

Revision of *Aphelonotus* Uhler (Hemiptera: Heteroptera: Pachynomidae), with description of six new species and documentation of nymphal morphology for three species

RANDALL T. SCHUH,¹ CHRISTIANE WEIRAUCH,² AND HORACIO GRILLO³

ABSTRACT

Aphelonotus Uhler is revised with the recognition of 14 species, six of them described as new: *A. alvarengai*, *A. elongatus*, *A. minutus*, *A. paramedius*, *A. taino*, and *A. xenos*. *Aphelonotus brevirostris* Carayon and Villiers is treated as a junior synonym of *A. fraterculus* Harris. Color habitus images and illustrations of the male parameres are provided for all species; morphology for the adult female of *A. major* is documented through the use of scanning electron microscopy (SEM). Measurements of male and female specimens are presented and analyzed, documenting a strong correlation between total length and the length of the proximal portion of the antennal pedicel and the consequent utility of either of these measurements in species discrimination. Nymphs are described for the first time for the genus, for the species *A. fraterculus*, *A. major*, and *A. xenos*; their morphology is documented by SEM and color images. Distributional maps show a pattern of occurrence restricted primarily to the New World tropics, including Cuba, with a single species known from the Congo Basin and East Africa. All specimens were provided with unique specimen identifiers and their associated data are now available on the Internet

¹ Division of Invertebrate Zoology, American Museum of Natural History.

² Department of Entomology, University of California, Riverside, California.

³ Universidad Central "Marta Abreu" de Las Villas, Santa Clara, Cuba.

INTRODUCTION

Aphelonotus Uhler, 1894, is the most speciose of the four recognized genera of Pachynomiidae. All but one of the known species is from the New World tropics, with a single species recorded from Central Africa. Harris (1931) made the primary descriptive contribution to the group; he placed it in the nabid subfamily Prostemmatinae. Later, Carayon and Villiers (1968) revised the Pachynomidae as a whole, provided the first detailed observations on morphology (including antennal and abdominal trichobothria, male and female genitalia, metathoracic glands, and Brindley's glands), proposed a new subfamily classification that recognized the monogeneric Aphelonotinae and the Pachynominae with three genera, documented their reduvioid affinities, and described two additional species from the New World tropics and one from Africa.

Because existing species concepts take little account of variation, and because the nymphs have never been described for any of the genera, we offer for *Aphelonotus* in the present paper a substantial increase in our knowledge of the species-level diversity, distributions, morphometric variation, and nymphal morphology for three species, the last being documented through the use of scanning electron microscopy. We recognize a total of 14 species, six of these being described as new; one previously described species is treated as a junior synonym.

The limited sample of specimens available to prior authors presumably resulted from the fact that many species are quite small and may be overlooked by general collectors. Furthermore, specimens are seldom collected in their habitat, but rather at lights or in Malaise traps and Winkler extractions. We are fortunate to have been able to examine more than 538 specimens from a broad range of localities and with long series of several species.

MATERIALS AND METHODS

Specimens materials used in the present study are housed in the following institutions; curators or others responsible for loan of material are listed after the institution:

AMNH	American Museum of Natural History, New York
BMNH	Natural History Museum, London, Mick Webb
CAS	California Academy of Sciences, San Francisco, Norman Penny
CIAP	Centro de Investigaciones Agropecuarias, Collection of Horacio Grillo, Facultad de Ciencias Agropecuarias de la Universidad Central de Las Villas, Cuba
CMNH	Carnegie Museum of Natural History, Pittsburgh, Chen Young
FMNH	Field Museum of Natural History, Chicago, Margaret Thayer
INBIO	Instituto Nacional de Biodiversidad, San Jose, Costa Rica, James Lewis
MNRJ	Museu Nacional, Rio de Janeiro, Brazil
MPEG	Museu Emelio Goeldi, Belém, Brazil, José Antonio Fernandes
LSU	Louisiana State University Entomological Museum, Baton Rouge, Victoria Bayless
UCR	University of California, Riverside

USNM National Museum of Natural History, Smithsonian Institution, Washington, DC, Thomas J. Henry

Specimen data were recorded using the AMNH-PBI implementation of the Arthropod Easy Capture relational database application for capture of biological specimen data. Data on specimens examined were generated directly from the database. All specimens listed have been examined during the course of this study.

Specimen images were taken using a Visionary Digital photomicrographic system equipped with an Infinity K2 Long Distance Microscope and a Canon digital single lens reflex camera or a Leica Microsystems setup with a Leica Z16 APO Macroscopic. Paramere illustrations show a ventral view of the right paramere, which seems to present the greatest amount of detail for these bilaterally symmetrical structures; dorsal and ventral views are provided for *A. taino* and *A. xenos*. Specimen measurements were taken using a stage micrometer and recording data directly to a spreadsheet (AMNH) or using a Leica Microsystems setup (UCR). Scanning electron micrographs for *Aphelonotus major* were prepared using a Hitachi 3400 microscope at the AMNH. Micrographs of *A. fraterculus* were taken using a XL30 FEG microscope at UCR.

Aphelonotus Uhler

Aphelonotus Uhler, 1894: 208 (new genus); Harris, 1931: 15 (redescription, discussion); Carayon and Villiers, 1968: 703 ff. (morphology, classification).

DIAGNOSIS: Recognized by the relatively small size (length pronotal collar-apex hemelytron 2.07–5.57 mm), uniformly brown coloration, the body usually densely covered with suberect to erect setae, sometimes with only scattered setae, subdivided antennal segment II (pedicel) with an intrapediceloid, the presence of a single trichobothrium on the distal portion of the pedicel, the presence of ocelli, the sinuous margin of the corium, and the pairs of ventral abdominal trichobothria being restricted to segments 6–9.

REDESCRIPTION: *Male:* **COLORATION:** Brown to castaneous, legs sometimes lighter than general body coloration. **SURFACE AND VESTITURE:** Body surface moderately shining to dull. Entire body with scattered to moderately dense covering of long erect to reclining simple setae, although these not so dense in *A. taino* and *A. xenos* (figs. 1–3, 8, 9). Distal pseudosegment of antennal pedicel with a single trichobothrium at midpoint (fig. 9). **STRUCTURE: Head:** Moderately elongate (fig. 3) or elongate (fig. 12), weakly declivent, necklike behind eyes, weakly constricted about 1/3 distance between anterior margin of pronotum and eyes; eyes located at about midpoint of head in lateral view; eyes slender and reniform (fig. 12) or more globular (fig. 3) in lateral view; one pair of ocelli present, located about midway between pronotum and eyes, weakly to widely separated (figs. 1–3, 8, 9). *Antennae:* Scape more or less cylindrical, barely reaching (fig. 3) or weakly to distinctly surpassing (figs. 1, 2) apex of head; pedicel subequal in diameter to scape, subdivided into a proximal and distal pseudosegment at about midpoint by a ringlike intrapediceloid; flagellomeres very slender, about half diameter of pedicel. *Labium* (fig. 9A, B): Short, robust, just surpassing posterior margin of head; segment 1 short, triangular in lateral view,

segments 2, 3, and 4 subequal in length, segment 4 sharply tapered to acuminate apex. **Thorax:** *Pronotum:* Anterior lobe occupying nearly entire length of pronotum along midline, anterior margin with a narrow collar, lateral margin nearly straight to strongly convex, posterior margin concavely excavated across scutellum; calli swollen, occupying entirety of anterior lobe, separated by a deep, longitudinal, median sulcus; posterior lobe separated from anterior by an almost straight transverse sulcus, very short at midline, length greater at humeral angles. *Scutellum:* Mesoscutum broadly exposed; scutellum with elevated areas anterolaterally and apically. *Wings:* Corium with clavus narrow, endocorium as long as clavus, exocorium about twice as long as endocorium; medial fracture relatively long (most species) or short (*A. taino*, *A. xenos*); membrane expanded apically in latter case. Corium with irregular pitlike depressions, especially on both sides of claval suture (most *Aphelonotus* spp.) or completely smooth (*A. xenos*). Costal fracture absent or obsolete; membrane with two closed cells (figs. 1, 2; most species) or without cells (fig 3; *A. taino*, *A. xenos*); rarely brachypterous with forewing extending onto abdominal tergum 2 (figs. 2, 3). *Legs:* Fore- and middle trochanters with 1–3 spines medioventrally. Forefemur greatly swollen, ventrally either rounded (majority of species) or flattened (*A. taino*, *A. xenos*), armed with parallel rows of spines on ventral surface (fig. 10D), rows either adjacent to each other (most species) or widely separated (*A. taino*, *A. xenos*); middle femur weakly swollen, with parallel, adjacent rows of spines on ventral surface; hind femur more or less tubular, with scattered ventral spines (fig. 12E). Foretibia ventrally either rounded (most species) or flattened and slightly concave (*A. taino*, *A. xenos*), ventrally either with one median row of short, moderately densely aligned spines (fig. 11B) on surface opposing rows on femur (most species), or with one very dense row of moderately elongate spines along anterior margin and one very stout spine of about twice the length of other spines in a median and subapical position (*A. xenos*); middle tibia ventrally either without spines (*A. taino*, *A. xenos*) or with a median row of moderately densely aligned spines similar to foretibia (all other species); hind tibia with a few scattered spines. Fossula spongiosa on apex of foretibiae relatively large (figs. 10E, 11A); fossula spongiosa present on middle leg, but much smaller (fig. 11F); fossula absent from hind leg (fig. 12F). **Abdomen:** Pairs of trichobothria ventrad of the ventral connexival suture of segments 6 and 7, laterally on segment 8, and distally on segment 9 (pygophore) (fig. 8F); trichobothrium on segment 6 located close to posterior margin of segment. Median apodeme between sternites 6 and 7 inconspicuous, short (*A. taino*, *A. xenos*) or large (other species). **GENITALIA:** Pygophore and parameres symmetrical (fig. 8B, D); parameres inserted posteriorly, with blade-shaped distal portion of right and left parameres pointing mediad and crossed (fig. 8B; most species) or with more slender, sinuous blades parallel and pointing anteriorly (*A. taino*, *A. xenos*) (figs. 3, 19E, F); tip of paramere either slightly capitate (*A. africanus*, *A. xenos*) or tapering (remaining species).

Fifth instar nymph: See comments below under Discussion.

DISCUSSION: *General:* With the aim of removing past confusion, we have prepared a redescription of *Aphelonotus* that is in large part based on the work of Carayon and Villiers (1968), who provided the most authoritative and wide-ranging morphological documentation for the group, with alterations to accommodate the new species *A. taino* and *A. xenos*. The lack of a rigorous phylogenetic approach to the establishment of relationships caused many authors, including Harris (1931) and Cobben (1978), to fail to appreciate the reduvioid affinities of the

Pachynomidae and to group them with the Nabidae on an ill-defined concept of overall similarity and the frequent invocation of parallel development. Cobben (1978: 234) treated the antennal trichobothrium of Pachynomidae as autapomorphic for the group, as apparently had Carayon and Villiers (1968: 727). Nonetheless, this morphological attribute occurs in all members of the Reduvidae, although some Reduviidae possess 10 or more specialized setae (Wygodzinsky and Lodhi, 1989). The distalmost pedicellar trichobothrium in higher Reduviidae (sensu Hwang and Weirauch, 2012) has been proposed to be homologous to the single trichobothrium in Pachynomidae and Reduviidae in the Phymatine Complex (sensu Carayon et al., 1958), thus providing evidence on the nature of the pedicellar subdivision in the Pachynomidae (Wygodzinsky and Lodhi, 1989; Weirauch, 2003). Much of the early argumentation about pachynomid relationships revolved around the apparently 5-segmented antenna in Prostemmatinae (Nabidae) and Pachynomidae that was interpreted as a potentially shared character. However, the presence of an intrapediceloid in the Pachynomidae together with the distally located trichobothrium indicate that the apparently 5-segmented antenna in this group is fundamentally different from the one in prostemmatine nabids where the elongate prepedicellite contributes an additional apparent segment (e.g., Schuh and Stys, 1991).

Our diagnoses of *Aphelonotus* species are heavily based on measurements and the details of paramere shape. Variation in paramere structure was first illustrated by Harris (1931) and later by Carayon and Villiers (1968) and Kerzhner (1969); the figures of Harris have been reproduced by most subsequent authors, with the exception of some additional original illustrations presented by Carayon and Villiers (1968) and Kerzhner (1969), such that little in the way of new observations has been published on these structures since the work of Harris (1931). Our observations indicate that shape and general morphology of the parameres is probably the most reliable approach to recognizing species. Most other features of *Aphelonotus*, except size, are remarkably constant across the genus and therefore we have not prepared elaborate descriptions for each species because most of the information would be repetitive.

Morphometrics: The large numbers of specimens available to us has permitted the acquisition of morphometric data that allow us to draw some conclusions about species limits based on measurements. The data for these conclusions are presented in figures 5–7 and table 1; within the diagnoses and descriptions we offer the range of raw measurements for individual species without making a distinction between males and females. The major conclusions to be drawn are:

(1) Body size as measured from the pronotal collar to the apex of the membrane is strongly correlated with the length of the proximal portion of the pedicel (fig. 5).

(2) Both of these measurements are relatively constant within species (fig. 4) and show little variation between males and females (fig. 4) and therefore serve as reliable aids to identification of several species whose sizes do not overlap with other species.

(3) The interocular distance in most species shows relatively little variation (fig. 6) and offers additional evidence for corroborating species identifications.

Fossula spongiosa: This structure is present apically on the fore- and middle tibiae of the adults, the setae comprising them being padlike apically (figs. 8F, 10F, 11A, F, 12B, 19C). The fossula of the foreleg contains approximately three times as many setae as that of the middle tibia. The fossula spongiosa appears to be present only on the forelegs in nymphs and not so extensive

as in adults, although the structure of the constituent setae appears to be the same. The fossula spongiosa is subtended by distinctive flattened, curving, acuminate setae (figs. 8F, 10F, 11A, F, 12B). Carayon and Villiers (1968) indicated that the fossula was present only on the foreleg in Pachynomidae, although this apparent error may be the result of the limited extent of the structure on the middle leg and the difficulty in observing it with incident light and a stereoscope.

Trichobothria and macrosetae: In conformity with the observations of Carayon and Villiers (1968), our studies indicate that in male Aphelonotinae trichobothria are present on segments 6 and 7 posterior to and ventrad of the spiracles, and often broken off, but the bothrium is nonetheless clearly visible; on segments 8 and 9 (pygophore) the trichobothria are obvious, long, and typically intact (easily visible in figure 2, *A. fuscus*, UCR_ENT 48895; fig. 8B, D). There are no trichobothria on segments 2–5. In females of various *Aphelonotus* spp. that we have examined for these structures trichobothria on segments 6 and 7 are in a similar position to those of males and are also typically broken off; trichobothria are present on the gonocoxa of segment 8 and on paratergite 9 and usually intact (fig. 9A, inset). In nymphs (of *A. xenos* and *A. fraterculus*) trichobothria are present in the same position on segments 6 and 7 as in the adults, although these were not observable on the abdomen of the only available specimen of *A. major* (fig. 13B, 14E, F). Given that segments 8 and 9 are not yet completely developed in the immature forms it is therefore probably not surprising that trichobothria are absent on these two segments.

What we call macrosetae are present submedially on the abdominal dorsum of segments 4–7 in immature forms (fig. 14F, 15A), but obviously absent in adults (fig. 8D). Erect submedial macrosetae are present on the abdominal venter of adults and nymphs in positions similar to those seen on the nymphal dorsum, intermixed with a thick covering of recumbent simple setae. There are also macrosetae located laterally (fig. 8D) on the abdomen and apically (fig. 8B, D) on the pygophore.

We have referred to pairs of long erect setae present on the vertex and frons in adults and nymphs (fig. 13E) as trichobothria, as has been common practice in the literature, even though in the Pachynomidae, Saldidae and other taxa the base of the seta is not of the classic trichobothrial type, as seen only in the cephalic setae of the Gerromorpha. Based on their position, we nonetheless judge the erect, paired cephalic setae to be homologous across all Heteroptera in which they occur.

Paramere morphology: Beginning with the work of Harris (1931) the structure of the paramere has been used to distinguish species. Nonetheless, the accuracy of the comparisons being made is not always easy to evaluate. For example, Carayon and Villiers (1968) apparently did not examine the parameres of all species they recognized, because they copied the paramere figures of Harris (1931) for *A. simplicis*, *A. fraterculus*, and *A. medius*. In order to provide comparable information for all taxa, we have dissected more than 60 specimens and provide original illustrations for all of the taxa we recognize (fig. 4). As part of this exercise we have been able to demonstrate that the oft-repeated drawings of Harris, although pointing to distinct taxa, were not always drawn in a way that allows them to be usefully compared with newly acquired specimens which one may be trying to identify. For the preponderance of species we have drawn the ventral view of the right paramere, such that the paramere attachment is facing

upward in the drawing and the paramere blade is lying flat or nearly so; we provide alternate views for *A. taino* and *A. xenos*, because the ventral view alone does not reveal the distinctive structural details for these two species. This approach differs from that of Harris who drew the dorsal paramere surface, but nonetheless there is little difference in shape from our illustrations and those of Harris, and the illustrations essentially appear as mirror images of one another when drawn in the same orientation, for all species except *A. taino* and *A. xenos*.

Nymphal morphology and habitus: The nymphal morphology of *A. fraterculus* and *A. major* is documented under the individual species. A habitus image for a fifth instar immature is provided for *A. xenos* (fig. 3). We can make several general observations based on our comparisons of nymphal and adult morphology:

First, the structure of the antenna, and the single antennal trichobothrium, are essentially identical in the two life stages.

Second, the setation of the head and eyes appears to be essentially identical in both life stages, with at least two, possibly more, pairs of erect macrotrichiae located submedially on the vertex. The eyes have at least three setae in adults and four in the nymphs.

Third, the structure of the pretarsus is likewise identical with elongate setiform parempodia and the absence of a dorsomedian sensillum in all life stages.

Fourth, the ventral abdominal trichobothria are present in nymphs, as well as adults.

Key to the species of *Aphelonotus*, with emphasis on size and paramere shape

- 1. Membrane with two cells (figs. 1, 2), endocorium reaching to tip of scutellum (fig. 3: white arrow), foretibia ventrally rounded and with median row of well-separated, small spines, without much longer subapical spine; parameres in dorsal view sickle shaped, blades crossing in repose 2
- Membrane without cells (fig. 3), endocorium restricted to area adjacent to claval suture, not reaching to tip of scutellum (fig. 3: white arrow), foretibia ventrally flattened or slightly concave, anterior margin with very dense row of moderately elongate spines, and with long and stout subapical spine, parameres in dorsal view slender and sinuous, blades pointing anteriorly and subparallel in repose 13
- 2. Large, length from pronotal collar to apex of membrane greater than 4.75 mm 3
- Smaller, length from pronotal collar to apex of membrane less than 4.50 mm 4
- 3. Paramere with nearly parallel-sided blade and fairly strongly curving; inner angle of paramere cleft but not toothed (fig. 4) *major*
- Paramere with blade more obviously tapered toward apex and not so strongly curving; inner angle with a distinct tooth (fig. 4) *paramedius*
- 4. Very small, length pronotal collar-apex membrane less than 2.25 mm; right paramere as in figure 4. *minutus*
- Medium sized, length pronotal collar-apex membrane 2.50 and 4.00 mm. 5
- 5. Smaller, length pronotal collar apex-membrane 2.50 and 3.15 mm 6
- Larger, length pronotal collar-apex membrane 3.25 and 4.00 mm. 10

6. Paramere with subapical tooth on outer surface of blade (fig. 4); Africa *africanus*
 – Paramere without subapical tooth on outer surface of blade; New World 7
7. Paramere with fingerlike appendage on inner angle directed toward base (fig. 4; *confusus*,
simplus) 8
 – Paramere without fingerlike appendage on inner angle directed toward base 9
8. Outer surface of paramere smoothly and evenly rounded (fig. 4) *simplus*
 – Outer surface of paramere with distinct undulation (fig. 4) *confusus*
9. Paramere blade conspicuously narrowed apically, inner margin distinctly curving and concave (fig. 4) *alvarengai*
 – Paramere blade broad over most of length, inner margin nearly straight (fig. 4)
 *wygodzinskyi*
10. Paramere strongly arcuate on outer margin, blade broad, very long, and scimitar shaped (fig. 4) *fracterculus*
 – Paramere not so long, not so smoothly and evenly rounded on outer margin, and not so strongly flattened 11
11. Paramere blade at right angle to basal shaft, inner margin of blade nearly straight (fig. 4) *elongatus*
 – Inner angle of paramere not forming a distinct right angle as above 12
12. Paramere body conspicuously bulbous at point of inner angle, blade distinctly curving on exterior margin and with an elevated ridge (fig. 4) *medius*
 – Paramere body not so obviously swollen at inner angle, blade tapering and without elevated ridge (fig. 4) *fuscus*
13. Paramere with a subapical tooth (fig. 4); only known from Costa Rica *xenos*
 – Paramere without subapical tooth (fig. 4); only known from Cuba *taino*

Aphelonotus africanus Carayon and Villiers

Figures 1, 4, 5, 7, table 1, map 1

Aphelonotus africanus Carayon and Villiers, 1968: 784 (n. sp., figs.).

DIAGNOSIS: This small species ranges in length from 2.48–2.61 mm; the basal portion of pedicel ranges in length from 0.26–0.31 mm. The paramere is almost right angulate; the blade is elongate, slender, and unique in having a subapical tooth on the outer surface. Known from Central Africa. Most similar in size to *A. confusus*, *A. simplus*, and *A. wygodzinskyi*, but distinguished from them by the structure of the paramere and its occurrence in Africa.

DISTRIBUTION: Congo Basin into East Africa.

DISCUSSION: We have not examined the holotype of *A. africanus* which is deposited in the Museum National d'Histoire Naturelle, Paris. The type locality is: CENTRAL AFRICAN REPUBLIC: Krebedjé (Fort-Sibut). Nonetheless, we are confident in our identifications, with all specimens we have examined of uniform morphology and with the shape of the left paramere closely matching the illustrations provided by Carayon and Villiers (1968: fig. 18), including the slender paramere blade with a subapical tooth on the outer surface.

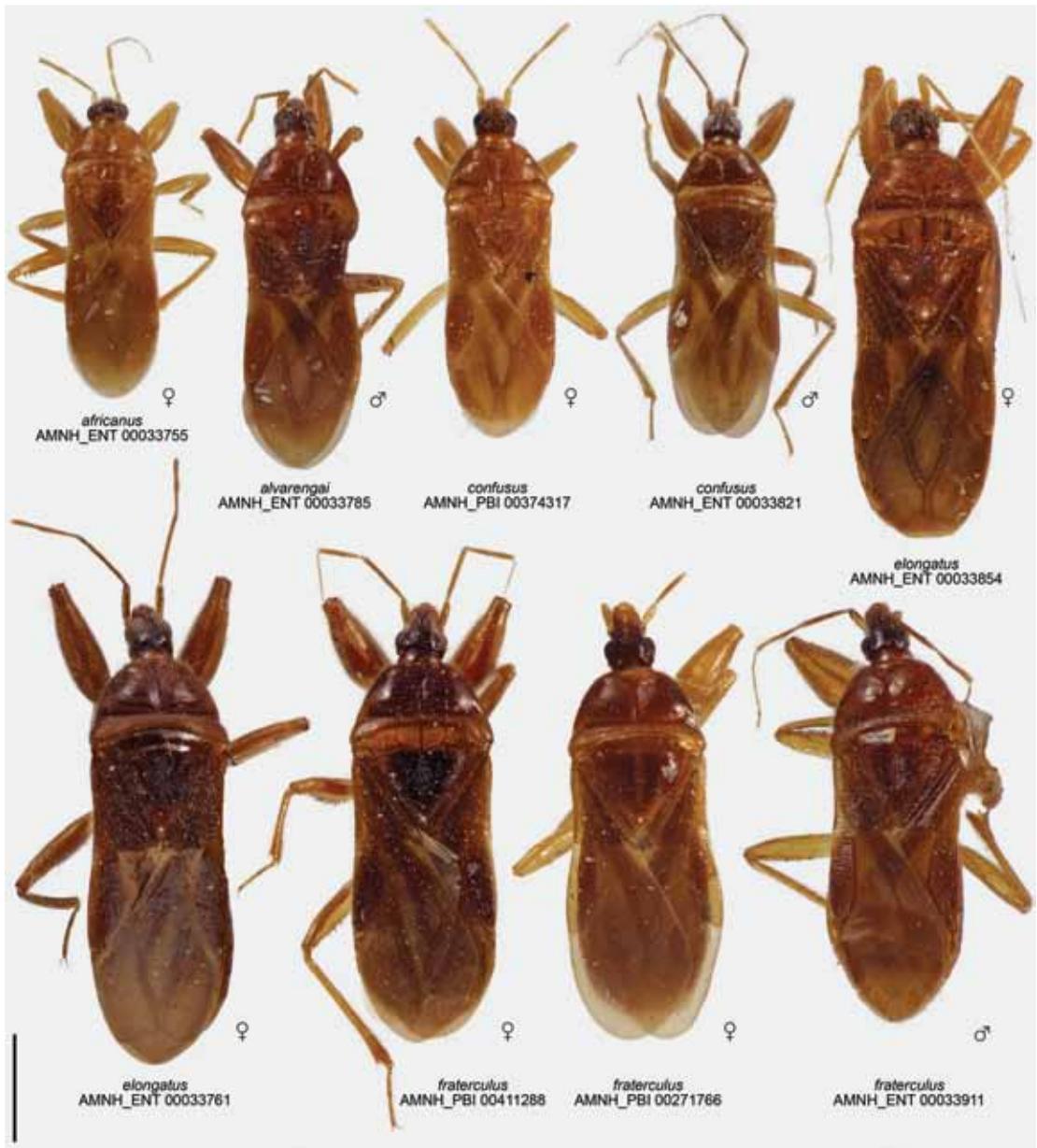


FIG. 1. Habitus images of *Apelonotus* spp. (*A. africanus*–*A. fraterculus*).

SPECIMENS EXAMINED: DEMOCRATIC REPUBLIC OF THE CONGO: Equateur: Lukolela, 1.05°S 17.2°E, 11 Jan 1931, collector unknown, 3♂ (AMNH_ENT 00033749–AMNH_ENT 00033751) (AMNH). Lukolela, Left Bank of Congo River (1°5' S), 1.06071°S 17.17595°E, 06 Jan 1921–21 Jan 1921, J.P. Chapin, 6♀ (AMNH_ENT 00033752–AMNH_ENT 00033757) (AMNH). **UGANDA:** Kawanda [Agricultural Research Institute, KARI],

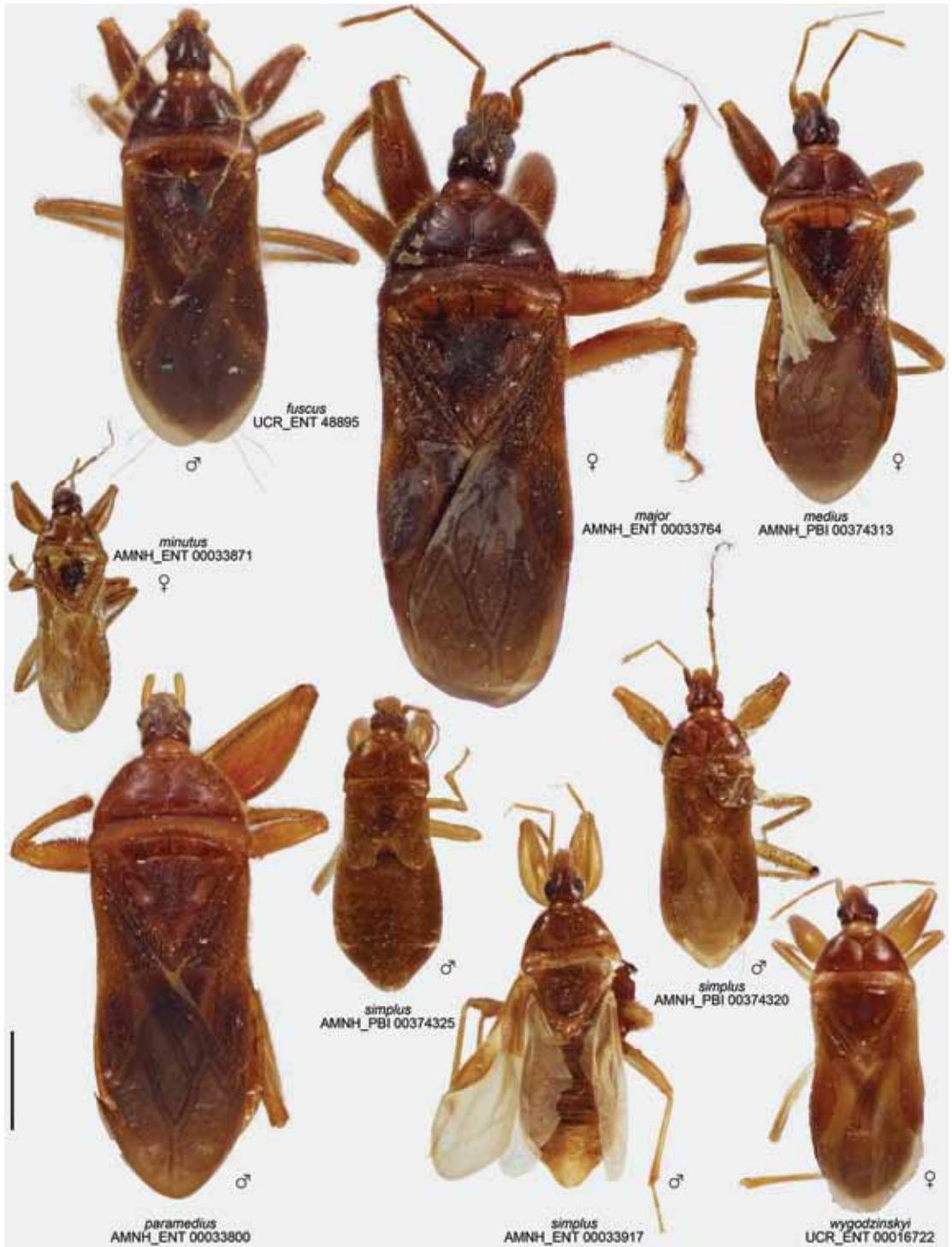


FIG. 2. Habitus images of *Aphelonotus* spp. (*A. fuscus*-*A. wygodzinskyi*).

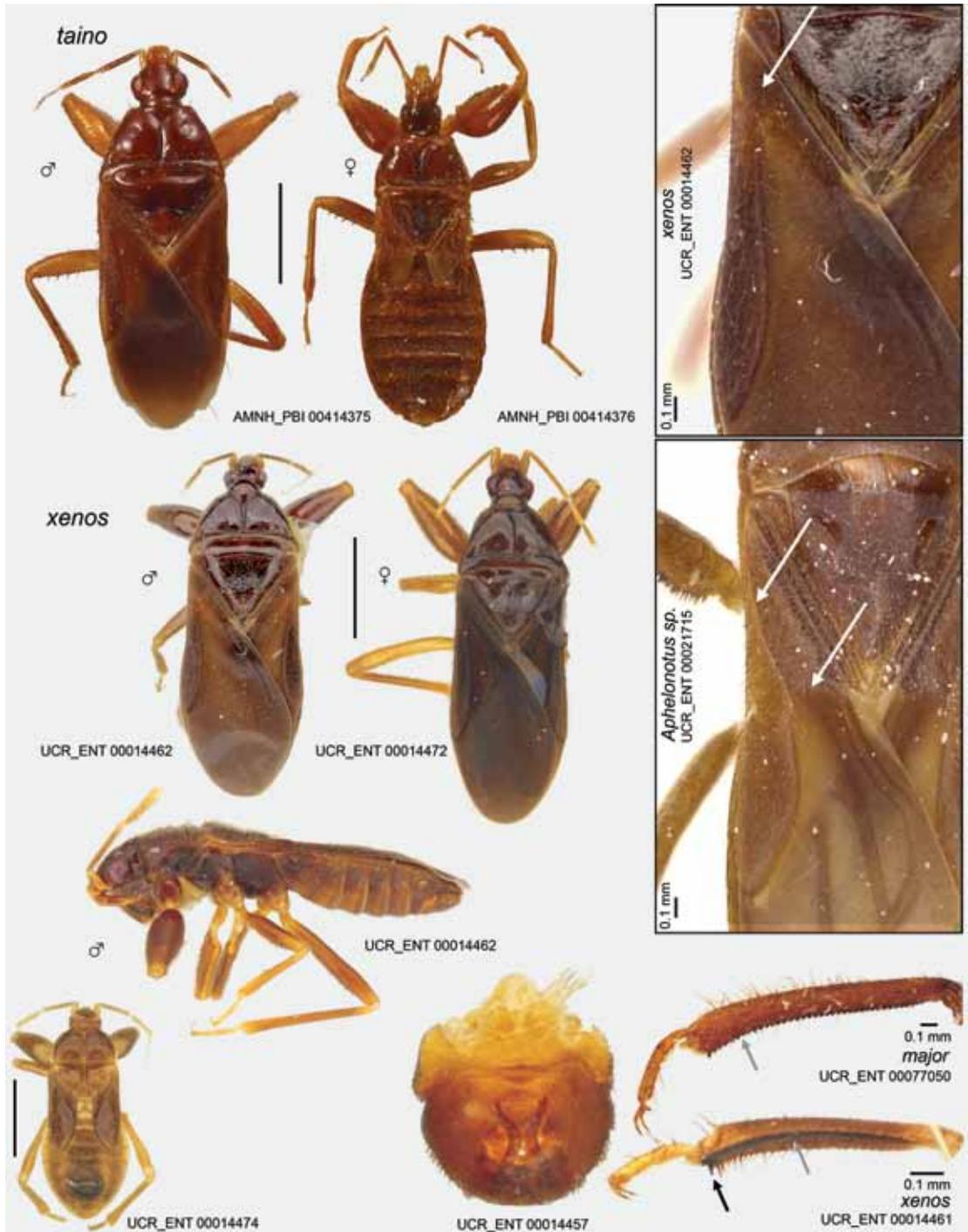


FIG. 3. Habitus images of *Aphelonotus taino* (male and female) and *A. xenos* (male, female, and immature), comparative wing and foretibial features of *Aphelonotus* species, and dorsal view of the pygophore of *A. xenos* showing the parallel and sinuous parameres. Foretibia: grey arrows indicate the ventral row of spines; the black arrow the very stout spine in *A. xenos*. Wing: white arrows indicate length of endocorium.

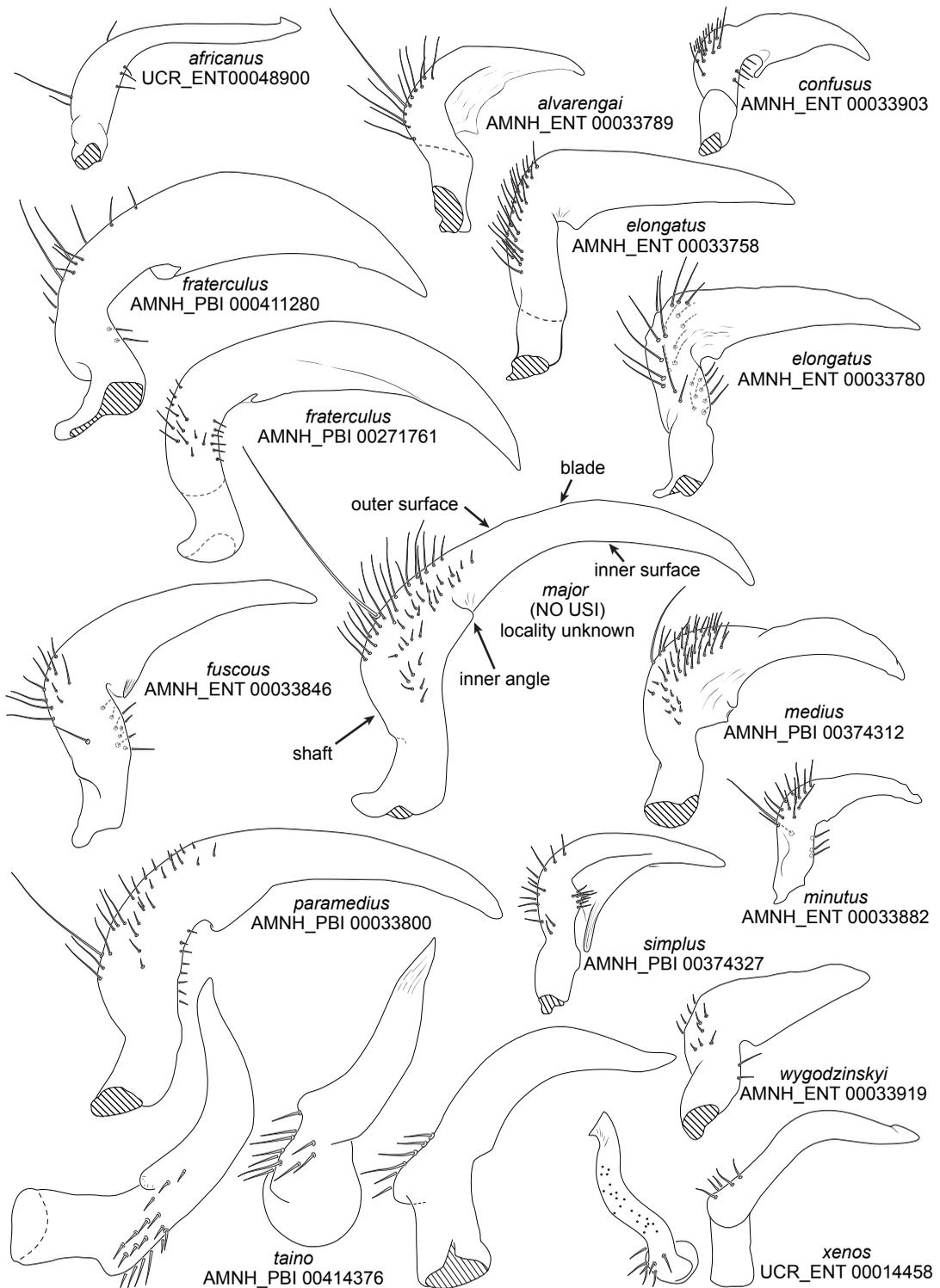
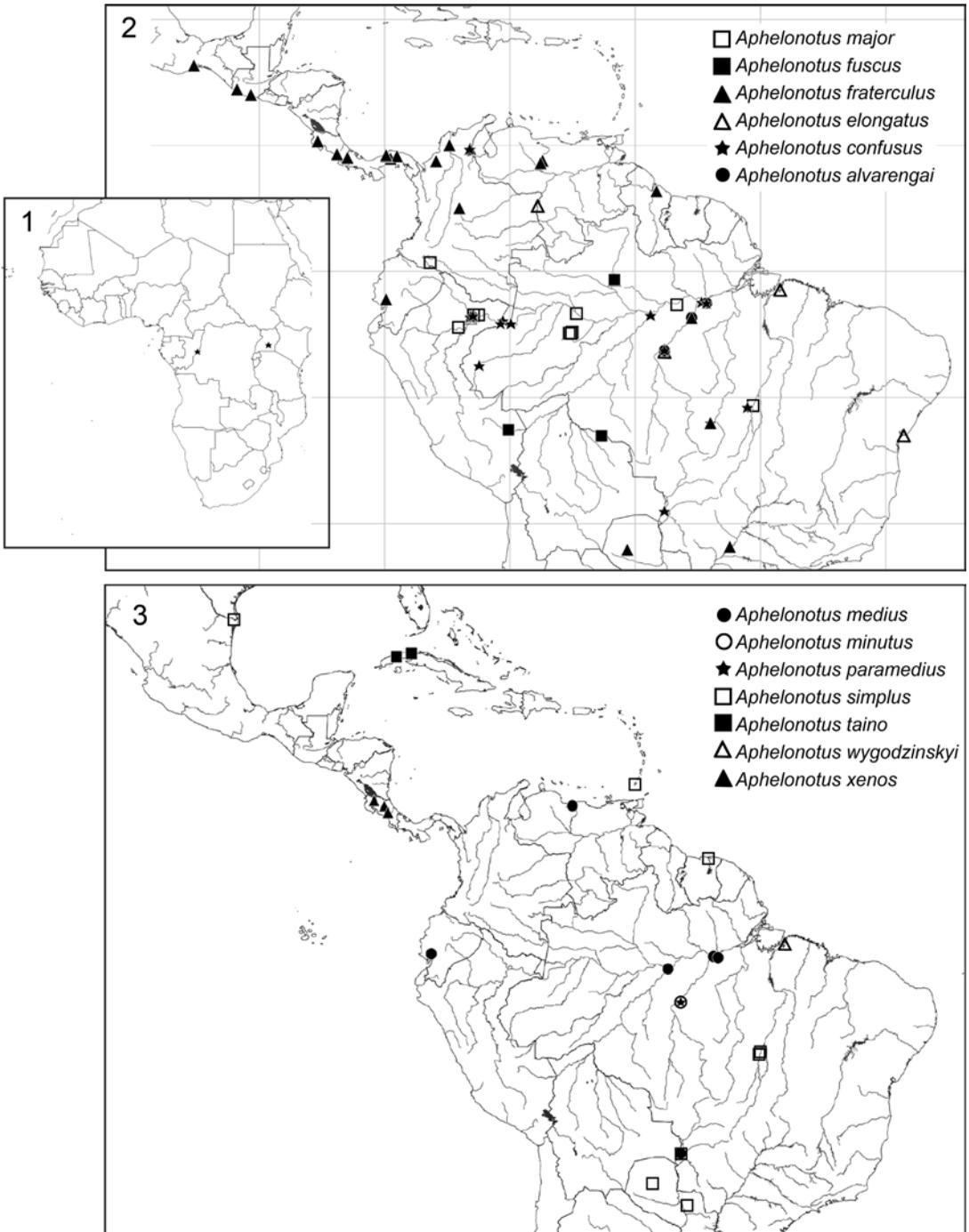


FIG. 4. Left paramere of *Aphelonotus* spp. Ventral view. Drawn to same scale.



MAPS 1-3. 1. Distribution of *Aphelonotus*. 2. Distribution of *A. spp.* 3. Distribution of *Aphelonotus spp.* (continued).

Table 1. Measurements of *Aphelonotus* spp.

Abbreviations: **AcrEyes**, width across eyes; **AntSeg2**, length (proximal portion of) antennal segment 2; **InterOcel**, interocellar distance; **InterOcul**, interocular distance; **Neck**, width across neck (behind compound eyes); **Ocellus**, ocellus diameter; **Pcol-Apex**, longitudinal distance from pronotal collar to posterior margin of pronotum along midline; **Pron**, width pronotum.

Species	Length		Width			InterOcul	Ocellus	InterOcel	AntSeg2
	Pcol-Apex	Pron	AcrEyes	Neck					
<i>africanus</i>									
♂ (<i>N</i> = 3)	2.61	0.93	0.39	0.30	0.14	0.04	0.11	0.29	
	2.59	0.86	0.37	0.30	0.17	0.03	0.11	0.27	
	2.49	0.92	0.41	0.34	0.19	0.03	0.11	0.29	
♀ (<i>N</i> = 3)	2.58	0.92	0.39	0.30	0.16	0.03	0.11	0.26	
	2.57	0.89	0.39	0.31	0.18	0.04	0.12	0.31	
	2.48	0.92	0.39	0.35	0.19	0.03	0.11	0.27	
<i>alvarengai</i>									
♂ (<i>N</i> = 3)	3.01	1.08	0.42	0.40	0.17	0.04	0.15	0.45	
	2.97	1.05	0.43	0.37	0.18	0.04	0.16	0.43	
	2.95	1.10	0.43	0.40	0.19	0.05	0.14	0.45	
♀ (<i>N</i> = 3)	3.06	1.17	0.44	0.42	0.18	0.02	0.18	0.44	
	3.11	1.16	0.47	0.41	0.23	0.04	0.16	0.47	
	2.85	1.07	0.42	0.37	0.20	0.04	0.16	0.42	
<i>confusus</i>									
♂ (<i>N</i> = 4)	2.82	0.99	0.39	0.34	0.18	0.04	0.13	0.36	
	2.62	0.98	0.40	0.35	0.18	0.03	0.11	0.37	
	2.59	0.99	0.39	0.35	0.16	0.03	0.13	0.41	
	2.51	0.97	0.38	0.31	0.16	0.04	0.12	0.39	
♀ (<i>N</i> = 6)	3.04	1.15	0.43	0.39	0.19	0.05	0.14	0.45	
	2.84	1.00	0.40	0.36	0.16	0.03	0.10	0.37	
	2.75	0.98	0.39	0.34	0.18	0.04	0.13	0.37	
	2.74	1.06	0.43	0.36	0.19	0.05	0.13	0.37	
	2.73	1.00	0.42	0.36	0.20	0.04	0.12	0.40	
2.49	0.96	0.38	0.34	0.16	0.03	0.12	0.37		
<i>elongatus</i>									
♂ (<i>N</i> = 5)	3.78	1.29	0.46	0.43	0.11	0.06	0.13	0.67	
	3.73	1.40	0.48	0.43	0.10	0.05	0.16	0.71	
	3.59	1.28	0.48	0.43	0.11	0.05	0.16	0.66	
	3.45	1.26	0.47	0.44	0.18	0.05	0.15	0.62	
	3.34	1.20	0.45	0.45	0.20	0.05	0.16	0.59	
♀ (<i>N</i> = 5)	3.96	1.33	0.50	0.46	0.12	0.05	0.16	0.70	
	3.89	1.37	0.50	0.46	0.17	0.05	0.17	0.68	
	3.82	1.43	0.52	0.48	0.16	0.05	0.16	0.72	
	3.71	1.26	0.46	0.45	0.11	0.04	0.15	0.59	

Species	Length		Width			InterOcul	Ocellus	InterOcel	AntSeg2
	Pcol-Apex	Pron	AcrEyes	Neck					
	3.08	1.16	0.46	0.41		0.23	0.05	0.16	0.45
<i>fraterculus</i>									
♂ (N = 5)	3.74	1.37	0.51	0.44		0.30	0.04	0.21	0.56
	3.56	1.24	0.49	0.42		0.29	0.05	0.20	0.58
	3.47	1.29	0.49	0.48		0.26	0.04	0.19	0.55
	3.38	1.29	0.52	0.44		0.28	0.05	0.18	0.49
	3.24	1.30	0.49	0.42		0.27	0.05	0.18	0.45
♀ (N = 10)	3.58	1.37	0.50	0.44		0.31	0.04	0.19	0.53
	3.52	1.33	0.51	0.45		0.30	0.04	0.20	0.52
	3.49	1.32	0.50	0.42		0.31	0.05	0.19	0.48
	3.48	1.30	0.53	0.45		0.32	0.06	0.20	0.45
	3.44	1.34	0.49	0.44		0.31	0.03	0.21	0.52
	3.44	1.35	0.55	0.45		0.29	0.05	0.20	0.50
	3.43	1.21	0.50	0.42		0.31	0.04	0.17	0.43
	3.40	1.24	0.49	0.44		0.34	0.04	0.19	0.46
	3.40	1.29	0.50	0.40		0.29	0.04	0.21	0.55
	2.99	0.85	0.42	0.39		0.29	0.03	0.11	0.52
<i>fuscus</i>									
♂ (N = 3)	4.02	1.50	0.51	0.47		0.24	0.08	0.12	0.65
	3.99	1.43	0.53	0.45		0.21	0.06	0.18	0.65
	3.91	1.42	0.52	0.44		0.24	0.05	0.17	0.62
♀ (N = 1)	3.88	1.46	0.52	0.46		0.26	0.05	0.17	0.61
<i>major</i>									
♂ (N = 2)	5.05	1.93	0.66	0.58		0.29	0.08	0.23	0.89
	5.28	1.91	0.64	0.62		0.23	0.05	0.25	0.92
♀ (N = 5)	5.57	1.77	0.70	0.63		0.28	0.07	0.22	0.86
	5.40	1.96	0.66	0.62		0.28	0.09	0.20	0.91
	5.28	1.93	0.67	0.57		0.28	0.06	0.22	0.87
	5.21	2.00	0.70	0.61		0.29	0.07	0.24	0.91
	5.12	1.96	0.64	0.60		0.31	0.07	0.22	0.86
<i>medius</i>									
♂ (N = 2)	4.32	1.67	0.58	0.47		0.25	0.06	0.22	0.73
	3.63	1.40	0.53	0.42		0.22	0.05	0.17	0.56
♀ (N = 1)	3.74	1.35	0.50	0.41		0.26	0.05	0.17	0.57
	3.62	1.23	0.51	0.43		0.24	0.04	0.16	0.56
<i>minutus</i>									
♂ (N = 3)	2.09	0.77	0.33	0.28		0.13	0.02	0.16	0.12
	2.09	0.73	0.33	0.28		0.14	0.03	0.14	0.13
	2.08	0.76	0.32	0.28		0.12	0.03	0.11	0.13

Species	Length		Width			InterOcul	Ocellus	InterOcel	AntSeg2
	Pcol-Apex	Pron	AcrEyes	Neck					
♀ (N = 3)	2.13	0.79	0.31	0.31	0.14	0.03	0.12	0.13	
	2.10	0.75	0.33	0.33	0.13	0.04	0.10	0.12	
	2.07	0.72	0.30	0.26	0.13	0.03	0.11	0.12	
<i>paramedius</i>									
♂ (N = 1)	4.86	1.73	0.64	0.57	0.29	0.05	0.23		
<i>simplus</i>									
♂ (N = 4)	2.86	1.04	0.42	0.37	0.24	0.03	0.18	0.39	
	2.70	0.99	0.40	0.37	0.24	0.04	0.19	0.42	
	2.55	1.00	0.42	0.35	0.25	0.04	0.15	0.41	
	2.54	0.96	0.41	0.34	0.23	0.03	0.17	0.40	
♀ (N = 4)	2.91	1.03	0.47	0.36	0.25	0.04	0.15	0.39	
	2.82	1.02	0.42	0.34	0.21	0.04	0.15	0.36	
	2.59	0.97	0.40	0.34	0.23	0.03	0.18	0.38	
	2.55	0.98	0.40	0.34	0.23	0.03	0.18	0.39	
<i>taino</i>									
♂ (N = 1)	3.24	1.27	0.58	0.44	0.34	0.04	0.23	0.52	
♀ (N = 1)	2.93	0.95	0.43	0.40	0.29	0.03	0.17	0.41	
<i>wygodzinsky</i>									
♂ (N = 3)	2.78	1.05	0.42	0.36	0.22	0.04	0.13	0.35	
	2.63	1.00	0.42	0.33	0.21	0.04	0.13	0.38	
	2.51	1.00	0.41	0.34	0.21	0.03	0.16	0.35	
♀ (N = 3)	2.84	1.07	0.43	0.35	0.25	0.03	0.16	0.38	
	2.81	1.03	0.41	0.38	0.24	0.03	0.15	0.37	
	2.74	1.09	0.45	0.37	0.25	0.03	0.15	0.35	
<i>xenos</i>									
♂ (N = 5)	3.33	1.16	0.46	0.38	0.28	0.05	0.14	0.60	
	3.15	1.17	0.47	0.37	0.28	0.06	0.13	0.57	
	3.36	1.16	0.49	0.37	0.30	0.05	0.14	0.53	
	3.23	1.18	0.48	0.34	0.28	0.06	0.15	0.52	
	3.25	1.16	0.52	0.38	0.30	0.05	0.16	0.61	
♀ (N = 5)	3.26	1.21	0.49	0.40	0.30	0.05	0.15	0.57	
	3.39	1.18	0.50	0.39	0.31	0.06	0.14	0.51	
	3.46	1.19	0.50	0.40	0.31	0.06	0.14	0.50	
	3.40	1.23	0.50	0.38	0.30	0.05	0.15	0.56	
	3.29	1.16	0.51	0.41	0.31	0.04	0.16	0.51	

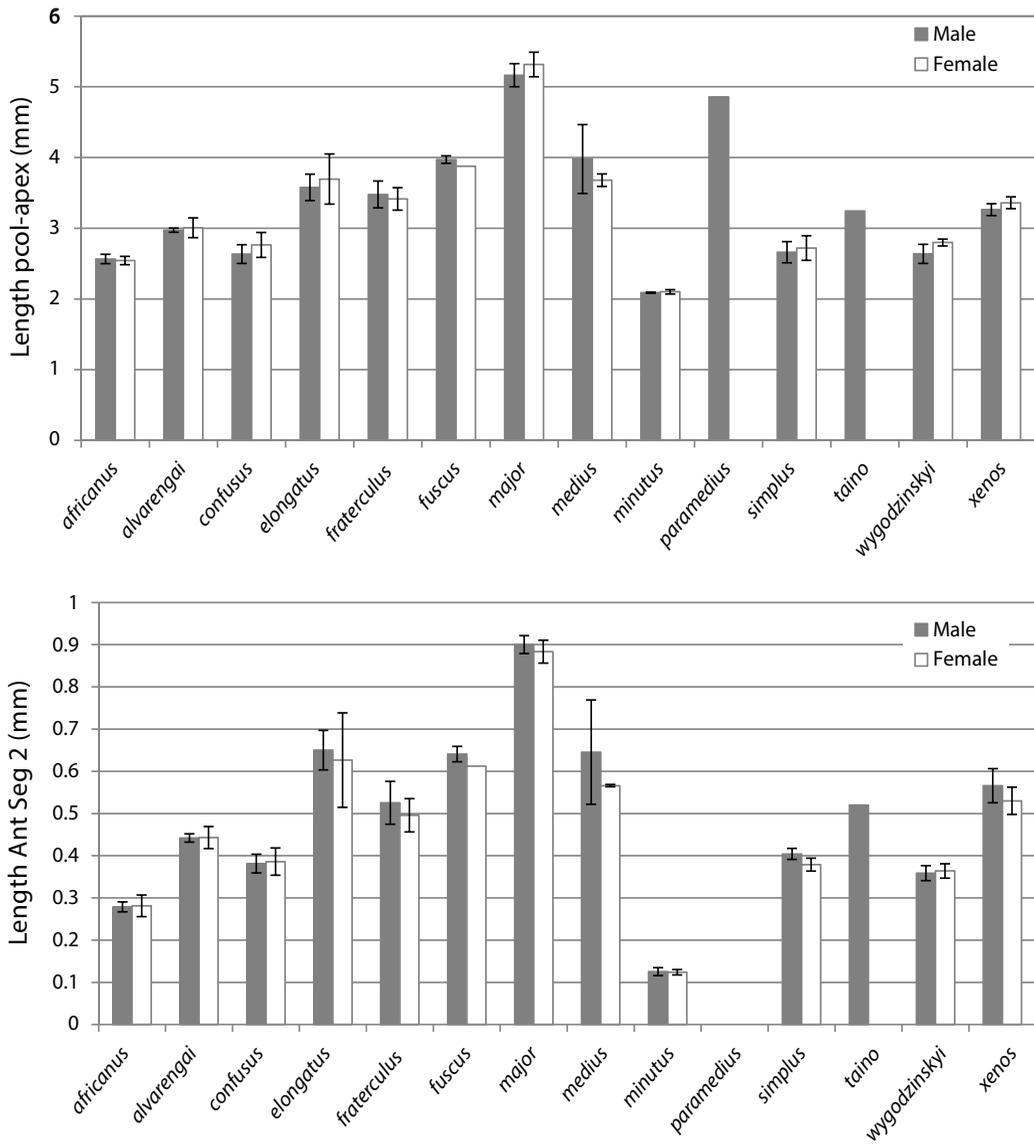


FIG. 5. Means and standard deviations comparing male and female measurements of *Aphelonotus* spp. for (*upper graph*) body length (measured as distance from pronotal collar to apex of membrane/abdomen) and (*lower graph*) length of proximal portion of antennal pedicel.

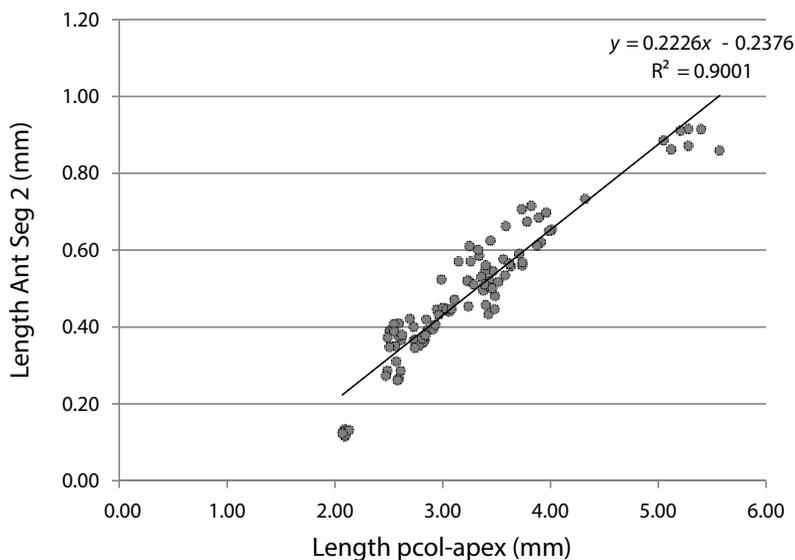


FIG. 6. Regression line showing strong correlation between body length and length of proximal portion of antennal pedicel.

0.40694°N 32.53528°E, 05 Oct 1957, collector unknown, 1 ♂ (UCR_ENT 00048900), 1 ♀ (UCR_ENT 00048901) (BMNH).

***Aphelonotus alvarengai*, new species**

Figures 1, 4, 5, 7, table 1, map 2

DIAGNOSIS: This moderately small species ranges in length from 2.85–3.11 mm; the basal portion of pedicel ranges in length from 0.42–0.47 mm. The paramere angle is smoothly and broadly rounded; the blade is relatively short with a broad, weakly sclerotized inner angle as also seen in *A. confusus* and *A. simplus*. Most similar in size *A. elongatus* and *A. fraterculus*, but distinguished from them by its distinctive paramere structure, which is most similar to that of *A. confusus* and *A. simplus*, but those species usually smaller than *A. alvarengai* and with a medial fingerlike projection parallel to paramere shaft, whereas this area is simply membranous and very weakly sclerotized in *A. alvarengai*.

DESCRIPTION: Character complement as in generic description; habitus as in figure 1; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for Moacyr Alvarenga, the collector of many specimens of *Aphelonotus*, including representatives of this species.

DISTRIBUTION: Lower Amazon River Basin.

HOLOTYPE: **BRAZIL: Pará:** Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, light trap, 1 ♂ (AMNH_ENT 00033785) (MNRJ).

PARATYPES: **BRAZIL: Pará:** Fordlandia, Rio Tapajos, 3.6666°S 55.5°W, 92 m, 01 Jan 1932, J. G. Myers, 2 ♂ (UCR_ENT 00048877, UCR_ENT 00048878), 2 ♀ (UCR_ENT 00048879, UCR_ENT 00048880) (BMNH). Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alva-

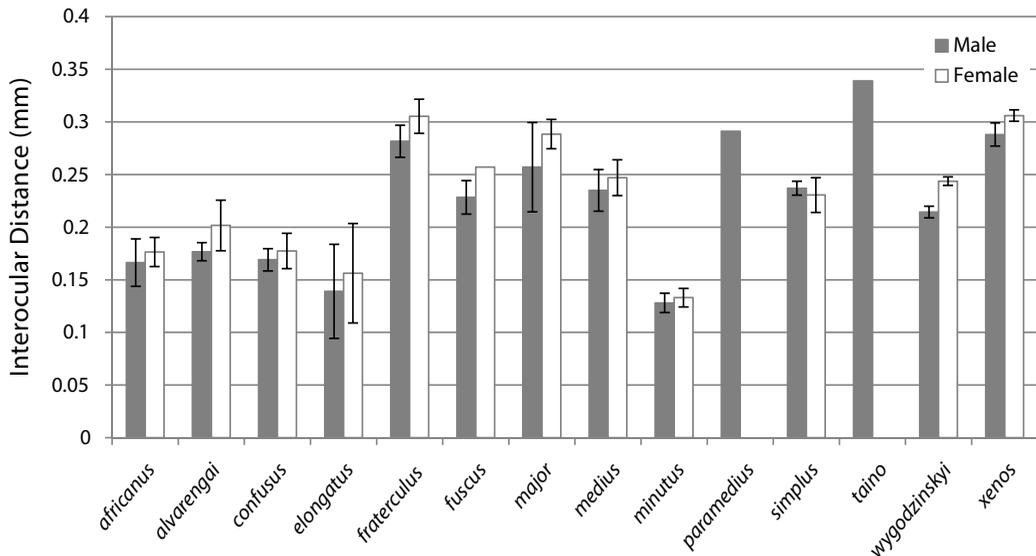


FIG. 7. Means and standard deviations for combined male and female measurements of *Aphelonotus* spp. for interocular distance.

renga, light trap, 6♂ (AMNH_ENT 00033784, AMNH_ENT 00033786-AMNH_ENT 00033790), 7♀ (AMNH_ENT 00033792-AMNH_ENT 00033796, AMNH_ENT 00033798, AMNH_ENT 00033799) (AMNH), light trap, 1♀ (AMNH_ENT 00033791) (MNRJ), light trap, 1♂ (AMNH_ENT 00033783), 1♀ (AMNH_ENT 00033797) (UCR). Taperinha, 2.53232°S 54.29482°W, no date provided, H. H. Smith, 1♂ (AMNH_PBI 00374323) (USNM).

Aphelonotus confusus Harris

Figures 1, 4, 5, 7, table 1, map 2

Aphelonotus confusus Harris, 1931: 16 (n. sp.).

DIAGNOSIS: This moderately small species ranges in length from 2.49–3.04 mm; the basal portion of pedicel ranges in length from 0.36–0.45 mm. The paramere is more or less right angled with an indentation on the outer surface just distad of the angle; the blade is relatively short with a broad, more weakly sclerotized inner angle as also seen in *A. alvarengai* and *A. simplus*, this area with a fingerlike projection, as also seen in *A. simplus*. Most similar in size to *A. africanus*, *A. wygodzinskyi*, and *A. simplus*, but distinguished from the first two by its distinctive paramere structure, which is most similar to that of *A. alvarengai* and *A. simplus*, but *A. alvarengai* lacking the medial fingerlike projection parallel to the paramere shaft as seen in *A. confusus* and *A. simplus*; outer surface of paramere blade in *A. simplus* smoothly curving and without the indentation near the angle as in *A. confusus*; paramere blade in *A. wygodzinskyi* very short and broad with a straight inner surface.

DISTRIBUTION: Northern Colombia south to the Beni region of Bolivia, with most records from the Amazon Basin.

DISCUSSION: *Aphelonotus confusus* is one of the most widespread species in the genus and relatively common in collections. Our concept of the species is based on examination of the holotype, topotypic paratype, and a large number of additional specimens, including parameres from a broad range of localities.

HOLOTYPE: **BRAZIL: Amazonas:** Madeira River above Manaus [sic], 3.46666°S 58.78333°W, 27 m, 01 Sep 1923, Lee Prizer, 1 ♀ (USNM).

PARATYPE: **BRAZIL: Amazonas:** Madeira River above Manaus [sic], 3.46666°S 58.78333°W, 27 m, 01 Sep 1923, Lee Prizer, 1 ♀ (AMNH_PBI 00374317) (USNM).

OTHER SPECIMENS EXAMINED: **BOLIVIA: El Beni:** Isla Flores, Rio Itenez, 13.03333°S 62.7°W, 184 m, 07 Aug 1964, J.K. Bouseman, J. Lussenhop, 2 ♀ (AMNH_ENT 00033908, AMNH_ENT 00033909) (AMNH). **BRAZIL: Amazonas:** Macura, 7.46667°S 72.46667°W, 187 m, no date provided, H.H. Smith, light trap, 4 ♀ (CMNH_TCN 00013896-CMNH_TCN 00013899) (CMNH). **Mato Grosso:** Jacare Parque Nacional Xingu, 12°S 54°W, Nov 1965, Alvarenga and Werner, 2 ♀ (UCR_ENT 00046689, UCR_ENT 00046690) (CAS). Porto Velho, Rio Tapirape, 10.75747°S 51.00853°W, 18 Dec 1962, collector unknown, 1 ♀ (UCR_ENT 00046691) (CAS). Rio Sao Lourenco, near Corumba, 19°S 57.65°W, 128 m, Jan, H.H. Smith, light trap, 1 ♂ (CMNH_TCN 00013885) (CMNH). **Pará:** Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, light trap, 1 ♂ (AMNH_ENT 00033842) (AMNH). Santarem, 2.4333°S 54.7°W, no date provided, H.H. Smith, light trap, 46 ♂ (CMNH_TCN 00013781-CMNH_TCN 00013825, CMNH_TCN 00013900), 37 ♀ (CMNH_TCN 00013826-CMNH_TCN 00013853, CMNH_TCN 00013886-CMNH_TCN 00013894) (CMNH), 1 ♂ (AMNH_PBI 00391612), 1 ♀ (AMNH_PBI 00391613) (LSU); 01 Jan 1925, collector unknown, 1 ♂ (AMNH_ENT 00033766), 2 ♀ (AMNH_ENT 00033767, AMNH_ENT 00033768) (AMNH), 1 ♂ (AMNH_PBI 00374316) (USNM). Taperinha, 2.53232°S 54.29482°W, no date provided, H.H. Smith, light trap, 14 ♀ (CMNH_TCN 00013854-CMNH_TCN 00013866, CMNH_TCN 00013895), 18 ♂ (CMNH_TCN 00013867-CMNH_TCN 00013884) (CMNH). **COLOMBIA: Amazonas:** 7 km N Leticia, 4.14215°S 69.93442°W, 20 Feb 1972–25 Feb 1972, S. and J. Peck, 1 ♂ (UCR_ENT 00021719) (FMNH). Letitia [sic], 16 Jun 1965, P.R. Craig and J. Robb, 2 ♂ (UCR_ENT 00046692, UCR_ENT 00046693) (CAS). **Cesar:** 10 km E of Becerril, El Rincon, Sierra de Perija, 9.7°N 73.18333°W, 260 m, 15 Nov 1969, B. Malkin, 1 ♂ (AMNH_ENT 00033905) (AMNH). **PERU: Loreto:** Estiron, Rio Ampiyacu, 4.13333°S 70.73333°W, 02 Apr 1970, B. Malkin, 1 ♀ (AMNH_ENT 00033910) (AMNH). Padre Island, Iquitos, 3.65°S 73.16666°W, 106 m, 18 Jul 1972, R.T. and J.C. Schuh, 1 ♂ (AMNH_ENT 00033801), 2 ♀ (AMNH_ENT 00033802, AMNH_ENT 00033803) (AMNH). Vista Alegre, 70 km W of Leticia, 3.88333°S 70.55°W, 71 m, 04 May 1970, B. Malkin, 3 ♂ (AMNH_ENT 00033901, AMNH_ENT 00033902, AMNH_ENT 00033904), 2 ♀ (AMNH_ENT 00033906, AMNH_ENT 00033907) (AMNH). **Ucayali:** Lake Yarinacocha, 10 km NW of Pucallpa, 150 m, 27 Dec 1971, R.T. Schuh, light trap, 1 ♂ (AMNH_ENT 00033903) (AMNH). Pucallpa, 3.4636°S 72.9225°W, 150 m, 03 Dec 1971, R.T. Schuh, light trap, 13 ♀ (AMNH_ENT 00033804-AMNH_ENT 00033816), 14 ♂ (AMNH_ENT 00033817-

AMNH_ENT 00033830) (AMNH), light trap, 1 ♀ (UCR_ENT 00016195), 1 ♂ (UCR_ENT 00016196) (UCR).

Aphelonotus elongatus, new species

Figures 1, 4, 5, 7, table 1, map 2

DIAGNOSIS: This medium-sized species ranges in length from 3.08–3.96 mm; the basal portion of pedicel ranges in length from 0.45 mm–0.72. The paramere forming a sharp right angle with a protuberance on the inner surface just distad of the angle; the blade is nearly straight on both the inner and outer surfaces. Most similar in size to *A. fraterculus*, *A. fuscus*, and *A. medius*, but distinguished from *A. fraterculus* and *A. medius* by obvious differences in paramere structure, the blade in the former very long, broad, and scimitar shaped, in the latter fingerlike and not distinctly broad and flat; paramere of *A. fuscus* most similar to that of *A. elongatus*, but paramere blade weakly curving in *A. fuscus* as opposed to inner surface nearly straight in *A. elongatus*.

DESCRIPTION: Character complement as in generic description; habitus as in figure 1; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for the elongate shape of the paramere.

DISTRIBUTION: Widely throughout the Amazon Basin with a single record from Bahia, Brazil.

DISCUSSION: The single male specimen listed under Additional Specimens Examined is not listed as a paratype because the dissection indicates minor differences from what we have seen in other specimens.

HOLOTYPE: **BRAZIL: Pará:** Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, light trap, 1 ♂ (AMNH_ENT 00033841) (MNRJ).

PARATYPES: **BRAZIL: Bahia:** Bahia, 12.9833°S 38.5167°W, 06 Dec 1903, J.D. Haseman, 1 ♂ (AMNH_PBI 00391616), 1 ♀ (AMNH_PBI 00391617) (LSU), 1 ♂ (AMNH_PBI 00271760) (USNM). **Para:** 8 km E Belem. Ananideua, 1.438°S 48.427°W, 01 Nov 1963, Oliveira & Wygodzinsky, light trap, 1 ♂ (AMNH_ENT 00033845) (AMNH). Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, light trap, 10 ♂ (AMNH_ENT 00033831-AMNH_ENT 00033840), 15 ♀ (AMNH_ENT 00033850-AMNH_ENT 00033864), 9 ♂ (AMNH_ENT 00033772-AMNH_ENT 00033780), 1 ♀ (AMNH_ENT 00033781) (AMNH), light trap, 1 ♂ (AMNH_ENT 00033843), 2 ♀ (AMNH_ENT 00033847, AMNH_ENT 00033848) (MNRJ), light trap, 1 ♀ (AMNH_ENT 00033849) (UCR); 01 Jan 1970, F.R. Barbosa, 1 ♂ (AMNH_ENT 00033844) (UCR). **Roraima:** Lower Rio Branco, 0.66666°S 61.66666°W, 30 m, 01 Jan 1932, J. G. Myers, 5 ♂ (UCR_ENT 00048881-UCR_ENT 00048885) (BMNH). **PERU: Loreto:** Padre Island, Iquitos, 3.65°S 73.16666°W, 106 m, 18 Jul 1972, R. T. & J. C. Schuh, 1 ♀ (AMNH_ENT 00033782) (AMNH). **Ucayali:** Lake Yarinacocha, 10 km NW of Pucallpa, 150 m, 27 Dec 1971, R. T. Schuh, light trap, 1 ♂ (AMNH_ENT 00033758), 3 ♀ (AMNH_ENT 00033759, AMNH_ENT 00033761, AMNH_ENT 00033762) (AMNH). Pucallpa, 3.4636°S 72.9225°W, 150 m, 03 Dec 1971, R. T. Schuh, light trap, 1 ♀ (AMNH_ENT 00033760) (AMNH). **VENEZUELA: Amazonas:** Samariapo, 5.2°N 67.78333°W, 91 m, 12 Jun 1950, J. Maldonado, 1 ♀ (AMNH_PBI 00271786) (USNM).

Aphelonotus fraterculus Harris

Figures 1, 4, 5, 7, table 1

Aphelonotus fraterculus Harris, 1931: 18 (n. sp.).*Aphelonotus brevirostris* Carayon and Villiers, 1968: 737 (n. sp., figs.), new synonymy.

DIAGNOSIS: This medium-sized species ranges in length from 2.99–3.74 mm; the basal portion of pedicel ranges in length from 0.43 mm–0.58. The paramere is very broadly rounded on the outer surface, the inner surface just distad of inner angle usually with a blunt or angulate protuberance; the blade is very long, broad, being widest at about the midpoint, and conspicuously flattened. Most similar in size *A. elongatus*, *A. fuscus*, and *A. medius*, but distinguished from all of those species by obvious differences in paramere structure, none of them possessing the scimitar shape in the paramere blade.

DISTRIBUTION: Widely across Central America and northern South America, as far south as Guayaquil, Ecuador, and the central Amazon Basin. Two additional specimen records from Mato Grosso, Brazil, and Paraguay are both females, so it is not possible to compare paramere structure.

DISCUSSION: Our examination of a large number of specimens assignable to Harris's concept of *A. fraterculus*, including several paratypes, indicates to us that *A. brevirostris* Carayon and Villiers is a junior synonym of *A. fraterculus*. Our taxonomic conclusion is based on the detailed figures of *A. brevirostris* published by Carayon and Villiers (1968); we did not examine the holotype of *A. brevirostris*. The type locality of *A. brevirostris* is San Fernando de Apure, Venezuela. The sizes of these two nominal species are largely overlapping and the structure of the left paramere, as judged from figure 30 of Carayon and Villiers (1968), shows some variability in detail of structure but without a pattern that would allow us to recognize multiple species (fig. 4).

Aphelonotus fraterculus, along with *A. simplus* (fig. 2) and *A. taino* (fig. 3), is known to have brachypterous forms. In all three species the forewings are truncate and reach only a short distance onto the abdominal dorsum.

HOLOTYPE: PANAMA: Panama: Rio Trinidad, 8.65694°N 78.53889°W, 09 Jun 1912, A. Busck, 1 ♂ (AMNH_PBI 00413095) (USNM).

PARATYPES: ECUADOR: Guayas: Guayaquil, 2.2°S 79.9°W, 01 Jan 1925, F. Campos R., 2 ♀ (AMNH_PBI 00271764, AMNH_PBI 00271765) (USNM). **PANAMA: Canal Zone:** Tabernilla, 9.13333°N 79.03333°W, 30 m, 01 May 1907, Aug Busck, 1 ♀ (AMNH_PBI 00271768) (USNM). **Panama:** Ancon, Canal Zone, 8.95728°N 79.54944°W, 12 May 1911, A.H. Jennings, 1 ♂ (AMNH_PBI 00271762), 2 ♀ (AMNH_PBI 00271766, AMNH_PBI 00271767) (USNM). Rio Trinidad, 8.65694°N 78.53889°W, 20 Mar 1912, Aug Busck, 1 ♂ (AMNH_PBI 00271761) (USNM).

OTHER SPECIMENS EXAMINED: BRAZIL: Mato Grosso: Jacaré Parque Nacional Xingu, 12°S 54°W, Nov 1965, Alvarenga & Werner, 1 ♂ (UCR_ENT 00046688) (CAS). Rio Caraguata, 21.8°S 52.45°W, 303 m, 01 Mar 1953, F. Plaumann, 1 ♀ (AMNH_PBI 00271783) (USNM). **Pará:** Fordlandia, Rio Tapajos, 3.66666°S 55.5°W, 92 m, 01 Jan 1932, J. G. Myers, 2 ♂ (UCR_ENT 00048887, UCR_ENT 00048888), 3 ♀ (UCR_ENT 00048889-UCR_ENT

00048891) (BMNH). **COLOMBIA: Cesar:** El Roncon about 10-12 km E of Becerril, Rio San Juan, 9.744°N 73.173°W, 260 m, 19 Nov 1969, B. Malkin, 1 ♀ (AMNH_ENT 00033913) (AMNH). **Cordoba:** Monteria, 8.7575°N 75.89°W, 25 m, 10 Oct 1971 - 11 Oct 1971, R. T. & J. C. Schuh, 1 ♂ (AMNH_ENT 00033911), 1 ♀ (AMNH_ENT 00033912) (AMNH). **Magdalena:** Rio Magdalena, Barranquilla to El Banco, 10°N 74.83333°W, 10 m, 01 Jun 1924 - 30 Jul 1924, C. Allen, 1 ♂ (UCR_ENT 00048886) (BMNH). **Unknown province:** unknown locality, 5°N 74°W, 01 Jan 1925, unknown collector, 1 ♂ (AMNH_PBI 00271763), 1 ♀ (AMNH_PBI 00271770) (USNM). **COSTA RICA: Guanacaste:** Palo Verde NP, OTS research station, 10.3452°N 85.33876°W, 20 m, 16 Aug 2010 - 20 Aug 2010, OTS Heteroptera course, 1 ♂ (UCR_ENT 00003871) (AMNH). **Puntarenas:** Las Alturas Biological Field Station, 20 km N of San Vito de Hava, 9.0141°N 82.96666°W, 10 Jul 1992 - 31 Jul 1992, Snyder, 1 ♀ (AMNH_ENT 00033770) (AMNH). **San José:** San Isidro, Butler's Finca, 9.3°N 83.78333°W, 28 Jan 1976, Roth and Schroepfer, 1 ♀ (AMNH_ENT 00033771) (AMNH). **GUATEMALA: Escuintla:** Paso Antonio, 14.01666°N 90.66666°W, 122 m, 01 Jan 1880, G.C. Champion, 1 ♂ (UCR_ENT 00048898) (BMNH). **Retalhuleu:** Paraiso [near Champerico], 14.45°N 91.78333°W, 91 m, 01 Jan 1880, G.C. Champion, 1 ♀ (UCR_ENT 00048899) (BMNH). **GUYANA: Demerara-Mahaica:** 50 km SW of Georgetown, 6.36666°N 58.3°W, 30 m, 27 Sep 1991 - 30 Sep 1991, J.H. Martin, 2 ♀ (UCR_ENT 00048892, UCR_ENT 00048893) (BMNH). **HONDURAS: Choluteca:** 14 mi NW Choluteca, 17 Jun 1974, O'Briens & Marshall, 3 ♂ (UCR_ENT 00046679-UCR_ENT 00046681), 3 ♀ (UCR_ENT 00046682-UCR_ENT 00046684) (CAS). **Unknown province:** unknown locality, 08 Jun 1964, B. K. Dozier, 1 ♀ (AMNH_PBI 00271769) (USNM); 26 May 1992, unknown collector, 1 ♀ (AMNH_PBI 00271785) (USNM). **MEXICO: Oaxaca:** Tehuantepec, 16.33333°N 95.23333°W, 11 Jun 1964, J. & D. Pallister, 1 ♀ (AMNH_ENT 00033769) (AMNH); 15 Aug 1972, G. F. and S. Hevel, 1 ♀ (AMNH_PBI 00271782) (USNM). **PANAMA: Canal Zone:** Barro Colorado, 9.16666°N 79.83333°W, 01 Apr 1941, J. Zetek, 2 ♀ (AMNH_PBI 00271771, AMNH_PBI 00271772) (USNM); 01 May 1941, J. Zetek, 1 ♀ (AMNH_PBI 00271773) (USNM). Barro Colorado Island, 9.15562°N 79.84895°W, 07 Aug 1925, unknown collector, 1 ♀ (AMNH_ENT 00033915) (AMNH). Barro Colorado Island, Canal Zone, 9.15472°N 79.84806°W, 04 Jan 1929, C. H. Curran, 1 ♀ (AMNH_ENT 00033914) (AMNH). Tres Rios Plantation Gatun Lake, 9.23519°N 79.88568°W, 1931, T.O. Zachokke, 1 ♀ (UCR_ENT 00046685) (CAS). **Cocle:** none, 20 Nov 1952, F. S. Blanton, 1 ♀ (AMNH_PBI 00271784) (USNM). **Panama:** Las Cumbres, 06 Jan 1975, L. B. O'Brien, light trap, 1 ♂ (UCR_ENT 00046687) (CAS). **Unknown province:** "Panama," no date provided, T.O. Zachokke, 1 ♀ (UCR_ENT 00046686) (CAS). **PARAGUAY: Boqueron:** Mariscal Estigarribia, 22.03333°S 60.61666°W, 165 m, 01 Dec 1993, unknown collector, 1 ♀ (AMNH_PBI 00271781) (USNM). **VENEZUELA: Guarico:** 8 km N of Coroza Pando, 8.58333°N 67.56666°W, 72 m, 17 Jun 1984, F.W. Eiland and V. Linares, 4 ♂ (AMNH_PBI 00411278-AMNH_PBI 00411281), 3 ♀ (AMNH_PBI 00411288, AMNH_PBI 00411290, AMNH_PBI 00411293) (AMNH), 2 ♂ (AMNH_PBI 00411276, AMNH_PBI 00411277), 2 ♀ (AMNH_PBI 00411315, AMNH_PBI 00411316) (UCR), 11 ♂ (AMNH_PBI 00411265-AMNH_PBI 00411275), 30 ♀ (AMNH_PBI 00411282-AMNH_PBI 00411287, AMNH_PBI

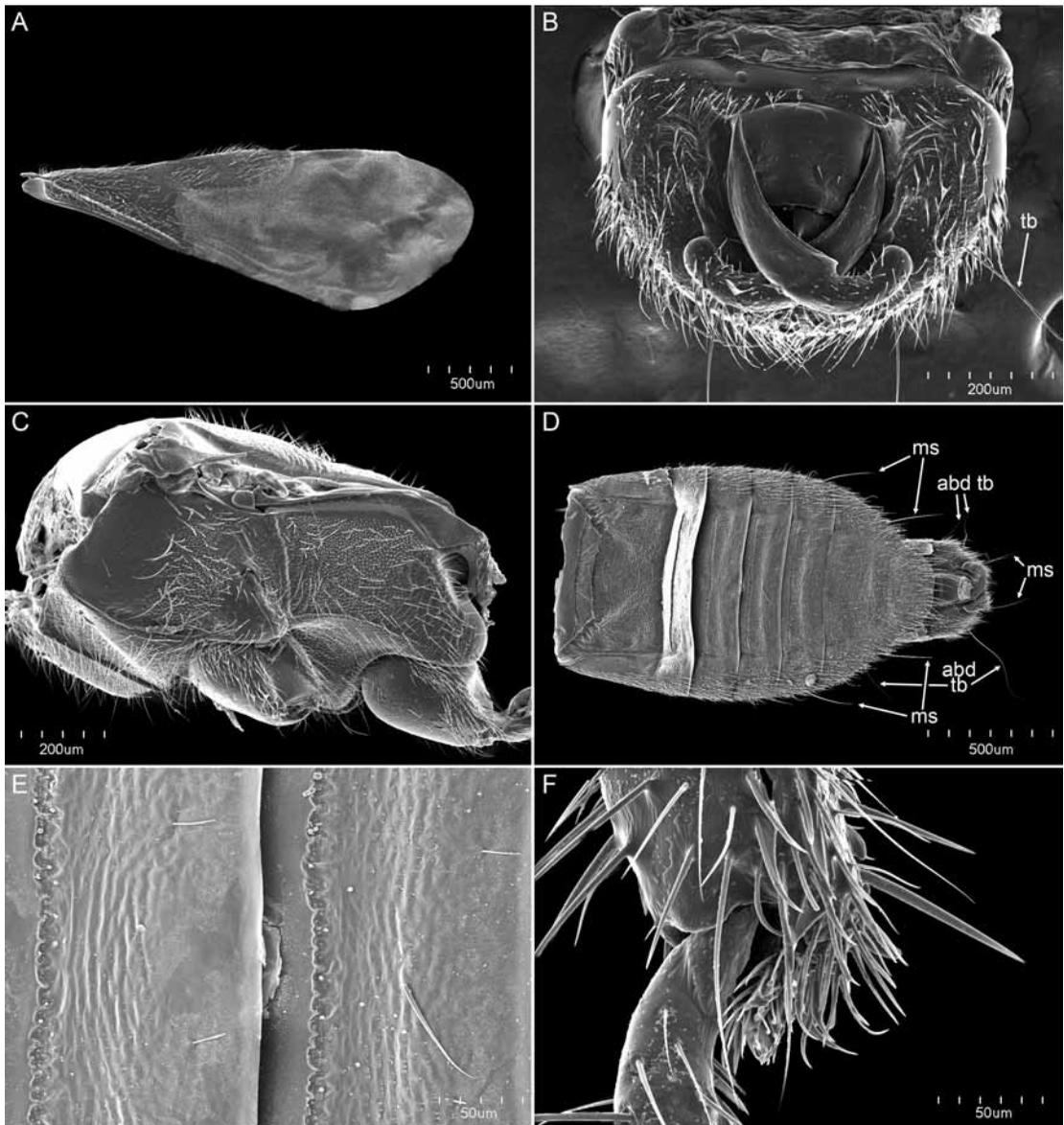


FIG. 8. Scanning micrographs of adult male *Aphelonotus fraterculus*. **A.** Right hemelytron. **B.** Dorsal view of pygophore showing parameres in repose and indicating right tricobothrium. **C.** Lateral view of meso- and metathorax. **D.** Dorsal view of abdomen and pygophore with trichobothria extending laterally from segment 8 and posterolaterally from the pygophore. **E.** Detail of dorsal abdominal gland opening between terga 4 and 5. **F.** Front leg showing fossula spongiosa and specialized curved setae that subtend it. Abbreviations: **abd tr**, abdominal trichobothria; **ms**, macroseta.

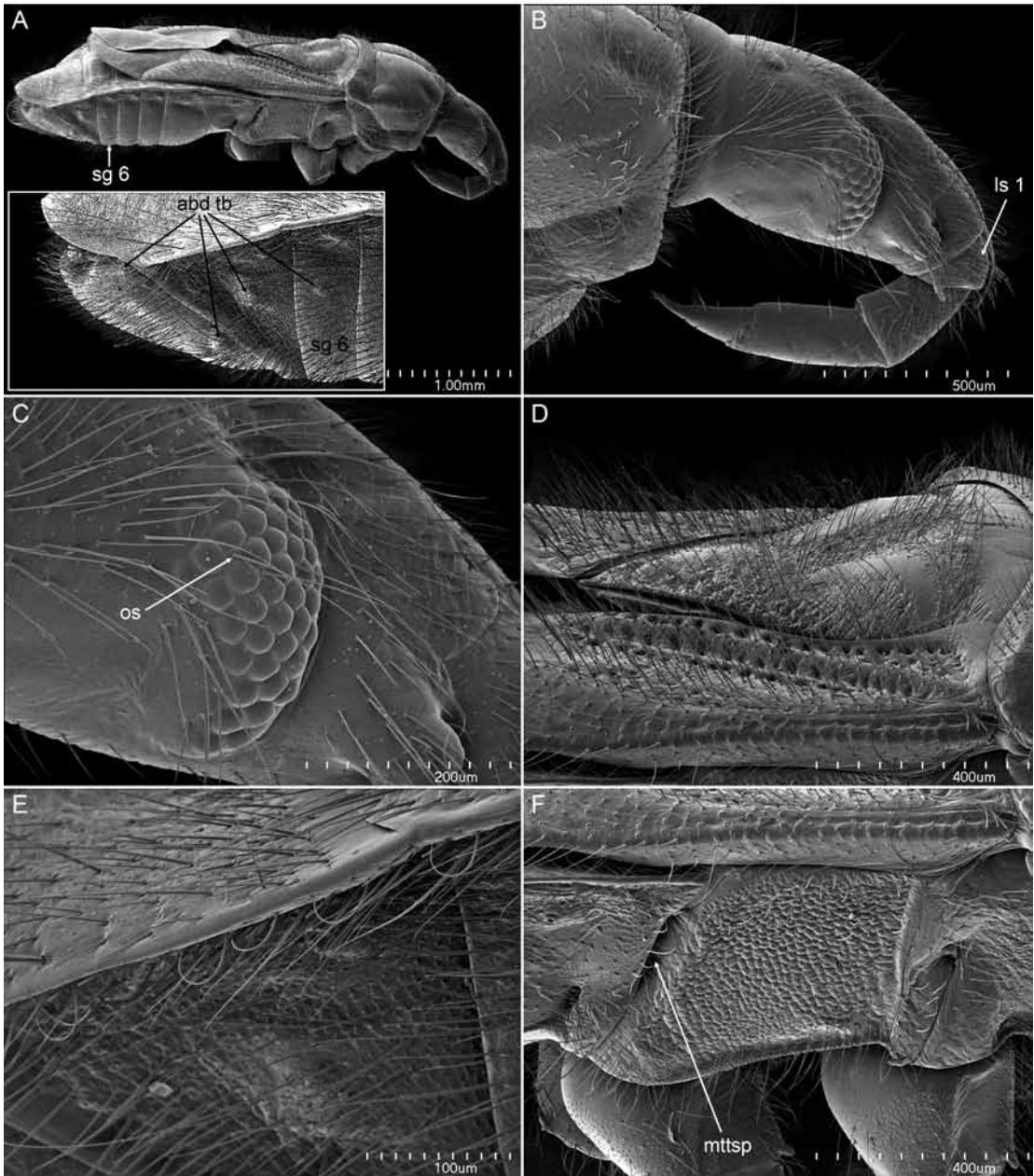


FIG. 9. Scanning micrographs of adult male *Aphelonotus major*. **A.** Lateral view of body (legs and antennae removed). **B.** Lateral view of head and *Labium*. **C.** Detail of compound eye showing ocular setae. **D.** Detail of scutellum and clavus, showing long erect vestiture of dorsum and heavy punctures along claval suture and cubital vein. **E.** Costal margin of hemelytron. **F.** Thoracic pleuron, showing meso- and metacetabulum and metathoracic spiracle. Abbreviations: **abd tr**, abdominal trichobothria **ls 1**, labial segment 1; **os**, ocular setae; **mttsp**, metathoracic spiracle.

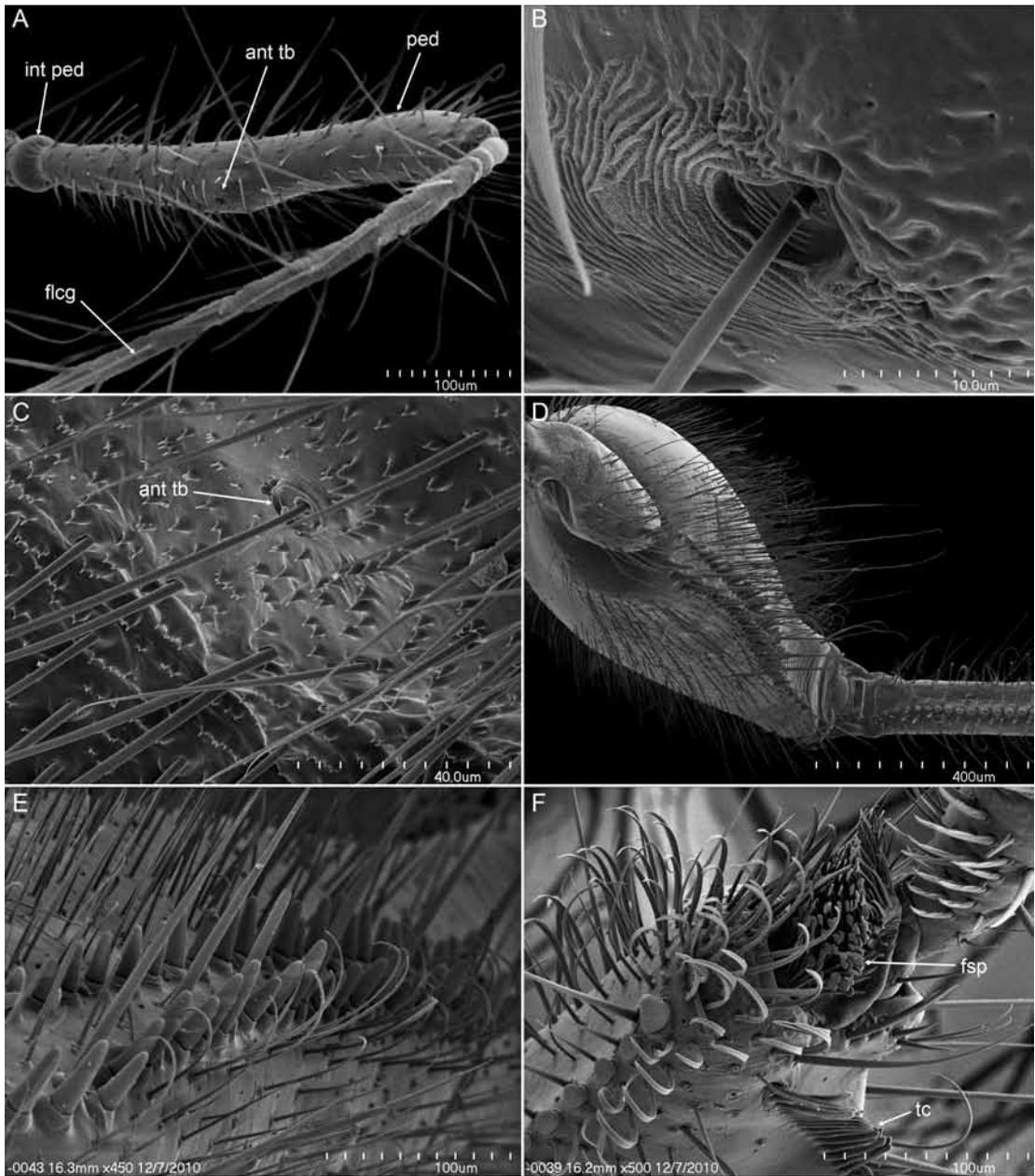


FIG. 10. Appendages and trichobothria of adult *Aphelonotus major*. **A.** Distal portion of antennal pedicel (segment 2), showing intrapediceloid and single trichobothrium. **B.** Detail of antennal trichobothrium. **C.** Abdominal venter showing submedial trichobothrium. **D.** Forefemur and proximal portion of tibia, showing spines on opposing surfaces. **E.** Forefemur showing details of spination. **F.** Apex of foretibia, showing tibial cleaning comb and fossula spongiosa subtended by distinctive hooklike setae. Abbreviations: **ant tr**, antennal trichobothrium **flg**, flagellum; **fsp**, fossula spongiosa; **int ped**, intrapediceloid; **ped**, pedicel; **tc**, tibial comb.

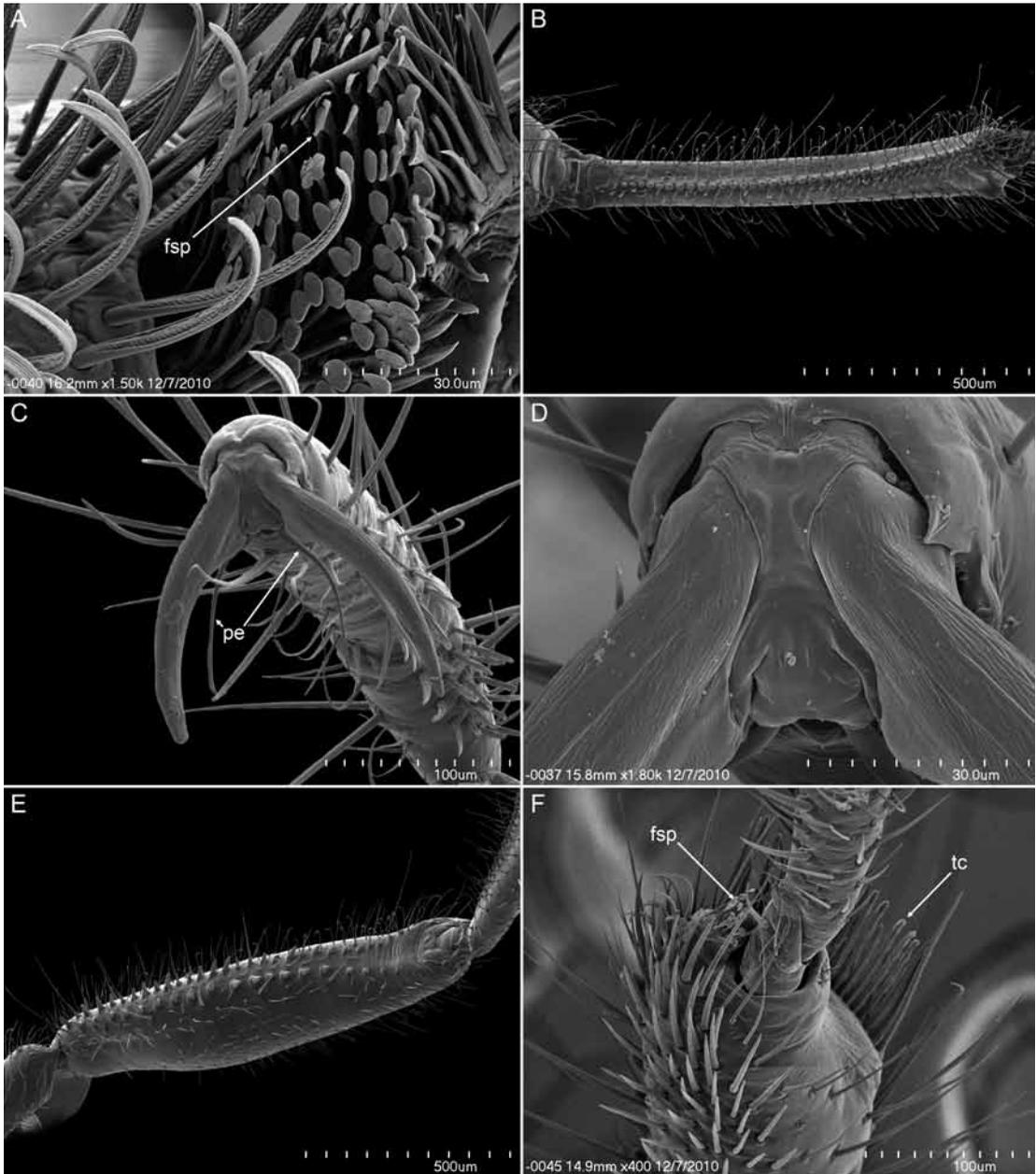


FIG. 11. Legs of adult *Aphelonotus major*. **A.** Detail of fossula spongiosa of foreleg. **B.** Foretibia, ventral view. **C.** Foreleg pretarsus, general view. **D.** Foreleg pretarsus, with detail of claw bases. **E.** Femur, middle leg, ventral view. **F.** Tibial apex, middle leg, showing fossula spongiosa, cleaning comb, and base of tarsus. Abbreviations: **fsp**, fossula spongiosa; **pe**, parempodium; **tc**, tibial comb.

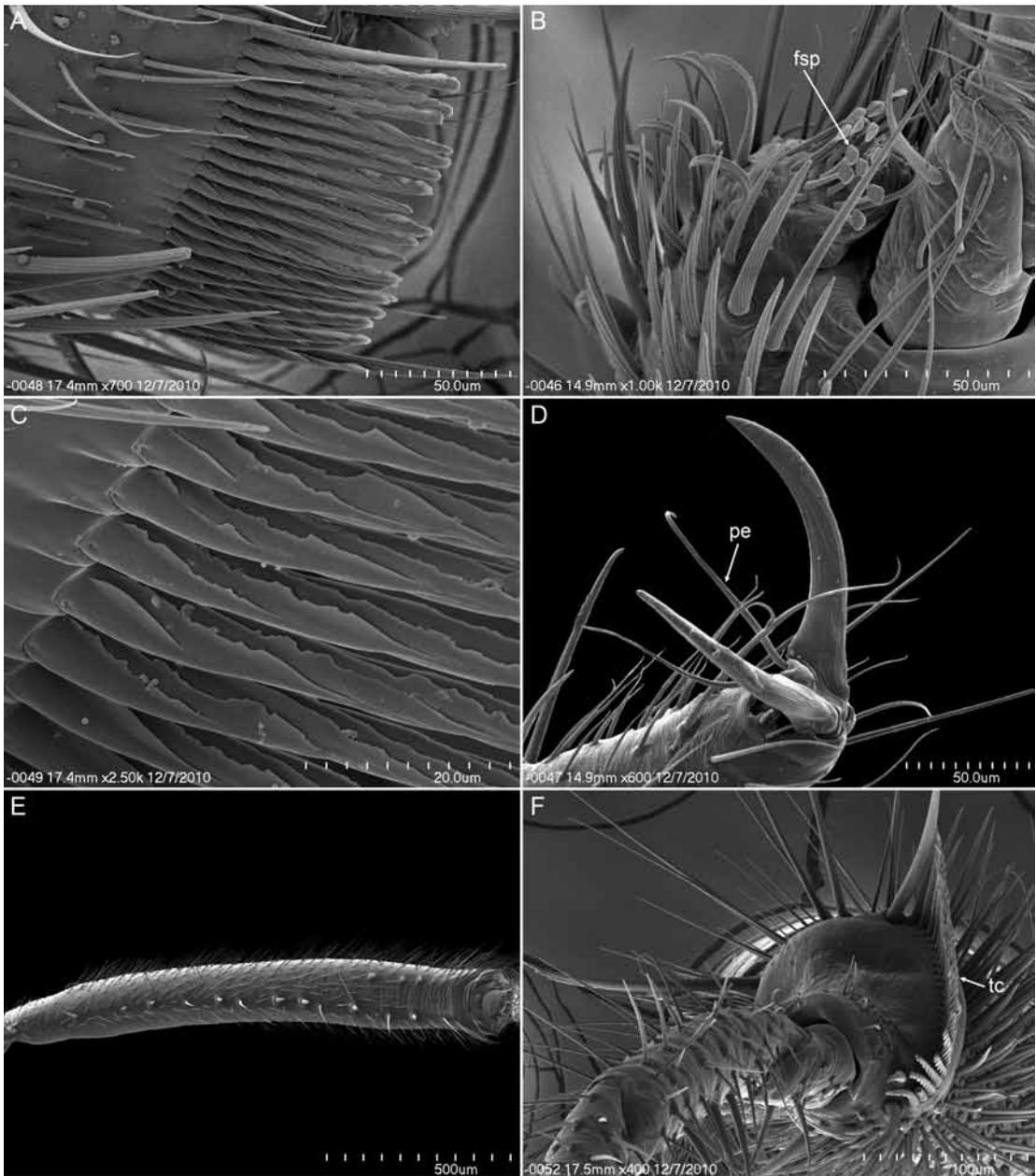


FIG. 12. Middle and hind legs of adult *Apelonotus major*. **A.** Middle leg, tibial comb. **B.** Middle leg, fossula spongiosa and tarsal insertion. **C.** Middle leg, detail of setae in tibial comb. **D.** Middle leg pretarsus. **E.** Hind femur, ventral view. **F.** Hind leg tibia and tarsus, showing tibial comb and absence of fossula spongiosa. Abbreviations: **fsp**, fossula spongiosa; **pe**, parempodium; **tc**, tibial comb.

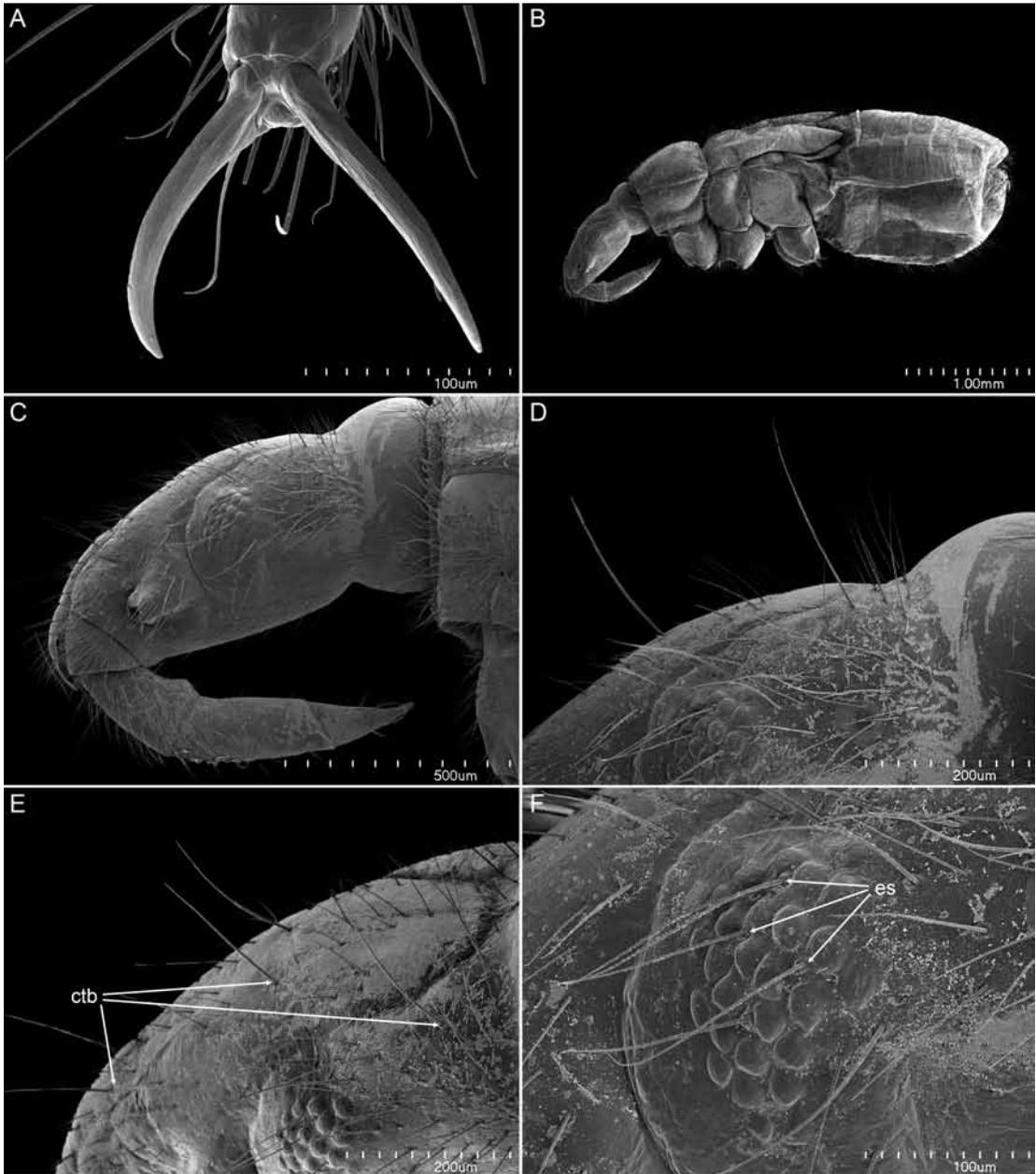


FIG. 13. *Aphelonotus major*. **A.** Adult hind leg pretarsus. **B–F.** Nymphal characters. **B.** Lateral view of body, antennae and legs removed. **C.** Lateral view of head. **D.** Detail of eye and vertex, showing cephalic trichobothria (macrosetae) and ocular setae. **E.** Detail of vertex and macrosetae. **F.** Detail of compound eye and ocular setae. Abbreviations: **ctb**, cephalic trichobothria; **es**, eye setae.

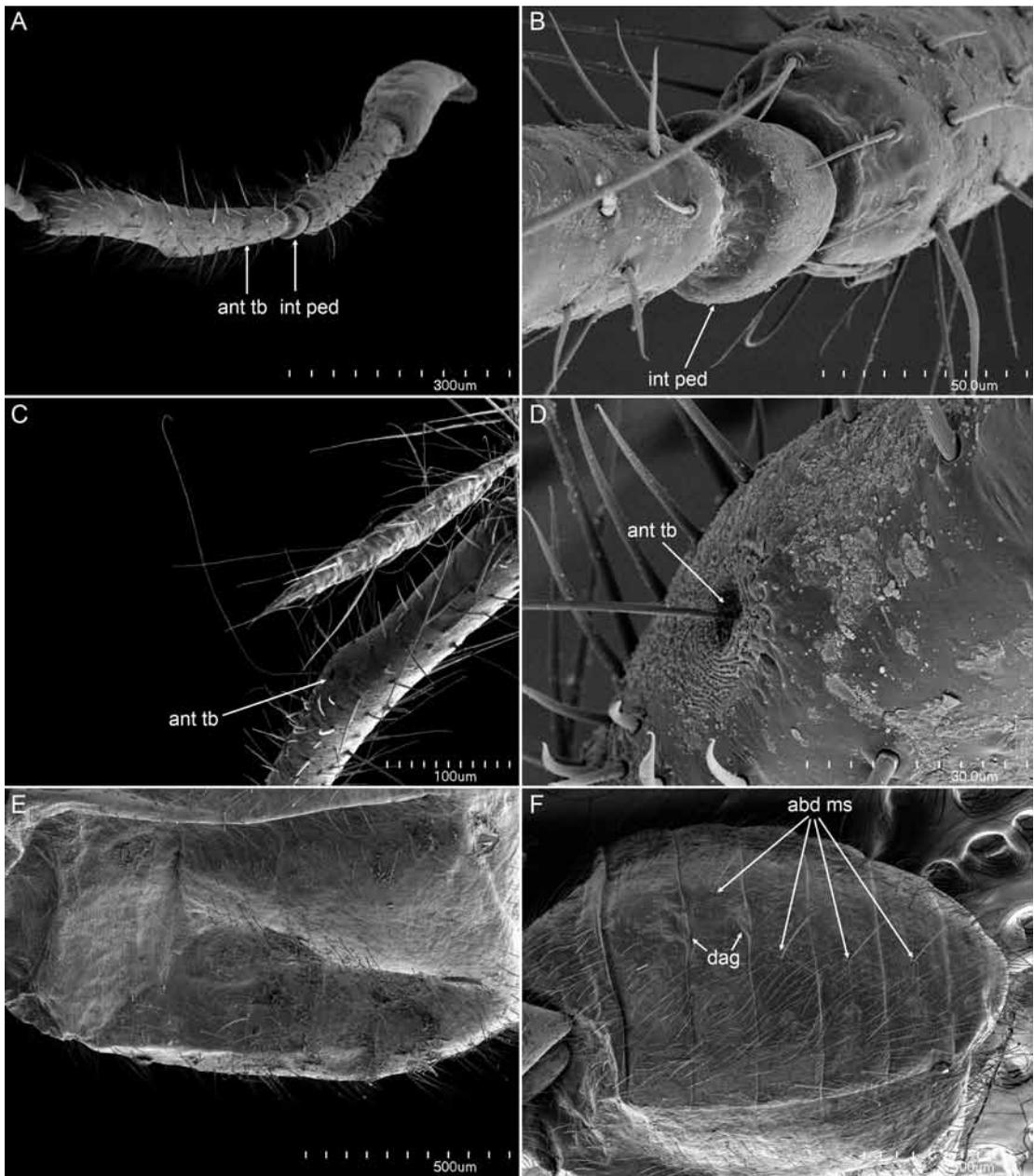


FIG. 14. Nymph of *Aphelonotus major*. **A.** Antennal scape and most of pedicel, showing trichobothrium and intrapediceloid. **B.** Close up of antenna and intrapediceloid. **C.** Distal portion of antennal pedicel with trichobothrium. **D.** Detail of bothrium and basal portion of trichobothrium. **E.** Lateral view of abdomen (see fig. 8B for orientation). **F.** Lateroventral view of abdomen showing trichobothria lateral to midline on segments 4–7. Abbreviations: **ant tr**, antennal trichobothrium; **int ped**, intrapediceloid; **ms**, macroseta.

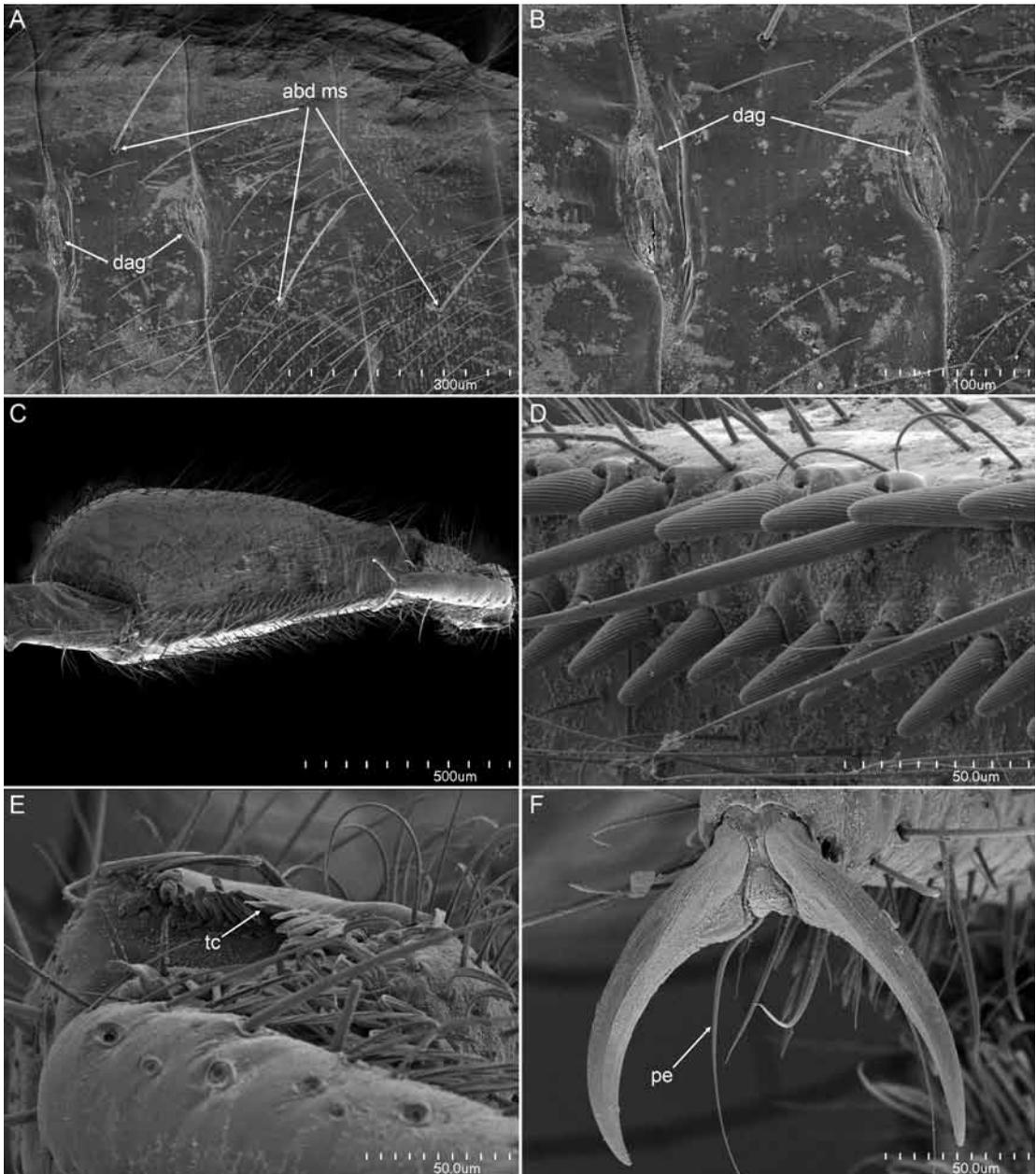


FIG. 15. Nymph of *Aphelonotus major*. **A.** Detail of abdominal venter, showing trichobothria lateral to midline on segments 4–6. **B.** Dorsal view of abdomen showing dorsal abdominal scent gland openings between terga 3–4 and 5–6. **C.** Ventral view of forefemur. **D.** Detail of spines on ventral surface of forefemur. **E.** Tibial comb of foreleg. **F.** Foreleg pretarsus, dorsodistal view, showing parempodium. Abbreviations: **abd tb**, abdominal trichobothrium; **dag**, dorsal abdominal gland; **ms**, macroseta; **pe**, parempodium; **tc**, tibial comb.

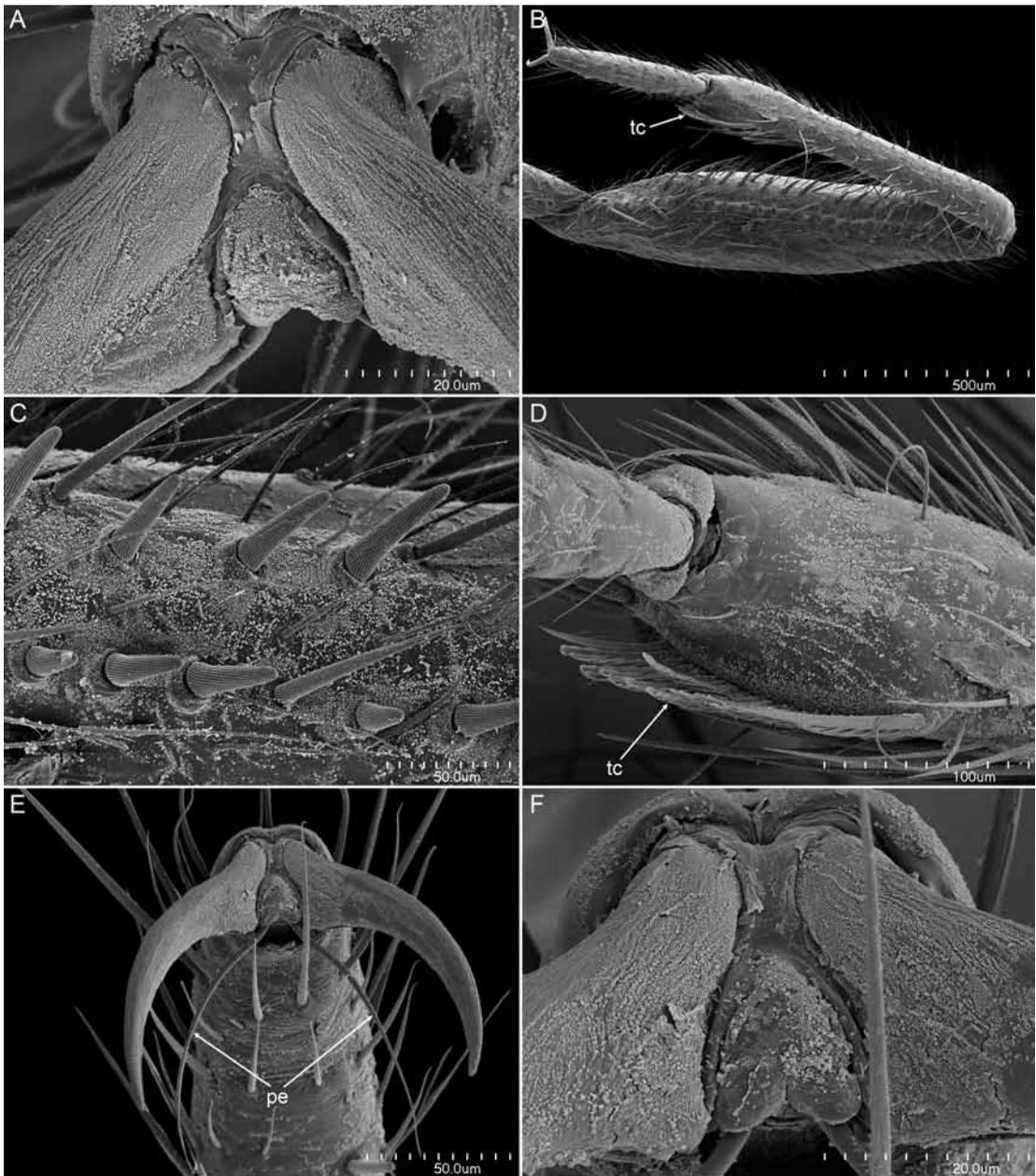


FIG. 16. Nymph of *Aphelonotus major*. **A.** Detail of articular area between claws of foreleg. **B.** Ventral view of middle femur showing peglike spines, and tibial comb on femur. **C.** Detail of spination on middle femur. **D.** Middle tibial comb. **E.** Pretarsus of middle leg showing parempodia. **F.** Detail of articular area between claws of middle leg. Abbreviations: **pe**, parempodium; **tc**, tibial comb.

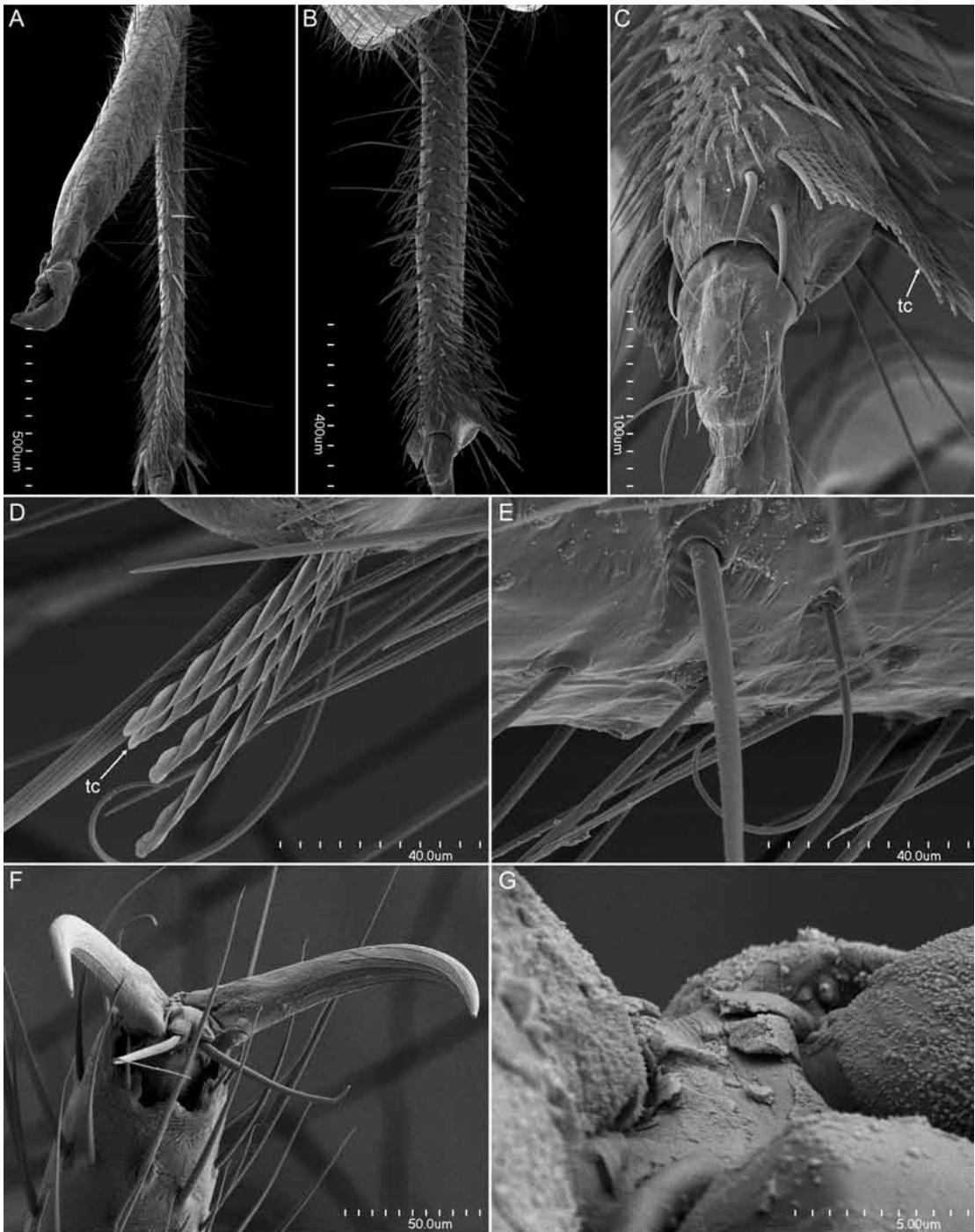


FIG. 17. Nymphs of *Aphelonotus major*. **A.** Hind leg. **B.** Detail of medial face of hind tibia. **C.** Detail of hind-leg tibial comb. **D.** Detail of setae in hind-leg tibial comb. **E.** Detail of setae on hind tibia. **F.** Hind-leg pretarsus. **G.** Detail of articular area between claws on hind-leg pretarsus. Abbreviation: **tc**, tibial comb.

00411289, AMNH_PBI 00411291, AMNH_PBI 00411292, AMNH_PBI 00411294-AMNH_PBI 00411314) (USNM). 12 km S of Calabozo, 8.8°N 67.4°W, 80 m, 06 Feb 1969 - 12 Feb 1969, P. & P. Spangler, light trap, 1 ♂ (AMNH_PBI 00271779) (USNM).

Aphelonotus fuscus Carayon and Villiers

Figures 2, 4, 5, 7, 8, table 1, map 2

Aphelonotus fuscus Carayon and Villiers, 1968: 76 (n. sp., figs.).

DIAGNOSIS: This medium-sized species ranges in length from 3.88–4.02 mm; the basal portion of pedicel ranges in length from 0.61–0.65 mm. The paramere is sharply right angulate with a protuberance on the inner surface just distad of the inner angle; the blade is weakly curving on both the outer and inner surfaces. Most similar in size *A. elongatus*, *A. fraterculus*, and *A. medius*, but distinguished from *A. fraterculus* and *A. medius* by obvious differences in paramere structure, the blade in the former very long, broad, and scimitar shaped, in the latter fingerlike and not distinctly broad and flat; paramere in *A. fuscus* most similar to that of *A. elongatus*, but blade smoothly and weakly curving in *fuscus* as opposed to inner surface being nearly straight in *elongatus*.

DISTRIBUTION: Known distribution includes the northern and southwestern margins of the Amazon Basin.

DISCUSSION: Our concept of this species is based on the description and paramere illustration provided by Carayon and Villiers (1968); we did not examine the holotype. The type locality is: San Fernando de Apure, Apure, Venezuela.

SPECIMENS EXAMINED: **BOLIVIA: El Beni:** Isla Flores, Rio Itenez, 13.03333°S 62.7°W, 184 m, 07 Aug 1964, J.K. Bouseman, J. Lussenhop, light trap, 1 ♂ (AMNH_ENT 00033846) (AMNH). **BRAZIL: Roraima:** Lower Rio Branco, 0.66666°S 61.66666°W, 30 m, 01 Jan 1932, J.G. Myers, 1 ♂ (UCR_ENT 00048894), 1 ♀ (UCR_ENT 00048895) (BMNH). **PERU: Madre de Dios:** Los Amigos Biol. Sta., 12.56922°S 70.1°W, 268 m, 19 Dec 2010, C. Weirauch, 1 ♂ (UCR_ENT 00044335) (UCR).

Aphelonotus major Harris

Figures 2, 4, 5, 7, 9–17, table 1, map 2

Aphelonotus major Harris, 1931: 19 (n. sp.).

DIAGNOSIS: This, the largest species of *Aphelonotus*, ranges in length from 5.05–5.57 mm; the basal portion of pedicel ranges in length from 0.86–0.91 mm. The paramere angle is broadly curving as is the strongly elongate, nearly parallel-sided blade. Most similar in size to *A. paramedius*, but distinguished from that species by differences in size and paramere structure; *A. major* much larger and inner angle of the paramere with a dull tooth in *A. paramedius* and a cleft in *A. major*.

DISTRIBUTION: Along most of the length of the Amazon River.

DISCUSSION: Our concept of this species is based on the examination of the holotype and a topotypic paratype, and of substantial additional material, and the homogeneity of size and paramere structure for this very large species.

HOLOTYPE: BRAZIL: Amazonas: Tefé [sic], 3.3667°S 64.7°W, 28 Jan 1920, H.S. Parish, 1 ♂ (AMNH_PBI 00413096) (USNM).

PARATYPE: BRAZIL: Amazonas: Tefé [sic], 3.3667°S 64.7°W, 21 Jan 1920, H.S. Parish, 1 ♀ (AMNH_PBI 00374315) (USNM).

OTHER SPECIMENS EXAMINED: BRAZIL: Amazonas: Coari: Base de Operações Geólogo Pedro de Moura, Porto Urucu, CL 24, 4.84722°S 65.08417°W, 85 m, 06 Sep 2006, unknown collector, 2 ♀ (AMNH_PBI 00413040, AMNH_PBI 00413043) (AMNH), 1 ♂ (AMNH_PBI 00413045), 1 ♀ (AMNH_PBI 00413038) (MPEG). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J22, 4.88722°S 65.22694°W, 85 m, 22 Sep 2006, unknown collector, 1 ♂ (AMNH_PBI 00413044) (AMNH). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J40, 4.87694°S 65.15083°W, 85 m, 17 Jul 2006, unknown collector, 1 ♂ (AMNH_PBI 00413036) (AMNH). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J61, 4.81306°S 65.0325°W, 85 m, 14 Jul 2006, unknown collector, 1 ♀ (AMNH_PBI 00413041) (MPEG). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J66, 4.81139°S 65.03361°W, 85 m, 10 Jul 2006, unknown collector, 1 nymph (AMNH_PBI 00413035) (AMNH). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J70, 4.80639°S 65.03472°W, 85 m, 08 Jul 2006, unknown collector, 1 ♀ (AMNH_PBI 00413037) (AMNH). Base de Operações Geólogo Pedro de Moura, Porto Urucu, J87, 4.84167°S 65.06417°W, 85 m, 27 Sep 2006, unknown collector, 1 ♀ (AMNH_PBI 00413042) (AMNH), 1 ♂ (AMNH_PBI 00413039) (MPEG). Parintins, 2.63111°S 56.68333°W, 6 m, 01 Aug 1935, G.V. Vredenburg, 1 ♀ (UCR_ENT 00048876) (BMNH). Tefé, 3.366°S 64.7°W, 2007, R.A. Puente, unknown collector, 1 ♂ (AMNH_PBI 00414374) (CIAP). **Mato Grosso:** Tapirape Indian Village at confluence of R. Tapirape and R. Araguaia, 10.65426°S 50.60386°W, 01 Dec 1960 - 11 Dec 1960, B. Malkin, 1 ♀ (UCR_ENT 00021711) (FMNH). **ECUADOR: Orellana:** Yasuni Bio. Res. Stn., 0.66667°N 76.38333°W, 01 Jul 1998, B. Brown, 1 ♂ (UCR_ENT 00077050) (UCR). **PERU: Loreto:** San Antonio, 4.45°S 74.1°W, 103 m, 23 Aug 1965, J.C. Hitchcock, 1 ♀ (AMNH_PBI 00271787) (USNM). Yasua Indian village, at headwaters of the Rio Loreto Yacu, 3.47502°S 72.51718°W, 22 Apr 1970 - 02 May 1970, B. Malkin, 2 ♀ (AMNH_ENT 00033763, AMNH_ENT 00033764) (AMNH). **Ucayali:** Pucallpa, 3.4636°S 72.9225°W, 150 m, 03 Dec 1971, R. T. Schuh, 1 ♀ (AMNH_ENT 00033765) (AMNH).

Aphelonotus medius Harris

Figures 2, 4, 5, 7, table 1, map 3

Aphelonotus medius Harris, 1931: 18 (n. sp.).

DIAGNOSIS: This medium-sized species ranges in length from 3.62–4.32 mm; the basal portion of pedicel ranges in length from 0.56–0.73 mm. The paramere angle is curving and swollen, inner angle also swollen with a cleft; the blade is moderately curving on both the outer and inner surfaces, with a ridge on the outer surface, and appearing somewhat fingerlike. Most similar in size to *A. elongatus*, *A. fraterculus*, and *A. medius*, but distinguished from *A. fraterculus* by obvious differences in paramere structure, the blade in the first is very long, broad, and scimitar shaped, whereas the paramere is right angled in the last two.

DISTRIBUTION: Broadly distributed throughout northern South America.

DISCUSSION: Our concept of this species is based on examination of the holotype, other specimens identified by H.H. Harris, and his illustrations of the paramere of this taxon (Harris, 1931).

HOLOTYPE: **BRAZIL: Amazonas:** Madeira River above Manaus [sic], 3.46666°S 58.78333°W, 27 m, 01 Sep 1923, Lee Prizer, 1 ♂ (AMNH_PBI 00413097) (USNM).

SPECIMENS EXAMINED: **BRAZIL: Mato Grosso:** Rio São Lourenço, near Corumba, 19°S 57.65°W, 128 m, Jan, H.H. Smith, light trap, 1 ♂ (CMNH_TCN 00013912) (CMNH). **Pará:** Santarem, 2.4333°S 54.7°W, no date provided, H.H. Smith, light trap, 6 ♂ (CMNH_TCN 00013903-CMNH_TCN 00013908), 4 ♀ (CMNH_TCN 00013913-CMNH_TCN 00013916) (CMNH), 1 ♀ (AMNH_PBI 00391615) (LSU), 1 ♂ (AMNH_PBI 00374311) (USNM). Taperinha, 2.53232°S 54.29482°W, no date provided, H.H. Smith, light trap, 3 ♂ (CMNH_TCN 00013909-CMNH_TCN 00013911), 3 ♀ (CMNH_TCN 00013917-CMNH_TCN 00013919) (CMNH), 1 ♀ (AMNH_PBI 00391614) (LSU), 1 ♂ (AMNH_PBI 00374312) (USNM). **ECUADOR: Guayas:** Guayaquil, 2.2°S 79.9°W, 01 Jan 1941, C.L. Fagan, 1 ♀ (AMNH_PBI 00374313) (USNM). **Province unknown:** locality unknown, 13 Nov 1957, C.A. Johnson, 1 ♀ (AMNH_PBI 00374314) (USNM). **VENEZUELA: Province unknown:** locality unknown, 17 May 1972, collector unknown, 1 ♂ (AMNH_PBI 00271780) (USNM).

Aphelonotus minutus, new species

Figures 2, 4, 5, 7, table 1, map 3

DIAGNOSIS: This, the smallest species of *Aphelonotus*, ranges in length from 2.07–2.13 mm; the basal portion of pedicel ranges in length from 0.12–0.13 mm. The smallest specimens in the next largest species start at 2.48 mm. Paramere small, more or less right angled, outer surface with a unique subapical indentation. Most similar in size to *A. africanus*, *A. confusus*, and *A. simplus*, but those species all significantly larger, at 2.48 mm or greater.

DESCRIPTION: Character complement as in generic description; habitus as in figure 2; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for its very small size, the smallest known representative of the genus.

DISTRIBUTION: Known from a single locality in the central Amazon Basin.

DISCUSSION: The species was collected together with *A. alvarengai* and *A. elongatus* at Jacareacanga, Pará, Brazil, and is known only from that locality.

HOLOTYPE: **BRAZIL: Pará:** Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, 1 ♂ (AMNH_ENT 00033878) (MNRJ).

PARATYPES: **BRAZIL: Pará:** Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, 3 ♂ (AMNH_ENT 00033879, AMNH_ENT 00033880, AMNH_ENT 00033882), 8 ♀ (AMNH_ENT 00033885-AMNH_ENT 00033892) (AMNH), 1 ♀ (AMNH_ENT 00033883) (MNRJ), 1 ♂ (AMNH_ENT 00033881), 1 ♀ (AMNH_ENT 00033884) (UCR); Dec 1969, F.R. Barbosa, 3 ♂ (AMNH_ENT 00033865-AMNH_ENT 00033867), 8 ♀ (AMNH_ENT 00033868-AMNH_ENT 00033870, AMNH_ENT 00033872-AMNH_ENT 00033876) (AMNH), 1 ♀ (AMNH_ENT 00033871) (MNRJ); Jun 1970, F.R. Barbosa, 1 ♂ (AMNH_ENT 00033893), 7 ♀ (AMNH_ENT 00033894-AMNH_ENT 00033900) (AMNH).

Aphelonotus paramedius, new species

Figures 2, 4, 5, 7, table 1, map 3

DIAGNOSIS: This large species is known from a single specimen which measures 4.86 mm in length; the antennal pedicel is missing in the only known specimen. The paramere angle is broadly curving as is the elongate, blade. Most similar in size to *A. major*, but distinguished from that species by differences in size and paramere structure, *A. major* being significantly larger and with the inner angle of the paramere with a dull tooth in *A. paramedius* and a cleft in *A. major*.

DESCRIPTION: Character complement as in generic description; habitus as in figure 2; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for its similarity in size to *Aphelonotus medius* Harris.

DISTRIBUTION: Known from a single locality in the central Amazon Basin.

DISCUSSION: Based on its large size and the similarity of paramere structure we posit that this new taxon is most closely related to *A. major*. We describe it to draw attention to the additional but poorly known diversity in *Aphelonotus*.

HOLOTYPE: BRAZIL: Pará: Jacareacanga, 6.2667°S 57.65°W, 88 m, Dec 1968, M. Alvarenga, 1 ♂ (AMNH_ENT 00033800) (MNJR).

Aphelonotus simplus Uhler

Figures 2, 4, 5, 7, table 1, map 3

Aphelonotus simplus Uhler, 1894: 209 (n. sp.).

DIAGNOSIS: This moderately small species ranges in length from 2.54–2.91 mm; the basal portion of pedicel ranges in length from 0.36–0.42 mm. The outer surface of the paramere is smoothly and broadly rounded; the blade is relatively short with a broad, more weakly sclerotized inner basal area as also seen in *A. alvarengai* and *A. simplus*, this area with a fingerlike projection, as also seen in *confusus*. Most similar in size to *A. africanus*, *A. confusus*, and *A. wygodzinskyi*, but distinguished from the first two by its distinctive paramere structure, which is most similar to that of *A. alvarengai* and *A. confusus*, but *A. alvarengai* lacking the medial fingerlike projection parallel to paramere shaft as seen in *A. confusus* and *A. simplus*; outer surface of paramere in *A. simplus* smoothly curving and without the indentation as in *A. confusus*; paramere blade in *A. wygodzinskyi* very short and broad with a straight inner surface.

DISTRIBUTION: Known localities range from southernmost Texas to Paraguay, including the type locality, Grenada, in the southern Lesser Antilles.

DISCUSSION: Our concept of this species is based on the examination of four male and one female specimens from Mt. Gay Estate, Grenada, used by Uhler (1894) in the preparation of his original description and the erection of the genus. We have designated one of the male specimens as the lectotype and remaining specimens as paralectotypes. Although it is known from only a limited number of specimens, the consistent structure of the parameres suggest that this is one of the most widespread species in the genus.

LECTOTYPE: GRENADA: Mount Gay Estate (leeward side), 12.05°N 61.73333°W, H.H. Smith, 1 ♂ (UCR_ENT 00048896) (USNM).

PARALECTOTYPES: **GRENADA:** Mount Gay Estate (leeward side), 12.05°N 61.73333°W, H.H. Smith, 1 ♀ (UCR_ENT 00048897) (BMNH), 3 ♂ (AMNH_PBI 00374320, AMNH_PBI 00374324, AMNH_PBI 00374327) (USNM).

OTHER SPECIMENS EXAMINED: **BRAZIL: Mato Grosso:** Barra do Tapirape, 10.46666°S 50.51667°W, 07 Aug 1962, B. Malkin, 1 ♂ (AMNH_ENT 00033916) (AMNH). Tapirape Indian Village at confluence of R. Tapirape and R. Araguaia, 10.65426°S 50.60386°W, 01 Dec 1960–11 Dec 1960, B. Malkin, 3 ♀ (UCR_ENT 00021712–UCR_ENT 00021714), 1 ♂ (UCR_ENT 00021718) (FMNH). **Mato Grosso do Sul:** Corumba, 19.012°S 57.624°W, 13 Dec 1919–22 Dec 1919, Cornell Univ. Biological Expedition, 1 ♀ (AMNH_PBI 00374331) (USNM). **PARAGUAY: Concepcion:** Horqueta, 45 miles E of Paraguay River, 23.3428°S 57.0597°W, 27 Jan 1934, Alberto Schultze, 1 ♀ (AMNH_PBI 00374328) (USNM). **Province unknown:** Chaco, 21 °S 60°W, 144 m, no date provided, Fiebrig, 2 ♀ (AMNH_PBI 00391618, AMNH_PBI 00391619) (LSU), 2 ♂ (AMNH_PBI 00374321, AMNH_PBI 00374322) (USNM). **SURINAME: Paramaribo:** Paramaribo, 5.8333°N 55.1667°W, 2 m, 04 Aug 1908, C. Heller, 1 ♀ (AMNH_PBI 00374330) (USNM). **TRINIDAD AND TOBAGO: Trinidad: Saint George Co.:** St. Augustine, 01 Jan 1925, Neal A. Weber, 1 ♂ (AMNH_ENT 00033917) (AMNH). **USA: Texas:** Cameron Co.: Brownsville, 25.90139°N 97.49722°W, 10 Mar 1936, P.A. Glick, 1 ♂ (AMNH_PBI 00374326) (USNM); 12 Mar 1936, P.A. Glick, 1 ♂ (AMNH_PBI 00374325) (USNM).

Aphelonotus taino, new species

Figures 3, 4, table 1, map 3

DIAGNOSIS: This species is recognized, along with *A. xenos*, by the moderate size (3.15–3.36 mm), moderately elongate head, globular eyes, the very short endocorium (rendering the medial fracture very short), the smooth corium, the membrane without cells, the flattened ventral surface of the foretibia with an anterior row of stout and moderately elongate spines and with long, subapical setae, but without the long and stout subapical spine seen in *A. xenos*, the slender and sinuous paramere without a subapical tooth, and the parallel orientation of the parameres in repose. This species is easily confused with *A. xenos* on the basis of the characters listed above, but can be distinguished by the lack of a subapical tooth on the paramere, whereas that structural detail is present in *A. xenos*. Among other *Aphelonotus* spp., the paramere structure is similar to that of *A. africanus*, but that and all species except *A. taino* and *A. xenos* are distinguished by an elongate exocorium, similar form of spines on foretibia, membrane with veins, the pronotum and most of dorsum much more hirsute than in *A. xenos* and *A. taino*, and with the parameres pointing medially and overlapping rather than pointed anteriorly and parallel to one another.

DESCRIPTION: Character complement as in generic description; habitus as in figures 3; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for the native peoples of Cuba; a noun in apposition.

DISTRIBUTION: Known from two localities in Cuba.

DISCUSSION: See Discussion under *A. xenos*.

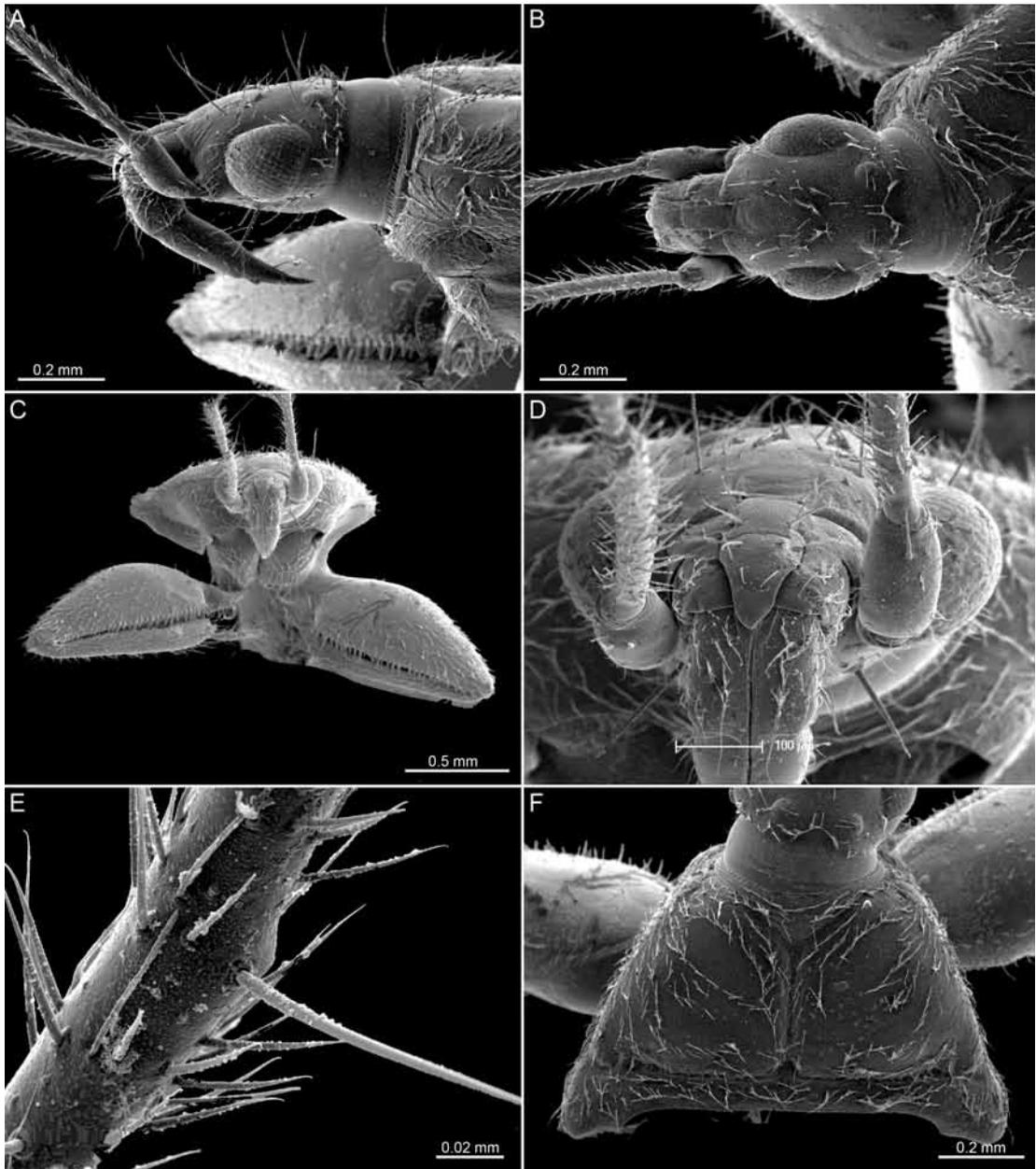


FIG. 18. Adult male of *Aphelonotus xenos*. A. Head, lateral view. B. Head, dorsal view. C. Head and thorax, frontal view. D. Head, frontal view. E. Detail of distal portion of pedicel, showing seta. F. Thorax, dorsal view.

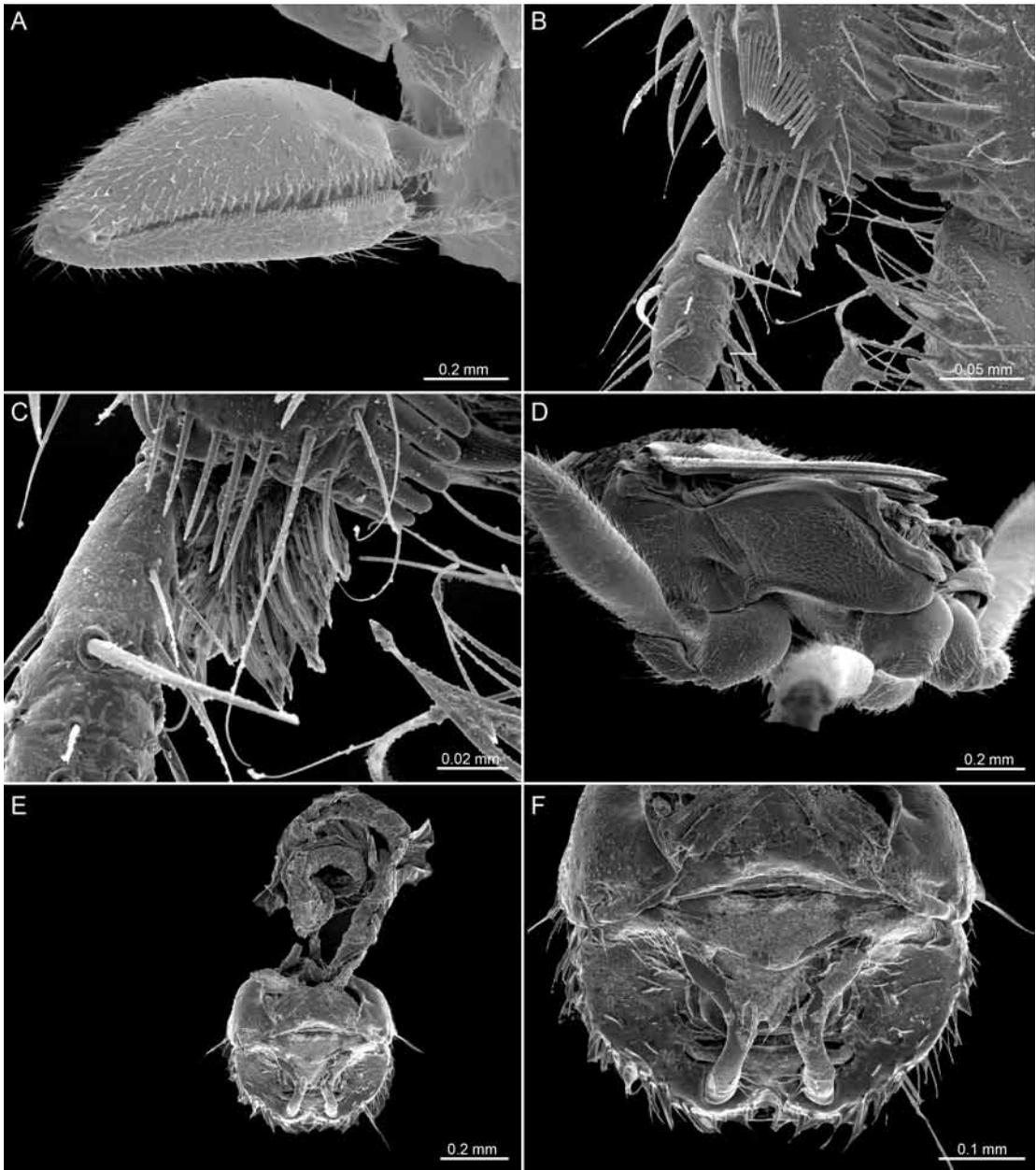


FIG. 19. Adult male of *Aphelonotus xenos*. **A.** Foreleg, anterior view. **B.** Foretibia, tip with tibial comb and showing distal part of ventral row of spines, anterior view. **C.** Foretibia, close-up of figure 18B. **D.** Meso- and metathorax, lateral view. **E.** Pygophore and ductus seminis, dorsal view. **F.** Pygophore, dorsal view.

We treat the only known female of Pachynomidae so far known from Cuba as belonging to *A. taino*, based primarily on the structure of the foretibial spines. The brachypterous nature of the specimen makes it difficult to compare much of the morphology with the male holotype, but we note that the reduced membrane in the female lacks veins as does the male.

HOLOTYPE: CUBA: Artemisa: Lomas de Soroa, 22.8°N 83°W, Jun 1971, P. Alayo, 1 ♂ (AMNH_PBI 00414376) (CIAP).

OTHER SPECIMENS EXAMINED: CUBA: Mantanzas: Cuabales de Corral Nuevo, 23.05889°N 81.67389°W, Feb 1980, L. Armas, 1 ♀ (AMNH_PBI 00414375) (CIAP).

Aphelonotus wygodzinskyi Kerzhner

Figures 2, 4, 5, 7, table 1, map 3

Aphelonotus wygodzinskyi, 1969: 196 (n. sp.).

DIAGNOSIS: This moderately small species ranges in length from 2.51–2.84 mm; the basal portion of pedicel ranges in length from 0.35–0.38 mm. The outer surface of the paramere angle is moderately broadly rounded; the blade is short, broad, and flat, with an indentation on the inner angle. Most similar in size *A. africanus*, *A. confusus*, and *A. simplus*, but distinguished from all of them by its distinctive small, short, broad blade of the paramere.

DISTRIBUTION: Known from the type locality near the mouth of the Amazon River and from Sara Province in Bolivia.

DISCUSSION: Our concept of this species is based on examination of the holotype and numerous additional paratypes designated by Kerzhner (1969) in his description of the species. Although virtually all known specimens are from the type locality in Brazil, genitalic structures and measurements suggest that this species also occurs in Bolivia and that additional collecting should produce specimens from intermediate localities.

HOLOTYPE: BRAZIL: Pará: Município Ananindeua (adjoining Marituba), 1.36583°S 48.37194°W, Nov 1963, Oliveira and Wygodzinsky, light trap, (AMNH).

PARATYPES: BRAZIL: Pará: Município Ananindeua (adjoining Marituba), 1.36583°S 48.37194°W, Nov 1963, Oliveira and Wygodzinsky, light trap, 13 ♂ (AMNH_ENT 00024196, AMNH_ENT 00033918-AMNH_ENT 00033929), 24 ♀ (UCR_ENT 00016722, AMNH_ENT 00033930-AMNH_ENT 00033952) (AMNH).

OTHER SPECIMENS EXAMINED: BOLIVIA: Santa Cruz: Sara Province: locality unknown, Nov 1912, Steinbach, light trap, 2 ♂ (CMNH_TCN 00013901, CMNH_TCN 00013902) (CMNH).

Aphelonotus xenos, new species

Figures 3, 4, 18, 19, table 1, map 3

DIAGNOSIS: This species is recognized, along with *A. taino*, by the moderate size (3.15–3.36mm), moderately elongate head, globular eyes, the very short endocorium (rendering the medial fracture very short), the smooth corium, the membrane without cells, the flattened ventral surface of the foretibia with an anterior row of stout and moderately elongate spines and with a long and stout subapical spine, the slender and sinuous paramere, and the parallel orientation of the parameres in repose. This species is easily confused with *A. taino* on the basis of the characters

listed above, but can be distinguished by its possession of a subapical tooth on the paramere, whereas that structural detail is absent in *A. taino*. Among other *Aphelonotus* spp., the paramere structure is similar to that of *A. africanus*, but that and all species except *A. taino* are distinguished by an elongate exocorium, similar form of spines on foretibia, membrane with veins, the pronotum and most of dorsum much more hirsute than in *A. xenos* and *A. taino*, and with the parameres pointing medially and overlapping rather than anteriorly and parallel to one another.

DESCRIPTION: Character complement as in generic description; habitus as in figures 3, 18, and 19; dimensions as in table 1; paramere shape as in figure 4.

ETYMOLOGY: Named for the character combination of this species that is very different from almost all other described species in the genus, after the Greek *xenos* meaning “stranger”; noun in apposition.

DISTRIBUTION: Known from three localities in Costa Rica, where it occurs at mid (700–800m) to relatively high (1300–1400 m) elevations. All known specimens were collected in Malaise traps or using Winkler extractors.

DISCUSSION: This species shows a combination of characters that sets it apart from all other known species of *Aphelonotus* except *A. taino*. These two species are clearly diagnosed as belonging to the Aphelonotinae based on the presence of ocelli (absent in Pachynominae), the sinuate margin between corium and membrane of the hemelytron (straight in Pachynominae), the absence of the apical corial trichobothrium that is diagnostic for the Pachynominae, and the abdominal trichobothria being restricted to segments 6–9 (also present on segments 3–5 in Pachynominae). We refrain from erecting a new genus for *A. xenos* and *A. taino* and instead modify the diagnosis and description of *Aphelonotus* to accommodate these novel taxa. The shaft-like paramere shape, which is similar to that seen in *A. africanus*, may be homologous, but the overall character complement shows some homoplasy. Thus, corroboration of this hypothesis will have to await a broad-based phylogenetic analysis of Pachynomidae.

HOLOTYPE: **COSTA RICA: Heredia: Sarapiquí:** P.N. Braulio Carrillo, 16 Km SSE La Virgen, 10.26784°N 84.084°W, 1050 m, 09 Apr 2001, INBio-OET-ALAS, 1 ♂ (UCR_ENT 00014462) (INBIO).

PARATYPES: **COSTA RICA: Alajuela:** Parque Nacional Volcan Tenorio. Estacion El Pilon, 1.5 km. SO C. Carmela., 10.70314°N 84.99036°W, 700 m, 13 Jun 2006 - 05 Jul 2006, J. Azofeifa, 1 ♂ (UCR_ENT 00014463), 1 ♀ (UCR_ENT 00014471) (INBIO); 09 Oct 2006 - 11 Nov 2006, J. Azofeifa, 1 ♀ (UCR_ENT 00014472) (INBIO). **Cartago: Paraiso Co.:** Parque Nacional Tapanti. Send. Pava-Catarata., 9.73207°N 83.78013°W, 1300 m, 06 Dec 2008 - 08 Dec 2008, M. Solis & S. Meuses, 1 ♂ (UCR_ENT 00014464) (AMNH), 1 ♂ (UCR_ENT 00014465) (INBIO); 07 Apr 2009, M. Solis, O. Diaz, 1 ♀ (UCR_ENT 00014473) (INBIO). **Heredia: Sarapiquí Co.:** P.N. Braulio Carrillo, 16 Km SSE La Virgen, 10.26784°N 84.084°W, 1050 m, 09 Mar 2001, INBio-OET-ALAS, 1 ♀ (UCR_ENT 00014466) (INBIO); 09 Mar 2001 - 21 Mar 2001, INBio-OET-ALAS, 2 ♂ (UCR_ENT 00014457, UCR_ENT 00014458) (INBIO); 21 Mar 2001, INBio-OET-ALAS, 1 ♀ (UCR_ENT 00014467) (INBIO); 21 Mar 2001, INBio-OET-ALAS, 1 ♂ (UCR_ENT 00014459) (INBIO); 21 Mar 2001, INBio-OET-ALAS, 1 ♂ (UCR_ENT 00014460) (INBIO); 21 Mar 2001 - 09 Apr 2001, INBio-OET-ALAS, 1 ♀ (UCR_ENT 00014468) (INBIO), 1 ♂ (UCR_ENT 00014461) (UCR); 09

Apr 2001 - 21 Apr 2001, INBio-OET-ALAS, 1 ♀ (UCR_ENT 00014470) (INBIO); 09 Apr 2001 - 21 Apr 2001, INBio-OET-ALAS, 1 ♀ (UCR_ENT 00014469) (INBIO).

OTHER SPECIMENS EXAMINED: **COSTA RICA: Cartago: Paraiso:** Parque Nacional Tapanti. Send. Pava-Catarata., 9.73207°N 83.78013°W, 1300 m, 07 Apr 2009, M. Solis, O. Diaz, 1 nymph (UCR_ENT 00014474) (INBIO).

ACKNOWLEDGMENTS

We thank the curators mentioned under Material and Methods for the loan of specimens. We thank Steve Thurston, AMNH, for preparing the habitus images and digitized versions of the paramere illustrations and Ruth Salas, AMNH, for her meticulous preparation of the measurements and her assistance in their evaluation and presentation. We also thank two anonymous reviewers for their comments, which helped to improve the final version of the manuscript.

REFERENCES

- Carayon, J., and A. Villiers. 1968. Étude sur les Hémiptères Pachynomidae. *Annales de la Société Entomologique de France (N.S.)* 4 (3): 703–739.
- Carayon, J, R.L. Usinger, and P. Wygodzinsky. 1958. Notes on the higher classification of the Reduviidae, with the description of a new tribe of the Phymatinae. *Revue de Zoologie et Botanique Africaines* 57: 256–281.
- Cobben, R.H. 1978. Evolutionary trends in Heteroptera. Pt. 2. Mouthpart structures and feeding strategies. *Mededlingen Landbouwhogeschool* 78-5: 407 pp Wageningen, Netherlands: H. Veeman.
- Harris, H.M. 1931. The genus *Aphelonotus* (Hemiptera, Nabidae). *Bulletin of the Brooklyn Entomological Society* 24: 13–20.
- Hwang, W.S, and C. Weirauch. 2012. Evolutionary history of assassin bugs (Insecta: Hemiptera: Reduviidae): insights from divergence dating and ancestral state reconstruction. *PLoS ONE* 7 (9): 1–12. e45523. [doi:10.1371/journal.pone.0045523]
- Kerzhner, I.M. 1969. Zur Kenntnis der Familie Pachynomidae (Heteroptera). *Acta Entomologica Musei Nationalis Pragae* 38: 195–198.
- Schuh, R.T., and P. Stys. 1991. Phylogenetic analysis of cimicomorphan family relationships. *Journal of the New York Entomological Society* 99: 298–350.
- Uhler, P.R. 1894. On the Hemiptera-Heteroptera of the Island of Grenada. *Proceedings of the Zoological Society of London* 1894: 167–224.
- Weirauch, C. 2003. Pedicellar structures in Reduviidae – a comment on cave organ and trichobothria. *European Journal of Entomology* 100: 571–580.
- Wygodzinsky, P., and S. Lodhi. 1989. Atlas of antennal trichobothria in the Pachynomidae and Reduviidae (Heteroptera). *Journal of the New York Entomological Society* 97: 371–393.

All issues of *Novitates* and *Bulletin* are available on the web (<http://digitallibrary.amnh.org/dspace>). Order printed copies on the web from:

<http://shop.amnh.org/a701/shop-by-category/books/scientific-publications.html>

or via standard mail from:

American Museum of Natural History—Scientific Publications
Central Park West at 79th Street
New York, NY 10024

Ⓢ This paper meets the requirements of ANSI/NISO Z39.48-1992 (permanence of paper).