THE GENUS RHOPALOSYRPHUS (DIPTERA: SYRPHIDAE)

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ABSTRACT

The flower fly genus Rhopalosyrphus Giglio-Tos (Diptera: Syrphidae) is revised. The genus is redescribed; a key to species is presented; the phylogenetic relationships of the genus and species are hypothesized; the included species are described; with new species, R. ramulorum Weems & Deyrup, described from Florida (type) and Mexico; R. australis Thompson from Brazil and Paraguay (type); and the critical characters are illustrated.

Key Words: taxonomy, identification key, neotropics, nearctic

RESUMEN

El género de la mosca de la flor del género, Rhopalosyrphus, (DIPTERA: Syrphidae) es revisada y es redescrita; se presenta una clave para las especies; la relación filogeográfica del género y las especies es formulada; las especies incluidas son descritas; con las nuevas especies, R. ramulorum Weems & Deyrup, descrita de Florida (tipo) y México; R. australis Thompson de Brasil y Paraguay (tipo); y los caracteres críticos son ilustrados.

Translation provided by author.

Rhopalosyrphus Giglio-Tos is a small group of microdentine flower flies restricted to the New World subtropics and tropics, ranging from southern United States to northern Argentina. These flies are rarely collected, only some two dozen specimens are known. The adults mimic eumenine vespids, such as Zethus, which nest in twigs (Bohart & Stange 1965). The immature stages are known for only one species. These were found in ant nests (Pseudomyrmex) in twigs and grass culms, where the larvae probably prey on ant brood. The genus contains only three species. One wide ranging species, R. guentherii, is found from southwestern United States to northern Argentina. The others are more restricted in their ranges; R. ramulorum, presently known from a few specimens from Florida and Mexico, and R. australis from southeastern Brazil, Peru and Paraguay. The genus is here revised, with complete synonymies, descriptions, and distributional and biological data given for all taxa. Adult terminology follows Thompson (1999), larval terminology follows Hartley (1961) and Rotheray (1991).

GENUS RHOPALOSYRPHUS GIGLIO-TOS

Rhopalosyrphus Giglio-Tos 1891: 3. Type species, Holmbergia guentherii Lynch Arribalzaga (subsequent monotypy, Giglio-Tos 1892a: 2). Williston 1892: 78 (catalog citation, descriptive note); Giglio-Tos 1892b: 34 [journal (1893: 130) (description); Aldrich 1905: 347 (catalog citation); Kertész 1910: 360 (catalog citation); Hull 1949: 312, figs (description, figures of habitus, head, abdomen, hind leg); Capelle 1956 (review, key); Cole & Schlinger 1969: 307 (descriptive notes); Thompson et al. 1976: 60 (catalog citation); Vockeroth & Thompson 1987: 729 (key reference).


Head: face convex, produced anteroventrally, pilose; gena small, linear, pilose; frontal prominence absent, antenna inserted above middle of head; frons short, about ¾ as long as face, as wide as face (♂) or slightly narrowed dorsally (♀), pilose; vertex broad, about 3 times as long as frons, as wide as frons, not swollen, pilose and punctuate; ocellar triangle small, equilateral, well separated from eye margins; occiput broad on dorsal Vr, eye bare, dichoptic in male. Antenna elongate, longer than face; scape and basoflagellomere elongate, at least 4 times as long as pedicel; scape about 6 times as long as broad; clypeus bare, inserted basolaterally on mesal surface, about as long as scape.

Thorax: longer than broad; pronotum pilose; meso-anepisternum with anterior portion not differentiated, uniformly pilose; meso-katepisternum completely pilose; meso-anepimeron with anterior portion bare; meropleuron with barrette...
pilose; metasternum developed, pilose (although reduced in some species); scutum punctate, with appressed pile; metatibia expanded apically; scutellum with or without small apical calcar, without distinct ventral pile fringe. Wing: brown on anterior 1/3, extensively microtrichious; marginal cell broadly open; stigmatic crossvein present; vein M1 with apical portion straight, joining vein R4+5 perpendicularly; vein M2 present or absent; vein R4+5 with spur.

Abdomen: petiolate; 1st segment short; 2nd segment as broad as thorax basally, but constricted, cylindrical apically; 3rd segment cylindrical; 4th and 5th segments forming a compact club; aedeagus bifid.

Puparium: elongate with broader ventral than dorsal surface; marginal band of variously-sized setae; dorsal surface flat; ventral surface convex; marginal band notched anteriorly; prothorax and mesothorax hidden beneath metathorax; mandible with serrate ventral margin.

Rhopalosyrphus belongs to the subfamily Microdoninae and is the sister group of Ceriомicrodon Hull, together these taxa are the sister group of Microdon Meigen, sensu lato. Rhopalosyrphus is defined (synapomorphy) by its 1) abdominal structure and 2) pilose metepisternum. Other diagnostic characters are 3) antenna elongate, longer than face, usually about twice as long; 4) scape and basal flagellomere elongate; 5) face produced ventrally; 6) occiput greatly developed on dorsal 1/3; 7) metasternum developed, not reduced; and 8) metasternum flared apically. The relationship to Microdon, sensu lato is unresolved: Rhopalosyrphus shares with the Microdon clade the bifid aedeagus and appears closely related to Ceriомicrodon. Ceriомicrodon shares characters 3, 4, 5, 6, 7, 8 and its abdominal shape could be considered derived from that of Rhopalosyrphus. The two differ only by the presence of pile on the metepisternum.

Microdon auricinctus, described by Sack (1921: 138) in Rhopalosyrphus, belongs to the Pseudomyrmex group of Microdon. The species of this group differ from Rhopalosyrphus in the characters listed above and in having the vertex swollen and shiny.

Based on puparial characters, the immature stages of Rhopalosyrphus closely resemble Microdon. They both have the anterior end consisting of the metathorax, with the prothorax and mesothorax hidden beneath it, a marginal band of setae which surrounds the puparium except for a notch at the anterior end, sharply-pointed antennomaxillary organs and mandibles with a serrated ventral margin.

The very distinctive shape of the puparium of Rhopalosyrphus separates it from that of Microdon: it has a curved ventral surface that is broader than the narrow, flat dorsal surface. Also, the whole structure is elongate rather than oval in outline. The reverse appears in Microdon, with the dorsal surface being broader and curved and the ventral surface narrower and flat. These differences in shape suit the larva to life in hollow twigs and grass culms in which its prey, larvae and pupae of the ant, Pseudomyrmex, live.

**KEY TO SPECIES OF RHOPALOSYRPHUS**

1. 3rd tergum short, about 1/3 as long as 2nd; 2nd tergum elongate (Fig. 9); eye with an area of enlarged ommatidia medially and posterior to antenna

   3rd tergum elongate, as long as 2nd; 2nd tergum not greatly elongate posteriorly (Fig. 10); eye without enlarged ommatidia

2. Alula completely microtrichose; cell R extensively microtrichose, bare only on basoposterior 1/4 or less; metasternum appearing bare, with pile greatly reduced; face and anepisternum partially black pilose

   Alula bare basomedially; cell R completely bare behind spurious vein; metasternum with long, distinct pile, not reduced; face and anepisternum entirely white pilose

**Rhopalosyrphus guentherii** Lynch Arribalzaga

Figs. 10-13

Holmbergia guentherii Lynch Arribalzaga 1981: 198, Figs. 3 (habitus) Argentina, Buenos Aires (T ? MACN lost?). Giglio-Tozzi 1892a: 2 (notes), 1893: 131 [sep. 35], pl. 1, Figs. 10, 10a-b (description, figures of abdomen, wing); Aldrich 1905: 347 (catalog citation); Kertész 1910: 360 (catalog citation); Pluke 1957: 36 (catalog citation); Capelle 1956: 172, Figs. 2 (description, synonymy, key reference, figure of head); Thompson et al. 1976: 60 (catalog citation).

**Rhopalosyrphus carolae** Capelle 1956: 174 A*


Wing length: 8.8 mm (♂)-10.5 mm (♀). Head: brownish black, yellowish white pilose; occiput grayish white pollinose on ventral 2/3, shiny dorsally; eye with ommatidia of more or less equal size; antenna brownish black except orange basal 1/3 of scape, about twice as long as face; antennal ratio 5: 1: 8.
Thorax: brownish black; pleuron silvery-white pilose; scutum brown pilose medially, silvery white pilose anteriorly, along transverse suture, laterally and posteriorly; scutellum silvery white pilose; calypter white, with brown margin and fringe; halter orange; wing brown anteriorly, hyaline posteriorly, microtrichose except bare cell R & BM, anterobasal 1/2 of cell CuP and basomedially on alula; legs reddish brown except yellow basal 1/2 of metafemur; pro- and mesofemora black pilose anteriorly, yellow pilose posteriorly; pro- and mesotibia yellow pilose; tarsi black pilose; metafemur black pilose with a few yellow pili intermixed; metatibia yellow pilose basally, black pilose apically.

Abdomen: brownish black except yellow basal 1/3 of 3rd tergum and reddish apically on 2nd tergum; 1st tergum white pilose; 2nd tergum constricted on apical 1/3, yellowish white pilose; 3rd tergum about twice as broad apically as basally, yellow pilose; 4th tergum brown pilose basomedially 2/3, yellow-white pilose apically, about as long as 2nd tergum; 5th tergum yellowish-white pilose.

Distribution: Texas (Cameron, Harris, Hidalgo, Kenedy and Kleberg counties); Arizona (Chiapas, Colima, Michoacan, Morelos); Guatemala, Costa Rica, Peru, Brazil, Paraguay, Argentina (Lynch Arribalzaga).


GUATEMALA: Alta Vera Paz, Trece Aguas, “Cacao,” XI-1965, “GPCol” (1 ♂ USNM), MEXICO: [label just examined and are representative of the widespread taxa (new synonym)].

Rhopalosyrphus australis Thompson, new species

Wing length: 10 mm (♂) - 11 mm (♀). Head: Face reddish to brownish black (except holotype broadly yellowish dorsolateral), always black medially, white pilose except for a few black pili ventrally; gena small, linear, white pilose; frons and vertex black, white pilose; occiput reddish brown, white pollinose and pilose on ventral 1/3, shiny
Thorax: brownish black; pleuron white pilose; mesonotum punctate, very short appressed pilose, white pilose in males, more extensively black pilose medially in females; metasternum with short, appressed pile; calypter white, with brown margin and fringe; halter orange with brown head; wing brown anteriorly, hyaline posteriorly, microtrichose except bare cell R & BM, anterobasal 1/2 of cell CuP and basomedially on alula; legs reddish brown except yellow basal 2/3 of metatibia, pale pilose except black pilose dorso-medially on pro- and mesotibiae and tarsi, with dense black spinose pile on ventrolateral 2/3 of metafemur, with ventromedial appressed black spinose pile on basal 2/3 of metatibia.

Abdomen: black except yellow 3rd tergum and reddish apically on 2nd tergum, mainly short appressed white pilose, except black pilose medially on 4th tergum; 1st short, as long as 3rd; 2nd tergum half as long as entire abdomen, constricted and cylindrical on apical 2/3, as wide as thorax basally; 3rd tergum short, as long as 1st; 4th tergum oval, as long as 2nd, forming with 3rd a distinct club in ♀; 5th tergum elongate, about 1/2 as long as 2nd, forming with 3rd and 4th a distinct club in ♀.

Distribution: Peru, southern Brazil and Paraguay.

Holotype ♀: PARAGUAY, Villarica, I-1939, F. Schade, deposited in the American Museum of Natural History, New York. Paratypes: BRAZIL: Ceará, Russa, s., II-1940, D. C. Alves (1 ♀ USNM); Ceará, Limoeiro, X-1938, R. C. Shannon (1 ♀ USNM); Ceará, Luixeramobug, XI-1940, D. C. Alves (1 ♀ MZUSP); Minas Gerais, Belo Horizonte, 800 m, Estacao Ecologica, UFMG Campus, clear trail 60 m in from road, near swamp, Malaise trap, S. D. Gaimari, 25-29-V-1993 (1 ♀ USNM); Minas Gerais, Belo Horizonte, 800 m, Estacao Ecologica, UFMG Campus, clear trail 60 m in from road, near swamp, Malaise trap, S. D. Gaimari, 25-29-V-1993 (1 ♀ USNM ENT 00032860 USNM). PERU: Junín, Colonia Pernone, Rio Pernone, 184 miles NE La Merced, 3-1-1955, E. I. Schlinger & E. S. Ross (1 ♀ USNM ENT 00030699 CAS).

*Rhopalosyrphus austalis* is readily distinguished from the other two species of *Rhopalosyrphus* by its distinctive abdominal shape. The epithet, *austalis*, refers to the southern distribution of the species and is an adjective.

*Rhopalosyrphus ramulorum* Weems & Deyrup, new species

Figs. 1-8, 14

Wing length: 6 mm (♂) -7 mm (♀). Head: black; face silvery white pilose, with a few dark pili medially; frons sparsely white pilose, with a distinct bare fascia dorsally and separating off vertex; gena white pilose; vertex silvery white pilose, with a few dark pili medially; eye with ommatidia of more or less equal size; occiput white pilose on ventral 2/3, shiny dorsally; antenna brownish black except orange basal 1/3 of scape, about 1.5 times as long as face; antennal ratio 5:1:7 ♀: 4:1: 5 ♀.

Thorax: black, silvery white appressed pilose on pleuron except with some dark pili on anepisternum; scutum dark appressed pilose except silvery white pilose anteriorly, along transverse suture and anterior to scutellum; calypter white, with brown margin and fringe; halter yellow; legs dark brownish black, except yellow basal 1/3 of pro- and mesotibia and basal 2/3 of metatibia, black pilose except pale pilose on pale areas. Wing: extensively dark fumose, except paler on posterior 1/3, microtrichose except bare basal 1/3 of cell R.

Abdomen: black except very narrowly yellow basolaterally on 3rd tergum; 1st tergum black pilose laterally, white pilose medially; 2nd tergum constricted on apical 1/3, black pilose on basal 2/3, white apically; 3rd tergum about twice as broad apically as basally, black pilose on basal 1/2, yellowish white pilose apically; 4th tergum about as long as 2nd tergum, black pilose on basal 1/2 and extending to posterior 1/3 laterally, yellowish white pilose on apicomedial 1/2 and apicolaterally; 5th tergum yellowish white pilose.

Puparium: 7.5 mm, width 2.5 mm; semi-circular in cross-section with a ventral surface about twice as broad as dorsal surface; elongate, nearly 3 times as long as broad; antennomaxillary organs (extracted from puparium) sharply pointed; prothorax and mesothorax retracted into metathorax so that structures associated with mouthparts not visible; posterior margin of puparium consisting of metathorax; cephalopharyngeal skeleton (extracted from puparium, Fig. 14) similar to *Microdon* (Garrett et al. 1990); mandible blade-like, with serrated ventral margin, with rounded tip; abdominal segments with 5 dorsal (about marginal band of setae) groups of sensilla; each group with 2-3 terminal setae, 4 ventral groups which lack terminal setae, with some sensilla group on two separate papillae; marginal band composed of 2 types of papillae alternating with each other: larger papillae with 3 terminal sensilla group on two separate papillae; marginal band longer and packed close together on anterior and posterior ends of puparium; above these alternating bands of papillae 2 rows of short papillae, about as long as those bearing sensilla; marginal band interrupted only on anterior margin of metathorax; dorsal surface coated in small, dot-like papillae aggregated into vague reticulate pattern; ventral surface smooth, lacking setae and papillae; mid-dorsal region of abdominal segments 2-7 with 6 longitudinal rows of larger papillae, between outer 2 rows dot-like papillae densely ag-
Figs. 1-8. Puparium of *Rhopalosyrphus ramulorum*. 1-3, habitus, 1, dorsal, 2, lateral, 3, anterior. 4, anterior spiracular process, lateral. 5, 6, posterior respiratory process. 5, dorsal view and surrounding papillae, anterior end uppermost; 6, lateral view, anterior end to the left. 7-8. Papillae from marginal band.

Aggregated creating impression of vague pair of vittae running along dorsal surface (Fig. 1). Posterior respiratory process (Fig. 6): 0.3 mm long, 0.2 mm high, oval, nodulate with mid-dorsal projection, surrounded by papillae, with 4 pairs of interspiracular setae and 3 pairs of spiracular openings (Fig. 5).

Distribution: USA (Florida) south to Mexico (Chiapas).

Rhopalosyrphus ramulorum is similar to guentheri, but is smaller, narrower, not as robust, and has much more extensive black pile on face, scutum and anepisternum. The metasternal pile is greatly reduced and closely appressed, so the metasternum appears bare at low magnifications.

Although many specimens of R. ramulorum have been collected, two of these are reared specimens and provide most of our insights into the natural history of the genus Rhopalosyrphus. When alive, the reared adults, like many other syrphids, bore a strong resemblance to stinging Hymenoptera. The wasp-like features of elongate antennae, narrow abdominal "petiole," pale bands and spots, and dark wings are enhanced by the wasp-like habit of holding the wings out from the body. The wings are also partially folded, so that they appear long and narrow. The general impression is of a very small individual of the twig-nesting cemenid genus Zethus.

One specimen was found in a nest of the ant Pseudomyrmex simplex in a small twig (hence the species epithet "ramulorum," the epithet to be treated as a noun in the genitive case) of Carya floridana in long unburned Florida scrub habitat. The adult emerged from its pupa the day after the twig was opened. A second specimen was in a nest of P. ejectus in a culm of Cladium jamaicen; the interior of the nest was opened. A second specimen was in a nest of C. jamaicen. The adult emerged from its pupa the day after the nest was opened. The nests of these two species of Pseudomyrmex are kept clean and free of debris and fungi, and it is probable that the fly larvae are not scavengers, but predators feeding on ant brood. This would fit well with the known larval habits of the closely related genus Microdon, (Duffield 1981; Garnett et al. 1985). This is apparently the only known example of a predatory inquiline attacking members of the large neotropical ant genus Pseudomyrmex, though there must be others, especially among the Eucharitidae. Pseudomyrmex species are less susceptible to inquilines than most ants because the nests are in plant cavities with access by only one or a few small, well-guarded holes, and the nests themselves are bare, with minimal edible detritus and no hiding places for inquilines.

The holes used by Pseudomyrmex simplex and P. ejectus are much too small to permit the adult fly to escape, and it seems probable that emergence from the puparium is delayed until the nest has been broken open. Since the term "strategy" has been used extensively in discussing Microdon (Duffield 1981), the problem of adult egress is a major flaw in the strategy of R. ramulorum. It may be, however, that there are ways an ovipositing female can increase the likelihood that her offspring will be freed. Small, dead, exposed twigs are more likely to get broken off than larger twigs in the interior of the tree crown. Culms on the edge of a tussock of sedge or grass are more likely to get broken off than culms in the interior. If there is some special site selection by the female, this may explain why only two pupae were found in a 10-year study of Florida ants, a study that involved opening hundreds of colonies of Pseudomyrmex.

This brings up the topic of apparent rarity of Rhopalosyrphus species, especially in Florida. At the Archbold Biological Station, two Townes traps running continuously for 3 years captured only one specimen. If the adults spend their time in the tops of trees or in extensive open marshes, this would explain why so few specimens appear in Malaise traps, which are usually set-up in understory flyways. If R. ramulorum is actually dependent on chance events to release the adults, actual populations would need to be quite high for the sexes to meet, even if there were a mechanism for adult aggregation, and even if some synchronous emergence were provided by wind storms. Whatever the actual abundance of Rhopalosyrphus species, the rarity of specimens in collections suggests that there could be additional undiscovered species, especially in the neotropics, where the fauna of arboreal ants is large.

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