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Revision of the *Apocephalus pergandei*-group of Ant-decapitating Flies (Diptera: Phoridae)

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of Los Angeles County

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CONTENTS

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ABSTRACT. The monophyletic *Apocephalus pergandei*-group is revised and found to include 63 species, including the following 45 new to science: *A. aequalis*, *A. albiapex*, *A. altus*, *A. amplexus*, *A. anacurvus*, *A. aquilonius*, *A. arachnes*, *A. astrictus*, *A. barbarus*, *A. brevitergum*, *A. bulbosus*, *A. carcinus*, *A. cinereus*, *A. clarilocus*, *A. collatus*, *A. commensuratus*, *A. concisus*, *A. ctenicoxa*, *A. cyathus*, *A. epicautus*, *A. euryterminus*, *A. fernandezi*, *A. flexiseta*, *A. frameatus*, *A. fusciapex*, *A. glomerosus*, *A. hippurus*, *A. hystricosus*, *A. inaffectus*, *A. latiapex*, *A. medius*, *A. opimus*, *A. planus*, *A. platycauda*, *A. pluteus*, *A. ponderosus*, *A. radiatus*, *A. reburrus*, *A. rotundus*, *A. rugosus*, *A. sharkeyi*, *A. sincerus*, *A. staurotus*, *A. superatus*, and *A. vangus*. The species *A. sagittarius* Borgmeier is placed in synonymy with *A. vicinus* Borgmeier (**new synonymy**).

INTRODUCTION

The genus *Apocephalus* is a large group of phorid flies that are nearly all parasitoids of ants (Hymenoptera: Formicidae). General information about the genus, including its classification into subgroups was given by Brown (1997), but in general they are small, dark brown to yellow flies, usually 1–5 mm in length, with dark, sclerotized, parasitic-type ovipositors (Plate 1). They are called "ant-decapitating flies" because the larvae, which feed inside the head capsule of the host, sometimes cause the head of the ant to fall off before the rest of the body stops moving (Fox, 1888; Pergande, 1901), but this name is used for species of other genera as well. Species of *Apocephalus* are found almost exclusively in the New World.

The *Apocephalus pergandei*-group includes the type species of the genus and the original ant-decapitating fly whose behavior was reported by Fox (1888) and Pergande (1901). Adult female flies attack ant hosts by hovering over them and darting down to lay an egg in (not on, as is frequently misreported) the body of the host ant. All species with known hosts attack ants of the genus *Camponotus* Mayr, with the exception of one new species that was attracted to crushed *Pachycondyla impressa* (Roger, 1861) (Table 1).

The last treatment of all species in this group was Borgmeier's (1971) key to the genus *Apocephalus*; since then no new species have been described. As part of my long-term revision of this genus (Brown, 1993, 1994, 1996, 1997, 2000), I studied all the previously described *A. pergandei*-group species and described the newly discovered material.

METHODS AND MATERIALS

METHODS

Terms for phorid morphology are those of the Manual of Nearctic Diptera (McAlpine, 1981). The nomenclature of ant species was checked against the most recent catalog (Bolton, 1995), in which references for ant names can also be found.

Statistics were calculated for the frons and for wing venation, namely mean frontal and mean costal ratios. The frontal ratio is the height of the frons divided by the width of the frons. The costal ratio is the distance from the basicosta to the apex of the costa, divided by the distance from the basicosta to the apex of the wing.

Geographical coordinates usually are quoted as decimal degrees, rather than degrees, minutes, and seconds (e.g., 90.50°W, rather than 90°30′W; Crawford, 1983).

The term "ALAS" in the lists of specimens examined refers to the Arthropods of La Selva (Costa Rica) project (Longino, 1994). Codes from the ALAS project, for example "M/04/067," refer to Malaise trap (M; L for light trap), trap number (04), and sample number (067). "CAP" refers to the Colombia Arthropod Project that is being conducted by Michael Sharkey, collaborators in Colombia, and myself; "CAP-299" refers to sample number 299 in this survey.

In addition to the usual insect labels recording locality information, barcoded insect labels were affixed to specimens (Thompson, 1994) and data were recorded in a database. All barcoded labels that begin with the abbreviation "LACM ENT" indicate that the data are stored in the Natural History Museum of Los Angeles County (LACM). Specimens with barcoded labels beginning "INBIO" have their data stored at LACM and the Instituto Nacional de Biodiversidad in Costa Rica. To make later recognition of holotypes easier, I list their individual barcode number in square brackets.

Phylogenetic relationships depicted in cladograms (Figs. 1, 2) were derived by hand, based on characters 1–16 listed in Classification section under Systematics. All characters were consistent within the defined groups.

MATERIALS

This revision is based on female specimens. In some species there are described male specimens, but many were questionably associated with the females. The only males that I newly recognize are of *A. horridus* Borgmeier and *A. wirthi* Borgmeier, both of which are extremely distinctive and which do not co-occur with species with which they could be confused.

Specimens belong to the following institutions (codens from Arnett et al., 1993; curator or collection manager names are in parentheses):

AMNH Department of Entomology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA (D. Grimaldi).

BHMH Laboratorio de Ecologia e Comportamento de Insetos, Departamento de Biologia Geral, ICB-UFMG, C.P. 486, 30.161-970, Belo Horizonte, MG, Brazil (R. Parentoni Martins).

BMNH Department of Entomology, The Natural History Museum, London SW7 5BD, United Kingdom (J. Noyes).

CASC Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA (N. Penny).

CMNH Section of Invertebrate Zoology, Carnegie Museum of Natural History, 900 Forbes Avenue, Pittsburgh, PA 15213, USA (C. Young).

CNCI Biosystematics Research Centre, Agriculture Canada, Central Experimental Farm, Ottawa, Ontario, Canada K1A 0C6 (J.M. Cumming).

CUMZ University Museum of Zoology, Downing Street, Cambridge CB3 2EJ, United Kingdom (R.H.L. Disney).

DEBU Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada N1G 2W1 (S.A. Marshall).

DENH Department of Entomology, University of New Hampshire, Durham, NH 03824, USA (D.S. Chandler).

EMUS Department of Biology, Utah State University, Logan, UT 84322-5305, USA (W.J. Hanson).

FSCA Florida State Collection of Arthropods, 1911 SW 34th Street, Gainesville, FL 32608-1268, USA (G. Steck).

INBC Instituto Nacional de Biodiversidad, A.P. 22-3100, Santo Domingo, Heredia, Costa Rica (M. Zumbado).

INPA Instituto Nacional de Pesquisas da Amazônia, Estrada do Aleixo, 1756, C.P. 478, 69.011, Manaus, Brazil (J. Rafael).

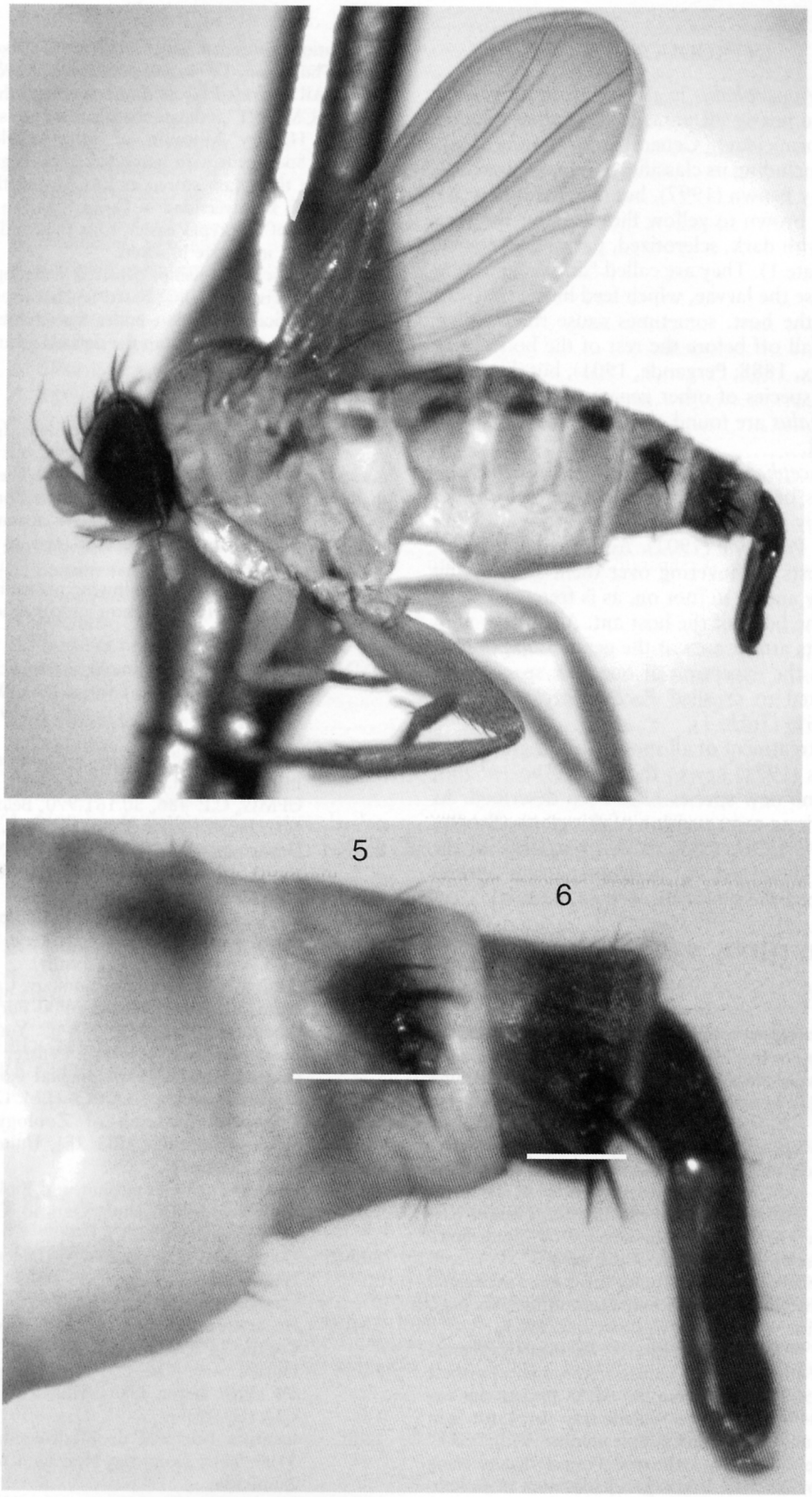


Plate 1 *Apocephalus pergandei* Coquillett, ♀, Huntley Meadows, Virginia, left lateral. **Top,** habitus. **Bottom,** posterior segments of abdomen. Symbols: 5, segment 5; 6, segment 6; white bars, ventral limit of abdominal tergites

Table 1 Host-parasite list. References refer to published record or to new information in this paper.

Host	Parasite	Reference
Camponotus cingulatus	*A. bispinosus*	Borgmeier, 1928
C. crassus	*A. crucicauda*	New record
C. crassus	*A. setiventris*	Borgmeier, 1971
C. ferrugineus	*A. coquilletti*	New record
C. pennsylvanicus	*A. concisus*	New record
C. pennsylvanicus	*A. coquilletti*	Brues, 1904 (as *A. pergandei*); new record
C. pennsylvanicus	*A. pergandei*	Pergande, 1901; new record
C. rufipes	*A. lanceatus*	Borgmeier, 1925
C. rufipes	*A. camponoti*	Borgmeier, 1925
C. sansabeanus	*A. similis*	Brues, 1904 (as *A. pergandei*); new record
C. vicinus	*A. horridus*	New record
Pachycondyla impressa	*A. collatus*	New record

LACM Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, CA 90007, USA (B.V. Brown).

MCZC Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138, USA (on indefinite loan to B.V. Brown).

MIUP Museo de Invertebrados Graham B. Fairchild, Universidad de Panama, Estafeta Universitaria, Panama (D. Quintero).

MUCR Museo de Insectos, Universidad de Costa Rica, San Pedro, San José, Costa Rica (P. Hanson).

MUSM Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Av. Arenales, 1267, Apartado 14-0434, Lima-14, Peru (G. Lamas).

MZSP Museu de Zoologia, Universidade de São Paulo, Av. Nazaré 481, C.P. 7172, 01051, São Paulo, Brazil (F.C. do Val).

NHRS Naturhistoriska Riksmuseet, Sektionen fur Entomologi, S-10405, Stockholm, Sweden (T. Pape).

NYSM New York State Museum, Biological Survey, Room 3132, Cultural Education Center, Albany, NY 12230, USA (J.K. Barnes).

QCAZ Quito Catholic Zoology Museum, Departamento de Biologia, Pontificia Universidad Catolica del Ecuador, 12 de Octubre y Carrion, Apto. 2184, Quito, Ecuador (G. Onore).

SEMC Snow Entomological Museum, University of Kansas, Lawrence, KS 66044, USA (R. Brooks).

UMRM W.R. Enns Entomological Museum, 1-87 Agriculture Building, University of Missouri, Columbia, MO 65201, USA (R. Sites).

UNCB Museo de Historia Natural, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Apto. 7495, Santa Fé de Bogotá, Colombia (E. Flores).

USNM United States National Museum, Smithsonian Institution, Washington, DC 20560, USA (on indefinite loan to B.V. Brown).

WSUC M.T. James Entomological Collection, Department of Entomology, Washington State University, Pullman, WA 99163, USA (R. Zack).

SYSTEMATICS

CLASSIFICATION

At this time I have insufficient information to provide a detailed phylogenetic revision of this group. Some characters, however, indicate the following subgroupings that I use as a provisional classification (see cladograms: Figs. 1, 2).

Two main subgroups are recognized: the monophyletic *A. pergandei*-subgroup and the possibly nonmonophyletic *A. lanceatus*-group. Within the *A. pergandei*-subgroup, I further recognize the *A. hispidus*-series and the *A. pergandei*-series. Within each of these groups are smaller subgroupings, discussed below.

Character states used to construct cladograms are as follows; hypothesized primitive states are given in parentheses.

1. Tergite 6 broader (extending farther laterally and ventrally on segment; Plate 1, Bottom) and markedly longer than tergite 5 (tergite 6 equal in length and width or narrower than tergite 5).

   This character state defines the *A. pergandei*-group.
2. Sternite 6 extremely large (e.g., Fig. 14), occupying much of venter of segment (sternite 6 at most occupying a small portion of segment 6).

   This character state defines the *A. pergandei*-subgroup.
3. Abdominal segment 6 with ventrobasal process (Figs. 12–17) (process absent).
4. Venter of abdomen with numerous scattered setae (Figs. 12–17) (setae fewer, usually organized into posterior rows).

   Dense ventral setae are also found in *A. reburrus* new species (Fig. 18), but they are hypothesized to be independently derived.

   These two character states (3 and 4) define the *A. hispidus*-series.
5. Ovipositor with lateral clear areas devoid of sclerotization (Figs. 4–6) (clear areas absent).

   This character state defines the *A. hispidus*-subseries.
6. Ovipositor with anteroventral process (Fig. 7) (process absent).

   This character state defines a group contain-

ing *A. hispidus* Borgmeier, *A. frameatus* new species, and *A. hippurus* new species.

7. Ventral apex of ovipositor laterally expanded (Figs. 9, 10) (apex narrow).
8. Ventrobasal process of abdominal segment 6 greatly expanded (Figs. 15, 16) (process smaller, narrower).
9. Posterolateral setae of ventrobasal process greatly enlarged, thickened, blunt (Figs. 15, 16) (setae, if large, long and pointed).

Character states 7–9 define a sister-group relationship between *A. aculeatus* Borgmeier and *A. hystricosus* new species.

10. Venter of ovipositor curved dorsally along edges (Fig. 42) (ventral sclerite not curved dorsally).

This character state defines the *A. pergandei*-series.

11. Posterolateral setae of tergite 6 extremely enlarged, bristlelike (posterolateral setae subequal to other setae of tergite 6).

This character state defines a group composed of all *A. pergandei*-series species except *A. collatus* new species, *A. concisus* new species, *A. cyathus* new species, *A. glomerosus* new species, and *A. staurotus* new species (Fig. 2).

12. Posteroventral setation of abdominal segment 6 consists of extremely small setae with large sockets (either large setae with large sockets or small setae with small sockets present).

This character state defines a group containing *A. coquilletti* Malloch, *A. disparicauda* Borgmeier, *A. camponoti* Borgmeier, *A. crucicauda* Borgmeier, *A. reburrus*, and all *A. pergandei*-subseries species (Fig. 2).

13. Ovipositor apically expanded (Figs. 25, 26) (ovipositor apically narrowed).

This character state defines a sister-group relationship between *A. coquilletti* and *A disparicauda.*

14. Ovipositor with well-developed, dorsomedial, bicarinate ridge (e.g., Figs. 31, 32) (ovipositor dorsally relatively flat).

This character state defines the *A. pergandei*-subseries. The ovipositor of *A. reburrus* also has a medial ridge, but it is structurally different from that of *A. pergandei*-subseries taxa, being smoothly rounded.

15. Apical sclerite of dorsum of ovipositor with anteriorly directed arm (Figs. 46, 47, 49) (sclerite, if present, without anteriorly directed processes).

This character state defines the *A. facettalis*-series.

16. Apex of ovipositor curved dorsally (Fig. 52) (apex straight or downturned).

This character state defines the *A. velutinus*-series.

TAXONOMY

Apocephalus Coquillett

Apocephalus Coquillett, 1901:501, fig. 1. Type species: *A. pergandei* Coquillett, by original designation.

Pseudoplastophora Schmitz, 1915:327, figs. 6, 7. Type species: *P. caudataria* Schmitz, by monotypy. Synonymized by Borgmeier, 1968.

Anaclinusa Borgmeier, 1969:63–64, figs. 35–37. Type species: *Anaclinusa lopesi* Borgmeier, by original designation. Synonymized by Brown, 2000.

Pleurophorina Borgmeier, 1969:66, figs. 40–42. Type species: *P. turgida* Borgmeier, by original designation. Synonymized by Brown, 1997.

Zyziphora Peterson and Robinson, 1976:119, figs. 1–5. Type species: *Z. hirtifrons* Peterson and Robinson, by original designation. Synonymized by Brown, 1992.

Apocephalus pergandei-group

DIAGNOSIS. Tergite 6 broader and longer than tergite 5, extended ventrolaterally on side of segment. Species with known hosts are almost all parasitoids of *Camponotus* ants.

Apocephalus pergandei-subgroup

DIAGNOSIS. Abdominal sternite 6 extremely large, occupying much of venter of segment.

Apocephalus hispidus-series

DIAGNOSIS. Abdominal segment 6 with ventrobasal process. Venter of abdomen with numerous scattered setae.

Apocephalus hispidus-subseries

DIAGNOSIS. Ovipositor with lateral clear areas devoid of sclerotization.

Apocephalus amplexus new species

(Figs. 4, 12)

REMARKS. This species is recognized by the broad, rounded ovipositor encircling the lateral clear areas (Fig. 4), and the large, triangular shape of the ventrobasal process of the venter of abdominal segment 6 (Fig. 12).

DESCRIPTION. Body length 1.4 mm. Frons blackish-brown. Frontal ratio 1.43. Flagellomere 1 dark brown, slightly lighter than frons, oval. Supraantennal setae absent. Palpus yellow. Scutum yellowish-brown. Scutellum yellowish-brown. Anterior pair of scutellar setae three times length and two times thickness of posterior setae of scutum. Posterior pair of scutellar setae slightly greater in length and twice thickness of anterior pair. Pleuron yellowish-brown. Mean costal ratio 0.45. Halter brown. Apex of hind femur without anterior or posterior dark spot, slightly darker than rest of femur. Abdominal tergites yellowish-brown, darker

400 m (INBC, LACM, MUCR); Puntarenas: Cerro Rincon, 8.52°N, 83.47°W, 1♀, i.1991, P. Hanson, Malaise trap (LACM).

Apocephalus concisus new species

(Fig. 20)

REMARKS. The short, downturned ovipositor (Fig. 20) of this species is unusual for a member of the *A. pergandei*-series and makes it instantly recognizable.

DESCRIPTION. Body length 1.5–2.5 mm. Frons dark brown. Frontal ratio 0.99. Flagellomere 1 pale yellow, oval. Supra-antennal setae absent. Palpus pale yellow. Scutum light brown. Scutellum light brown. Anterior pair of scutellar setae twice length and thickness of posterior setae of scutum. Posterior pair of scutellar setae one and one-half times length and thickness of anterior pair. Pleuron yellowish-brown. Mean costal ratio 0.47. Halter brown, with narrow yellow marking. Apex of hind femur without anterior or posterior dark spot. Tergite 1 brown, lighter anteriorly and posteriorly; tergite 2 light brown to brown, darker at lateral margins; tergites 3–4 light brown with lighter medial strip, dark brown laterally; or tergites 3–4 dark brown, light brown medially and along posterior margin; tergite 5 light brown, dark brown along lateral margins; tergite 6 brown to dark brown, with yellowish-brown anterior third. Venter of abdomen yellowish-brown; segments 2–5 sometimes grayish-brown laterally; segment 6 grayish-brown to brown. Ventrolateral setae of tergite 6 greatly enlarged, bristlelike. Venter of abdominal segments 1–3 bare; segment 4 with row of thin setae; segment 5 with narrow, lightly sclerotized sternite and row of thicker setae; segment 6 with large, square sternite and row of posterior setae subequal in thickness to those in segment 5. Ovipositor short, expanded posteriorly, with broadly truncate apex. Ovipositor dorsally with two, small posterolateral setae.

GEOGRAPHICAL DISTRIBUTION. Southeastern USA.

HOST. I collected specimens of this species as they hovered over and darted at *Camponotus pennsylvanicus* (DeGeer, 1773) workers that were feeding at a tuna bait.

DERIVATION OF SPECIFIC EPITHET. The name is Latin for short, referring to the shape of the ovipositor.

HOLOTYPE. ♀, USA: Missouri: Laclede Co., Bennett Springs State Park, 7–8.viii.1988, B.V. Brown, over *Camponotus pennsylvanicus* (LACM) [LACM ENT 010961].

PARATYPES. USA: Florida: Alachua Co., Gainesville, 1♀, 20.iv.1967, W.W. Wirth, Malaise trap (USNM); Georgia: Liberty Co., St. Catharines Island, 2♀ (and two possible males of this species, which I do not treat as paratypes), 24–28.iv.1972, Thompson and Picchi, 4♀, 18–21.ix.1972, F.C. and B.J. Thompson (AMNH); Maryland: Montgomery Co., Colesville, 18.ix.1977, W.W. Wirth, Malaise trap (USNM), Plummer's Island, 4♀, 8.vii.1968, P.J. Spangler, Malaise trap (LACM, USNM); Missouri: Laclede Co., Bennett Springs State Park, 3♀, 7–8.viii.1988, B.V. Brown, over *Camponotus pennsylvanicus* (LACM), Wayne Co., Williamsville, 1♀, 16.vii–8.viii.1988, J.T. Becker, Malaise trap (CNCI).

Apocephalus cyathus new species

(Fig. 21)

REMARKS. This species is easily recognized by the form of the ovipositor (Fig. 21), which is ventrally curled at the apex.

DESCRIPTION. Body length 1.4–2.3 mm. Frons dark brown. Frontal ratio 1.08. Flagellomere 1 light brown to brown, pyriform. Supra-antennal setae absent. Palpus light brown. Scutum light brown anteriorly, darker posteriorly. Scutellum brown to dark brown. Pleuron yellowish-brown. Mean costal ratio 0.51. Apex of hind femur without anterior or posterior dark spot. Tergites dark brown with a lightened, narrow, medial strip on tergites 1–5; tergites 2–5 lightened anteriorly, with or without lightening on posterior margin; tergite 6 with or without lightening anteriorly. Venter of abdomen yellowish-brown, gray laterally and posteriorly. Ventrolateral setae of tergite 6 slightly enlarged. Venter of abdominal segments 1–3 bare; segment 4 with few thin setae; segments 5–6 with large, square, lightly sclerotized sternites and thicker posterior setae. Ovipositor expanded at apical one-third; lateral margins dark; apically with two rounded free sclerites. Apical third of ovipositor curved ventrally. Ovipositor dorsally without large setae.

GEOGRAPHICAL DISTRIBUTION. Tropical lowlands from Mexico to Brazil.

DERIVATION OF SPECIFIC EPITHET. The name is based on a Greek word, *kyathos,* for cup, referring to the curved apex of the ovipositor.

HOLOTYPE. ♀, COSTA RICA: Heredia: La Selva Biological Station, 10.43°N, 84.02°W, 1–8.v.1989, B. Brown, D. Feener, Malaise trap, primary forest, CC 400 (LACM) [LACM ENT 013278].

PARATYPES. BRAZIL: Pará: Oriximiná, 1.8°S, 53.83°W, 1♀, 13.xi.1992, J. Rafael, Malaise trap (INPA); Roraima: Ilha de Maraca, 3.37°N, 61.43°W, 1♀, 20–30.iii.1987, L. Aquino, Malaise trap (INPA). COSTA RICA: Cartago: Cachi, 9.83°N, 83.80°W, 1♀, ix–x.1997, G. Chavez, Malaise trap, 1000 m (LACM); Guanacaste: Santa Rosa National Park, 10.95°N, 85.62°W, 1♀, 27.ix–18.x.1986, Malaise trap SE-5-O, 1♀, 18.x–8.xi.1986, Malaise trap SE-6-C, 1♀, 21.ii–14.iii.1987, D. Janzen, I. Gauld, Malaise trap, 300 m (LACM); Heredia: Chilamate, 1♀, v.1989, Malaise trap, P. Hanson (CMNH), La Selva Biological Station, 10.43°N, 84.02°W, 1♀, ii.1980, W. Mason (CNCI), 1♀, 15–21.v.1989, B. Brown, D. Feener, Malaise trap, SOR@SHO (LACM), 2♀, 21.i–

3.ii.1991, J. Noyes, Malaise trap (LACM), 1♀, iii.1991, 1♀, ix.1992, P. Hanson, Malaise trap (LACM), 6♀, 2–3.iii.1993, ALAS, Malaise trap M/01/016, M/05/020, M/10/025, M/14/029, 4♀, 15.iii.1993, ALAS, Malaise trap M/02/033, M/05/036, 2♀, 1.iv.1993, ALAS, Malaise trap M/05/52, 3♀, 1–15.iv.1993, ALAS, Malaise trap M/04/67, M/05/068 (INBC), 2♀, 18.v.1993, ALAS, Malaise trap M/01/096, M/02/097, 6♀, 15.v–1.vi.1993, ALAS, Malaise trap M/04/111, M/07/113, M/10/116, M/14/120 (INBC), 2♀, 22–24.vi.1993, B. Brown, D. Feener, Malaise trap #1, 1♀, 22–26.vi.1993, B. Brown, D. Feener, Malaise trap #4 (LACM), 3♀, 1.vii.1993, ALAS, Malaise trap M/06/151, M/09/143 (INBC), 6–11.vii.1993, B. Brown, D. Feener, Malaise trap #1 (LACM), 3♀, 15.vii–3.viii.1993, ALAS, Malaise trap M/01/164, M/08/170, 3♀, 1.xi.1993, ALAS, Malaise trap M/01/248, M/05/224, 1♀, 15.xi.1993, ALAS, Malaise trap M/05/268, 5♀, 3.ii.1994, ALAS, Malaise trap M/06/347, 2♀, 15.ii.1994, ALAS, Malaise trap M/05/352, M/11/357, 3♀, 1.iii.1994, ALAS, Malaise trap M/05/364, M/12/370, 1♀, 1.viii.1995, ALAS, Malaise trap M/05/415, 1♀, 2.i.1996, ALAS, Malaise trap M/01/531, 2♀, 1.ii.1996, ALAS, Malaise trap M/03/557, 1♀, 15.v.1996, ALAS, Malaise trap M/03/641, 1♀, 15.x.1997, ALAS, Malaise trap M/18/686, 1♀, 19.iii.1998, ALAS, Malaise trap M/18/704 (INBC); Limón: 4 km NE Bribri, 9.63°N, 82.28°W, 2♀, iv–vi.1990, 14♀, xii.1989–iii.1990, 2♀, vii–ix.1990, P. Hanson, Malaise trap, 50 m (LACM, MCZC, NHRS), 7 km SW Bribri, 9.58°N, 82.88°W, 6♀, ix–xi.1989, P. Hanson, Malaise trap (LACM), 16 km W Guapiles, 10.15°N, 83.92°W, 1♀, ii.1989, 1♀, iii.1989, 1♀, v–vi.1990, 4♀, i–iv.1991, 1♀, vi–ix.1991 P. Hanson, Malaise trap, 400 m (LACM), Pandora, Estrella Valley, 1♀, 20.ii.1984, H. and A. Howden, Malaise trap (LACM); Puntarenas: Cerro Rincon, 8.52°N, 83.47°W, 2♀, i.1991, 1♀, ii.1991, 1♀, iii.1991, P. Hanson, Malaise trap (LACM), Coopemarti, 8.63°N, 83.47°W, ii.1991, P. Hanson, Malaise trap, 30 m (LACM), 5 km W Piedras Blancas, 8.77°N, 83.28°W, 1♀, vi–viii.1989, 1♀, iv–v.1991, 1♀, i.1993, P. Hanson, Malaise trap, 100 m (LACM), 10 km W Piedras Blancas, 8.75°N, 83.3°W, 2♀, iii–v.1989, P. Hanson, Malaise trap (LACM), 24 km W Piedras Blancas, 8.77°N, 83.4°W, 3♀, iii–iv.1989, P. Hanson, I. Gauld, 3♀, vii–ix.1990, 3♀, xii.1990, 1♀, i–iii.1991, 1♀, iv–v.1991, 1♀, i.1992, 6♀, ii.1992, P. Hanson, Malaise trap, 200 m (LACM, MUCR), 3 km SW Rincon, 8.68°N, 83.48°W, 2♀, xii.1989, 1♀, iii–iv.1991, P. Hanson, Malaise trap, 10 m (LACM), Rio Piro, 8.28°N, 83.32°W, 2♀, ii.1991, P. Hanson, Malaise trap, 75 m (LACM). GUATEMALA: Escuintla, 1♀, 10.viii.1965, P.J. Spangler (USNM). MEXICO: Quintana Roo: Felipe Carrillo Puerto, 1♀, 10–14.x.1986, [no collector], Malaise trap (EMUS), Kohunlich, 68 km W Chetumal, 1♀, 14–17.vii.1982, S. and J. Peck, FIT, second growth, 160 m (LACM). NICARAGUA: Rio San Juan: Refugio Bartola, 16 km ESE El Castillo, 10.98°N, 84.34°W, 1♀, 22.iv–10.v.1999, L. LaPierre, Malaise trap (LACM). PANAMA: Canal Zone: Barro Colorado Island, 9.15°N, 79.85°W, 1♀, 1–7.iv.1993, J. Pickering, Malaise trap #936, 1♀, 23.iv–9.v.1993, J. Pickering, Malaise trap #964, 1♀, 16–23.iii.1994, J. Pickering, Malaise trap #2372, 1♀, 17–24.i.1996, J. Pickering, Malaise trap #6578 (LACM, MIUP); Darien: Cruce de Mono, 7.92°N, 77.62°W, 1♀, 6.ii–4.iii.1993, R. Cambra, J. Coronado, Malaise trap (MIUP); San Blas: Nusagandi Reserve, 9.33°N, 79°W, 1♀, 16–23.iv.1994, J. Pickering, Malaise trap #2862 (LACM). TRINIDAD: Asa Wright Nature Center, 1♀, 15.i.1981, G.E. Bohart (EMUS).

Apocephalus glomerosus new species

(Fig. 22)

REMARKS. This species can be recognized by the peculiar rounded dorsal sclerite of the ovipositor (Fig. 22).

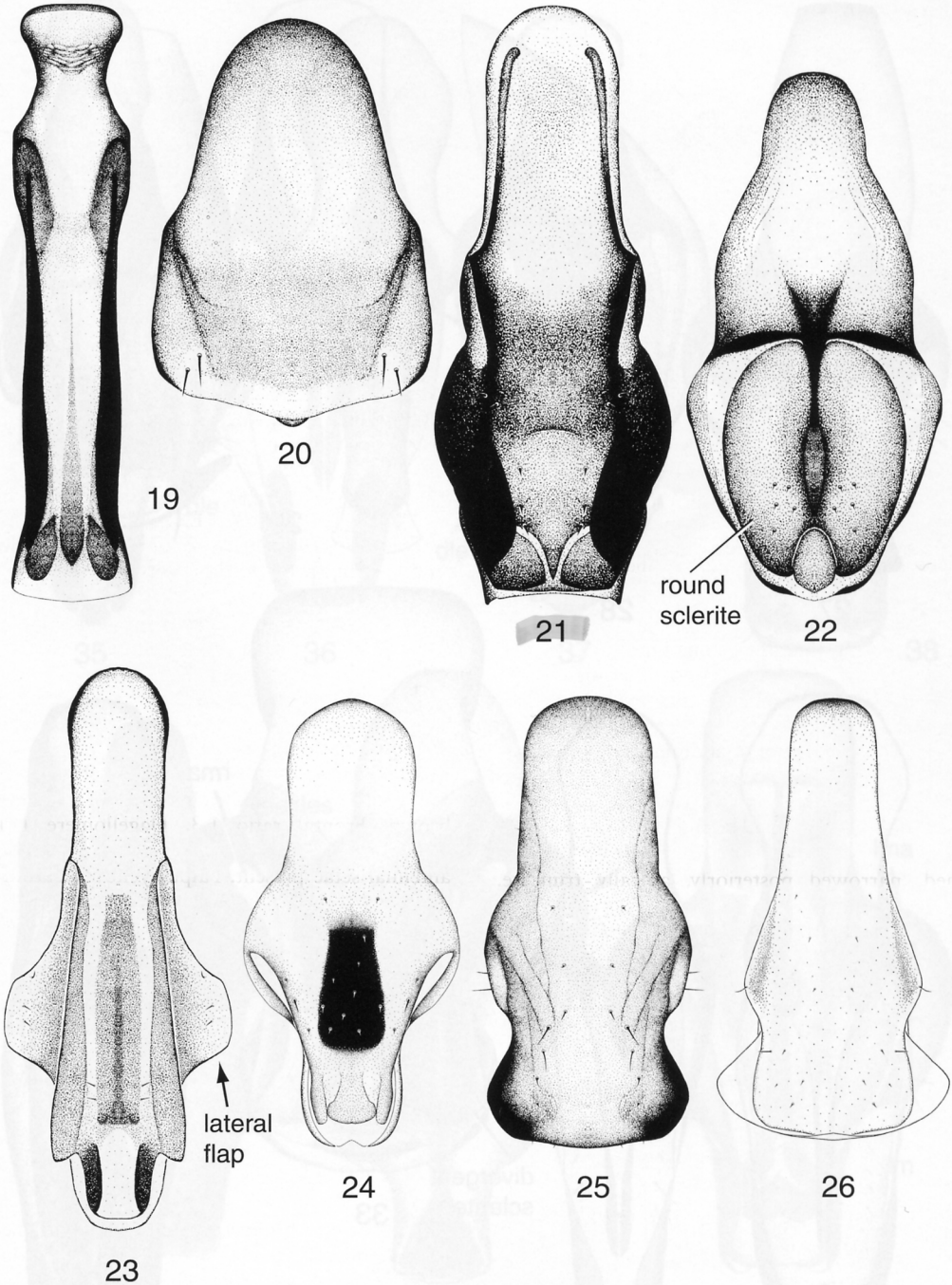
DESCRIPTION. Body length 1.6–2.2 mm. Frons dark brown. Frontal ratio 1.02. Flagellomere 1 yellowish-brown, oval. Supra-antennal setae absent. Palpus yellowish-brown. Scutum light brown. Scutellum light brown. Anterior pair of scutellar setae two and one-half times length and three times thickness of posterior setae of scutum. Posterior pair of scutellar setae one and one-half times length and twice thickness of anterior pair. Pleuron yellowish-brown. Mean costal ratio 0.48. Halter yellowish-brown, anteroapical half brown. Apex of hind femur without anterior or posterior dark spot. Tergite 1 light brown, medially shortened; tergite 2 brown in posterior three-fifths, light brown in anterior two-fifths, light brown medially and along posterior margin; tergites 3–4 brown, light brown anteriorly, medially, and along posterior margin; tergite 5 light brown, dark brown laterally; tergite 6 light brown in anterior half, dark brown in posterior half and laterally. Venter of abdomen yellowish-brown. Ventrolateral setae of tergite 6 greatly enlarged, bristlelike. Venter of abdominal segments 1–3 bare, segments 4 and 5 with posterior row of thin setae. Venter of abdominal segment 5 with narrowed, lightly sclerotized sternite. Venter of abdominal segment 6 with large, square, lightly sclerotized sternite with row of thin setae across posterior third. Ovipositor expanded at midlength, narrowed posteriorly. Dorsal sclerite oval in shape, with a separate oval sclerite inset at apex. Ovipositor dorsally without large setae.

GEOGRAPHICAL DISTRIBUTION. Missouri, USA.

DERIVATION OF SPECIFIC EPITHET. The name is Latin for rounded, referring to the shape of the dorsoapical sclerite.

HOLOTYPE. ♀, USA: Missouri: Wayne Co., Williamsville, vii.1987, J.T. Becker, Malaise trap (LACM) [LACM ENT 010992].

PARATYPE. USA: Missouri: Laclede Co., Ben-



Figures 19–26 Ovipositors, dorsal. **19.** *Apocephalus collatus* new species. **20.** *Apocephalus concisus* new species. **21.** *Apocephalus cyathus* new species. **22.** *Apocephalus glomerosus* new species. **23.** *Apocephalus staurotus* new species. **24.** *Apocephalus planus* new species. **25.** *Apocephalus coquilletti* Malloch. **26.** *Apocephalus disparicauda* Borgmeier