

# Immature Stages of Five European *Hybomitra* Species of the *bimaculata*- and *montana*-Groups (Diptera, Tabanidae)

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**Abstract.** Descriptions of mature larvae and pupae of five common European so-called "red-sided" *Hybomitra*-species (*H. muehlfeldi* Brauer, 1880, *H. bimaculata* Macquart, 1826, *H. ciureai* Séguy, 1937, *H. lundbecki* Lyneborg, 1959 and *H. tropica* Linnaeus, 1758) are presented. To date, only descriptions of larva have been available for *Hybomitra tropica* Panzer (= *bimaculata* Macq.) given by STAMMER (1924) and later by SKUFIN (1967). Both these descriptions are inadequate and, according to SKUFIN, it was impossible to find distinctive characters between *Hybomitra tropica* Panzer and *Hybomitra solstitialis* Schiner (= *ciureai* Séguy).

The authors give characters distinctive both for larvae and pupae which satisfactorily separate immature stages of the *Hybomitra*-species in question; some structures (glossae, lateral sclerites spiracles, etc.) are characterized for the first time. The authors have found conspicuous distinctive characters common to *H. muehlfeldi* Br., *H. bimaculata* Macq. and *H. ciureai* Séguy, and on the other hand, to *H. lundbecki* Lyneb. and *H. tropica* L., which corresponds with well-known groups of species (*bimaculata*- and *montana*-groups) which support separation of the adults. All the main and significant characters are figured.

Even though the adults of horseflies have been studied in Europe very intensively recently, nearly nothing is known about their immature stages. This gap in our knowledge on such an economically important group of flies as Tabanidae is rather startling. Much has been written on the economic importance of Tabanidae both in agriculture and as vectors of certain important diseases of man and animals, but no control can be carried out without knowing the biology and life history of at least the common species. The history of mosquito studies is the best proof of this fact.

Several papers and descriptions of immature stages of European species given by various authors are insufficient (e.g. BRAUER 1883, STAMMER 1924, or SKUFIN 1967). The exception is recent paper of TAMARIÑA (1965), who gives precise descriptions of *Chrysops relictus* Meig. and *Chrysops rufipes* Meig. A much better situation is in North America, where immature stages of Tabanidae have been studied more intensively by many authors, e.g. by MARCHAND (1920), CAMERON (1926, 1934), STONE (1930), PHILIP (1931), JOHANNSEN (1935), SCHWARDT (1936)

and TESKEY (1964). A most complete survey of the known immature stages of North American Tabanidae is given by ROBERTS and DICKE (1964). An outstanding paper on all larval instars and pupa of the very common Palaeartic *Haematopota pluvialis* L. was published by CAMERON in 1934. The last mentioned paper, as well as some papers of ENGLISH (1951, 1954, 1961) and COSCARON and PHILIP (1967) concerning Australian Pangoniinae and South American genus *Dasybasis* respectively, are very important because of the precise description of the head capsule and mouth parts of larvae in question. Some recent papers on immature stages of several Japanese Tabanidae are given by OGAWA (1959) and SAITO (1965).

## MATERIAL AND METHODS

Larvae of different species have been separated mainly according to various characters such as location of striations in the skin on various segments, coloration of larvae, length and number of pseudopodial circlets, shape of rings and other pubescent areas on thoracic and abdominal segments, or the size and shape of anal segment and siphon. No specific characters on the head capsule and mouth parts have been studied, and if so (e.g. ISAAC 1924, PHILIP 1931, CAMERON 1934, ENGLISH 1952 to 1961, TAMARINA 1965 or COSCARON and PHILIP 1967), they have been considered only for their generic value. Even though head capsule and mouth parts are rather simple and uniform in this family, they possess some specific differential characters. The head capsule with its mouth parts can be seen in slides only when magnified. The structure of the head capsule is the same in mature larvae as in younger instars except the first.

The head capsule (Fig. 1) in mature larvae of *Hybomitra*-species is slender, heavily chitinized and can be completely withdrawn into thoracic segments. It is very mobile and can be rotated about 180°. It consists of two wide epicranial bands which are pointed at apex and of two slender apically downcurved tentorial apodemes. Laterally near the apices of epicranial bands there are on both sides small more sclerotized plates (lateral sclerites) of characteristic shape (Fig. 22a-e), which seem to be a valuable taxonomic feature when separating species.

Labrum (Fig. 2) is long and only slightly chitinized, narrowed to somewhat rounded and upturned tip and joined basally with clypeus, forming combined clypeus and labrum. Three pairs of distinct long setae are placed dorsally, the apical pair being separated by nearly twice the distance between the basal two pairs. Ventral part of labrum is less sclerotized and somewhat widened, armed with numerous short spines with an antero-ventral patch longer and directed forward.

Mandibles (Fig. 3) are sickle-shaped, very dark and heavily chitinized, with distinct serrations ventrally on apical third which become shorter and indistinct posteriorly. Each mandible possesses a longitudinal canal opening to a pore dorsally before tip.

Maxillae (Fig. 4) are much less chitinized than mandibles, rather transparent, representing two plates broad at base, apically pointed, and with a sharp ventral edge. Upper part is somewhat recessed at sides forming a groove for mandibles. Ventral part is armed on apical half with rather long, slender and pointed spines (4a) and there are distinct furrows above them running from apex of maxilla to its base. The apex is naked, without any spines. The maxilla is armed ventrally with very small spines numbering from 1 to 5 which arise from scale-shaped tubercles (4b) and with several combs of very long and basally broad spines (4c) directed downwards. The mandible articulates with the upper basal sclerite of the maxilla, which is linked at the same time with cephalic brush (Fig. 5), a small area with very closely set branched spines (Fig. 6 left) becoming smaller and usually only bifid at margins (Fig. 6 right).

Maxillary palps are two-segmented; apex of second segment is covered with sensory papillae (Fig. 7). Basal segment is armed beneath with a row of three very long setae becoming shorter

toward base, plus a rounded pore at base. Both segments are traversed by a longitudinal broad canal, which is rather sclerotized and finely wrinkled inside, especially at apex of basal segment.

Labium (Fig. 8) lies between the mandibles and is of elongated shovel-like form when viewed from above, terminating in paired pointed glossae; their shape and presence or absence of some setae or serrations appear to be a valuable taxonomic feature (Fig. 21a—j). The apex of labrum lies between glossae. Labium represents two longitudinal plates fused along their lower margins forming a heavily sclerotized hypopharynx, in cross-section being groove-like. One-segmented labial palps (Fig. 9) are very small, placed ventrally on labium near base and directed downwards; apex of palps is covered with sensory papillae.

Basally behind the labium there is a single ventral plate which is bifid distally and somewhat pointed basad. The ventral plate (ventral sclerite) is about one and one half times longer than the labium, nearly uniform in all species, with its anterior margin connected with the base of maxillary palp.

Antennae (Fig. 10) are three-segmented; terminal segment is bifid and very short, of about one-third length of second segment; the latter is traversed by an uninterrupted median canal. First segment is the longest, about as long as apical two segments together, bearing on the inner side near apex some teeth and two short setae anteriorly.

Some distinctive characters are to be found also on spiracles. The paired anterior spiracles (Fig. 13) are very small, placed dorsolaterally at the posterior margin of prothorax. Each is elongated, its atrium reaches as far as to metathorax, oval when viewed from above and often mushroom-shaped when viewed from the side. Eighth abdominal segment bears the posterior spiracles.

The larvae of *Hybomitra*-species are cylindrical or spindle-shaped, tapering to prothorax and anal segment; when extended, they are more than one-third times longer than in contraction. The larva is comprised of the head capsule and eleven segments, three thoracic and eight abdominal, ending in the respiratory siphon usually of varying shapes. There are four pairs of abdominal pseudopods (ventral, latero-ventral, lateral and dorsal) on first to seventh abdominal segments and more or less developed anterior rings on all thoracic and abdominal segments. The skin is distinctly striated except for smooth areas on dorsal and ventral parts of thoracic segments, and for fine network pattern on pseudopodial circlets and adjacent intersegmental furrows. The larvae are specifically ornate and conspicuously coloured from orange and reddish to green or brown with more or less extensive dark maculations.

The present paper deals with five very common so called "red-sided" *Hybomitra*-species of the *bimaculata*- and *montana*-groups. The larvae have been collected and reared by one of the authors (J. Ježek); all larvae of the five *Hybomitra*-species were collected during 1964—1966 at Jabkenice, Central Bohemia, on the periphery of ponds, usually submerged and, during winter months, under ice in frozen *Phragmites*, *Carex* and *Juncus*.

## 1. *Hybomitra muehlfeldi* (Brauer, 1880)

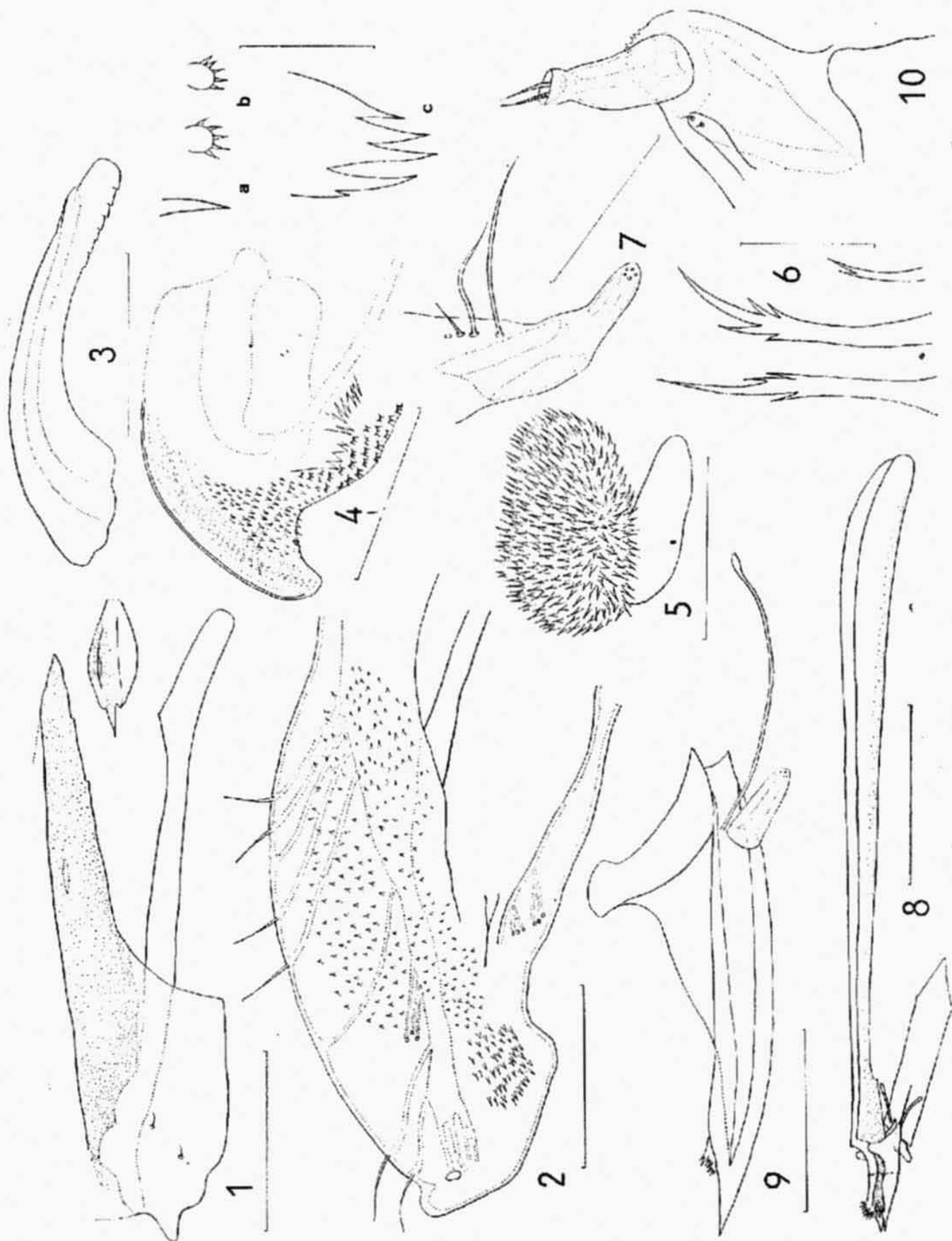
Figs. 1—20, 21a, b, 22a

Synonyms: *H. tropica* Pauzer of auctt. nec Linnaeus, partim; *H. solstitialis* Schiner of auctt., nec Meigen, partim.

Material: 18 exuviae, 42 pupal cases (24 ♂, 18 ♀). All larvae were collected from late March to the beginning of May 1966 and pupated from 24 April to 11 May. The pupal period was recorded in 10 specimens from 9 to 15 days at laboratory temperatures.

**Larva.** Mature larva 22 to 32 mm when extended. Living larvae vary from pink and orange to yellowish-brown with distinct pubescent rings on each segment.

The head capsule and mouth parts are figured in Figs. 1—10. Mandibles with 7 teeth on apical part beneath, glossae smooth without serrations, only occasionally



**Figs. 1-10.** Mouth parts of *Hybomitra muehlfeldi* Br. 1 - Head capsule. 2 - Labrum. 3 - Mandible. 4 - Maxilla; 4a-c - Spines of maxillae. 5 - Cephalic brush. 6 - Spines of cephalic brush. 7 - Maxillary palp. 8 and 9 - Labium with glossae and palp. 10 - Antenna. (All lateral view.) The scale line represents 1 mm in Figs. 1 and 8, 0.2 mm in Figs. 2 to 5, 7, 9 and 10, 0.05 mm in Figs. 4a, b, c and 6.

with apex slightly bifid. Lateral sclerite very pointed at tip, anteriorly extended in a long and sharp tooth about as long as one-third of the rest of the sclerite.

Prothoracic pubescent ring light brown and projected backward into five abbreviated narrow longitudinal stripes (two dorsal, two lateral and one ventral). Likewise, rings on meso- and metathorax light brown, posteriorly with only six short angular prongs; the lateral ones are especially indistinct. These dorsal projections are accentuated as distinct dark spots which are sometimes nearly as wide as pubescent ring. Abdominal segments 1 to 7 with two narrow and compact rings of about the same width; the posterior ring encloses pseudopods. The brown dorsal pubescent spots are present on all abdominal segments except the last. Both narrow rings are connected ventro-laterally on first abdominal segment, by a dark dorsal spot also latero-dorsally. Anterior ring is widely interrupted laterally on segments 2 to 7, while posterior ring only at sides of lateral pseudopods, the former often much more reduced on segments 6 and 7. The seventh abdominal segment with narrow ring at the hind margin, its maximum width is about 0.2 mm (0.1—0.3 mm). Exceptionally, it can be reduced to only two brown dorsal spots. Anal segment without any maculations. Siphon, when extended, shorter than anal segment, slightly tapering and rounded at tip. Postanal ring light brown at base of siphon and rather narrow, about as broad as one-third to one-half of the length of atrium of posterior spiracle. Pre-anal and postanal ridge with long and thin spines, the largest spines of pre-anal ridge shorter than the length of transverse cuticular rods of posterior spiracle. Atrium of anterior spiracle (spiracular chamber between spiracle and trachea) is mushroom-shaped, and index of the largest width to length is 1 : 1.5.

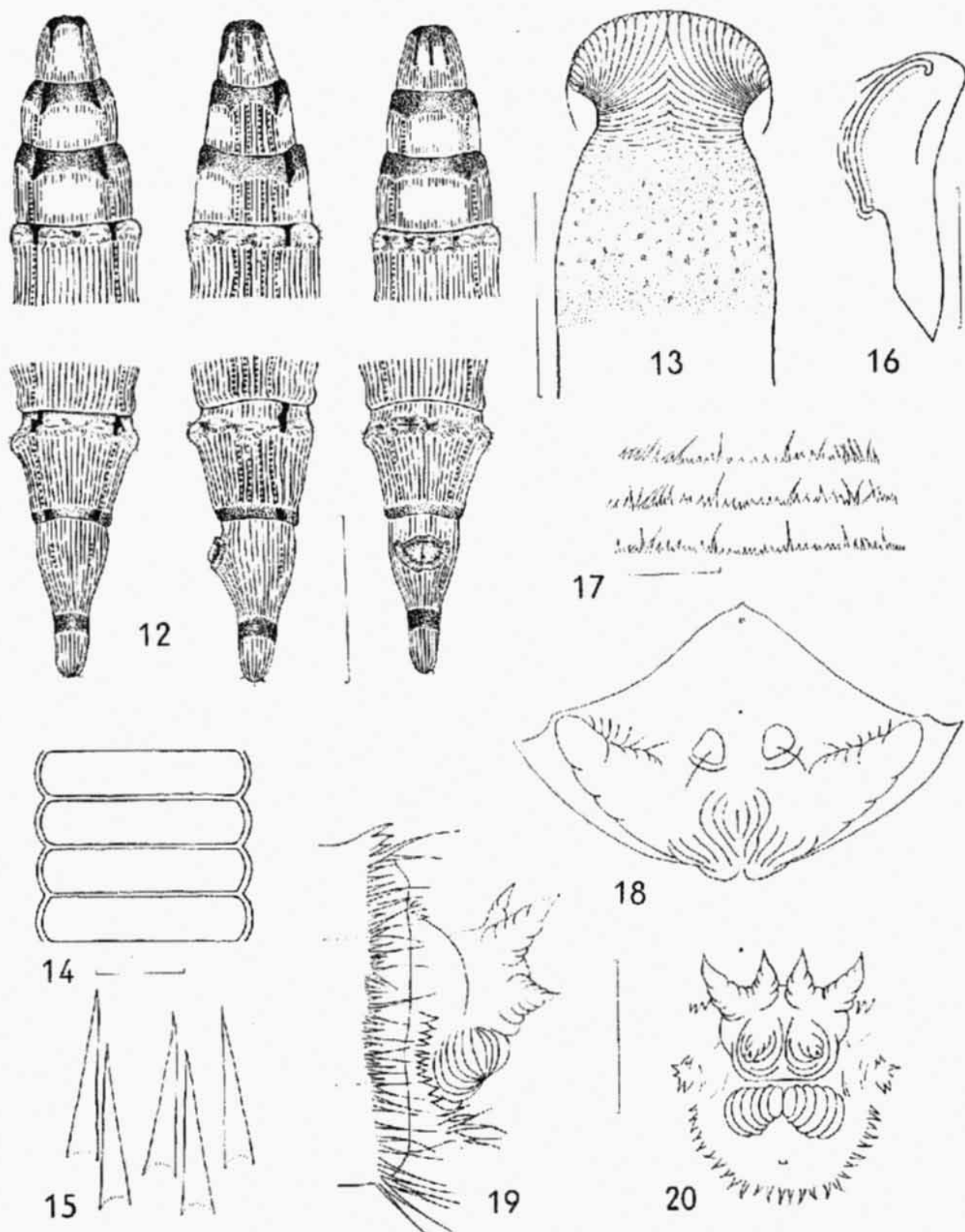
**Pupa.** Pupal case 16 to 19 mm in length, yellowish-brown; dark pigmentation on head and thorax not very distinct, reduced to the area between antennae and maxillary palps, to a broad stripe along dorso-median hatching suture and to dorsum of thorax. The venter of thorax and other parts on head with only very pale pigmentation.

The wide median cleft between frontal carinae very narrowed anteriorly, sometimes both carinate tubercles touching above. Frontal tubercles rounded and smooth. Head shield usually without any irregular striae, its margin with only slightly visible tooth near tip of antennal sheaths. The back of head only slightly striated.

Mesonotal spiracle plain and smooth, rima curved, dorsally very narrow. Spiracle on first abdominal segment slightly conical with rugose surface, about twice larger than spiracles on following segments. Rima elongate and eccentric. Spiracles on segments 2 to 7 of the same structure but much smaller and rimas nearly circular.

Spinose fringes on tergites complete, spines in one row only. Each tergite predominantly with short and broad spines, and, on medial third, a pair of long and very thin spines, which divides tergite into thirds, and some additional thin spines laterally. Sides with only thin spines in two rows, sternites with one row of thin spines of various length, but they are never as long as the medial pair on tergites;

no broad spines on sternites. Sides of segment 7 with 25 to 30 spines. Dorsal prongs of anal aster longer than the ventral prongs but of the same stoutness, lateral prongs more prominent, longer and thicker at base. Dorsocentral comb with 3 to 7 spines



**Figs. 12-20. *Hybomitra muehlfeldi* Br.** 12 — Larva (dorsal, lateral and ventral view, schematically). 13 — Anterior spiracle of larva, lateral view. 14 — Cuticular rods of larval posterior spiracle, lateral view. 15 — The largest spines of pre-anal ridge in larva. 16 — Mesonotal spiracle of pupa. 17 — Spinose fringes on abdominal tergites in pupa, dorsal view. 18 — Head shield, frontal view. 19 — Anal aster, lateral view. 20 — The same, caudal view. The scale line represents 5 mm in Fig. 12, 2 mm in Fig. 17. 1 mm in Figs. 18 to 20, 0.5 mm in Fig. 16, 0.1 mm in Fig. 13, 0.02 mm in Figs. 14 and 15.

which are slightly smaller than the 5 to 8 spines of lateral comb. Pre-anal fringe in male with 24 to 27 short spines of about half the length of the long spines on tergite 7; female with 7 to 9 spines on each side, the spines being longer towards medial gap but not longer than in male.

## 2. *Hybomitra bimaculata* (Macquart, 1826)

Figs. 21c, d, 22b, 23—31

Synonyms: *H. tropica* Panzer of auctt. nec Linnaeus, partim; *H. confinis* Zetterstedt; *H. bisignata* Jaenicke; *H. collini* Lyneborg.

Material: 20 exuviae, 78 pupal cases (40 ♂, 38 ♀). All larvae were collected from November 1965 until early May 1966. Larvae collected in November pupated during March 1966, the others collected from March to the beginning of May pupated in the first half of May. The pupal period was recorded in eight specimens from 12 to 14 days, and in single specimens 11 and 17 days at laboratory temperatures.

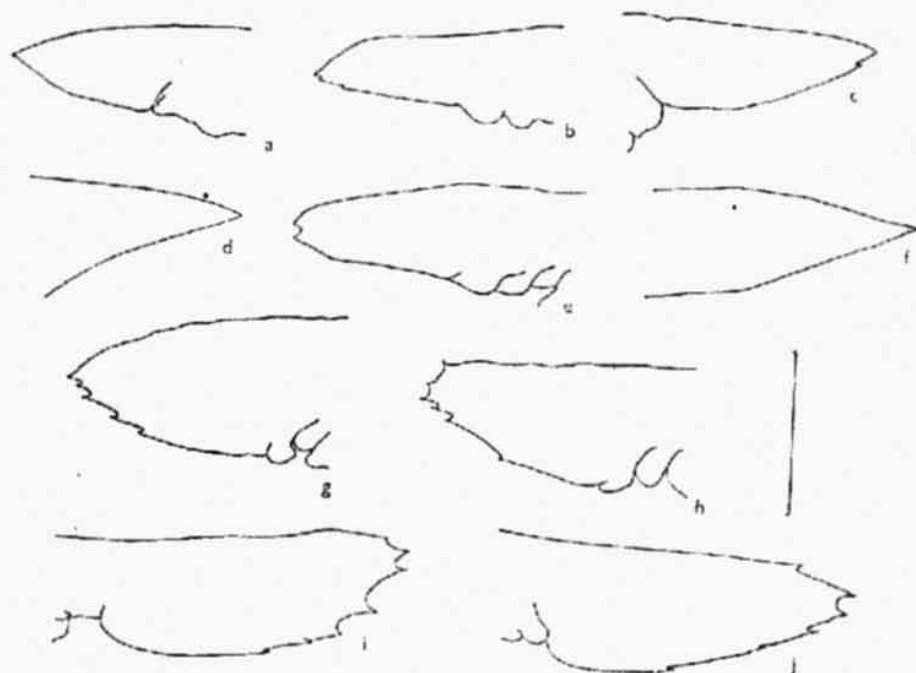


Fig. 21. Glossae of *H. muehlfeldi* Br. (a, b); *H. bimaculata* Macq. (c, d); *H. ciureai* Séguy (e, f); *H. lundbecki* Lyneb. (g, h); *H. tropica* L. (i, j). The scale line represents 0.05 mm.

**Larva.** Mature larva 25 to 32 mm when extended, with living coloration from reddish-orange and brownish to greyish-green, and with distinct pubescent rings on each segment.

Mandibles with 8 to 9 teeth on apical part beneath, glossae smooth without serrations. Lateral sclerites rounded at tip or with very short and blunt teeth.

Prothoracic ring dark brown, extended backwards into three narrow longitudinal incomplete stripes, one ventral and two lateral. Ring on meso- and metathorax dorsally with two blackish projections about as wide as pubescent ring. Both narrow rings on abdominal segments 1 to 7 are connected laterodorsally by blackish projections of anterior rings. Small pubescent areas sometimes also in front of large dorsal pubescent spots on abdominal segments 6 and 7. The seventh with rather

broad and somewhat rugose ring at the posterior margin, its width is about 0.4 mm (0.3—0.5 mm). Dark postanal ring at base of siphon rather broad, about as broad as one half to two-thirds of atrium length of posterior spiracle. The largest spines of pre-anal ridge nearly twice longer than the length of transverse cuticular rods of posterior spiracle. Atrium of anterior spiracle about twice longer than its maximum width.

**Pupa.** Pupal case 18 to 21 mm, yellowish brown with distinct dark brown pigmentation on head and thorax, especially on ventral part of head shield, on the back of head and on dorsum of thorax. Pigmentation on ventral part of thorax less distinct.

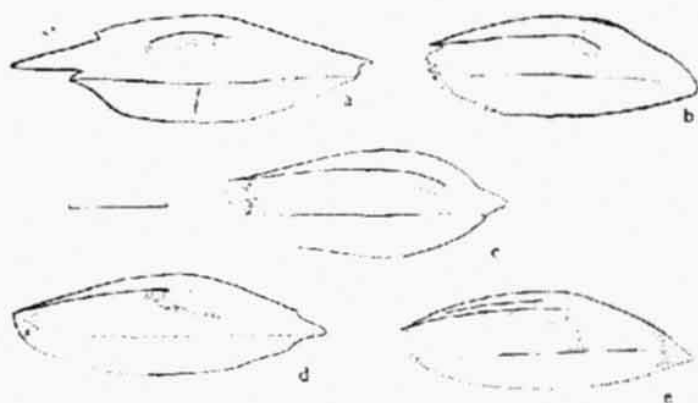


Fig. 22. Lateral sclerite of *H. muehlfeldi* Br. (a); *H. bimaculata* Macq. (b); *H. ciureai* Séguy (c); *H. lundbecki* Lyneb. (d); *H. tropica* L. (e). The scale line represents 0.2 mm.

Carinate tubercles with well developed and prominent lateral pair of carinae, carinal ridge continuous but with shallow median sulcus and with distinct dorsal striation. Frontal tubercles rounded to conical, with surface slightly rugose. Some irregular striae on head shield often present, the latter with slight tooth on margin near tip of antennal sheath. The back of head with dark pigmentation on broad stripe on dorso-median suture and with distinct striation.

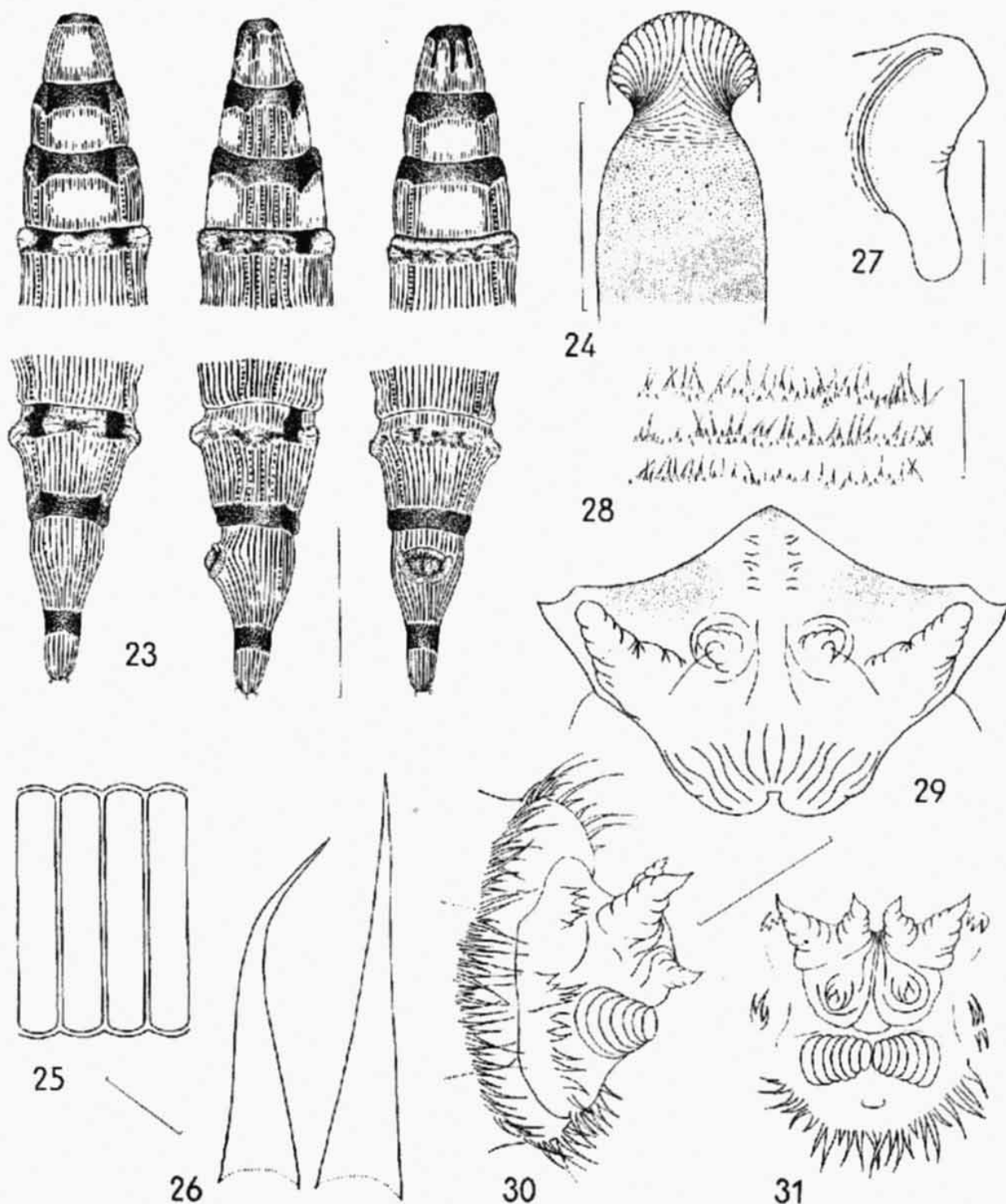
The spiracular mound on thorax usually overlaps anteriorly the end of rima; striation behind rima reaches the tip of spiracular mound. The spiracle on first abdominal segment usually reaches the sheath of wing; rima of abdominal spiracles slightly elongated or nearly circular on last segments.

Abdominal tergites with one or two irregular spinal fringes; anterior spines, when present, short and broad, posterior spines very long and thin, all of equal length. Sides with thin spines as long as on tergites, often, especially on basal segments, with complete anterior row of short spines. Sternites with one row of shorter thin spines, sometimes with few additional short spines anteriorly. Dorsal and ventral prongs of anal aster of about the same length, lateral prongs large and nearly three times longer. Dorsolateral comb with 1 to 5 spines, lateral combs with 3 to 6 spines. Pre-anal fringe in male with 23 to 25 spines; female with 6 to 8 spines on each side becoming longer mesally.

All reared specimens were the pale specimens with reddish lateral spots in the adults on first three abdominal tergites, named by LYNEBORC (1959) as *Hybomitra collini*.

Synonyms: *H. solstitialis* Schiner of auctt., nec Meigen, partim;? *H. manchurica* Takahasi; *H. schineri* Lyneborg.

Material: 7 exuviae, 11 pupal cases (8 ♂, 3 ♀). Larvae were collected in April and May 1966 pupated from 10 May to 8 June. The pupal period was recorded in 2 ♂ and 1 ♀ always 13 days at laboratory temperatures.

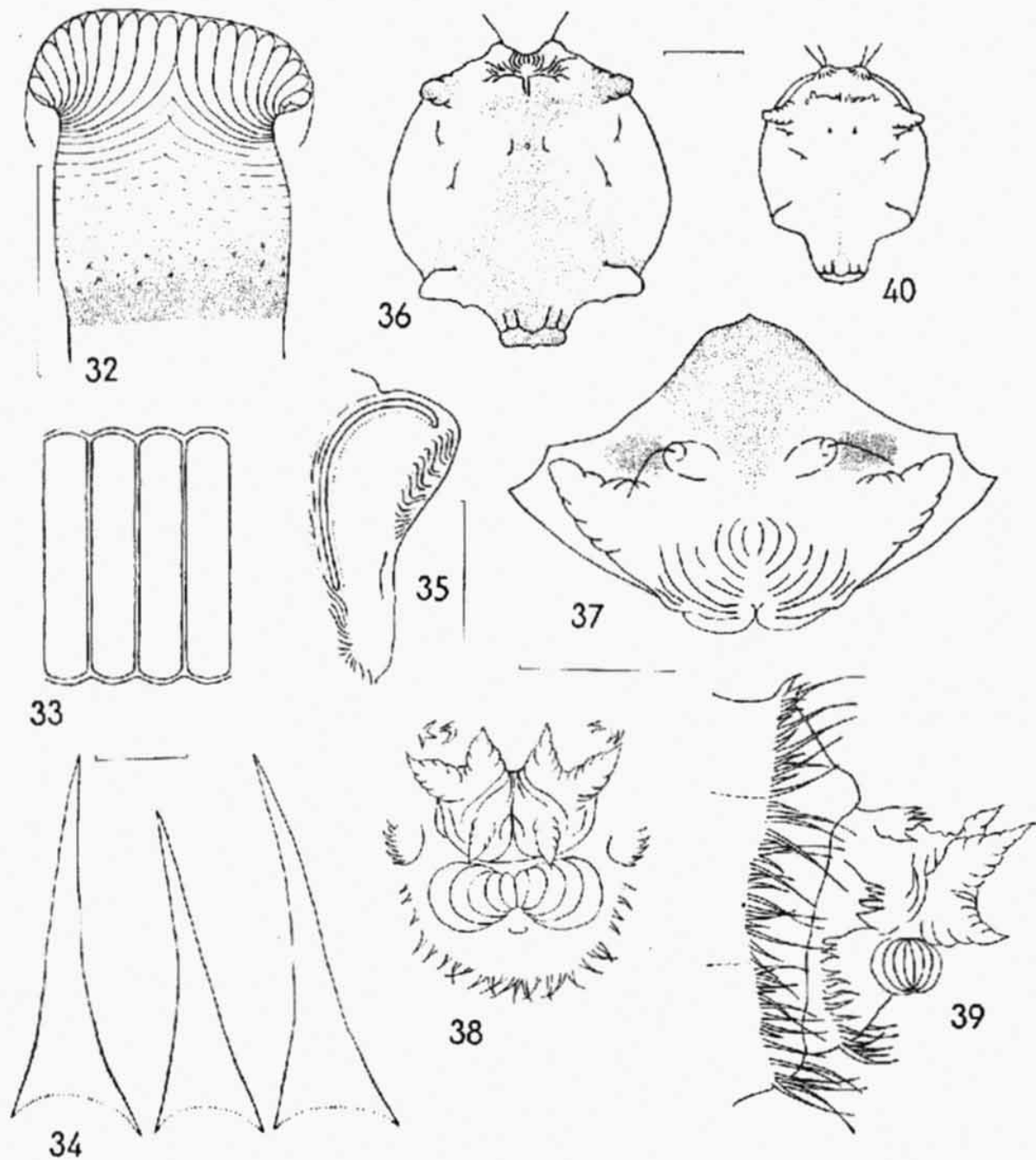


Figs. 23—31. *Hybomitra bimaculata* Macq. 23 — Larva (dorsal, lateral and ventral view, schematically). 24 — Anterior spiracle of larva, lateral view. 25 — Cuticular rods of larval posterior spiracle, lateral view. 26 — The largest spines of pre-anal ridge in larva. 27 — Mesonotal spiracle of pupa. 28 — Spinose fringes on abdominal tergites in pupa, dorsal view. 29 — Head shield, frontal view. 30 — Anal aster, lateral view. 31 — The same, caudal view. The scale line represents 5 mm in Fig. 23, 1 mm in Figs. 29 to 31, 2 mm in Fig. 28, 0.5 mm in Fig. 27, 0.1 mm in Fig. 24, 0.02 mm in Figs. 25 and 26.

**Larva.** Mature larva 29 to 33 mm when extended, the coloration in living larvae from pinkish-red to reddish-brown with distinct pubescent rings on each segment.

Mandibles with 8 to 9 teeth, and glossae smooth without serrations. Lateral sclerite produced anteriorly into short but pointed tooth about as long as one-fifth of the sclerite; its posterior margin with serrations.

Prothoracic ring dark brown, projected caudad as three abbreviated stripes as in *bimaculata* Macq. Meso- and metathoracic anterior rings with shorter prongs,

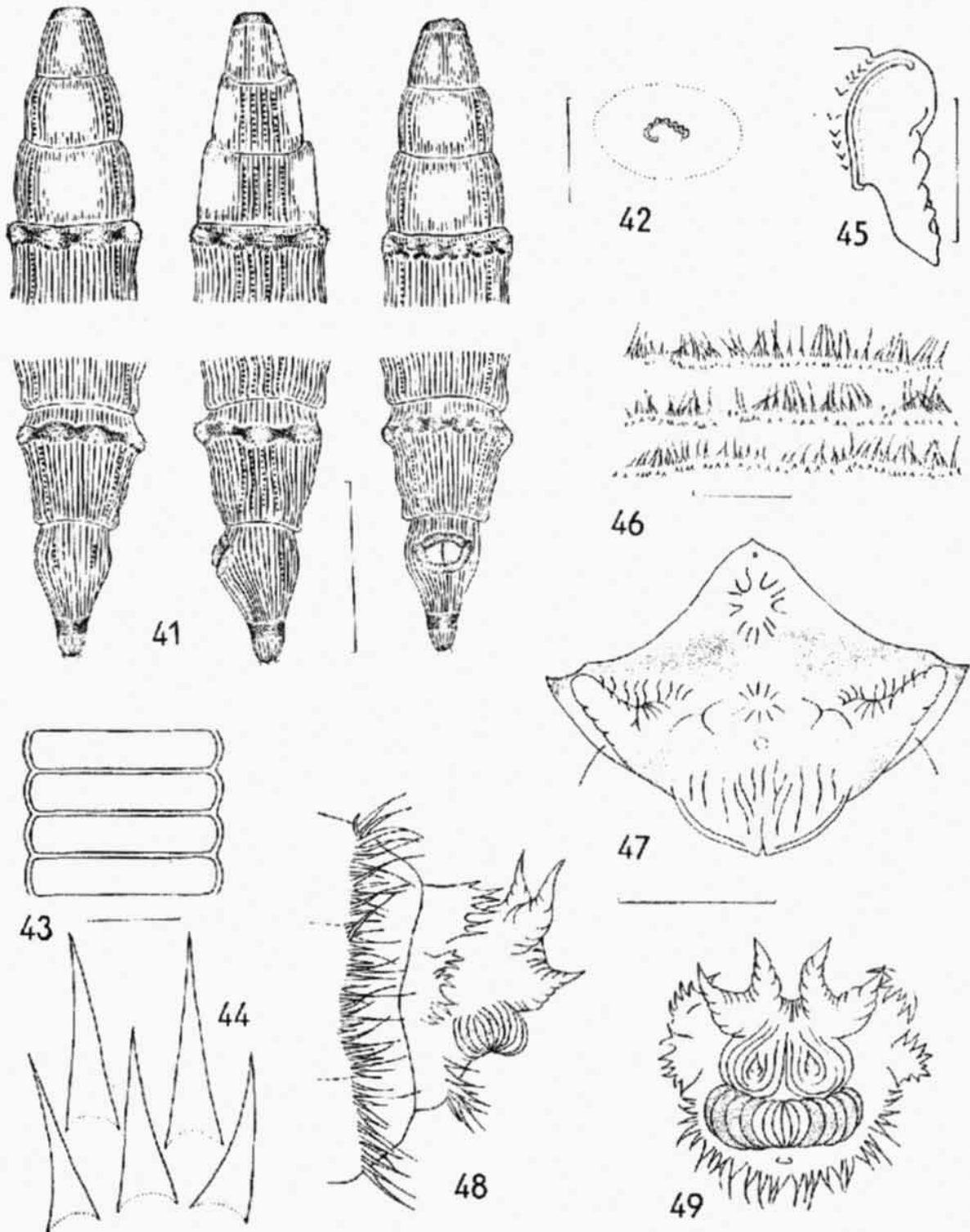


**Figs. 32–39.** *Hybomitra ciureai* Ségué. 32 – Anterior spiracle of larva, lateral view. 33 – Cuticular rods of larval posterior spiracle, lateral view. 34 – The largest spines of pre-anal ridge in larva, 35 – Mesonotal spiracle of pupa. 36 – Head shield, ventral view. 37 – The same, frontal view.

38 – Anal aster, caudal view. 39 – The same, lateral view.;

**Fig. 40.** *Chrysops pictus* Meig., head shield, ventral view. The scale line represents 1 mm in Figs. 36 to 40, 0.5 mm in Fig. 35, 0.1 mm in Fig. 32, 0.02 mm in Figs. 33 and 34.

two larger dorsal and two smaller ventral projections. Both narrow rings on abdominal segments 1 to 7 as in *bimaculata*, the ring at the posterior margin of segment 7 is not so rugose and its maximal width is about 0.3 to 0.4 mm. Dark postanal ring as in *bimaculata*. Atrium of anterior spiracle with length and width subequal.



Figs. 41–49. *Hybomitra lundbecki* Lynceb. 41 – Larva (dorsal, lateral and ventral view, schematically). 42 – Anterior spiracle of larva, lateral view. 43 – Cuticular rods of larval posterior spiracle, lateral view. 44 – The largest spines of pre-anal ridge in larva. 45 – Mesonotal spiracle of pupa. 46 – Spinose fringes on abdominal tergites in pupa, dorsal view. 47 – Head shield, frontal view. 48 – Anal aster, lateral view. 49 – The same, caudal view. The scale line represents 5 mm in Fig. 41, 2 mm in Fig. 46, 1 mm in Figs. 47 to 49, 0.5 mm in Fig. 45, 0.05 mm in Fig. 42, 0.02 mm in Figs. 43 and 44.

**Pupa.** Pupal case 16 to 20 mm, head and thorax dark brown, abdomen somewhat greyish-brown, sometimes tinged with greenish. Dorsal part of head shield with distinct dark pigmentation which reaches to and between frontal tubercles; ventral part with distinct pigmentation on anterior margin to sheaths of maxillary palps as in *bimaculata*.

Antennal sheaths sometimes overlap very slightly the coronal suture, and carinate tubercles apically contiguous. Head shield with irregular striation, its margin near tip of antennal sheaths with slight angulation. The back of head with distinct striation.

Mesonotal spiracle in front of rima with deep fold and strong rugosity; similar rugosity also dorsally behind rima. Spiracle on first abdominal segment only slightly larger than on following segments, rimas nearly circular.

Spinal fringes on abdominal tergites as in *muehlfeldi*, with only one row of short and broad spines in addition to one long and thin pair on medial third and some other thin spines at sides on each tergite. Sides with thin spines in one row, sides of segment 7 with 15 to 20 spines. Dorsolateral combs with 4 to 7 spines, lateral combs with 5 to 7 spines of about the same length as in dorsocentral comb. Pre-anal fringe in male with 24 to 29 spines, female with 10 to 11 spines on each side.

#### 4. *Hybomitra lundbecki* Lyneborg, 1959

Figs. 21g, h, 22d, 41—49

Synonym: *H. fulvicornis* auctt., nec Meigen.

Material: 10 exuviae, 13 pupal cases (10 ♂, 3 ♀). Larvae were collected at Jabkenice in November 1965 and in March 1966, and all pupated in late April and in May. The pupal period was recorded in 8 specimens from 11 to 14 days at laboratory temperatures.

**Larva.** Mature larva 25 to 29 mm when extended, living coloration from orange and yellowish-brown to pale greenish.

Glossae with 4 to 6 very pointed teeth anteriorly, lateral sclerite produced anteriorly into short but pointed tooth about as long as one-fifth of the sclerite. Otherwise mouth parts as in *muehlfeldi* but epicranial bands somewhat paler, without whitish patches posteriorly, and lateral sclerite with larger aperture mesally.

Prothoracic ring light brown and without any stripes or projections posteriorly. Anterior rings on meso- and metathorax very reduced, interrupted on metathorax, or entirely missing on mesothorax. Both pubescent rings on abdominal segments 1 to 7 are often separated and very reduced, usually missing on anal segment. Postanal ring darker, rather narrow but distinct, about as broad as one quarter of the length of atrium of posterior spiracle. The largest spines of pre-anal ridge about as long as transverse cuticular rods of posterior spiracle. Anal segment is about two and one half times longer than siphon. Posterior spiracle as in the species of the *bimaculata*-group, but anterior spiracle is quite different: oval when viewed from above but atrium is not mushroom-shaped, while transverse cuticular rods are missing.

**Pupa.** Pupal case 16 to 18 mm in length, head and thorax with dark pigmentation, abdomen very pale yellowish-brown. Sheaths of wings dark, indicated future veins much paler, without pigmentation.

Frontal carinae separated by a deep but very narrow median cleft, median frontal area laterally with longitudinal rugosities, striae reaching long carinate tubercles. Dorsal part of head shield only slightly rugose, its lateral margin near tip of antennal sheaths with indistinct tooth.

Thoracic spiracular tubercle rugose on outer margin, dorsally behind rima a rather deep and wide furrow. Spiracles on basal abdominal segments in form of slightly elevated plates, on posterior segments somewhat conical with narrow elongated rimas.

Spines on tergites in two very close rows, anterior row with short and broad spines, posterior one with very long and thin spines. Sides with only thin spines in one row, sternites with thin but slightly shorter spines in one row as well. Sides of segment 7 with 26 to 30 spines. Dorsal prongs of anal aster longer than the ventral ones, lateral prongs the largest, straight and directed upwards. Dorsolateral combs with 5 to 8 spines at base, spines of lateral combs smaller, 8 to 10 in male and 6 to 9 in female. Anal tubercles at sides with distinct dark pigmentation in the male, and pre-anal fringe with 28 to 30 thin spines, shorter than those on tergite 7; female with 4 to 8 spines on each side becoming longer mesally.

### 5. *Hybomitra tropica* (Linnaeus, 1758)

Figs. 21i, j, 22e, 50—56

Synonyms: *H. montana* Meigen of auctt. partim; *H. tuxeni* Lyneborg.

Material: 1 exuvium, 1 pupal case. A single larva was collected at Jabkenice in the same locality and under the same conditions as other *Hybomitra*-species on 6 November 1965 which pupated on 1 April 1966. Female emerged at laboratory temperatures after a pupal period of 13 days.

**Larva.** Mature larva (reared) 28 mm when extended, living coloration pinkish.

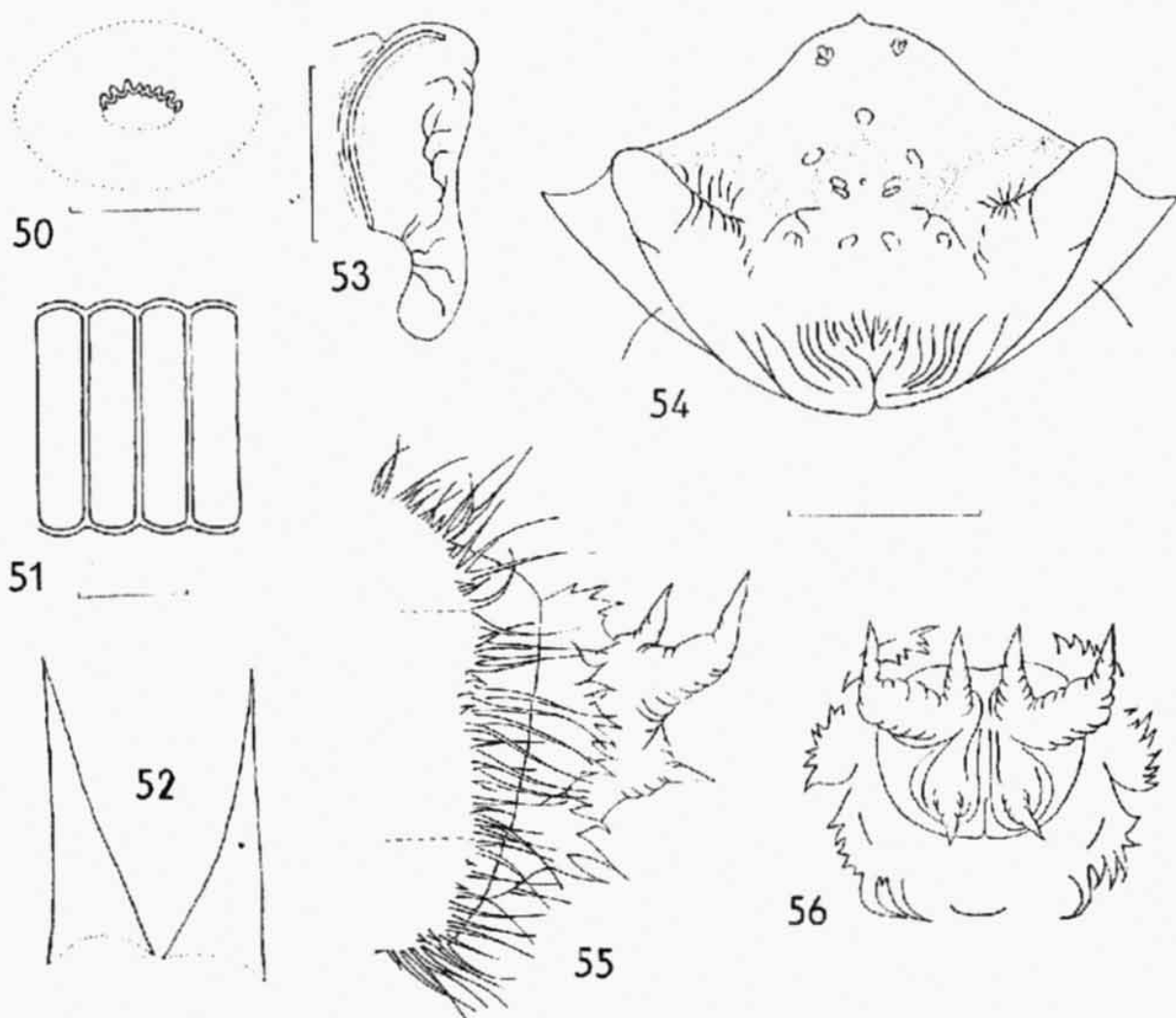
Glossae with up to 7 pointed teeth, lateral sclerite and other mouth parts as in *lundbecki*. Pubescent rings on thoracic and abdominal segments are pale and reduced similarly to *lundbecki*. Postanal ring is slightly narrower (1 : 6 in *lundbecki* compared to 1 : 7 in *tropica* when viewed from above). The largest spines of pre-anal ridge are one and a half times longer than transverse cuticular rods of posterior spiracle, the spines being distinctly broader at base than in *lundbecki*. Anterior spiracle of the same shape as in *lundbecki* but its aperture is nearly twice as long.

**Pupa.** A single pupal case 16 mm in length, yellowish, head and thorax with distinct brown pigmentation. Frontal carinae contiguous mesally, median frontal area with radiating as well as longitudinal rugosities. Frontal tubercles smooth, small and conical, between them and dorsally additional nine usually smaller round tubercles. The head shield margin near tip of antennal sheaths nearly without angulation.

Thoracic spiracular tubercle on outer margin partly smooth with distinct and

strongly sclerotized fold, the cleft dorsally behind rima rather narrow and shallow. Abdominal spiracles in form of rounded knobs, rimas very narrow.

Spines of abdominal fringes consist of two rows as in *lundbecki*, anterior row with short and broad spines, posterior spines very long and thin. Spines on sternites



**Figs. 50–56.** *Hybomitra tropica* L. 50 — Anterior spiracle of larva, lateral view. 51 — Cuticular rods of larval posterior spiracle, lateral view. 52 — The largest spines of pre-anal ridge in larva. 53 — Mesonotal spiracle of pupa. 54 — Head shield, frontal view. 55 — Anal aster, lateral view. 56 — The same, caudal view. The scale line represents 1 mm in Figs. 54 to 56, 0.5 mm in Fig. 53, 0.05 mm in Fig. 50, 0.02 mm in Figs. 51 and 52.

arranged in one row, thin but shorter than on corresponding tergites, sides with somewhat longer thin spines. Dorsal prongs of anal aster rather thin and longer than the ventral pair. Lateral prongs are the largest, directed laterally on basal half, on apical half sharply upturned. Dorsolateral combs with 5 spines, lateral combs with 8 spines, the largest about as long as ventral prongs of anal aster. Pre-anal fringes in female with 6 to 8 long spines on each side, of about the same length as lateral prongs.

**KEY TO MATURE LARVAE OF KNOWN EUROPEAN TABANID GENERA  
AND *HYBOMITRA*-SPECIES**

- 1 Mature larvae small, usually less than 20 mm. Third antennal segment as long as or longer than second segment. Abdominal segments with only three pairs of pseudopods, tracheal trunks unswollen, usually a protrusile spine at tip of siphon (subfamily Chrysopinae) . . . . . *Chrysops* Meig.
- Mature larvae usually larger (except to *Haematopota*), often much more than 20 mm. Third antennal segment distinctly shorter than the second. Abdominal segments with four pairs of pseudopods, tracheal trunks usually swollen, and only very seldom (in Nearctic species) a protrusile spine at tip of siphon (subfamily Tabaninae) . . . . . 2
- 2 (1) Larva ornamented on the dorsum with apparent dark brown, fine and dense small spines. Mandibles with about 17 uninterrupted cross-furrows on the whole perimeter. A small swelling with very long spines at each side of pre-anal ridge; dorsal pseudopods with combs of spines which are twice longer than on other pseudopods (*pellucens* Fabr.) . . . . . *Heptatoma* Meig.
- Dorsum of larva without dark brown oration. Mandibles serrated only on the ventral edge. No long spines at sides of pre-anal ridge and no combs of spines on dorsal pseudopods . . . . . 3
- 3 (2) Anal segment rounded, respiratory siphon short and nearly hemispheric, about one-third length of anal segment. The longitudinal sclerotized canal in second antennal segment interrupted. Mature larvae of smaller size (under 20 mm) . . . . . *Haematopota* Meig.
- Anal segment elongated, siphon distinctly longer than one-third length of anal segment. The longitudinal canal in second antennal segment continuous. Mature larvae usually larger . . . . . 4
- 4 (3) Larvae white to yellowish-white in colour. Anal segment usually with dorso-lateral spots. The ventral edge of mandibles with 13 to 23 teeth on its whole length. First segment to maxillary palps 2.5 to 3 times longer than the second . . . . . *Tabanus* L.
- Larvae distinctly coloured: orange, reddish, greenish or brownish. No dorso-lateral spots to anal segment (only exceptionally small lateral spots in Nearctic species). The ventral edge of mandibles with 7 to 9 teeth on apical part only (Fig. 3). First segment to maxillary palps shorter, about twice longer than the second (Fig. 7) . . . . . *Hybomitra* End. . . . . 5
- 5 (4) Dorsal pseudopods with distinct dark patches laterally, anterior pubescent rings on thoracic segments uninterrupted (Figs. 12 and 23). Anterior spiracles mushroom-shaped (Fig. 13) (*bimaculata*-group) . . . . . 6
- No dark patches laterally to dorsal pseudopods; dark pubescent ring only on prothorax; on meso- and metathorax at most small pubescent patches (Fig. 41). Anterior spiracles plain and circular (*montana*-group) . . . . . 8

- 6 (5) Patches at sides of dorsal pseudopods not very distinct, brown and rather narrow; prothoracic ring with five longitudinal stripes on hind margin (Fig. 12). Posterior ring on abdominal segment 7 averaging narrower (0.1—0.3 mm). Very long and pointed tooth occupying anterior third of the lateral sclerite (Fig. 22a) . . . . . *muehlfeldi* Br.
- Patches at sides of dorsal pseudopods very distinct, black and rather wide; prothoracic ring with only three stripes on hind margin (Fig. 23). Posterior ring on abdominal segment 7 averaging broader (0.3—0.5 mm). Lateral sclerite anteriorly at most with only a small tooth . . . . . 7
- 7 (6) Atrium of anterior spiracle about twice longer than its maximal width (Fig. 24). The largest pre-anal spines about five to six times longer than broad at base (Fig. 26). Lateral sclerite usually round at fore tip or the tooth shorter than one-fifth of the sclerite (Fig. 22b) . . . . . *bimaculata* Macq.
- Atrium of anterior spiracle about as long as its maximal width (Fig. 32). The largest pre-anal spines shorter, about three times longer than broad at base (Fig. 34). The short and pointed anterior tooth occupying about one-fifth of the lateral sclerite (Fig. 22 c) . . . . . *ciureai* Séguy
- 8 (5) Anterior spiracle shorter than the length of transverse cuticular rods of posterior spiracle; the largest pre-anal spines as long as these cuticular rods and about as broad as or slightly broader than the width of cuticular rods (Figs. 43 and 44). Dark postanal ring at base of siphon dorsally slightly broader (1 : 6) . . . . . *lundbecki* Lyneb.
- Anterior spiracle longer than the length of transverse cuticular rods of posterior spiracle; the largest pre-anal spines equalling one and a half length of the cuticular rods and nearly twice broader than the width of these rods (Figs. 51 and 52). Dark postanal ring dorsally somewhat narrower (1 : 7) . . . . . *tropica* L.

**KEY TO PUPAE OF KNOWN EUROPEAN TABANID GENERA  
AND HYBOMITRA-SPECIES**

- 1 Frontal tubercle with two setae. Sheath of proboscis on the head shield elongate, sheath of labrum about one-third as long as proboscis, measured to lower margin of the sheath of maxillary palps (Fig. 40). Neither dorsolateral nor lateral combs on anal segment (subfamily Chrysopinae) . . . . . *Chrysops* Meig.
- Frontal tubercle with one seta. Sheath of proboscis much shorter, sheath of labrum usually reaching nearly the lower margin of the sheath of maxillary palps (Fig. 36). At least dorsolateral combs present on anal segment (missing only in several Nearctic species) (subfamily Tabaninae) . . . . . 2
- 2 (1) Antennal sheaths elongated, the tip much exceeding the coronal suture (eclosian line). Frons rather wide, nearly twice as wide as high (tribe *Haematopotini*) . . . . . 3

- Antennal sheaths short, the tip not reaching the coronal suture or very short. Frons about as wide as high (tribe *Tabanini*) . . . . . 4
- 3 (2) Both dorsolateral and lateral combs present on anal segment, former very long and strong. Dorsal and ventral prongs on anal aster small, of equal length; lateral prongs straight and very prominent. Abdominal segments with two very close spinose fringes; all spines very strong, the front rows distinctly longest (*pellucens* Fabr.) . . . . . *Heptatoma* Meig.
- Only dorsolateral comb on anal segment, lateral combs absent. Anal aster otherwise. Abdominal segments with single rows of only one type of spinose fringes . . . . . *Haematopota* Meig.
- 4 (2) Carinate tubercles between bases of antennal sheaths divided laterally into two parts. Head shield and thorax without any pigmentation; abdominal segments concolorous with thorax. Dorsal prongs of anal aster as a rule distinctly shorter than the ventral ones . . . . . *Tabanus* L.
- Carinate tubercles undivided laterally. Head shield and thorax with pigmentation, abdominal coloration different than thorax. Dorsal prongs of anal aster as a rule distinctly longer than the ventral ones . . . . . *Hybomitra* End. . . . . 5
- 5 (4) Median frontal area marked with radiating rugosities, longitudinal rugosity along frontal ridge absent; frons more or less smooth (Figs. 18, 29, 37). Abdominal tergites with one spinose fringe (Fig. 17), in doubtful cases (*H. bimaculata* Macq., Fig. 28) apex of mesonotal spiracle always distinctly overlaps the end of peritreme (*bimaculata*-group) . . . . . 6
- Median frontal area marked with both radiating and longitudinal rugosities, the latter reaching the outer part of carinate tubercles; frons more or less rugose or with small tubercles (Figs. 47, 54). Abdominal tergites with two spinose fringes (Fig. 46) (*montana*-group) . . . . . 8
- 6 (5) Abdominal tergites with one fringe of spines which are short and broad at base. A pair of long and thin spines mesally on each tergite; tergal spines form two longitudinal rows dividing this area into thirds (Fig. 17) . . . . . 7
- Abdominal tergites with two close and irregular fringes of spines (broad anteriorly, thin posteriorly), or with only one fringe of thin spines. All spines in one fringe of equal length, no single long mid-tergal spines (Fig. 28) . . . . . *bimaculata* Macq.
- 7 (6) Mesonotal spiracle in front of peritreme smooth and without any fold (Fig. 16). First abdominal spiracle about twice larger than the second one, its peritreme nearly straight. Sides of abdominal segment 7 with about 25 to 30 spines (Fig. 19). Dorsolateral combs with spines somewhat smaller than in lateral combs. Pre-anal fringes in female with 7 to 9 spines . . . . . *muehlfeldi* Br.
- Mesonotal spiracle in front of peritreme with deep and densely rugose fold (Fig. 35). Peritreme of first abdominal spiracle nearly circular, somewhat lar-

ger than the second. Sides of abdominal segment 7 with about 15 to 20 spines (Fig. 39). The spines of dorsolateral combs on anal segment subequal in length to those in lateral combs. Pre-anal fringes in female with 10 or 11 spines . . . . . *ciureai* Séguy

- 8 (5) Carinate tubercles between base of antennal sheaths separated by a deep median cleft; frontal tubercles rather large and semiglobular, between and above them some areas with radiating rugosities (Fig. 47). Lateral prongs of anal aster nearly straight (Fig. 49) . . . . . *lundbecki* Lyncb.  
 — Carinate tubercles contiguous; frontal tubercles smaller and conical, between and above them a number of small tubercles (Fig. 54). Lateral prongs of anal aster apparently-turned upward, nearly at right angles (Fig. 56) . . . *tropica* L.

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