

# Larvae and pupae of three European *Tabanus* species (Diptera, Tabanidae)

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Although Tabanidae belong to one of the most economically important families of flies, our knowledge of the preimaginal stages of the genus *Tabanus* L. is very incomplete when compared with the number of about 50 European species of the genus so far known. Descriptions of larvae of only 8 European species and pupae of only 4 species have been described up to the present time, often very inadequately. There are several descriptions and figures of larvae and pupae of *Tabanus autumnalis* L., *T. bromius* L. and *T. maculicornis* Zett. However, in many cases they are totally inadequate for use in identification.

Table of descriptions of the three species discussed:

?*Tabanus autumnalis* Linné, 1761:

Larva — Graber (1882), Marchand sensu Graber (1882)

*T. autumnalis* Linné, 1761:

Larva — Skufin (1967), Ivanišček (1970)

*T. bromius* Linné, 1761:

Larva — Beling (1975), Marchand (1920) sensu Beling (1875), Stammer (1924), Surcouf & Fischer (1924), Skufin (1967), Ivanišček (1970)

Pupa — Beling (1875), Surcouf & Ricardo (1909), Marchand (1920) sensu Beling (1875), Marchand (1920) sensu Surcouf & Ricardo (1909), Surcouf & Fischer (1924)

*T. maculicornis* Zetterstedt, 1842:

Larva — Stammer (1924), Ivanišček (1970)

Pupa — Kröber (1910), Ségué (1926)

Beling (1875) described the larva and pupa of *T. bromius* L., but his diagnosis cannot be used for a key. Of only historical value is the figure of the pupa of *T. bromius* L. given by Surcouf & Ricardo (1909) and *T. maculicornis* Zett. given by Kröber (1910). Although Stammer (1924) described the larvae of species of *T. bromius* L. and *T. maculicornis* Zett., it is difficult to differentiate the larvae using characters given in his descriptions. Ségué (1926) figured habitus of pupa of *T. maculicornis* Zett. in lateral view and anal aster of pupa of this species in caudal view, but neither figure is acceptable. By contrast Surcouf & Fischer (1924) described and figured appendages of head capsule perfectly. The habitus of the pupa of mentioned species in lateral view is only of historical interest.

Skufin (1967) described and figured the larvae of *T. autumnalis* L. and *T. bromius* L., Ivanišček (1970) described and figured the larva of *T. maculicornis* Zett. Both

authors compiled the keys to larvae of several species of various genera and placed mentioned species in them. Unfortunately, the morphology of the appendages of the head capsule is not included in these papers.

The most complete descriptions of North American preimaginal stages of the genus *Tabanus* L. are given by Teskey (1969).

Generic keys to larvae and pupae, including the genus *Tabanus* L. are given e. g. by Hennig (1968) and Chvála & Ježek (1969).

### Genus *Tabanus* Linné, 1767

Last instar larvae of *Tabanus* may be diagnosed as follows:

Larvae white to yellowish-white in colour. Length usually more than 16 mm. Anal segment usually with spots. The ventral edge of mandibles with 13 to 23 teeth on its whole length beneath. First segment to maxillary palps 2.5 to 3 times longer than the second. Third antennal segment shorter than second, four pairs of pseudopodia on each of first seven abdominal segments.

Pupae of *Tabanus* may be diagnosed as follows:

Length usually more than 13 mm, single pair of callus setae. Carinate tubercles between bases of antennal sheaths mostly divided laterally into two parts. Antennal sheaths straight and, at most, only slightly exceeding epicranial suture. Head shield and thorax without stark pigmentation. Dorsal and lateral pair of preanal combs usually present, although sometimes vestigial. Dorsal prongs of anal aster as a rule distinctly longer than the ventral ones.

#### Key to last instar larvae of three European *Tabanus* species:

- 1 Larvae small, usually, 16–27 mm long, with rather moderately dark brown or dark wide pubescent rings on all segments, anal segment with typical pubescent maculations as figured (Fig. 24, 37) ..... 2
- Larvae larger, usually, 28–44 mm long, without wide expressive pubescent rings on all segments, anal segment with typical pubescent maculations as figured (Fig. 11) ..... *T. autumnalis* L.
- 2 (1) Dorsal and ventral parts of thoracic segments without striations, lateral pubescent projections from prothoracic annulus very expanded apically (Fig. 23) ..... *T. bromius* L.
- Dorsal and ventral parts of thoracic segments with striations, lateral pubescent projections from prothoracic annulus without bifurcation or expansion apically (Fig. 36) ..... *T. maculicornis* Zett.

#### Key to pupae of three European *Tabanus* species:

- 1 Pupae rather small, 13–18 mm long, lateral pairs of combs of anal segment big, with 3–10 long spines, dorsal prongs of anal aster rather longer (Figs. 54, 56), pre-anal fringe in female with 8–11 spines ..... 2

- Pupae larger, 23–28 mm long, lateral pairs of combs of anal segment very small, with 1–3 short spines, dorsal prongs of anal aster rather shorter (Fig. 52), pre-anal fringe in female with 5–8 spines ..... *T. autumnalis* L.
- 2 (1) Thorax without pigmentation, head shield as figured (Fig. 44), pleura of 7th abdominal segment with 26–30 spines, dorso-lateral combs with 3–7 spines, pre-anal fringe in male with about 22–24 spines ..... *T. bromius* L.
- Thorax with slight pigmentation dorsally, head shield as figured (Fig. 46), pleura of 7th abdominal segment with 30–40 spines, dorso-lateral combs with 6–12 spines, pre-anal fringe in male with about 28–36 spines ..... *T. maculicornis* Zett.

### *Tabanus autumnalis* Linné, 1761

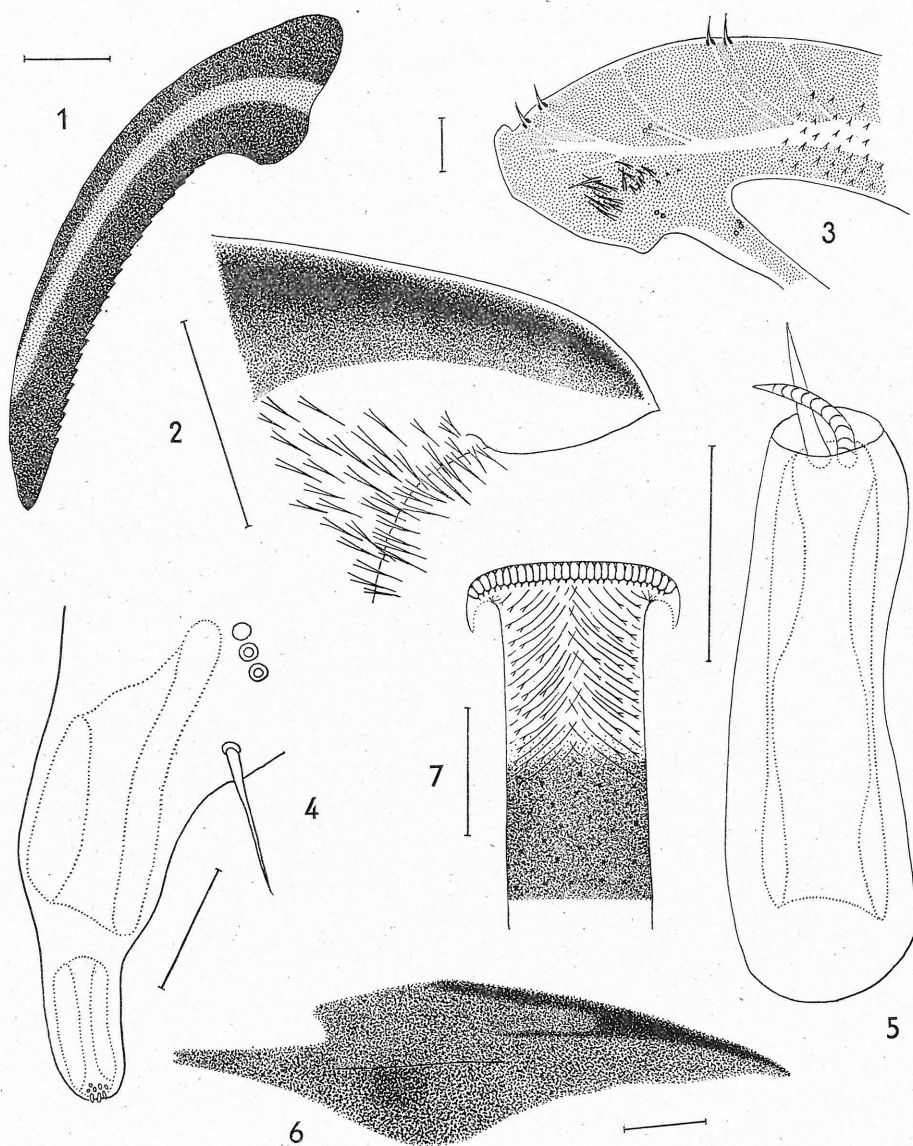
Last instar larvae (Figs. 8–13, 40, 41)

28–44 mm long when extended, the coloration of living larvae white to creamy white. Mandibles (Fig. 1) mostly with 23 teeth on whole part beneath. Basal segment of maxillary palps (Fig. 4) being more than twice as long as apical segment. Cephalic brush with rather strong spines, branched apically. First antennal (Fig. 5) segment with 9–12 teeth on the inner side near apex. Maxilla, Clypeus and Labrum as figured (Figs. 2, 3). Lateral sclerite (Fig. 6) elliptical-shaped, with a long tooth anteriorly, slight chitinized, the aperture distinct.

Superior part of the lateral sclerite strongly chitinized. The striations present on usual aspects of all segments except dorsal and ventral parts of pro-, meso- and metathorax, on which it is only on the hind parts. Abdominal segments usually with the striations more widely spaced or absent ventrally, the striations more closely spaced laterally than on the dorsal parts of the abdominal segments. Prothoracic pubescent annulus dark (Figs. 8, 10, 12), with five longitudinal stripes (2 dorsal, 2 lateral, 1 narrower ventral), about as long as  $\frac{3}{4}$  the length of the first segment. Area between lateral and dorsal stripes filled with pubescence. Meso- and meta-thoracic annulus between dorsal stripes narrower, the longitudinal stripes of these segments as wide as ventral prothoracic stripe. The seventh abdominal segment with dark ring at the hind margin as wide as  $\frac{1}{5}$  (more laterally) the length of this segment. The largest spines of pre-anal ridge about twice as long as the length of transverse cuticular rods of posterior spiracle. The base of these spines is sometimes up to twice as wide as the width of transverse cuticular rods. The length to the breadth of those spines as 3 : 1. Anal segment with typical pubescent maculations as figured (Figs. 9, 11, 13). Siphon, when extended 2.5 times shorter than anal segment. Postanal ring rather broader than the length of atrium of posterior spiracle. Atrium of anterior spiracle (spiracular chamber between spiracle and trachea) mushroom-shaped (Fig. 7), the largest width to the length as 1.0 : 1.2–1.5, in posterior spiracle 1 : 1.5.

#### Pupa.

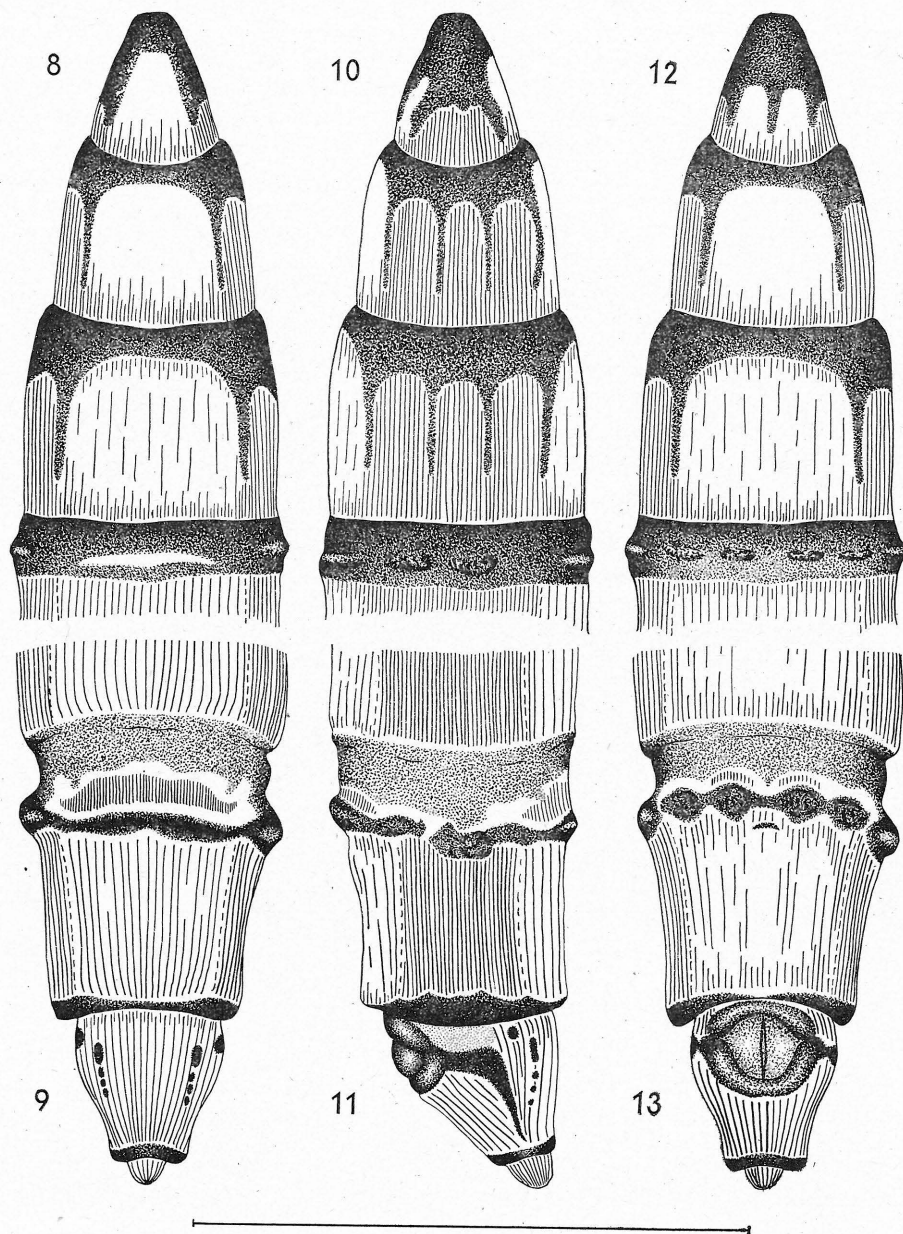
Length of pupal case 23–28 mm. colour rather uniformly yellowish brown. The median cleft (Fig. 42) between frontal carinae wide, with scarce strongly sclerotized rugosities dorsally, lateral pair of carinae with distinct sulcus. Antennal



Figs. 1-7: *Tabanus autumnalis* L. — Last instar larvae.

1 — Mandible. 2 — Maxilla. 3 — Clypeus and labrum. 4 — Maxillary palp. 5 — Antenna. 6 — Lateral sclerite. 7 — Anterior spiracle. The scale line 0.1 mm.





Figs. 8–13: *Tabanus autumnalis* L. — Last instar larvae (schematically).  
8, 9 — Dorsal view. 10, 11 — Lateral view. 12, 13 — Ventral view. The scale line 10 mm.

sheaths rather short, the tip frequently not in the least exceeding the coronal suture (eclosian line). Frontal tubercles with irregular, often strongly sclerotized margin. Ventrally of them is frequently an additional tubercle with many rugosities and divided into two parts. The frontal part of the head shield without pigmentation, with faint striations, as well as ventral part and the hind part of the head. The sheath of maxillary palps at base about three times broader than on the top. Mesonotal spiracle (Fig. 48) flattened, without pigmentation, on one quarter of the ventral part with folds. The top of the spiracular mound on thorax usually overlaps anteriorly the end of rima. Thorax without pigmentation. Spiracle on first abdominal segment hemispherical with slight rugosities, rima semicircular, about twice larger than on the following segment. Rima of abdominal spiracle 2—7 semicircular. Abdominal fringes on most sclerites biseriata (Fig. 43); spines of anterior series minute, of posterior series slender and acuminate, of same basal diameter as adjacent anterior spines but about five times as long. Fringes practically uniseriate on sternites. Pleura of the 7th segment with about 30 to 45 spines. Dorsolateral combs with 10—12 spines lateral comb with 1—3 short strong spines. Pre-anal fringe in male with 24—30 spines, female with 5—8 spines on both sides. Anal aster as figured (Figs. 51, 52).

Material: 10 exuviae of last instar larvae, 96 last instar larvae, 28 pupal cases (11 ♂, 17 ♀).

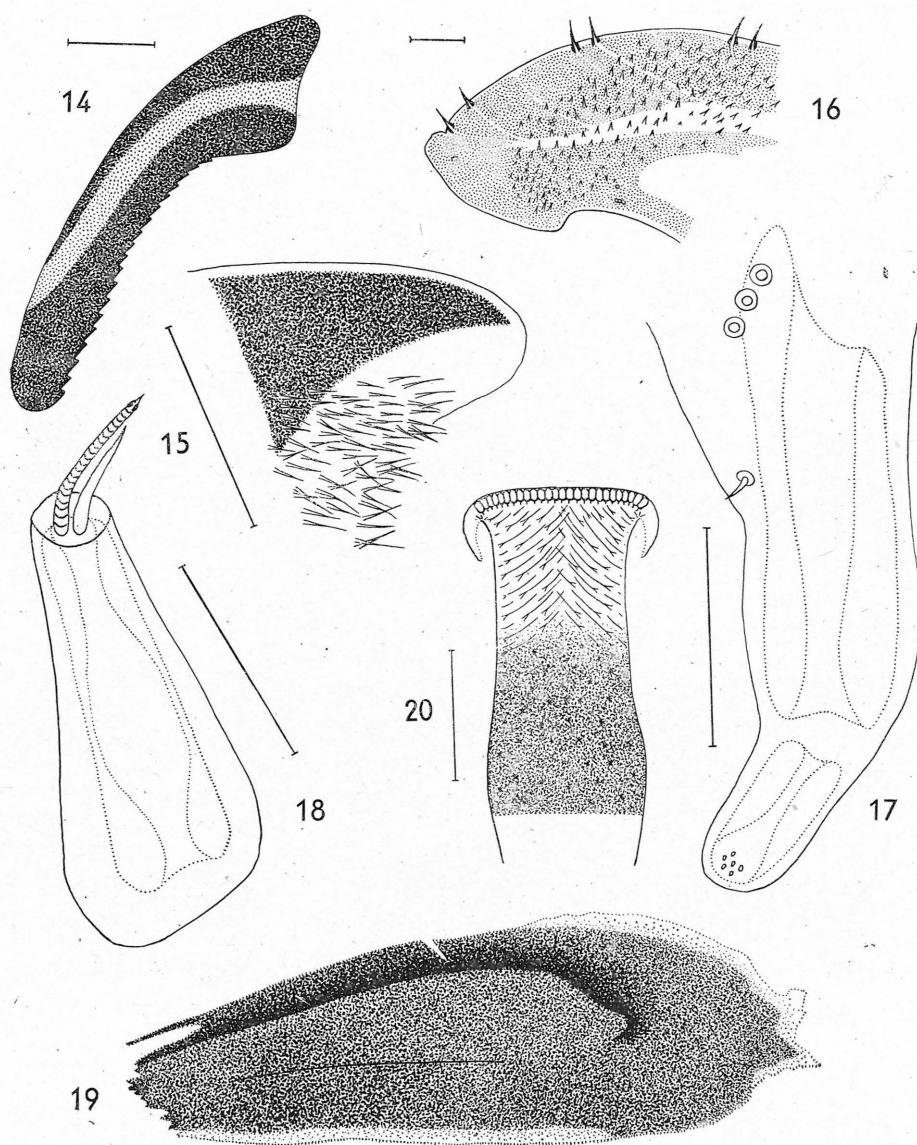
Larvae were found during March to August (1964, 1966, 1968, 1971) in substrates of such a wide variety of habitats as totally organic soil of *Alnus* inundation forest with plants as *Scirpus*, *Carex*, *Typha*, *Phragmites*, *Iris* and *Equisetum* (in this habitat larvae commonly associated with *Chrysops pictus* Meig. and *Haematopota crassicornis* Wahl.), in living or dead vegetation at the margins of a marsh forest ponds with plants as *Carex*, *Juncus*, *Phragmites*, *Quercus*, *Pinus*, *Picea*, *Larix* and *Alnus* around, clay and mud water ponds, along the margins of drainage ditches with plants as *Populus* and *Salix* near ranches and cattlepens.

Localities: Kostomlaty on the river of Labe, Jabkenice env. Nymburk (Bohemia centr.), Třebon (Bohemia mer.), Lednice (Moravia mer.), Martovce env. Komárno (Slovakia mer.), Brekov env. Humenné (Slovakia or.). Larvae pupated during June to August; pupal period of 8—12 days was recorded in several specimens. One larva, which I collected 21st August 1964 in Jabkenice env. Nymburk pupated and emerged as an adult during August 1966 at laboratory temperatures!

### ***Tabanus bromius* Linné, 1761**

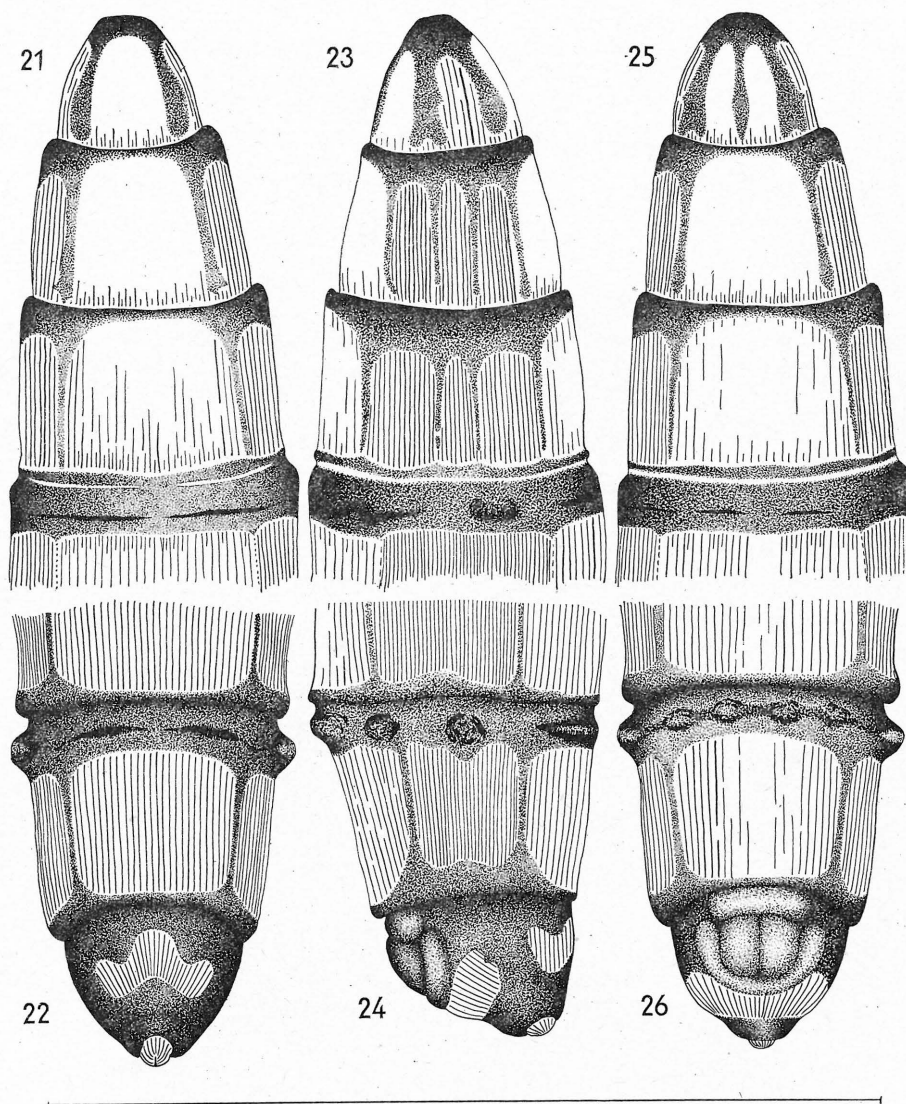
Last instar larvae (Figs. 21—26)

23—27 mm long when extended, the coloration of living larvae white to creamy-white, with rather moderately dark brown or dark wide pubescent rings on all segments. Mandibles (Fig. 14) with up to 20 teeth on whole part beneath. Basal segment of maxillary palps (Fig. 17) three times longer than apical segment. Glossae with many pointed teeth, cephalic brush with rather thin spines. First antennal (Fig. 18) segment with about 20 teeth on the inner side near apex. Maxilla, Clypeus and Labrum as figured (Figs. 15, 16). Lateral sclerite (Fig. 19) elliptical-shaped, with one or more blunt teeth anteriorly, superior part of the lateral sclerite very chitinized, aperture indistinct. The striations present on usual aspects of all segments except dorsal and ventral area of pro-, meso- and metathorax. Stria on the abdominal



Figs. 14—20: *Tabanus bromius* L. — Last instar larvae.

14 — Mandible. 15 — Maxilla. 16 — Clypeus and labrum. 17 — Maxillary palp. 18 — Antenna. 19 — Lateral sclerite. 20 — Anterior spiracle. The scale line 0.1 mm.



Figs. 21–26: *Tabanus bromius* L. — Last instar larvae (schematically).  
 21, 22 — Dorsal view. 23, 24 — Lateral view. 25, 26 — Ventral view. The scale line 10 mm.

segments ventrally in part frequently missing, the striations a little narrower laterally than on the dorsal parts of the abdominal segments. Prothoracic pubescent annulus dark (Figs. 21, 23, 25), with five longitudinal stripes (2 dorsal, 2 lateral very expanded apically, 1 ventral). Meso- and metathoracal annulus with the longitudinal stripes



as wide as ventral prothoracal stripe (or rather broader). Anterior and posterior annuli with teeth on the 4—7 (8) segments dorsally and ventro-laterally, opposing with projections mostly joining on the 8 (9) — 10 segments dorsally and ventro-laterally. Anal segment as figured (Figs. 22, 24, 26). The largest spines of pre-anal ridge about 2.5 times longer than the length of transverse cuticular rods of posterior spiracle. The base of these spines is more than twice as wide as the width of transverse cuticular rods. Siphon, when extended 2—2.5 times shorter than anal segment. Postanal ring as wide as the length of atrium of posterior spiracle. Atrium of anterior spiracle mushroom-shaped (Fig. 20), the largest width to the length as 1 : 1.7 (1.8), in posterior spiracle as well.

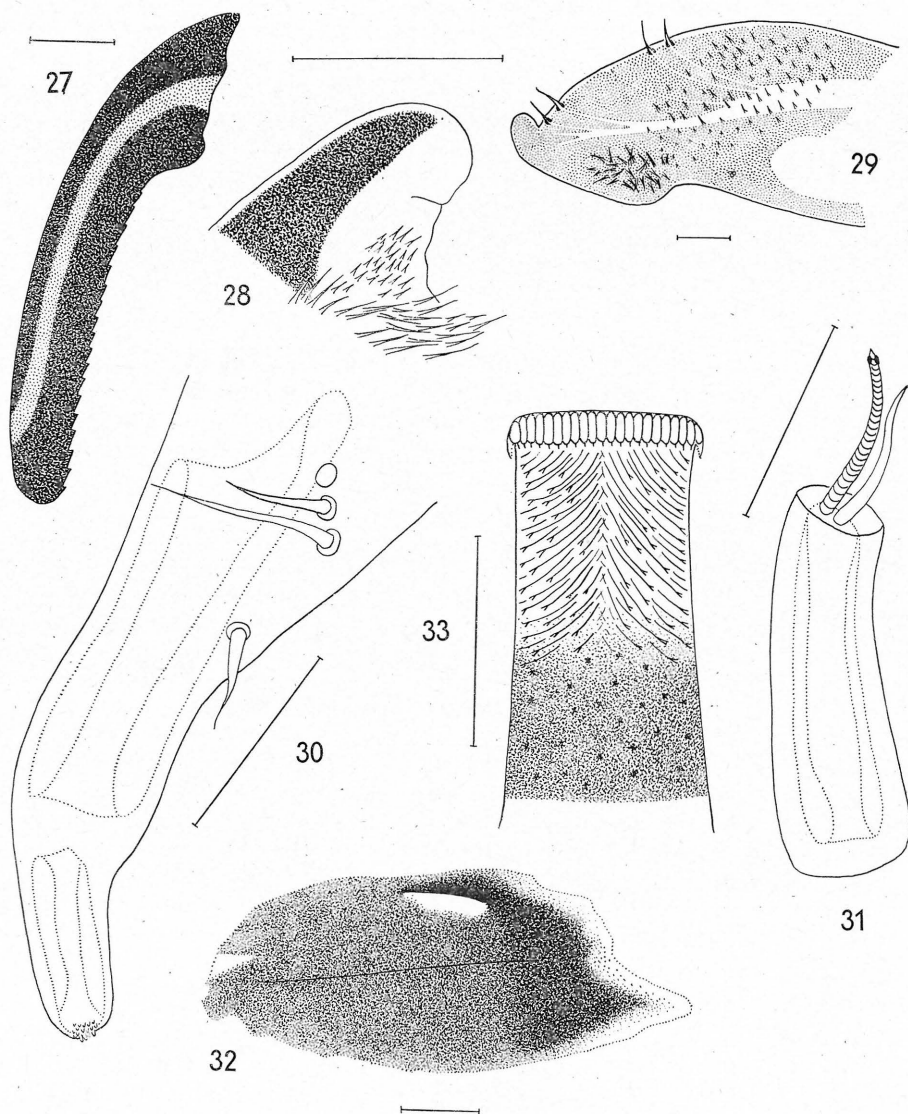
#### Pupa.

Length of pupal case 14—18 mm, colour uniformly yellowish brown. The median cleft (Fig. 44) between frontal carinae wide, lateral pair of carinae frequently with distinct sulcus. Antennal sheaths not exceeding the coronal suture. Frontal tubercles rugosed, with irregular, strongly sclerotized margins. Ventrally of them additional tubercle with rugosities to the median cleft. The frontal part of the head shield ventrally slightly sclerotized in male, strongly in female. The ventral part with transverse slight rugosities. Pigmentation above tentorial pits missing as well as on the hind part of the head. The sheath of maxillary palps at base about three times broader than on the top. Mesonotal spiracle (Fig. 49) rather flattened, on ventral part with up to 4 folds. The top of the spiracular mound much overlaps anteriorly the end of rima. The deep cleft dorsally behind rima with rugosities, without pigmentation. Thorax and abdomen without pigmentation as well. Spiracle on first abdominal segment conical, with strong rugosities, the same size as on the other segments, rima on first segment semicircular, otherwise practically circular. Abdominal fringes on most sclerites biseriate (Fig. 45), but sometimes indistinctly separated; spines of posterior series longer. Fringes uniseriate on sternites, the length of the spines average approximately 2/3 length of adjacent spines on tergites. Fringes of pleura of the 7th segment biseriate with about 26 to 30 spines. Dorsolateral combs with 3—7 spines, lateral combs with 3—8 of that. Pre-anal fringe in male approximately with 24 spines, in female with 8—11 spines on both sides. Anal aster as figured (Figs. 53, 54).

Material: 23 exuviae of last instar larvae, 27 last instar larvae, 43 pupal cases (23 ♂, 20 ♀).

Larvae were found during late November 1965 to May 1966 at Jabkenice near Nymburk, Central Bohemia, under snow and ice during winter months in frozen Phragmites, Carex and Juncus on the periphery of forest ponds with Quercus, Pinus and Betula around. The larvae commonly associated with *Heptatoma pellucens* (Fabr.), *Hybomitra bimaculata* (Macq.), *H. muehlfeldi* (Br.), *H. ciureai* (Ség.), *H. lundbecki* Lyneb. and *H. tropica* (L.). Several larvae were collected in the molehills on the pasture near Chalmová-Bystřičany env. Prievidza (Slovakia centr.) during April 1971. Larvae pupated during May to June; pupal period of 14—16 days was recorded in 8 specimens.





Figs. 27—33: *Tabanus maculicornis* Zett.-Last instar larvae.  
 27 — Mandible. 28 — Maxilla. 29 — Clypeus and labrum. 30 — Maxillary palp. 31 — Antenna.  
 32 — Lateral sclerite. 33 — Anterior spiracle. The scale line 0.1 mm.

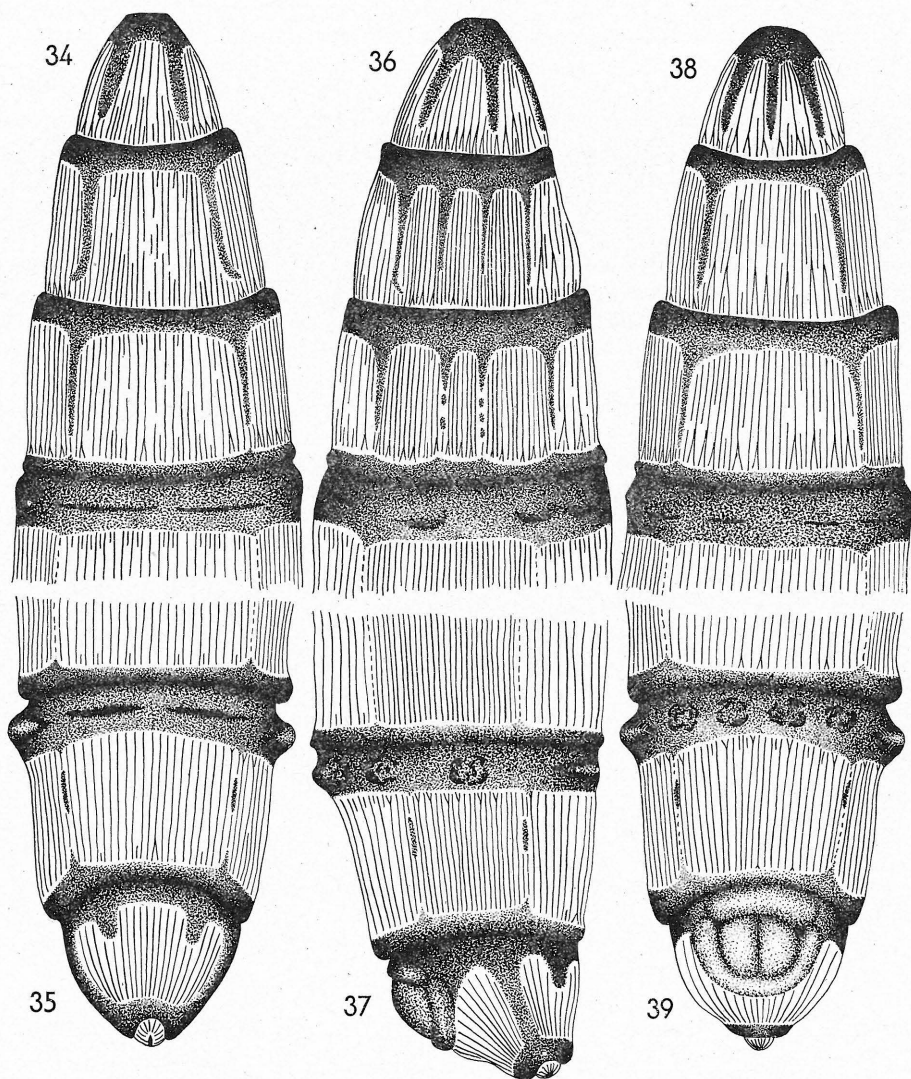
*Tabanus maculicornis* Zetterstedt, 1842

Last instar larvae (Figs. 34–39)

16–23 mm long when extended, the coloration of living larvae white to creamy-white with moderately dark or dark brown wide pubescent rings on all segments. Mandibles (Fig. 27) with to 19 teeth on whole part beneath. Basal segment of maxillary palps (Fig. 30) nearly three times longer than apical segment. Glossae with many pointed teeth, cephalic brush with rather thin spines. Maxilla, Clypeus and Labrum and Antenna as figured (Figs. 28, 29, 31). Lateral sclerite (Fig. 32) elliptical-shaped, with rounded tooth anteriorly, anterior and superior part of the lateral sclerite very chitinized, aperture distinct. The striations present on usual aspects of all segments, but stria of dorsal and ventral area of pro-, meso- and metathorax widely spaced and sometimes interrupted. The striations a little narrower laterally than on the dorsal parts of the abdominal segments. Prothoracic pubescent annulus dark (Figs. 34, 36, 38), with five longitudinal stripes (2 dorsal, 2 lateral without expansion apically, 1 ventral). Meso- and metathoracic annulus with very thin longitudinal stripes, often interrupted, dorsal stripes somewhat broader (2 dorsal, 4 lateral, 2 ventral). Anterior and posterior annuli with rather teeth on 4–10 segments dorsally and ventro-laterally. Anal segment as figured (Figs. 35, 37, 39). The largest spines of pre-anal ridge to 1.5 times longer than the length of transverse cuticular rods of posterior spiracle. The base of those spines as wide as the breadth of transverse cuticular rods. Siphon, when extended about twice shorter than anal segment. The breadth of the basal annulus of siphon to the length of that as about 1 : 3. Basal annulus connected with postanal annulus. Atrium of anterior spiracle mushroom-shaped (Fig. 33), the largest width to the length as 1 : 1.8 (1.9), in posterior spiracle as 1 : 1.8.

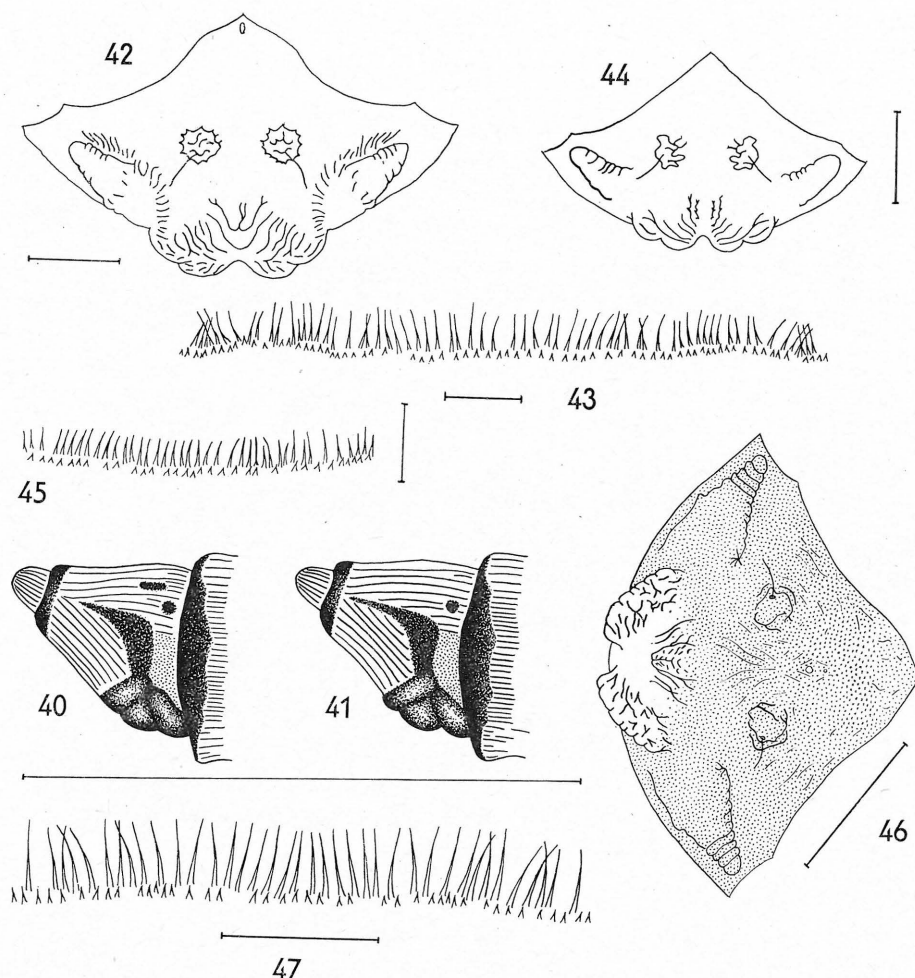
Pupa.

Pupal case 13–18 mm long, colour yellowish brown but thorax with slight pigmentation dorsally. The median cleft (Fig. 46) between frontal carinae rather wide, the sulcus between frontal and lateral carinae sometimes absent. Antennal sheaths not, or only insignificantly exceeding the coronal suture. Frontal tubercles slightly rugose, with irregular, strongly sclerotized margins. Ventrally of them additional tubercle with many rugosities, strongly sclerotized and divided by median scratch. The frontal part of the head shield with strong rugosities, frequently with slight pigmentation, strongly sclerotized ventrally. The ventral part of the head shield with uneven surface and with slight pigmentation, above tentorial pits the pigmentation more distinct. The sheaths of maxillary palps at base about three times broader than on the top. The hind part of the head with slight pigmentation: Mesonotal spiracle (Fig. 50) rather flattened dorsally, on ventral part with 5–9 strong folds. The top of the spiracular mound overlaps much the end of rima anteriorly. The deep cleft dorsally behind rima with rugosities and slight pigmentation. Thorax dorsally with slight pigmentation. Spiracle on first abdominal segment conical, with slight rugosities, a little larger than on the following segments, rima twice larger (or the same size) than on the following segments, semicircular. Abdominal tergites without pigmentation. Abdominal fringes biseriate (Fig. 47), spines of posterior series longer. Fringes often almost uniseriate, the spines a little shorter than on



Figs. 34—39: *Tabanus maculicornis* Zett.-Last instar larvae (schematically).  
34, 35 — Dorsal view. 36, 37 — Lateral view. 38, 39 — Ventral view. The scale line 10 mm.

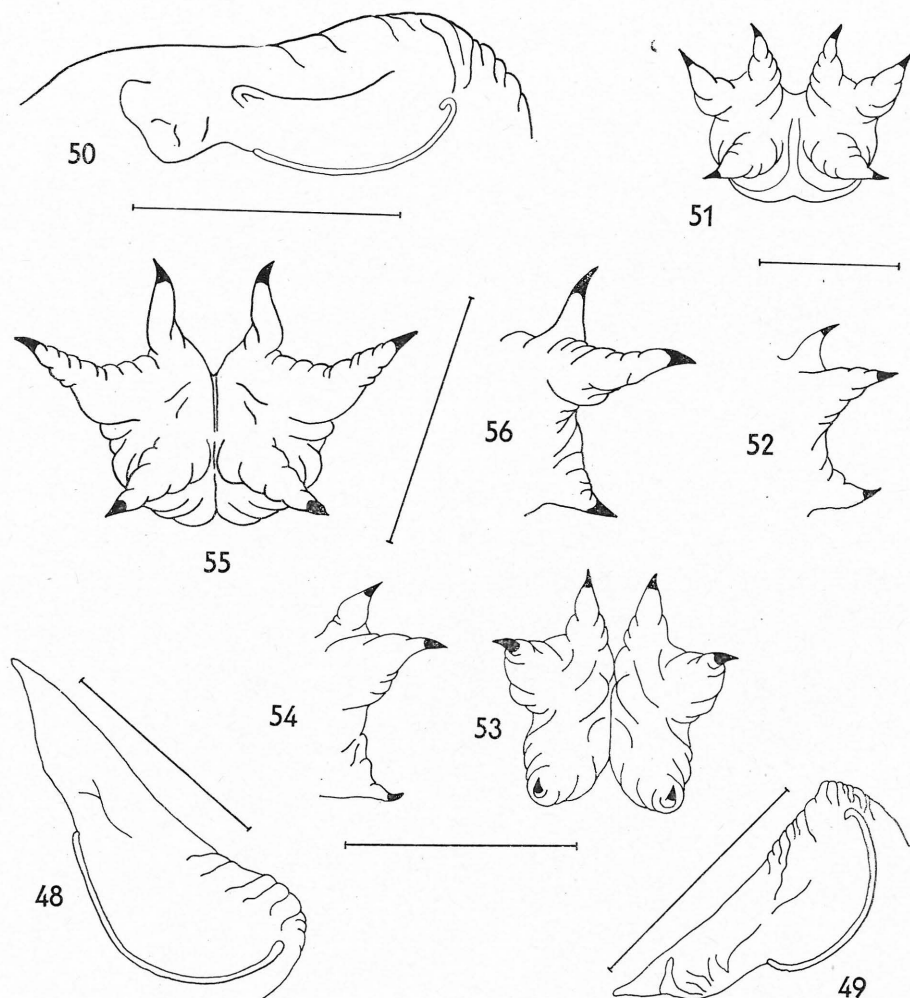
the tergites. Fringes of pleura of the 7th segment biseriata, with about 30—40 spines. Dorsolateral combs with 6—12 spines, lateral combs with 6—10 of that. Pre-anal fringe in male with 28—36 spines, in female with 8—11 spines on both sides. Anal aster as figured (Figs. 55, 56).



Figs. 40—47: 40, 41 — Variation of last instar larvae of *Tabanus autumnalis* L. 42, 43 — Pupa of *T. autumnalis* L. (42 — Head shield of male in frontal view; 43 — Spinose fringe on the 4th abdominal tergite). 44, 45 — Pupa of *Tabanus bromius* L. (44 — Head shield of male in frontal view; 45 — Spinose fringe on the 4th abdominal tergite in pupa). 46, 47 — Pupa of *Tabanus maculicornis* Zett. (46 — Head shield of male in frontal view; 47 — Spinose fringe on the 4th abdominal tergite). The scale line 1 mm.

Material: 31 exuviae of last instar larvae, 89 last instar larvae, 39 pupal cases (17 ♀, 22 ♂).

Larvae were found during March 1970 and 1971 under overhanging turfs of grass on margins of a peatbog, where the peat in bygone days had been cut. Many larvae were found in the molehills on the pastureland and on the forest meadow near lakes and streams.



Figs. 48—56: 48, 51, 52 — Pupa of male of *Tabanus autumnalis* L. (48 — Mesonotal spiracle; 51 — Anal aster, caudal view; 52 — The same, lateral view). 49, 53, 54 — Pupa of male of *Tabanus bromius* L. (49 — Mesonotal spiracle; 53 — Anal aster, caudal view; 54 — The same, lateral view). 50, 55, 56 — Pupa of male of *Tabanus maculicornis* Zett. (50 — Mesonotal spiracle; 55 — Anal aster, caudal view; 56 — The same, lateral view). The scale line 1 mm.

Localities: Třeboň (Bohemia mer.) and Dolní Loučky env. Tišnov (Moravia centr.). Larvae pupated in May and June.

#### SUMMARY

The author presents the descriptions of last instar larvae and pupae of three European *Tabanus* species (*T. autumnalis* Linné, 1761; *T. bromius* Linné, 1761;



*T. maculicornis* Zetterstedt, 1842) and gives diagnostic characters of both larvae and pupae. Many detailed differences were ascertained and figured both on the head capsule of larvae and on its appendages. The main purposes of this paper are descriptions of pupae; pupa of *T. autumnalis* L. is described for the first time. Keys for determination of larvae and pupae of the mentioned species of genus *Tabanus* L. are included.

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