PROC. ENTOMOL. SOC. WASH.
92(1), 1990, pp. 36–43

PHYLOGENETIC REVIEW OF THE *STIROPIUS* GROUP OF GENERA (HYMENOPTERA: BRACONIDAE, ROGADINAE) WITH DESCRIPTION OF A NEW NEOTROPICAL GENUS

JAMES B. WHITFIELD

Department of Biology, University of Missouri–St. Louis, St. Louis, Missouri 63121.

Abstract.—The four New World genera of the *Stiropius* group of rogadine braconid genera are discussed and a cladogram is presented along with supporting characters. The fourth genus, ***Choreborogas*** gen. n., is described with ***C. birostratus*** sp. n. as type-species. A second Neotropical representative of the genus, ***C. andeanus*** sp. n., is also described, to illustrate the range of variation found within the genus.

Key Words: Hymenoptera, Rogadinae, *Stiropius*, phylogeny, character analysis

The generic classification of the tribe Rogadini has long been in need of revision, especially for the non-Holarctic groups. The recent interest in the related tribes Exothecini (van Achterberg 1983; Belokobyl'skii 1984, Papp 1975) and Rhysipolini (Whitfield 1988b; Whitfield & van Achterberg 1987), as well as comparative biological studies of the three tribes (Shaw 1983), now make it possible to begin investigating the Rogadini in a clearer biological and phylogenetic context. This paper, along with Whitfield (1988a), treats the four genera of a moderate-sized group of relatively primitive Rogadini that are confined to the New World. Work is under way on eventually revising all of the species (almost entirely undescribed) of the four genera. The Neotropical faunas of three of the four genera are considerably larger and more abundant than had previously been suspected, probably because many of the species are tiny and nocturnally active.

MATERIALS AND METHODS

The following institutions and curators supplied specimens used in this study: American Entomological Institute, H. K. Townes (HKT); Canadian National Collection of Insects, Ottawa, M. J. Sharkey (CNC); Rijksmuseum van Natuurlijke Historie, Leiden, C. van Achterberg (RMNH); Texas A&M University, R. A. Wharton (TAMU); R. A. Wharton Collection (RAW); J. B. Whitfield Collection (JBW).

Morphological terminology follows that of Whitfield (1988a) and Whitfield & van Achterberg (1987), except for the use of the term metapostnotal-propodeal groove, which follows Whitfield et al. (1989). All drawings and measurements, with the exception of the wings, were made at 35× or 70× using an ocular micrometer scale and grid, along with squared paper. The wings were slide-mounted in Faure's medium and projected onto a wall and traced.

Phylogenetic analyses made use of the PAUP program (Swofford 1980) to find the shortest trees, and of the MACCLADE program (Maddison & Maddison 1987) to explore the consequences of alternative character polarities and codings.

MORPHOLOGY AND CHARACTER ANALYSIS

Ten characters were found especially useful as phylogenetic indicators at the generic

level. These are listed below along with discussion of the alternate states and of character polarities. A matrix of the genera and their character states is provided in Table 1.

1) *Malar (subocular) suture.* Most, indeed nearly all, genera of Rogadinae s.l. possess distinct malar sutures (state 0). Almost certainly the absence of this suture (state 1), as found in *Polystenidea* (Fig. 3) and *Aleiodes*, is derived.

2) *Malar space.* As with character 1, the putative ancestral state 0, a short malar space of half the eye height or less, is widespread, nearly universal, among Rogadinae *s.l.* There are other genera outside the *Stiropius*-group that have long malar spaces, but this feature is not necessarily correlated with loss of the malar suture. In *Polystenidea*, the malar space is long (state 1) but not produced into a rostrum; instead, it is swollen along with the postgenae.

3) *Vein 2Rs of fore wing.* In most Rogadinae that have a distinct 2Rs segment (delimited distally by 2r-m), 2Rs is at least as long as 2r, or nearly so (state 0). The exceptions, including *Artocella* van Achterberg, appear not to be closely related so I have treated them as independently derived conditions. In *Viridipyge* 2Rs is less than half as long as 2r (state 1) and often even reduced to nothing, such that the second cubital cell is triangular.

4) *Vein 2r-m of fore wing.* The presence of this vein (state 0) is ancestral for Rogadinae, indeed for all the cyclostome subfamilies and for the family as a whole. As pointed out by Mason (1981), the loss of this vein can often occur by different means, even among relatively closely related groups. Within the *Stiropius* group of genera, *Polystenidea* and *Choreborogas* have lost this cross-vein (state 1).

5) *Origin of vein r on pterostigma.* The apparent sister-group of Rogadini, the Rhysipolini (see Belokobyl'skii 1984 and Shaw 1983), as well as most Rogadini, have r arising near the midlength of a relatively broad stigma (state 0). The species of *Choreborogas* have r arising relatively proximally on the stigma (state 1), as the result of distal elongation of the stigma. This distal stigmal elongation occurs in some other Rogadinae s.l., e.g. Hormiini and some Exothecini, but is not universal in those groups and the genera concerned are not particularly closely related to Rogadini s.s.

Table 1. Character state matrix for the *Stiropius* group of genera. Characters are described using the same numbers in the text.

Taxa	Characters									
	1	2	3	4	5	6	7	8	9	10
Viridipyge	0	0	1	0	0	1	0	0	0	1
Choreborogas	0	0	0	1	1	1	1	1	0	0
Stiropius	0	0	0	0	0	0	0	1	1	0
Polystenidea	1	1	0	1	0	0	0	1	1	0

6) *Hind femora and tarsomeres.* The biological significance of these modifications is unclear. Generally speaking, the only rogadine genus outside the *Stiropius* group possessing similar leg modifications is *Yelicones* Cameron, which differs so strongly in metasomal structure and wing venation that I cannot think the resemblance is due to common inheritance of the feature. Virtually all species of *Viridipyge* and *Choreborogas* possess swollen hind femora and ultimate tarsomeres (state 1) to some degree, at least on the hind legs of the females.

7) *Posterior width of metasomal T1.* The articulation of T1 and T2 in Rogadini is typically along virtually the entire width of the anterior edge of T2, and T1 broadens posteriorly to meet this width (state 0). In *Choreborogas*, T1 does not broaden appreciably posteriorly, at least not to the extent that it articulates with the anterolateral corners of T2. The result (state 1) is that T2 has anterolateral 'shoulders' extending laterally beyond the edges of T1, giving the metasoma a petiolate appearance.

8) *Metasomal sternite plates.* In virtually all Rogadini s.s. and Rhysipolini s.s., the

metasomal sternites are relatively evenly sclerotized beyond S2 (state 0), although usually not rigid or heavily pigmented. In many Hormiini and some Exothecini, as well as in all of the *Stiropius* group except *Viridipyge*, the sternites (occasionally excepting some posterior ones) are largely desclerotized except for sublateral, pigmented plates (state 1), which usually bear a number of setae. I am forced to regard the medial desclerotization of the sternites in other tribes as independently derived (and in those groups it is accompanied as well by general desclerotization of large portions of the metasoma).

9) *Metasomal tergite IV.* In *Polystenidea* and *Stiropius*, T4 bears a subbasal semicircular groove or depression (state 1), into which, in some stances, the posterior margin of T3 fits. This feature appears to be virtually identical in the two genera and does not appear, to my knowledge, elsewhere. The usual situation is an even, sometimes sculptured, fourth tergite that is capable of being entirely telescoped under T3 (state 0).

10) *Hypopygium.* The usual condition in Rogadini is a short, truncate hypopygium (state 0), except in some of those very few species with long ovipositors. In *Viridipyge*, the hypopygium is more elongate and triangular, such that it projects posteriorly, often beyond the posterior extent of the metasomal dorsum (state 1).

Phylogeny and Classification

Figure 1 depicts the favored cladogram of *Stiropius*-group relationships. PAUP analyses using the ALL TREES option found several alternative possibilities of equal length, but which required unlikely polarities or favoring of weak shared character states (e.g. losses) at the expense of more convincing ones.

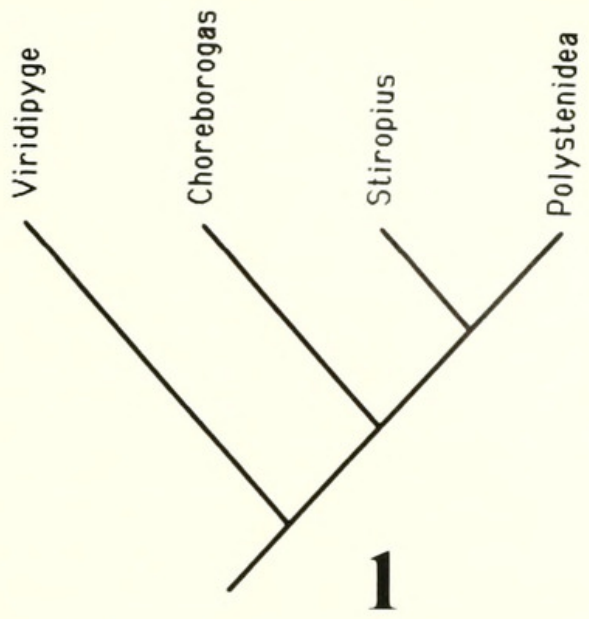
In this scheme, *Viridipyge* is the sister-group of the other three genera, which share the following synapomorphy: metasomal sternites 3–5 desclerotized medially, with sublateral pigmented plates. *Viridipyge* has two autapomorphies: the short 2Rs of the fore wing, and the large, triangular hypopygium. If this cladogram realistically depicts the relationships among the genera, then either a) the swollen hind femora and apical tarsomeres of *Viridipyge* and *Choreborogas* are ancestral for the entire group of genera, or b) they have been independently derived in these two genera.

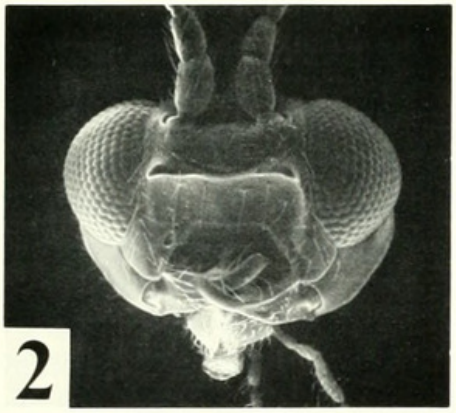
Choreborogas is then the sister-group of the remaining two genera, which share: metasomal tergite IV with subbasal semicircular groove. Two autapomorphies then characterize *Choreborogas*: T1 much narrower posteriorly than anterior edge of T2 (metasoma subpetiolate), and r arising relatively proximally on a distally elongate stigma. A realistic alternative set of relationships is *Choreborogas* + *Viridipyge* forming a sister group to the other two genera; I have considered the evidence for this alternative, the sharing of the swollen hind femora and tarsomeres, to be weaker than the shared sternite structure of *Choreborogas* + *Stiropius* + *Polystenidea*.

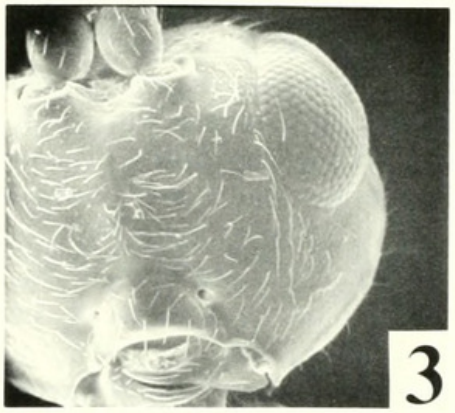
Polystenidea shares (apparently as the result of convergence) with *Choreborogas* the loss of cross-vein 2r-m of the fore wing. It also has two autapomorphies (additionally distinguishing it from *Stiropius*): the elongate malar space and the loss of the malar suture. It is possible that *Stiropius* is paraphyletic with respect to *Polystenidea*; Viereck (1912) noted the extreme similarity in metasomal structure. The addition of more characters to the analysis would help resolve whether the 2r-m loss in *Polystenidea* is an independent development or the cross-vein has been regained in *Stiropius*. As the two genera are amply distinguishable, I prefer not to combine them until the possible paraphyly of *Stiropius* is better established.

Key to the Genera of the *Stiropius* Group of Genera

1 Fore wing vein 2r-m present 2
– Fore wing vein 2r-m absent 3
2 2Rs of fore wing at most two-thirds as long as







Figs. 1–3. 1, Cladogram of *Stiropius* group of genera; 2, face of *C. birostratus*, ♀, anterior view; 3, face of *Polystenidea* sp., anterior view.

2r; hind femora and apical tarsomeres enlarged, swollen; second metasomal tergite at least 1.5× as broad posteriorly as anteriorly; hypopygium triangular in profile, protruding ..... *Viridipyge* Whitfield

– 2Rs of fore wing subequal in length with 2r, sometimes longer; hind femora and apical tarsomeres not enlarged; second metasomal tergite variable but seldom as much as 1.5× as broad posteriorly as anteriorly; hypopygium truncate, short ..... *Stiropius* Cameron

3 Malar suture present and distinct between compound eye and mandibular base (Fig. 2); malar space relatively short, less than half eye height; pterostigma of fore wing almost always elongate distally, so that r arises from stigma well before midlength (Figs. 4, 10); hind femora often swollen or otherwise modified (Fig. 5); metasomal tergite IV without semicircular subbasal groove or depression .. *Choreborogas*, new genus

– Malar suture absent, at least not apparent; malar space long, nearly equal to eye height (Fig. 3); r arising from stigma at about midlength; hind femora not modified or swollen, metasomal tergite IV with semicircular subbasal groove or depression ..... *Polystenidea* Viereck

Choreborogas, gen. n.

Type-species: Choreborogas birostratus, n. sp., described below.

Diagnosis.—This genus shares with the other three related genera the following

combination of features: antennae 13–14 segmented; reduced notauli, especially posteriorly; areolate propodeum; metasomal pseudo-carapace incorporating T1–T3 and, to a lesser extent, T4; ovipositor and sheaths short, partially exserted; gonobase of male subtriangular, nearly as long as broad. There are no really substantiated host records; I expect the hosts, as in the other three genera, are lyonetiid or related leafmining Lepidoptera, and that the wasps endoparasitically mummify the host larvae or prepupae.

Choreborogas differs from *Polystenidea* in lacking the semicircular, subbasal groove on the fourth metasomal tergite, in having an apically elongate pterostigma (as in *Chorebus*, hence the generic name), in having distinct malar or subocular sutures and in often having swollen hind femora and apical tarsomeres. It is also distinguished from *Stiropius* by all of the above differences except the subocular sutures, as well as by lacking vein 2r-m of the fore wing. Finally, it differs from *Viridipyge* in possessing sublateral, pigmented, more strongly sclerotized plates on metasomal sterna 2–5, in having the apically elongate pterostigma, and in lacking the vein 2r-m of the forewing.

Stiropius and *Viridipyge* will both key to *Bucculatriplex* in Marsh et al. 1987; *Polystenidea* and (sometimes with great difficulty) *Choreborogas* will key to *Polystenidea*.

Comments.—As far as is known, the species of *Choreborogas* are all predominantly Neotropical, with several of the species ranging into the southeastern U.S. and probably into parts of Arizona as well. They are quite abundant in some light trap samples from Central America, indicating that they are probably nocturnally active and often numerous. I have seen an estimated 20 species in collections. Two new species, the first being the type, are described below to illustrate the range of features found in this remarkable, yet essentially unknown, group of wasps.

***Choreborogas birostratus*, sp. n.**

Figs. 2, 4, 5, 6, 7

Female.—*Body length:* 1.4–2.1 mm, fore wing length 1.6–2.4 mm.

Head: Color orange-brown, often with darker brown regions around ocelli, facial carinae and occipital carina. Supraoral depression enlarged to include lower 0.3–0.5 of frons; clypeus embedded within this depression and flattened; depression marked dorsally and laterally by carina, which is produced submedially into two flattened pointed noselike projections. Mandibles enlarged and strongly overlapping when closed. Inner margins of eyes parallel to diverging ventrally. Malar space less than 0.3 eye height, with strong malar suture. Antennae 14-segmented, slightly shorter than body, with apical flagellomeres 3–4× as long as broad. Maxillary and labial palpi pale yellowish, slender. Hypostomal and occipital carinae remaining separate to mandibular bases. Ocelli roughly equidistant from each other.

Mesosoma: Entirely pale orange-brown (occasionally darker brown in generally darker specimens). Pronotum with shallow, narrow dorsal and ventral grooves, otherwise nearly smooth. Mesoscutum very finely granular, matte, with weak indentations indicating courses of notauli. Scutoscutellar scrobe composed of two transverse excavations, narrower medially and traversed medially by a thin ridge. Scutellar disc finely punctate, flat. Mesopleuron weakly granular, with shallow, sinuate logitudinal groove. Propodeum with narrow but distinct metapostnotal-propodeal groove, medial longitudinal carina over anterior 0.4–0.5, and posterior medial gothic-arch-shaped areola; costulae obsolescent or entirely absent.

Wings: C+Sc+R and stigma pale yellow-brown; stigma occasionally whitish in some specimens. Remainder of prominent venation evenly brownish. Fore wing (Fig. 4) with r originating in basal 0.3–0.4 of stigma,

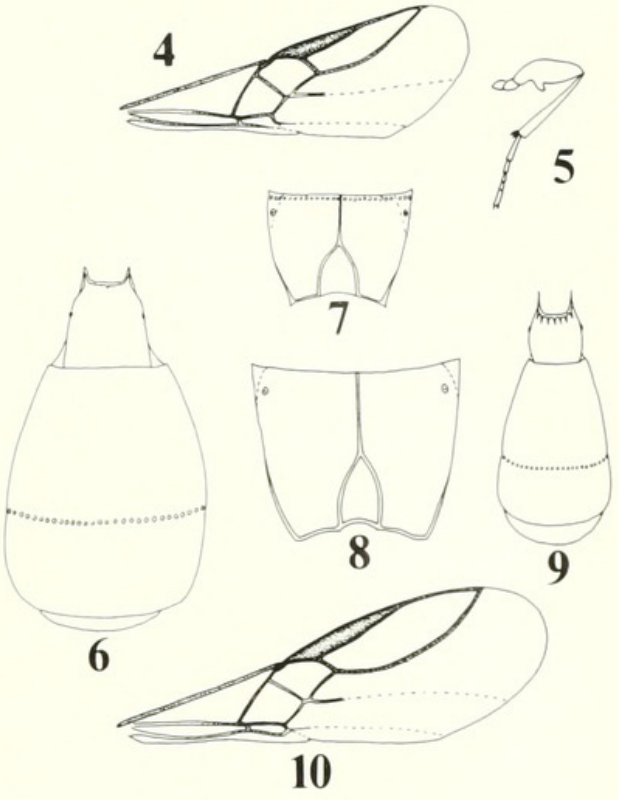
2r-m absent. Stigma 4× as long as broad. 3Rs meeting wing edge about 0.6 of distance between distal end of stigma and wing tip, just short of end of R1 (metacarp).

Legs: All legs pale yellow-brown with ultimate tarsomeres dark brown apically. Hind femora (Fig. 5) swollen, each with subbasal ventral toothlike projection. Hind tibiae armed with considerably longer setae than remainder of legs. Front and hind apical tarsomeres enlarged, about 2× as broad as preceding tarsomeres.

Metasoma (Fig. 6): T1, T2, anterior edge of T3 light orange-brown and mostly with granular sculpturing. T3 and T4 darker brown. Tergite 1 weakly broadening posteriorly, about 1.3× as long as posteriorly broad, with semicircular basal carina and longitudinal medial carina. T2 1.4× as broad posteriorly as long, 1.6× as broad posteriorly as anteriorly, separated from T3 by crenulate furrow. T2 1.5× as broad as T1 at junction with T1. T3 2× as broad as long, weakly rounded posteriorly and strongly overlapping T4. T4 much narrower than T3, anteriorly transversely striate, posteriorly granular. Hypopygium short, truncate, not projecting. Ovipositor and sheaths short, subexserted.

Males.—Essentially same size range as females but with some pronounced morphological differences: lower portion of frons not incorporated into large supraoral depression (thus facial carinae and projections are absent); mandibles not enlarged apically; stigma broader (3× as long as broad); hind femora less strongly swollen and without subbasal, ventral toothlike projection.

Material examined.—*Holotype* ♀: MEXICO: Guerrero, 17 mi. E. Tixtla, 11.vii.1985 (*Woolley, Zolnerowich*) (TAMU, deposited in USNM). *Paratypes*: MEXICO: Colima: 1 ♂, Parque Nac. de Volcan Colima, 8.2 mi. from Hwy. 54, 12.vii.1984 (*Woolley*) (TAMU). Guerrero: 3 ♀, same data as holotype; 1 ♀, 3 ♂, 6 mi. E. Xochipala, 13.vii.1985 (*Woolley, Zolnerowich*) (TAMU); 4 ♀, 3 ♂, 6.2 mi. SW Xochipala, 13.vii.1985 (*Woolley, Zolnerowich*) (TAMU); 1 ♂, 2 mi. E. Ocotito, 11.vii.1985 (*Woolley, Zolnerowich*) (TAMU); 1 ♀, 32 mi. SE Petatlan, 10.vii.1985 (*Woolley, Zolnerowich*) (TAMU). Michoacan: 1 ♀, 49 mi. SE Aguila, 13.vii.1984 (*Woolley, Zolnerowich*) (TAMU); 1 ♀, 28.5 mi. S. Nueva Italia, 9.vii.1985 (*Woolley, Zolnerowich*) (TAMU); 1 ♀, 10 mi. S. Uruapan, 7.vii.1985 (*Woolley, Zolnerowich*) (TAMU). Oaxaca: 1 ♀, 4.4 mi. NE San Pedro Mixtepec, 16.vii.1985 (*Woolley, Zolnerowich*) (TAMU). Tamaulipas: 2 ♀, 5 ♂, 5 mi. W. Gomez Farias, 20.iii.1986 (*Wharton*) (RAW, deposited in USNM).



Figs. 4–10. 4, Fore wing of *C. birostratus*, sp.n., ♀; 5, hind leg of *C. birostratus*, sp. n., ♀; 6, metasomal tergites of *C. birostratus*, sp. n., ♀; 7, propodeum of *C. birostratus*, sp. n., ♀; 8, propodeum of *C. andeanus*, sp. n., ♀; 9, metasomal tergites of *C. andeanus*, sp. n., ♀; 10, fore wing of *C. andeanus*, sp. n., ♀.

Comments.—This species is as remarkable for its pronounced sexual dimorphism

as for its unusual facial features. At least one other undescribed species from Central America shares a similar facial modification (along with even more extreme modifications of the hind legs), but many species are similar to *C. birostratus* males in both sexes. This species can be easily separated from the following one by the shape of the metasomal tergites (Fig. 6), the small size (usually less than 2 mm), the distally less elongate fore wings, as well as by the striking modifications of the face and hind femora in the females.

***Choreborogas andeanus*, sp. n.**
Figs. 8, 9, 10

Females.—*Body length:* 2.0–2.4 mm; fore wing length 2.7–3.1 mm.

Head: Entirely deep brown except light yellow-brown labrum, mandibles and palpi. Supaoral depression round, small; clypeus apically concave. Frons finely granular; inner margins of eyes parallel. Antennae 14-segmented, apical 5 flagellomeres more terete. Malar spaces about 0.3 eye height, with strong malar suture. Ocelli roughly equidistant from each other.

Mesosma: Mostly weakly punctate/granular dorsally, shinier laterally, entirely deep brown. Pronotum smooth, polished, with narrow, shallow dorsal and ventral grooves. Mesoscutum with no sign of notauli, evenly and finely punctate. Scutoscutellar scrobe composed of two broad rectangular excavations separated by a narrow ridge. Scutellar disc sculptured as mesoscutum, weakly convex, subtriangular. Mesopleuron highly polished, with very faint to absent longitudinal depression. Propodeum (Fig. 8) with narrow but distinct metapostnotal-propodeal groove, medial longitudinal carina over anterior 0.5–0.6, and horseshoe-shaped to narrower pointed medial areola posteriorly. Costulae absent.

Wings: Wings disproportionately large relative to body size. Venation entirely pale brownish. Fore wing (Fig. 10) with apically extremely elongate stigma (stigma 7× as long as broad), r arising in its proximal 0.2. 3Rs strongly curved, reaching wing margin approximately halfway between distal end of stigma and wing tip.

Legs: All legs pale yellow-brown with darker, strongly swollen ultimate tarsomeres. Hind femora swollen but otherwise unmodified, with sparse setae of average length.

Metasoma (Fig. 9): Tergite 1 finely punctate, 1.3× as long as posteriorly broad, weakly broadening to spiracle then parallel-sided, with semicircular carina anteriorly and obsolescent medial longitudinal carina. Tergite 2 finely granular, 1.5× as broad at T1/T2 junction as T1, slightly longer than apically broad, separated from T3 by shallow, crenulate groove. T3 smooth, polished, 1.9× as broad as long, with strongly rounded posterior margin. T4 and succeeding tergites smooth, more flexible, telescoped under T3. Hypopygium short, truncate, not projecting ventrally. Ovipositor and sheaths short, subexserted.

Males.—Essentially similar to females, but with slightly more parallel-sided T2 and relatively less transverse T3, which tends to have more (albeit weak) sculpturing as opposed to the smoother T3 in the female.

Material examined.—*Holotype* ♀: COLOMBIA: Putumayo, 2900 m, 1°10′N, 77°15′W, 2.xii.1972 (*Helava*) (CNC). *Paratypes:* 1 ♀, 6 ♂, same data as holotype; COLOMBIA: Antioquia, 1 ♀, 1800 m, 7°5′N, 76°30′W, (no date) (*Helava*) (CNC); Quindio, 1 ♀, 11 km E. Calarca, 7000′, 5.iii.1974 (*Peck & Peck*) (CNC). PERU: Amazonas, 1 ♂, 2800 m, 6°48′S, 77°38′W, 13.ii.1973 (*Helava*) (CNC).

Comments.—At first glance, the peculiar long-winged and polished appearance of this species makes it seem entirely unrelated to *C. birostratus*. In many structural features, however, the two species are quite similar, one or the other being more extreme in some respect. The peculiar appearance of both species is produced by exaggeration of tendencies found in most species of the genus

to some degree. It would be quite interesting to know what advantage, if any, the long wings of *C. andeanus* confer.

Acknowledgments

I would especially like to thank Michael J. Sharkey (Ottawa) and Robert A. Wharton (College Station) for repeatedly obtaining and sorting out numerous specimens belonging to the *Stiropius* group, especially from unsorted Neotropical collections. In addition, Kees van Achterberg (Leiden), Mark R. Shaw (Edinburgh) and Roy A. Shenefelt provided helpful and encouraging discussions on the systematics and biology of Rogadinae. Robert A. Wharton and Michael S. Arduser offered useful comments on an earlier draft of this paper. The early period of study of this group was supported by a fellowship awarded in 1985 by the North Atlantic Treaty Organization to the author.

Literature Cited

van Achterberg, C. 1983. Revisionary notes on the Palaearctic genera and species of the tribe Exothecini Foerster (Hymenoptera, Braconidae). Zool. Meded. 57: 339–355.

Belokobyl'skii, S. A. 1984. [On the division of the tribe Exothecini s.l. (Hymenoptera: Braconidae) in two with the description of a new genus and subgenus.] Zool. Zhurn. 63: 1019–1026. [In Russian, English summary.]

Maddison, W. P. and D. R. Maddison. 1987. MacClade, Version 2.1. A phylogenetics computer program distributed by the authors.

Marsh, P.M., S. R. Shaw, and R. A. Wharton. 1987. An identification manual for the North American genera of the family Braconidae (Hymenoptera). Mem. Entomol. Soc. Wash. 13. 98 pp.

Mason, W. R. M. 1981. The polyphyletic nature of *Apanteles* Foerster (Hymenoptera: Braconidae): A phylogeny and reclassification of Microgastrinae. Mem. Entomol. Soc. Canada 115. 147 pp.

Papp, J. 1975. Three new European species of *Colastes* Hal. with taxonomic remarks. Acta Zool. Acad. Sci. Hung. 21: 411–423.

Shaw, M. R. 1983. One evolution of endoparasitism: The biology of some genera of Rogadinae (Braconidae). Contrib. Amer. Entomol. Inst. 20: 307–328.

Swofford, D. L. 1980. PAUP—Phylogenetic Analysis Using Parsimony. Version 2.4.1. Computer program available from the author, Illinois Natural History Survey.

Viereck, H. L. 1912. Descriptions of one new family, eight new genera, and thirty-three new species of ichneumon-files. Proc. U.S. Nat. Mus. 43: 575–593.

Whitfield, J. B. 1988a. Revision of the Nearctic species of the genus *Stiropius* Cameron (= *Bucculatriplex* auct.) with the description of a new related genus (Hymenoptera: Braconidae). Syst. Entomol. 13: 373–385.

———. 1988b. Taxonomic notes on Rhyssalini and Rhysipolini (Hymenoptera: Braconidae) with first Nearctic records of three genera. Proc. Entomol. Soc. Wash. 90: 471–473.

Whitfield, J. B. and van Achterberg, C. 1987. Clarification of the taxonomic status of the genera *Cantharoctonus* Viereck, *Noserus* Foerster and *Pseudavga* Tobias (Hymenoptera: Braconidae). Syst. Entomol. 12: 509–518.

Whitfield, J. B., Johnson, N. F., and Hamerski, M. R. 1989. Identity and phylogenetic significance of the metapostnotum in the non-aculeate Hymenoptera. Ann. Entomol. Soc. Amer. 82. (In press.)