sp.** have much less densely spaced umbilicae (state 1)), but a distinct patch of flattened setae is always present among otherwise filiform setae. We consider the presence of this arrangement of umbilicae on the dorsal head a synapomorphy supporting the monophyly of the genus. Two specimens of an undescribed extralimital species of *Chryseida* in the USNM display state 2. As only this species of *Chryseida* shows state 2, this character may bear examination across all Chalcidoidea to assess its utility.

17. Subocular depression

0, absent (Fig. 22).

1, present (Fig. 6).

This large, reniform depression below the eye in *Ap. diabolus* is autapomorphic for this genus.

18. Pronotal process

0, absent (Figs. 28, 32).

1, present, single process (Figs. 10, 29).

2, present, paired processes (Figs. 30, 31).

Most Eurytomidae in this analysis lack any production of the pronotum anteromedially. All *Aximopsis* species and *Mesoeurytoma* possess state 2 (*A. hippolytis* has the processes reduced) while *Conoaxima*, *Axima* and *Aplatoides* have a single process.

19. Pronotal setation

0, absent (Figs. 28–30).

1, present (Fig. 31).

Pronotal setation is autapomorphic for *A. morio.*

20. Prepectus

0, large, exposed portion equal or greater than the length of tegula (Figs. 32, 35).

1, small, exposed portion at most half the length of tegula (Fig. 33).

Chalcidoidea are the only apocritans possessing an externally visible prepectus, an independent sclerite between the posterolateral pronotum and anterodorsal margin of the mesepisternum (Huber & Sharkey 1993; Gibson 1999). Rotoitidae have the prepectus hidden (Gibson & Huber 2000), and some chalcids have it fused to the pronotum as in Eucharitidae (Heraty 1994). The visible portion of the prepectus typically is as large as or larger than the tegula, and this condition has been hypothesized to be the plesiomorphic condition (Zerova 1988). In contrast, a highly reduced prepectus is considered apomorphic. The only taxa possessing a small prepectus in this analysis, the two species of Heimbrinae, are slightly unusual in that they possess certain apomorphic features within this putatively plesiomorphic lineage.

21. Prepectal flange

0, absent (Fig. 34).

1, present (Figs. 7, 9).

The prepectal flange is a flattened finlike process arising from the ventromedial prepectus. All *Aximopsis*, *Conoaxima*, *Aplatoides*, *Mesoeurytoma*, *Axima zabriskiei* and the two *Eurytoma* included in this analysis possess a flange. Many species of *Eurytoma* do not possess a flange, nor do many of the more eurytomids having an elongate habitus (e.g., *Macrorileya*, *Archirileya*). To a certain extent it may be correlated with habitus, occurring more frequently in taxa having closer appression between the head, procoxae, and mesosternum.

22. Prepectal concavity

0, absent (Fig. 38).
1, present (Fig. 39).

This concavity occurs ventrad the exposed triangular portion of the prepectus and is usually distinctly visible if present. The degree of contact between the ventrolateral pronotum and the lateral mesosoma occasionally can diminish the visibility of this feature. It appears to be similar in distribution with character 21, but is not present in *Eurytoma* spp. and *C. bennetti*.

23. Mesosternal carina

0, absent (Figs. 32, 34).
1, present (Fig. 35).

A transverse carina located posterad procoxae delimits a concavity that receives the procoxae. It differentiates distinct anterior and ventral surfaces of the mesosternum. In many cases (e.g., *Axima zabriskiei*, *Aximopsis* spp.) it is produced into a longitudinal median keel projecting between the procoxae. In those taxa lacking a mesosternal carina (e.g., *Macrorileya*, *Tetramesa*, *Systole*), the mesosternum is evenly convex and not subdivided into distinct anterior and ventral surfaces.

*24. Longitudinal scutellar kee*l

0, absent (Fig. 32).
1, present (Fig. 10).

A scutellar keel is autapomorphic for *Aplatoides diabolus*.

25. Scutellum

0, not distinctly pointed posteriorly (Figs. 32, 38).
1, distinctly pointed posteriorly (Fig. 33).

A scutellum lacking an apical production is variously rounded, with a vague blunt edge or otherwise acarinate. A carinate scutellum can be blunt, where the carina is slightly thickened and/or lacking a sharp edge apically, or fine in which a sharp apex is present. A produced scutellum has a spiniform process apically. The spiniform process is found in *Heimbra bicolor* Subba Rao and *H. opaca* (Ashmead). A similar process also is seen in *Conoaxima* in this analysis as an upturned, small, broadly triangular structure. The different processes seen in *Heimbra* spp. and *Conoaxima* are not homologous.

26. Dorsellum anterior sublateral invagination

0, absent (Fig. 36).
1, present (Fig. 11).

The dorsellum is an often-overlooked structure when considering the relationships among Eurytomidae. Within this analysis the plesiomorphic condition is considered to be a relatively unmodified strip of cuticle of varying width and topical sculpturing. Apomorphically the anterior margin of the dorsellum is invaginated, creating a pair of pockets sublaterally between the posterior margin of the scutellum and the body of the dorsellum. The apomorphic condition is widespread and diverse in form among the species in the analysis and perhaps deserves further consideration as to its definition.

27. Dorsellum posterior median invagination

0, absent (Fig. 36).

1, present (Fig. 11).

As with character 26, this character has been overlooked. The apomorphic condition is represented by the posterior margin of the dorsellum having a single, large pocket anterior to the anterodorsal margin of the propodeum. The central area of the dorsellum often has a posteriorly protruding strip of cuticle, but this condition could not be homologized across the taxa in the analysis. The apomorphic condition is widespread among the species in the analysis and perhaps deserves further consideration as to its definition.

28. Lateral panel of the propodeum

0, convex (Fig. 36).

1, concave (Figs. 11, 38).

In this analysis the lateral panel is considered the region of the propodeum on the dorsal surface between the ridge at the lateral border of the median channel and the callus as indicated by the position of the propodeal spiracle. In the plesiomorphic condition this region on the propodeum is convex dorsally, nearly dome-shaped in appearance. In the apomorphic condition this area is concave dorsally and buttressed, with a more boxlike appearance. This state has evolved once in the hypothesized tree at the node supporting *Philolema*+*Mesoeurytoma*+*Aximopsis*+*Conaxima*+*Axima* with a reversal to the plesiomorphic condition for the clade supporting *Aplatoides diabolus*+*Axima brasiliensis*.

29. Dorsal propodeum lateral silhouette

0, arclike (Fig. 32).

1, angled (Fig. 38).

In lateral view, the profile of the dorsal surface of the propodeum is smooth and subcircular (arclike) in the plesiomorphic condition. Apomorphically, there is a dorsal section of the propodeum that is separated from a posterior facing portion (ppp) that is separated by a distinct angle.

30. Median channel of propodeum

0, wider than lateral panel (Fig. 28, 36).

1, subequal or narrower than lateral panel (Fig. 12).

The presence of a median channel on the dorsal propodeum is considered a diagnostic character for most of Eurytomidae. In this analysis, a broad median channel wider than the space between the lateral carina of the median channel and the propodeal spiracle (lateral panel) is considered the plesiomorphic condition. Apomorphically, the median channel is much narrower, narrower than the lateral panel.

31. Propodeum with nuchal pocket (np)

0, absent (Fig. 36).
1, present (Figs. 11, 52).

The anterodorsal apex of the petiole seems to have a close association with the structures immediately adjacent to it on the extreme posterior edge of the nucha of the propodeum. This association is strongly demonstrated in a dorsally protruding knob or lip on the petiole and an associated concavity on the nucha (np). The plesiomorphic condition is for the np to be absent and derived in those taxa which possess it. This character might merit evaluation across Chalcidoidea, but seems to be at least locally informative.

32. Propodeum with vertical space above petiolar insertion (posterior propodeal panel, ppp)

0, absent (Fig. 36).
1, present (Figs. 12, 39).

Those taxa that have the propodeum separated into a dorsal and posterior section often have an additional region defined on all sides by carinae that is concave and posteriorly directed (ppp). The plesiomorphic condition is for this area to be absent. Apomorphically, this space is clearly defined and often quite large relative to the remaining propodeum.

33. Vertical space above base of petiole (dimensions of ppp)

0, wider than high or height and width subequal (Fig. 36).
1, higher than wide (Fig. 12).

Plesiomorphically the ppp is smaller (less dorsally expanded) so that the width and height are subequal or it is wider than high. The apomorphic condition is for the ppp to be expanded vertically so that it is much higher than wide. This state is present in all of the species of *Aximopsis* and an undescribed species of *Mesoeurytoma* from Peru.

34. Supracoxal flange of propodeum with lateral "teeth"

0, absent (Fig. 46).
1, present (Fig. 47).

The supracoxal foramen often is bordered by a carina dorsally and laterally that overhangs the metacoxa. In this analysis, the plesiomorphic condition is represented by the carina smoothly continuous laterally. In the apomorphic condition the lateral portion of the carina has one to several emarginations that make the margin appear toothlike.

35. Supracoxal flange of propodeum

0, absent dorsally (Fig. 32).
1, present dorsally (Fig. 38).

The extent and presence of the supracoxal flange dorsally varies across taxa, and the plesiomorphic condition is for the flange not to extend medially over the base of the metacoxa. Apomorphically, the flange extends medially and often is continuous with the lateral carina defining the ppp.

36. Basal forewing

0, bare (Figs. 4, 5).

1, setose (Fig. 40).

In the plesiomorphic condition of this state the forewing is completely setose basally, as in *Archirileya* and *Macrorileya*. The remaining taxa in this analysis have the basal forewing bare.

37. Ratio of marginal vein to postmarginal vein (mv/pmv)

0, < 2.0 (Fig. 40).

1, 2.0 – 3.0 (Fig. 4).

2, 3.0 > (Fig. 41).

The relative lengths of forewing veins have been used historically for diagnostic and phylogenetic purposes (Bouček 1988, Grissell 1995, Gibson 1997; references therein), with relatively longer venation hypothesized as plesiomorphic. The taxa with the longer forewing venation are typically those with an elongate habitus (e.g., *Archirileya*, *Macrorileya*) and with corresponding longer marginal and postmarginal veins, the plesiomorphic condition. However, in those taxa that have relatively shorter forewing venation, there usually is a concordant shortening of forewing veins relative to one another. Thus, those taxa also have a similar ratio between the lengths of mv/pmv, indicating that this character may be of limited utility.

38. Ratio of marginal vein to stigmal vein (mv/stv)

0, < 3.0 (Figs. 5, 40).

1, 5.0 > (Figs. 4, 41).

Both this and the preceding character serve to provide support for the *Axima*+*Aplatoides* clade. Both genera have long marginal veins relative to the length of either the stigmal or postmarginal veins.

39. Male anteroventral petiole with large scooplike process

0, absent (Fig. 42).

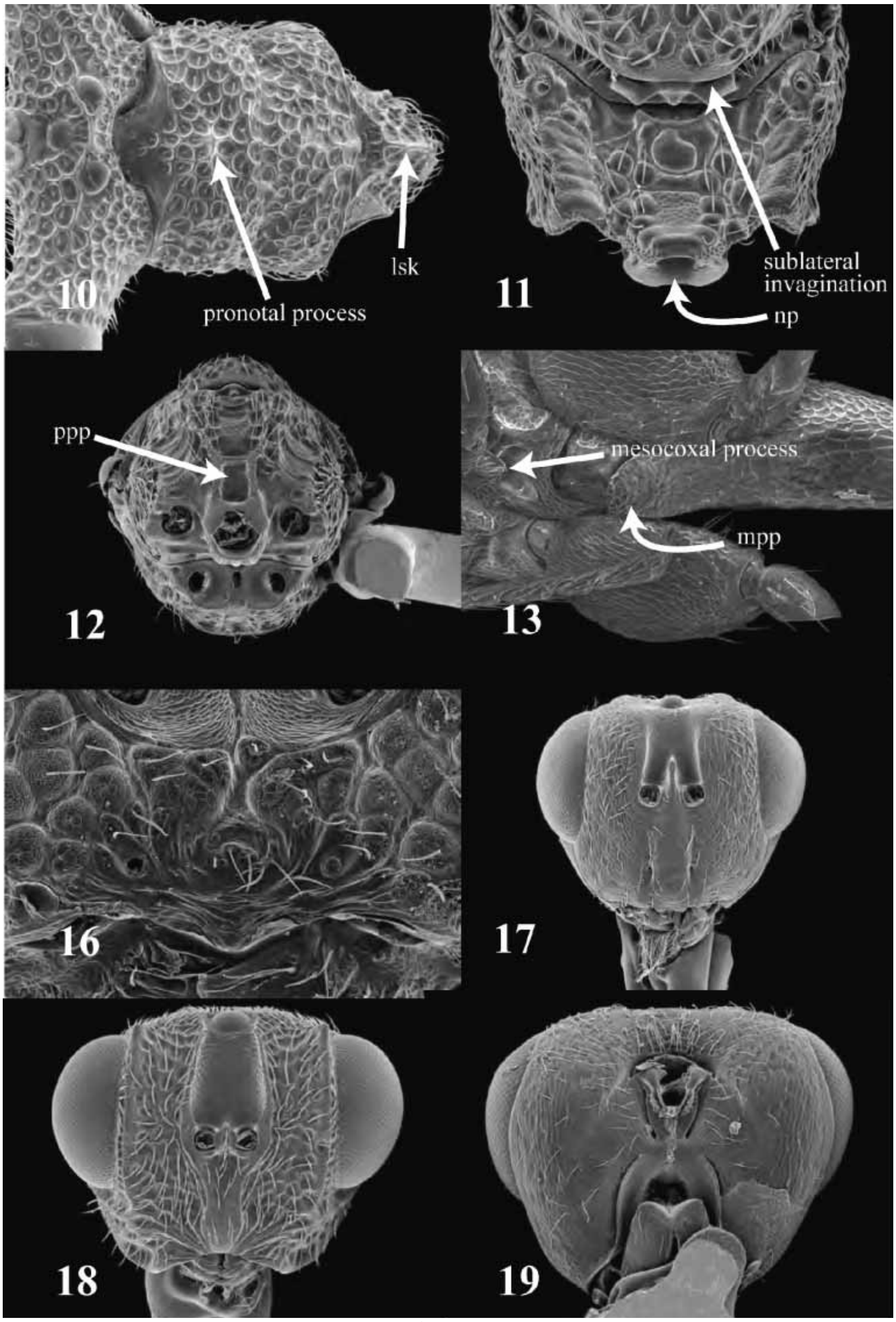
1, present (Fig. 13).

The “bottle opener on the anteroventral petiole is a synapomorphy for *Aximopsis*. It appears to function as a stop when appressed to the nucha ventrally and may brace the petiole+gaster when the petiole is flexed ventrad. It is also possible that this structure comes into contact with the posterior mesocoxal protuberances seen in *Aximopsis* (Fig. 13).

40. Petiole cross-section shape

0, round, triangular.

1, square, rectangular.



FIGURES 10–13, 16–19. 10. *Ap. diabolus*, female, anterodorsal mesosoma. 11–12. *Aximopsis vogti*, female: 11. propodeum, dorsal, 12. propodeum, posterior, 13. petiole, anteroventral (male). 16. *Heimbra opaca*, female, clypeus. 17. *Macrorileya oecanthi*, female, head, anterior. 18. *A. vogti*, female, head, anterior. 19. *M. oecanthi*, female, head, posterior.

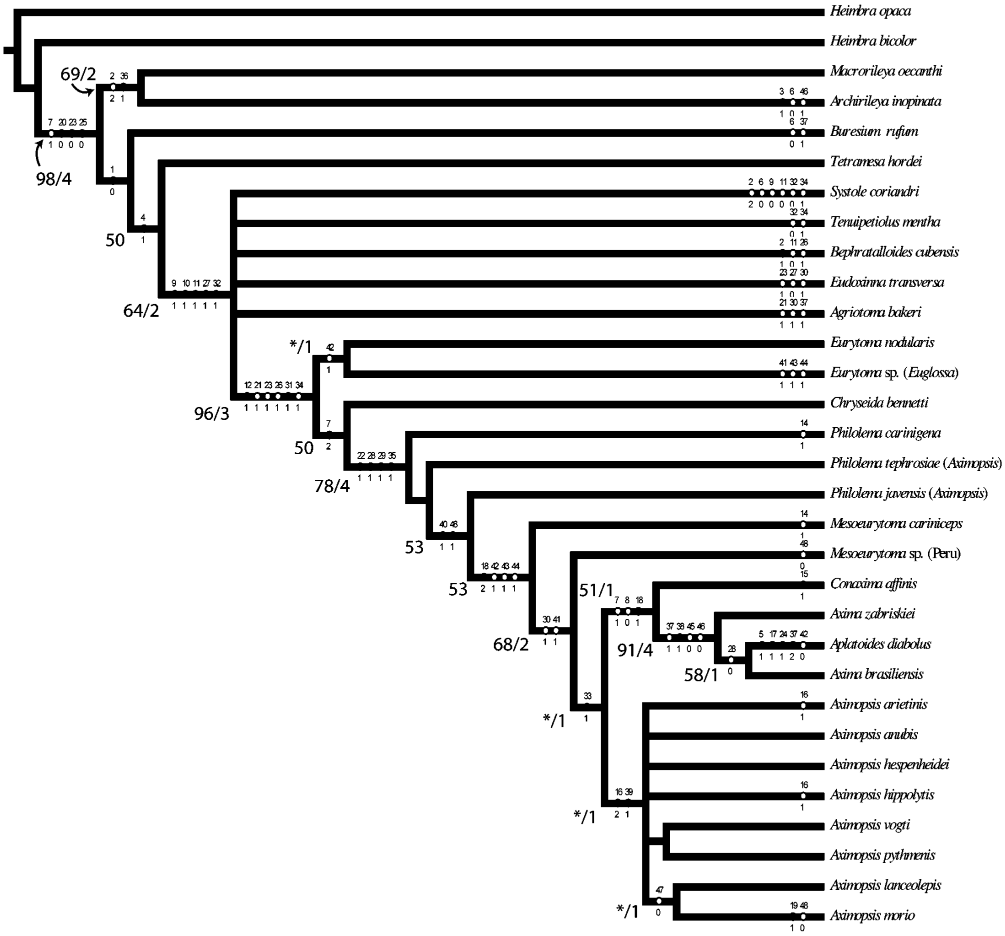


FIGURE 14. Strict consensus of 30 tree islands produced with Nixon Ratchet implemented in Winclada (steps = 88, CI = 0.55, RI = 0.87). The same consensus tree was obtained with a PAUP* analysis that resulted in 45 trees representing further rearrangements of the same tree islands. Open circles and closed circles represent homoplastic and synapomorphic support, respectively. Bootstrap/Bremer nodal support values subtend nodes. An * appears at nodes with <50 percent bootstrap support.

Plesiomorphically, a cross-sectional view of the petiole is either round, defining a cylinder, or triangular with a flat dorsal surface and a subcylindrical ventral surface. The apomorphic condition is for the cross-section to be square or rectangular with distinct corners at the dorso- and ventrolateral corners.

41. Petiole with median carina on dorsal surface anteriorly

0, absent (Fig. 43).
1, present (Fig. 44).

42. Petiole with median carina on dorsal surface posteriorly

0, absent (Fig. 43).

1, present (Fig. 44).

43. Petiole with lateral carina on dorsal surface anteriorly
0, absent (Fig. 43).
1, present (Fig. 44).

44. Petiole with lateral carina on dorsal surface posteriorly
0, absent (Fig. 43).
1, present (Fig. 44).

45. Petiole with carina on lateral surface anteriorly
0, absent (Fig. 45).
1, present (Fig. 46).

46. Petiole with carina on lateral surface posteriorly
0, absent (Fig. 45).
1, present (Fig. 46).

47. Petiole with median carina on ventral surface anteriorly
0, absent (Fig. 47).
1, present (Fig. 48).

48. Petiole with median carina on ventral surface posteriorly
0, absent (Fig. 47).
1, present (Fig. 48).

Characters 41–48 focus on the petiole and seek to homologize carinae seen in sculpturally complex petioles (e.g., *Aximopsis*). The petiole of *Aximopsis* is the most derived within this analysis as it is extensively carinate and sculptured. Other taxa such as *Conoaxima*, *Axima*, *Aplatoides*, and *Mesoeurytoma* share some or all putatively homologous carinae with *Aximopsis*, but only *Conoaxima* shares the full complement. The plesiomorphic condition is a simple, more or less tubular, structure lacking ornamentation. It may or may not be visible dorsally. The petiole as a source for phylogenetic character systems bears further examination across Chalcidoidea.

Cladistic results

We generated a matrix of 31 taxa and 48 characters (Table 1). All characters were binary except five characters 2, 7, 16, 18, and 37, which were three-state. Initial Nixon Ratchet analysis produced 30 tree islands of 88 steps, and the strict consensus of these trees is shown in Fig. 14 (CI = 0.55, RI = 0.87). The analysis using PAUP* resulted in 45 trees, but these represented further rearrangements of the same tree islands found in Winclada and produced the same consensus tree. Successive reweighting reduced the number of trees to nine, which were a subset of the original 45 trees (CI = 0.59, RI = 0.89). The reweighting provided increased resolution for all of the outgroup taxa, but the relationships among the species of *Aximopsis* remained ambiguous (Fig. 15). Below we list the character descriptions and, where meaningful, their evolution on the tree.

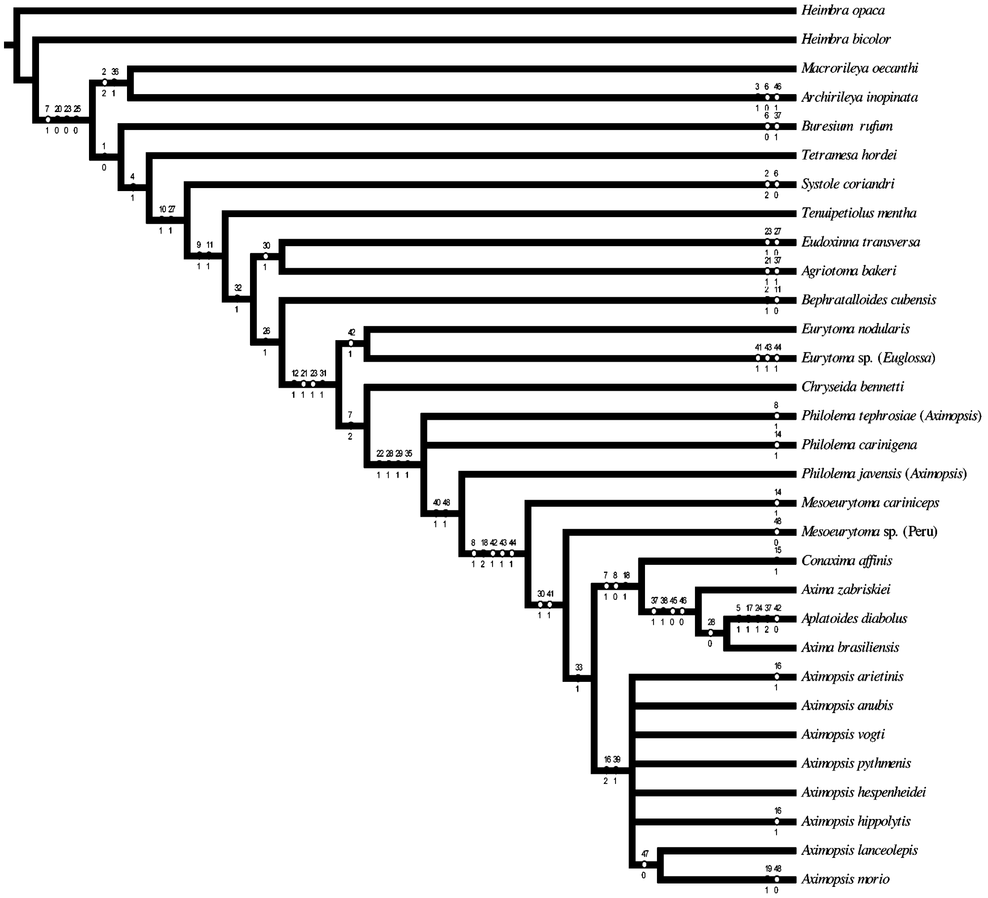


FIGURE 15. Successive approximations reweighting, strict consensus of 9 trees (CI = 0.59, RI = 0.89).

Genus *Aximopsis* Ashmead

Aximopsis Ashmead, 1904: 259. Type species: *Aximopsis morio* Ashmead, 1904 by monotypy.

Diagnosis

Two synapomorphies support the monophyly of *Aximopsis* as defined herein: the presence of dense umbilicae (Figs. 27, 30) on dorsal head within and surrounding the ocellar triangle, and male petiolar process ("can opener (Fig. 13)). A suite of characters can be used in combination to aid in diagnosing and identifying *Aximopsis*, including a

TABLE 1. Morphological character matrix.

Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Agriotoma bakeri Burks	0	0	0	1	0	1	1	0	1	1	1	0	?	?	0	0	0
Aplatoides diabolus Yoshimoto & Gibson	0	0	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1
Archirileya inopinata Silvestri	1	2	1	0	0	0	1	0	0	0	0	0	?	?	0	0	0
Axima brasiliensis Ashmead	0	0	0	1	0	1	1	0	1	1	1	1	1	0	0	0	0
Axima zabriskiei Howard	0	0	0	1	0	1	1	0	1	1	1	1	1	0	0	0	0
Aximopsis anubis, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	2	0
Aximopsis arietinis, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	1	0
Aximopsis hespenheidei, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	2	0
Aximopsis hippolytis, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	1	0
Aximopsis lanceolepis, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	2	0
Aximopsis morio Ashmead	0	0	?	?	0	1	2	1	1	?	1	1	1	0	0	2	0
Aximopsis pythmenis, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	2	0
Aximopsis vogti, **n. sp.**	0	0	0	1	0	1	2	1	1	1	1	1	1	0	0	2	0
Bephratalloides cubensis (Ashmead)	0	1	0	1	0	1	1	0	1	1	0	0	?	?	0	0	0
Buresium rufum Bouček	0	0	0	0	0	0	1	0	0	0	0	0	?	?	0	0	0
Chryseida bennetti Burks	0	0	0	1	0	1	2	0	1	1	1	1	0	0	0	0	0
Conaxima affinis Brues	0	0	0	1	0	1	1	0	1	1	1	1	0	0	1	0	0
Eudoxinna transversa (Walker)	0	0	0	1	0	1	1	0	1	1	1	0	?	?	0	0	0
Eurytoma nodularis Boheman	0	0	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0
Eurytoma sp. ("Euglossa")	0	0	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0
Heimbra bicolor Subba Rao	1	0	0	0	0	1	0	0	0	0	0	0	?	?	0	0	0
Heimbra opaca Ashmead	1	0	0	0	0	1	0	0	0	0	0	0	?	?	0	0	0
Macrorileya oecanthi (Ashmead)	1	2	0	0	0	1	1	0	0	0	0	0	?	?	0	0	0
Mesoeurytoma cariniceps Cameron	0	0	0	1	0	1	2	1	1	?	?	1	0	1	0	0	0
Mesoeurytoma sp. (Peru)	0	0	0	1	0	1	2	1	1	1	1	1	0	0	0	0	0
Philolema carinigena Cameron	0	0	0	1	0	1	2	0	1	?	?	1	0	1	0	0	0
Philolema javensis (Aximopsis) Girault	0	0	0	1	0	1	2	0	1	?	1	1	0	0	0	0	0
Philolema tephrosiae (Aximopsis) Girault	0	0	0	1	0	1	2	1	1	?	?	1	0	0	0	0	0
Systole coriandri Gussakovsky	0	2	0	1	0	0	1	0	0	1	0	0	?	?	0	0	0
Tenuipetiolus mentha Bugbee	0	0	0	1	0	1	1	0	1	1	1	0	?	?	0	0	0
Tetramesa hordei (Harris)	0	0	0	1	0	1	1	0	0	0	0	0	?	?	0	0	0

to be continued.

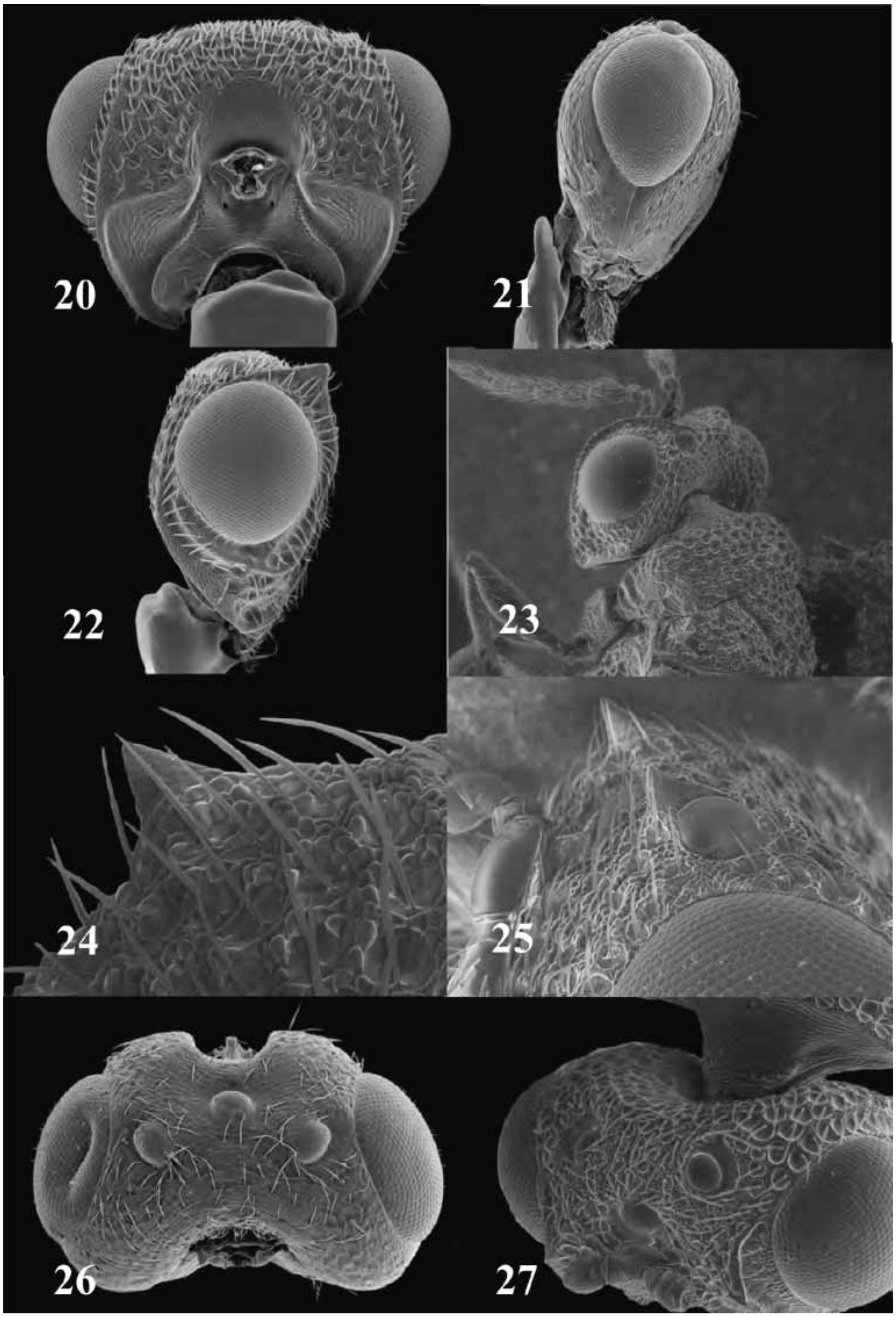
TABLE 1 (continued).

Taxon	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Agriotoma bakeri Burks	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1
Aplatoides diabolus Yoshimoto & Gibson	1	0	0	1	1	1	1	0	1	1	0	1	1	1	1
Archirileya inopinata Silvestri	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Axima brasiliensis Ashmead	1	0	0	?	1	1	0	0	1	1	0	1	1	1	1
Axima zabriskiei Howard	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis anubis, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis arietinis, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis hespenheidei, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis hippolytis, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis lanceolepis, **n. sp.**	2	0	0	?	1	1	0	0	1	1	1	1	1	1	1
Aximopsis morio Ashmead	2	1	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis pythmenis, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Aximopsis vogti, **n. sp.**	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Bephratalloides cubensis (Ashmead)	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
Buresium rufum Bouček	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chryseida bennetti Burks	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1
Conaxima affinis Brues	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Eudoxinna transversa (Walker)	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
Eurytoma nodularis Boheman	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1
Eurytoma sp. ("Euglossa")	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1
Heimbra bicolor Subba Rao	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0
Heimbra opaca Ashmead	0	0	1	0	0	1	0	1	0	0	0	0	1	0	0
Macrorileya oecanthi (Ashmead)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Mesoeurytoma cariniceps Cameron	2	0	0	1	1	1	0	0	1	1	1	1	0	1	1
Mesoeurytoma sp. (Peru)	2	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Philolema carinigena Cameron	0	0	0	?	1	1	0	0	1	1	1	1	0	1	1
Philolema javensis (Aximopsis) Girault	0	0	0	?	1	1	0	0	1	1	1	1	0	1	1
Philolema tephrosiae (Aximopsis) Girault	0	0	0	?	1	?	0	0	1	1	1	1	0	1	1
Systole coriandri Gussakovsky	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tenuipetiolus mentha Bugbee	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tetramesa hordei (Harris)	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0

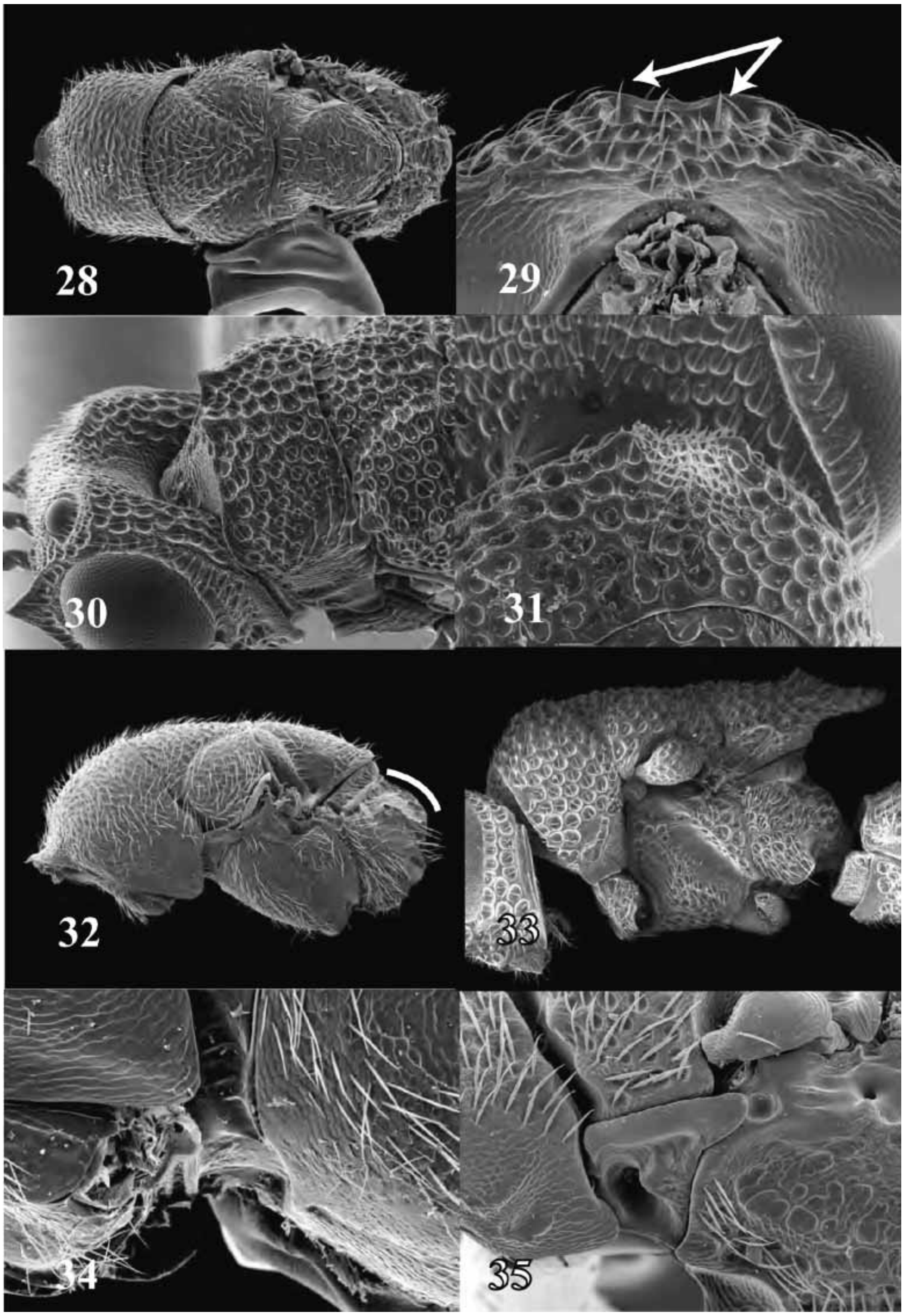
to be continued.

TABLE 1 (continued).

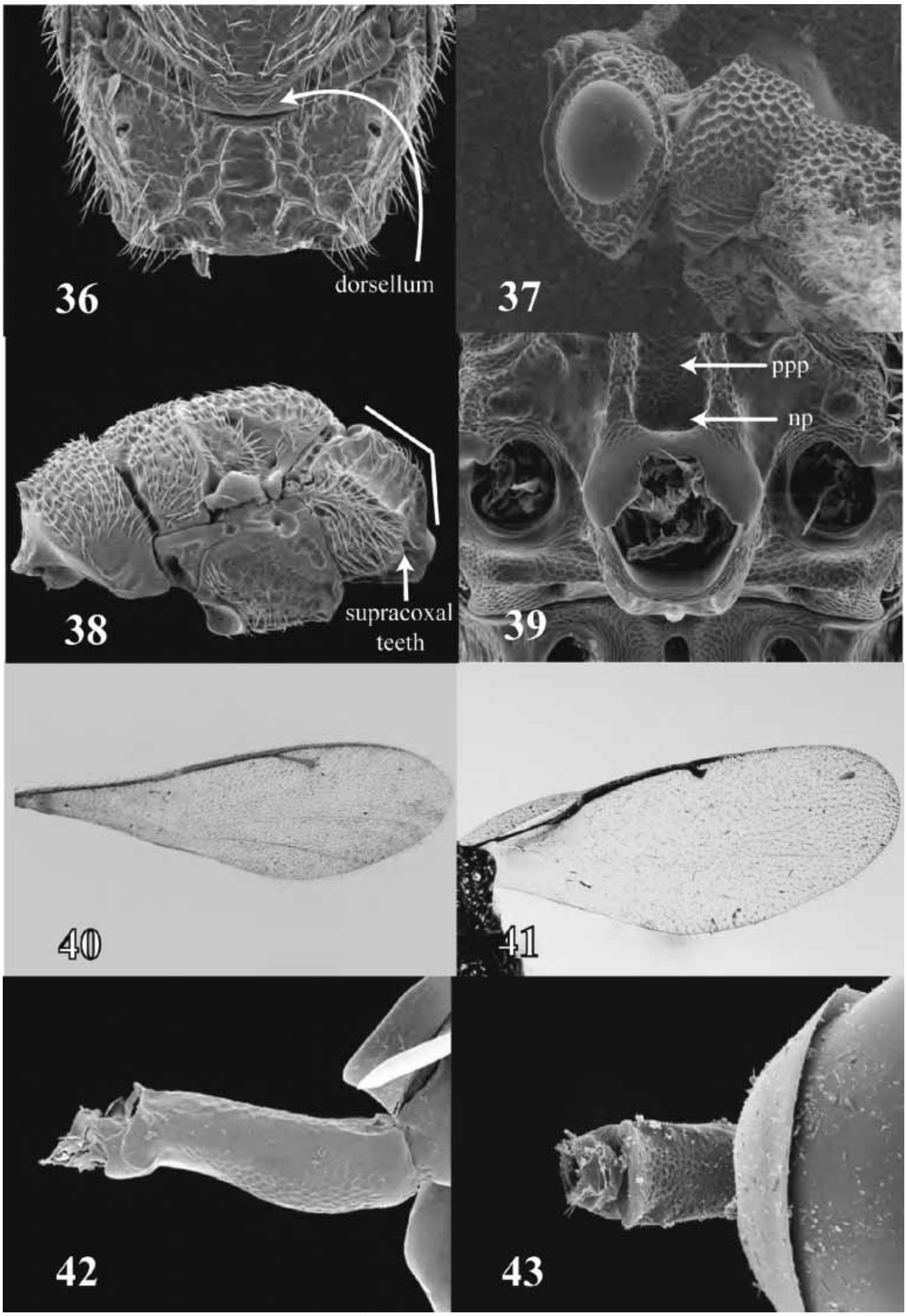
Taxon	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Agriotoma bakeri Burks	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Aplatoides diabolus Yoshimoto & Gibson	1	1	1	0	2	1	?	1	1	0	1	1	0	0	1	1
Archirileya inopinata Silvestri	?	0	0	1	0	0	?	0	0	0	0	0	0	1	0	0
Axima brasiliensis Ashmead	1	1	1	0	1	1	?	1	1	1	1	1	0	0	1	1
Axima zabriskiei Howard	1	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1
Aximopsis anubis, **n. sp.**	1	1	1	0	0	0	?	1	1	1	1	1	1	1	1	1
Aximopsis arietinis **n. sp.**	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
Aximopsis hespenheidei **n. sp.**	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
Aximopsis hippolytis **n. sp.**	1	1	1	0	0	0	?	1	1	1	1	1	1	1	1	1
Aximopsis lanceolepis **n. sp.**	1	1	1	0	0	0	?	1	1	1	1	1	1	1	0	1
Aximopsis morio Ashmead	1	1	1	0	0	0	1	1	1	1	1	1	1	1	0	0
Aximopsis pythmenis **n. sp.**	1	1	1	0	0	0	?	1	1	1	1	1	1	1	1	1
Aximopsis vogti **n. sp.**	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1
Bephratalloides cubensis (Ashmead)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buresium rufum Bouček	?	0	0	0	1	0	?	0	0	0	0	0	0	0	0	0
Chryseida bennetti Burks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conaxima affinis Brues	1	1	1	0	0	0	?	1	1	1	1	1	1	1	1	1
Eudoxinna transversa (Walker)	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0
Eurytoma nodularis Boheman	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Eurytoma sp. ("Euglossa")	0	1	0	0	0	0	?	0	1	1	1	1	0	0	0	0
Heimbra bicolor Subba Rao	?	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0
Heimbra opaca Ashmead	?	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0
Macrorileya oecanthi (Ashmead)	?	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mesoeurytoma cariniceps Cameron	0	1	1	0	0	0	?	1	0	1	1	1	0	0	0	1
Mesoeurytoma sp. (Peru)	0	1	1	0	0	0	?	1	1	1	1	1	1	1	1	0
Philolema carinigena Cameron	0	1	1	0	0	0	?	0	0	0	0	0	0	0	0	0
Philolema javensis (Aximopsis) Girault	0	1	1	0	0	0	?	1	0	0	0	0	1	1	1	1
Philolema tephrosiae (Aximopsis) Girault	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Systole coriandri Gussakovsky	?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tenuipetiolus mentha Bugbee	?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetramesa hordei (Harris)	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



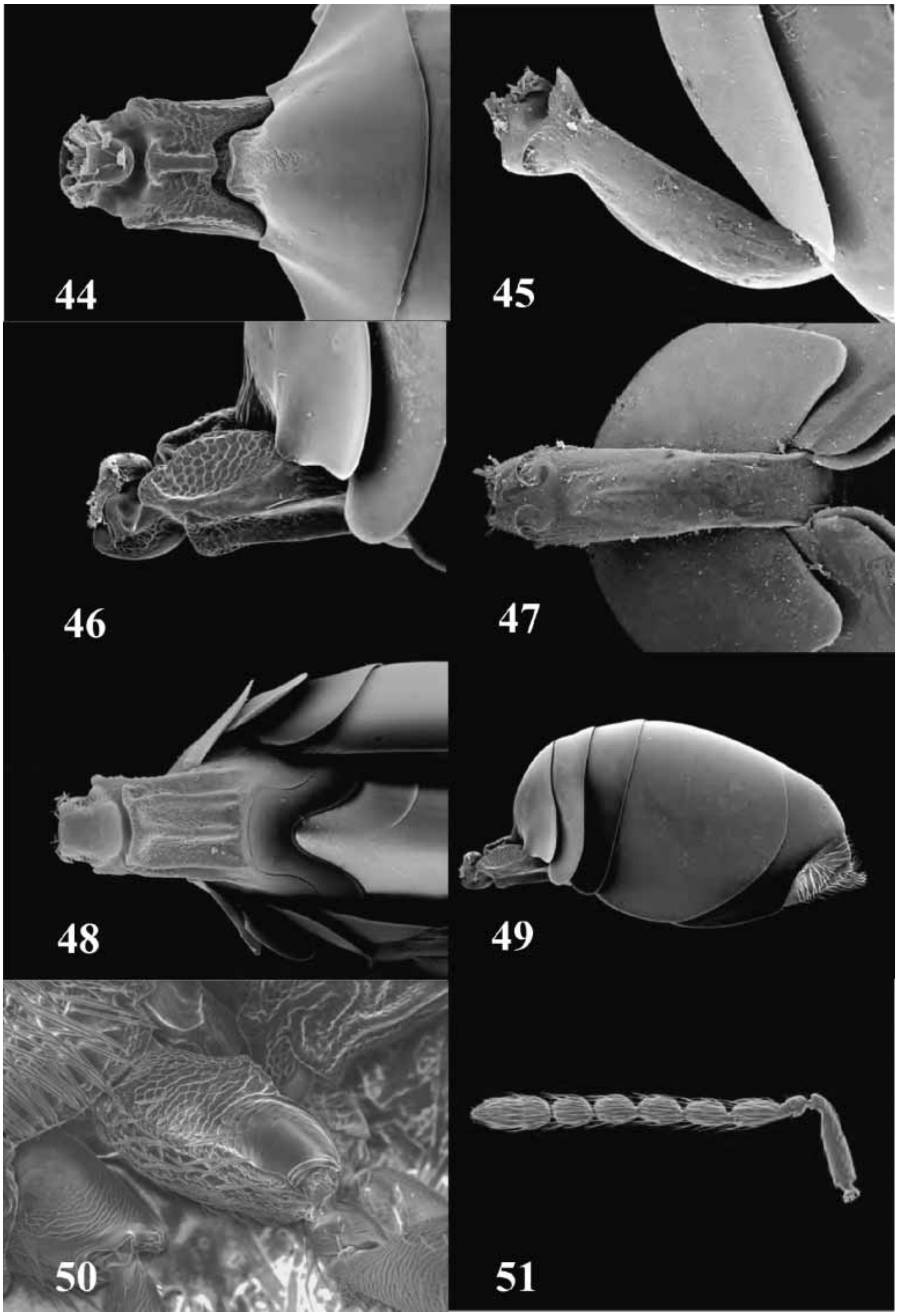
FIGURES 20–27. 20. *A. vogti*, female, head, posterior. 21. *M. oecanthi*, female, head, lateral. 22. *A. vogti*, female, head, lateral. 23. *Philolema carinigena* (type), female, head+mesosoma, dorsolateral. 24. *Conoaxima affinis*, female, lateral vertex, anterior. 25. *C. affinis*, female, vertex, lateral. 26. *M. oecanthi*, female, head, dorsal. 27. *A. hippolytis*, female, vertex, dorsolateral.



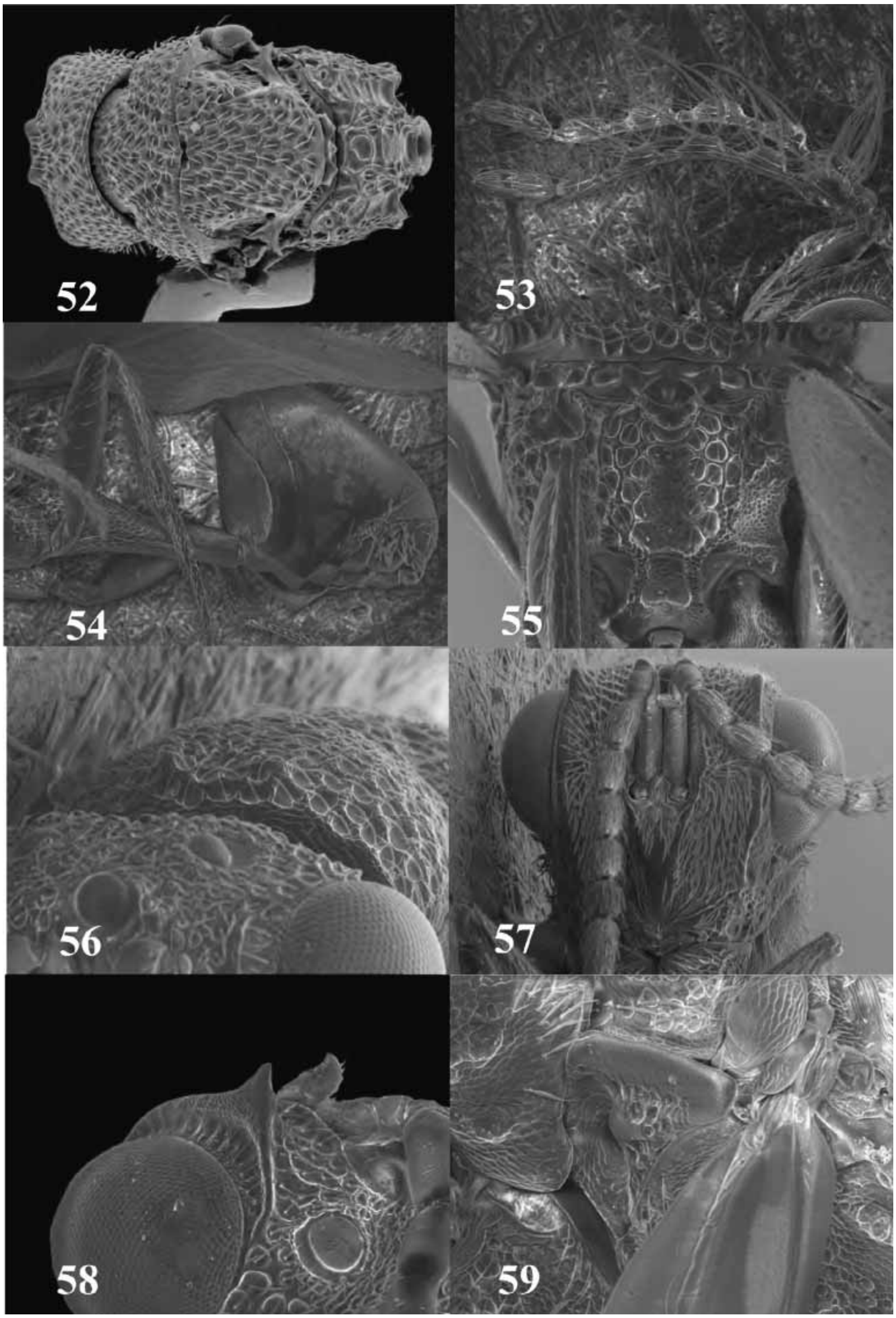
FIGURES 28–35. 28. *M. oecanthi*, female, mesosoma, dorsal. 29. *Ax. zabriskiei* female, pronotum, anterior. 30. *A. vogti*, female, head+mesosoma, dorsolateral. 31. *A. morio*, female, mesosoma, dorsoposterior. 32. *M. oecanthi*, female, mesosoma, lateral. 33. *H. opaca*, female, mesosoma, lateral. 34. *M. oecanthi*, female, prepectus, lateral. 35. *A. vogti*, female, prepectus, lateral.



FIGURES 36–43. 36. *M. oecanthi*, female, propodeum, dorsal. 37. *M. cariniceps* female, head+anterior mesosoma, lateral. 38. *A. vogti*, female, mesosoma, lateral. 39. *A. vogti*, female, propodeum, posterior. 40. *M. oecanthi*, female, forewing. 41. *Ap. diabolus*, female, forewing. 42. *Eurytoma robusta*, male, petiole, lateral. 43. *C. bennetti*, female, petiole, dorsal.



FIGURES 44–51. 44. *A. vogti*, female, petiole, dorsal. 45. *C. bennetti*, female, petiole, lateral. 46. *A. vogti*, female, petiole, lateral. 47. *C. bennetti*, female, petiole, ventral. 48. *A. vogti*, female, petiole, ventral. 49. *A. vogti*, female, metasoma, lateral. 50. *A. lanceolepis*, female, metacoxa, lateral. 51. *A. vogti*, female, antenna.



FIGURES 52–59. 52. *A. vogti*, female, mesosoma, dorsal. 53. *A. vogti*, male, antennae. 54. *A. vogti*, male, metasoma, lateral. 55. *A. hespenheidei*, female, propodeum, dorsal. 56. *A. hippolytis*, female, pronotum, anterior. 56. *A. vogti*, female, metasoma, lateral. 57. *A. lanceolepis*, female, head, anterior. 58. *A. pythmenis*, female, head, dorsolateral. 59. *A. anubis*, prepectus, lateral.

dorsally channeled metacoxa (to receive the metafemur) (Fig. 50), often pale setation on forewing (Fig. 5), elevated and blocky propodeum (Figs. 11, 12, 38, 52), preorbital carinae (often extend over dorsum of vertex) (Figs. 18, 22, 57, 58), vertex horns arising as expansion of preorbital carinae (Figs. 22, 30, 57, 58), and the presence of pronotal processes (Figs. 30, 31, 52, 56). *Aximopsis* may be most likely confused with *Conoaxima*, but the latter can be reliably separated by having ocellar horns (Figs. 24, 25) rather than vertex horns and by the presence of an upturned scutellar process apically. Other taxa possessing preorbital carinae and/or vertex horns (i.e., *Axima*, *Aplatoides*) have distinctly different forewing venation (Fig. 4; compare Fig. 5) and metasomal habitus (Fig. 2; compare Fig. 3).

Redescription of the genus

Female. Length 1.9–4.3 mm. Dark brown to black, non-metallic, generally umbilicate with interstices alveolate (Figs. 1, 38). Mesosoma (Figs. 38, 52). Mesepisternum (anterior to femoral depression), metapleuron, and lateral areas of propodeum covered with contiguous, shallow, setigerous punctures. Prepectal concavity extremely deep. Femoral depression relatively shallow. Upper mesepimeron with flattened surface and deep depressions; lateral panel of pronotum elongate-imbricate ventrally; mesepimeron and femoral depression striate; prepectus glabrous with a medial concavity and some species with a ventral concavity; procoxa shallowly umbilicate anteriorly, alveolate laterally, convex anteriorly, laminate anteroapically; mesocoxa glabrate to finely imbricate; metacoxa indistinctly imbricate, shallowly umbilicate dorsolaterally, carinate posteromedially and posterolaterally; femora indistinctly imbricate. Forewing (Fig. 5) hyaline, veins yellow, setae on disk short and sparse, absent in basal 1/3 except for bsl. Gaster shiny (Figs. 3, 49), effaced reticulate laterally.

Head (Figs. 18, 20, 22, 30, 69). Occipital margin rounded, concave posteriorly. Genal carina well developed; preorbital carina strong, most species with production into a horn at vertex, joining postorbital carina that circumnavigates lower eye margin and terminates as a weak fold prior to meeting occipital margin. Scrobal depression imbricate, weakly carinate laterally and ventrally, carina produced ventrally to meet clypeus; interantennal projection spadelike. Lower face with striae radiating dorsolaterally from clypeus. Ventral margin of toruli at about half eye height, toruli separated by 1 torulus diameter. Gena below lower eye margin with middle elevated and only alveolate. Postgenal carina robust, apically lamellate. Antenna (Figs. 51, 57, 72) with filiform setae and sparse MPS. Antennal formula 1:1:1:5:3. Anellus transverse. Apical width of pedicel subequal to length, narrowed basally. Funicular segments cylindrical to spheroidal, broadest medially. Clava with first and second segments subequal; third segment partially fused to second, acuminate, extreme apex extruded into a nipplelike extension with a crown of microsetae.

Mesosoma (Figs. 30, 38, 52). Dorsal pronotum wider than long, most species with paired pronotal processes. Mesoscutum broader than long; notaulus evident as a diagonal line of punctae reaching anterior margin of scutellum. Anterior margin of axilla in line with anterior margin of scutellum. Scutellum longer than wide at its widest; broadly convex dorsally. Dorsellum glabrous. Lateral channel of propodeum formed from absence of punctae, only alveolate. Procoxa dorsally convex to accommodate postgenal carina, basal margin strongly carinate, depressed anterobasally for reception of lower head, depression semicircular in frontal view. Mesocoxa with setose posteromedial protuberances (Fig. 13). Mesopleuron in ventral view with inverted V-shaped carina inserted between bases of procoxae (Fig. 9). Forewing (Fig. 5) disk setation sparse, bare in basal third with exception of bsl.

Metasoma (Fig. 3, 44, 46, 48, 49). Petiole dorsal surface with median and lateral carinae. Gaster ovate in lateral view, slightly acuminate posteriorly; syntergum with short setation.

Male. Similar to female in coloration and structure except as follows: scape with indistinct ventral plaque in basal half (Fig. 53), flagellomeres pedicellate with whorls of setae on dorsal surface basally and apically, five funicular segments, and a two-segmented clava. Petiole with anteroventral petiolar process (Fig. 13, mpp), thickest and broadest in basal third. Gaster lacking acuminate terminal segments (Fig. 54), highest in anterior third, Gt_1 with longitudinal depression to accommodate petiole,

Key to the Species of *Aximopsis*

1. Pronotum with distinctly different patch of short, thickened, yellowish brown setae anteromedially on the dorsal surface (Fig. 31).................... *Aximopsis morio* Ashmead
   Pronotum with setae of uniform size, shape, and color (Fig. 30) 2
2. Propodeum excavated medially, median furrow with fine punctulae, anterior and posterior sections of furrow separated by one transverse carina (Fig. 55) ....*Aximopsis hespenheidei*, **n. sp.**
   Propodeum deeply punctate medially, punctae enlarged forming a channel of deep foveae separated by raised carinae (Figs. 62, 63, 69) 3
3. Vertex horns (Fig. 66) and often pronotal processes reduced (Fig. 56) ....*Aximopsis hippolytis*, **n. sp.**
   Vertex with prominent lateral, hornlike extensions (Fig. 22) AND dorsal pronotum with prominent paired spinelike processes anteromedially (Fig. 30, 52)...................... 4
4. Setae on the lower face distinctly flattened, scalelike (Fig. 57)..................................... .... *Aximopsis lanceolepis*, **n. sp.**
   Setae on the lower face filiform or only slightly flattened (Fig. 18)............................ 5
5. Lower face long, head 1.25–1.30X as broad as high (Fig. 68); vertex horns as broad (see diagnosis) as long. ....*Aximopsis pythmenis*, **n. sp.**
   Lower face shorter, head ~1.50X as broad as high (Fig. 18); vertex horns broader than long (1.5–2.0X) 6
6. Female vertex with patch of short, thickened, yellowish brown setae about the same density as that on rest of head (Fig. 64; cf. Fig. 30)............. *Aximopsis arietinis*, **n. sp.**
   Female vertex with patch of short, thickened, yellowish brown setae, denser than that of rest of head (Fig. 30).. 7

7. Petiole length and width subequal or only slightly longer than wide (Fig. 44) ....*Aximopsis vogti*, **n. sp.**
   Petiole 3X longer than wide ....*Aximopsis anubis*, **n. sp.**

Aximopsis anubis **Gates, n. sp.**

(Figs. 59–62)

Etymology

anubis (Latin, noun, feminine) = a noun in apposition recalling the dark god of the chase or hunt of Egyptian myth.

Diagnosis and identification

Aximopsis anubis is the only known species occurring in the Caribbean islands. This species possesses the diagnostic features of the genus and is most similar to *A. vogti* in having prominent vertex horns; dense, dirty blonde, vertex setae; a shorter lower face; setae of the lower face filiform, not lanceolate; prominent pronotal processes; and a deeply punctate median channel of the propodeum. It differs from *A. vogti* by the female having a petiole that is 3X longer than it is wide while the length and width of the female petiole in *A. vogti* are nearly subequal.

Female. Length 2.9–3.0 mm. Prepectus with a shallow finely alveolate concavity (Fig. 59). Metacoxa posterolateral carina weak (Fig. 60). Gaster with effaced reticulation occurring dorsally on posterior segments; Gt_1 coarsely alveolate anteriorly just above petiolar insertion. Antenna dark brown, base of scape yellow. Legs brown, except extreme bases and apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, pretarsus brown.

Head. 1.4X wider than high; 1.4X wider than pronotum; HTE:msp 2.65. POL 2.0X longer than OOL. Width of oral fossa 0.37X width of head. Scape 5X longer than broad. Antennal segment ratios 30:6:1:12:11:11:11:11:23. Clava 3X longer than broad.

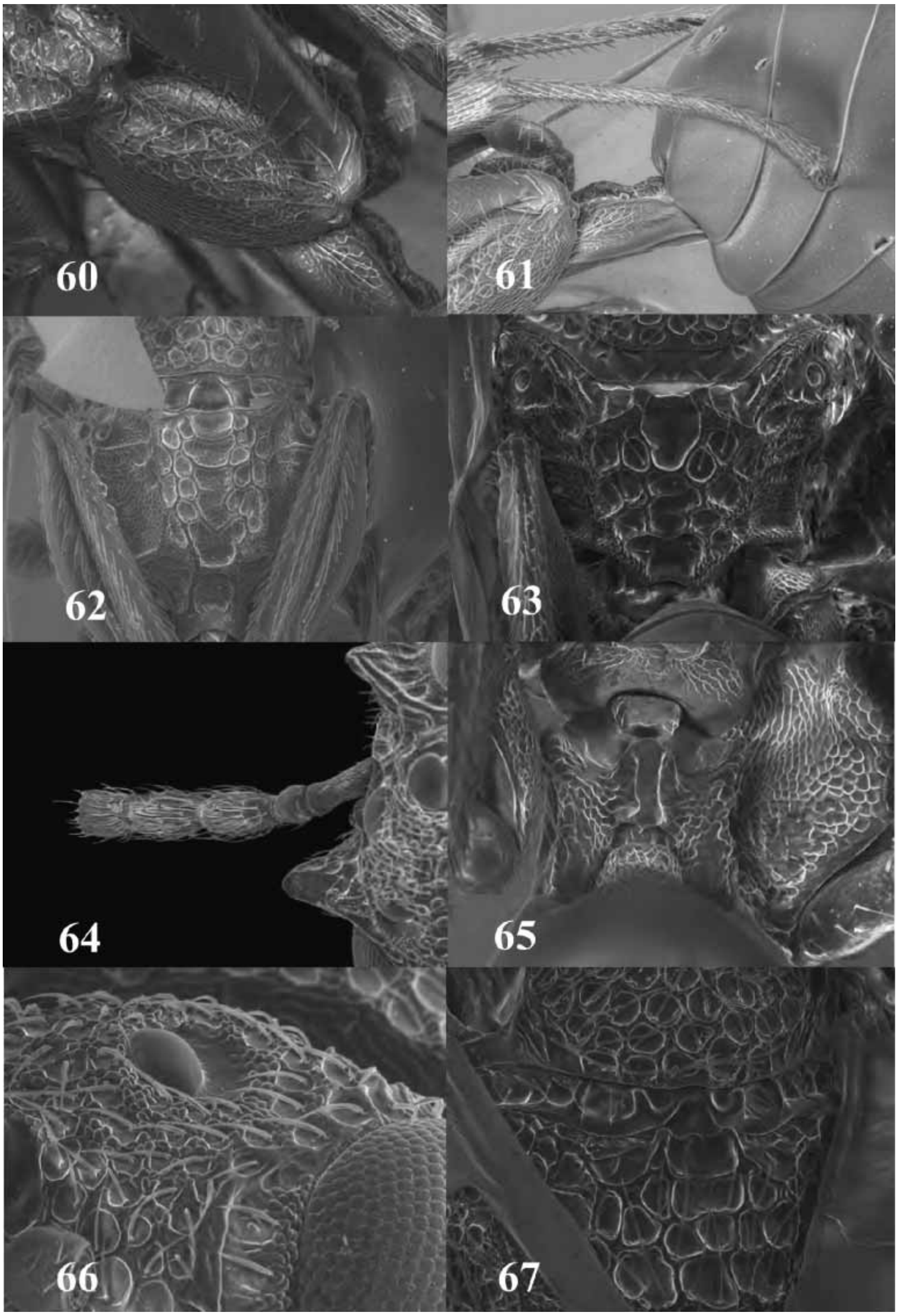
Mesosoma. Dorsal pronotum 2.8X wider than long, with paired pronotal processes. Mesoscutum 3X broader than long. Scutellum length subequal to its width at its widest; broadly convex dorsally. Dorsellum disc composed of a central -shaped structure with lateral arms broadening laterally into paddle-shapes (Fig. 62). Propodeum deeply punctate in central depression with interstices alveolate. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 2.4.

Metasoma. Petiole 3.0X longer than wide; dorsal lateral carinae weak; median carina discontinuous subapically; lateral surface with strong carina; ventral surface with medial and lateral carinae.

Male. Unknown.

Variation

The type series exhibits very little variation.



FIGURES 60–67. 60. *A. anubis*, female, metacoxa, lateral. 61. *A. anubis*, female, petiole+anterior gaster, lateral. 62. *A. anubis*, female, propodeum, dorsal. 63. *A. arietinis*, female, propodeum, dorsal. 64. *A. arietinis*, male, antenna. 65. *A. hespenheidei*, female, petiole, dorsal. 66. *A. hippolytis*, female, vertex, anterolateral. 67. *A. hippolytis*, female, dorsellum, dorsal.

Type material (3♀)

Holotype ♀ (USNM ENTO 00481367) (USNM); West Indies: Tobago: Goldsborough: Ex. neglected citrus orchard bordering on primary forest, 5–12.v.1994, M.J. Sommeijer, Malaise trap. Paratypes 2♀ (USNM ENTO 00481327, 00481328, 004800041) (USNM), same data as holotype.

Aximopsis arietinis **Gates, n. sp.**

(Figs. 63–64)

Etymology

arietinus (Greek, noun, masculine) = of a ram; a feminized adjective describing the hornlike extensions typical of species in this genus.

Diagnosis and identification

Aximopsis arietinis possesses the characteristic horns on the vertex and dorsomedial pronotum of the genus, but lacks a distinctly different patch of short, thickened, yellowish brown setae on the female vertex.

Female. Length 3.1–3.3 mm. Prepectus with shallow concavities in middle and along ventral border, ventral concavity finely alveolate; metacoxa posterolateral carina irregularly shaped. Gt_1 glabrous anteriorly. Antenna brown (Fig. 64). Legs brown, except extreme apices of femora and tibiae pale yellow and tarsomeres pale yellow, pretarsus brown.

Head. 1.5X wider than high; 1.5X broader than pronotum; HTE:msp 2.53. POL 1.8X longer than OOL. Width of oral fossa 0.33X width of head. Scape 5X longer than broad, apical width of pedicel subequal to length, narrowed basally. Antennal segment ratios 24:5:1:13:11:10:10:9:18. Clava 2.5X longer than broad.

Mesosoma. Dorsal pronotum 2.25X wider than long, with paired pronotal processes. Mesoscutum 2X broader than long. Scutellum 1.3X longer than wide at its widest. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes (Fig. 63). Propodeum (Fig. 63) medially with greatly enlarged punctae and a depression posteriorly. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.67.

Metasoma. Petiole 1.5X longer than wide; dorsal median carina with anterior and posterior thickened processes, lateral carinae higher in middle; ventral surface with weak medial and lateral carinae.

Male. Length 3.4–3.5 mm. Similar to female in coloration and structure except as follows: scape 4.0–4.4X longer than broad, indistinct ventral plaque in basal half; petiole 6.8–7.0X longer than broad, reticulate-rugose, broadest and highest in anterior half, thinning apically, two irregular dorsomedial carinae diverging from unique origin anteriorly, fading by midlength, with anterodorsal carinae fading by midlength, mpp reticulate with ventrolateral carinae diverging from mpp, extending length of petiole.

Variation

One female (USNM ENT 00480041) with alveolate sculpturing at base of Gt_1 anteriorly. One male (USNM ENT 00480000) has the dorsal petiolar carinae indistinct, but traceable.

Type material (5♀, 3♂)

Holotype ♀ (USNM ENTO 00480039) (USNM); Brazil: Santa Catarina: Bananal Selva, vi.1961, G.B. Vogt, Vogt coll. #61-1344, reared from *Taphrocerus* (Coleoptera: Buprestidae) ex palm. Paratypes 3♀ (USNM ENTO 00480001, 00480003, 004800041) (USNM), 3♂ (USNM ENTO 00480000, 00480022, 004800030) (USNM), same data as holotype; 1♀ (USNM ENTO 00480024) (USNM), same data as holotype, Vogt coll. #61-1339.

Aximopsis hespenheidei **Gates, n. sp.**

(Figs. 5, 55, 65)

Etymology

This epithet is a patronymic noun, genitive masculine singular, recognizing Dr. Henry A. Hespenheide for his contribution to the study of leaf-mining Buprestidae, which this group of wasps parasitizes.

Diagnosis and identification

Aximopsis hespenheidei is unique among the remaining species in having the median, excavated furrow of the propodeum composed of fine punctulae rather than large punctae and the anterior and posterior sections of furrow separated by one transverse carina (Fig. 55).

Female. Length 1.9–3.3 mm. Prepectus with shallow finely alveolate concavities in middle and along ventral border. Metacoxa posterolateral carina irregular. Gaster with effaced reticulation occurring dorsally on some segments; Gt_1 coarsely alveolate anteriorly in shape of an isosceles triangle. Antenna dark brown, scape and pedicel light brown. Legs brown, except extreme apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, pretarsus brown.

Head. 1.3X wider than high; subequal in width to pronotum; HTE:msp 2.32. POL 2.25X longer than OOL. Width of oral fossa 0.36X width of head. Scape 5X longer than broad. Antennal segment ratios 18:5:1:9:7:7:8:8:16. Clava 3X longer than broad.

Mesosoma. Dorsal pronotum 3X wider than long, with paired pronotal processes. Mesoscutum 2X broader than long. Scutellum 1.1X longer than wide at its widest; broadly convex dorsally. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes. Propodeum alveolate only in central depression. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.87 (Fig. 5).

Metasoma. Petiole length and width subequal; dorsal lateral carinae higher and thickened in mediolateral plane in middle (Fig. 65); ventral surface with weak medial and lateral carinae.

Male. Length 3.2 mm. Similar to female in coloration and structure except as follows: scape 4.0X longer than broad; petiole 5.0–5.4X longer than broad, reticulate-rugose, broadest and highest in anterior half, thinning apically, with anterodorsal carinae fading by midlength, mpp reticulate with ventrolateral carinae diverging from mpp, extending length of petiole.

Variation

One female (USNM ENT 00480021) is approximately 2/3 the size of the holotype. This specimen has more brown undertones and the legs are more of a concolorous brown. The femora and tibiae, for example, in the remaining material tend toward a much darker brown to black medially. The sculpture on this specimen is slightly reduced, a presumed scaling effect due to reduced size.

Type material (10♀, 2♂). Holotype ♀ (USNM ENTO 00480033) (USNM), Mexico, Tabasco, 83km E Palo Mulato, 1982, G.B. Vogt, Vogt coll. #82-61, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. *Psidium* (guava). Paratypes 2♀ (USNM ENTO 00480038, 00480457) (USNM), 1♂ (USNM ENTO 00480025) (USNM) same data as holotype; 1♀ (USNM ENTO 00480010) (USNM), Colombia, Valle de Cauca, San Jose de Anchicaya, vii.21-27.1970, G.B. Vogt, Vogt coll. #70-96; 1♀ (USNM ENTO 00480012) (USNM) same data, vii.21-viii.27-1970, Vogt coll. #70-97; 1♀ (USNM ENTO 00481004) Panama, Canal Zone, Pipeline Road, 13km NW Gamboa, 9°12’N 79°47’W, Coll.: 16.vii.1978, Emer.: 1.viii.1978, H.A. Hespenheide, reared from *Pachyschelus* (Coleoptera: Buprestidae), VS HAH 78:81, (Urticaceae); 1♂ (USNM ENTO 00481000) (USNM) same data, VS HAH 78:82; 1♀ (USNM ENTO 00481002) (USNM) same locality, Coll.: 31.viii.1977, Emer.: 2.ix.1977, T.W. Sherry, reared from *Pachyschelus* (Coleoptera: Buprestidae), V.S. 77:1325, IN LEGUME; 1♀ (USNM ENTO 00481001) (USNM) Panama, Canal Zone, 7km W Margarita, 9°20’N 79°58’W, Coll.: 23.vii.1978, Emer.: 13.viii.1978, H.A. Hespenheide, reared from *Pachyschelus* (Coleoptera: Buprestidae), VS HAH 78:207, (Leguminosae); 1♀ (USNM ENTO 00481003) (USNM) Costa Rica, Puntarenas Prov., Parque Nacional Corcovado, Estacion Sirena, 8°28-31’N 83°36’W, Coll.: 20.iii.1981, Emer.: 5.iv.1981, H.A. Hespenheide, reared from *Pachyschelus* (Coleoptera: Buprestidae), VS # 81-09, (Urticaceae); 1♀ (USNM ENTO 00480021) (USNM) no data, Vogt coll. #60-750.

Aximopsis hippolytis **Gates, n. sp.**

(Figs. 27, 56, 66–67)

Etymology

hippolyta (Greek, noun, feminine) = the Amazon queen of Greek myth; a feminized adjective attributing the exotic, fantastical Brazilian locality.

Diagnosis and identification

Aximopsis hippolytis lacks distinct preorbital horns on the vertex, being represented by only a slight angulation of the preorbital carina (Fig. 27, 66). It is unique among the known species in lacking distinct paired spinelike processes anteromedially on the dorsal pronotum, which are present as low alveolate bosses (Fig. 56).

Female. Length 2.9–3.3 mm. Prepectus with only a shallow weakly striate concavity in middle, alveolate ventrally. Metacoxa posterolateral carina weak. Gaster effaced reticulation occurring dorsally on some segments; Gt_1 lacking sculpture anteriorly. Antenna dark brown. Legs brown, except extreme apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, apical tarsomere and pretarsus brown.

Head. 1.2X wider than high; 1.1X width of pronotum; HTE:msp 2.14. Preorbital carina horn at vertex greatly reduced. POL 0.83X longer than OOL. Width of oral fossa 0.36X width of head. Scape 4X longer than broad. Antennal segment ratios 20:5:1:11:10:10:9:9:17. Clava 3X longer than broad.

Mesosoma. Dorsal pronotum 2X wider than long, paired pronotal processes absent. Mesoscutum 2X broader than long. Scutellum 1.3X longer than wide at its widest. Dorsellum disc composed sublateral ∪ shaped structures with lateral arms descending into space between scutellum and propodeum (Fig. 67). Propodeum (Fig. 67) central depression scarcely recognizable. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.83.

Metasoma. Petiole 1.9X longer than wide; dorsal lateral carinae formed by discontinuous anterior and posterior portions; ventral surface with weak sublateral carinae.

Male. Unknown

Variation

One female (USNM ENT 00480026) has slightly more distinct paired, differential sculpturing on the dorsal pronotum that correlate with the spinelike pronotal processes of other species.

Type material (2♀)

Holotype ♀ (USNM ENTO 00480028) (USNM); Brazil; Rio Grande do Sul; Ilha do Pavao; ii.1962; G.B. Vogt; Vogt coll. #62-269; reared from *Taphrocerus* (Coleoptera: Buprestidae) ex. *Cyperus* (giant flatsedge). Paratype 1♀ (USNM ENTO 00480026) (USNM) same locality as holotype; ii.22-23.1962; Vogt coll. # 62-229; reared from *Taphrocerus* (Coleoptera: Buprestidae) ex. *Scirpus* (bullrush).

Aximopsis lanceolepis **Gates, n. sp.**

(Figs. 3, 57, 68)

Etymology

lancea (Latin, noun, feminine) = spear + *lepis* (Greek, noun, feminine) = scale; "the one with lanceolate, scalelike setae a noun in apposition describing the dense setation of the thorax.

Diagnosis and identification

Aximopsis lanceolepis is unique among the other species by have a dense covering of distinctly lanceolate, scalelike setae on the lower head including the gena, lower face, supraclypeal area, and interantennal projection (Fig. 57). Other species have setae that is mostly filiform or, at most, only slightly flattened.

Female. Length 3.0 mm. Prepectus with a shallow weakly striate concavity in middle. Gaster with effaced reticulation occurring dorsally on some segments; Gt_1 with striate sculpturing anteromedially and expanding posterolaterally into “Y” shape. Antenna dark brown, scape at extreme base and pedicel dark yellow. Legs brown, except extreme apices of fore- and midfemora, apices of tibiae, and tarsomeres pale yellow, pretarsus brown.

Head (Fig. 57). 1.2X wider than high; subequal to width of pronotum; HTE:msp 2.38. Preorbital carina produced into a horn at vertex. POL 3.6X longer than OOL. Width of oral fossa 0.38X width of head. Scape 5.4X longer than broad. Antennal segment ratios 20:4:1:9:8:8:7:7:14. Clava 2.3X longer than broad.

Mesosoma. Dorsal pronotum 2.9X wider than long, with paired pronotal processes. Mesoscutum 2X broader than long. Length and width of scutellum subequal. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes. Propodeum central depression formed from a reduction of interstices, large foveum present dorsally, lateral ridges expanded and umbilicate. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.87.

Metasoma (Fig. 3). Petiole length and width subequal; dorsal lateral carinae higher and thickened in mediolateral plane in middle; ventral surface with weak medial and lateral carinae.

Male. Unknown

Type material

Holotype ♀ (USNM ENTO 00480018) (USNM); Bolivia: Santa Cruz: La Guardia, v.5-13.1962, G.B. Vogt, Vogt coll. #62-345, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex *Annona*.

***Aximopsis morio* Ashmead**
(Fig. 33)

Aximopsis morio Ashmead, 1904: 460.

Diagnosis and identification

Aximopsis morio is unique among the species of *Aximopsis* in having the pronotum with distinctly different patch of short, thickened, yellowish brown setae anteromedially on the dorsal surface (Fig. 33) and by having the setae on the disk of the forewing reduced to the apical half.

Redescription of the holotype female

Prepectus with shallow finely alveolate concavities in middle and along ventral border. Metacoxa posterolateral carina irregular. Gaster absent. Scape, pedicel, anellus, and first funicle dark brown. Pro- and mesolegs brown, except extreme apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, pretarsus brown, hindleg missing.

Head. 1.4X wider than high; 1.7X wider than pronotum; HTE:msp 2.62. Preorbital carina produced into a horn at vertex. POL 1.5X longer than OOL. Width of oral fossa 0.36X width of head. Scape 5X longer than broad. Antennal formula 1:1:1:?:?, only F1 remains on specimen.

Mesosoma. Dorsal pronotum 2.6X wider than long, with paired pronotal processes. Mesoscutum 2.2X broader than long. Scutellum 1.4X longer than wide at its widest. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes. Propodeum central depression created from reduction of interstices, mostly only alveolate. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 1.75.

Metasoma. Petiole 2X longer than wide; dorsal lateral carinae higher and thickened in mediolateral plane in middle; ventral surface with weak sublateral carina. Gaster absent.

Male. Unknown. There exists in the USNM a series of males, 3 from Trinidad and Tobago (Santa Cruz) and 2 from Ecuador (Cononaco & Tzapino), that share the patch of yellowish brown setae between the pronotal processes. One specimen from Trinidad and Tobago also shares with the type a dorsally continuous preorbital carina that is produced as a low protuberance posterolaterad posterior ocellus near the eye margin. The remaining males from Trinidad and Tobago and Ecuador lack this posterior protuberance and have a distinct, bulging ventral plaque on the scape. This is unlike males of other *Aximopsis* described herein. It is likely that several more species exist that are similar to *Aximopsis morio*, but it is impossible to associate females and males until more reared material becomes available.

Notes. The holotype is labeled with four labels: Santarem; Type (handwritten); Type No. 60507 U.S.N.M. (Red label); *Aximopsis morio* ♀ Type (handwritten). The specimen is incomplete, missing antennae beyond F1, left mesoleg, both hindlegs beyond hind coxa, and gaster.

***Aximopsis pythmenis* Gates, n. sp.**

(Figs. 58, 68–69)

Etymology

pythmen (Greek, noun, masculine) = bottom, base; this name is a feminized adjective describing the long petiole of this species.

Diagnosis and identification

Lower face (Fig. 68) is much longer, head 1.25–1.30X as broad as long compared to approximately 1.50X in other species of *Aximopsis*. The vertex horns are as broad as high (at base, defined by hypothetical continuation of preorbital carinae through base of horn) as opposed to being much broader than high (1.5–2.0X as broad as high) in other *Aximopsis*.

Female. Length 3.1–4.3 mm. Prepectus with a shallow finely alveolate concavity in middle. Gaster effaced reticulation occurring dorsally on some segments; Gt_1 coarsely alveolate anteriorly above petiolar insertion. Antenna dark brown, extreme base of scape light brown. Legs brown, except extreme apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, pretarsus brown.

Head (Fig. 58). 1.3X wider than high; 1.5X wider than width of pronotum; HTE:msp 2.5. Preorbital carina produced into a horn at vertex. POL 2.1X longer than OOL. Width of oral fossa 0.36X width of head. Scape 5X longer than broad. Antennal segment ratios 21:5:1:10:10:10:9:8:. Clava 3X longer than broad.

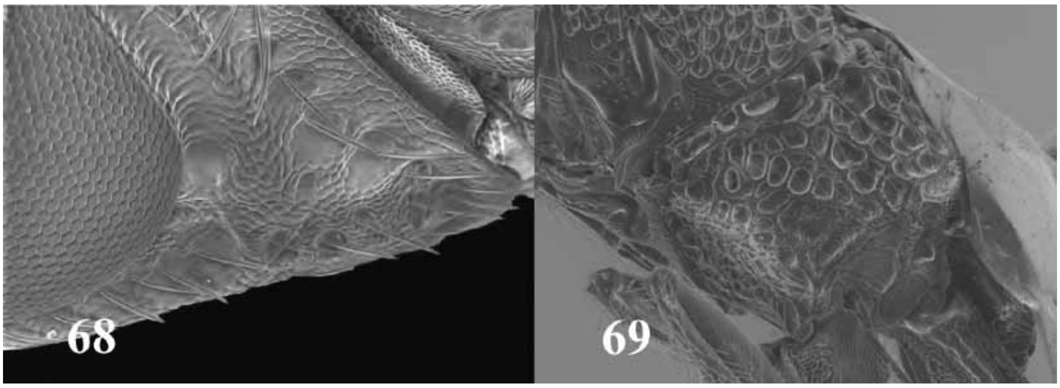
Mesosoma. Dorsal pronotum 2X wider than long, with paired pronotal processes. Mesoscutum 2X broader than long. Scutellum 1.3X longer than wide at its widest. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes. Propodeum central depression not obvious, entire dorsal surface with large fovea, lateral ridges obscured (Fig. 69). Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.86.

Metasoma. Petiole 1.7X longer than wide; dorsal surface lateral carinae higher and thickened in mediolateral plane in middle; ventral surface with strong medial and lateral carinae.

Male. Unknown.

Type material (2♀)

Holotype ♀ (USNM ENTO 00480014) (USNM); Brazil; Santa Catarina; Bananal Selva; vi.1961; G.B. Vogt; Vogt coll. #61-1295; reared from *Taphrocerus* (Coleoptera: Buprestidae) ex. *Bactris*. Paratype 1♀ (USNM ENTO 00480008) (USNM), same data as holotype; Vogt coll. # 61-1296.



FIGURES 68–69. 68. *A. pythmenis*, gena, lateral. 69. *A. pythmenis*, propodeum, dorsolateral.

Aximopsis vogti Gates, n. sp.

(Figs. 9, 11–13, 18, 20, 22, 30, 35, 38, 39, 44, 46, 48, 49, 51–54)

Etymology

This epithet is a patronymic noun, genitive, masculine singular, recognizing George B. Vogt for his extensive collecting resulting in the availability of this material for study.

Diagnosis and identification

Aximopsis vogti has the sculpturing on Gt_1 narrowly triangular and the petiole roughly as broad as long. *Aximopsis pythmenis* also has triangular sculpturing on Gt_1, but the petiole is 1.7X longer than broad. *Aximopsis hespenheidei* has somewhat triangular sculpturing on Gt_1 and the petiole roughly as long as broad, but the excavated furrow of the propodeum composed of fine punctulae rather than large punctae and the anterior and posterior sections of furrow separated by one transverse carina is unique within the genus.

Female. Length 2.5–3.3 mm. Prepectus with shallow finely alveolate concavities in middle and ventrally. Gaster effaced reticulation occurring dorsally on some segments; Gt_1 coarsely alveolate anteriorly above the petiolar insertion. Antenna dark brown, extreme base of scape light brown. Legs brown, except extreme apices of femora, bases and apices of tibiae, and tarsomeres pale yellow, pretarsus brown.

Head (Figs. 18, 20, 22, 51). 1.4X wider than high; 1.1X wider than width of pronotum; HTE:msp 2.5. Preorbital carina produced into a horn at vertex. POL 2.0X longer than OOL. Width of oral fossa 0.32X width of head. Gena below lower eye margin with middle elevated and alveolate. Scape 5X longer than broad. Antennal segment ratios 8:4:1:9:7:7:7:7:15. Clava 3X longer than broad.

Mesosoma (Figs. 9, 11–13, 30, 35, 38, 39, 52). Dorsal pronotum 3X wider than long, with paired pronotal processes. Mesoscutum 2X broader than long. Scutellum 1.3X longer than wide at its widest. Dorsellum disc composed of a central ovoid structure with lateral arms broadening laterally into paddle-shapes (Fig. 43). Propodeum central depression not obvious, entire dorsal surface with large fovea, lateral ridges obscured. Postmarginal vein subequal in length to stigma, ratio of mv:pmv 0.86.

Metasoma (Figs. 44, 46, 48, 49). Petiole 1.3X longer than wide; dorsal surface median carina discontinuous, lateral carinae higher and thickened in mediolateral plane in middle; ventral surface with medial and lateral carinae.

Male (Figs. 53–54). Length 2.5–3.5 mm. Similar to female in coloration and structure except as follows: scape 3.8–4.3X longer than broad with indistinct ventral plaque in basal half; petiole 4.3–5.5X as long as broad, reticulate-rugose, broadest and highest in anterior half, thinning apically, with anterodorsal carinae fading by midlength, lacking mediodorsal carinae, mpp reticulate with ventrolateral carinae diverging from mpp, extending length of petiole (Fig. 54).

Variation

There is some variation in the size of the specimens. Slightly smaller specimens may have less distinct sculpturing overall (e.g., extent of sculpturing on Gt_1 in female).

Type material (17♀, 7♂)

Holotype ♀ (USNM ENTO 00480015) (USNM), Panama: Panama: Cerro Campana, vii.29-viii.2.1970, G.B. Vogt, Vogt coll. #70-131, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. *Curitella*. Paratypes 1f (USNM ENTO 00480016) (USNM), same data as holotype, Vogt coll. # 70-128; 1♂ (USNM ENTO 00480017) (USNM), same data as holotype, Vogt coll. # 70-129; 1♀ (USNM ENTO 00480009) (USNM), Panama: Panama: Fort William Davis, 1983, G.B. Vogt, Vogt coll. # 83-259, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. *Ochroma* (balsa); 1♂ (USNM ENTO 00480027) (USNM), same data, Vogt coll. # 83-260; 1♂ (USNM ENTO 00480037), Panama: Colon: Fort San Lorenzo, viii.13.1977, G.B. Vogt, Vogt coll. # 77-396, reared from *Pachyschelus* (Coleoptera: Buprestidae); 1♀ (USNM ENTO 00480013) (USNM), Costa Rica: Puntarenas: Sirena, viii.1978, G.B. Vogt, Vogt coll. # 78-209, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. *Serjania*; 1♀ (USNM ENTO 00480029) (USNM), Costa Rica: Limon: 4.6 mi N Escuintla, ix-x.1978, G.B. Vogt, Vogt coll. # 78-588, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. nettle; 1♀ (USNM ENTO 00480036), 1♂ (USNM ENTO 00480007) (USNM), no data, Vogt coll. # 81-80; 2♀ (USNM ENTO 00480043, 00480044), 1♂ (USNM ENTO 00480002) (USNM), no data, Vogt coll. # 81-82; 1♀ (USNM ENTO 00480042) (USNM), no data, Vogt coll. # 81-83; 1♀(USNM ENTO 00480020) (USNM), no data, Vogt coll. # 81-84; 2♀ (USNM ENTO 00480019, 00480034) no data, Vogt coll. # 81-85; 3♀ (USNM ENTO 00480004, 00480006, 00480040) (USNM), no data, Vogt coll. # 81-86; 1♀ (USNM ENTO 00480011) (USNM), no data, Vogt coll. # 60-748; 1♀ (USNM ENTO 00480023) (USNM), no data, Vogt coll. # 60-745; 1♂ (USNM ENTO 00480036) (USNM), no data, Vogt coll. # 81-89; 1♂ (USNM ENTO 00480032) (USNM), no data, Vogt coll. # 80-124.

Additional material of *Aximopsis* that cannot be determined to species includes the following: One ♂ (USNM ENTO 00480031) (USNM), Brazil: Santa Catarina: Bananal Selva, vi.1961, G.B. Vogt, Vogt coll. #61-1336, reared from *Taphrocerus* (Coleoptera: Buprestidae) ex. palm. One ♂ (USNM ENTO 00480005) (USNM), Bolivia: Santa Cruz: La Guardia, v.5-13.1962, G.B. Vogt, Vogt coll. #62-364, reared from *Pachyschelus* (Coleoptera: Buprestidae) ex. *Sapindus* (soapberry). The male from Brazil (00480031) has a dorsoventrally flattened mesosoma and the pronotal processes are absent.

Incertae sedis

Aximopsis elegans Masi, 1917. *Incertae sedis*. A loan of type was requested from the BMNH in 2001, but the specimens were lost in transit. Britain’s Royal Mail confirmed that the parcel containing the type of *A. elegans* and one other type specimen was shipped to MG and that it left the country. However, these packages never arrived in Washington, D.C. Concurrently, the U.S. Post Office located at Brentwood in Washington, D.C. was closed after an anthrax attack in October 2001. This facility would have received the type parcel. Efforts were made to track the whereabouts of this parcel after all mail in the Brentwood facility at the time of the attack was removed and rerouted to Ohio (USA) for irradiation. Additionally, official reports were filed with the Mail Recovery Center in Atlanta, Georgia. Unfortunately, the type of *A. elegans* was never recovered and is considered lost. The original material was collected in the Seychelles (Masi 1917) with the following locality information: “Mare au Cochons—Côtes d’or Estate”.

Species removed from *Aximopsis*

Aximopsis javensis and *Aximopsis tephrosiae* Girault, 1917. Both placed in *Philolema* based upon the possession of the generic characters of *Philolema* as determined by examination of the type species, *Philolema carinigena* Cameron, 1908 (BMNH; Type (circular label with red rim); P. Cameron Col., 1914-110; *Philolema carinigena* Cameron, Type Borneo (handwritten); B. M.TYPE HYM. 5.348G), and contrasting this with the closely related *Mesoeurytoma cariniceps* Cameron, 1911 (BMNH; Type (circular label with red rim); Kuching, Mar. (struck), J. H. (handwritten initials); P. Cameron Col., 1914-110; *Mesoeurytoma cariniceps* Cameron, Type Borneo (handwritten); B. M.TYPE HYM. 5.349). Characters defining *Philolema* include frons concave with distinct preorbital carinae converging toward the posterior edge of the anterior ocellus, although the carina is much reduced by this point, and ecarinate pronotum. *Mesoeurytoma* is similar but differentiated by the preorbital carina terminating near the anterior ocellus as an elevated boss and the pronotum carinate anteriorly with two toothlike processes. Both *Philolema* and *Mesoeurytoma* are somewhat similar to *Aximopsis* in general habitus, but lack the two putative synapomorphies of the latter genus (sculpture/setation at ocellar triangle, male petiolar process). Further, *Philolema* lacks the majority of the suite of diagnostic characters that are used in combination to recognize *Aximopsis*, including the elevated and angled propodeum, pronotal processes, and vertex horns. The four syntypes representing *A. javensis* are distributed on two point mounts as follows: 2 females on one point with red label (20656) and handwritten identification label in Girault’s hand and one female and one male on the second point with a similar red label and handwritten identification label of E. F. Riek, 1968, of *Philolema* sp. The two complete syntypes representing *A. tephrosiae* are both mounted on a point along with a single female head. The pin has a red label (20657) and an identification label in Girault’s hand.

Aximopsis ovi Girault. *Nomen nudum*. This name originally was mentioned in Ayyar (1920) as a parasitoid of the eggs of *Oxya velox* (Orthoptera: Acrididae). He indicated that this name would be applied to specimens in the possession of and being described by A. A. Girault. Farooqi & Subba Rao (1986) first reported this name as unavailable. Specimens in the USNM labeled as *Aximopsis ovi* bear the red label "20748" as well as the identification label in Girault’s hand. However, nothing that would satisfy the criteria for availability was ever published.

Aximopsis tumidiscapi Girault. *Nomen nudum*. Noyes (2003) indicated that this name originally was mentioned in Ayyar (1920). We cannot find reference to it in this publication. Thompson (1944) lists *A. tumidiscapi* as a parasitoid of the eulophid *Centrodora oophaga* (Girault) (as *Tumidiscapus oophagus* Girault), reported in Ayyar

(1920) as a parasitoid of the eggs of *Oxya velox* (Orthoptera: Acrididae). Farooqi & Subba Rao (1986) first reported this name as unavailable. The specimen in the USNM labeled as *Aximopsis tumidiscapi* bears the following labels 1.XII.15, South India, Coimbatore, par from *Oxya* eggs, Y. R. Coll.; No. 11, 1.X.16; (red label) 20747; *Aximopsis tumidiscapi* ♀ Type Girault (Girault's handwriting); *Philolema* sp. E.F. Riek det 1968. However, nothing that would satisfy the criteria for availability was ever published.

Aximopsis tricolor Girault, 1913, **n. comb**. The type specimen was examined in 1999 at which time a description was written, measurements taken, and rough sketches completed. The female syntytpe (ZMHB) bears the following labels "Paraguay, San Bernardino, K. Fiebrig S.V.; TYPE (red label); *Aximopsis tricolor* ♀ Type Girault (illegible comment) (Girault's handwriting); 5.mile.pr 1010 (?difficult to read); Zool. Mus. Berlin; ex coll Luchs; GBIF-ChalcIS-D, ID: ChalcD0680. The male syntype has the following label information: "Paraguay, San Bernardino, K. Fiebrig S.V.; TYPE (red label); ex coll. Girault; Zool. Mus. Berlin. It is herein placed in *Eurytoma* given that it lacks those features that would ally it with *Aximopsis* as redescribed above. Not only is this species orange in overall coloration (unknown in *Aximopsis*), but also the preorbital carinae are fine and not produced into horns at vertex. The petiole is completely unlike that of *Aximopsis* in lacking carinae and microsculpture, rather, it is glabrous with a few fine striae and lacks an anterodorsal process (bilobate crest anteriorly).

Discussion and biological information

The host records of *Aximopsis* reported herein detail the advantage of having material reared from hosts and having notes that detail biological information. The Vogt collection of reared leafminers proves its value again (Metz et al. 2005). In addition to gleaning the biological associations with other host insect and plant taxa, the number of specimens available from a similar collecting event simplifies the task of taxonomy.

Of the 5 previously described species, only one remains in *Aximopsis*, and it had not been described with a male that can be associated with the female type. No host records had been recorded previously.

Given the known host distribution, *Aximopsis* appear to have radiated solely upon buprestids in the subfamily Agrilinae, tribe Trachyini. Two genera, *Taphrocerus* Solier (subtribe Brachyina) and *Pachyschelus* Solier (subtribe Pachyschelina), are the sole recorded hosts from which *Aximopsis* have been reared. This tribe of buprestids is primarily Neotropical in distribution but does extend into the Nearctic, especially the southern and eastern United States. *Taphrocerus* spp. commonly are associated with monocots, such as palms and sedges, and can be locally abundant (N. Woodley, pers. comm.), whereas *Pachyschelus* spp. have greater dietary breadth encompassing numerous herbs and smaller trees (dicots).

Parasitization of leafmining Buprestidae by *Aximopsis* appears to terminate somewhere in Mexico as *Aximopsis* has not been collected in the Nearctic Region north of Mexico. Previous reports on parasitism in leafmining *Pachyschelus* and *Taphrocerus* list several families of Chalcidoidea but not Eurytomidae. Hespenheide & Kim (1992) reported *Spilochalcis* (now *Conura*), two pteromalid and two eulophid genera attacking *Pachyschelus psychotriae* Fisher in Panama, while Story & Robinson (1979) recorded *Chrysocharis* sp. attacking *Taphrocerus schaefferia* Nicolay & Weiss in Virginia, USA. This is not to say *Aximopsis* has never been documented from *Pachyschelus* or *Taphrocerus* previously as Queiroz (2002) recorded 6 species of Chalcidoidea as parasitoids of immatures of *Pachyschelus coerulipennis* Kerremans in Brazil.

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