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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 redescrito; se presenta una clave para las especies; la relación filogenética 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 microdontine 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 Gilgio-Tos 1891: 3. Type species, *Holmbergia guentherii* Lynch Arribálzaga (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).

Holmbergia Lynch Arribálzaga 1891: 195. Type species, *guentherii* Lynch Arribálzaga (monotypy). Synonymy by Giglio-Tos (1892a).

Head: face convex, produced anteroventrally, pilose; gena small, linear, pilose; frontal prominence absent, antenna inserted above middle of head; frons short, about ¼ 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 ⅓; 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; arista bare, inserted basolaterally on mesal surface, about as long as scape.

Thorax: longer than broad; postpronotum pilose; meso-anepisternum with anterior portion not differentiated, uniformly pilose; meso-katepisternum completely pilose; meso-anepimeron with posterior portion bare; meropleuron with barrette

pilose; metasternum developed, pilose (although reduced in some species); scutum punctuate, 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 Microdontinae and is the sister group of *Ceriomicrodon* 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 meropleuron. Other diagnostic characters are 3) antenna elongate, longer than face, usually about twice as long; 4) scape and basoflagellomere elongate; 5) face produced ventrally; 6) occiput greatly developed on dorsal 1/3; 7) metasternum developed, not reduced; and 8) metatibia flared apically. The relationship to *Microdon*, *sensu lato* is unresolved: *Rhopalosyrphus* shares with the *Microdon* clade the bifid aedeagus and appears closely related to *Ceriomicrodon*. *Ceriomicrodon* 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 meropleuron.

Microdon aurcinctus, described by Sack (1921: 138) in *Rhopalosyrphus*, belongs to the *Pseudomicrodon* 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 . . . . . *australis*

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

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 . . . . . *ramulorum*

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

Rhopalosyrphus guentherii Lynch Arribálzaga
Figs. 10-13

Holmbergia güntherii Lynch Arribálzaga 1891: 198, Fig. 3 (habitus) Argentina, Buenos Aires (T ♀ MACN lost?). Giglio-Tos 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); Fluke 1957: 36 (catalog citation); Capelle 1956: 172, Fig. 2 (description, synonymy, key reference, figure of head); Thompson et al. 1976: 60 (catalog citation).

Rhopalosyrphus carolae Capelle 1956: 174 A* ♂♀ Arizona, Huachuca Mts., Sunnyside Canyon (HT ♀ UKaL). Byers et al. 1962: 168 (HT UKaL); Wirth et al. 1965: 599 (catalog citation); Cole & Schlinger 1969: 307 (descr. note, distr. western N.A.); Thompson et al. 1976: 60. **NEW SYNONYM**

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 basomedial 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; Mexico (Chiapas, Colima, Michoacan, Morelos); Guatemala, Costa Rica, Peru, Brazil, Paraguay, Argentina (Lynch Arribálzaga).

Material examined: PARAGUAY: Colonia Nueva Italia, X-XI-1940, Pedro Willim (1 ♀ AMNH). BRAZIL: Amazonas: Parana do Xiboreninho, 03°15.S 60°00.W, mixed water, Canopy fogging project, TRS #60 Tray 392, 7-VIII-1979, Erwin, Adis & Montgomery (1 ♂ USNM ENT 00032864 USNM). PERU: Lambayeque, l km S Lambayeque, 24, 26-27-VII-1975, C. Parker & L. Stange (1 ♀ USNM ENT 0003863 FSCA). COSTA RICA: Alajuela, Cerro La Lana, San Ramón, 1200 m, LN 221750_481050, 17-I-1997, Betty Thompson, lot# 45327 (1 ♀ INBIOCRI002499628 INBIO); Guanacaste, Estación Exper. Enrique Jimenez Nuñex, 20 km SW Cañas, 5-17-XI-1991, Malaise Trap, A. S. Menke (1 ♀ USNM ENT 0003862 USNM); Puntarenas, Coto Brus. Sabalis, Estación El Progresso, Sector Fila Pizote, 1400 m, LS 317700_597800, 11-V-2001, M. Alfaro Libre, lot# 63200 (1 ♀ INB0003331118 INBIO). GUATEMALA: Alta Vera Paz, Trece Aguas, "Cacao," XI-1905, "GPColl" (1 ♂ USNM). MEXICO: [label just as "Mex."], (1 ♂ ANSP); Chiapas, Gutierrez, 20 miles S Tuxtla, 12-VIII-1963, F. D. Parker & L. A. Stange (1 ♂ USNM ENT 00032859 UCDavis); Colima, 6 km NE Tepames, 23-IX-Sept 1986, R. Miller & L. Stange (1 ♂ 1 ♀ USNM ENT 0003865-6 USNM, FSCA); Michoacan, Hidago, 12-VII-1963, F. D. Parker & L. A. Stange (1 ♀ USNM ENT 00032858 UCDavis); Morelos, 3 miles N Alpuyeka, 3400', 5-VI-1959, HE Evans (1 ♂ Cornell); …, Huajitlan, 27-IX-1957, R. & K. Dreisbach (1 ♀ USNM ENT 00032867 FSCA); Puebla, Chinantla, Sallé (1 ♀ UTOR). USA. ARIZONA: [Cochise/Santa Cruz Counties], Huachuca Mts, Sunnyside Canyon, 9-VII-1940, DE Hardy (allotype ♂, UKaL). TEXAS: Hidalgo Co: Pharr, 23-VI-1947 (1 ♀ USNM); La Joya, 19-III-1970, J, O'Grady (1 ♀ USNM), Rio Grande Park, 10 July 1981, A. Hook (1 ♀ USNM); … 12-VII-1981, A. Hook (1 ♀ USNM); McAllen, Valley Botanical Garden, 28-III-1975 (2 ♂ USNM ENT 0003868-9 FSCA), … 20-III-1976 (1 ♀ USNM ENT 0003870 FSCA), … 3-IV-1975 (1 ♀ USNM ENT 0003871 FSCA), … 5-IV-1975 (1 ♀ USNM ENT 003872 FSCA), … 2-IX-1975 (1 ♂ USNM ENT 0003873 FSCA); Relampago, 17-X-1986, FC Fee (1 ♂ 1 ♀ Fee) flying around flowering shrub, *Schinus* sp.; Santa Ana N.W.R., 17-X-1984 (1 ♀ Fee); Madero, 18-X-1995, FD Fee (1 ♂ Fee), 11-XI-1995, FD Fee (1 ♀ Fee) collected on flowers of composite shrub, *Gochnatia hypoleuca* DC. Kenedy Co.: 27°10.N 97°40.W, 8-X-1975, J.E. Gillaspy (1 ♂ USNM). Cameron Co.: Brownsville, Los Palamos Mgt Area, 17-X-1976, FD Fee (1 ♀ USNM, 2 ♂ Fee); Brownsville, VI, ("Cata 1439" Brooklyn Mus Coll 1929 (1 ♀ USNM); Brownsville, 23-X-1976, FD Fee (1 ♂ 2 ♀ Fee); Sabal Palm Grove Sanctuary, 9-X-1986, FD Fee (1 ♀ Fee), … 20-X-1986, FD Fee (4 ♂ 1 ♀ Fee), all individuals fly about, attracted to, or feeding on exudate from glands at base of leaves of sapling trees of *Ehretia anagua* (Teran & Berl.) I. M. Johson; … 27-III-1988 (1 ♂ Fee), 5-IV-1988 (1 ♂ Fee) flying about or attracted to flowers of *Zanthoxylum fagara* (L.) Sarg.; … 21-XI-1995, FD Fee (1 ♂ Fee). Harris Co.: Houston, 45 W Virginia Str., 28-VIII-1969, at black light trap, TJ Henry (1 ♂ USNM). Kleberg Co.: Kingsville, South Pasture, 26-IX-1976, at Baccharis, JE Gillaspy (1 ♂ USNM)

The traditional nomenclature and taxonomy of *Rhopalosyrphus* are maintained. Giglio-Tos established that there was a single widespread species, ranging from Mexico to Argentina, and that the appropriate name for that taxon was *Rhopalosyrphus guentherii*. The specimens studied support the single widespread taxon concept of Giglio-Tos. That the appropriate name for the taxon is *quentherii* is not as certain, as the holotype of *quentherii* has not been found and nothing mentioned in the original description will unequivocally allow the assignment of that name to either the widespread taxon or *australis*. The types of *Rhopalosyrphus carolae* Capelle were examined and are representative of the widespread taxon (**new synonym**).

Rhopalosyrphus australis Thompson, **new species**
Fig. 9

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

dorsally; eye with a medial fasciate area of enlarged ommatidia; antenna about 1.5 times as long as face, antennal ratio 5:1:10.

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 dorsomedially 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: Ceara, Russa, s., II-1940, D. C. Alves (1 ♀ USNM); Ceara, Limoeiro, X-1938, R. C. Shannon (1 ♂ USNM); Ceara, Luixeramobug, XI-1940, D. C. Alves (1 ♂ MZUSP); Minas Gerais, Belo Horizonte, 800 m, Estacao Ecológica, 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), … 15-18-VI-1993 (1 ♂ USNM ENT 00032860 USNM). PERU: Junin, Colonia Perene, Rio Perene, 18 miles NE La Merced, 3-I-1955, E. I. Schlinger & E. S. Ross (1 ♀ USNM ENT 00030699 CAS).

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

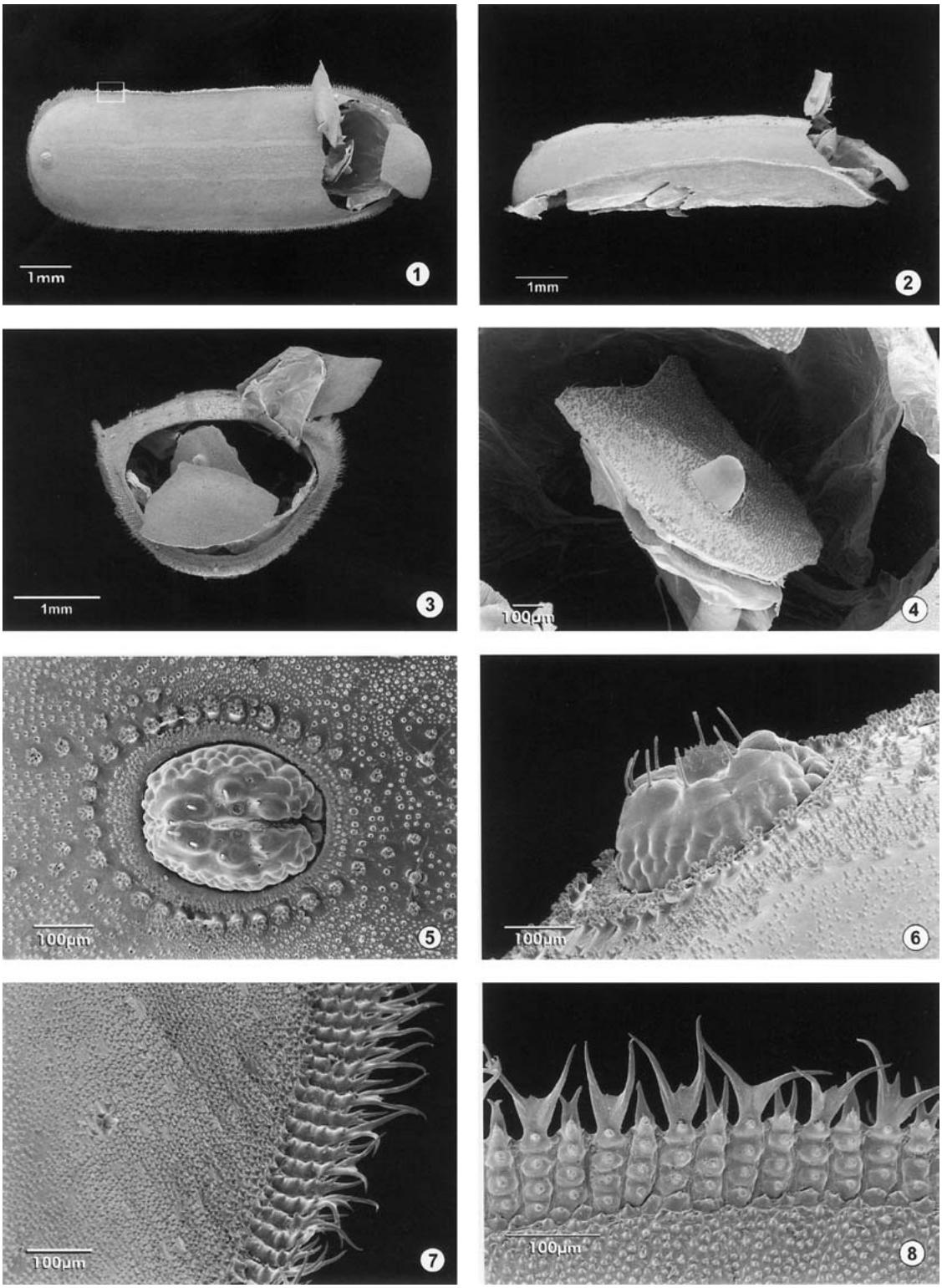
Rhopalosyrphus ramulorum Weems & Deyrup,
new species
Figs. 1-8, 14

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 ♀.

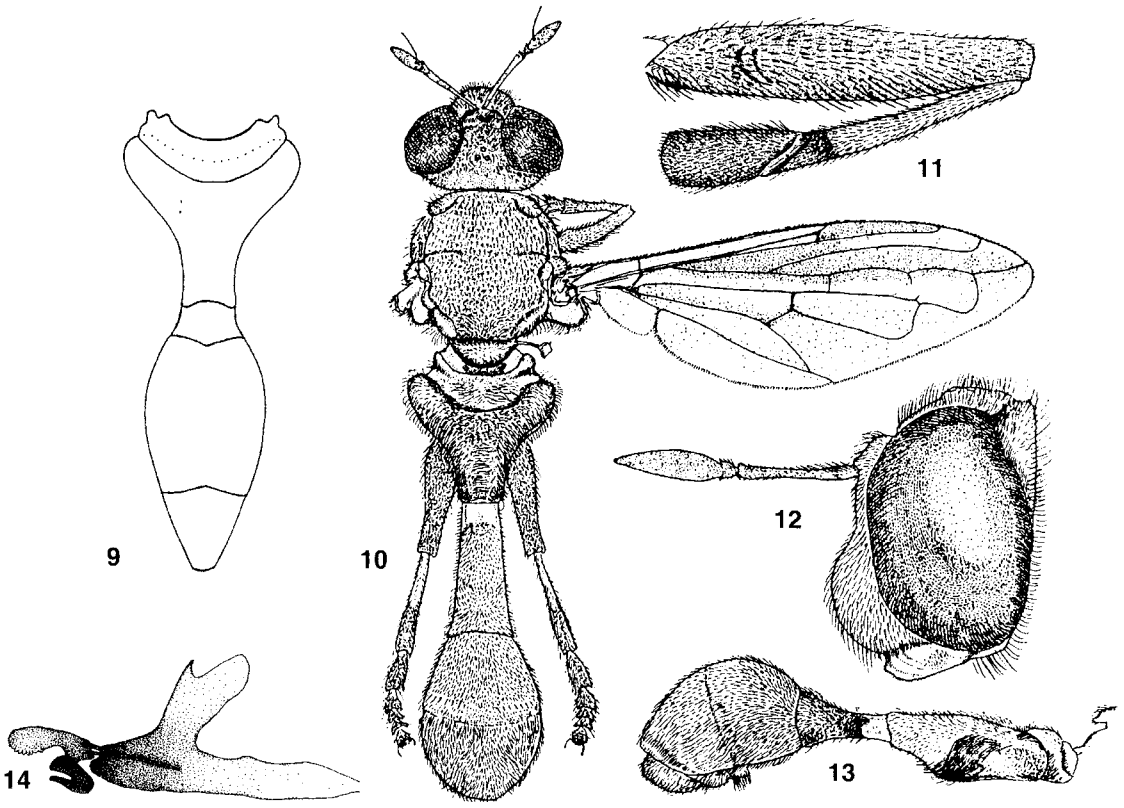
Thorax: black, silvery white appressed pilose on pleuron except with some dark pili on anepisternum; scutum dark appressed pilose except silvery white pilose anteriorly, along transverse suture and anterior to scutellum; calypter white, with brown margin and fringe; halter yellow; legs dark brownish 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; anterior margin of puparium consisting of metathorax; cephalopharyngeal skeleton (extracted from puparium, Fig. 14) similar to *Microdon* (Garnett 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 setae and smaller papillae with 2 terminal setae (Fig. 8); papillae comprising 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.



Figs. 9-14. Features of *Rhopalosyrphus*. 9, abdomen, *australis*, dorsal; 10. Habitus *guentherii*, dorsal; 11, hind leg, *guentherii*, lateral; 12. head, *guentherii*, lateral; 13. abdomen, *guentherii*, lateral; 14. cephalopharyngeal skeleton, *ramulorum*, lateral. Figures 10-13 from Hull (1949).

gregated 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).

Holotype ♂: USA: Florida, Highlands Co., Lake Placid, Archbold Biological Station, Trail 1 SSo, 22-V-1985, Malaise Trap, M. Deyrup, deposited in the National Museum of Natural History (USNM), Washington. Paratypes: USA. FLORIDA, same locality as holotype, 5-V-1986, reared from nest of *Pseudomyrmex simplex* in twig of *Carya floridana*, M. Deyrup (1 ♀ USNM); …, L. L. Lampert, Jr. & H. W. Weems, Jr., 8-IV-1978 (2 ♂ USNM ENT 0003891-2 FSCA); …, 11-IV-1978 (1 ♀ USNM ENT 0003893 FSCA); …, 18-III-1975, H. W. Weems, Jr. (1 ♂ USNM ENT 0003894 FSCA); …, 17-IX-1979, T. A. Webber & H. W. Weems, Jr. (1 ♀ USNM ENT 0003895 FSCA); F. E. Lohrer, H. W. Weems, Jr., 11-15-IV-1980 (1 ♀ USNM ENT 0003896 FSCA), …, 21-22-IV-1980 (1 ♂ USNM ENT 0003897 FSCA); …, 14-15-V-1980 (1 ♂ USNM ENT 0003898 FSCA); …, 18-20-V-1980 (1 ♂ USNM ENT 0003899 FSCA); …, Highlands Hammock State Park, 3-IV-1965, H. Weems, Jr. (1 ♀ USNM ENT 0003877 FSCA); …, 27-III-1966 (1 ♀ USNM ENT 0003878 FSCA); Collier County, SR94, 1.8 miles south of US 41, 25-II-1992, M. Deyrup & B. Ferster, reared from nest of *Pseudomyrmex ejectus* in culm of *Cladium jamaicense* (ABS); Liberty Co., Torreya State Park, 14-V-1964, H. Weems, Jr. (1 ♀ USNM ENT 0003875 FSCA); …, 30-IV-5-V-1973, C. R. Artaud & H. Weems, Jr., Malaise trap, (1 ♂, 4 ♀♀ USNM ENT 0003879-83 FSCA, USNM); Alachua Co., Gainesville, Beville Heights, L. A. Stange, Blacklight, 2-VII-1980 (2 ♀♀ USNM ENT 0003886-7 FSCA); …, 1-VII-1980 (1 ♀ USNM ENT 0003888 FSCA); …, 5-VII-1980 (1 ♂ USNM ENT 0003889 FSCA); …, 30-VII-1979 (1 ♀ USNM ENT 0003890 FSCA); Dade Co., Ross & Castello Hammock, 30-III-1963, C. F. Zeiger (1 ♂ USNM ENT 0003884 FSCA); …, Fuch's Hammock, near Homestead, 27-29-VII-1978, Terhune S. Dickel & H. Weems, Jr. (1 ♀ USNM ENT 0003885 FSCA); Chekika State Recreation Area, 10-XI-1982, FD Fee (1 ♂ Fee). MEXICO. Morelos, 3 miles N Alpuyeka, 3400', 5 June 1959, HE Evans, 14-V-

1959, Biol. Note 601 (1 ♂ USNM ENT 0003876 FSCA); Chiapas, 28 miles west Cintalpa, 9-IV-1962, F. D. Parker (1 ♂ USNM). Another broken ♂ specimen is in the Canadian National Collection and is labelled "Letitia, Colombia? (or Florida)." According to Vockeroth (pers. comm.) this specimen was found in a Malaise trap which had been used both in the Florida Keys and Colombia.

Rhopalosyrphus ramulorum is similar to *guentherii*, 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 eumenid 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 jamaicense*; this adult also emerged a 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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References Cited

ALDRICH, J. M. 1905 A catalogue of North American Diptera. Smithsn. Misc. Coll. 46(2), 680 p.

BOHART, R. M., AND L. A. STANGE. 1965. A revision of the genus *Zethus* Fabricius in the Western Hemisphere (Hymenoptera: Eumenidae). Univ. California Publ. Ent. 40, 208 p.

BYERS, G. W., F. BLANK, W. J. HANSON, D. F. BENEWAY, AND R. W. FREDRICHSON. 1962. Catalogue of the types in the Snow Entomological Museum. Part III (Diptera). Univ. Kansas Sci. Bull. 43: 131-181.

CAPELLE, K. J. 1956. The genus *Rhopalosyrphus*, with a description of a new species from Arizona (Diptera, Syrphidae). J. Kansas Ent. Soc. 29: 170-175.

COLE, F. R., AND E. I. SCHLINGER. 1969. The flies of Western North America. xii + 693 p. Berkeley & Los Angeles.

DUFFIELD, R. M. 1981. Biology of *Microdon fuscipennis* (Diptera: Syrphidae) with interpretation of the reproductive strategies of *Microdon* species found north of Mexico. Proc. Ent. Soc. Washington 83: 716-724.

FLUKE, C. L. 1957. Catalogue of the family Syrphidae in the Neotropical Region (Diptera). Revta Brasil. Entomol. 7: 1-181. [1957.06.20]

GARNETT, W. B., R. D. AKRE, AND R. S. ZACK. 1990. External morphology of four species of *Microdon* immatures (Diptera: Syrphidae) from the Pacific Northwest. Ann. Ent. Soc. America 83: 68-80.

GARNETT, W. B., R. D. AKRE, AND G. SEHLKE. 1985. Cocoon mimicry and predation by myrmecophilous Diptera (Diptera: Syrphidae). Florida Entomol. 68: 615-621.

GIGLIO-TOS, E. 1891. Diagnosi di quattro nuovi generi di Ditteri. Boll. Mus. Zool. Anat. Comp. Univ. Torino 6 (108), 6 p.

GIGLIO-TOS, E. 1892a. Sui due generi Sirfidi *Rhopalosyrphus* ed *Omegasyrphus*. Boll. Mus. Zool. Anat. Comp. Univ. Torino 7 (l18), 3 p.

GIGLIO-TOS, E. 1892b. Ditteri del Messico. Parte I. Stratiomyidae—Syrphidae. 72 p., 1 pl. Also published in Mem. R. Accad. Sci. Torino 43 (Cl. Sci. Fis. Mat. Nat.): 99-168, 1 pl. 1893.

HARTLEY, J. C. 1961. A taxonomic account of the larvae of some British Syrphidae. Proc. Zool. Soc. London 136: 505-573.

HULL, F. M. 1949. The morphology and inter-relationship of the genera of syrphid flies, recent and fossil. Trans. Zool. Soc. London 26: 257-408, 25 figs.

KERTÉSZ, K. 1910. Catalogus dipterorum hucusque descriptorum. Vol. 7, 470 p. Lipsiae, Budapestini (=Leipzig, Budapest).

LYNCH ARRIBÁLZAGA, F. 1891. Dipterologia Argentina (Syrphidae). An. Soc. Cien. Argentina 32: 80-99; 118-131; 194-202; 247-256; 307-314.

ROTHERAY, G. E. 1991. Larval stages of 17 rare and poorly known British Hoverflies (Diptera: Syrphidae). J. Nat. Hist. 25: 945-969.

SACK, P. 1921. Dr. L. Zürcher's Dipteren-Ausbeute aus Paraguay: Syrphiden. Archiv Naturgesch. (abt. A) 87: 127-149.

THOMPSON, F. C. 1999. A key to the genera of the flower flies of the Neotropical Region with the description of two new genera and eight new species and a glossary of characters and terms used. Contr. American Entomol. Inst. 3: 321-378.

THOMPSON, F. C., J. R. VOCKEROTH, AND Y. S. SEDMAN. 1976. Family Syrphidae. Catalog. Dipt. Amer. S. United States 46, 195 p.

VOCKEROTH, J. R., AND F. C. THOMPSON. 1987. Family Syrphidae. Pp. 713-743. *In* J. F. McAlpine (ed.), Manual of Nearctic Diptera. Res. Br., Agric. Canada, Monogr. 28, v + pp. 675-1332.

WILLISTON, S. W. 1892. Fam. Syrphidae. Pp. 57-79 (February 1892). *In* F. D. Godman and O. Salvin (eds.), Biologia Centrali-Americana, or, contributions to the knowledge of the fauna and flora of Mexico and Central America. Zoologia. Diptera. Vol. III. Taylor & Francis, London.

WIRTH, W. W., Y. S. SEDMAN, AND H. V. WEEMS, JR. 1965. Family Syrphidae. Pp. 557-625. *In* A. Stone, C. W. Sabrosky, W. W. Wirth, R. H. Foote and J. R. Coulson (eds.), A catalog of the Diptera of America north of Mexico. U. S. Dept. Agric. Handbk 276, 1696 p.