

Revision of the Genus *Agaporomorphus* Zimmermann (Coleoptera: Dytiscidae)

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ABSTRACT The Neotropical genus *Agaporomorphus* Zimmermann is revised. The genus includes five species, including three new species: *A. mecolobus* Miller, new species, *A. dolichodactylus* Miller, new species and *A. grandisinuatus* Miller, new species. A key is presented for identification of the species. *Agaporomorphus inaciculatus* Guignot is transferred to the genus *Hydrodytes* Miller, new combination. Male and female genitalia and other taxonomically important features are illustrated. A phylogenetic analysis of the genus is presented.

KEY WORDS *Agaporomorphus*, Dytiscidae, Neotropical, diving beetles, phylogeny

THE NEOTROPICAL GENUS *Agaporomorphus* Zimmermann is composed of several species of rather small Dytiscidae. Previously, five species were recognized in the genus. However, the concept of this genus has changed with the recent recognition that the group, as historically used, was paraphyletic with respect to Hydroporinae (Miller 2001a). A new genus, *Hydrodytes* Miller, and new subfamily, Hydrodytinae Miller, were described to include two species previously placed in *Agaporomorphus*, *Hydrodytes opalinus* (Zimmermann) and *H. dodgei* (Young) (Miller 2001a). An additional species examined during this revision, *A. inaciculatus* Guignot, was found to also belong to *Hydrodytes* and is, therefore, transferred to that genus, new combination. *Agaporomorphus* (as delimited here) is monophyletic based on the synapomorphy of the lack of a bursa copulatrix (Figs. 16–19) (Miller 2001a) and the presence of fine, aciculate striae on the surface of the elytra, though many *Copelatus* Erichson also have striae that may be homologous. The genus is in the subfamily Copelatinae and is the sister group to the remaining members of the subfamily (Miller 2001a). The species of *Agaporomorphus* can be frequently collected at lights in the Neotropics, but little is known of their biology or preferred habitat.

Taxonomically, the species have had little treatment. They were keyed and catalogued by Guéorguiev (1968). Young (1989) discussed members of the genus suggesting that some may be parthenogenetic, but he was certainly referring to members of *Hydrodytes*, several of which are known only from females, rather than *Agaporomorphus* species which are known from females. He also mentioned that species of *Agaporomorphus* lack a lateral bead on the pronotum. However, both *Agaporomorphus* and *Hydrodytes* possess a lateral bead, though it is indistinct on some specimens, particularly of *Hydrodytes*. In any case, this reduction is secondary given the phylogeny of the group (Miller 2001a). In this article, I review

the species of *Agaporomorphus*, including three species new to science.

Materials and Methods

Illustrations. Illustrations were made using a drawing tube on a Wild M3C dissecting microscope and a Leitz Dialux 20 compound microscope. The illustrations were scanned and edited using bitmap editing software.

Measurements. Measurements were obtained using an ocular scale on a Wild M3C dissecting microscope. Only intact specimens were measured. The total length (TL) and greatest width (GW) of specimens are provided, including the range and mean. The ratio TL/GW is also provided to give an indication of shape.

Material. This revision is based on specimens in the Florida State Collection of Arthropods, Gainesville, FL, (FSCA), the Cornell University Insect Collection, Ithaca, NY, (CUIC) and my collection (KBMC). Type specimens were borrowed from Oberösterreichisches Landesmuseum, Linz (OLML).

Dissection of Females. Female genitalia were extracted, prepared, and examined using a method similar to Mazzoldi (1996) and Miller (2001b).

Classification System. Several authors have recently proposed abandonment of the Linnaean system of classifying taxa in ranks (e.g., de Queiroz and Gauthier 1990, 1992; Cantino et al. 1999). There are abundant and substantial reasons for rejecting this idea (Dominguez and Wheeler 1997, Nixon and Carpenter 2000), and I reject it for this revision. My classification follows the traditional system of ranking taxa as governed by the International Code of Zoological Nomenclature and the principle of grouping by monophyly (Hennig 1966).

Agaporomorpha Zimmermann, 1921

Agaporomorpha Zimmermann, 1921; Blackwelder, 1944; Guéorguiev, 1968.

Diagnosis. Size very small (<3.65 mm); scutellum visible with elytra closed; metacoxal lines very closely approximated; lateral lobes with apical straplike segment bearing several slender apical setae; metacoxae without oblique, fine striae; bursa copulatrix absent but female genitalia otherwise of the typical copelatin type (Miller 2001a); dorsal surfaces of elytra and pronotum with very fine, short striae evenly distributed over surface.

Description. Prosternal process relatively short, anterior metasternal emargination short, indistinct; head and pronotum with fine microreticulation; size small (<3.65 mm); basal abdominal sterna with curved, slender, longitudinal striae; lateral pronotal bead narrow; median lobe very complex in form, asymmetrical (Figs. 2 and 6, 8, 11, 15), lateral lobes with dorsal setal fringe, apex with small, straplike segment (Figs. 3 and 4, 9, 12, 13); spermatheca well-developed, fertilization duct very slender, gonocoxae long, apically slightly expanded, laterotergites well-developed, long, bursa absent, spermathecal duct very slender, attached to gonocoxae near anterior apex. Male with natatory setae along venter of metatibia and metatarsomeres in addition to dorsal setae; female with only dorsal setae, ventral setae absent.

Type Species. *Agaporomorpha knischi* Zimmermann, 1921, by subsequent designation of Guignot (1946).

Key to the Species of *Agaporomorpha*

- 1. Male with antennomeres 5 and 6 distinctly expanded (Fig. 30); male with stridulatory apparatus comprised of oblique rugulae on abdominal sternum 3 and peg-like setae along ventral margin of metatibia (Figs. 31–32); male with apicomedial process on abdominal sternum 5 (Fig. 32) *A. knischi* Zimmermann
Antennae not modified; without oblique rugulae and peg-like setae; apicomedial process absent 2
- 2. Pro- and mesotarsal claws of male very long, subequal in length to mesotarsomere 5 (Figs. 23 and 24); apex of mesotarsomere 5 with distinct lobe (Figs. 23 and 24); median lobe with very long basodorsal process (Figs. 10 and 14) 3
- Pro- and mesotarsal claws much shorter than length of mesotarsomere 5 (Figs. 20–22); apex of mesotarsomere 5 without lobe (Figs. 20–22); median lobe without long process or with process short (Figs. 1 and 5, 7) 4
- 3. Median lobe in lateral aspect very robust apically (Fig. 10); apical lobe on mesotarsomere 5 less than one-fourth length of mesotarsomere 5 (Fig. 23) *A. mecolobus* n. sp.
Median lobe in lateral aspect more slender apically (Fig. 14); apical lobe on mesotarsomere

- 5 greater than one-fourth length of mesotarsomere 5 (Fig. 24) *A. dolichodactylus* n. sp.
- 4. Posterior claw of mesotarsus slightly sinuate in dorsal aspect (Fig. 27); median lobe in lateral aspect with two large dorsal convexities, a larger one medially and a smaller lobe more basally, ventrally without series of setae (Fig. 7) *A. grandisinuatus* n. sp.
Posterior claw of mesotarsus not sinuate in dorsal aspect (Fig. 26); median lobe in lateral aspect without convexities, ventrally with series of setae (Fig. 5) *A. pereirai* Guignot

Agaporomorpha knischi Zimmermann, 1921

(Figs. 1–3, 16, 20, 25, 30–33)

Agaporomorpha knischi Zimmermann, 1921; Blackwelder, 1944 (in tribe Hydroporini); Guéorguiev, 1968.

Diagnosis. Male antennomeres 5 and 6 expanded and ventrally convex (Fig. 30); male sternum 5 with an apical, acute process (Fig. 32); ventral metatibial setae and grooves on the second abdominal sternum of the male together forming a stridulatory apparatus (Figs. 31–32); male genitalia distinctive, median lobe with series of setae along both sides of dorsal margin (Fig. 1).

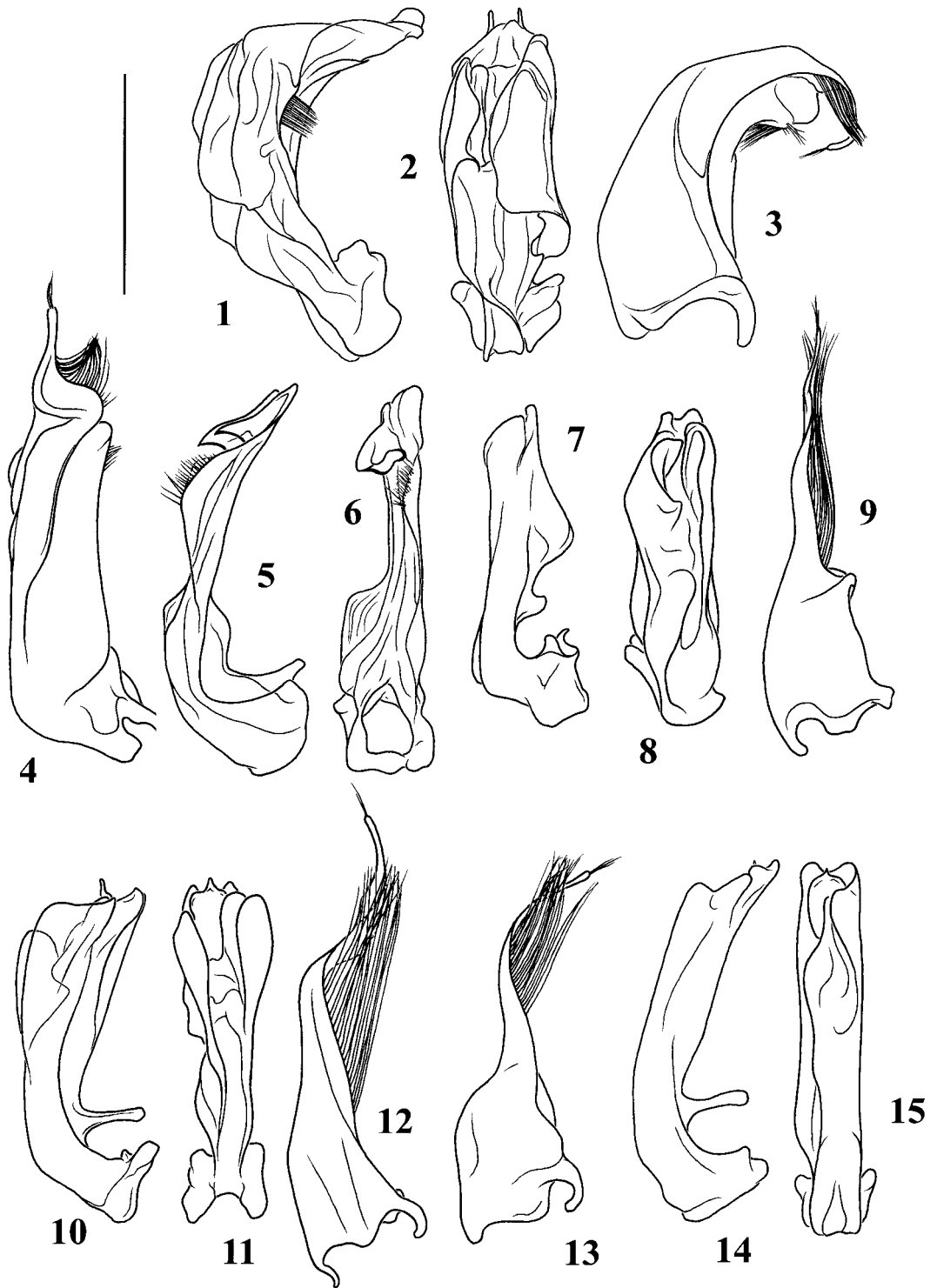
Description. Measurements. *n* = 14. TL = 2.99–3.51 mm (mean = 3.34), GW = 1.52–1.84 mm (mean = 1.65 mm), TL/GW = 1.78–2.21 (mean = 2.03).

Coloration. Yellow brown on all dorsal surfaces, slightly darker basally on pronotum and on medial portion of elytral disc distinctly lighter in basal band across elytra. All ventral surfaces and appendages yellow-brown.

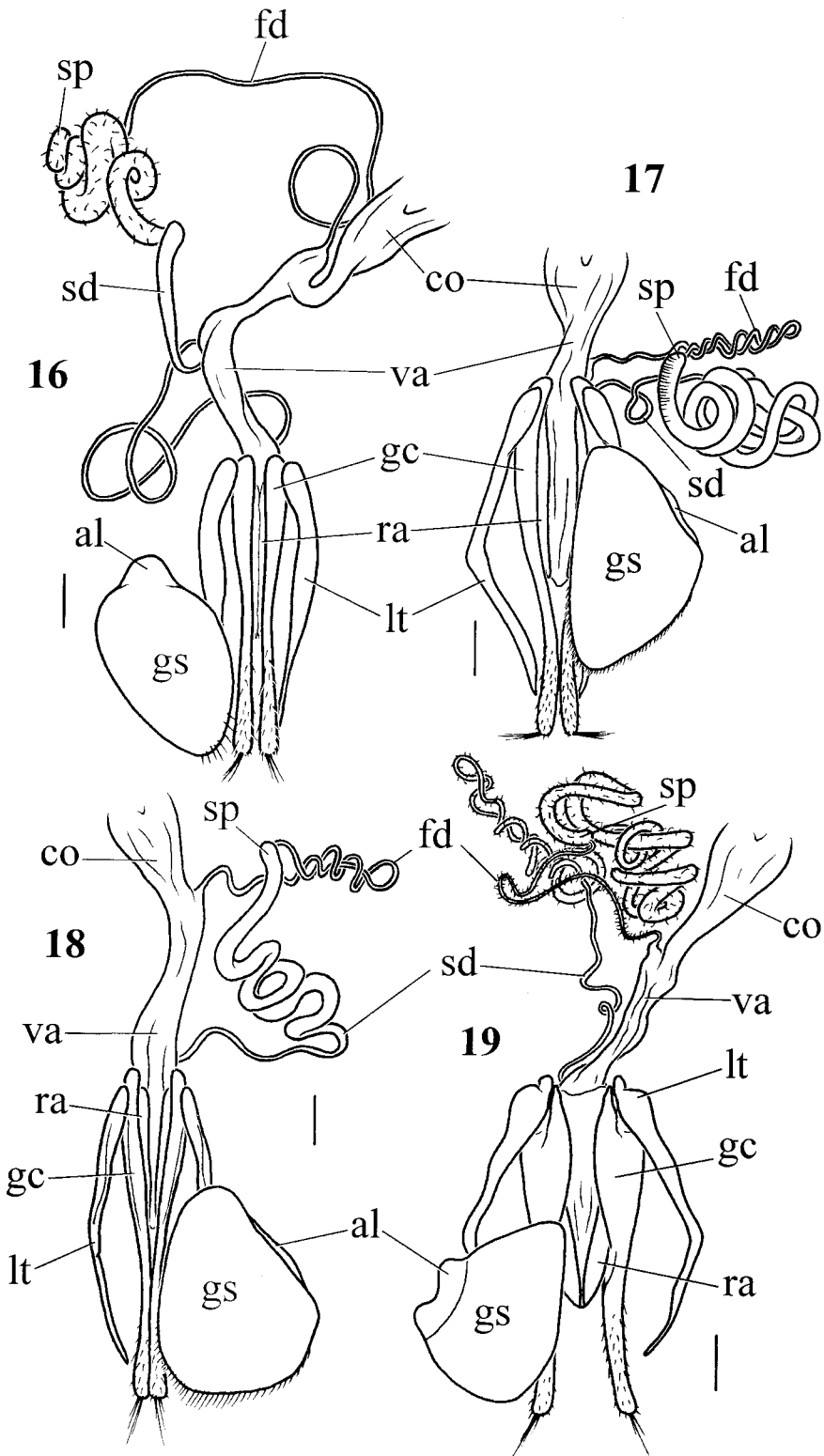
Sculpture and Structure. Pronotum with microsculpture consisting of fine, slightly longitudinally lengthened cells, medially with very fine and short longitudinal striae dispersed randomly and moderately densely, punctures more coarse basomedially; lateral pronotal bead obscured in anterior one-third to one-half. Prosternum medially strongly and sharply carinate; prosternal process medially with a rounded longitudinal carina extending to apex, laterally with broadly beaded margins. Elytron covered with extremely fine, evenly spaced, short striae. Metafemur moderately broad, length ≈3.0 times greatest width (Fig. 33).

Male Genitalia (Figs. 1–3). Median lobe in lateral aspect very robust, strongly curved and broad medially, with a short series of long setae along both sides of dorsal margins near middle of lobe (Fig. 1); in ventral aspect robust, broad with broad flange along right side, apex with two posterior extensions (Fig. 2). Lateral lobe broad, strongly curved, apex very strongly curved, with series of long setae along external margin subapically, additional series of setae medially along internal membrane (Fig. 3).

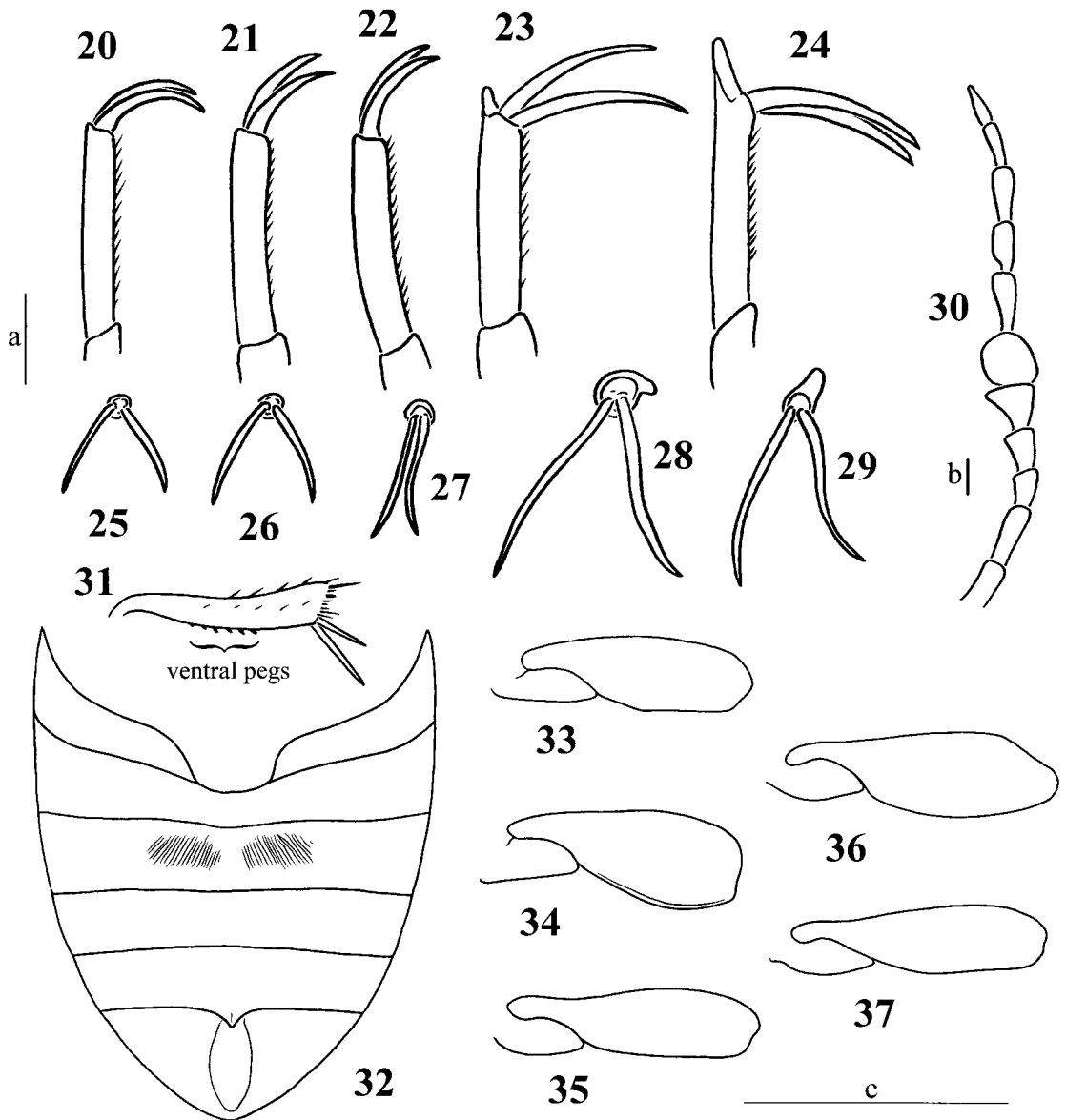
Female Genitalia (Fig. 16). Spermatheca elongate, evenly tapered to spermathecal duct; gonocoxa long, slender and approximately straight, slightly convex along lateral margin, apical setae extending posterolaterally off apex of gonocoxa; laterotergite relatively



Figs. 1-15. Male genitalia, *Agaporomorpha* species. (1-3) *A. knischi*. (1) Median lobe, right lateral aspect; (2) median lobe, ventral aspect; (3) right lateral lobe, right lateral aspect. (4-6) *A. pereirai*. (4) Right lateral lobe, right lateral aspect; (5) median lobe, right lateral aspect; (6) median lobe, ventral aspect. (7-9) *A. grandisinuatus*. (7) Median lobe, right lateral aspect; (8) median lobe, ventral aspect; (9) right lateral lobe, right lateral aspect. (10-12) *A. mecolobus*. (10) Median lobe, right lateral aspect; (11) median lobe, ventral aspect; (12) right lateral lobe, right lateral aspect. (13-15) *A. dolichodactylus*. (13) Right lateral lobe, right lateral aspect; (14) median lobe, right lateral aspect; (15) median lobe, ventral aspect. bar = 0.5 mm.



Figs. 16-19. Female genitalia, *Agaporomorphus* species. (16) *A. knischi*. (17) *A. grandisinuatus*. (18) *A. mecolobus*. (19) *A. dolichodactylus*. al = anterior lobe of gonocoxosternite, co = common oviduct, fd = fertilization duct, gc = gonocoxa, gs = gonocoxosternite, lt = laterotergite, ra = ramus, sd = spermathecal duct, sp = spermatheca, va = vagina. bars = 0.1 mm.



Figs. 20-37. (20-24) Left mesotarsomere 5 and mesotarsal claws of male, anterior aspect, bar = 0.1 mm. (20) *A. knischi*; (21) *A. pereirai*; (22) *A. grandisinuatus*; (23) *A. mecolobus*; (24) *A. dolichodactylus*. (25-29) Left mesotarsal claws of male, oblique lateral aspect; (25) *A. knischi*; (26) *A. pereirai*; (27) *A. grandisinuatus*; (28) *A. mecolobus*; (29) *A. dolichodactylus*. (30) Right antenna, dorsal aspect, *A. knischi*. (31) Right metatibia, anterior aspect, *A. knischi*. (32) Abdominal sterna, *A. knischi*. (33-37) Right metatrochanter and metafemur, anterior aspect; (33) *A. knischi*; (34) *A. pereirai*; (35) *A. grandisinuatus*; (36) *A. mecolobus*; (37) *A. dolichodactylus*. bar a = 0.5 mm for 20-29. bar b = 0.1 mm for 30. bar c = 1 mm for 31-37.

straight, lateral margin broadly and evenly curved (Fig. 16).

Sexual Dimorphism. Male antennae (Fig. 30) with antennomere 5 apically expanded into a broad triangle, ventral surface distinctly concave with medial margin of concavity marked by an oblique carina; antennomere 6 broadly expanded, circular in dorsal aspect, ventral surface deeply, irregularly and transversely concave; antennomere 8 with basomedial ex-

cavation and slight prominence medially; other male antennomeres and female antennae not modified. Male with series of stout, apically bifid and flattened pegs along basal half of ventral surface of metatibia (Fig. 31); pegs absent in female. Male with abdominal sternum two modified, area on both sides of middle with slightly oblique, longitudinal series of ridges (Fig. 32), female without ridges. Male abdominal sterna 5 and 6 modified; five with distinct, acute medial pro-

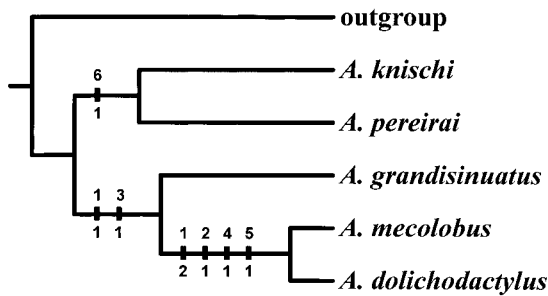


Fig. 38. Single most parsimonious cladogram of *Agaporomorphus* species derived from cladistic analysis (length = 7, CI = 1.00). Numbers above hatch marks refer to characters. Numbers below hatch marks refer to character state transformations.

jection directed posteriorly over sternum 6; sternum 6 with broad and shallow impression medially, impressed region smooth (Fig. 32), female abdomen unmodified. Male protarsal claws unmodified, straight in dorsal aspect, about half length of protarsomere 5 (Figs. 20 and 25); without apical lobe on protarsomere 5 (Figs. 20 and 25); protarsomeres 1 and 2 broadened, protarsomere 1 ventrally with two large adhesive setae, protarsomere 2 without adhesive setae; mesotarsomeres 1 and 2 slightly broadened, mesotarsomere 1 with one large medial adhesive seta and two large apical adhesive setae, mesotarsomere 2 with two very small apical sucker disks; female pro- and mesotarsomeres unmodified.

Variation. Variable in darkness of dorsal coloration and extent of basal light band on elytra.

Phylogenetic Relationships. This species is sister to *A. pereirai* (Fig. 38) based on the shape of the lateral lobe, which is robust and has an extensive medial membrane which bears a region of setae medially (Figs. 3 and 4).

Distribution. Known from Mato Grosso, Brazil and Madre de Dios, Peru.

Type Material Examined. LECTOTYPE (here designated to clarify the association of this name with this species): ♂ in ZSBS labeled, "Brasilien/Mato-Grosso Corumba/LECTOTYPE *Agaporomorphus knischi* Zimmermann, 1921 designated, KB Miller, 2001 [red label with double black line border]." PARALECTOTYPES: 29 (12 ♂, 17 ♀), same label data as lectotype.

Other Material Examined. BRAZIL. Mato Grosso. Cuiaba, 10 May 1972, BLT, R. Williams (2 ♂, 1 ♀, FSCA); Jacaré Parque Nacional Zingu, November 1965, Alvarenga & Bokermann (3 ♀, FSCA); Cuiaba, experiment station, BLT, 11 April 1972, W.H. Whitcomb (4 ♂, 1 ♀, FSCA); Cuiabá, agriculture experiment station, BLT, 22 April 1972, W.H. Whitcomb; Cuiaba agriculture experiment station, BLT, W.H. Whitcomb (1 ♂, 2 ♀, FSCA).

PERU. Madre de Dios. Río Tambopata Res, 30 air km SW Pto. Maldonado, 290 m, subtropical moist forest, 16–20 November 1979, J.B. Heppner (1 ♂, FSCA).

Agaporomorphus pereirai Guignot, 1957

(Figs. 4–6, 21, 26, 34)

Agaporomorphus pereirai Guignot, 1957; Guéorguiev, 1968.

Diagnosis. Female not examined. Male antenna and pro- and mesotarsal claws unmodified (Figs. 21 and 26); mesofemur very broad (Fig. 34); male genitalia very distinctive, median lobe with a ventral series of setae (Figs. 5 and 6), in lateral aspect with two anterodorsally extending, curved, sharp spines near apex (Fig. 5), in dorsal aspect, with a broad excavation on left side (Fig. 6); lateral lobe also very distinctive, apex strongly sinuate, dorsal series of long setae apically, with short series of shorter setae more basal to long setae (Fig. 4).

Description. *Measurements.* $n = 1$. TL = 3.44 mm, GW = 1.68 mm, TL/GW = 2.04. *Coloration.* Red brown on all dorsal surfaces, slightly darker basally on pronotum and on medial portion of elytral disc. All ventral surfaces and appendages yellow-brown.

Sculpture and Structure. Pronotum with microsculpture consisting of fine, slightly longitudinally lengthened cells, with very fine and short longitudinal striae dispersed randomly and moderately densely over entire surface; lateral pronotal bead obscured apically. Prosternum medially angulate becoming carinate posteriorly and on prosternal process; prosternal process medially rounded, moderately narrow, laterally with broad bead. Elytron covered with extremely fine, evenly spaced, short striae, denser and more rounded and punctiform laterally and posteriorly. Metasternum and metacoxae covered with extremely fine and long cells, other sculpture absent. Basal abdominal sterna with curved, oblique, elongate striae. Metafemur very broad medially, length ≈ 2.4 times greatest width (Fig. 34).

Male Genitalia (Figs. 4–6). Median lobe in lateral aspect relatively slender, with two apicodorsal, anteriorly-extending, curved spines, medially with broad ventral expansion, with ventral series of setae (Fig. 5); in ventral aspect with apex expanded, with broad excavation along left margin, with basal hole visible (Fig. 6). Lateral lobe in lateral aspect broad, elongate, with apex extending posteriorly, apex strongly sinuate, with subapical series of long setae along dorsal margin, with shorter series of setae along elongate dorsal lobe, margins of lateral lobe subparallel along most of length (Fig. 4).

Sexual Dimorphism. Female not examined, but male protarsal claws relatively unmodified, posterior claw slightly more curved medially than anterior claw; mesotarsal claws about half length of mesotarsomere 5 (Figs. 21 and 26); without apical lobe on mesotarsomere 5 (Figs. 21 and 26); protarsomeres 1 and 2 broadened, protarsomeres 1–3 with four rows of adhesive setae, protarsomere 1 with 2 setae apically, protarsomere 2 with two rows of four setae, protarsomere 3 with two setae; mesotarsomeres 1 and 2 slightly broadened, mesotarsomeres 1–3 with ventral adhesive setae similar in configuration to protarsomeres.

Phylogenetic Relationships. This is the sister species to *A. knischi* (Fig. 38). See the discussion under that species.

Distribution. I have examined a single male specimen from Surinam. The type locality is Cachimbo, Prov. Para, Brazil and Guignot (1957) also records the species from Corumba, Matto-Grosso, Brazil.

Remarks. I was not able to examine the type specimens of this species (probably in Museum National d'Histoire Naturelle, Paris), so I have based my identification of this species on Guignot's (1957) description and his illustration of the male genitalia of *A. pereirai*. Although there are apparently some minor differences between the genitalia of my specimens (Figs. 4–6) and Guignot's (1957; Figs. 9–10) illustrations, I attribute this to the complexity of the genitalia which I appear to have drawn in greater detail than Guignot. His drawings may be from a slightly different angle as well. However, the general shapes of the genitalia in his drawing and on my specimens are very similar in a group where shape differences in male genitalia between species are very great. Therefore, even without examination of the types, I feel comfortable applying the name *A. pereirai* to the species described above.

According to Guignot (1957), females are dimorphic with one form similar to male in size and form of the elytral sculpture. The other form is smaller and has the elytral striae deeper and shorter. It is certainly possible that he had a mixed series. Unfortunately, I was not able to examine the specimens, and his description does not appear to fit any of the other species described here.

Material Examined. SURINAM. Moengo, Boven, Cottica R., 20 May 1927 (1 ♂, CUIC).

Agaporomorphus grandisinuatus Miller, new species
(Figs. 7–9, 17, 22, 27, 35)

Diagnosis. Male genitalia very distinctive (Figs. 7–9), median lobe in lateral aspect with two dorsal expansions, a large one medially and a smaller, more basal one (Fig. 7); posterior claw of male mesotarsus sinuate (Fig. 27), claws much shorter than length of mesotarsomere 5 (Fig. 22).

Description. *Measurements.* $n = 14$. TL = 3.04–3.35 mm (mean = 3.17), GW = 1.49–1.75 mm (mean = 1.57 mm), TL/GW = 1.91–2.11 (mean = 2.02). *Coloration.* Yellow brown on all dorsal surfaces, slightly darker medially on pronotum, light yellow along anterior margin of elytron. All ventral surfaces and appendages yellow-brown.

Sculpture and Structure. Pronotum with microsculpture consisting of fine, slightly longitudinally lengthened cells, with very fine and short longitudinal striae dispersed randomly and moderately densely; lateral pronotal bead obscured in anterior half. Prosternum medially strongly and sharply carinate, carina extending onto prosternal process; prosternal process medially with a distinct longitudinal carina extending to apex, laterally with strongly beaded margins, apex pointed. Elytron covered with extremely fine, evenly

spaced, short striae, striae more punctiform laterally and apically. Metafemur slender, length ≈ 3.8 times greatest width (Fig. 35).

Male Genitalia (Figs. 7–9). Median lobe in lateral aspect robust, with a strong dorsal expansion medially, with a smaller, lobate expansion basal to medial 1 (Fig. 7); in ventral aspect very robust, broad, with complicated folding and structures dominated by lateral flange apically along right margin (Fig. 8). Lateral lobe broad basally, strongly narrowed medially, apical half very slender, with series of long setae along dorsal margin of slender portion (Fig. 9).

Female Genitalia (Fig. 17). Spermatheca very long, coiled, slender, tapered to spermathecal duct; spermathecal duct relatively short; fertilization duct very long, coiled; gonocoxa slender, lateral margin broadly convex, apical setae extending laterally off apex; laterotergite medially distinctly angulate.

Sexual Dimorphism. Male protarsal claws relatively unmodified, posterior claw slightly broader and more curved medially than anterior claw; mesotarsal claws about half length of mesotarsomere 5 (Fig. 22), posterior claw slightly sinuate in dorsal aspect (Fig. 27); without apical lobe on mesotarsomere 5 (Figs. 22 and 27); protarsomeres 1 and 2 broadened, protarsomere 1 with 2 large adhesive setae, protarsomere 2 without adhesive setae; mesotarsomeres 1 and 2 slightly broadened, mesotarsomere 1 with one large, medial adhesive seta and two large, apical adhesive setae, mesotarsomere 2 with two smaller, apical adhesive setae; female pro- and mesotarsomeres unmodified.

Variation. Several specimens from Peru are dark brown dorsally.

Etymology. This species is named *grandisinuatus* from the Latin words *grandi*, meaning "large" and *sinuatus*, meaning "S-shaped," after the unique shape of the dorsal margin of the median lobe (Fig. 7).

Phylogenetic Relationships. This is the sister species to *A. mecolobus* + *A. dolichodactylus* (Fig. 38) based on the common presence of sinuate posterior claws. However, *A. grandisinuatus* lacks the long claws, very long dorsal process and short apical spine on the median lobe, and distinctive lobe at the apex of mesotarsomere 5 of these other species.

Distribution. Known from Mato Grosso, Brazil and Madre de Dios, Peru.

Material Examined. HOLOTYPE: ♂ in FSCA labeled, "BRASIL: Mato Grosso, Jacaré-Parque Nat. Xingu xi.65 BLT Malvarenga & WCA Bokermann/HOLOTYPE: *Agaporomorphus grandisinuatus* Miller, 2001 [red label with double black line border]." PARATYPES, 16 total (6 ♂, 10 ♀); 4 ♂, 5 ♀, FSCA, same data as holotype; 2 ♀, FSCA labeled, "♀/BRASIL: Rio Grande del Norte - Natal iii.1952 M.Alvarenga;" 1 ♂, FSCA labeled, "BRASIL: Mato Grosso Jacaré Parque Nacional Xingu xi.1965 Alvarenga & Bokermann;" 1 ♂, 3 ♀, FSCA labeled, "PERU: Madre de Dios, Rio Tambopata Res, 30 air km. SW Pto. Maidonado 290 m, 16–20-xi-1979. J.B. Heppner, subtropical moist forest."

Agaporomorphus mecolobus Miller, new species
(Figs. 10–12, 18, 23, 28, 36)

Diagnosis. Male mesotarsal claws very long, subequal to length of mesotarsomere 5 (Fig. 23), posterior claw distinctly sinuate and slender in dorsal aspect (Fig. 28); apex of male mesotarsomere 5 with short lobe, less than one-fourth length of mesotarsomere 5 (Fig. 23); median lobe distinct, apex in dorsal and ventral aspect robust with medial apical spine, basally with very long, dorsal process (Figs. 10 and 11).

Description. *Measurements.* $n = 7$. TL = 3.35–3.62 mm (mean = 3.47), GW = 1.56–1.71 mm (mean = 1.65 mm), TL/GW = 2.01–2.15 (mean = 2.11).

Coloration. Dark brown on all dorsal surfaces. All ventral surfaces and appendages dark yellow-brown.

Sculpture and Structure. Pronotum with microsculpture consisting of fine, slightly longitudinally lengthened cells, medially with very fine and short longitudinal striae dispersed randomly and moderately densely; lateral pronotal bead obscured at apex, lateral margin slightly concave in this region. Prosternum medially strongly and sharply carinate, carina extending onto prosternal process; prosternal process medially with a distinct longitudinal carina extending to apex, laterally with strongly beaded margins. Elytron covered with extremely fine, evenly spaced, short striae, striae slightly more punctiform near apex. Metafemur moderately broad, length ≈ 3.3 times greatest width (Fig. 36).

Male Genitalia (Figs. 10–12). Median lobe in lateral aspect robust, dorsal and ventral margins strongly divergent apically, with apex slightly upturned and with distinctive ventroapical spine, basally with very long dorsal process (Fig. 10); in ventral aspect with lateral margins divergent and irregular, apical spine distinctive (Fig. 11). Lateral lobe in lateral aspect very slender in apical half, with elongate setae along dorsal margin of apical two-thirds (Fig. 12).

Female Genitalia (Fig. 18). Spermatheca very long, coiled, slender, tapered to spermatheca duct; spermathecal duct relatively short, slender; fertilization duct long, slender, coiled; gonocoxa very slender, elongate, lateral margin broadly concave; laterotergite with lateral margin broadly curved, slightly sinuate.

Sexual Dimorphism. Male protarsal claws modified, very long, subequal to length of protarsomere 5, posterior claw slightly more curved medially than anterior claw and distinctly broader; mesotarsal claws very long, subequal to length of mesotarsomere 5 (Fig. 23), anterior claw evenly curved, posterior claw sinuate, apex curved posteriorly in dorsal aspect (Fig. 28); mesotarsomere 5 with elongate, rounded, flattened process extending off posterior apex of mesotarsomere 5, lobe less than one-fourth length of mesotarsomere 5 (Fig. 23); protarsomeres 1 and 2 broadened, protarsomere 1 with two large, ventral adhesive setae, protarsomere 2 without setae; mesotarsomeres 1 and 2 moderately broadened, mesotarsomere 1 with one large medial adhesive seta and two large apical adhesive setae, mesotarsomere 2 with two moderately sized

adhesive setae; female pro- and mesotarsomeres unmodified.

Variation. This species is relatively constant in the single series examined.

Phylogenetic Relationships. This is the sister species to *A. dolichodactylus* (Fig. 38) based on several similarities including the common presence of a very long basodorsal process and spinous apical process on the median lobe, elongate pro- and mesotarsal claws and an apical lobe on mesotarsomere 5. The two species differ in the shape of the median lobe and the shorter apical mesotarsal lobe in *A. mecolobus*.

Etymology. This species is named *mecolobus* from the Greek words *meco*, meaning “long,” and *lobus*, meaning “lobe,” for the extremely long lobe on the dorsal surface of the median lobe (Fig. 10).

Distribution. Known only from near Saõ Paulo, Brazil.

Material Examined. HOLOTYPE: ♂ in FSCA labeled, “BRASIL: Saõ Paulo, Piracicaba, X.10.65 [handwritten], BLT CA Triplehorn/HOLOTYPE *Agaporomorphus mecolobus* Miller, 2001 [red label with double black line border].” PARATYPES: 1 ♂, 7 ♀, FSCA, same data as holotype.

Agaporomorphus dolichodactylus Miller, new species

(Figs. 13–15, 19, 24, 29, 37)

Diagnosis. Male mesotarsal claws very long, subequal to length of mesotarsomere 5 (Fig. 24), posterior claw distinctly sinuate and slender in dorsal aspect (Fig. 29); apex of male mesotarsomere 5 with long lobe, greater than one-fourth length of mesotarsomere 5 (Fig. 24); median lobe distinct, apex in dorsal and ventral aspect relatively slender with margins approximately parallel, with medial apical spine, basally with very long, dorsal process (Fig. 14).

Description. *Measurements.* $n = 11$. TL = 3.19–3.46 mm (mean = 3.37), GW = 1.47–1.74 mm (mean = 1.63 mm), TL/GW = 1.98–2.28 (mean = 2.07).

Coloration. Yellow brown to light brown on dorsal surfaces, slightly darker medially on pronotum; basal border of elytron yellow. All ventral surfaces and appendages yellow-brown.

Sculpture and Structure. Pronotum with microsculpture consisting of fine, slightly longitudinally lengthened cells, basomedially with very fine and short longitudinal striae dispersed randomly and moderately densely; lateral pronotal bead obscured at anterior apex, lateral margin slightly concave in this area. Prosternum medially strongly and sharply carinate, carina extending onto prosternal process; prosternal process relatively narrow, very strongly carinate, carina extending to apex, laterally with bead sharply carinate, apex relatively acutely pointed. Elytron covered with extremely fine, evenly spaced, short striae. Metafemur slender, length ≈ 3.8 times greatest width (Fig. 37).

Male Genitalia (Figs. 13–15). Median lobe in lateral aspect relatively slender, dorsal and ventral margins approximately parallel, with apex narrowed and with small ventroapical spine, basally with very long dorsal

process (Fig. 14); in ventral aspect with lateral margins parallel, apical spine distinctive (Fig. 15). Lateral lobe in lateral aspect very slender in apical half, with elongate setae along dorsal margin of apical half (Fig. 13).

Female Genitalia (Fig. 19). Spermatheca very elongate, tapered to spermathecal duct; spermathecal duct very long, coiled, very slender; fertilization duct relatively short, slender; gonocoxa long, slender and approximately straight, slightly concave along lateral margin, apical setae extending posterolaterally off apex of gonocoxa; laterotergite distinctly angled medially.

Sexual Dimorphism. Male protarsal claws modified, very long, slightly less than length of protarsomere 5, posterior claw slightly more curved medially than anterior claw; mesotarsal claws very long, subequal to length of mesotarsomere 5 (Fig. 24), anterior claw evenly curved, posterior claw sinuate, apex curved posteriorly (Fig. 29); mesotarsomere 5 with elongate, rounded, flattened process extending off posterior apex (Fig. 24); protarsomeres 1 and 2 broadened, protarsomere 1 with 2 large adhesive setae, protarsomere 2 without adhesive setae; mesotarsomeres 1 and 2 slightly broadened, mesotarsomere 1 with one large medial adhesive seta and two large apical adhesive setae, mesotarsomere 2 with two moderately-sized adhesive setae; female pro- and mesotarsomeres unmodified.

Variation. Color varying from yellow to brown; development of prosternal carinae variable.

Etymology. This species is named *dolichodactylus* from the Greek words *dolicho*, meaning "long," and *dactylus*, meaning "toe," in reference to the long pro- and mesotarsal claws in members of this species (Figs. 24 and 29).

Phylogenetic Relationships. This is the sister species to *A. mecolobus* (Fig. 38) based on the synapomorphies of very elongate pro- and mesotarsal claws and lobes on the apices of mesotarsomere 5. Also, the median lobe has an extremely long dorsal lobe in both species.

Distribution. Known from Mato Grosso, Brazil and lowland Bolivia.

Material Examined. HOLOTYPE: ♂ in FSCA labeled, "BRASIL: Mato Grosso Guiába (Cuyába) BLT Exp. Station iv.11.72 WH Whitcomb/Cuiaba/HOLOTYPE: *Agaporomorphus dolichodactylus* Miller, 2001 [red label with double black line border]." PARATYPES, 25 total: 5 ♂, 1 ♀, FSCA, same data as holotype; 2 ♀, FSCA labeled, "♀/BRASIL: Mato Grosso Cuiabá Agricultural Exp. Sta. iv.22.1972 BLT WH Whitcomb;" 1 ♂, FSCA labeled, "♂/BOLIVIA, SC. Santa Cruz v-11-12-1969 P.&P.Spangler/NMHN;" 1 ♂, 3 ♀, FSCA labeled, "BRASIL: Mato Grosso Jacaré. Parque Nat Xingu xi.65 BLT Malvarenga e WCABokermann;" 2 ♂, 2 ♀, KBMC labeled, "BOLIVIA: Beni, weedy pond 1.7 km E San Borja. 15 July 1998, KB Miller, colr./14° 52' 07 178 S, 66° 43' 53 178 W #1-11;" 1 ♂, KBMC labeled, "BOLIVIA: Beni 1.8 km E San Borja muddy pool 15 July 1998 KB Miller, colr./14° 52' 02 178 S, 66° 43' 49 178 W 001-0013;" 2 ♂, KBMC labeled, "BOLIVIA: Dpto Beni Prov. Cercado, 9.5 km N Trinidad shallow

Table 1. Data matrix of assigned states of characters for 5 species of *Agaporomorphus* and generalized outgroup based on numerous examined taxa. Character one coded as additive.

	123456
outgroup	000000
<i>A. knischi</i>	000001
<i>A. pereirai</i>	000001
<i>A. grandisinuatus</i>	101000
<i>A. mecolobus</i>	211110
<i>A. dolichodactylus</i>	211110

marsh, 17 June 1999, KB Miller, colr./14° 46' 34 178 S, 64° 58' 00 178 W #2-4;" 1 ♂, KBMC labeled, "BOLIVIA: Dpto Beni Prov. Cercado 9.5 km N Trinidad 18 June 1999 K.B. Miller, colr./14° 46' 34 178 S, 64° 58' 00 178 W #2-5;" 2 ♂, 1 ♀, KBMC labeled, "BOLIVIA: Beni. 3.4 km W. San Borja, roadside pond. 14 July 1998 KB Miller, colr./14° 52' 57 178 S, 66° 46' 03 178 W 001-0008;" 1 ♂, KBMC labeled "BOLIVIA: Beni. 4.5 km W. San Borja, shallow pond 14 July 1998 KB Miller, colr./14° 53' 39 178 S, 66° 46' 09 178 W 001-0009."

Cladistic Analysis.

Taxa. All five known species of *Agaporomorphus* were included in the analysis. The monophyly of this group was supported by a previous analysis (Miller 2001a) and is strongly supported by two synapomorphies: the secondary lack of a bursa copulatrix (Miller 2001a) and the presence of fine, short, longitudinal striae on the elytra. Exemplar taxa were examined from numerous groups, including species of *Copelatus*, *Lacconectus*, *Hydrodytes*, *Laccornis* and *Celina*, which are each relatively closely related to *Agaporomorphus* (Miller 2001a). As the characters used in the analysis would be coded identically for each member of the outgroup, a generalized outgroup terminal was used in the analysis and to root the tree.

Character Analysis. The data matrix was created and manipulated and trees were examined using the program Winclada (Nixon 1999). Trees were acquired using NONA (Goloboff 1995) and the commands "wh" and "mswap+," which returns all most parsimonious trees.

Characters. The following characters were used in the cladistic analysis. The single multistate character is treated as additive. Character states for taxa are presented in Table 1.

1. *Dorsobasal process on median lobe*; (0) absent (Figs. 1 and 5), (1) present, short (Fig. 7), (2) present, very long (Figs. 10 and 14) (additive). Members of *A. pereirai* have a basal convexity in the same general position as the process in other taxa (Fig. 5), but it is not shaped like the others, so I have not coded it as homologous with the state in other taxa.
2. *Short, spinous process subapically on median lobe*; (0) absent (Figs. 1-2, 4-5, 7-8), (1) present (Figs. 10-11, 14-15).
3. *Posterior mesotarsal claw of male*; (0) not sinuate (Figs. 25-26), (1) sinuate (Figs. 27-29).
4. *Pro- and mesotarsal claws of male*; (0) much shorter

than length of tarsomere 5 (Figs. 20–22), (1) long, subequal to length of tarsomere 5 (Figs. 23 and 24).

5. *Apical lobe on mesotarsomere 5 of male*; (0) absent (Figs. 20–22), (1) present (Figs. 23 and 24).
6. *Series of long setae on dorsal margin of lateral lobe*; (0) continuous (Figs. 9 and 12–13), (1) interrupted medially (Figs. 3 and 4).

Results of Parsimony Analysis. A single, completely resolved most parsimonious tree was found with complete character congruence (length = 7, CI = 1.00) (Fig. 38). Two main monophyletic groups were identified, *A. knischi* + *A. pereirai* and *A. grandisinuatus* + (*A. mecolobus* + *A. dolichodactylus*). The sister group relationship between *A. mecolobus* and *A. dolichodactylus* is particularly strong based on characters of the pro- and mesotarsal claws and male median lobe.

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