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SYRPHIDAE (FLOWER FLIES) 53

F. Christian Thompson, Graham E. Rotheray, and Manuel A. Zumbado

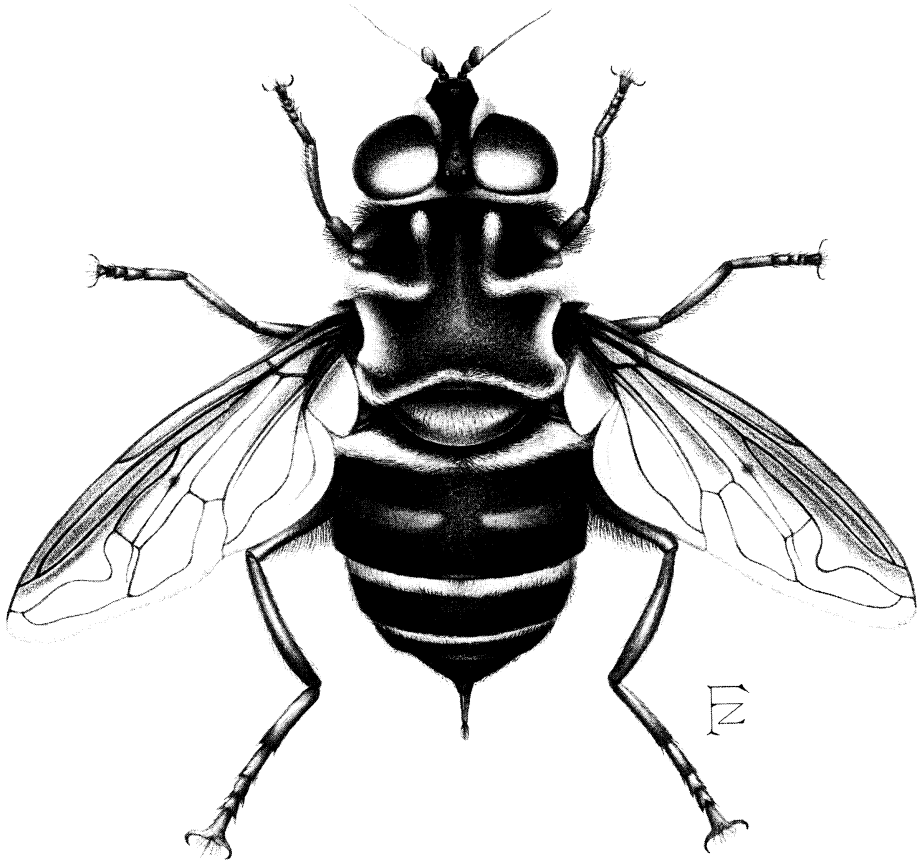


Fig. 53.1. Female of *Meromacrus loewi* Williston, (illustrated by F. Zeledón).

Diagnosis

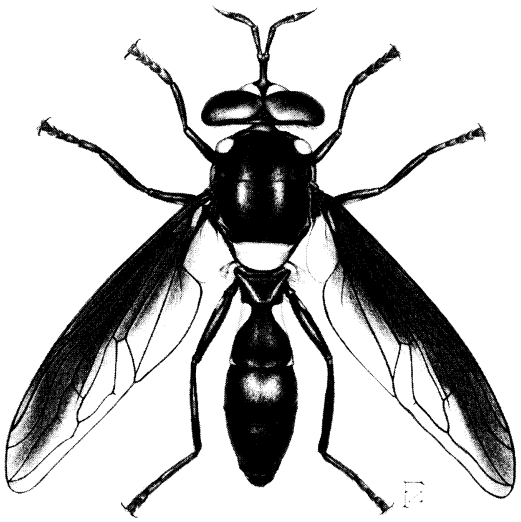
Small to large flies (body length 4–25 mm). Fully winged; usually with holoptic males (Figs. 2–3, 23–25, 27–28); females (Figs. 1, 26) and some males (Fig. 29) dichoptic; three ocelli present; antenna short to elongate, with distinct scape, pedicel, first flagellomere, and apical style (Figs. 2, 5–6) or dorsal to subbasal arista (Figs. 1, 3–4, 7–29); without head bristles, rarely with bristles on thorax (*Cheilosia*, *Copestylum*, and *Ornidia*); plumula (fringed posteroventral extension of subalar sclerite) short to long, rarely absent. Wing with large basal cells r, bm, and cu*p*; with closed apical cell (cell r_{4+5}) (Figs. 43–53); spurious vein often present between radial and medial fields (Fig. 51); calypter usually well developed. Abdomen slender or petiolate (Fig. 59, 60) to elongate (Fig. 55, 57) or oval (Fig. 58).

Larvae (third instar) (Figs. 62–72) and puparia (Fig. 73) recognized by combination of characters: anal segment bearing single, sclerotized breathing tube (except *Syrphus shorae* Fluke, in which the two tubes are separate); anus on anteroventral margin of anal segment, not separated from it by transverse integumental fold; dorsum of prothorax with longitudinal folds (inconspicuous in microdontines and some syrphines).

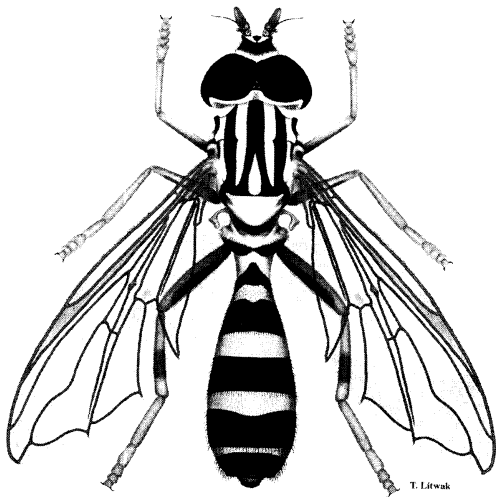
Four basic forms of larvae exist: (1) Microdontinae: mandibles at apex of head skeleton, bladelike with serrated ventral margins. Larva hemispheric, with distinct lateral fringe (Fig. 64). Mesothorax, prothorax, and mouthparts concealed in ventral pocket of metathorax, which consequently

forms anterior margin of larva. Anal segment and posterior respiratory process short. (2) Syrphinae: apex of head skeleton consists of elongated, thin, and tapered labrum and labium forming black sclerotized upper and lower rods; mandibles thin and styletlike and appear on each side of these rods. Anal segment and posterior respiratory process short. (3) Rhingiini and Merodontini: mandibles also at apex of head skeleton but hooklike in form and projecting from mouth. Anal segment and posterior respiratory process usually short. (4) Eristalinae, exclusive of Rhingiini and Merodontini: mandibles reduced and inconspicuous. With specialized potlike structure, formed from mandibles and their lobes. Anal segment usually elongate, extended, and partially retractile (Fig. 67). Prolegs with crochets (Figs. 67, 69), except in most eumerines and cheilosines and lacking in syrphines and microdontines.

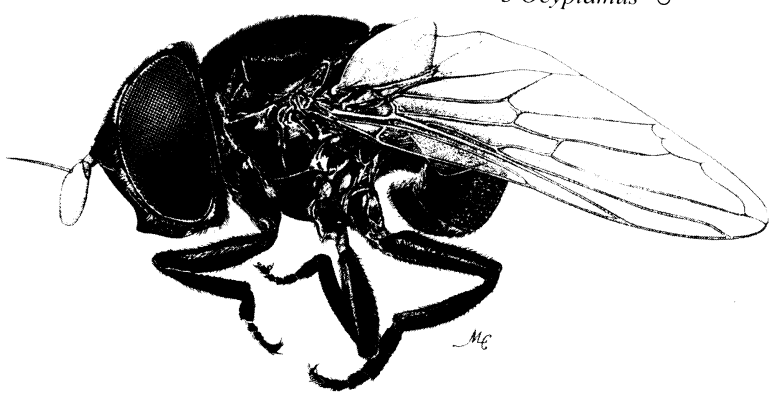
Syrphid flies are easily recognized by a combination of large basal cells (cells r, bm, and cu*p*) with a closed apical cell (cell r_{4+5}) (Fig. 51). A long spurious vein between the radial and medial sectors is a useful diagnostic character, but is not found in all species, and shorter spurious veins are found in some Conopidae.



2 *Ceriana* ♂



3 *Ocyptamus* ♂



4 *Cepa* ♀

Figs. 53.2–4. Habitus: dorsal view of (2) *Ceriana cacica* Walker and (3) *Ocyptamus* (*Mimocalla*) *tristani* Zumbado; lateral view of (4) *Cepa alex* Thompson (Thompson, 1999, fig. 12, as *Xela alex*). Figure 2 illustrated by F. Zeledón; Figure 3 illustrated by T. Litwak.

Biology

Most syrphid flies visit flowers, and many are pollinators, although the microdontines are only found in association with ant colonies. Males hover or rest near flowers and/or breeding sites awaiting females. Syrphid larvae have a wide range of niches. Saprophages occur in all types of wet environments, from tree sap to bromeliads, decaying plant parts, and specialized niches such as the refuse dumps of *Atta* leaf-cutter ants. Predatory species also vary in the niches occupied. Some live concealed in ant nests, attacking the early stages of ants or other myrmecophiles. Many syrphines live on plants, attacking colonial insects such as sternorrhynchous Hemiptera. Given this diversity, we have included in the synopsis below more specific information on the biology of each group.

Because of the diverse life histories of flower flies, they are of great importance. Adult flies are beneficial pollinators (Ssymank et al., 2009), some being used for greenhouse pollination of flowers and seed-producing plants. A number of the predaceous species are valuable biological control agents of plant pests on agricultural crops (Tenhumberg & Poehling, 1995), and phytophagous species have been used for weed control (*Cheilosia*). Some of the saprophagous species (*Palpada*, *Ornidia*) have been used to recycle wastes from coffee and orange juice production. In Europe, syrphids are used as ecological indicators to assess environmental quality (Sommaggio, 1999). A few species (of *Eumerus* and *Merodon*) are pests of ornamental flowers, and occasionally some species cause accidental myiasis.

Classification

Syrphidae are members of the cyclorrhaphan grade Aschiza and have long been considered to be the sister group to the Pipunculidae (e.g., Brauer, 1883; Hennig, 1948; Griffiths, 1972; McAlpine, 1989; Cumming et al., 1995). While some authors (Thompson, 1972) have split off the basal clades of Syrphidae, recognizing two separate families (Microdontidae, Syrphidae), the monophyletic status and contents of the Syrphidae sensu lato have remained unchanged since the group was first recognized by Latreille (1802).

There are 202 genera and 96 non-typic subgenera of Syrphidae currently recognized in the world, 60 of which occur in the Neotropical Region. The traditional view of the higher classification of flower flies based on adult data is recognition of three subfamilies, 13 tribes, and 12 subtribes (Thompson, 1972; Vockeroth, 1969). However, character evidence from the immature stages support a different view (Rotheray & Gilbert, 1999, 2008; Katzourakis et al., 2001), and new data from molecular sequences when used in a total evidence analysis strongly suggest that neither immature nor adult characters provide a complete picture of the relationships among the genera of flower flies (Ståhls et al., 2003; Mengual et al., 2008). Two clades (subfamilies Microdontinae and Syrphinae) are supported as monophyletic based on all evidence, but the Eristalinae is not. Hence, for pragmatic reasons, we follow the traditional classification here.

Identification

Thompson (1999) provided a key to genera for the Neotropical Region as a whole. The West Indian species were revised by Thompson (1981). Work on the Costa Rican fauna has stimulated revisions of many groups (see below) and will lead to a monograph of the Mesoamerican fauna. For other areas of the Neotropical Region, keys date back to the 1930s and 1940s; these works are noted in Thompson et al. (1976). The following adult key includes all genera known from Neotropical Mexico, the West Indies, and Central America. Most Central American syrphid larvae are unknown and have yet to be reared. Data on some genera are included in the larval key on the basis of material from other regions. This potential limitation on the utility of the key should be borne in mind when attempting to identify larvae. General information on syrphid larvae can be found in Rotheray (1993) and references therein. Figure 62 is a morphological map of a syrphid larva and gives the names and locations of the important features.

Note that the genus *Nothomicrodon* Wheeler, based on a single Panamanian species, *N. aztecarum* Wheeler (1924) (Fig. 75), is only known from larvae found in the carton nest of the ant *Azteca trigona* Emery. Although it was placed in family Syrphidae, we suspect it belongs elsewhere.

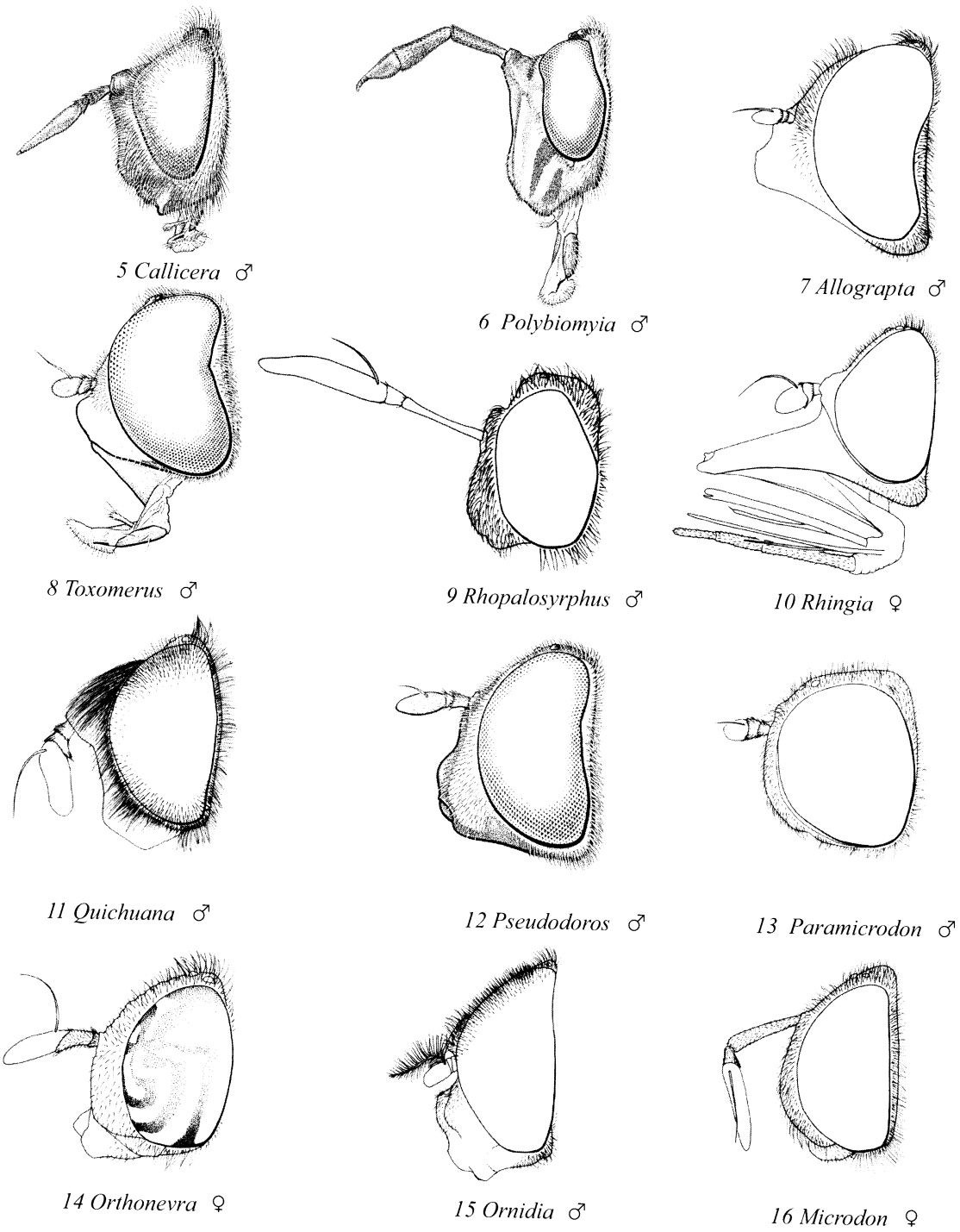
Key to the genera of Syrphidae of the northern Neotropical Region

1. Postpronotum pilose (Fig. 30); male abdomen with four unmodified pregenital segments; tergum 5 not visible in dorsal view 2

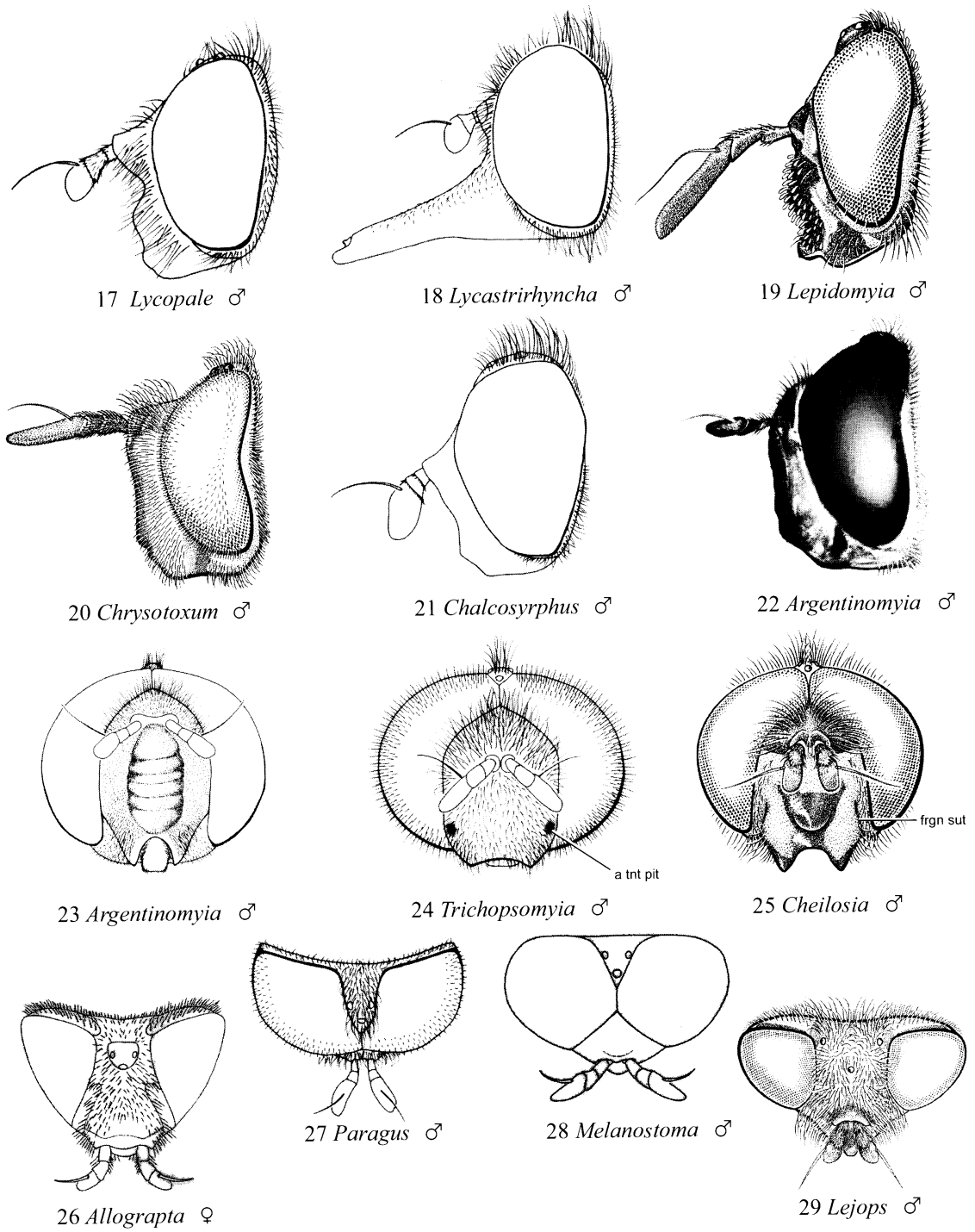
– Postpronotum bare, male abdomen with five unmodified pregenital segments; tergum 5 visible in dorsal view 63

2. Antenna with terminal style (Figs. 2, 5, 6) 3

– Antenna with subbasal dorsal arista (Figs. 4, 7–29) 7



Figs. 53.5–16. Heads: lateral view of (5) *Callicera erratica* (Walker), (Nearctic, MND, fig. 52.10), (6) *Polybiomyia townsendi* (Snow), (MND, fig. 52.12), (7) *Allograpta* (*Rhinoprosopa*) sp., (8) *Toxomerus geminatus* (Say), (Nearctic, MND, fig. 52.5), (9) *Rhopalosyrphus guentherii* (Lynch Arribalzaga), (10) *Rhingia nigra* Macquart, (11) *Quichuana angustiventris* Macquart, (12) *Pseudodoros clavatus* (Fabricius), (MND, fig. 52.6, mouthparts removed), (13) *Paramicrodon* sp., (14) *Orthonevra* sp., (15) *Ornidia obesa* (Fabricius), and (16) *Microdon* sp. Figures 7, 9–11, and 13–16 illustrated by D. Marques.



Figs. 53.17–29. Heads (*concluded*): lateral view of (17) *Lycopale chrysotaenia* Fluke, (18) *Lycastrirhyncha nitens* Bigot, (19) *Lepidomyia micheneri* (Fluke), (Nearctic, MND, fig. 52.14, mouthparts removed), (20) *Chrysotoxum derivatum* Walker, (Nearctic, MND, fig. 52.4, mouthparts removed), (21) *Chalcosyrphus* (*Neplas*) *schildi* Shannon, and (22) *Argentinomyia* sp.; frontal view of (23) *Ar. rugosonasus* Williston, (24) *Trichopsomyia* sp., and (25) *Cheilosia capillata* (Loew), (Nearctic, MND, fig. 52.35, mouthparts removed); dorsal view of (26) *Al. neotropica* Curran, (27) *Paragus* (*Pandasyophthalmus*) *haemorrhous* Meigen, (28) *Melanostoma* sp., and (29) *Lejops* (*Asemosyrphus*) *polygrammus* Loew, (MND, fig. 52.39). Figures 17, 18, 21, 23, 24, and 27 illustrated by D. Marques; Figure 22 illustrated by R. Vargas; Figures 26 and 28 illustrated by F. Zagonel.

Abbreviations: a tnt pit, anterior tentorial pit; frgn sut, frontogenal suture.

3. Eye pilose (Fig. 5); scutellum with ventral fringe; crossvein r-m basal to middle of cell dm ..... *Callicera* Panzer

– Eye bare; scutellum without ventral fringe; crossvein r-m apical to middle of cell dm 4

4. Frontal prominence absent or short, much shorter than scape (Fig. 6); postmetacoxal bridge complete or incomplete 5

– Frontal prominence elongate, at least as long as scape (Fig. 2); postmetacoxal bridge incomplete 6

5. Postmetacoxal bridge complete (Fig. 38). ..... *Polybiomyia* Shannon

– Postmetacoxal bridge incomplete, with membranous area posterodorsally to bases of hind coxae ..... *Sphiximorpha* Rondani

6. Abdomen petiolate. ..... *Monoceromyia* Shannon

– Abdomen elongate, only weakly constricted (Fig. 2) ..... *Ceriana* Rondani

7. Vein R_{4+5} strongly sinuate (Figs. 52–53); hind femur usually with basoventral patch of black setulae (Fig. 40) 8

– Vein R_{4+5} straight, not or only slightly sinuate (Figs. 45, 49); hind femur without basoventral patch of black setulae (Figs. 41–42) 18

8. Cell r_1 open (as in Fig. 53) 9

– Cell r_1 closed and petiolate (as in Fig. 52) 14

9. Arista plumose, with pile many times longer than basal diameter of arista (as in Fig. 15); vein R_{4+5} only slightly sinuate; hind femur without basoventral patch of setulae. ..... *Sericomyia* (*Arctophila*) Schiner, in part

– Arista bare; vein R_{4+5} strongly sinuate; hind femur with basoventral patch of black setulae (Fig. 40) 10

10. Eye pilose (as in Fig. 11) ..... *Quichuana* Knab

– Eye bare 11

11. Ocellar triangle extremely large; frons broad in both sexes (Fig. 29); scutum with pruinose vittae; male dichoptic ..... *Lejops* (*Asemosyrphus*) Bigot

– Ocellar triangle normal size, small; frons not broad; scutum usually not vittate; male dichoptic or holoptic. 12

12. Dark elongate flies; thorax and abdomen without distinct pale maculae or tomentose pile, with only short sparse pile; wing with anterior one-third dark; male broadly dichoptic ..... *Habromyia* Williston

– More brightly colored flies; thorax and abdomen with pale maculae and/or yellow tomentose pile; wing with or without dark anterior margin; male narrowly dichoptic or holoptic. 13

13. Frontoantennal region greatly produced anteriorly, subconical to conical (Fig. 17); scutum and frequently abdomen with distinctive pruinose patterns; hind femur not greatly swollen ..... *Lycopale* Hull

– Frontoantennal region not produced anteriorly; scutum and abdomen without distinctive pruinose patterns; hind femur greatly swollen ..... *Mallota* Meigen

14. Face drawn out into long slender porrect snout (Fig. 18) ..... *Lycastrirhyncha* Bigot

– Face not produced into snout 15

15. Katepimeron bare 16
– Katepimeron pilose (as in Fig. 30) 17

16. Eye bare; thorax usually with maculae of opaque tomentose pile . . . . . *Meromacrus* Rondani
– Eye pilose; thorax without tomentose pile . . . . . *Eristalis* (*Eoseristalis*) Kanervo

17. Meron and metepisternum with pile anterior to and/or ventral to metathoracic spiracle; eye usually without contrasting vittae or pile; wing with or without microtrichia . . . . . *Palpada* Macquart
– Meron and metepisternum without any pile near spiracle (as in Fig. 30); eye with contrasting vittae of light and dark colored pile; wing bare . . . . . *Eristalis* (*Eristalis*) Latreille

18. Arista plumose, with pile at least 3 times as long as basal diameter of arista (Fig. 15) 19
– Arista bare or pubescent, with pile not more than twice as long as basal diameter of arista (Figs. 16–22) 21

19. Eye bare; meron without pile anterior to metathoracic spiracle . . . . . *Sericomyia* (*Arctophila*) Schiner, in part
– Eye pilose; meron with patch of long pile anterior to metathoracic spiracle 20

20. Face with medial and two lateral tubercles (Fig. 15); posterior anepimeron pilose; notopleuron enlarged and produced posteriorly . . . . . *Ornidia* Lepeletier & Serville
– Face with only medial tubercle; posterior anepimeron bare; notopleuron normal, not produced . . . . . *Copestylum* Macquart

21. All femora with strong short ventral spinelike setae 22
– Femoral spinelike setae, if present, restricted to hind femur 23

22. Face with tubercle in both sexes (Fig. 19); antenna greatly elongate, with first flagellomere more than twice as long as broad, frequently with scape and pedicel elongate . . . . . *Lepidomyia* Loew
– Face with tubercle only in male; female with face concave; antenna short, with first flagellomere oval or subquadrate, less than twice as long as broad, with pedicel and scape not elongate . . . . . *Myolepta* Newman

23. Postmetacoxal bridge complete (Fig. 39) 24
– Postmetacoxal bridge incomplete, with membranous area ventroposterior to bases of hind coxae 43

24. Face bare, carinate; oral margin notched anteriorly; anterior tentorial pit elongate, not forming small round pit; vein R_{4+5} without appendix; hind femur swollen; scutum with two pairs of transverse yellow pruinose fasciae . . . . . *Sterphus* (*Ceriogaster*) Shannon
– Face pilose, straight or convex, not carinate; oral margin evenly rounded, usually not notched anteriorly; anterior tentorial pit small, round; vein R_{4+5} frequently with appendix into cell r_{4+5} (as in Fig. 46); hind femur and scutum various 25

25. Vein M_1 processive (strongly curved towards apex), directed outwardly and cell r_{4+5} with acute apex (Fig. 50); metasternum underdeveloped, bare . . . . . *Aristosyrphus* Curran
– Vein M_1 not processive, either straight or slightly recurrent and cell r_{4+5} with broader apex (Figs. 44, 46); metasternum various 26

26. Abdomen petiolate; metasternum underdeveloped, reduced to thin line, medially bare (Fig. 37) . . . . . *Mixogaster* Macquart
– Abdomen usually not petiolate, oval to elongate; if petiolate, then metasternum well developed, not reduced, and usually pilose (as in Fig. 36) 27

27. Anepimeron bare; antenna short, only about one-half as long as face; abdomen oval ..... *Paragodon* Thompson

– Anepimeron pilose; antenna usually long, usually longer than one-half as long as face; if shorter, then abdomen elongate, not oval 28

28. Antenna short, less than one-half as long as face; scape not more than twice as long as broad (Fig. 13); abdomen elongate, with parallel sides; vein R_{4+5} without appendix into cell r_{4+5} ..... *Paramicrodon* de Meijere

– Antenna long, more than one-half as long as face; scape much more than twice as long as broad (Figs. 9, 16); abdomen frequently oval or petiolate; vein R_{4+5} frequently with appendix into cell r_{4+5} 29

29. Katepimeron pilose; abdomen petiolate ..... *Rhopalosyrphus* Giglio-Tos

– Katepimeron bare; abdomen various; *Microdon* Meigen 30

30. Vein R_{4+5} without appendix; occiput uniform, as wide dorsally as ventrally; hind tibia narrow, with long hairs; abdomen elongate; small, pale orange to yellow flies ..... *Microdon* (*Rhoga)* Walker

– Vein R_{4+5} with appendix extending posteriorly into cell R_{4+5}; other characters various 31

31. Abdomen petiolate; second segment flattened, sometimes constricted or with large basolateral pale macula; third and fourth (males) and or fifth (females) forming club 32

– Abdomen oval or parallel sided 34

32. Metasternum pilose ..... *Microdon* (*abnormis* group)

– Metasternum bare 33

33. Vertex swollen, shiny, bare at least anteriorly; face convex, not produced ventrally; gena reduced, narrow, usually not visible in lateral view ..... *Microdon* (*Pseudomicrodon*) Hull

– Vertex not swollen nor shiny, pilose; face straight, produced ventrally; gena broad ..... *Microdon* (*diaphanus* group)

34. Hind tibia without hair brush along dorsal edge 35

– Hind tibia with long hair along dorsal edge, forming distinct brush of pile 40

35. Face with distinct mystax; scutellum deeply sulcate; large flies (26–28 mm) ..... *Microdon* (*Syrphipogon*) Hull

– Face without mystax; scutellum not deeply sulcate; smaller flies (under 20 mm) 36

36. Antenna inserted under large shelflike extension of frons; face bulging and prominent ventrally; head and thorax strongly punctate ..... *Microdon* (*Chrysidimyia*) Hull

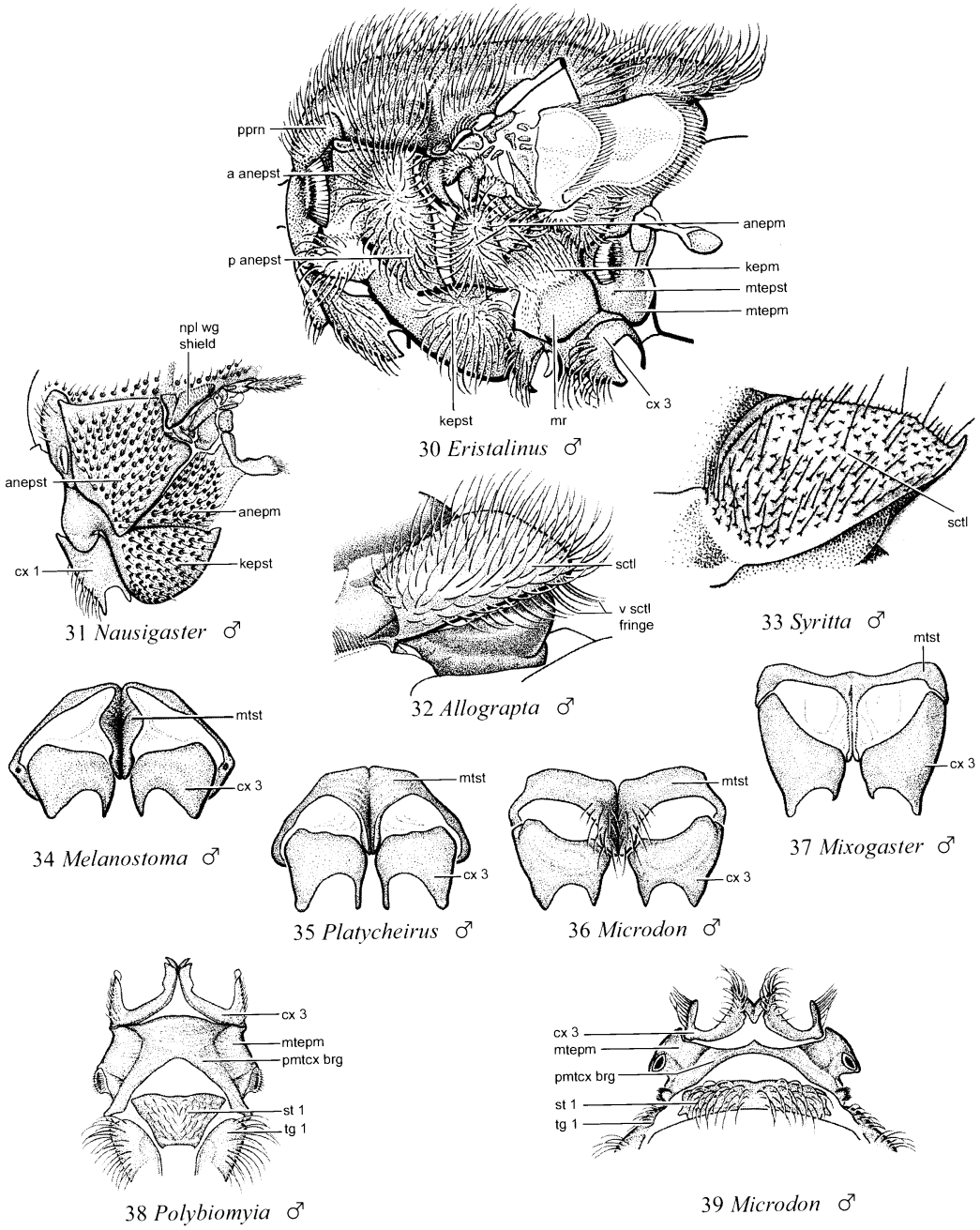
– Antenna not so inserted; face not bulging nor prominent ventrally; head and thorax not strongly punctate 37

37. Face carinate, medially swollen and laterally sunken; hind metatarsus enlarged, quadrate; abdomen oval, with terga and sterna overlapping; with fourth segment bent perpendicular to second ..... *Microdon* (*Ceratophya*) Wiedemann

– Face not carinate, evenly convex from eye to eye; abdomen oval or triangular; terga and sterna not overlapping; abdominal apex not perpendicular to base 38

38. Vein M_1 (apical crossvein) strongly recurrent on anterior one-third, usually with appendix; second abdominal segment with anterior margin rectangular; abdomen broadly triangular, broadest at base ..... *Microdon* (*Chymophila*) Macquart

– Vein M_1 rounded, not angulate, without appendix; second abdominal segment usually without rectangular anterior margin; abdomen various 39



Figs. 53.30–39. Thorax and thoracic structures: thoraces: lateral view of (30) *Eristalinus aenus* (Scopoli), (Holarctic, MND, fig. 52.64); anterior part of (31) *Nausigaster punctulata* Williston, (MND, fig. 52.74); lateral view of scutellum of (32) *Allograpta obliqua* (Say), (Nearctic, MND, fig. 52.63), and (33) *Syritta flaviventris* Macquart; ventral view of metasternum of (34) *Melanostoma mellinum* (Linnaeus), (Nearctic, MND, fig. 52.70), (35) *Platycheirus quadratus* (Say), (Nearctic, MND, fig. 52.71), (36) *Microdon piperi* Knab, (Nearctic, MND, fig. 52.73), and (37) *Mixogaster delongi* Hull, (Nearctic, MND, fig. 52.72); ventral view of postmetacoxal bridge of (38) *Polybiomyia townsendi* (Snow), (MND, fig. 52.81) and (39) *Mic. cothurnatus* Bigot, (Nearctic, MND, fig. 52.79). Figure 33 illustrated by F. Zagonel.

Abbreviations: a anepst, anterior anepisternum; anepm, anepimeron; anepst, anepisternum; cx, coxa; kepm, katepimeron; kepst, katepisternum; mr, meron; mtepm, metepimeron; mtepst, metepisternum; mtst, metasternum; npl wg shield, notopleural wing shield; p anepst, posterior anepisternum; pmtcx brg, postmetacoxal bridge; pprn, postpronotum; sctl, scutellum; st, sternite; tg, tergite; v sctl fringe, ventral scutellar fringe.

39. First two abdominal segments with three distinct depressions, two lateral and one anteromedial; abdomen more or less parallel sided; scutellum with apical calcar . . . . . *Microdon* (*Omegasyrphus*) Loew

– First two abdominal segments without such depressions; abdomen oval or triangular; scutellum with or without calcar. . . . . *Microdon* (*Microdon*) Meigen

40. Abdomen oval or rectangular, not triangular . . . . . *Microdon* (*Ubristes*) Walker

– Abdomen triangular, broad basally, strongly narrowed apically 41

41. Male first flagellomere furcate; female first flagellomere greatly elongate, about 2.5 times as long as scape; first tarsomere of midleg enlarged, quadrate; vertex greatly produced dorsally. . . . . *Microdon* (*Carreriamyia*) Doesburg

– First flagellomere not furcate, usually not greatly elongate, usually about twice as long as scape; first tarsomere of midleg not enlarged, elongate; vertex not greatly produced 42

42. Abdomen short, almost equilateral in shape . . . . . *Microdon* (*Hypselosyrphus*) Hull

– Abdomen much longer, not equilateral . . . . . *Microdon* (*Stipomorpha*) Hull

43. Vein M_1 recurrent or perpendicular; cell r_{4+5} with obtuse or rectangular apex (Figs. 47, 49) . . . 44

– Vein M_1 processive, directed apically; cell r_{4+5} with acute apex (Figs. 45, 50) 46

44. Eye bare, usually with metallic pattern (Fig. 14); first flagellomere elongate, at least twice as long as broad; antenna usually elongate. . . . . *Orthonevra* Macquart

– Eye sparsely or densely pilose, without pattern; first flagellomere orbicular or oval, less than twice as long as broad; antenna short 45

45. Crossvein r-m basal to middle of cell dm; vein M_1 once angulate (Fig. 49); propleuron bare; head fitting close to thorax, thus occiput reduced laterally to thin line, anterior thoracic spiracle hidden from lateral view and postpronotum greatly reduced . . . . . *Alipumilio* Shannon

– Crossvein r-m apical to middle of cell dm; vein M_1 twice angulate (Fig. 47); propleuron pilose; head not as above, occiput broad on dorsal one-third, anterior thoracic spiracle visible laterally and postpronotum normal; Old World, introduced elsewhere . . . . . [*Eumerus* Meigen]

46. Anepisternum uniformly raised, not differentiated into flattened anterior and convex posterior part (Fig. 31); antennal cavities broadly separated; scutum with large flaplike extension above wing base (notal wing shield); body densely punctate, with punctures large. . . . *Nausigaster* Williston

– Anepisternum clearly differentiated into flat anterior part and convex posterior part; antennal cavities usually confluent, rarely narrowly separated; notal wing shield absent; body usually not punctate; if punctate, then antennal cavities confluent. 47

47. Eye densely pilose (as in Fig. 24) 48

– Eye bare or nearly so, rarely with sparse short pile (as in Fig. 21) 50

48. Oral margin notched anteriorly; anterior tentorial pit elongate, not forming small pit (Fig. 25). . . . . *Cheilosia* Meigen, in part

– Oral margin evenly rounded, not notched anteriorly; anterior tentorial pit small, round (Fig. 24). 49

49. Anterior anepisternum pilose, with row of long erect pile posterior to mesothoracic spiracle; katepimeron pilose. . . . . *Trichopsomyia* Williston

– Anterior anepisternum bare; katepimeron bare; Nearctic Region, Chile. . . . . [*Pipiza* Meigen]

50. Face drawn out into long porrect snout (Fig. 10); costa and vein R_{4+5} ending well posterior to apex of wing ..... *Rhingia* Scopoli

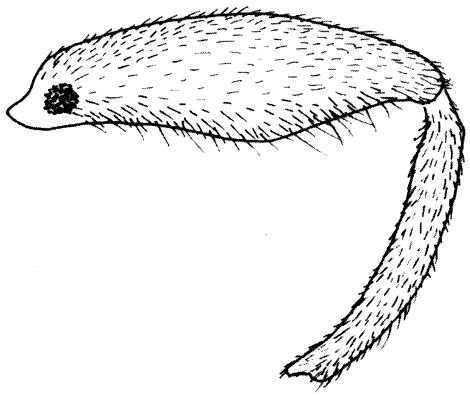
– Face not produced into snout; costa and vein R_{4+5} ending at or anterior to apex of wing 51

51. Antenna elongate, much longer than face; scape more than 3 times as long as broad ..... *Cacoceria* Hull

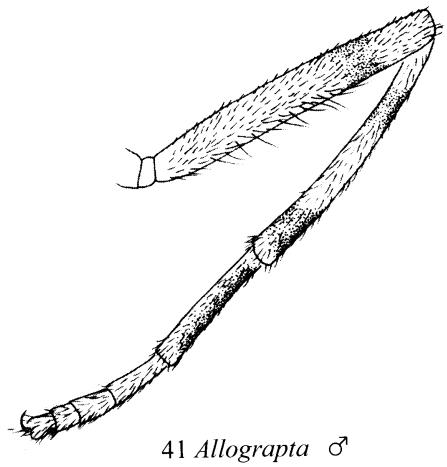
– Antenna short, only as long as or shorter than face; scape not more than twice as long as broad. 52

52. Metasternum reduced, difficult to see as mid- and hind legs are close together, pilose; face straight or slightly concave in profile; crossvein r-m basal to middle of cell dm and at level of end of vein sc; scutellum without bristles; abdomen oval, strongly recurved; small to medium-sized, compact, metallic flies (Fig. 4). ..... *Cepa* Thompson & Vockeroth

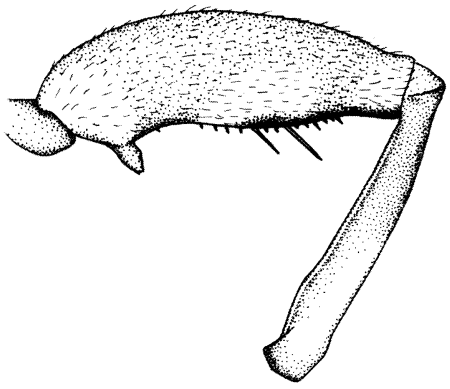
– Metasternum not reduced; other characters various, but not occurring all together in combination 53



40 *Palpada* ♂



41 *Allograpta* ♂



42 *Syritta* ♂

Figs. 53.40–42. Legs: lateral view of male hind leg of (40) *Palpada scutellaris* (Fabricius), (41) *Allograpta exotica* (Wiedemann), and (42) *Syritta flaviventris* Macquart. Figures 40–42 illustrated by D. Marques.

53. Metasternum bare 54
– Metasternum pilose, with pile as long as that on hind coxa 57

54. Face straight in profile, with distinct carinae, rarely with oral margin slightly produced . . . . . *Sterphus* (*Crepidomyia*) Shannon, in part
– Face either concave or tuberculate in profile, not straight 55

55. Face concave; wing not bicolored . . . . . *Xylota* Meigen
– Face tuberculate, usually with distinct tubercle, or carinate; wing bicolored or not 56

56. Abdomen oval, with second tergum wider than third tergum; male narrowly dichoptic, with eyes separated by aristal width only; crossvein r-m at midlength of cell dm; wing not bicolored, hyaline or uniformly gray . . . . . *Sterphus* (*Sterphus*) Philippi
– Abdomen petiolate, with third tergum about twice as wide as base of second tergum; male holoptic; crossvein r-m beyond middle of cell dm; wing bicolored, with anterior margin dark and posterior part hyaline . . . . . *Mutillimyia* Hull

57. Cell r_1 closed and petiolate (Fig. 45) . . . . . *Milesia* Latreille
– Cell r_1 open 58

58. Anterior anepisternum pilose; hind femur with single small ventroapical spine . . . . . *Spilomyia* Meigen
– Anterior anepisternum bare; hind femur without single small ventroapical spine (Fig. 42) 59

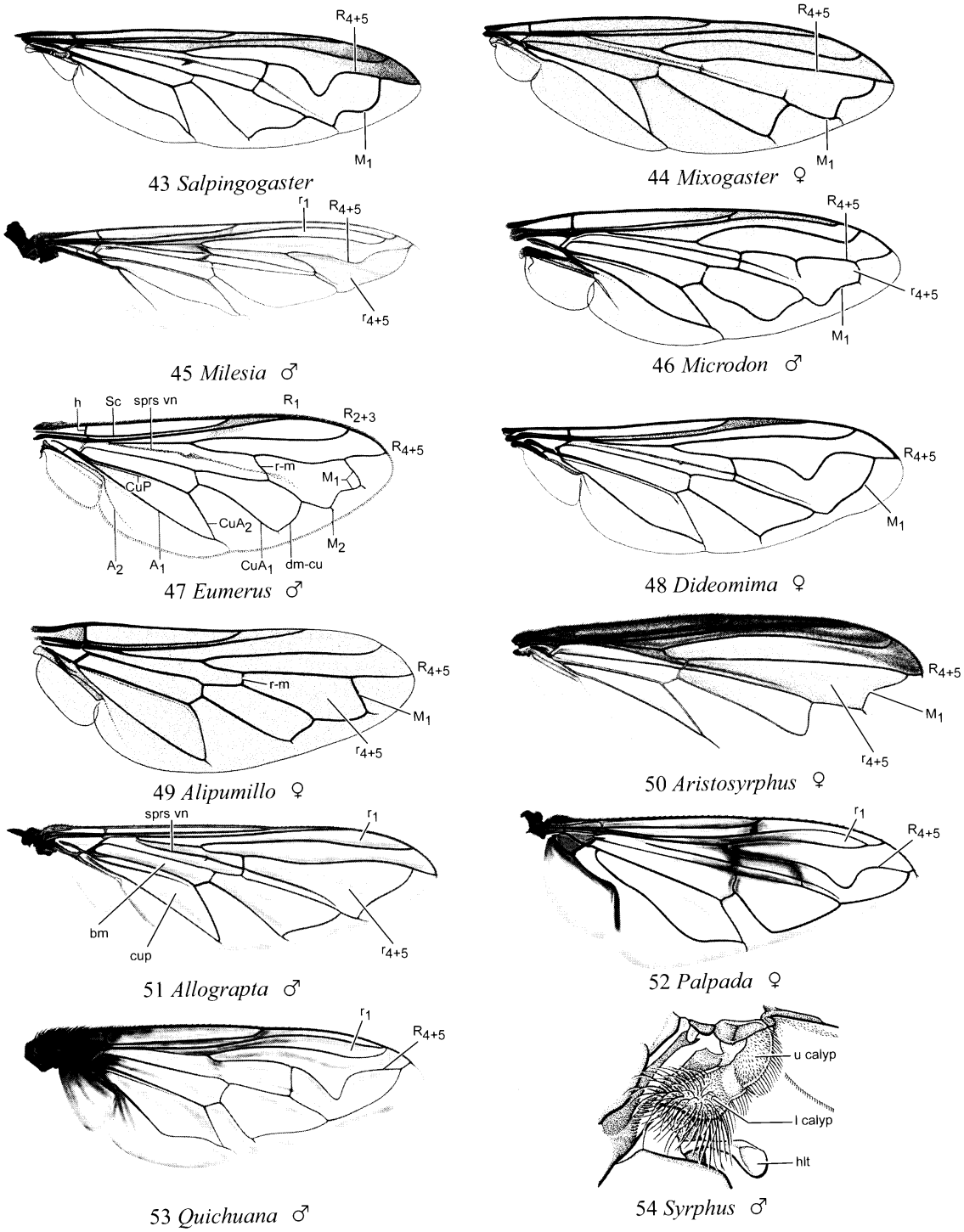
59. Scutellum without ventral fringe (Fig. 33); wing extensively bare, with microtrichia almost completely absent on basal two-thirds or more, sparse and scattered on apical one-third or less; metathoracic pleuron pilose, with some fine pile ventral to spiracle; Old World, introduced into North and South America . . . . . [*Syritta* Lepeletier & Serville]
– Scutellum with ventral pile fringe (as in Fig. 32); wing extensively microtrichose, apical one-half or more densely microtrichose, with only limited bare areas on basal one-third or less; metathoracic pleuron bare 60

60. Crossvein r-m basal, basal to middle of cell dm and at level of end vein sc; scutellum with marginal bristles; face distinctly tuberculate (Fig. 25); abdomen oval; medium-sized, black flies. . . . . *Cheilosia* Meigen (in part)
– Crossvein r-m medial to apical, at or beyond middle of cell dm and beyond level of end of vein sc; scutellum without bristles; other characters various 61

61. Face indistinctly tuberculate, not carinate nor concave; abdomen oval; large, robust bumble bee mimic, with long pilosity on body . . . . . *Criorhina* Meigen
– Face concave and subcarinate; abdomen elongate; small narrow flies, not bumble bee mimics, without long pilosity on body 62

62. First flagellomere oval, only as long as broad; face straight; posterior thoracic spiracle large, about as large as first flagellomere . . . . . *Sterphus* (*Crepidomyia*) Shannon, in part
– First flagellomere elongate, longer than broad; face slightly but distinctly concave in profile (Fig. 21); posterior thoracic spiracle small, much smaller than first flagellomere . . . . . *Chalcosyrphus* (*Neplas*) Porter

63. Anterior anepisternum usually with some distinct short pile posterodorsally; metathoracic pleuron usually with some long erect or subappressed pile ventral to spiracle; with pile on one of these two places (see Fig. 30) 64
– Anterior anepisternum bare; metathoracic pleuron bare (see Fig. 30 for reference) 66



Figs. 53.43–54. Wings and portion of thorax: dorsal view of wing of (43) *Salpingogaster nigra* Schiner, (44) *Mixogaster conopsoides* Macquart, (45) *Milesia pulchra* Williston, (46) *Microdon fulgens* Wiedemann, (47) *Eumerus strigatus* (Fallén), (Holarctic, MND, fig. 52.48), (48) *Dideomima* sp., (49) *Alipumilio femoratus* Shannon, (50) *Aristosyrphus* sp., (51) *Allograpta exotica* (Wiedemann), (52) *Palpada mexicana* (Macquart), (53) *Quichuana* sp., and lower calypter of (54) *Syrphus ribesii* Linnaeus, (Palearctic, MND, fig. 52.62). Figures 43, 44, 46, 48, and 49 illustrated by T. Litwak; Figures 45 and 50–53 illustrated by L. Donzo.

Abbreviations: hlt, halter; l calyp, lower calypter; sprs vn, spurious vein; u calyp, upper calypter.

64. Metasternum and/or eye pilose ..... *Ocyptamus* Macquart, in part

– Metasternum and eye bare 65

65. Eye on posterior margin with distinct triangular emargination at or dorsal to level of insertion of antenna; facial tubercle well developed, beginning immediately ventral to antennal bases and sometimes laterally compressed; face often produced anteriorly, sometimes strongly so (Fig. 8); abdomen usually oval, with at least weak premarginal sulcus, not strongly petiolate or long and thin; wing lacking dark markings; male genitalia with sclerotized, short to long triangular process arising from fused bacilliform sclerites and projecting caudad between bases of surstyli; phallus simple, unsegmented ..... *Toxomerus* Macquart

– Eye on posterior margin with emargination usually indistinct or shallow and rounded, if distinct and subtriangular, then situated ventral to level of antennal insertion; facial tubercle usually weak, not as described above, if distinct, then with strong concavity between it and antennal bases; face not produced anteriorly; abdomen usually petiolate, frequently long and thin, rarely parallel sided, not oval; wing frequently with dark markings; male genitalia without sclerotized process projecting between bases of surstyli, with at most weak semimembranous process in this position; phallus complex, segmented ..... *Ocyptamus* Macquart, in part

66. Face and scutellum black in ground color 67

– Face and/or scutellum partially pale in color, usually yellow or yellowish-brown in ground color 71

67. Abdomen petiolate, petiole much narrower than thorax (as in Figs. 59–60); face without tubercle, flat ..... *Leucopodella* Hull

– Abdomen oval (Fig. 58) or with parallel sides (Fig. 55), not narrower than thorax; face tuberculate 68

68. Antennal cavities confluent (as in Fig. 24); metathoracic pleuron with fine subappressed pile ventrad of spiracle; katepisternum with pile patches continuous anteriorly; face straight; hind coxa with pile tuft at posteromedial apical angle ..... *Xanthandrus* Verrall

– Antennal cavities separated (Fig. 23); metathoracic pleuron bare; katepisternum with pile patches usually broadly separated throughout; face and legs various 69

69. Metasternum greatly reduced, with deep posterior incision on each side so that median portion narrowly joined to lateral arms (Fig. 34); face not produced below, with small tubercle; facial pruinescence not punctate nor rippled; legs of male slender, without bristles, hair tufts, or modified hairs ..... *Melanostoma* Schiner

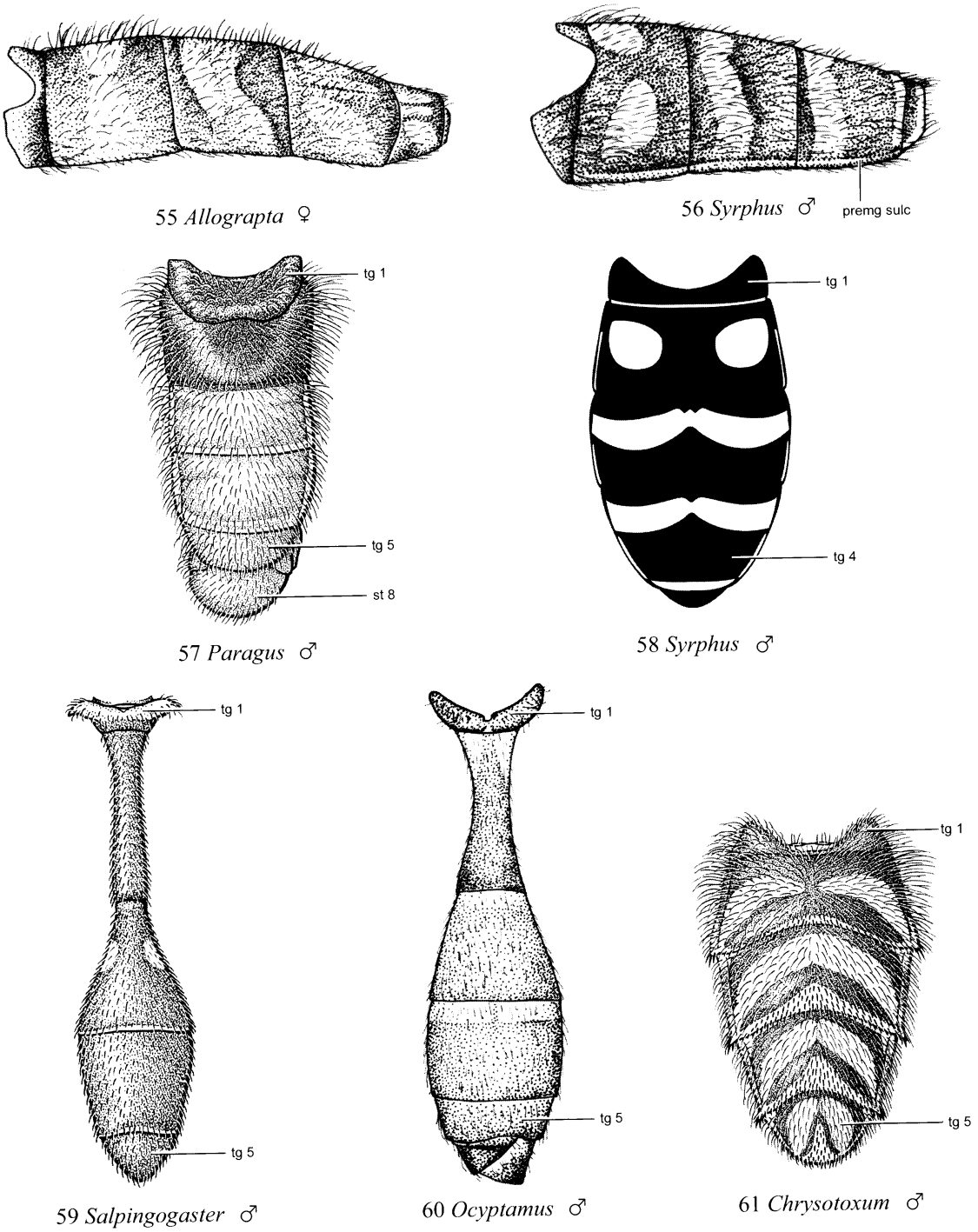
– Metasternum not greatly reduced, with median portion broadly joined to lateral arms (Fig. 35); face various, almost straight in profile with weak tubercle or moderately or strongly produced forward below, sometimes with pruinescence forming punctate or rippled pattern; legs of male sometimes slender and unornamented, sometimes with foretibia and tarsus broadened, or sometimes with femora or tibiae with bristles, hair tufts, or modified hairs 70

70. Face frequently produced anteriorly, densely pruinose and with puncturelike bare maculae or ripples; antenna short, with scape not more than twice as long as broad; male legs at least with strong black setae on foretibia; abdomen without pale-colored maculae, with silvery-gray maculae ..... *Platycheirus* (*Carposcalis*) Enderlein

– Face straight in profile, not produced anteriorly, usually uniformly pruinose, rarely with shiny (bare) punctate maculae; antenna frequently long, with scape much longer than broad (Fig. 22); male legs simple; abdomen frequently with pale-colored maculae ..... *Argentinomyia* Lynch Arribálzaga, in part

71. Metasternum pilose 72

– Metasternum bare (Fig. 35) 75



Figs. 53.55–61. Abdomens: dorsolateral view of (55) *Allograpta exotica* (Wiedemann) and (56) *Syrphus phaeostigma* Wiedemann; dorsal view of (57) *Paragus* (*Pandasyophthalmus*) *haemorrhous* Meigen, (MND, fig. 52.97), (58) *Sy. phaeostigma*, (redrawn by A.G. Brenes from Fluke 1942, fig. 3), (59) *Salpingogaster* (*Salpingogaster*) *punctifrons* Curran, (MND, fig. 52.95), (60) *Ocyptamus* (*Mimocalla*) *bonariensis* (Brèthes), and (61) *Chrysotoxum derivatum* Walker, (Nearctic, MND, fig. 52.94, as *Chrysotoxum integre* Williston). Figures 55, 56, and 60 illustrated by D. Marques.

Abbreviations: premg sul, premarginal sulcus; st, sternite; tg, tergite.

72. Abdomen with distinct strong premarginal sulcus, extending from middle of tergum 2 to end of tergum 5 (as in Fig. 56); scutum entirely dark or at most obscurely yellowish pruinose laterally; face not strongly produced anteriorly; oral opening not more than 2.5 times as long as broad ... . *Eupeodes* (*Metasyrphus*) Matsumura

– Abdomen without premarginal sulcus (Fig. 55); scutum often with well-defined bright yellow lateral or sublateral vitta extending at least from postpronotum to suture; face often produced anteriorly so that oral opening may be more than 3 times as long as broad 73

73. Scutellum with ventral fringe absent or nearly so on at least median third; male terminalia extremely large and globose..... *Sphaerophoria* Lepeletier & Serville

– Subscutellar fringe complete, well developed, moderately dense; male terminalia small, inconspicuous 74

74. Face produced anteriorly; oral apex distinctly more prominent than antennal bases; oral opening 3 or more times longer than broad; facial tubercle high, distinctly differentiated..... ..... *Allograpta* (*Fazia*) Shannon

– Face straight, not produced anteriorly; oral apex distinctly less prominent that antennal bases; oral opening only about 2 times as long as broad; facial tubercle usually low (except in *A. armillata* Fluke), not differentiated dorsally ..... *Allograpta* (*Allograpta*) Osten Sacken

75. Eye pilose (as in Fig. 20) 76

– Eye bare 79

76. Tergum 1 well developed, especially medially on disc where it is frequently one-half as long as tergum 2 and extends well beyond scutellum (as in Fig. 57), sublaterally about three-quarters as long as tergum 2; terga minutely punctate; length 7.5 mm or less..... *Paragus* Latreille

– Tergum 1 greatly reduced, on disc frequently almost linear and practically covered by scutellum, sublaterally at most one-half as long as tergum 2; terga not punctate; length 7.5 mm or more, usually about 10 mm 77

77. Antenna elongate, as long as or longer than face; first flagellomere 4 times as long as broad, longer than arista (Fig. 20); abdomen strongly convex dorsally, strongly marginated, with posterolateral angles of terga projecting (Fig. 61) ..... *Chrysotoxum* Meigen

– Antenna short, shorter than face; first flagellomere short, at most about 2.5 times as long as broad, shorter than arista; abdomen not strongly convex dorsally; terga without posterolateral angles projecting 78

78. Calypter with ventral lobe pilose, with long, coarse, erect yellow pile dorsally, especially on posteromedian portion (Fig. 54)..... *Syrphus* Fabricius, in part

– Calypter with ventral lobe bare, without pile..... *Dasysyrphus* Enderlein

79. Hind femur with distinct anteroventral and posteroventral rows of spinose setae on apical one-half; vein M_1 abruptly and strongly sinuate; vein R_{4+5} slightly to strongly sinuate (Fig. 43); postmetacoxal bridge complete; abdomen strongly petiolate (Fig. 59); *Salpingogaster* Schiner 80

– Hind femur without spinose setae; vein M_1 at most weakly sinuate; vein R_{4+5} usually straight or nearly so, if strongly sinuate, then postmetacoxal bridge incomplete and/or abdomen oval.... 81

80. Vein R_{4+5} strongly sinuate (Fig. 43); first tergum produced laterally into strong spur (Fig. 59); upper occipital cilia reduced to single row ..... *Salpingogaster* (*Salpingogaster*) Schiner

– Vein R_{4+5} only weakly sinuate; first tergum not produced into spur (as in Fig. 60); upper occipital cilia in three to four rows..... *Salpingogaster* (*Eosalpingogaster*) Hull

81. Calypter with ventral lobe pilose, with long, coarse, erect yellow pile dorsally, especially on posteromedian portion (Fig. 54). . . . . *Syrphus* Fabricius, in part

– Calypter with ventral lobe bare, without long pile. 82

82. Thorax without yellow maculae except on scutellum . . . . . *Pseudodoros* Becker

– Postpronotum yellow; scutum with lateral yellow vitta at least in front of suture; anepisternum and katepisternum partially yellow; frequently pleuron more extensively yellow 83

83. Vein R_{4+5} strongly sinuate (Fig. 48); face not produced anteriorly, with antennal bases slightly anterior to oral margin; oral opening less than twice as long as broad; abdomen oval, with strong premarginal sulcus (as in Figs. 56, 58) . . . . . *Dideomima* Vockeroth

– Vein R_{4+5} straight or nearly so (Fig. 51); face produced or not; oral opening various; abdomen petiolate or parallel-sided, without premarginal sulcus (Fig. 55) 84

84. Face vertical, not produced anteriorly, with antennal bases slightly anterior to oral margin; oral opening less than twice as long as broad; antenna elongate, with scape and first flagellomere twice as long as broad (Fig. 22). . . . . *Argentinomyia* Lynch Arribálzaga, in part

– Face strongly produced anteriorly, with oral margin greatly anterior to antennal bases; oral opening 3 or more times as long as broad (Fig. 7); antenna short, with scape and first flagellomere only slightly longer than broad 85

85. Face with abrupt tubercle; abdomen parallel-sided . . . . . *Allograpta* (*Costarica*) Mengual & Thompson

– Face with indistinct or no tubercle; abdomen petiolate . . . . . *Allograpta* (*Rhinoprosopa*) Hull

Key to the subfamilies and genera of larvae of Syrphidae of Central America

1. Larva with metathorax at front of body, prothorax and mesothorax narrow and telescoped into pocket underneath metathorax (Fig. 64); locomotory organs consisting of slight projections on ventral surface without crochets or suckers; band of setae around lateral margins of body; mandibles bladelike with serrated ventral margin; living in and around ant nests . . . . . MICRODONTINAE

– Larva with prothorax at front of body, not telescoped into ventral pocket of metathorax (Figs. 62–63, 65–72); usually lacking marginal band of setae (except some *Copestylum* living in bromeliads (Fig. 70), but these have crochets and/or suckers (Fig. 71)); mandibles without serrated ventral margin; various habitats 2

2. Anal segment without lappets (fleshy projections on lateral margins of anal segment) (Fig. 63); thorax narrower than abdomen; apex of head skeleton elongate and pointed (serrated apically in leaf-mining *Allograpta*); ventral surface smooth, without setae, prolegs, or crochets; living in and on plant surfaces; often with color pattern; SYRPHINAE 3

– Anal segment with up to three pairs of lappets (Fig. 66) (reduced and inconspicuous in long-tailed larvae (Fig. 67)); thorax as broad or broader than abdomen (Fig. 68); ventral surface usually with setae, prolegs, and crochets (Fig. 69) often present; living in decaying organic material, e.g., mud, but also in decay on live and dead plants; ERISTALINAE 13

3. Larva translucent, white or cream, lacking bright color 4

– Larva with bright color pattern formed from hemolymph pigments, fat bodies, or markings on body surface 6

4. Ventral surface with at least one sucker; tip of posterior respiratory process elongate (Fig. 65), with one pair of spiracles above other two pairs; predatory in bromeliads ..... *Ocyptamus* Macquart, in part

– Ventral surface without suckers; tip of posterior respiratory process flat with spiracles all on one plane; predatory in various habitats 5

5. Tip of anal segment with pair of rounded projections; posterior respiratory process with spiracles short, not extending over sides of dorsal plate; one European species predatory on gall-inducing psyllids and one Australasian species in ant nests ..... *Trichopsomyia* Williston

– Tip of anal segment without rounded projections; spiracles elongate, extending over sides of dorsal plate; in Europe, found in or around ant nests feeding on ant-attended Sternorrhyncha on plant roots ..... *Chrysotoxum* Meigen

6. Larva with dorsal projections on abdominal segments 1–7 (viewed from side) 7

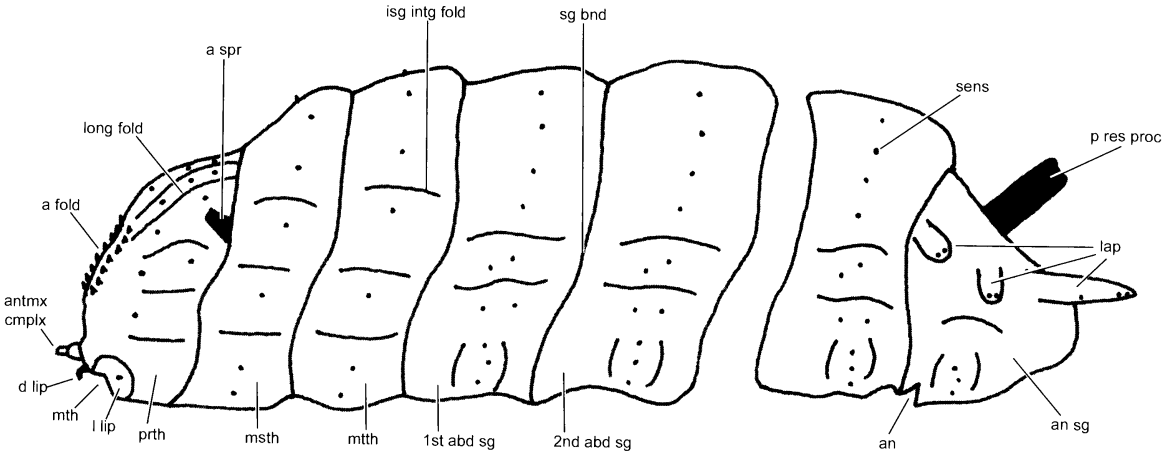
– Larva without dorsal projections on abdominal segments 1–7 8

7. Tip of anal segment with pair of posteriorly directed tapering projections ..... *Dasysyrphus* Enderlein

– Four bristlelike projections between posterior respiratory process and tip of anal segment ..... *Paragus* Latreille

8. Dorsal surface of larva with aggregated groups of dark, sclerotized spicules; stem of posterior respiratory process short with spiracles almost reaching integument .... *Eupeodes* Osten Sacken

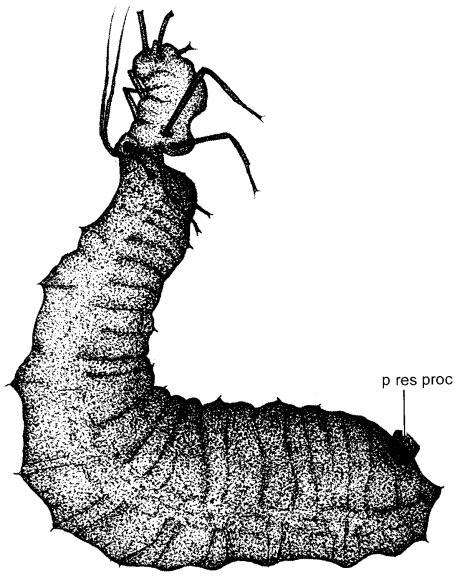
– Dorsal surface of larva without dark sclerotized spicules, vestiture absent or fleshy; stem of posterior respiratory process longer, spiracles not reaching integument 9



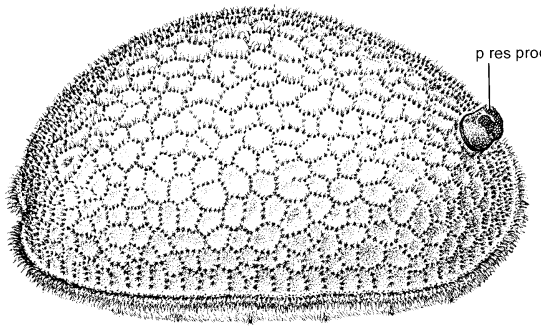
62 Third stage syrphid larva

Fig. 53.62. Morphological map of a third stage syrphid larva, lateral view, dorsal side uppermost, segments 3–6 not shown. Illustrated by G.E. Rotheray.

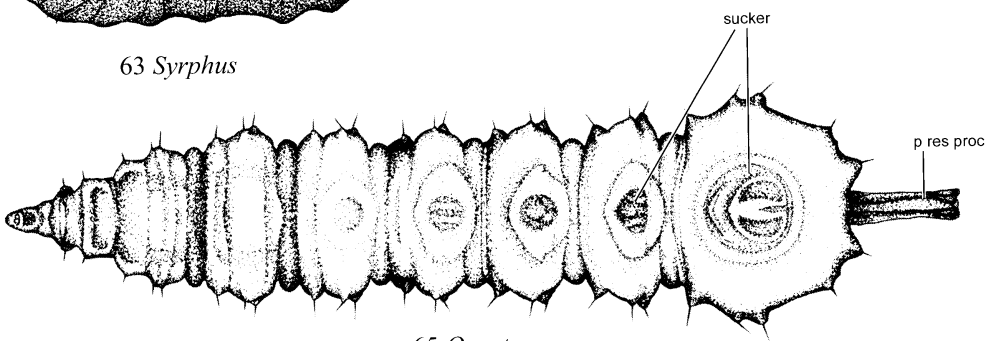
Abbreviations: a fold, anterior fold; a spr, anterior spiracle; abd sg, abdominal segment; an, anus; an sg, anal segment; antmx cmplx, antennomaxillary complex; d lip, dorsal lip; isg intg fold, intra-segmental integumental fold; l lip, lateral lip; lap, lappets; long fold, longitudinal fold on dorsum of prothorax; msth, mesothorax; mth, mouth; mtth, metathorax; p res proc, posterior respiratory process; prth, prothorax; sen, sensilla; sg bnd, segmental boundary.



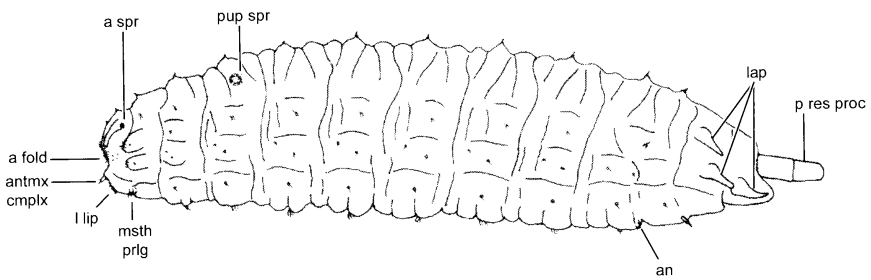
63 *Syrphus*



64 *Microdon*



65 *Ocyptamus*



66 *Ornidia*

Figs. 53.63–66. Third stage larvae: lateral view of (63) *Syrphus* sp. feeding on an aphid; dorsolateral view of (64) *Microdon ruficrus* Williston, (Nearctic, MND, fig. 52.107); ventral view of (65) *Ocyptamus* sp.; and lateral view of (66) *Ornidia major* Curran, (Rotheray et al., 2005, fig. 1). Figure 63 illustrated by G.E. Rotheray; Figure 65 illustrated by A.G. Brenes.

Abbreviations: a fold, anterior fold; a spr, anterior spiracle; an, anus; antmx cmplx, antennomaxillary complex; lap, lappets; l lip, lateral lip; msth prlg, mesothoracic proleg; p res proc, posterior respiratory process; pup spr, pupal spiracle.

9. Posterior respiratory process with dorsal spurs; spiracles dark lined ..... *Syrphus* Fabricius

– Posterior respiratory process without dorsal spurs; spiracles pale in outline but may become dark after pupariation 10

10. Apicoposterior margin of posterior respiratory process with posterior triangular-shaped projection; spiracles straight and parallel to each other; predatory on caterpillars ..... *Xanthandrus* Verrall

– Apicoposterior margin of posterior respiratory process smooth, without posterior triangular-shaped projection; spiracles not all parallel to each other; lifestyle various 11

11. Larva subrectangular in cross-section; mid-dorsal chevron-shaped fat bodies on abdominal segments; dorsal lateral margins of abdomen marked by thin, linear fat body ..... *Platycheirus* Lepeletier & Serville

– Larva flattened, subcyclindrical or irregularly shaped in cross-section; fat bodies not arranged as above 12

12. Posterior respiratory process apex longer than broad ..... *Ocyptamus* Macquart, in part

– Posterior respiratory process apex shorter than broad ..... *Allograpta* Osten Sacken

Note: The poorly-known larvae of *Toxomerus* Macquart and *Pseudodoros* Becker may also key out here.

13. Anterior fold of prothorax with fleshy vestiture; without posteriorly directed sclerotized spicules 14

– Anterior fold of prothorax with posteriorly directed sclerotized spicules 17

14. Larva with mouthhooks usually protruding from mouth; in exuding tree sap ..... *Alipumilio* Shannon

– Larva without protruding mouthhooks; various habitats 15

15. Larva with fleshy ridged mandibular lobes external, surrounding lateral margins of mouth; posterior end of abdomen coated in dark, sticklike projections ..... *Rhingia* Scopoli

– Larva with mandibular lobes internal, not surrounding lateral margins of mouth; mouth edge smooth; posterior end without dark, sticklike projections 16

16. Anal segment with setae not borne on fleshy papillae; anterior spiracles absent; crochets arranged in linear rows, little developed on abdominal segments 1–4; living in decaying vegetation in ponds and streams ..... *Orthonevra* Macquart

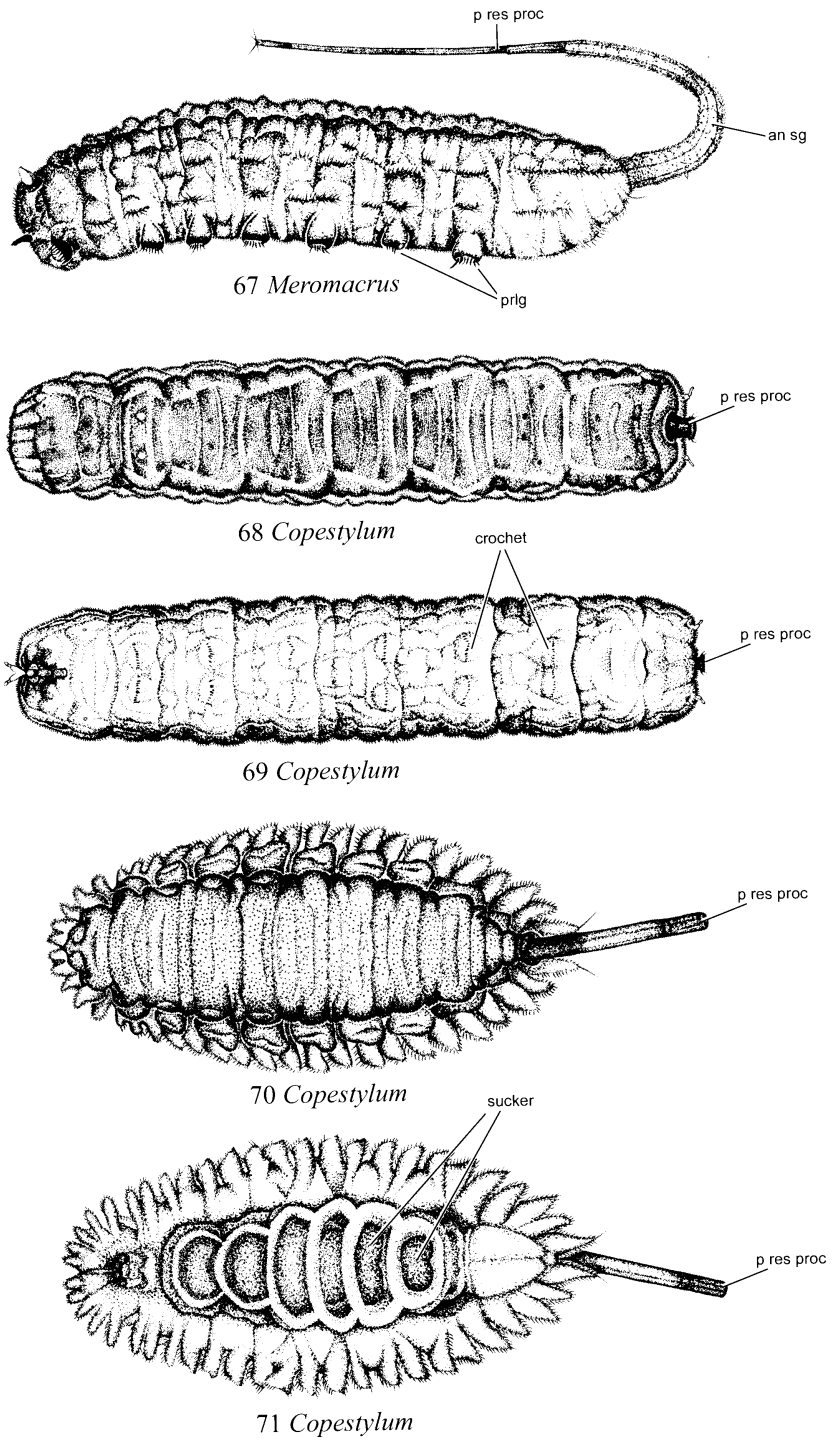
– Anal segment with tufts of setae borne on fleshy papillae; anterior spiracles present; crochets arranged in curved rows, well developed on abdominal segments 1–7; living in tree holes ..... *Myolepta* Newman

17. Thorax with dorsal or lateral brown or black sclerotized hooks (as in Fig. 74) (sclerotized structures larger than spicules on anterior fold) 18

– Thorax without hooks; dorsal and lateral margins of thorax may have isolated groups of spicules of mixed size 24

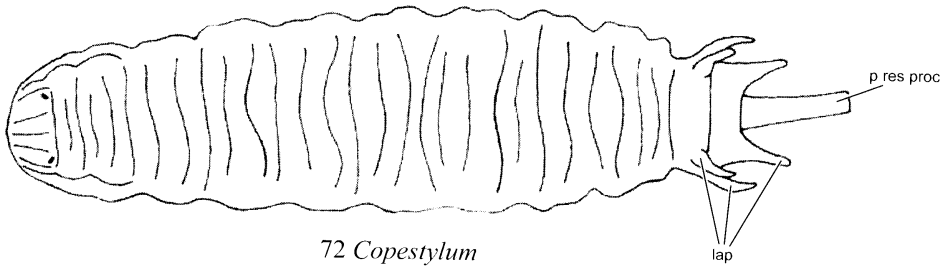
18. Anal segment narrow, elongate and tail-like, about as long as rest of body; anterior fold of prothorax with up to four pairs of laterally directed sclerotized pads bearing hooks (Fig. 74); living in bromeliad tanks ..... *Quichuana* Knab, in part

– Anal segment narrowing towards apex, not tail-like, shorter than rest of body; anterior fold of prothorax with spicules; sclerotized pads bearing hooks on dorsal and lateral margins of thorax; various habitats 19

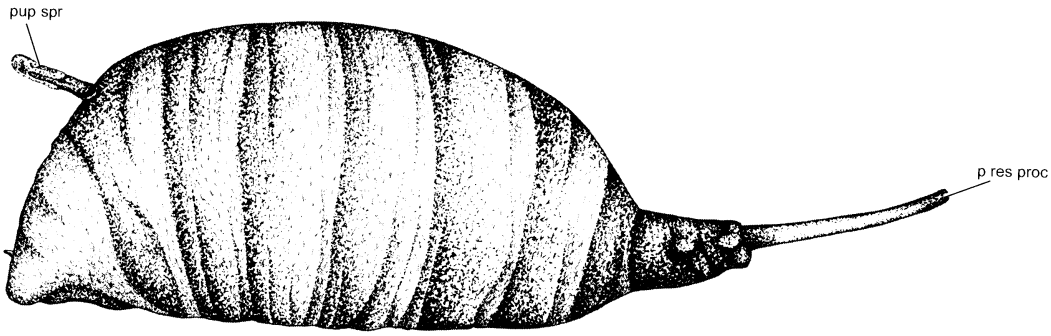


Figs. 53.67–71. Third stage larvae (*continued*): lateral view of (67) *Meromacrus* sp.; dorsal (68) and ventral (69) views of *Copestylum* sp.; dorsal (70) and ventral (71) views of *Copestylum* sp. Figures 67–71 illustrated by A.G. Brenes.

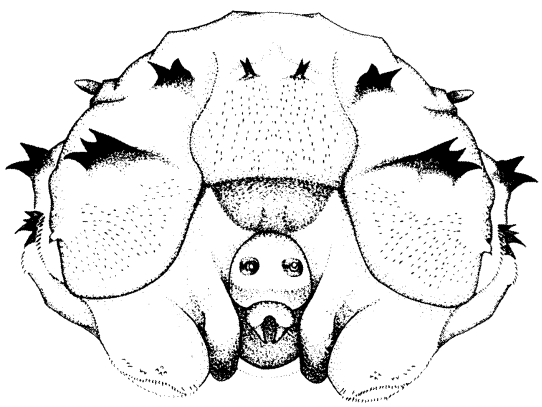
Abbreviations: an sg, anal segment; p res proc, posterior respiratory process; prlg, proleg.



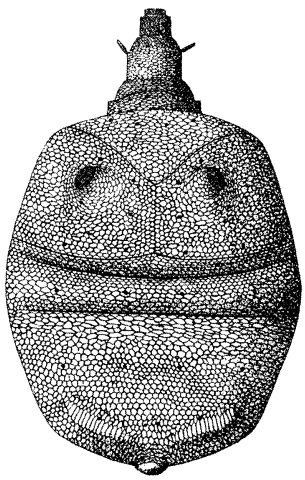
72 *Copestylum*



73 *Copestylum*



74 *Quichuana*



75 *Nothomicrodon*

Figs. 53.72–75. Third stage larvae (*concluded*) and puparium: dorsal view of larva of (72) *Copestylum* sp., (Rotheray et al., 2007, fig. 87); lateral view of puparium of (73) *Copestylum* sp.; frontal view of head of larva of (74) *Quichuana* sp.; and lateral view of larva of (75) *Nothomicrodon aztecarum* Wheeler, (Wheeler, 1924, fig. 2a). Figures 73 and 74 illustrated by A.G. Brenes.

Abbreviations: lap, lappets; p res proc, posterior respiratory process; pup spr, pupal spiracle.

19. Larva with one or two pairs of hooks on lateral margin of thorax; anal segment slightly extended, up to 1.5 times length of abdominal segment 7; living under bark in wet conditions ..... *Chalcosyrphus* (*Neplas*) Porter

– Larva with hooks on dorsal surface of thorax; anal segment more than 1.5 times length of abdominal segment 7; various habitats 20

20. Mid-dorsum of thorax with "Y" or triangular-shaped sclerotized pad bearing one to two pairs of small and large posteriorly directed hooks; lateral to this pad with pair of "cow-horn" laterally directed hooks; living in tree holes and decaying tree roots ..... *Criorhina* Meigen

– Mid-dorsum of thorax without "Y" or triangular-shaped sclerotized pad bearing one to two pairs of small and large posteriorly-directed hooks; various habitats 21

21. Thorax with one pair of sclerotized pads bearing one to three laterally directed hooks 22

– Thorax with groups of hooks mid-dorsally and/or laterally in addition to main pair of sclerotized pads bearing three or more hooks 23

22. Larva with blue-colored hemolymph; abdominal segments 1–7 each with pair of separate prolegs oval shaped in outline; living in decaying cacti and terrestrial bromeliads ..... *Nausigaster* Williston

– Larva white to pale gray, not blue; prolegs on abdominal segments 1–7 fused medially forming figure-8 shape in outline; living in tree holes ..... *Callicera* Panzer

23. Dorsolateral pads bearing more than three hooks; mid-dorsum of prothorax lacking single pair of hooks; living in tree holes and decaying tree roots ..... *Milesia* Latreille

– Dorsolateral pads bearing one to three hooks; mid-dorsum of prothorax with single pair of hooks; living in tree holes ..... *Spilomyia* Meigen

24. Base of first pair of lappets with short fleshy projection 25

– Base of first pair of lappets, if clearly present, without short fleshy projection 26

25. Three pairs of approximated lappets about equal in length and covered with setae (Fig. 66) ..... *Ornidia* Lepeletier & Serville

– One of first two pairs of lappets longer than other (Fig. 72), or lappets short and inconspicuous (Figs. 68–70), or, if lappets about equal, then bare, not covered with setae ..... *Copestylum* Macquart

26. Anterior fold of prothorax with dense coating of spicules discontinuous, divided into three or four groups with clear gaps; living in exuded tree sap and decaying cacti .... *Ceriana* Rondani, *Polybiomyia* Shannon

– Anterior fold of prothorax with continuous coating of spicules, not divided; various habitats .. 27

27. Anal segment not as long as body length (mouth to anus) 28

– Anal segment extended to body length or more; long-tailed or rat-tailed larvae (Fig. 67) 29

28. Anal segment with three pairs of about equally long and equidistant lappets ..... *Sterphus* (*Ceriogaster*) Shannon, *Xylota* Meigen

– Anal segment with first or second or both lappets reduced and inconspicuous ..... *Lepidomyia* Loew, *Myolepta* Newman

29. Anterior spiracles about as tall as broad, flat tipped and not retractile ..... *Sericomyia* Meigen

– Anterior spiracles longer than broad and retractile into pockets on thorax (often partially or completely retracted in preserved and live specimens) 30

30. Abdominal prolegs with crochets arranged in two main transverse rows 31

– Abdominal prolegs with crochets in three or more distinct semicircular rows (arranged in curved, not transverse row) 33

31. Abdominal segments 2–6 with sensilla 4–6 in the same horizontal plane ..... *Mallota* Meigen

– Abdominal segments 2–6 with sensilla 4 above 5 and 6 32

32. Thorax with hooks in addition to spicules (Fig. 74) ..... *Quichuana* Knab, in part

– Thorax lacking hooks, only spicules present ..... *Eristalis* Latreille, in part

33. Spicules on upper margin of anterior fold interrupted and not forming continuous line and not extending to dorsum of prothorax (Fig. 74) ..... *Quichuana* Knab, in part

– Spicules on upper margin of anterior fold continuous, either forming complete transverse line or extending from anterior fold on to dorsum of prothorax 34

34. Lateral margins of abdomen without rows of setae or, if present, only on segments 5 to 8 ..... *Eristalis* Latrielle, in part, *Palpada* Macquart

– Lateral margins of abdominal segments 1–8 with rows of conspicuous setae, becoming shorter towards head (Fig. 67) 35

35. Spicules of anterior fold long, longer than wide at base; abdominal sensilla on short and inconspicuous fleshy projections not as tall as wide ..... *Habromyia* Williston

– Spicules of anterior fold short, shorter than wide at base; abdominal sensilla on conspicuous fleshy projections, as tall as wide or taller 36

36. Anteroventral corners of metathorax with groups of spicules (Fig. 67) ... *Meromacrus* Rondani

– Anteroventral corners of metathorax without spicules ..... *Lycopale* Hull

Synopsis of the fauna

About 5825 species of Syrphidae are currently recognized. The greatest species richness is in the Neotropical Region, where some 1560 have been described, but many more await description and discovery. In the last few years in Costa Rica alone, some 265 new species have been discovered, but have not yet been described. The estimated total number of flower fly species for Central America is nearly 700.

***Alipumilio* Shannon.** Found from Mexico to Brazil, this genus includes four species, of which only *A. nigrocoeruleus* Vockeroth is found in Costa Rica (Vockeroth, 1964; Thompson & Wynne, in press). Larvae are saprophagous in exuding plant sap.

***Allograpta* Osten Sacken.** This genus is cosmopolitan, with 104 species, 63 of which occur in the Neotropical Region. The genus is currently organized into eight groups (Mengual et al., 2009), of which four subgenera occur in Central America. The typical subgenus (*Allograpta*) is cosmopolitan and has nine species in Central America; the larvae are predators of aphids and relatives (Hemiptera: Sternorrhyncha). The subgenus *Costarica* Mengual & Thompson is endemic to Costa Rica and contains only two species; the larvae are stem-borers. The subgenus *Fazia* Shannon is a Neotropical endemic, with 22 species known from Central America; the larvae are leaf-miners (Nishida et al., 2003). The subgenus *Rhinoprosopa* Hull is also a Neotropical endemic, with three species known from Central America; the immatures are unknown. The last key was that of Fluke (1942) as *Epistrophe* and *Allograpta*.

***Argentinomyia* Lynch Arribálzaga.** Found in the Neotropical Region only, except absent from the Chilean subregion, this genus includes 32 species. There are four named and 15

undescribed species from Costa Rica. The last key was that of Fluke (1945) as *Rhysops* and *Melanostoma*. Larvae are unknown.

***Aristosyrphus* Curran.** The six species of this genus are found from Mexico to Brazil, and two of them occur in Costa Rica. A revision is forthcoming (Thompson & Marioni, in press). Larvae are unknown.

***Cacoceria* Hull.** There are two species in this genus, found from Mexico to Argentina. Only *C. cressoni* Hull is found in Costa Rica. No key is available, and larvae are unknown.

***Callicera* Panzer.** This is a north temperate genus with extensions into the Oriental (India, Taiwan) and Neotropical Regions (south to Costa Rica). Of the 16 species, only *C. poultoni* Verrall is found in Costa Rica and the Neotropical Region. A revision of the New World species exists (Thompson, 1980). Larvae of Palearctic species are saprophagous in tree holes.

***Cepa* Thompson & Vockeroth.** Three species of this genus are known: two from Brazil and one from Costa Rica. The last key was that of Thompson (2007). Larvae are unknown.

***Ceriana* Rondani.** This is a north temperate genus whose distribution extends into the Neotropical Region, south to Costa Rica. There are 66 described species, with one named and one undescribed species in Costa Rica and the Neotropical Region. The last key was that of Curran (1941) as *Cerioides*. Larval stages are saprophagous, mostly in decaying plant sap.

***Chalcosyrphus* Curran.** This is a cosmopolitan group, with its greatest richness in the north temperate region. It is divided into 10 subgenera, of which subgenus *Neplas* Porter is restricted to the New World (Arizona southward to Brazil, absent from the Chilean subregion). Of the 29 species in subgenus *Neplas*, there are four named and five undescribed species in Costa Rica. The last key was that of Curran (1941) as *Planes*. Larvae are saprophagous under tree bark.

***Cheilosia* Meigen.** This is a north temperate genus whose distribution extends into the Oriental (Indonesia) and Neotropical Regions. There are 439 species, with one species in Chiapas, Mexico, and another in Guatemala. The last key was that of Hull & Fluke (1950). Larvae are phytophagous.

***Chrysotoxum* Meigen.** *Chrysotoxum* is another north temperate group with extensions into the Oriental (India, Indonesia), Afrotropical (one species), and Neotropical Regions (to Guatemala). There are 97 species, including one undetermined species in Guatemala. Shannon (1926) was the last to key the species. Larvae are predatory on root Sternorrhyncha in ant nests.

***Copestylum* Macquart.** Found from Canada south to Chile and Argentina, this large genus, with 309 species, including 299 in the Neotropical Region, is an important part of the Central American fauna. There are 30 named and 51 undescribed species in Costa Rica. The last key was that of Curran (1939a); see also Fluke (1951) and Curran (1953). Larvae are saprophagous in a wide variety of decaying materials, including exuding tree sap, decaying cacti and aloes, decaying forest flowers, fruits, stems of non-woody plants including ferns and terrestrial bromeliads, and watertanks of bromeliads and heliconias (Rotheray et al., 2007).

***Criorhina* Meigen.** This is a north temperate genus whose distribution extends into the Oriental (India) and Neotropical Regions (south to Costa Rica). There are 50 species, with two species in Mexico and three undescribed species in Costa Rica. No key to species is available. Larvae are saprophagous in wet decaying wood.

***Dasysyrphus* Enderlein.** Another north temperate group with extensions into the Oriental (Indonesia) and Neotropical Regions (south to Brazil), *Dasysyrphus* includes two or three species in the Neotropical Region. Only one undescribed species occurs in Costa Rica. Keys to species are in Fluke (1942) and Vockeroth (1986b). Larvae are predatory on Sternorrhyncha.

***Dideomima* Vockeroth.** There are four species in this genus, found from the southwestern USA (Arizona) to Costa Rica. Only *D. vockerothi* Thompson is known from Costa Rica. A revision by Thompson will be available soon (Thompson, in press b). Larvae are unknown, but probably are predatory.

***Eristalis* Latreille.** *Eristalis* is organized into two subgenera. Subgenus *Eristalis* is restricted to the Palearctic, Afrotropical, and Oriental Regions (two species), but *E. tenax* Linnaeus has been introduced into the cooler areas of the Neotropical and Australian Regions. The subgenus *Eoseristalis* Kanervo is northern temperate in distribution, with extensions into the Oriental (Indonesia) and Neotropical Regions (along cordillera). There are 96 species of *Eoseristalis*, of which nine are found in the Neotropical Region, but only *E. alleni* Thompson and *E. gatesi* Thompson occur in Costa Rica. A revision was published by Thompson (1997a). Larvae are saprophagous in decaying plant material.

***Eupeodes* Osten Sacken.** Cosmopolitan except absent from New Zealand, the main diversity of this genus is in north temperate areas. There are 90 species, with two in the Neotropical Region, and only *E. americanus* Wiedemann in Costa Rica. Larvae are predatory on Sternorrhyncha.

***Habromyia* Williston.** The four species of this genus are found from Costa Rica to Brazil. Only *H. coeruleithorax* Williston is present in Costa Rica (Thompson, in press a). Larvae are saprophagous in wet decaying wood.

***Lejops* Rondani.** Within *Lejops*, subgenus *Asemosyrphus* Bigot is found from Canada to Guatemala (also Colombia),

with three described species. The last key was that of Curran (1939b). Larvae are saprophagous in wetlands.

***Lepidomyia* Loew.** This genus is distributed from the southern USA (Texas) to Argentina, although it is absent from the Chilean subregion. Sixteen species are present, including 15 in the Neotropical Region. Two named and five undescribed species occur in Costa Rica. The last key was that of Hull (1946b). Larvae are saprophagous in exuding tree sap and in tree holes.

***Leucopodella* Hull.** This genus is found in the Neotropical Region only, except not from the Chilean subregion; of the 14 species, six are named and two undescribed species are from Costa Rica. The latest key to species is that of Thompson (1981). Larvae are unknown, but are probably predatory on Sternorrhyncha.

***Lycastirhyncha* Bigot.** Five described species are found from Mexico to Brazil, but only *L. willistoni* Coquillett is found in Costa Rica. In the last key, Doesburg (1966) recognized five species, but we suspect there is only one widespread species, *L. nitens* Bigot. Larvae are unknown.

***Lycopale* Hull.** One species, *L. wygodzinskyi* Thompson, occurs in Costa Rica and has been reared from a tree hole. Otherwise, there are nine species, found from Mexico to Brazil. A revision has been prepared (Thompson, in press a).

***Mallota* Meigen.** The distribution of this genus is north temperate, with extensions into the Oriental (Indonesia) and Neotropical Regions (south to Brazil). There are 64 described species, with 12 in the Neotropical Region and six in Costa Rica. A revision of Central American species was published by Thompson & Zumbado (2002). Larvae live in tree holes and decaying trunks of tree ferns.

***Melanostoma* Schiner.** Found in all biogeographical regions, this genus is only found in the Neotropical Region in Chiapas, but may also occur in the adjacent highlands of Guatemala. There are 57 species, with only *M. bellum* Giglio-Tos in Mexico. Larvae are predatory on Sternorrhyncha.

***Meromacrus* Rondani.** Found from the southern USA to Argentina and northern Chile, the 43 species of this genus include 40 in the Neotropical Region and seven from Costa Rica. The last key to the entire genus was that of Hull (1942), whereas a revision of the Central American species was presented by Blatch et al. (2003). Larvae are saprophagous in tree holes and decaying plant stems.

***Microdon* Meigen.** This genus is cosmopolitan, except absent in New Zealand and the smaller oceanic islands. There are many distinctive groups within the clade here treated as the genus *Microdon*. Unfortunately, their status and rank are not well understood (Cheng & Thompson, 2008), but they are included here as the adults are easily recognized. All the groups are restricted to the Neotropical Region except the typic group (*Microdon*), which is cosmopolitan, and *Omegasyrphus* Loew, which also occurs in the Nearctic Region. Overall, there are 352 species worldwide, including 141 in the Neotropical Region and 23 named and 31 unnamed species in Costa Rica. The latest key is that of Curran (1941). Larvae are found in ant colonies.

***Milesia* Latreille.** Found in all regions except the Australian, this genus is distributed in the Neotropical Region south only to Panama. There are 82 species, with only *M. nigra* Fluke and *M. pulchra* Williston in Costa Rica and Panama. The last monograph was that of Hippa (1990). Larvae are saprophagous in tree holes.

***Mixogaster* Macquart.** Found in the New World only, this genus is distributed from the USA (Massachusetts) south to Argentina, but is absent from the Chilean subregion. There are 17 species, with only *M. mexicana* Macquart and *M. orpheus* Hull occurring in Costa Rica. A revision was given by Hull (1954). Larvae live in ant nests.

***Monoceromyia* Shannon.** There are 45 species in this genus, of which nine species are found in the Neotropical Region. Two named and two undescribed species are found in Costa Rica. The last key was that of Curran (1941), as *Cerioides*. Larvae live in decaying plant sap.

***Mutillimyia* Hull.** The single species of this genus, *M. auricaudata* Williston, is known only from type series collected in Neotropical Mexico (Guerrero, Morelos). Larvae are unknown.

***Myolepta* Newman.** Found in all regions except the Australasian, there are 37 species of this genus, including 11 in the Neotropical Region. One named and four undescribed species occur in Costa Rica. The genus is usually split into subgenera (*Myolepta*, *Eumyiolepta* Shannon, and *Protolepidostola* Hull), but the status of these divisions, especially with respect to *Lepidomyia*, remains unclear. The last key to species is that of Fluke & Weems (1956); also see Thompson (1968). Larvae of known species (mainly Palearctic) are saprophagous in tree holes.

***Nausigaster* Williston.** This genus is found from the southern USA to Brazil and is absent from the Chilean subregion. There are 15 species, with nine in the Neotropical Region, and only *N. meridionalis* Townsend in Costa Rica. The latest key to species is Curran (1941). Larvae are saprophagous in wet decaying cacti, bromeliads, and probably other plants in arid or open habitats.

***Ocyptamus* Macquart.** This is a New World genus, found from southern Canada southward. There are 282 species, including 273 in the Neotropical Region, and 26 named and 64 undescribed species in Costa Rica. The latest key is that of Hull (1949), but it includes less than half the described species. There is a revision of the subgenus *Mimocalla* Hull (Thompson & Zumbado, 2000). Larvae are predators of

gregarious soft-bodied insects (such as aphids and psyllids) on plants, but some species have been reared as predators in epiphytic bromeliads (Rotheray et al., 2000).

***Ornidia* Lepeletier & Serville.** This is a New World endemic genus, found from the USA south to Chile and Argentina, with one species introduced into the Old World tropics. Four species are found in the Neotropical Region and Costa Rica (Thompson, 1990). Larvae are saprophagous in a wide variety of decaying plant materials from exuding tree sap to decaying flowers, fruits, and stems of non-woody plants. They are also associated with animals, apparently breeding in wounds, dung, and other waste materials including plant and animal compost (Rotheray et al., 2005).

***Orthonevra* Macquart.** This is a predominantly north temperate genus, with extensions into the Oriental and Neotropical Regions (south to Brazil). There are 59 species, eight in the Neotropical Region, including two named and one undescribed species in Costa Rica. Larvae of Palearctic species are saprophagous in accumulations of wet, decaying vegetation in slow-moving water bodies such as pools and lakes. No keys are available.

***Palpada* Macquart.** *Palpada* species are found from the southern USA, south to Chile and Argentina. There are 85 species, 82 in the Neotropical Region, 21 named and three undescribed species in Costa Rica. The last key was that of Curran (1934). Larvae are saprophagous in decaying plant material, including dung.

***Paragodon* Thompson.** In Costa Rica, this genus is represented only by *P. paragoides* Thompson. Otherwise, there are four species, found from Mexico to Brazil. A revision of the genus is given by Thompson (1969). Larvae are unknown.

***Paragus* Latreille.** This genus is cosmopolitan, except that it is absent from New Zealand and the Neotropical Region south of Costa Rica. There are 90 species organized into three major clades: subgenus *Pandasyophthalmus* Stuckenberg with only *P. haemorrhous* Meigen in Costa Rica; subgenus *Paragus* restricted to the north temperate region; and the *P. serratus* complex, restricted to the Old World tropics. Some authors want to recognize a number of new genera and species, but according to Vockeroth (1986a), there is only one variable species in this group in the New World, and only one genus is necessary for all the species. Larvae are predatory on Sternorrhyncha.

***Paramicrodon* de Meijere.** One undescribed species of this genus is found in Costa Rica. Otherwise, there are 10 species found in the Australian, Oriental, and Neotropical Regions. Larvae live in ant nests.

***Platycheirus* Lepeletier & Serville.** This is largely a north temperate group with extensions into Neotropical Region, Oriental Region (Philippines and Taiwan only), and New Zealand. A number of subgenera are recognized, but only the subgenus *Carposcalis* Enderlein is found in the Neotropical Region, where it ranges along the Andean Cordillera and is widespread in the south temperate areas. One hundred and sixty-six species are known world-wide, with 13 in the Neotropical Region and a couple of species in Costa Rica. The last key was that of Fluke (1945). Larvae are predatory on Sternorrhyncha.

***Polybiomyia* Shannon.** This genus is found from the southern USA to Argentina, but is absent from the Chilean subregion. Nineteen species are described, including 14 Neotropical species. There are four named species and five undescribed species in Costa Rica. The last key was that of Curran (1941), as *Cerioides*. Larvae are predatory, living in decaying plant sap.

***Pseudodoros* Becker.** This genus is found in Africa and New World, from the USA south. There are three species, including two in the Neotropical Region and only *P. clavatus* Fabricius in Costa Rica. The latest key was that of Kassebeer (2000). Larvae are predatory on Sternorrhyncha.

***Quichuana* Knab.** Found from Mexico to Brazil and Argentina, but absent from the Chilean subregion, there are 23 species of this genus. Seven named and three undescribed species are known from Costa Rica. The latest key is that of Hull (1946a). Larvae are saprophagous in pockets of wet decay on woody and non-woody plants.

***Rhingia* Scopoli.** All regions except the Australian have species of *Rhingia*. Of the 37 species, two are found in the Neotropical Region, but only *R. nigra* Macquart in Costa Rica. Fluke (1943) provided diagnostic notes to separate the two Neotropical species. Larvae of Palearctic species are saprophagous in animal dung.

***Rhopalosyrphus* Giglio-Tos.** This genus is distributed from the southern USA (Arizona, Texas, and Florida) to Argentina. There are four species, two of which are found in Costa Rica. The latest revision is by Weems et al. (2003). Larvae live in arboreal ant nests.

***Salpingogaster* Schiner.** The 35 species of this genus are found in the southern USA (Florida, Texas), south to Chile and Argentina. There are five named and 13 undescribed species from Costa Rica. Two subgenera are recognized, with most species in the subgenus *Salpingogaster*, and only one (*S. cochenillivorus* Guérin-Méneville) in subgenus *Eosalpingogaster* Hull in Central America. The latest key is that of Curran (1941). *Salpingogaster nigra* Schiner is a predator of spittlebugs on sugar cane. The species of the subgenus *Eosalpingogaster* are all predators of scales (Hemiptera: Coccoidea), and the Central American species *S. cochenillivorus* is a predator of the famous red (cochineal) scale, *Dactylopius coccus* Costa (Dactylopiidae).

***Sericomyia* Meigen.** This genus is found in north temperate areas with extensions into the Oriental (Taiwan) and Neotropical Regions (south to Costa Rica). There are a total of 30 species, with only *S. fairmanorum* Fairman in Costa Rica. A second species, *S. meyersi* Fluke, is found in central Mexico. The latest key is that of Thompson et al. (2000). The genus is usually organized into subgenera, with the two Mesoamerican species placed in subgenus *Arctophila* Schiner. Larvae of Palearctic species are saprophagous in pools and wet boggy ground, including seepages containing decaying vegetation.

***Sphaerophoria* Meigen.** This is a predominantly north temperate genus with limited extensions into the south temperate areas (South Africa and Australia). In the New World, one species, *S. contigua* Macquart, extends south to Chiapas, Mexico. The New World species were revised by Knutson (1973).

***Sphiximorpha* Rondani.** Cosmopolitan, except absent from New Zealand, this genus has 70 described species. There are 23 species in Neotropical Region, with two named species and five undescribed species in Costa Rica. The latest key is that of Curran (1941), as *Cerioides*. Larvae are saprophagous in wet decaying wood and decaying plant sap.

***Spilomyia* Meigen.** This is a predominantly north temperate genus with extension into the Neotropical Region, southward to Argentina. There are 36 species, with eight in the Neotropical Region, and three named and two undescribed species in Costa Rica. The last key is that of Thompson (1997b). Larvae are saprophagous in tree holes.

***Sterphus* Philippi.** The 41 species of *Sterphus* are distributed from Mexico southward to Chile and Argentina. There are four subgenera, three of which occur in Costa Rica: subgenus *Ceriogaster* Shannon, with 25 species and six unnamed species in Costa Rica (last key: Hull, 1943a); subgenus *Crepidomyia* Shannon, with 30 species and six unnamed species in Costa Rica (key to Costa Rican species: Zumbado & Thompson, 1997; also Hippa & Thompson, 1994); and subgenus *Sterphus* Philippi, with three species, but only *S. stimulans* Thompson and an undescribed species in Costa Rica (last key: Thompson, 1973). Larvae are unknown.

***Syrphus* Fabricius.** Largely north temperate with extensions into the Oriental and Neotropical Regions (Brazil, Argentina, and Chile), this genus has 70 species, including 17 in the Neotropical Region and three in Costa Rica. A key to the Neotropical species is in Thompson et al. (2000). Larvae are predatory on Sternorrhyncha.

***Toxomerus* Macquart.** Found in the New World (southern Canada and southward), *Toxomerus* has 141 species, including 132 in the Neotropical Region. There are 22 named species and nine undescribed species in Costa Rica. The last key to species is that of Hull (1943b), but Metz & Thompson (2001) revised the larger species. Some larvae are predatory on Sternorrhyncha, but some feed on pollen. The most famous pollen-feeder is *T. politus* (Say), which feeds on corn (*Zea mays*) pollen and was known to the Aztecs as an indicator of good corn harvests.

***Trichopsomyia* Williston.** This is a north temperate genus whose distribution extends into Australia and the Neotropical Region (south to Brazil). There are 28 species, including 12 in the Neotropical Region. In Costa Rica, there are one named and five undescribed species. The latest key is that of Fluke (1937). Larvae are predatory on psyllids and other Sternorrhyncha.

***Xanthandrus* Verrall.** This genus is cosmopolitan, except absent from New Zealand. There are 26 species, including 14 in the Neotropical Region. Two species are present in Costa Rica. The last keys are those of Fluke (1937) and Borges & Pamplona (2003). Some species are predators of caterpillars.

***Xylota* Meigen.** The 137 *Xylota* species are found in all regions except the Australian. Seven are found in the Neotropical Region, while eight undescribed species are in Costa Rica. A revision has been prepared (Thompson et al., in press). Larvae are saprophagous in wet decaying tree sap and wood.

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