ISSN 1211-3026 Čas. Slez. Muz. Opava (A), 62: 193-206, 2013
DOI: 10.2478/cszma-2013-0021

Key to adults and larvae of the genera of European Syrphinae (Diptera, Syrphidae)

Pavel Láska, Libor Mazánek & Vítězslav Bičík

Key to adults and larvae of the genera of European Syrphinae (Diptera, Syrphidae). – Čas. Slez. Muz. Opava (A), 62: 193-206, 2013.

Abstract: The name *Syrphus* and *Epistrophe* were widely used for most of the species of the present subfamily Syrphinae during the first half of the twentieth century. In the years 1967- 1969 there appeared three independent proposals where these polyphyletic genera were split into putative monophyletic genera and subgenera. The schemes were not identical, and some species in the genera *Epistrophella, Meligramma, Fagisyrphus, Megasyrphus, Eriozona, Leucozona, Xanthogramma, Lapposyrphus and Simosyrphus* have subsequently been arranged in various ways by different authors. *Semiscaeva* is now for practical purposes classified as subgenus of *Scaeva*, even though we would rather it were a genus. We give a key of adults of all 27 European genera and of larvae from 26 genera of Syrphinae. This classification is based on a long term detailed study of larvae and biology, on male genitalia and on some new adult characters. This system was almost fully supported by the molecular analysis. Only one change was made from that of the molecular analysis – the status of *Lapposyrphus*. Our discussion is limited to nine genera which have a different classification from that of the last 30 years. For the remaining 18 genera, up to now there are no doubts about their classification. Our discussion will justify the submitted nomenclature. The key and discussion are destined for use by authors of articles and local keys. Our classification remains open for further changes made on the basis of newly found characters. We do not recommend using older nomenclature arbitrarily.

Key words: Syrphidae, Syrphinae, taxonomy, *Fagisyrphus, Epistrophella, Meligramma, Megasyrphus, Eriozona, Lapposyrphus, Semiscaeva,* generic classification, morphology, male genitalia, larvae, key to genera

Introduction

The generic classification of the subfamily Syrphinae was rather artificial for a long time in the mid-twentieth century, with the large catch-all genera of *Syrphus* Fabricius, 1775 and *Epistrophe* Walker, 1852, in, for example, the monumental work of Sack (1932).

However, these two genera are polyphyletic or paraphyletic. Some of Sack´s species of *Syrphus* belong to *Epistrophe,* the genus *Melangyna* contained just one species while most species of the present genus *Melangyna* were treated as *Epistrophe*, etc. In the main, continental European workers used Sack's work, as well as Verrall (1901), Lundbeck (1916) and Stackelberg (1970). Some attempts to create a new generic classification were very superficial and artificial, such as those of Enderlein (1938), Szilády (1940) and Frey (1946) – only Séguy (1961) followed their proposals. Goffe (1952) proposed a better way of splitting the genera *Syrphus* and *Epistrophe*, resulting in a greater number of monophyletic genera.

In the years 1959 – 1962, shortly after the appearance of Hennig's (1952) compilation summarizing existing larval descriptions of Diptera, Dušek and Láska dealt mainly with the larval biology of aphidophagous Syrphidae, describing several previously undescribed larvae in German (Dušek & Láska, 1959a, 1960b, 1962) using Sack´s (1932) nomenclature, and simultaneously in Czech (Dušek & Láska, 1959b, 1960a, 1961) where the larvae were sorted into various natural groups. These were, for example, *Scaeva* and the *Syrphus corollae* group (the current genera *Eupeodes, Scaeva* and *Lapposyrphus*), the *Syrphus ribesii* group (the current genus *Syrphus*), the *Epistrophe euchroma* group (the current genus *Epistrophella*), the *Epistrophe eligans* group (the current genus *Epistrophe*), the *Epistrophe balteata* group (the current genera *Episyrphus* and *Meliscaeva*), the *Epistrophe triangulifera* group (the current genus *Meligramma*) and the *Syrphus albostriatus* group (the current genus *Dasysyrphus*). This was the first step in splitting the Syrphinae, but the authors decided not to give new names to their groups. Simultaneously the descriptions of syrphid larvae by Dixon (1960) appeared. Some years before, in North America, Heiss (1938) had described the larvae of many species of Syrphidae, and Fluke (1950) had proposed a way of splitting the genus *Syrphus*, *Epistrophe* and related genera based purely on male genitalia. The key to adults by Coe (1953), although based only on British genera, used some new modern characters (originating from works by Collin), making it possible to differentiate some groups of species within his genus *Syrphus*, including for the first time those that would become *Melangyna* and *Ischyrosyrphus*. Thus the time was ripe for establishing new monophyletic genera, and within a short period, three systems appeared independently: Dušek & Láska (1967), Hippa (1968) and Vockeroth (1969).

Each of these works agreed in their independent delineation of monophyletic groups created by splitting up the obviously polyphyletic genera *Syrphus* and *Epistrophe* but unfortunately, new, apparently monophyletic groups of species were classified at different ranks (as genera or subgenera) and unrelated subgenera were placed in one genus.

In the beginning the discrepancies were underestimated. Vockeroth (1980) in his article about the taxonomy of *Melangyna* Verrall, 1901, remarked that "Dušek & Láska (1967) and some other authors have treated *Meligramma* Frey, 1946 as a genus distinct from *Melangyna*; this, like the recognition of *Fagisyrphus* Dušek & Láska, 1967 as a distinct genus, has been a matter of personal preference". Currently taxa such as *Meligramma* and *Epistrophella* Dušek & Láska, 1967 are still treated in diverse ways. Thus for the last 40 years or more, various generic names have been used for particular species of Syrphini. The appearance of the molecular phylogenetic study by Mengual et al. (2008) was a major step forward in the phylogeny and classification of the Syrphinae, and its genera are in considerable agreement particularly with Dušek & Láska (1967); of recent systems, the most congruent is Rotheray & Gilbert (1999).

For the tribe Bacchini, the most important work was that of Andersson (1970) which clearly distinguished adults of *Platycheirus* and *Melanostoma*.

The present work is an attempt to stabilize at least European generic classification by providing a key to adults and third-instar larvae of European genera. We provide notes to some genera that have been problematic over the last thirty years. We think such stabilization necessary because otherwise works will continue to be published that are inconsistent with the current consensus, such as the recent paper of Ball et al. (2011), which has some aspects of its classification incongruent with the molecular data (see later).

Material & Methods

Biometrical data were obtained by ocular micrometer. Angles were measured on a specially modified microscope with the scale in angular degrees.

Larvae of syrphids were collected from colonies of aphids. Some larvae were obtained by rearing of eggs laid by gravid females. Colour and shape were studied in living larvae. The posterior respiratory process was drawn from puparia, if available; if not, it was drawn from third-instar larvae. Some genera have black carinae in the puparia, but not in the larvae.

The terminology used for descriptions of the larvae and pupae is the same as in our previous papers, from Dušek & Láska (1959a) to Láska et al. (2006). The term 'orificium' was used instead of 'spiracular openings', and the term 'periorificial' was used instead of 'interspiracular' for ornamentation, because this occurs not only between (inter) orificia, but also outside (peri) orificium I and III (see Bhatia 1939).

Abbreviation PRP means: posterior respiratory process

All European species were examined, unless stated otherwise, and we always state whether we examined the larvae and/or puparia.

Results

Syrphinae have bare humeri, in contrast with Milesinae (with hairy humeri) and Microdontini (with cell r_5 with an extra cross-vein). For the time being the tribe Pipizini (hairy humeri) is not included in our definition of the Syrphinae currently only one species was sequenced for molecular analysis, but clearly this group is related to the Syrphinae. We divided the subfamily into three tribes: Syrphini, Bacchini and Paragini. We propose to classify the European Syrphinae into 27 genera:

SYRPHINI:
Dasysyrphus Enderlein, 1938
Didea Macquart, 1834
Doros Meigen, 1803
Epistrophe Walker, 1852
Epistrophella Dušek & Láska, 1967
Episyrphus Matsumura & Adachi, 1917
Eriozona Schiner, 1860
Eupeodes Osten Sacken, 1877
Fagisyrphus Dušek & Láska, 1967
Chrysotoxum Meigen, 1803
Lapposyrphus Dušek & Láska, 1967
Leucozona Schiner, 1860 subgenus *Leucozona* s.str.
subgenus *Ischyrosyrphus* Bigot, 1822
Megasyrphus Dušek & Láska, 1967
Melangyna Verrall, 1901
Meligramma Frey, 1946
Meliscaeva Frey, 1946
Parasyrphus Matsumura & Adachi, 1917
Scaeva Fabricius, 1805 subgenus *Scaeva* s.str.
subgenus *Semiscaeva* Kuznetzov, 1985
Simosyrphus Bigot, 1882
Sphaerophoria Lepeletier & Serville, 1828
Syrphus Fabricius, 1775
Xanthogramma Schiner, 1860 (including *Olbiosyrphus* Mik, 1897)

BACCHINI:
Baccha Fabricius,1805
Melanostoma Schiner, 1860
Platycheirus Lepeletier & Serville, 1925
Xanthandrus Verrall, 1901

PARAGINI:
Paragus Latreille, 1804

Key to European genera of Syrphinae (for adults)

1 Tergite 1 well developed, especially on disc extending well beyond scutellum .... *Paragus (Paragini)*
- Tergite 1 greatly reduced, practically covered by scutellum **2**
2 Face and scutellum partially yellow or at least scutellum partially brown (Syrphini) **3**
- Face and scutellum black .... (Bacchini) **26**
3 Tergite 2 with large whitish or greyish spots or fasciae occupying almost whole tergite. Spots or fasciae on tergite 4 absent or much smaller than on tergite 2. Eye hairy .... ………………………………………………………………………………… *Leucozona*
- Tergite 2 black without or with smaller yellow spots or bands not occupying almost whole tergite. Spots or fasciae on tergite 4 usually absent, or as small as on tergite 2. If tergite 2 with large whitish or greyish spots, then eye bare **4**

4 Abdomen not marginated **5**
\- Abdomen marginated **13**
5 Anterior anepisternum pilose **6**
\- Anterior anepisternum bare **8**
6 Extreme posterior margin of wing with minute black dots **7**
\- Extreme posterior margin of wing without minute dots .... *Parasyrphus*
7 Metasternum hairy .... *Episyrphus*
\- Metasternum bare .... *Meliscaeva*
8 Meeting point of vein R_{2+3} with wing margin situated more basally than meeting point of vein R_{4+5} with vein M_1 (Fig. 21) .... *Sphaerophoria*
\- Meeting point of vein R_{2+3} with wing margin and meeting point of vein R_{4+5} with vein M_1 about equally distant from base of wing (Fig. 22) **9**
9 Extreme posterior margin of wing with minute dots .... *Fagisyrphus*
\- Extreme posterior margin of wing without minute dots **10**
10 Dark or black lateral spots longitudinal on sternite 2 separated by broad yellow area (Fig. 25). Hind coxa without pile tuft at posteromedial apical angle .... *Meligramma*
\- Dark or black spots on sternite 2 different (e.g. Figs 26, 27). Hind coxa with pile tuft posteromedially **11**
11 Face with black median stripe or completely black .... *Melangyna*
\- Face without black median stripe, completely yellow **12**
12 Katepisternum with dorsal and ventral pile patches narrowly joined posteriorly. Tergite 4 usually with entire yellow bands .... *Epistrophe*
\- Katepisternum with dorsal and ventral pile patches broadly separated. At least tergite 4 with two spots .... *Epistrophella*
13 Lower lobe of calypter with long pilose area dorsally .... *Syrphus*
\- Lower lobe of calypter without long pile **15**
14 Membrane on posterior margin of wing broad and mostly undulated. (Fig. 16, photo see Dušek & Láska 1985) **16**
\- Membrane on posterior margin of wing narrower and not undulated (Fig. 17) **19**
15 Vein R_{4+5} moderately dipped, cell r_5 in middle distinctly broader than in basal end. **16**
\- Vein R_{4+5} distinctly dipped, cell r_5 in middle almost as broad as in basal end **17**
16 2nd antennal segment approximately ten times shorter than elongate 3rd segment .... *Simosyrphus*
\- 2nd antennal segment more developed, approximately four times shorter than 3rd segment .... *Eupeodes*
17 Eye bare .... *Lapposyrphus*
\- Eye hairy **18**
18 Transverse axis of abdominal spot oblique .... *Scaeva s. str.*
\- Transverse axis of abdominal spot horizontal .... *Scaeva (sg. Semiscaeva)*
19 Margins of mesonotum and/or pleurae with sharply defined bright yellow pattern . **20**
\- Mesonotum and katepisternum all dark **22**
20 Antennae very long, more than 4 times longer than broad .... *Chrysotoxum*
\- Antennae short, about twice longer than broad **21**
21 Wing with dipped vein A_1 into anal cell before tip .... *Xanthogramma*
\- Wing with vein A_1 almost straight before apex .... *Doros*
22 Vein R_{4+5} dipped, cell r_5 about as broad in middle as in basal end **23**
\- Vein R_{4+5} not dipped, cell r_5 in middle broader than in basal end (Fig. 18) **24**
23 Eye hairy. Vein R_{4+5} slightly dipped (Fig. 19) .... *Megasyrphus*
\- Eye bare. Vein R_{4+5} slightly or strongly dipped (Fig. 20) .... *Didea*

24 Bumblebee-like flies with tergites 1 to 3 black and abdomen apically with brightly red to yellow hairs .... *Eriozona*

- Not bumblebee-like flies. Tergites 2 and 3 usually with yellow markings **25**

25 Whole eye uniformly pilose or nearly so. Stigma on wings often well developed .... *Dasysyrphus*

- Eye bare, at most densely pilose on dorsal half, nearly bare on ventral half. Stigma on wings usually less developed .... *Epistrophe*

26 Medial part of metasternum strongly reduced (see Andersson 1970) as if gnawed at ... . *Melanostoma*

- Metasternum in medial part regularly arched as usual in other genera **27**

27 Abdomen extremely long and narrow in narrowest part distinctly narrower than scutellum middle .... *Baccha*

- Abdomen otherwise **28**

28 Abdomen rather narrow with parallel sides third segment of antenna not longer than first and second together .... *Platycheirus*

- Abdomen rather broad, third segment of antenna longer than first and second together .... *Xanthandrus*

Key to third-instar larvae

1 Body with apparent segmental papillae bearing distinct setae on first seven abdominal segments, PRP with short high carinae with orificia (at most 0.08 mm) together resembling coffee bean, PRP width less than 0.4 mm .... *Paragus*

- Body without apparent segmental papillae on first seven papillae, or width of end of PRP more than 0.4 mm and carinae longer **2**

2 Last abdominal segment with pair of unusually long papillae terminated by seta .... *Dasysyrphus*

- Last abdominal segment with pair of at most smaller conical papillae with seta, or with blunt fleshy projections **3**

3 Larva flesh-coloured, without fat pattern, and in most genera with pair of blunt fleshy projections at end of last segment .... Pipizini

- Larva of different colour, mostly with fat pattern, without pair of blunt fleshy projections **4**

4 Spiracular plates in anterior part broader than in posterior part, outer ends of orificia I mutually more distant than outer ends of orificia II. Integumental vestiture present or absent **5**

- Spiracular plates as broad in anterior part as in posterior part, outer ends of orificia I mutually equally distant as orificia II **7**

5 Larva green with a whitish mid-dorsal line. Orificia II and III parallel. Orificium III inserted lower than orificium II **6**

- Larva brown to sandy coloured, without a whitish dorsal medial line. Orificia II and III not parallel, or if parallel, then inserted at the same level of the spiracular plate .... *Eupeodes*

6 Integumental microtrichia present (except for Oriental *Scaeva latimaculata*);Orificium III inserted at only about 1/3 the length of orificium II and posteriorly to orificium II; fleshy projection under segmental spines less developed, not apparent on puparium ... . S*caeva s. str.*

- Integumental microtrichia absent except sometimes on posterior part of body. Orificium III inserted about half-way or more posteriorly to orificium II; fleshy projections under segmental spines more prominent, when dry persisting as microtrichose portion under segmental spines on puparium, especially on posterior part of dorsum .... *Simosyrphus*

7 Integumental vestiture or at least spicules (cf. Rotheray 1993) present **8**

\- Integumental vestiture absent **12**

8 Larva green, or partially or completely brown, with whitish medial line on dorsum. PRP 0.35-0.65 mm broad apically .... *Scaeva (sg. Semiscaeva)*

\- Larva different from this **9**

9 Large larva, covered with integumental spicules; before PRP dorsally with one biconical feature (Fig. 15) as large as PRP; PRP broader than 1 mm .... *Eriozona*

\- Larva without combination of above characters **10**

10 Spiracular plates not inclined, PRP almost sessile .... *Lapposyrphus*

\- Larvae with spiracular plates inclined, PRP longer **11**

11 Spiracular plates inclined posteriorly (Fig. 11) .... *Megasyrphus*

\- Spiracular plates inclined medially .... *Didea*

12 Larva transparent, all orificia horizontal and parallel .... *Xanthandrus*

\- Larva variously coloured, not all orificia horizontal and parallel **13**

13 Small larva without segmental spines, basal colouring mostly green or greenish, PRP at most 0.36 mm broad **14**

\- Larvae of various colours with more or less developed segmental spines **16**

14 PRP longer than broad .... *Sphaerophoria*

\- PRP as long as broad or broader, at most 0.30 mm wide **15**

15 Larva green, mostly without whitish fat stripes, orificia very short, distant from centre of spiracular plate .... *Melanostoma* (Bacchini)

\- Larva greenish with two longitudinal fat stripes, orificia longer, in more medial position .... *Baccha* (Bacchini)

16 Orificia placed on common plate, rather minute .... *Platycheirus* (Bacchini)

\- Orificia more or less large, not placed on common plate **17**

17 Larva completely white or whitish, living hidden, circular in profile **18**

\- Larva of different colour; if rather whitish, then oval and flat **19**

18 Orificia of usual shape, not distinctly wavy .... *Chrysotoxum*

\- Orificia apparently wavy .... *Xanthogramma*

19 Larva broadly oval with distinct orange pattern, margin serrate; PRP width 0.38-0.45 mm (Figs 1, 2) .... *Epistrophella*

\- Larva with different characters **20**

20 Larva transparent with almost symmetrical whitish pattern; dorsal spur large; orificia placed mainly on sides of PRP (Fig. 5), less than half of orificia visible from above, PRP width 0.35-0.44 mm .... *Fagisyrphus*

\- Larva not like this **21**

21 Angle between orificia I and III about 110 – 135°; orificia linked by black; PRP width 0.42-0.47 mm **22**

\- Larva with orificia I and III about 180°, or at least 140° **23**

22 PRP without any trace of dorsal spurs; orificia III almost parallel; orificia edged with only narrow dark-coloured strips; PRP shorter than high, spiracular plates horizontal . ... *Episyrphus*

\- PRP with distinct, even if sometimes very tiny dorsal spurs; orificia III rather convergent towards apex (20 – 70°); orificia edged with broader blackish stripes; PRP as broad as high (*auricollis*) or shorter with posteriorly inclined spiracular plates (*cinctella*) .... *Meliscaeva*

23 Larva flat, rectangular or trapezoidal in outline, margin serrate (PRP width 0.32-0.36 mm .... *Meligramma*
- Larva not like this **24**
24 Large larva; angle between orificia I and III about 180°; PRP width 0.44-0.70 mm **25**
- Smaller larva; angle between orificia I and III about 145-165°; PRP width less than 0.44 mm **28**
25 Green larva, rarely whitish (sometimes orange when in diapause), flat, oval; periorificial feature hill-like, large (Figs 3, 4) .... *Epistrophe*
- Larva not like this **26**
26 Larva flat, cream or brown, parallel sided; PRP similar as above .... *Leucozona*
- Larva almost semi-circular in cross-section, yellow or variegated **27**
27 Larva with yellow or yellow-and-red pattern; spiracular plates almost circular .... *Syrphus*
- Larva with yellow, red and deep-brown pattern; spiracular plates in posterior half broadened (according to Fig. by Schneider, 1953) .... *Parasyrphus* (*P. nigritarsis*)
28 PRP broadening towards base .... *Parasyrphus*
- PRP broadened only just at the base (whole PRP on Figs 6, 7) .... *Melangyna*

Discussion

Epistrophella. European and Nearctic species of *Epistrophella* are distinguished from *Epistrophe* by a bare metasternum. Sternal spots are present. The genus differs from the common species *Meligramma trianguliferum* (Figs 23, 24) by a broader face. Fully developed larvae are flat and oval in outline (as in *Epistrophe*), but the colour pattern is distinct, characteristically orange without a median whitish stripe. The posterior respiratory process is very distinctive in the absence of dorsal spurs and by the overall shape (Figs 1, 2) (for *Epistrophe* see Figs 3, 4) (see also Dušek´s colour picture in Dušek & Láska 1959a).

Vockeroth (1969) classified *Epistrophella* as a subgenus of *Epistrophe*, and Hippa (1968) as a subgenus of *Meligramma*. Mengual et al. (2008) on the basis of molecular analysis found that it should be classified as separate genus different from *Epistrophe* and far distant from *Meligramma*. However, Ball et al. (2011) placed *E. euchroma* in *Meligramma*. We have not been able to examine *E. coronata*, included in *Epistrophella* by Doczkal & Vujić (1998).

Meligramma. The form of the sternal spots (Fig. 25) is different from *Epistrophella* and *Melangyna* (Figs 26, 27). It differs from *Melangyna* by the hind coxae lacking a pile tuft posteromedially (the character used by Vockeroth, 1969). Common species differ from *Epistrophella* by having a narrower face (Figs 23, 24) an exception is the very different species *M. cingulatum*, superficially similar to *Melangyna* with its broader and black face.

The habitus of larvae is very specific: the outline is rather rectangular to trapezoidal with lateral papillae (see Dušek's colour picture in Dušek & Láska 1959a). The posterior respiratory process has dorsal spurs (in contrast to *Epistrophella*). The male terminalia are uniform and distinctly different from *Melangyna*. Dušek & Láska (1967), Hippa (1968) and Rotheray & Gilbert (1989) all classified this taxon as a separate genus. Vockeroth (1969) and Thompson & Rotheray (1998) included it in the genus *Melangyna* as a subgenus, but Mengual et al. (2008) resolved *Meligramma* as a group different from *Melangyna*.

Fagisyrphus (Fig. 5) has a narrow face. The adult is clearly distinct from *Melangyna* and *Meligramma* because it has the extreme posterior wing margin with minute black dots. The posterior respiratory process of the larva with its peri-orificial ornamentation is less conspicuous than the situation in *Melangyna*, in which it is spherical and obvious (Figs 6, 7). Unusually, the orificia slope downwards in *Fagisyrphus* (Fig. 5, see also Dušek´s colour picture in Dušek & Láska 1962). The larvae are quite different from *Meligramma* in the absence of serrate margins and simple outline of the body, and by the large dorsal spurs of the posterior respiratory process. There is only a single species worldwide. In the recent literature it was classified as a species of *Melangyna* or *Meligramma*, although *Fagisyrphus* was used by Torp (1984, 1994) and recently by Haarto & Kerppola (2007) and Bartsch (2009). Vockeroth (1968) was influenced by Heiss (1938), where the larva of *Meligramma trianguliferum* was wrongly presented as "*Meligramma cincta*". Mengual et al. (2008) resolved *Fagisyrphus* as a sister-group of *Meligramma*. Ball et al. (2011) placed *F. cinctus* as a member of *Melangyna*.

Megasyrphus (Figs 10, 11, 12, 14). Larvae are robust and caterpillar-like, similar to *Scaeva*, but without ventral metathoracal spines. The PRP has its spiracular plates declined behind, and orificia I and III have angles distinctly greater than in *Didea*. *Didea* was classified as a separate genus by Dušek & Láska (1967), Hippa (1968), Vockeroth (1969) and Rotheray & Gilbert (1999). Vockeroth (1992) wrote that although the larvae of *Megasyrphus* and *Didea* are very similar, the adults are so different that he could not accept the synonymy of the two names as proposed by other authors. In the larva of *Megasyrphus*, the spiracular plate slopes posteriorly (Fig. 12). Vockeroth & Thompson (1987) included *Megasyrphus* in *Eriozona* Schiner, 1860, as did Vockeroth (1992) and Thompson & Rotheray (1998) because of the similarity of male terminalia. The striking difference of the adults is not confined to the bumblebee mimicry of *Eriozona*, since there are differences also in wing venation. An important character is the vein R_{4+5} in *Eriozona*, which is not dipped as in *Megasyrphus* (Figs 18, 19). Even if the larvae of *Eriozona* are of a similar type, they have unusual protuberances before the posterior respiratory process (Fig. 15), and the spiracular plate is not sloped downwards (Fig. 14). In the shape of the male genitalia, they are similar to the very distant *Episyrphus*. *Eriozona* is accepted as a separate genus in Mengual et al. (2008) according to molecular analysis, and Haarto & Kerppola (2007) and Bartsch (2009) also admit this genus. Ball et al. (2011) included *M. erraticus* in the genus *Eriozona*.

Eriozona (Figs 13, 14, 15, 18). This is a robust bumblebee-like fly, with vein R_{4+5} not dipped. The larvae are very robust and caterpillar-like, with unusual protuberances; the angle between orificium I and III is about 130°. There are large dorsal protuberances, and especially in the last dorsal pair of segmental spines where they are fused into a single large dorsal feature (Fig. 15). The spiracular plate is not sloped (Fig. 14). There is just a single species worldwide.

Lapposyrphus. The eyes are bare, the vein R_{4+5} is distinctly dipped, and the membrane on the posterior margin of the wing is broad and undulated. The larvae are caterpillar-like, hairy, and with distinct ventral spines on the metathorax. The body has a brownish pattern, similar to *Eupeodes*. Orificia II and III are not parallel. The larvae differ from *Eupeodes* by less-distant outer ends of orificia I. Vockeroth (1969) and Dušek & Láska (1967) included *Lapposyrphus* as a subgenus of *Metasyrphus* (=*Eupeodes*), but using the structure of the male genitalia Hippa (1968) treated it as a subgenus of *Scaeva*. *Lapposyrphus* has vein R_{4+5} dipped, but not in the same way as in *Scaeva*, and different from *Eupeodes*. Torp (1984) and Speight (2006) classified it as a separate genus. Mengual et al. (2008) recommend treating it as a distinct genus according to the molecular analysis.

Semiscaeva is treated here as only a subgenus of the genus *Scaeva* for practical reasons. The adults are extremely similar to the nominal subgenus *Scaeva*, but the posterior respiratory process of the larva is quite different and uniform. Kuznetzov (1985) created the subgenus *Semiscaeva* for the species *Scaeva dignota* on the basis of its small angle of approximation of the eyes. He placed *S. selenitica*, in fact a species very closely related to *S. dignota*, in the subgenus *Scaeva* together with *S. pyrastri* L. and other species. Thus the present composition of *Semiscaeva* is quite different from Kuznetzov's conception and corresponds to the *S. selenitica* group of Dušek & Láska (1985).

Leucozona includes two distinct subgenera, *Leucozona* s. str. and *Ischyrosyrphus* Schiner, 1860. Dušek & Láska (1967) left these subgenera as genera but remarked that *Ischyrosyrphus* is close to *Leucozona* according to external morphology, genitalia and larval morphology.

Xanthograma currently includes the previously separate genus *Olbiosyrphus* Mik, 1897. The mesonotum is distinctly yellow on the sides, and the anal vein is distinctly dipped in A_1. Dušek & Láska (1967) left *Olbiosyrphus* as a separate genus, but noted that it is very close to *Xanthogramma* and could be united with it, an action taken by Vockeroth (1969).

Simosyrphus. In this genus, the genus *Ischiodon* Sack, 1913 by Láska et al. (2006) was included according to larvae and molecular analyses.

The new or neglected taxonomic characters of adults used here are the following:

1. The broad and undulating wing membrane posterior to the marginal veins in *Scaeva*, *Lapposyrphus* and *Eupeodes* (see Fig. 16 and photo in Dušek & Láska 1985). Although for experts this is the best character, it has never been used in the keys of other authors.
2. The wing venation in *Sphaerophoria* (Fig. 21).
3. The sternal pattern of the abdomen in *Meligramma* (Fig. 25) and *Melangyna*.
4. The dipping of vein A_1 into the anal cell before the tip in *Xanthogramma*, in contrast to *Doros*.

In the larval key are many new characters on the posterior respiratory process and spiracular plates. In existing keys, just the colouring is used in some cases.

The first attempt to compare the three independent systems of Dušek & Láska (1967), Hippa (1968) and Vockeroth (1969) was done by Dušek & Láska (1972) in defending the status of their genera. However, this contribution was published in Czech and was not cited by most authors.

It is interesting that the type species of many genera of *Syrphini* are rather peculiar species not characteristic for most species of the present genus, e. g. *Eupeodes volucris* Osten Sacken, 1877, with its extremely large male genitalia, for the genus *Eupeodes*. All the rest of the species of this genus have normal male genitalia of the usual type. The female of type species *Melangyna quadrimaculata* (Verrall, 1873) lack the colour pattern present in other species of this genus. *Leucozona lucorum* (Linnaeus, 1758) is a bumblebee mimic, whereas other species are more similar to the normal syrphine habitus. *Eriozona syrphoides* (Fallén, 1817), an extremely striking bumblebee mimic, was proposed (unfortunately, in our opinion) as congeneric with *Megasyrphus*, which is typically syrphine-coloured. This situation is explained by the fact that unusual and peculiar species are usually described as new genera before other, less-conspicuous related species. In contrast, *Fagisyrphus* as an adult is similar to other common genera such as *Episyrphus*, *Meliscaeva*, *Melangyna*, *Epistrophella*, hence its generic status has been overlooked.

The larvae are the cardinal stages for understanding the classification of Syrphini. For example, whereas we have no specific characters for the adults of the genus *Dasysyrphus*, the larvae are very characteristic and quite different from the larvae of other genera. The same is true for larvae of the genus *Epistrophe*: imaginal characters (except genitalia) are very dubious, but the larvae are clearly separate. This is amply demonstrated by the history of studying the larvae of this genus. Both Vockeroth (1969) and Dušek & Láska (1967) were surprised by Dixon's (1960) unusual description of the larvae of *E. grossulariae*, which did not fit at all with the other members of *Epistrophe*. Fortunately Rotheray (1986) discovered that *E. grossulariae* was misidentified by Dixon (1960), and presented the correct description of its larva which in its larval characters now fits perfectly with the other members of the genus.

Unfortunately larval characters are not known by most syrphidologists who deal with the adults. For this reason we studied the imaginal characters and attempted to find good generic characters for adults (up to now only for genera occurring in Europe). Adult generic characteristics are still insufficient for *Epistrophe*, which key out in two places in the key (as partim), and for *Dasysyrphus*, where we also have no specific characters except for hairy eyes.

Acknowledgements: The authors would like to thank Tore R. Nielsen, who generously donated specimens of *Meligramma cingulatum* for our study, and Graham Rotheray for lending us the puparium of *Eriozona syrphoides*. We are obliged also to Miroslav Barták for loan of some specimens, to Monika Hanáková for help with some figures and especially to Francis Gilbert and both anonymous reviewers for their comments and language improvement.

References

Andersson H. (1970): Taxonomic notes on the genera *Platycheirus* and *Melanostoma* (Dipt., Syrphidae) with lectotype designations. – Entomol. Scandinavica 1: 236-240.

Ball S. G., Morris R. K. A., Rotheray G. E. & Watt K. R. (2011): Atlas of the hoverflies of Great Britain (Diptera, Syrphidae). Wallingford, Biological Records Centre, 183 pp.

Bartsch H. (2009): Tvavingar: Blomfugor (Diptera: Syrphidae: Syrphinae). Sveriges lantbruksuniversiteit, 406 pp.

Bhatia M. L. (1939): Biology, morphology and anatomy of aphidophagous Syrphid larvae. – Parasitology 31: 78-129.

Coe R. L. (1953): Diptera. Family Syrphidae. Handbooks for identification of British insects. – Trans. R. Entomol. Soc. London 10 (1): 1-98.

Dixon T. J. (1960): Key to and descriptions of the third instar larvae of some species of Syrphidae (Diptera) occurring in Britain. – Trans. R. Entomol. Soc. London 112: 345-379.

Doczkal D. & Vujić A. (1998): Redescription of *Epistrophella coronata* (Rondani, 1857), stat. rest., comb. nov., with first description of the male, and notes on the generic assignment (Diptera, Syrphidae). – Volucella 3: 51-62.

Dušek J. & Láska P. (1959a): Beitrag zur Kenntnis einiger unbekannter aphidophager Syrphiden-Larven (Diptera, Syrphidae). – Acta Soc. Entomol. Čechoslov. 56: 279-292.

– (1959b): Contribution to knowledge of hoverfly larvae (Syrphidae, Diptera). – Přírod. Čas. Slezský 20: 273-287 (in Czech, Summary in German).

– (1960a): Contribution to knowledge of hoverfly larvae (Syrphidae, Diptera) II. – Přírod. Čas. Slezský 21: 299-320 (in Czech, Summary in German).

– (1960b): Weitere unbekannte Syrphidenlarven (Diptera, Syrphidae). – Acta Soc. Entomol. Čechoslov. 57: 371-380 + 7 Tab.

– (1961): Contribution to knowledge of hoverfly larvae (Syrphidae, Diptera) III. – Přírod. Čas. Slezský 22: 513-541 (in Czech, Summary in German).

– (1962): Beitrag zur Kenntnis einiger Syrphiden-Larven (Diptera, Syrphidae). – Acta Soc. Entomol. Čechoslov. 59: 348-356.

– (1964): A contribution to distinguishing the European species of the subgenus *Syrphus* Fabricius (Diptera, Syrphidae) according to male genitalia and larvae. – Acta Soc. Entomol. Čechoslov. 61: 58-70.

– (1967): Versuch zum Aufbau eines natürlichen Systems mitteleuropäischer Arten der Unterfamilie Syrphinae (Diptera). – Acta Sci. Nat. Acad. Sci. Bohemoslov. Brno 1: 349-390.

– (1972): The problems of generic classification of the subfamily Syrphinae (Syrphidae, Diptera). – Sbor. Jihoč. Muz. České Budějovice 12 /Suppl. 2/: 69-73 (in Czech, English summary).

– (1985): A review of the genus *Scaeva* Fabricius (Diptera, Syrphidae) with the description of a new species from Chile. – Acta Entomol. Bohemoslov. 82: 206-228.

Enderlein G. (1938): Beiträge zur Kenntnis der Syrphiden. – Sitzb. Ges. Naturf. Fr. Berlin, 4-7: 192-237.

Fluke C. L. (1950): The male genitalia of *Syrphus*, *Epistrophe* and related genera (Diptera, Syrphidae). – Trans. Wisc. Acad. Sci. Arts Lett. 40: 115-148.

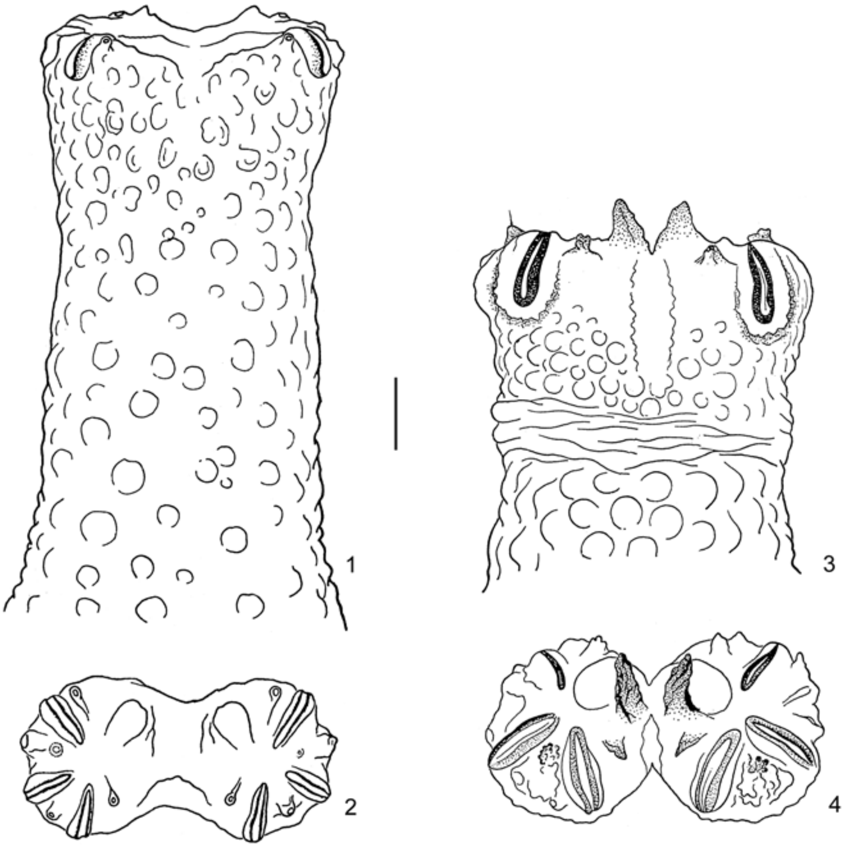
Frey R. (1946): Übersicht der Gattungen der Syrphiden-Unterfamilie Syrphinae (Syrphinae plus Bacchinae). – Notulae Entomol. 25(1945): 152-172.

Goffe E. R. (1952): An outline of revised classification of the Syrphidae on phylogenetic lines. – Trans. Soc. British Entomol. 11 : 92-124.

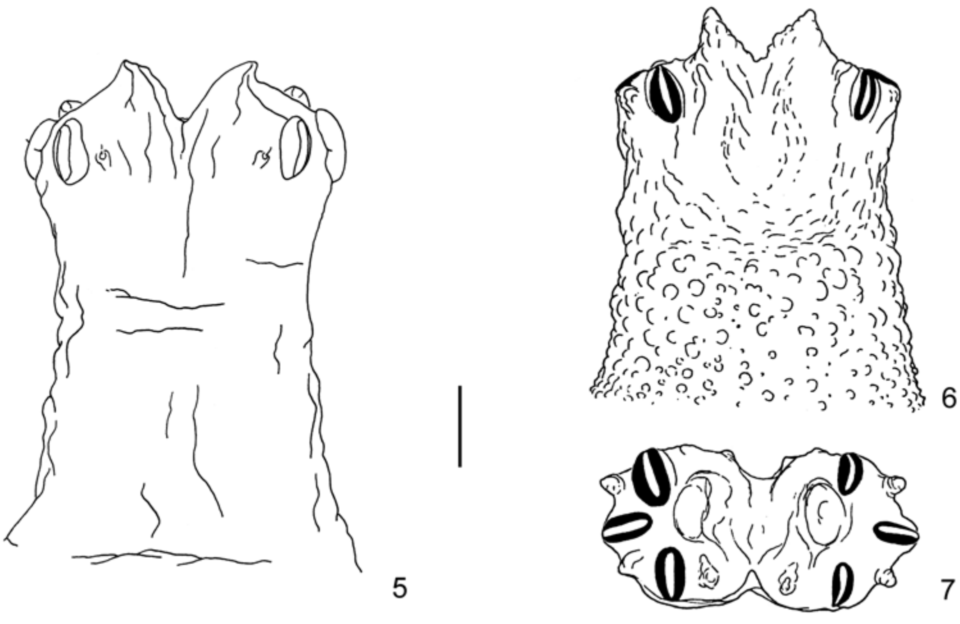
Haarto A. & Kerppola S. (2007): Finnish hoverflies and some species in adjacent countries. Keuruu, 647 pp.
Heiss E. M. (1938): A classification of the larvae and puparia of the Syrphidae of Illinois exclusive of aquatic forms. – Ill. Biol. Monogr. 16: 1-142.
Hennig W. (1952): Die Larvenformen der Dipteren, Teil 3, Berlin, 658 pp.
Hippa H. (1968): A generic revision of the genus *Syrphus* and allied genera (Diptera, Syrphidae) in the Palaearctic region, with descriptions of the male genitalia. – Acta Entomol. Fenn. 25: 1-94.
Kuznetzov S. Y. (1985): Hoverflies of the genus Scaeva Fabricius (Diptera, Syrphidae) of the Palaearctic fauna. – Entomol. Obozr. 64: 398-418 (in Russian).
Láska P., Bičík V., Dušek J., Mazánek L. & Holinka J. (2000): Description of the puparia of *Afrosyrphus varipes* and *Dideopsis aegrotus* (Diptera, Syrphidae). – Acta Univ. Palackianae Olomucensis, Fac. Rer. Nat. Biologica 38: 79-83.
Láska P., Pérez-Bañón C., Mazánek L., Rojo S., Ståhls G., Marcoz-García M. A., Bičík V. & Dušek J. (2006): Taxonomy of the genera *Scaeva*, *Simosyrphus* and *Ischiodon* (Diptera: Syrphidae): description of immature stages and status of taxa. – Eur. J. Entomol. 103: 637-655.
Lundbeck W. (1916): Diptera Danica 5 (Lonchopteridae, Syrphidae, Copenhagen, 591 pp.
Mengual X., Ståhls G. & Rojo S. (2008): First phylogeny of predatory flower flies (Diptera, Syrphidae, Syrphinae) using mitochondrial COI and nuclear 28S rRNA genes: conflict and congruence with the current tribal classification. – Cladistics 24: 543-562.
Rotheray G. E. (1986): The larve and puparium of *Epistrophe grossulariae* (Meigen) (Dipt., Syrphidae) with a note on overwintering behaviour. – Entomol. Month. Mag. 122: 215-218.
– (1993): Colour guide to hoverfly larvae (Diptera, Syrphidae) in Britain and Europe. Dipterists Digest 9, 155 pp.
Rotheray G. E. & Gilbert F. S. (1989): The phylogeny amd systematics of European predacious Syrphidae (Diptera) based on larval and puparial stages. – Zool. J. Linn. Soc. 95: 29-70.
– (1999): Phylogeny of Palaearctic Syrphidae (Diptera): evidence from larval stages. – Zool. J. Linn. Soc. 127: 1-112.
Sack P. (1932): Syrphidae. In: Lindner E. (ed.): Fliegen der Palaärktischen Region, Stuttgart 4(6) no. 31, 451 pp.
Séguy E. (1961): Diptères Syrphides de l´Europe occidentale. - Mém. Mus. National Nat. Nouv. Ser A Zoologie, Paris 248 pp.
Schneider F. (1953): *Syrphus nigritarsis* Zett., ein Ei- und Larvenräuber von *Melasoma* (Chrysom., Col.). – Tijdschrift over Plantenziekten 59: 192-194.
Speight M. C. D. (2006): Species accounts of European Syrphidae (Diptera), Ferrara 2006. In: Speight M. C. D, Castella E., Sarthou J-P. & Monteil C. (eds): Syrph the Net: The databasae of European Syrphidae, Dublin 54, 252 pp.
Stackelberg A. A. (1970): 49. Syrphidae. In: Bei-Bienko G. Y. (ed.): Classification Key to the Insects of the European pars of USSR 5 (2). Opredeliteli po Faune SSSR 103: 11-96 (in Russian).
Szilády Z. (1940): Über paläarktische Syrphiden: IV. – Ann. Mus. National Hungarici (Zool) 33: 54-70.
Thompson F. C. & Rotheray G. (1998): Family Syrphidae. In Papp L. & Darvas B. (eds): Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). Vol. 3, Higher Brachycera. Science Herald, Budapest. pp. 81-139.
Torp E. (1984): De Danske svirrefluer (Diptera: Syrphidae): kendetegn, levcevis og udbredelse, Danmarks Dyreliv 1**,** Fauna Bøger, 300 pp.
– (1994): Danmarks Svirrefluer (Diptera: Syrphidae). Danmarks Dyreliv 6. Apollo books, Stenstrup, 490 pp.
Verrall G. H. (1901): Syrphidae of Great Britain. British flies 8, 691 pp.
Vockeroth J. R. (1969): A Revision of the genera of the Syrphini (Diptera: Syrphidae). – Mem. Entomol. Soc. Canada 62: 1-176.
– (1992): The Flower Flies of the subfamily Syrphinae of Canada, Alaska, and Greenland. Diptera: Syrphidae. The Insects and Arachnids of Canada. Part 18. Publ. nr. 1867, 456 pp.
– (l980): A review of the Nearctic species of *Melangyna* (*Meligramma*) Frey (Diptera: Syrphidae). – Canad. Entomol. 112: 775-778.
Vockeroth J. R. & Thompson F. C. (1987): Syrphidae. – In: McAlpine J. F. et al. (eds): Manual of Nearctic Diptera. Vol. 2. Res. Branch, Agric. Canada, Monogr. 28, Chapter 52, pp. 713-743.

Authors' addresses: Pavel Láska, Vítězslav Bičík, Department of Zoology, Natural Science Faculty, 17. listopadu 50, CZ-771 46 Olomouc, Czech Republic. E-mail: askap@seznam.cz, bicikv@seznam.cz
Libor Mazánek, Jívová 231, 783 16 Jívová E-mail: syrphidae@centrum.cz

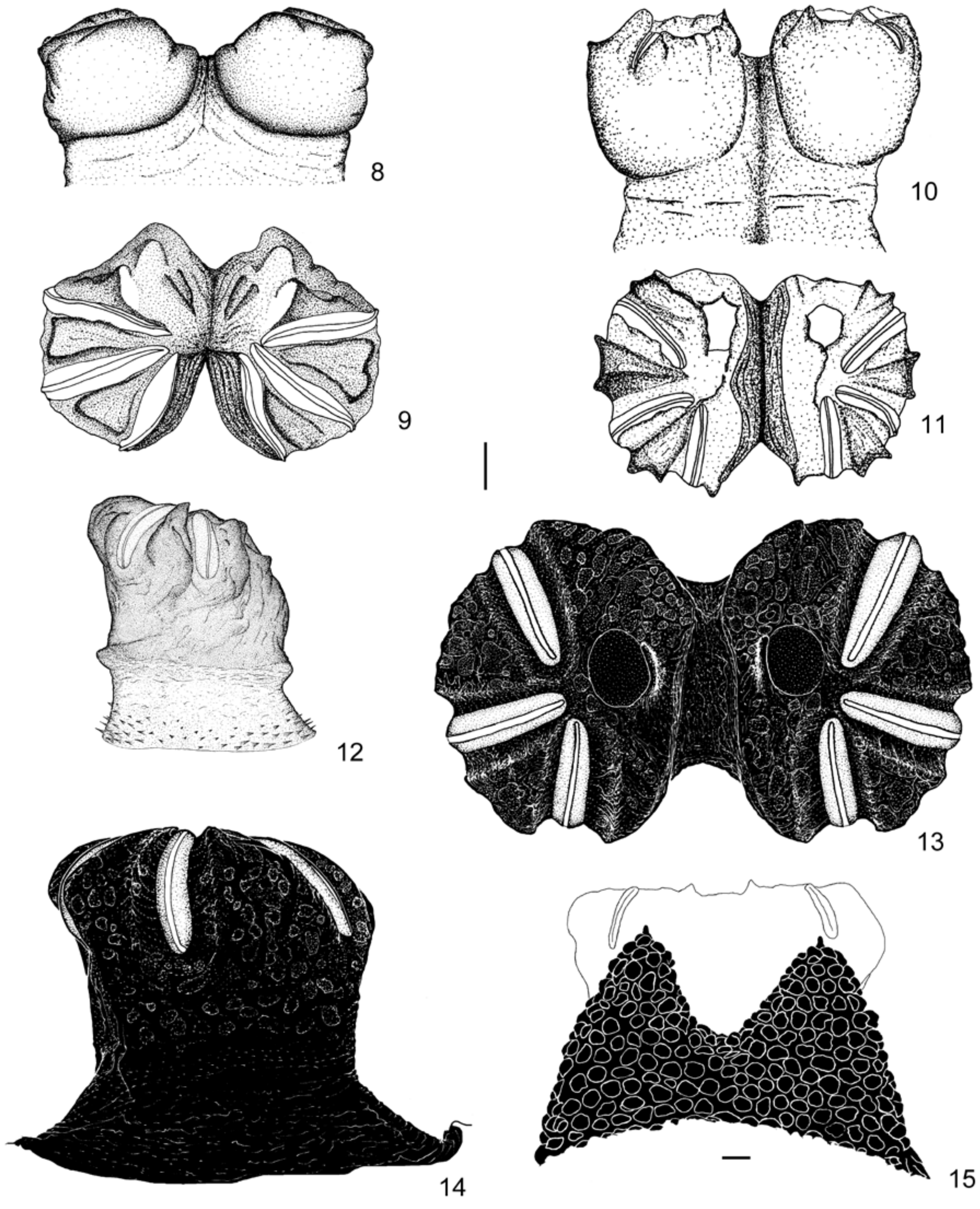
Appendix



Figs 1-4: Posterior respiratory process of third instar larvae. **l.** *Epistrophella euchroma*, frontal view; **2.** *E. euchroma*, spiracular plate; **3.** *Epistrophe nitidicollis*, frontal view; **4.** *E. nitidicollis*, spiracular plate. – Scale: 0. 1 mm.

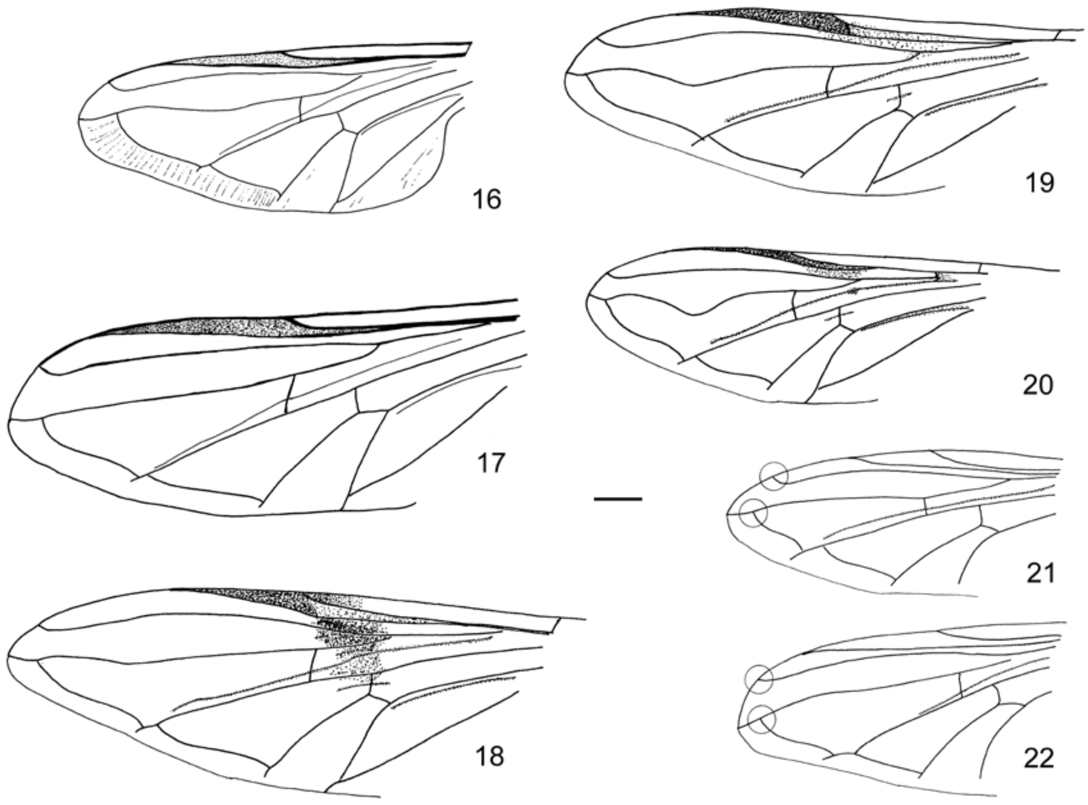


Figs 5-7: Posterior respiratory process of third instar larvae. **5.** *Fagisyrphus cinctus*, frontal view; **6.** *Melangyna umbellatarum*, frontal view; **7.** *M. umbellatarum*, spiracular plate. – Scale: 0. 1 mm.

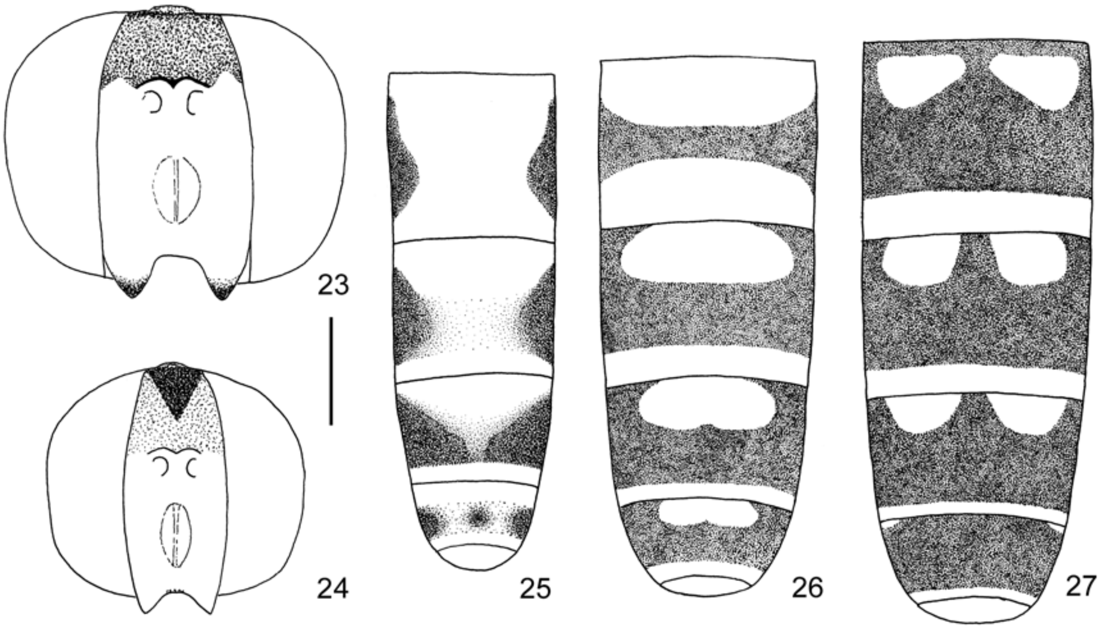


Figs 8-14: Posterior respiratory process of third instar larvae (according to puparia): **8.** *Didea fasciata*, frontal view; **9.** *D. fasciata*, spiracular plate; **10.** *Megasyrphus erraticus*, frontal view; **11.** *M. erraticus*, spiracular plate; **12.** *M. erraticus*, lateral view. **13.** *Eriozona syrphoides*, spiracular plate; **14.** *E. syrphoides*, lateral view.

Fig 15: *E. syrphoides*: dorsal segmental protuberances before posterior respiratory process. – Scales: 0. 1 mm.



Figs 16-22: Wings. **16.** *Eupeodes corollae*; **17.** *Epistrophe eligans*; **18.** *Eriozona syrphoides*; **19.** *Megasyrphus erraticus*; **20.** *Didea fasciata*; **21.** *Sphaerophoria scripta*; **22.** *Meligramma trianguliferum*. – Scale: 1mm.



Figs 23-24: Heads ♀, frontal view. **23.** *Epistrophella euchroma*; **24.** *Meligramma trianguliferum.*
Figs 25-27: Abdominal sternites, ♀. **25.** *Meligramma guttatum*; **26.** *Melangyna umbellatarum*; **27.** *Melangyna lasiophthalma*. – Scale: 1mm.