

New Species and New Records of *Apocephalus* Coquillett (Diptera: Phoridae) that Parasitize Ants (Hymenoptera: Formicidae) in America

by

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ABSTRACT

The following new species of *Apocephalus* ant-parasitizing flies are described: *Apocephalus exlobicornis* Brown & Disney, *A. exstriatus* Brown & Disney, *A. flavitenuipes* Brown & Disney, *A. intermedius* Brown & Disney, *A. longisetarum* Brown & Disney, *A. necdivergens* Brown & Disney, *A. noetingerorum* Brown & Disney, *A. penicillatus* Brown & Disney, and *A. philhispidus* Brown & Disney. Host records are reported for each species, as well as new host records for the previously described *A. mucronatus* Borgmeier, *A. neivai* Borgmeier, *A. setitarsus* Brown, *A. velutinus* Borgmeier, *A. viscosae* Disney, and for one further unnamed species.

Key Words: parasitoids, *Apocephalus* sp., new species.

INTRODUCTION

Parasitoid Phoridae attack a wide range of hosts. Some species are extremely host specific, others less so, and for most we have little data. Furthermore, some phorids may be attracted to and “visit” non-target hosts (e.g., Weissflog *et al.* 2008). In order to establish the true ant hosts of any species of phorid fly, one needs to observe oviposition attacks and/or undertake rearings from known ant hosts. The purpose of this paper is to report on such evidence obtained for species of *Apocephalus* Coquillett in Argentina, Colombia, and Paraguay. Many of the fly species proved to be new to science and are described below, along with the evidence of their host ants (Table 1).

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METHODS

Most of the specimens dealt with below were obtained by LE, while being supervised by PJF. LE mounted a few on slides but most were mounted by RHLD in Berlese Fluid (Disney 2001). Other specimens studied by BVB were chemically dried with HMDS (Brown 1993).

Holotypes and some paratypes, as well as ant host species and morphospecies, have been deposited in the Museum Bernardino Rivadavia, Buenos Aires (MBR). Other duplicates and paratypes have been deposited in the Museum of Zoology, University of Cambridge (MZUC), the collection of PJF at the Universidad Nacional de Quilmes (PJF), and Natural History Museum of Los Angeles County (LACM).

The seasons referred to in the “Way of life” sections are as follows: winter is from 21 June-20 September, spring is from 21 September to 20 December, summer is from 21 December to 20 March, and autumn is from 21 March to 20 June. Afternoon is 13:00 h until no daylight is present.

Genus *Apocephalus* Coquillett

More than 300 species are known in this genus, which is organized into two subgenera: *Apocephalus* and *Mesophora* Borgmeier. Subgenus *Apocephalus*

Table 1. Ant hosts of *Apocephalus* parasitoids mentioned in this paper

Phorid fly	Ant host
<i>A. barbicauda</i>	<i>Acromyrmex lundii</i>
<i>A. exlobicornis</i>	<i>Acromyrmex lobicornis</i>
<i>A. exstriatus</i>	<i>Acromyrmex fracticornis, striatus</i>
<i>A. flavitenuipes</i>	<i>Pheidole</i> sp.
<i>A. intermedius</i>	<i>Acromyrmex hispidus</i> Santschi
<i>A. longisetarum</i>	<i>Atta vollenweideri</i>
<i>A. mucronatus</i>	<i>Camponotus blandus</i>
<i>A. necdivergens</i>	<i>Acromyrmex crassispinus, lobicornis, rugosus</i>
<i>A. neivai</i>	<i>Acromyrmex crassispinus, beyeri, hispidus, bystrix, lobicornis, lundii, striatus</i>
<i>A. noetingerorum</i>	<i>Acromyrmex crassispinus, lundii</i>
<i>A. penicillatus</i>	<i>Acromyrmex hispidus, A. lundii</i>
<i>A. peniculatus</i>	unknown
<i>A. phillipidus</i>	<i>Acromyrmex hispidus</i>
<i>A. rionegrensis</i>	<i>Acromyrmex brunneus</i>
<i>A. setitarsus</i>	<i>Atta vollenweideri, Ac. saltensis</i>
<i>A. sp.</i>	<i>Acromyrmex lundii, crassispinus</i>
<i>A. velutinus</i>	<i>Camponotus rufipes</i>
<i>A. viscosae</i>	<i>Atta laevigata, vollenweideri</i>

includes all species referred to as “ant-decapitating flies”, including all species treated in this paper; however, not all of them decapitate the host. In fact, most of the species reported here pupate outside the host and do not decapitate it. The species of both *Apocephalus* subgenera were keyed by Borgmeier (1971) but the treatment of subgenus *Apocephalus* has been largely revised by Brown (1997, 2000, 2002) supplemented by Corona & Brown (2004) and Brown & LeBrun (submitted). Most species can only be named in the female sex in our present state of knowledge; usually, collecting males in copula with females is necessary to ensure correct association of the sexes. All larvae whose habits are known are endoparasitoids of ants.

Segments 7-10 of the female abdomen form a structure for inserting eggs into the host referred to as the ovipositor. Segment 7 forms the main rigid structure, referred to by Brown (1997, 2000, 2002) as the “ovipositor”, but considered by RHLD to be an ovipositor sheath (that embraces the retractile ovipositor proper). In the terminology of the *Manual of Central American Diptera* (Cumming & Wood 2009), it is called the oviscape, a usage we follow herein. In species of the *A. attophilus* group (most of those considered in this paper), the oviscape has a separate apical sclerite that is of great taxonomic importance. The other rigid structure, comprised of segments 8-10, is an apically pointed structure Brown refers to as the stylet. Other terms are as in the *Manual of Central American Diptera*.

Apocephalus attophilus group

Diagnosis. This group was diagnosed by Brown (1997; refined by Brown, 2000) to include all species with a separate apical sclerite posterior to the oviscape.

A. peniculatus subgroup

Diagnosis. Oviscape with long setae dorsally (Figs. 1-3, 5).

A. peniculatus series

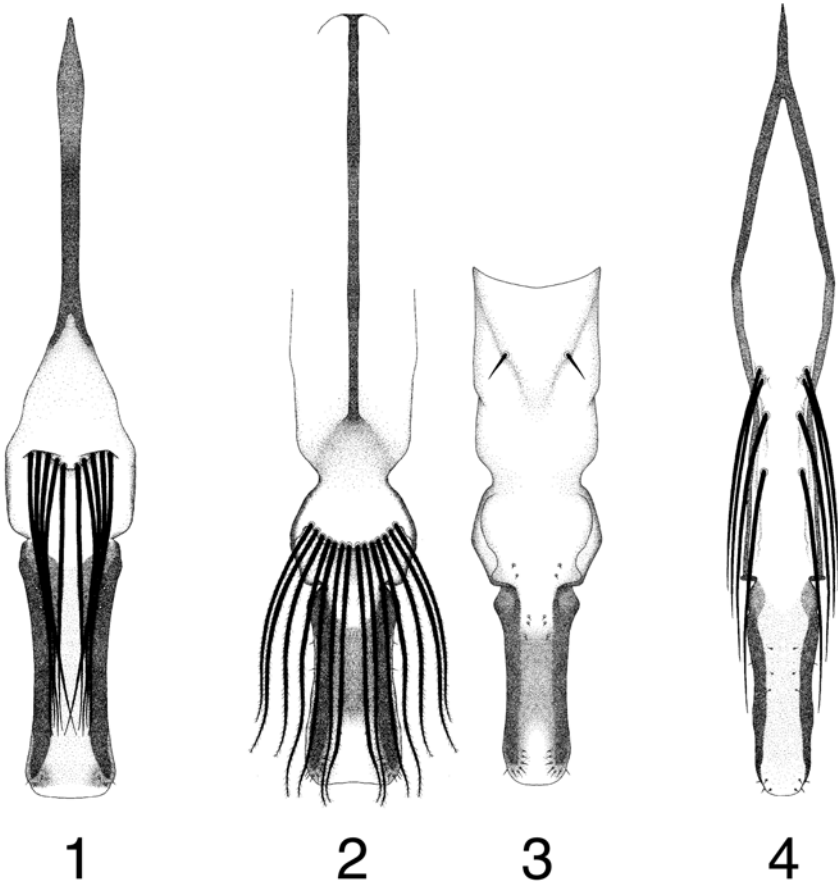
Diagnosis. Venter of oviscape with pair of thick, divergent setae (Fig. 3).

Apocephalus intermedius new species

(Fig. 1)

Apocephalus sp. k, Elizalde 2009.

Species recognition. This species is part of a cluster of extremely similar forms that might or might not deserve species status: *A. barbicauda* Borgmeier (synonymized with *A. rionegrensis* Borgmeier by Brown 1997), *A. peniculatus* Borgmeier, *A. rionegrensis*, and *A. penicillatus* new species. These

*A. intermedius**A. penicillatus**A. neivai*

Figs. 1-4. Oviscapes, dorsal (1-2, 4), ventral (3).

species need to be re-assessed, and analysis of molecular characters probably will be necessary to ascertain the proper groupings. All are parasitoids of *Acromyrmex* species (Table 1; the host of *A. peniculatus* is not known), all have a transverse row of long setae across the apex of the oviscape, and they share with *A. cantleyi* Brown a pair of divergent, thick setae ventrally on the oviscape (Fig. 3). *Apocephalus intermedius* is most similar to *A. rionegrensis*, as they both have a squared apical portion of the oviscape and the long setae are parallel, not radiating as in *A. peniculatus* and *A. penicillatus*. They differ in that *A. intermedius* has the apical sclerite relatively shorter and has a brown halter (yellow in *A. rionegrensis*). The costal length in *A. intermedius* is extremely long (mean 0.61 wing length), but as all specimens were reared, it is possible that the wings were not full expanded. An extremely long costa (0.58 wing length) was also found in *A. rionegrensis*, but not *A. barbicauda* (0.49- still a long costa), and constituted one of Borgmeier's main justifications for recognition of the latter.

Description. Female. Frons yellowish-brown. One pair of strong supra-antennal setae present. Flagellomere 1 light brown, round. Palpus yellow, small, with thick, black, pointed setae. Dorsum of thorax light brown; pleuron yellow. Legs light yellowish brown, except apex of hind femur dark darkened. Tarsomere 5 not elongate or narrowed, tarsal claws small, but not reduced. Wing length 1.2-1.3 mm (n=5). Mean costal length 0.61 wing length, range 0.59-0.61. Wing vein R_{2+3} present. Halter brown. Abdominal tergites brown, with short scattered setae, except tergite 2 with few longer thicker setae laterally; tergite 6 entire, anteriorly shallowly emarginate. Venter of abdomen light brown, bare except for row of long setae encircling posterior margin of segment 6 and few scattered, shorter ones anterior to row on venter. Oviscape (Fig. 1) with long anterior process; main portion of oviscape relatively square, with transverse row of 8-10 long, parallel setae; ventrally with pair of thick, divergent setae; apical sclerite elongate, length divided by basal width 2.6-2.8.

Way of life. Specimens were reared from ants collected in winter. Adult flies emerged in winter and the beginning of spring. All reared individuals were from *Acromyrmex hispidus* Santschi collected from foraging trails and

those working on refuse piles. The larvae leave the ant host to pupate. In the only locality where it was found, its abundance was low.

Etymology. Named for being intermediate between *A. peniculatus* and *A. rionegrensis*.

Material examined: Holotype female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, over *Acromyrmex hispidus*, 18 September 2005, L. Elizalde (MBR). Paratypes: 4 females, as holotype except reared from same host in lab, 23 August, 15 September, 15 November 2005, & 21 June 2006 (except 1 female, MZUC, 39-32).

***Apocephalus penicillatus* new species**

(Figs. 2-3)

Apocephalus sp. a, Elizalde 2009.

Species recognition. This species differs from others in the *A. peniculatus* series by the long dorsal setae of the oviscape that extend posteriorly past the apex of the apical sclerite.

Description. Female. Frons light brown. One pair of strong supra-antennal setae present. Flagellomere 1 light brown, round. Palpus yellow, small, with thick, black, pointed setae. Dorsum of thorax light brown; pleuron yellowish-brown. Legs light yellowish brown, except apex of hind femur darkened. Tarsomere 5 not elongate or narrowed, tarsal claws small, but not reduced. Wing length 1.4-1.5 mm (n=5). Mean costal length 0.52 wing length, range 0.51-0.53. Wingvein R₂₊₃ present. Halter brown. Abdominal tergites brown, with short scattered setae, except tergite 2 with few longer thicker setae laterally; tergite 6 entire, anteriorly shallowly emarginate. Venter of abdomen light brown, bare except for row of long setae encircling posterior margin of segment 6 and few scattered, shorter ones anterior to row on venter. Oviscape (Fig. 2) with long anterior process; main portion of oviscape relatively rounded, with round-transverse row of 14-18 long, diverging setae; ventrally with pair of thick, divergent setae (Fig. 3); apical sclerite elongate, length divided by basal width 2.5.

Way of life. This species pupates outside the host, and was reared in the lab from *Acromyrmex lundii* (Guérin-Méneville). In addition, it was collected

in the field perched on the side of foraging trails of *Ac. hispidus*, during the afternoon and night. No oviposition attempt was observed.

Etymology. Named after its resemblance to *A. peniculatus* in the possession of long bristles, like a paint brush, on the oviscape.

Holotype female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, reared from *Acromyrmex lundii* in lab, 23 August 2005, L. Elizalde (MBR). Paratypes: 1 female, same locality, from colony of *Ac. lundii*, 23 August 2006, L. Elizalde (MBR). 2 females, Formosa: Parque Nacional Río Pilcomayo, Estero Poi, 25.12°S, 58.17°W, from colony of *Acromyrmex hispidus*, 8 June 2004, L. Elizalde (MBR). 2 females, Chaco: Parque Nacional Chaco, 26.86°S, 59.62°W, over *Ac. hispidus*, 16 May 2004, L. Elizalde (MZUC, 39-27).

other *A. peniculatus* subgroup species

Apocephalus neivai Borgmeier (Fig. 4)

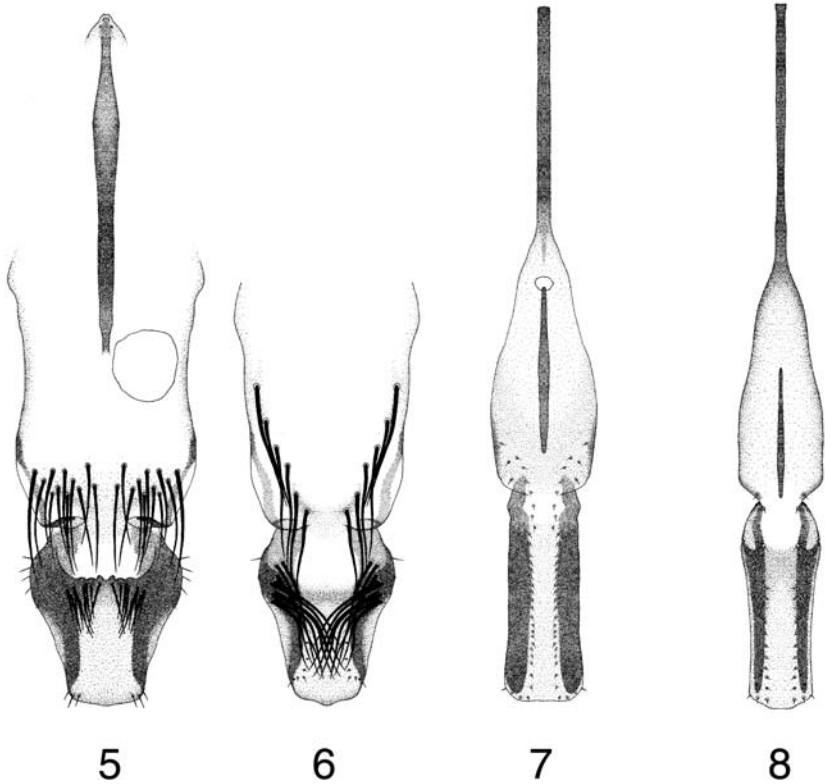
The specimens examined here differ slightly from the description in Brown (1997). The apical sclerite of the oviscape is longer and more nearly parallel sided (Fig. 4), the body color is generally paler, with a largely yellow thorax, both flagellomere 1 and palpus are yellow, and the legs are paler. In *A. neivai*, flagellomere 1 was reported to be brown, in contrast to the yellow palpus. Color reported from old, alcohol-preserved material, however, is not reliable (as noted by Brown, 1997: 3).

A second series of specimens, from Colombia, are similar to the new Argentinian specimens noted here. Possibly, a group of cryptic species is involved, and newly-collected specimens from the type locality (Bom Retiro, Santa Catarina, Brazil) would be helpful.

Way of life. This species pupates outside the host and was reared in the lab from foragers of *Acromyrmex crassispinus* (Forel), *Ac. heyeri* (Forel), *Ac. lobicornis* (Emery), and *Ac. lundii*. In addition, females were collected in the field, attacking foragers of all these species, as well as *Ac. hispidus* and *Ac. hystrix* (Latreille). The flies landed on the leaf transported by the target ants and attempted oviposition in the side of the head, probably in the mandibular suture.

Material examined: 1 female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, reared from *Acromyrmex lobicornis* in lab, 5 January 2006,

L. Elizalde (MBR); 3 females, as above, except 28 April 2004 and collected over a foraging trail of *Ac. lobicornis* (one, MZUC, 39-37); 2 females, as above except over *Ac. crassispinus.*, 6 May 2004 (MBR, MZUC, 39-38); 1 female, as holotype except 5 December 2005; 1 female, as holotype except reared from *Ac. lundii*, 21 June 2005. 1 female, Córdoba: Noetinger, 32.32°S, 62.36°W, collected over a foraging trail of *Ac. heyeri*, 23 December 2005, L. Elizalde (MZUC, 39-37). COLOMBIA: Amazonas: Amacayacu National Park, 3.82°S, 70.26°W, 6♀, 31.viii.1997, 1♀, 1.ix.1997, B. Brown, G. Kung, attacking *Acromyrmex hystrix* (LACM).



A. noetingerorum

A. exlobicornis

A. exstriatus

Figs. 5-8. Oviscapes, dorsal (5, 7-8), ventral (6).

***Apocephalus noetingerorum* new species**

(Figs. 5-6)

Apocephalus sp. 1, Elizalde 2009.

Species recognition. This *A. peniculatus* subgroup species differs from others by the convergent ventral tufts of setae, the transverse row of setae across the apical sclerite, and other peculiarities of the ovipositor.

Description. Female. Frons yellow. One pair of small supra-antennal setae present. Flagellomere 1 light brown, round. Palpus yellow, small, with thick, black, pointed setae. Dorsum of thorax light brown; pleuron yellowish-brown. Legs light yellowish brown, except apex of hind femur dark darkened. Tarsomere 5 not elongate or narrowed; foretarsal claws slightly enlarged, mid- and hind tarsal claws small. Wing length 1.6-1.9 mm (n=5). Mean costal length 0.51 winglength, range 0.50-0.53. Wingvein R_{2+3} present. Halter light brown. Abdominal tergites brown, lighter medially, with medium-sized scattered setae along lateral margins; tergite 6 entire. Venter of abdomen yellowish, with darker lateral markings, bare except for row of long setae encircling posterior margin of segment 6 and few scattered, shorter ones on segments 5-6. Oviscape (Fig. 5) with long anterior process; main portion of oviscape short, broad, with transverse row of about 24 long setae; ventrally with lateral row of long setae converging apically (Fig. 6); apical sclerite short, broadest basally, with transverse row of setae near base. Internal sclerotized loop large, round.

Way of life. Even after thousands of hours of sampling in the field, this species was not collected over the ants. It was reared, however, from *Acromyrmex crassispinus* and *Ac. lundii* workers collected in the foraging trails at San Cristóbal and Noetinger. Pupae were formed outside the ant's body.

Etymology. Named after the Noetinger family whose farm at Noetinger-Córdoba is the type locality and in recognition of the help extended to LE during her field work there.

Holotype female, ARGENTINA: Córdoba: Noetinger, 32.32°S, 62.36°W, reared from *Acromyrmex lundii*, 29 December 2005, L. Elizalde (MBR). Paratypes: 1 female, ARGENTINA: Buenos Aires, 30km W B. A., Moreno, 34.14°S, 58.78°W, 9.iv.2005, C. Coviella, Malaise trap (LACM), 1 female, Castelar, 34.67°S, 58.67°W, 5.i-6.ii.2007, G. Logarzo, Malaise trap (LACM);

2 females, 3 males, as holotype except (1 male, 1 female, MZUC, 39-20); 1 female as holotype except 30 December 2005; 1 female, as holotype except 19 April 2005; 2 females, as holotype, but reared from *Acromyrmex crassispinus* in lab, 29-30 December 2005, L. Elizalde (MBR).

Other *A. attophilus* group species

***Apocephalus exlobicornis* new species**

(Figs. 7, 20)

Species recognition. In the key to the *Apocephalus attophilus* group (Brown 1997) the female will run to couplet 42, with *A. attophilus* Borgmeier and *A. facis* Brown. Both of these species have a much narrower apical sclerite of the oviscape, with narrower dark margins, and longer foretarsomeres. It further differs from *A. exstriatus* new species by the lateral darkenings of the apical sclerite, which are not apically narrowed in *A. exlobicornis*.

Description. Female (note all specimens are teneral, and colors are probably not as dark as in a fully-matured adult). Frons yellow. One pair of supra-antennal setae present. Flagellomere 1 brown, collapsed in all specimens but probably slightly oval. Palpus yellow, small, with normal-sized, black, pointed setae. Dorsum of thorax light yellowish-brown; pleuron darker brown. Legs light yellowish brown, except apex of hind femur dark brown. Tarsomeres not narrowed, relatively short and thick (Fig. 20), tarsal claws not reduced. Wing length 1.3 mm (only one specimen measurable, others teneral). Costa 0.43 wing length. Wing vein R_{2+3} not visible in these teneral specimens. Halter yellow. Abdominal tergites not visible. Venter of abdomen light gray, bare except for row of setae along posterior margin of segment 6. Oviscape (Fig. 7) with long anterior process and thin medial sclerite; near apex with cluster of setulae. Apical sclerite elongate, parallel sided, with relatively broad darkened lateral margins; dorsally with row of many small setulae medial to each lateral margin. Internal sclerotized loop small, round.

Way of life. All specimens of this species were reared from foragers of *Acromyrmex lobicornis*. In the only locality where it was found, its abundance was low. It was reared only from ants collected during spring, and adults emerged in summer. This species pupates outside the host.

Etymology. Named after the host ant.

Holotype female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, reared from *Acromyrmex lobicornis* in lab, 3 January 2006, L. Elizalde (MBR). Paratypes: 1 female, 1 male, as holotype except (female, CUMZ, 39-29); 1 female, as holotype except 5 January 2006 (MBR).

***Apocephalus exstriatus* new species**

(Fig. 8)

Apocephalus sp. d, Elizalde 2009

Species recognition. This species is most similar to *A. exlobicornis*, but the apical sclerite of *A. exstriatus* is shorter and the lateral darkenings are more tapered apically.

Description. Female. Frons brown. One pair of supra-antennal setae present. Flagellomere 1 light brown, round. Palpus yellow, small, with normal-sized, black, pointed setae. Dorsum of thorax and pleuron brown. Legs light yellowish brown, except apex of hind femur dark brown. Tarsomeres not narrowed, relatively short and thick (as in Fig. 19), tarsal claws not reduced. Wing length 0.93-1.05 mm (n=2). Costa 0.41 wing length (no variation). Wing vein R₂₊₃ present. Halter yellow. Abdominal tergites brown, with short scattered setae; tergite 6 entire, anteriorly emarginate. Venter of abdomen light gray, bare except for row of setae along posterior margin of segment 6. Oviscape (Fig. 8) with long anterior process and thin medial sclerite; near apex with one setula only. Apical sclerite elongate, parallel sided, with relatively darkened lateral margins narrowed apically; dorsally with row of many small setulae medial to each lateral margin.

Way of life. This species was reared from *Acromyrmex striatus* (Roger) and *Ac. fracticornis* (Forel) workers collected in foraging trails. It pupates outside the host ant. It was also collected flying along the foraging trail of *Ac. striatus*. One female landed on a leaf transported by an ant.

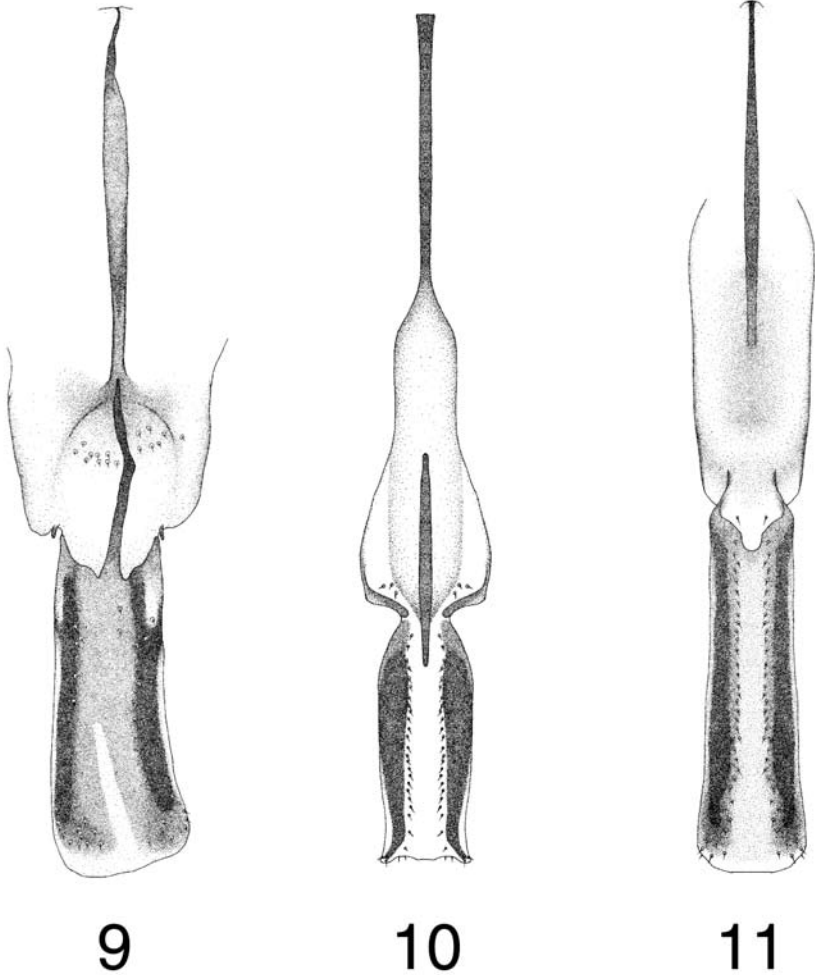
Etymology. Named after one of the host ants.

Holotype female, ARGENTINA: Formosa: Reserva Natural Formosa, 24.32°S, 61.80°W, over *Ac. striatus*, 30 September 2004, L. Elizalde (MBR). Paratypes: 2 females as holotype (one, MZUC, 39-29). 1 female, Santa Fe: San Cristóbal, 30.21°S, 61.15°W, reared from *Ac. striatus* in lab, 9 March 2006, L. Elizalde (MBR).

Apocephalus longisetarum new species
(Figs. 9, 21)

Apocephalus sp. p, Elizalde 2009.

Species recognition. This species is recognized by the asymmetrical female



A. longisetarum

A. philhispidus

A. setitarsus

Figs. 9-11. Oviscapes, dorsal.

oviscape, otherwise known only in *A. asymmetricus* Brown, and the extraordinarily long setae on the hind tarsomeres.

Description. Female. Frons yellow. One pair of strong supra-antennal setae present. Flagellomere 1 light yellow, round. Palpus yellow, small, with thick, black, pointed setae. Dorsum of thorax and pleuron yellowish-brown. Legs light yellowish brown, except apex of hind femur darkened. Tarsomere 5 not elongate or narrowed, tarsal claws reduced; hind tarsomeres with extremely long setae (Fig. 21). Wing length 1.50-1.63 mm (n=2). Costa 0.48 wing length, range 0.46-0.50. Wing vein R_{2+3} present. Halter brown. Abdominal tergites brown, lighter medially, with short scattered setae, except tergite 2 with few longer thicker setae laterally; tergite 6 entire, anteriorly emarginate. Venter of abdomen light grey, bare except for row large setae encircling posterior margin of segment 6. Oviscape extremely modified (Fig. 9): with long anterior process; main portion of oviscape invaginated, irregular sclerotized area; apical sclerite asymmetrical, curved to right; anteromedial process of apical sclerite curved dorsally, then ventrally towards anterior apex.

Host. Reared from and collected with *Atta vollenweideri* Forel.

Way of life. This species was reared from *Atta vollenweideri* Forel foragers and pupated outside ant's body. In addition, it was collected flying along this ant's foraging trails. In one instance it was collected at night. In the only locality where it was found, its abundance was low.

Etymology. Named for the long setae on the hind tarsus.

Holotype female, ARGENTINA: Santa Fe, San Cristóbal, 30.21°S, 61.15°W, reared from *Atta vollenweideri*, May 2005, L. Elizalde (MBR). Paratype female as holotype (MZUC, 39-21); 2 females, same locality, with *At. vollenweideri*, 6 & 15 December 2005, L. Elizalde (MBR). 1 female, same data except, collected over *At. vollenweideri*, 2 May 2006 (MZUC, 39-31).

Apocephalus philbispidus new species

(Fig. 10)

Apocephalus sp. i, Elizalde 2009.

Species recognition. This species keys to couplet 42 (in Brown 1997), where it matches neither *A. facis*, *A. attophilus*, nor the newly described *A. exlobicornis*

or *A. exstriatus*. It differs from all of these species by the shape of the apical sclerite, which has the lateral darkenings curved outwards at the apex.

Description. Female. Frons light brown. One pair of strong supra-antennal setae present. Flagellomere 1 light brown, slightly pointed. Palpus yellow, small, with thick, black, pointed setae. Dorsum of thorax and pleuron light brown to whitish-brown. Legs light yellowish brown, except apex of hind femur and hind tibia darkened. Tarsomeres of foreleg shortened, shorter than foretibia, tarsomere 5 not elongate or narrowed, tarsal claws not reduced. Wing length 1.33-1.40 mm (n=3). Costa 0.41 wing length, range 0.40-0.43. Wing vein R_{2+3} present. Halter light brown. Abdominal tergites brown, with short scattered setae, except tergite 2 with few longer thicker setae laterally; tergite 6 entire, anteriorly emarginate. Venter of abdomen grey, bare except for row large setae encircling posterior margin of segment 6. Oviscape (Fig. 10) with long anterior process and thin medial sclerite, broadened apically; near apex with short setulae only. Apical sclerite elongate, parallel sided, with relatively darkened lateral margins narrowed apically and curving laterally; dorsally with row of many small setulae medial to each lateral margin.

Way of life. This species was not collected as adults in the field; however, it was reared from workers collected in foraging trails of *Acromyrmex hispidus*. It pupated outside ant's body.

Etymology. Named for its host ant.

Holotype female, ARGENTINA: Santa Fe, San Cristóbal, 30.21°S, 61.15°W, reared from *Acromyrmex hispidus* in lab, 6 March 2006, L. Elizalde (MBR). Paratypes: 1 female, as holotype except date 28 February 2006 (female, MZUC, 39-35); 1 female, reared from *Ac. hispidus*, 2 January 2006, L. Elizalde (MBR).

Apocephalus setitarsus Brown
(Figs. 11, 22)

Apocephalus sp. c, Elizalde 2009.

Taxonomic note. This species was previously described from Costa Rica, where specimens are yellower in color. The figure for the oviscape of this species in Brown (1997: fig. 59) is somewhat inaccurate; that presented here

(Fig. 11) is more correct. Males of this species are easily recognized by the enlarged palpus with tiny reduced setulae; females have distinctive ventral setae on the midtarsomeres (Fig. 22).

Host. Reared from *Atta vollenweideri*; also collected with *Acromyrmex hispidus* and *Atta saltensis* Forel. This was the only species collected with both of these ant genera.

Way of life. This species was collected in the field attacking *Atta saltensis* Forel and *At. vollenweideri* workers that were cutting vegetation. They deposited the eggs in the side of the head, probably in the mandibular suture. In addition, specimens were reared from ants collected in the foraging trails of *At. vollenweideri*. They pupated outside ant's body, and more than one larva could develop in an individual ant at the same time, with one ant producing two flies and two ants producing three flies (out of a total of 17 parasitized ants).

Material examined: 3 females, 2 males, ARGENTINA: Santa Fe, San Cristóbal, 30.21°S, 61.15°W, over *Atta vollenweideri*, September to October 2005, L. Elizalde (MBR, except 1 male & 1 female, MZUC, 39-20); 1 female, with *At. vollenweideri*, 6 May 2004, L. Elizalde (PJF); 1 male, from same locality, reared from *At. vollenweideri* in lab, 19 May 2005, (MZUC, 39-22); 1 male, emerged from *At. vollenweideri*, 16 May 2005, and 4 females, 6 males, emerged 5 December 2005, L. Elizalde (MBR, except 1 female, MZUC, 39-22), 1 female, with *Ac. hispidus*, 23 August 2006, L. Elizalde (MBR). 3 females, Santiago del Estero: La María (INTA), 28.03°S, 64.29°W, with *At. saltensis*, 25 October 2004, L. Elizalde (MBR). 2 females, Corrientes: Mercedes, 29.15°S, 57.99°W, with of *At. vollenweideri*, 31 October 2004, L. Elizalde (MBR).

Apocephalus vicosae Disney

Way of life. This species was originally caught over *Atta laevigata* (F. Smith) and *A. sexdens* (Linnaeus) in Brazil (Disney & Bragança 2000). LE found this species in the field attacking *Atta vollenweideri* workers in foraging trails. They deposited their eggs in the side of the host ant head, near the mandibular suture. To reach that area, they used the leaf fragment transported by the ants as platform. In addition, specimens were reared from ants collected in foraging trails of *At. vollenweideri*. They pupated inside the ant's thorax, as was previously described for this species (Bragança and Medeiros 2006).

Material examined: 2 females, ARGENTINA: Santa Fe, San Cristóbal, 30.21°S, 61.15°W, over *Atta vollenweideri*, June 2005, L. Elizalde (39-20) (MZUC).

Apocephalus grandipalpis group

Diagnosis. Ovipositor short, with dorsal sclerite narrower than ventral sclerite, producing distinct, rounded, lateral concavity in dorsal view (Brown, 1997).

Taxonomic note. There are many closely similar species of this group. Description of the following structures are necessary to differentiate these species: tergite 6, ventral setation of the abdomen, oviscape, stylet.

Apocephalus necdivergens new species

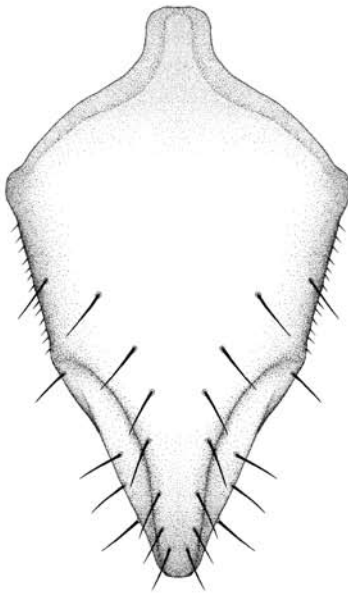
(Figs. 12, 14, 17, 18)

Apocephalus sp. e, Elizalde 2009.

Species recognition. In the key of Borgmeier (1971) this species will run to couplet 36, to *A. divergens* Borgmeier. It differs most notably in that tergite 6 is divided into two small sections in *A. necdivergens*, but is entire in *A. divergens*. Other differences await a re-evaluation of the holotype of *A. divergens*.

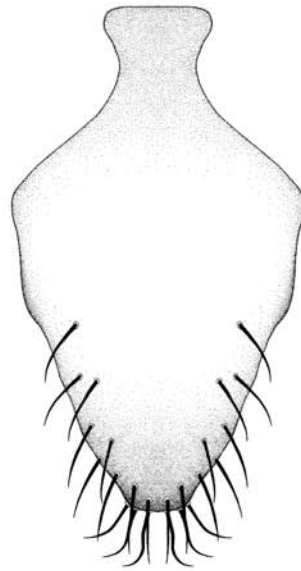
One specimen has extra bristles on the frons, namely four (not two) supra-antennals and on the left side only with two extra bristles in addition to the normal four. The extra pair of supra-antennal setae will take this specimen to couplet 20 instead, where the form of the oviscape excludes both species. Likewise the subsequently described *A. laceyi* Disney, which will run to the same couplet, has a different oviscape.

Description. Female. Frons brown. One pair of small supra-antennal setae present. Flagellomere 1 light brown, round. Palpus yellow, small, with small, black, pointed setae. Dorsum of thorax brown, pleuron yellowish-brown. Legs light yellowish brown, hind femur dark not darkened. Tarsomere 5 not elongate or narrowed, tarsal claws small. Wing length 0.88-1.15 mm (n=4). Costa 0.46 wing length (no variation). Wing vein R_{2+3} present. Halter brown. Abdominal tergites brown, with short scattered setae; tergite 6 divided into two round sclerites, each with two long, thick setae posteriorly (Fig. 17). Venter of abdomen light brown, bare except short, wide bar of sclerotization mediolaterally on venter of segment 6; each bar with one larger medial and



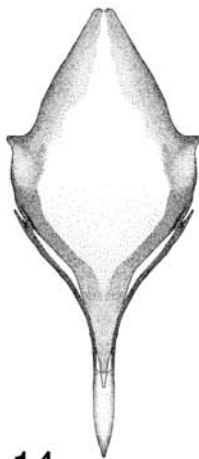
12

A. necdivergens



13

A. flavitenuipes



14

A. necdivergens



15

A. flavitenuipes



16

Figs. 12-16. Ovipositor structures. 12-13. Oviscapes, dorsal. 14-16. Stylets, dorsal (14-15), lateral (16).

two smaller lateral setae (Fig. 18). Oviscape (Fig. 12) short, triangular, without separate apical sclerite; laterally and posteriorly with numerous medium-sized setae. Stylet with anterior arms convergent (Fig. 14); ventral posterior apex much shorter than dorsal posterior apex.

Way of life. This species was collected in the field over foraging trails of *Acromyrmex crassispinus* and *Ac. lobicornis*, and over a nest of *Ac. rugosus* (F. Smith). However, no oviposition attempts were observed.

Etymology. Named after its close resemblance to *A. divergens*.

Holotype female, PARAGUAY: Cordillera: Loma Grande, 25.17°S, 57.22°W, over *Acromyrmex rugosus*, 18 January 2004, L. Elizalde (MBR). Paratypes: 1 female as holotype. 1 female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, over *Acromyrmex crassispinus*, 2 May 2004, L. Elizalde (MBR). 1 female, Formosa: Reserva Natural Formosa, 24.32°S, 61.80°W, at nest of *Acromyrmex lobicornis*, 5 October 2004 (MZUC, 39-21).

Apocephalus sp.

Apocephalus sp. g, Elizalde 2009.

Taxonomic notes. This species appears to belong in the *A. grandipalpis* group. In the key of Borgmeier (1971) the female will run to couplet 36, to *A. divergens* Borgmeier, or couplet 44, to *A. angularis* Borgmeier. In both cases the bristles of the palps are much shorter than in the present species. There are however, many undescribed species that would fall into this part of the key.

The abdomens of the three specimens were all highly damaged by slide-mounting. The species will not be distinguishable from other *A. grandipalpis* group species, as details of the oviscape, stylet, and tergite 6 are not clearly visible, so for now we leave it undescribed.

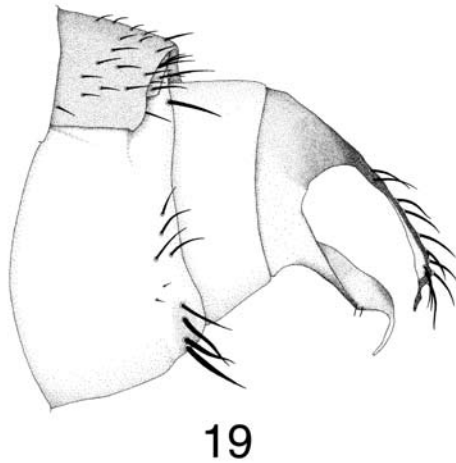
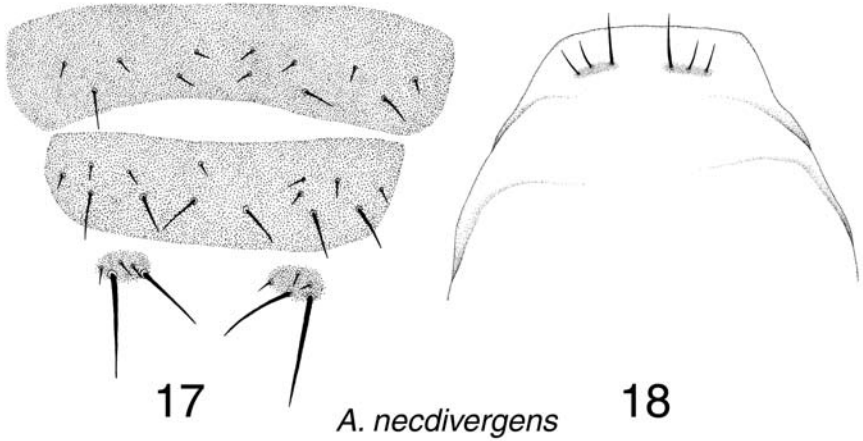
Way of life. This species was collected in the field over foraging trails of *Acromyrmex lundii* and over a refuse pile of *Ac. crassispinus*. No oviposition attempts were observed, and in both cases females were collected in copula with males.

Material examined: ARGENTINA: Buenos Aires: Carmen de Areco, 34.33°S, 59.90°W, from colony of *Acromyrmex lundii*, 1 female, 17 March 2004, L. Elizalde (MBR), 1 female, over *Ac. lundii*, 17 March 2004, L. Elizalde

(MZUC, 39-28). 1 female, Santa Fe: San Cristóbal, 30.21°S, 61.15°W, over *Ac. crassispinus*, 26 January 2006, L. Elizalde (MBR).

Apocephalus pergandei group

Diagnosis. This group was diagnosed and revised by Brown (2002).



A. flavitenuipes

Figs. 17-19. Abdominal structures. 17, tergites 4-6. 18, venter of abdominal segments 4-6. 19, segments 5-10, lateral.

Apocephalus velutinus Borgmeier*Apocephalus* sp. 21, Elizalde 2009.

Taxonomic note. Newly collected specimens are lighter in color, with yellow flagellomere 1 and palpus, than some Brazilian specimens.



20

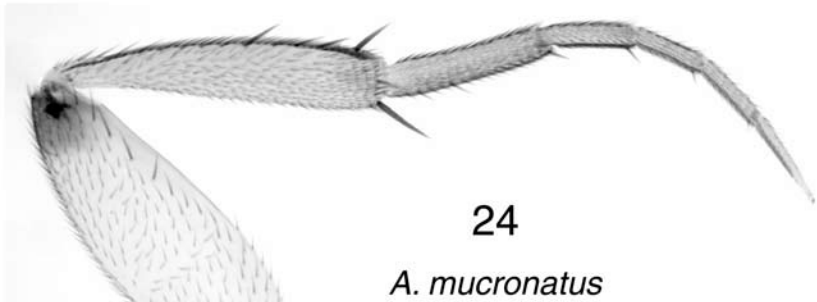
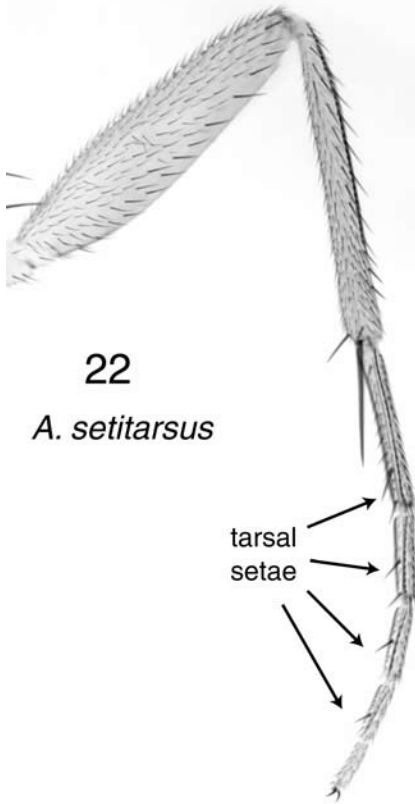
A. exlobicornis

21

A. longisetarum

Figs. 20-21. Legs. 20, foreleg. 21, hind leg.

Way of life. This species was collected over nests of *Camponotus rufipes* (Fabricius). A hole was intentionally made in the nest, and a couple of minutes later the ants rushed out in a defensive behavior. Flies appeared and started pursuing individual ants. They flew close to, and eventually landed on the



Figs. 22-24. Legs. 22, midleg. 23, foreleg. 24, hind leg.

gaster for several seconds, where they oviposited.

Material examined: ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, over *Camponotus rufipes*, 1 female, 20 January 2006, 4 females, 28 April 2006, L. Elizalde (4 females MBR, 1 female MZUC, 39-31).

Other *Apocephalus*

Apocephalus flavitenuipes new species

(Figs. 13, 15-16, 19, 23)

Apocephalus sp. 23, Elizalde 2009.

Species recognition. In the key of Borgmeier (1971) the female runs to couplet 28, lead 1, to *A. tenuipes* Borgmeier, but the latter, as a species of the *A. feeneri* group, has a much different oviscape with longer and fewer lateral setae. Also, *A. tenuipes* has flagellomere 1 brown.

Description. Female. Frons yellow. One pair of small supra-antennal setae present. Flagellomere 1 light yellow, round. Palpus yellow, small, with small, black, pointed setae. Dorsum of thorax and pleuron yellowish-brown. Legs light yellowish brown, hind femur dark not darkened. Tarsomere 5 elongate, narrowed (especially on foreleg; Fig. 23), tarsal claws reduced. Wing length 1.35-1.50 mm (n=5). Costa 0.38 wing length, range 0.37-0.39. Wing vein R₂₊₃ present. Halter yellow. Abdominal tergites yellowish-brown with darker line posteriorly, with short scattered setae; details of tergite 6 not visible. Venter of abdomen yellow, bare except for row of about eight large setae along posterior margin of segment 6 (Fig. 19), arranged in shallow V-shape, with apex pointing anteriorly. Oviscape (Fig. 13) short, triangular, without separate apical sclerite; laterally and posteriorly with numerous medium-sized setae. Stylet with unusual truncate anterior apex (Fig. 15), curled basally (Fig. 16); posteriorly with long pair of apical setae; ventral posterior apex much shorter than dorsal posterior apex.

Way of life. This species was collected over nest entrance holes of *Pheidole* sp. during the summer in San Cristóbal, when this ant species was foraging actively. Both male and female flies appeared in the nest entrance holes. The females oviposited quickly in the gaster of soldier ants.

Etymology. Named for its superficial similarity to *A. tenuipes*.

Holotype female, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S,

61.15°W, over *Pheidole* sp., 10 January 2006, L. Elizalde (MBR). Paratypes: 1 female, as holotype (MBR, PJE, MZUC, 39-28); 3 females, as holotype, except 11 January 2006; 1 female, as holotype except 4 February 2006 (female & 1 male, MZUC 39-29). 1 female, Formosa: Reserva Natural Formosa, 24.32°S, 61.80°W, over *Pheidole* sp., 30 September 2004, L. Elizalde (MZUC, 39-29).

Apocephalus mucronatus Borgmeier
(Fig. 24)

Species recognition. This species is easily recognized by the form of the oviscape (Borgmeier 1958: fig. 43) and the pointed tarsomere 5 in all legs (Fig. 24).

Way of life. This species was collected over nest entrance holes of *Camponotus blandus* (F. Smith). Two pairs were collected flying in copula. Females followed the larger workers of *C. blandus*, flying close to the gaster, where they oviposited quickly. The specimens collected over *Acromyrmex striatus* were only hovering and no oviposition attempts were observed. It was common that both ant species were nesting close together.

Material examined: 3 females, 3 males, ARGENTINA: Santa Fe: San Cristóbal, 30.21°S, 61.15°W, over *Camponotus blandus*, 6 November 2005, L. Elizalde (39-26-27); 1 female, same data except 9 January 2006; 1 female, hovering over *Acromyrmex striatus*, 22 January 2006, L. Elizalde (39-26) (MBR).

AMENDMENTS TO EXISTING KEYS TO *APOCEPHALUS* FEMALES

The addition of the new species above means that three sections of the key to the *A. attophilus*-group (Brown 1997) require rewriting as follows:

From couplet 5:

5. Apical sclerite with transverse group of setae (Fig. 5); venter of apical sclerite with convergent tufts of long setae (Fig. 6).....

.....*A. noetingerorum* new species

- Apical sclerite lacking transverse setae and ventrally bare..... 5A

5A. Apical sclerite relatively rounded in shape; long setae relatively few

- and bent at midlength (Brown 1997: fig. 8) *A. octonus* Brown
 - Apical sclerite parallel-sided; long setae more numerous and straight 5B
 5B. Long setae overreach tip of apical sclerite (Fig. 2)
 *A. penicillatus* **new species**
 - Long setae not reaching tip of apical sclerite 5C
 5C. Apical portion of oviscapae rounded (as in Fig. 2); long setae radiating
 *A. peniculatus* Borgmeier
 - Apical portion of oviscapae truncate (Fig. 1); long setae parallel 6
 6. Halter brown; apical sclerite shorter, length 2.8 times greatest width ..
 *A. intermedius* **new species**
 - Halter yellow; apical sclerite longer, length more than 3 times greatest
 width *A. rionegrensis* Borgmeier

From couplet 27:

27. Apical sclerite asymmetrical (Fig. 9, Brown 1997, fig. 44) 27A
 - Apical sclerite bilaterally symmetrical 28
 27A. Apical sclerite with thin process on right side (Brown 1997, fig. 44);
 hind tarsomeres without long setae *A. asymmetricus* Brown
 - Apical sclerite without thin process on right side (Fig. 9); hind tarsomeres
 with long setae (Fig. 21) *A. longisetarum* **new species**

From couplet 42:

42. Lateral darkenings of apical sclerite curved outwards at apex (Fig.
 10) *A. philhispidus* **new species**
 - Lateral darkenings not curved outwards at apex 42A
 42A. Foretarsomeres shortened (Fig. 20), such that length of tarsomere 1
 = 0.3 or less of foretibia; lateral darkenings relatively broad; apical sclerite
 relatively short, about one-half length of oviscapae 42B
 - Foretarsomeres longer (as in Fig. 23), such that length of tarsomere 1 =
 0.4 or more of foretibia; lateral darkenings relatively thin; apical sclerite
 relatively long, narrow, subequal to length of oviscapae (Brown 1997: figs.
 60-61) 42C
 42B. Lateral darkenings of apical sclerite apically tapered (Fig. 8)
 *A. exstriatus* **new species**

- Lateral darkenings of apical sclerite not tapered apically (Fig. 7).....
*A. exlobicornis* new species
 42C. Ovipositor with at least faint, “V”-shaped darkening (Brown 1997, fig. 60); apical sclerite straight in lateral view.....
*Apocephalus facis* Brown (in part)
 - Ovipositor with triangular-shaped sclerite and long anterior process only, without “V”-shaped darkening (Brown 1997, fig. 61); apical sclerite sinuate in lateral view.....*Apocephalus atrophilus* Borgmeier

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