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The Morphology of *Platycephala planifrons* (Fabricius, 1798) (*Diptera, Chloropidae*)

Morfologia *Platycephala planifrons* (Fabricius, 1798) (*Diptera, Chloropidae*)

The morphology of an adult insect has been known since 1798 (4). The first description of the species was supplemented and broadened successively by Fallen (5), Meigen (7), Zetterstedt (14), Becker (2) and Duda (3). The description of the third instar larva comes from the end of the 19th c. (13) and it is very superficial and contains many inaccuracies. The other developmental stages are not known.

In view of the fact that *Platycephala planifrons* is a little known species, studies were undertaken on the complex morphology of this fly. The present study analyzes all the pre-imaginal stages of the species, neglecting quite well known imaginal form.

P. planifrons is a palearctic species (1, 10, 11). It occurs in the *Phragmitetum* community. It produces characteristic, little visible galls on the tops of common reed blades (*Phragmites communis* Trin.) within which its development takes place (6).

I would like to express my greatest thanks to Prof. Zdzisław Cmoluch, who supervised my work, for his valuable advice and consultations in the course of my work on the paper.

MATERIALS AND METHODS

The galls produced by *P. planifrons* and the adult forms of the insect were collected in Ćmiłów and Snopków near Lublin, every two weeks from April to October between 1982 and 1986. The method of observation, individual dissection of stems carried out under a stereo-microscope and the scoop method were made use of. Totally, 5105 blades attacked by *Diptera* were obtained as well as 1270 individuals at different developmental stages: 246 eggs, 234 L_1, 58 L_2, 240 L_3, 163 praepupa, 266 pupa and 63 puparia.

In order to analyze in detail the morphology of the earlier developmental stages, microscopic preparations were made. Preserved in 75% alcohol (with an addition of glycerine in the proportion 1:1) or fresh specimens were leached about 24 hours in 10% KOH at room temperature. Next, they were washed in destilled water and chloralhydrate, shone through in chloraphenol and again washed in chloralhydrate. The preparation made in this way was closed in Berles liquid, All together, 100 microscopic preparations were made, 25 for each developmental stage (L_1, L_2, L_3, P).

Providing morphological descriptions of the larval stages I applied the terminology used in the studies of Nye (12), Nartshuk (8, 9) and Andersson (1).

ANALYSIS OF THE MATERIAL

Egg (Fig. 1). Milk-white. Length 1.440–1.608, width 0.225–0.383 mm (Table 1). A membraneous collar on the anterior pole. The rear pole is culminated by a spherical callosity. The sculpture of the chorion is formed by longitudal rims the number of which reaches 20. These are inter-connected by means of transverse, much more delicate structures visible in 160-fold enlargment (Fig. 2). No eggs of identical sculpture of the chorion were found.

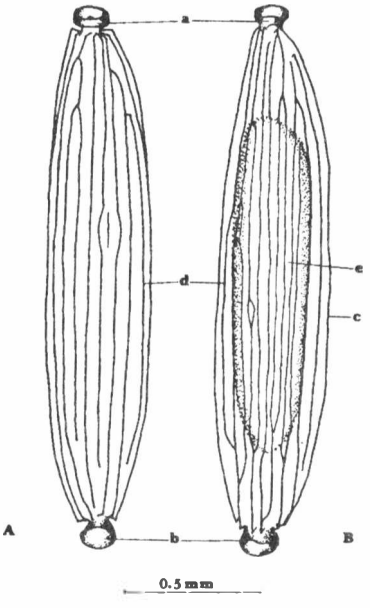


Fig. 1. The egg of *P. planifrons;* A — ventral side, B — dorsal side; a — anterior pole, b — posterior pole, c — chorion, d — longitudinal rims, e — the area with which the egg adjoined the plant

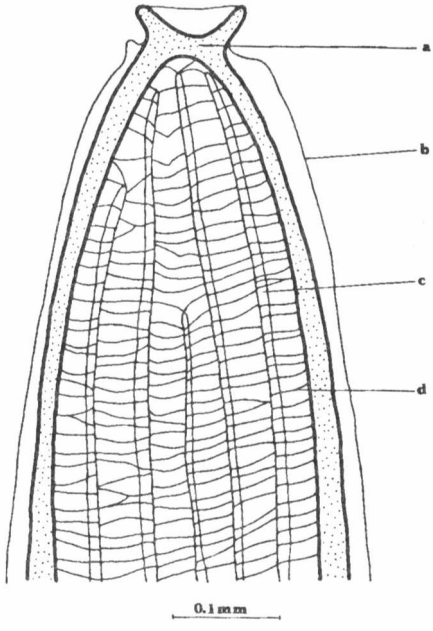


Fig. 2. A fragment of the surface of the egg chorion of *P. planifrons;* a — anterior pole, b — chorion, c — longitudinal rims, d — transverse rims

Larva. All the three larval stages — milk-white or light cream colour, built of 12 segments. The sensory organs on the first, cephalic one. Next follow three thoracal and eight abdominal ones. The final (anal) segment is transversely "divided" through the anus. This opening is in front and from the back surrounded by numerous spicules. This gives an impression of the ninth segment. The posterior spiracles are on the anal segment. The anterior spiracles (this concerns II and III stages) are at the posterior edge of the thoracal segment. The first stadium metapneustic.

Key to mark the larval stages of *P. planifrons*

1. No anterior spiracles. Posterior spiracles located on stigmophors. Papilla in the shape of nodules. The cephalo-pharyngeal skeleton equipped with a narrow, arched singular sklerite, placed square to its longitudal axe ..... I stage

— Anterior spiracles occur. Posterior spiracles lack stigmaphors. Papilla in the shape of cones. The cephalo-pharyngeal skeleton lacks the transverse sklerite 2

2. Papilla occur exclusively on three thoracal segments. Anterior spiracles are with 19–20 "V"-shaped digital rods. The cephalopharyngeal skeleton with a long atrial rod ..... II stage

— Papilla occur on all thoracal, abdominal or anal segments. Anterior spiracles with 15–22 "U"-shaped digital rods. The cephalo-pharyngeal skeleton with a short, base-widened atrial rods ..... III stage

Larva of the I stage (Fig. 3). Length 0.911–2.650 mm. Width 0.233–0.595 mm (Table 1). The greatest diameter is reached by the first thoracal segment. The

Table 1. The range of the body's measurements of particular developmental stages of *Platycephala planifrons*

Stage of development	Length (mm)	Width (mm)
Eggs	1.440–1.608	0.225–0.383
Larvae:		
L_1	0.911–2.650	0.223–0.595
L_2	2.250–2.925	0.600–0.800
L_3	5.850–7.500	1.150–1.350
Pupae	7.100–8.300	1.150–1.350

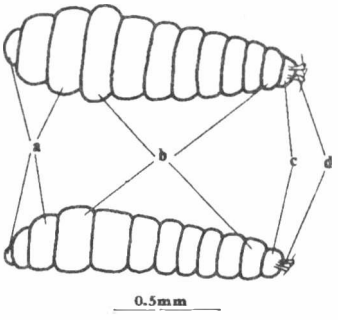
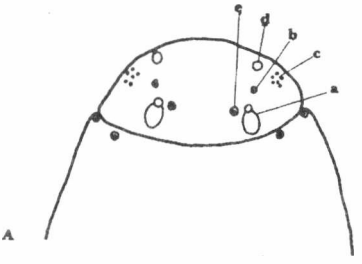


Fig. 3. Larva of the first stage of *P. planifrons* — general habitat; a — thoracal segments, b — abdominal segments, c — anal segments, d — posterior spiracles



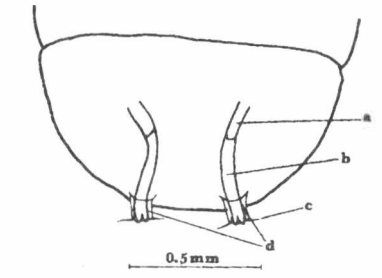


Fig. 4. Segments of the larva of the first stage of *P. planifrons:* A — cephalic; a — antenna, b — maxillary palp (palpus maxillaris), c — clusters of lateral papilla, d — frontal palp (palpus frontalis), e — anterior papilla; B — anal; a — main dorsal trunk, b — spiracular trunk, c — spiracular papilla (stigmophor), d — hair

limits between the segments are marked more strongly than in older larvae. No anterior spiracles.

The cephalic segment (Fig. 4A). A considerable part is occupied by the facial mask. Antennas are most exposed on the mask. Behind there are maxillary palps in the form of small papillas. Bellow, a pair of frontal palps. A pair of anterior papillas at the base of the antennas. Lateral papilla a little besides, on both sides of the mask.

The cephalic-pharyngeal skeleton (Fig. 5, 6A). Below the facial mask. Length 0.381–0.394 mm (Table 2). It is formed by two parallel sklerites. A pair of

Table 2. The measurements of the cephalo–pharyngeal skeleton of the larval stages of *Platycephala planifrons*

Stage of development	Length (mm)	
	skeleton	mouth hooks
L_1	0.381–0.394	0.037–0.044
L_2	0.526–0.578	0.164–0.170
L_3	0.815–0.973	0.101–0.113

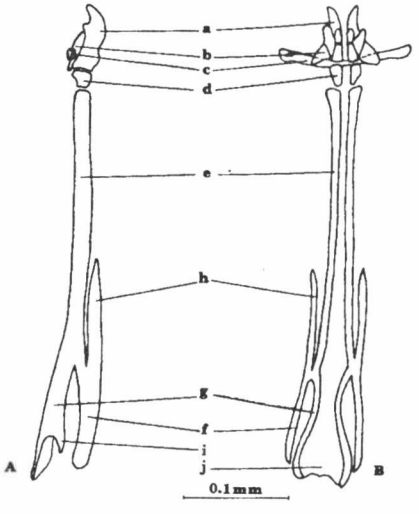


Fig. 5. The cephalic-pharyngeal skeleton of the first stage larva *P. planofrons;* A — lateral side, B — dorsal side; a — mouth hooks, b — triangular horizontal plates, c — arched sclerite, d — hypopharynx, e — pharyngeal sclerite, f — dorsal wing, g — ventral wing, h — dorsal sclerite, i — wing process, j — pharyngeal membrane

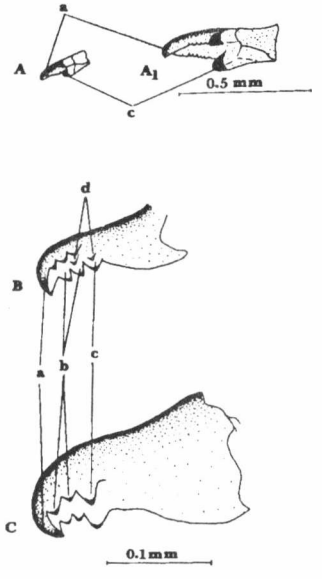


Fig. 6. Mouth hooks of *P. planifrons* larva; A_1A_1 — first stage, B — second stage, C — third stage; a — apical tooth, b — oral teeth, c — basal tooth, d — medial teeth

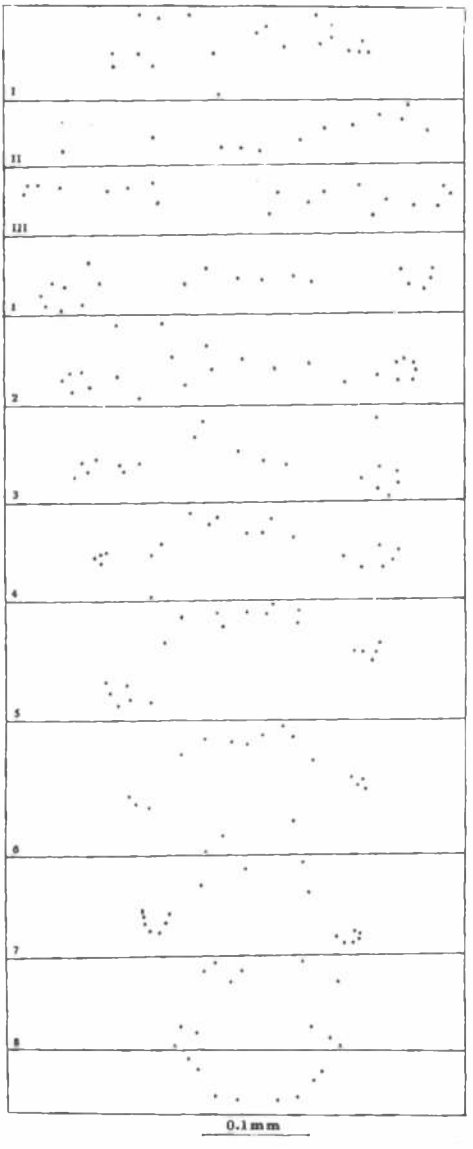


Fig. 8. A scheme of the distribution of papilla on the dorsal side of the body of first instar larva *P. planifrons*

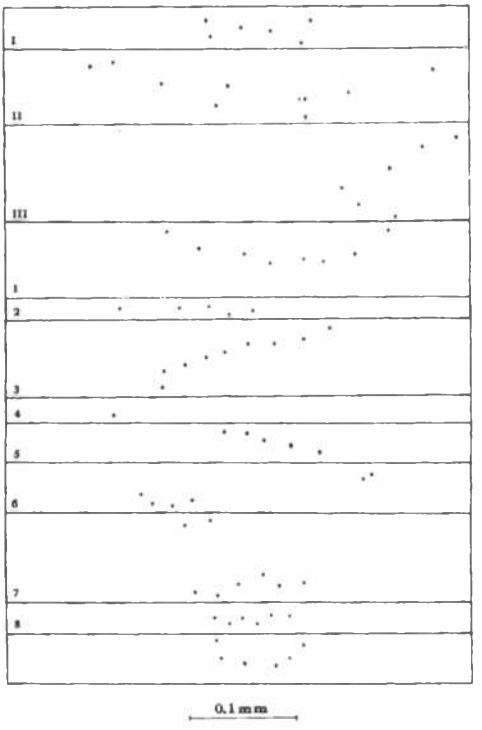


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Fig. 7. A scheme of the distribution of papilla on the ventral side of the body of first instar larva *P. planifrons*

sclerotized mouth hooks in the anterior part (Fig. 6A). The length of the hooks 0.037–0.044 mm (Table 2). Each of them is closed with a single apical tooth. The lateral edges of the tooth are serrate. The serration occurs in the place of the appearance of oral teeth in older larvae. A pair of basal teeth behind the apical tooth. They are nodule-shaped and based on the basal part of the mouth hook. It is observed from the side that these nodules overlap, which suggests the occurrence of a single basal tooth. Outside the mouth hooks, there are triangular

plates placed perpendicularly to them (Fig. 5). Under the hooks there is a narrow sclerite arched towards the abdomen and placed perpendicularly to the longitudal axe of the skeleton. Its ends are club-shaped widened from behind and cut slantwise, its length being considerably higher than the spacing of both the mouth hooks. Behind the hooks, there is a pair of hypostomal sclerites (intermediate ones), clearly distinguished from the pharyngeal sclerites. According to Nartshuk (9), in the first larval stages of *Chloropidae* these two kinds of sclerites are inter-connected. The pharyngeal sclerites are divided into two wings in the final part. The dorsal wing turns into a prolate, lanceolate dorsal sclerite. The ventral wing with a wing process. The right and the left ventral wings are connected by means of a pharyngeal membrane.

Thorax and abdomen. No anterior spiracles. Papilla in the shape of nodules (Figs. 7 and 8). Posterior spiracles (Fig. 4B) open outside in two spiracle slits (stigmas). Between the stigmas there are fairly long single hairs. Posterior spiracles are on stigmaphors.

Larva of the II stage (Fig. 9). Length 2.250–2.925 mm (Table 1). Anterior spiracles present. Posterior ones are not placed on stigmaphors.

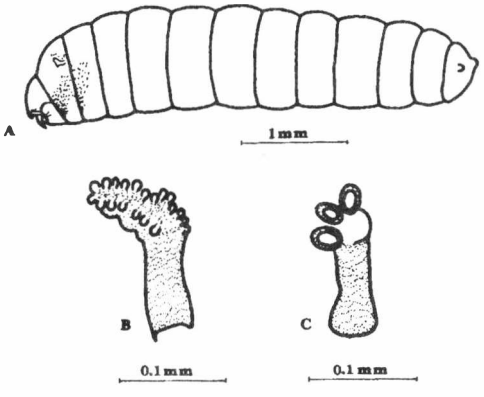

Fig. 9. Second instar larva *P. planifrons* — general habitat; B — anterior spiracle, C — posterior spiracle

The cephalic segment (Fig. 10). On the facial mask, dimerous antenna with a broader base with a small top segment thrust in it. The maxillary palps are in the form of open rings. The frontal palps appearing in the larva of the first stage are replaced by numerous, tiny papilla. Their numbers vary from 11 to 13. The lateral papilla are outside the maxillary palps.

The cephalic-pharyngeal skeleton (Figs. 11 and 6B). Length 0.381–0.394 mm (Table 2). Mouth hooks (Fig. 6B) with nine teeth. The apical tooth is the longest, hooked claw-like downwards. Four oral ones — two on each side. Behind it, single basal teeth. Two single mediary teeth between the second oral and basal teeth. The basal teeth more or less halfway the hook are based on its basal part. The hook base is hollow from the back (Fig. 11). From the dorsal side it is closed

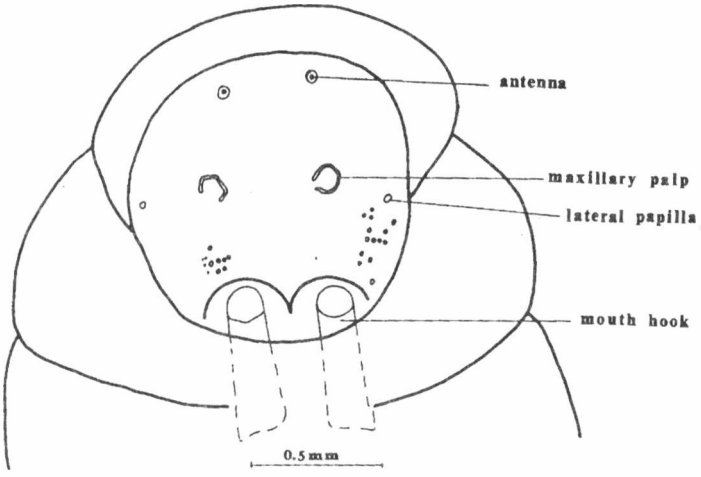

Fig. 10. The facial mask of second instar larva *P. planifrons*

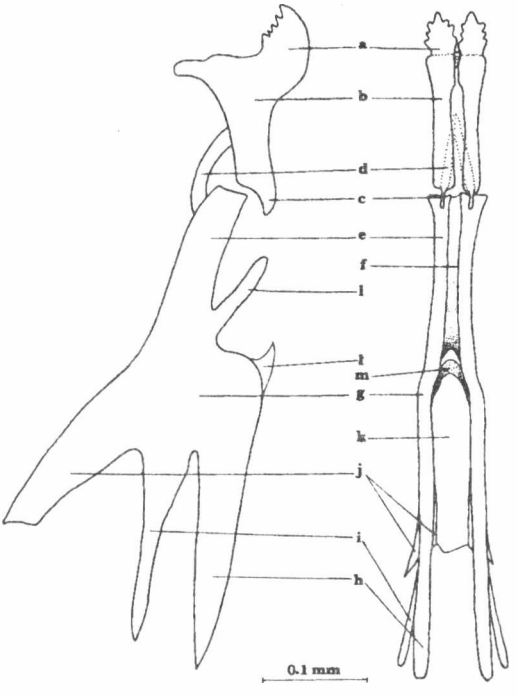

Fig. 11. The cephalic-pharyngeal skeleton of second instar larva, *P. planifrons;* A — dorsal side, B — lateral side; a — mouth hook, b — basal part of the mouth hook, c — dorsal sclerite of the mouth hook, d — arched sclerite (uvular plate), e — hypopharynx, f — hypostomal copula, g — pharyngeal sclerite, h — dorsal wing of pharyngeal sclerite, i — middle wing of pharyngeal sclerite, j — ventral wing of pharyngeal sclerite, k — pharyngeal membrane, l — atrial rod, ł — antero-dorsal sclerite, m — membraneous fold joining dorsal sclerites

by a dorsal sclerite which is the place of the muscles coordinated with all the skeleton.

In the area of the basal tooth from the ventral side, a strong muscle connects both the hooks into one functional whole. The uvular plates are situated on the border of the mouth hooks and hypostomal sclerite. From the ventral side they

are joined by a hypostomal copula. The hypostomal sclerite pass into pharyngeal sclerites with no clear limit. These, in turn, are divided into three wings — dorsal, middle and ventral ones. The latter wings of both the sclerites are connected by a pharyngeal membrane from the ventral side. The dorsal wings turn into antero-dorsal sclerites joined by a membraneous fold. The atrial spiracle is rod-shaped.

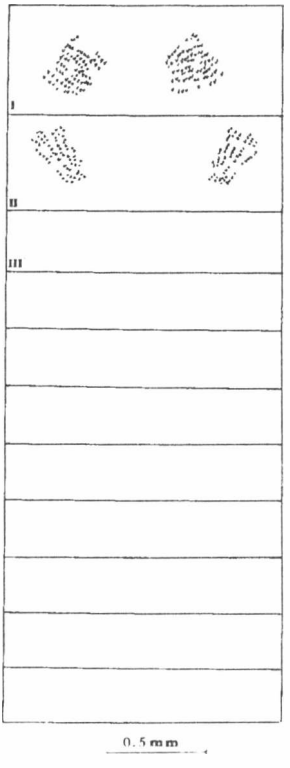

Fig. 12. A scheme of the distribution of papilla on the body of second instar larva *P. planifrons*

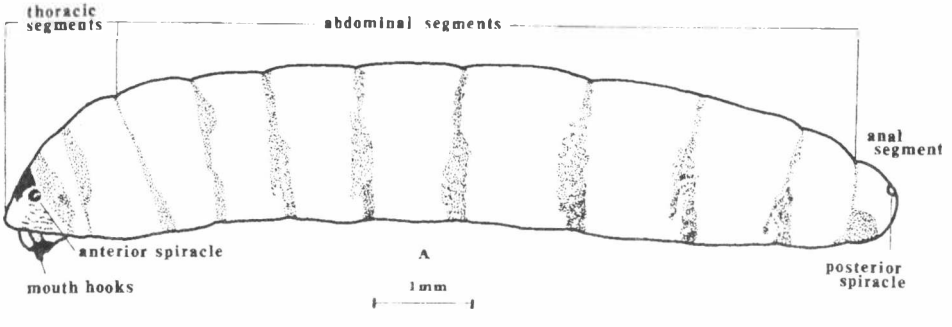

Fig. 13. Third instar larva *P. planifrons* — general habitat

Thorax and abdomen. The spicular zones (Fig. 12) are on two first segments. The light brown papilla are cone-shaped. The anterior spiracles (Fig. 9B) at the posterior edge of the first segment of the thorax, constitute the ending of the main tracheal trunks running on the sides of the larva's body. The tracheal trunks pass into spiracular trunks, which open outside by spiracular openings (stigmas). The spiracles with 19–20 spiracular rods are "V"-shaped. According to Nartshuk (9), there are 13 digitate rods. The posterior sclerites (Fig. 9C) on the anal segment is devoid of hair.

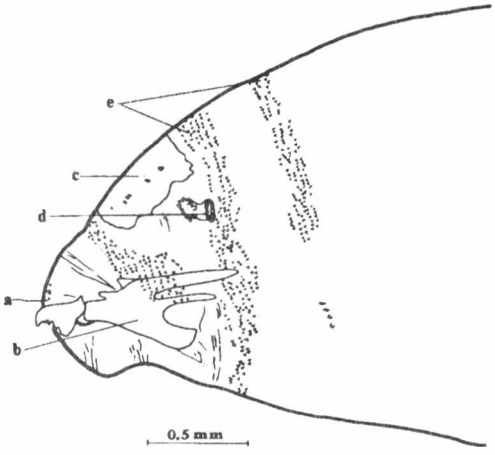

Fig. 14. The anterior section of the third instar larva — *P. planifrons* (lateral side), a — facial mask, b — cephalic-pharyngeal skeleton, c — chitin plate, d — anterior spiracles, e — papillar zones

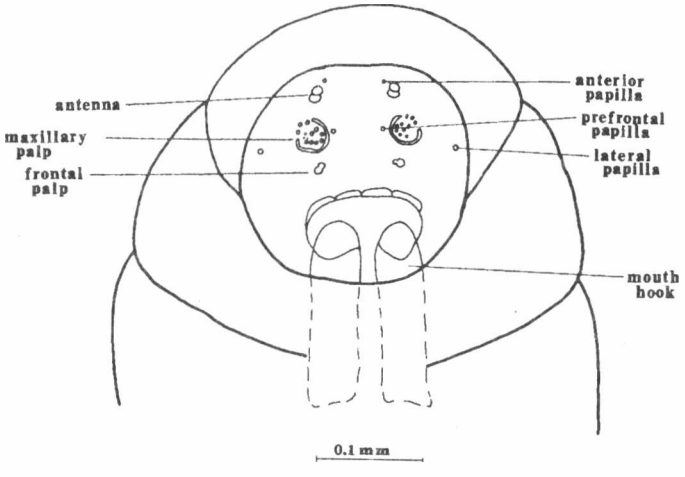

Fig. 15. The facial mask of third instar larva *P. planifrons*

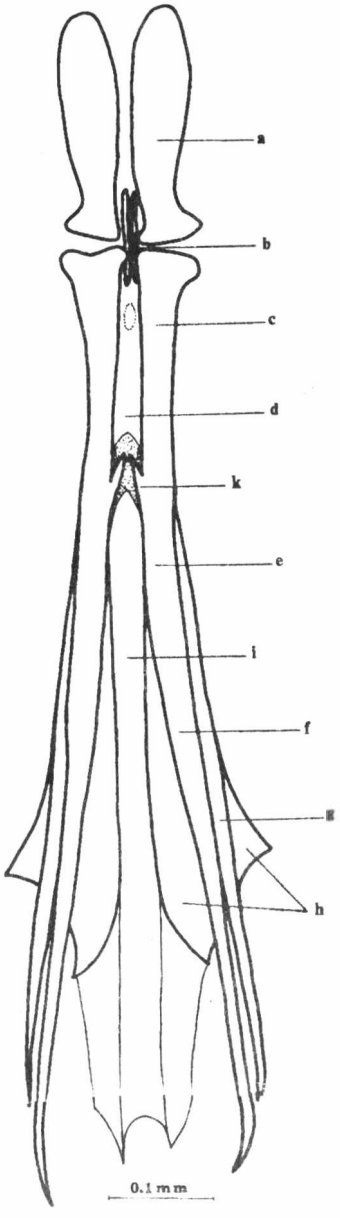

Fig. 16. The cephalic-pharyngeal skeleton of third instar larva *P. planifrons* (dorsal side): a — mouth hook, b — arched sclerite, c — intermediate sclerite, d — hypostomal membrane vault, e — pharyngeal sclerite, f — dorsal wing of the pharyngeal sclerite, g — middle wing of the pharyngeal sclerite, h — ventral wing of the pharyngeal sclerite, i — pharyngeal membrane, k — dorsal sclerite

Larva of the III stage (Figs. 13 and 14). Length 5.850–7.500 mm, width 1.150–1.350 mm (Table 1).

The cephalic segment. On the facial mask (Fig. 15) the farthest from mouth hooks a pair of dimerous antennas. The maxillary palps are in the form of an incomplete ring including 6–7 major and 3–4 minor papillas. Three single, arched

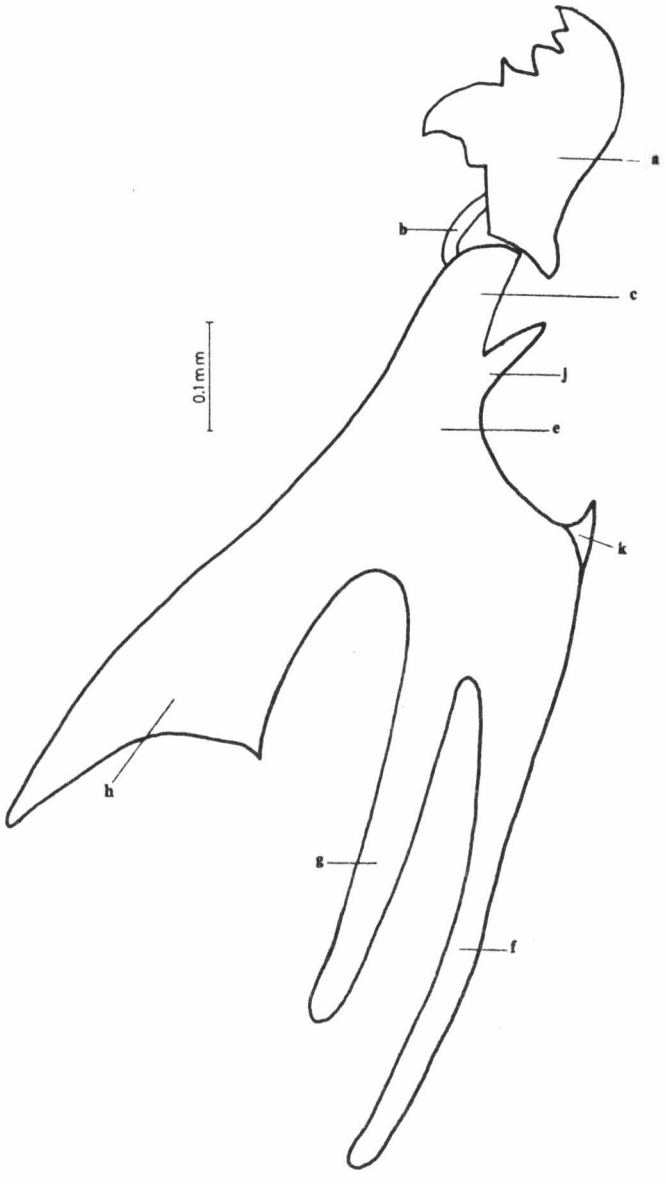

Fig. 17. The cephalic-pharyngeal skeleton of third instar larva *P. platanifrons* (lateral side); a — mouth hook, b — arched sclerite (uvular plate), c — intermediate sclerite, d — pharyngeal sclerite, f — dorsal wing of the pharyngeal sclerite, g — middle wing of the pharyngeal sclerite, h — ventral wing of the pharyngeal sclerite, j — atrial rod, k — dorsal wing

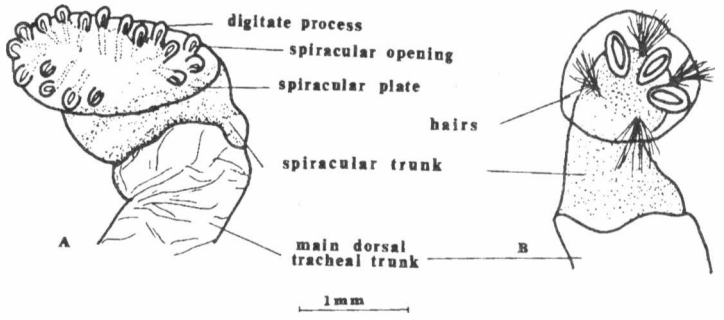

Fig. 18. Spiracles of third instar larva *P. planifrons;* A — anterior, B — posterior

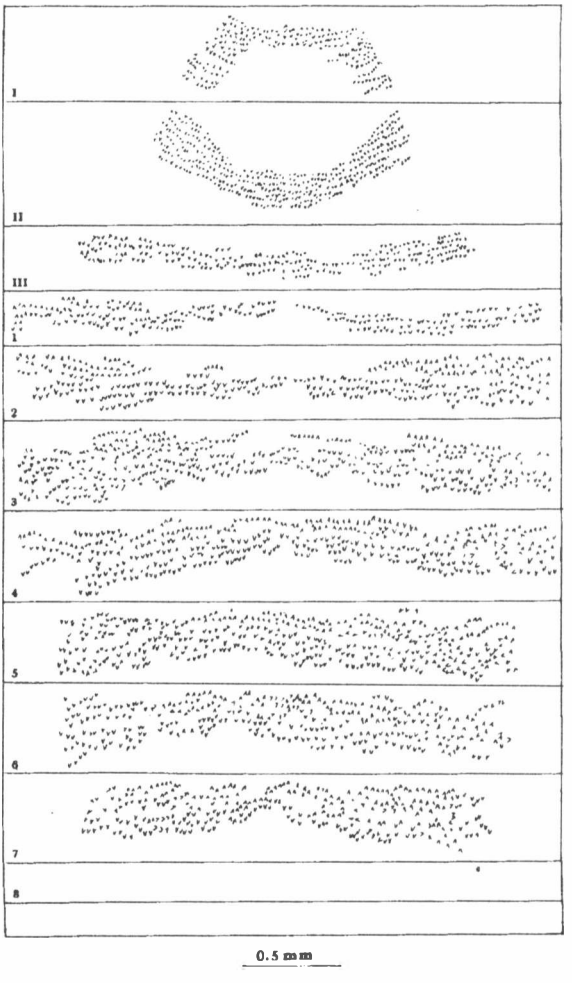

Fig. 19. A scheme of the distribution of papilla on the dorsal side of third instar larva *P. planifrons*

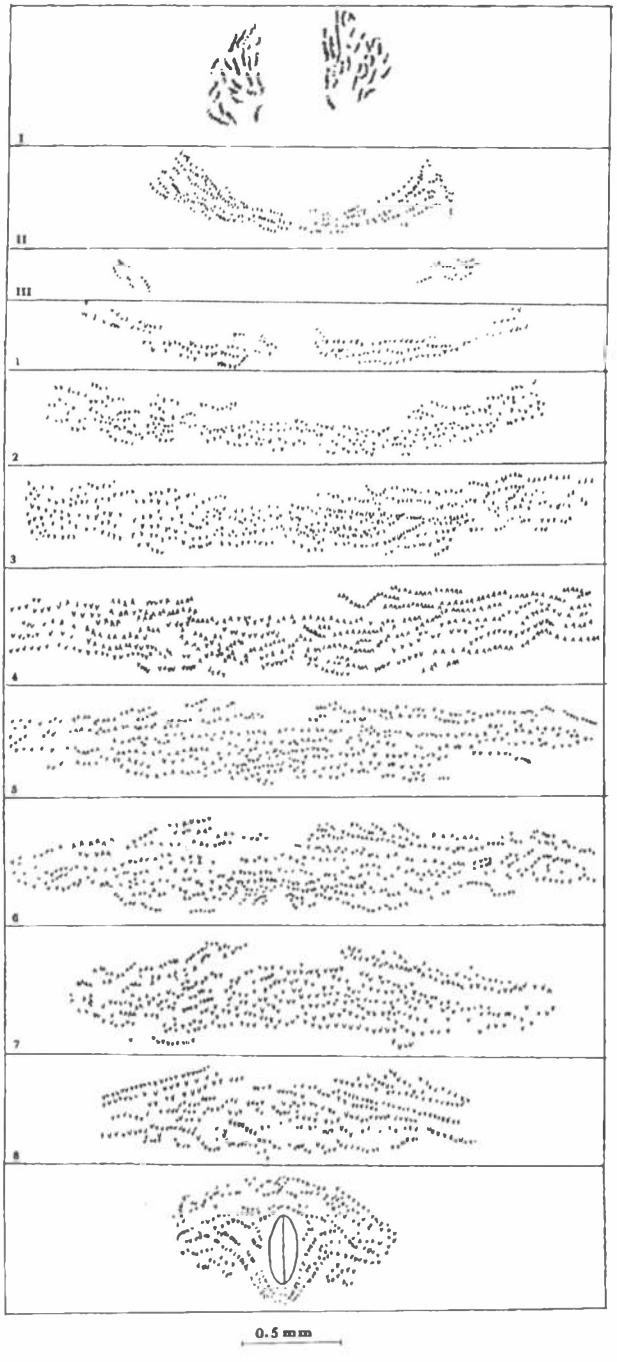

Fig. 20. A scheme of the distribution of papilla on the ventral side of third instar larva *P. planifrons*

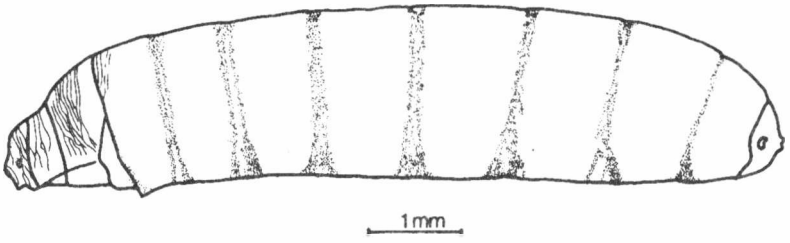

Fig. 21. A pupa of *P. planifrons* (lateral side)

papillas, close the ring forming maxillary palps. Between the latter and the mouth hooks there is a pair of dimerous frontal palps, Binate front, lateral and genal papillas. The facial mask devoid of rami.

The cephalic-pharyngeal skeleton (Figs. 16 and 17). Length 0.815–0.973 mm including the hooks' length 0.037–0.044 mm (Table 2). Each of the mouth hooks is from the bottom equipped with 7 teeth (Fig. 6C) — 4 oral teeth, 2 on each side, and a pair of basal teeth. From behind, the mouth hooks adjoin the intermediate sclerite (hypostomal one) with the basal part. The uvular plates take part in the junction of these two parts. Both hypostomes are joined by a membraneous vault. The intermediate sclerites pass into pharyngeal ones with no boundary. Each of these is divided into three wings — dorsal, middle and ventral ones. A pair of ventral wings closes the pharyngeal part of the skeleton from the bottom by means of a membraneous fold running along the whole pharyngeal part. The atrial rods are triangular in shape. The dorsal sclerites pass into antero-dorsal sclerites connected by a membraneous fold. The scaffolding of the pharynx in its closing part passes into very delicate musculature.

Thorax and abdomen. A light brown skeletonized plate on the first thoracal segment from the dorsal side (Fig. 14). A pair of anterior spiracles with 15 to 22 digitate processes on both its sides at the base of the segment (Figs. 14 and 18A). In an individual, the number of the rods varies in both spiracles. Most frequent combinations were 19–21 and 18–19. The spicular zones (13, 19, 20) in the form of rings at the front edge of each segment. This does not concern the eigth and anal segment (Figs. 19 and 20). The papilla forming the zone are cone-shaped. Posterior spiracles (Fig. 18B) with three spiracular openings are on the anal segment. Each of the stigmas is accompanied by clusters of hair on both sides.

Pupa (Fig. 21) of a fly. Length 7.100–8.300 mm, width 1.150–1.350 mm (Table 1). Dark brown, cylindrical shape with poorly visible segmentation. A typical exarate pupa within the puparium (Figs. 22 and 23). Initially, it is of cream colour. At the end of its development it reaches the colours close to those of an adult, and its body is covered by setae. An exarate pupa is surrounded by transparent, very delicate chrysaloid integument which after diptera leaves the spurious cocoon, remains inside it.

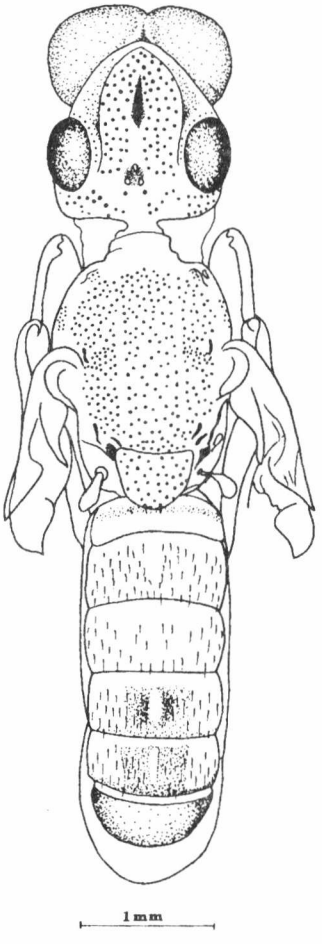

Fig. 22. A pupa of *P. planifrons* taken from the puparium (dorsal side)

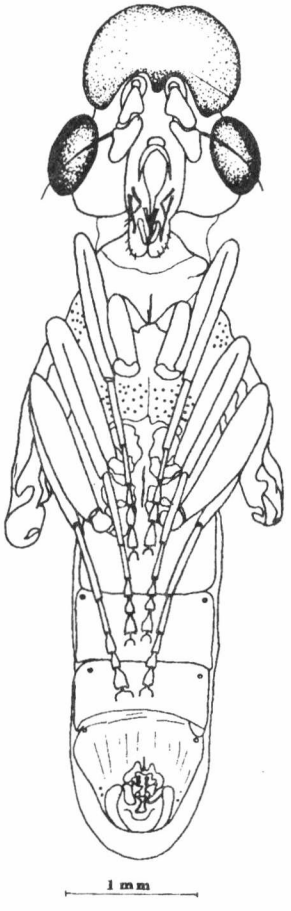

Fig. 23. A pupa of *P. planifrons* taken from the puparium (ventral side)

REFERENCES

1. Andersson H.: Taxonomic and Phylogenetic Studies on *Chloropidae* (*Diptera*) with Special Reference to Old World Genera. Entom. Scand. Suppl. **8**, 126–130 (1977).
2. Becker T.: *Chloropidae*. Eine monographische Studie. Palãarktische Region. Archiv. Zoolog. **1** (15), 38–40 (1910).
3. Duda O.: 61 *Chloropidae*. Die Fliegen der Palãarktischen Region. E. Lindner (Herausg.) **6** (1), 115–117 (1932/1933).
4. Fabricius J. C.: Entomologia Systematica. Suppl. Hafniae 1798.
5. Fallén C. F.: *Diptera* Sveciae. II Oscinides. Lundae 1820, 2–3.
6. Grochowska M.: *Platycephala planifrons* F. (*Diptera, Chloropidae*) Life Cycle and Morphology. Abstracts of the First International Congress of Dipterology, Budapest, 17th–24th August. Budapest 1986.

7. Meigen J. W.: Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. **6**, 23–26 (1830).
8. Нарчук Э. П.: Виды рода *Oscinella* Beck. (*Diptera: Chloropidae*) европейской части СССР и их кормовые растения. Энтомол. Обозрение **35** (4), 857–882 (1956).
9. Нарчук Э. П.: Злаковые мухи (*Diptera: Chloropidae*) их система, эволюция и связи с растениями. Труды зоол. института АН СССР, **136** (11), 180, 195–197 (1987).
10. Nartshuk E. P.: Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei 302 *Chloropidae*. Part II: Subfam. *Chloropinae*. Folia Entomologica Hungarica, Suppl. **26**, 271–272 (1973).
11. Nartshuk E. P.: *Chloropidae* (*Diptera*) from the Mongolian People's Republic. Fragm. Faun. **20** (22) 407–413 (1976).
12. Nye J. W. B.: The External Morphology of Some of the Dipterous Larvae Living in the *Gramineae* of Britain. Trans. Roy. Entom. Soc. **110**, 411–487 (1958).
13. Wandolleck B.: Zur Anatomie der cycloraphen Dipterenlarven. Anatomie der Larve von *Platycephala planifrons* (F.). Abhandl. u. Ber. Königl. zool. Mus. Festschrift. **7**, 1–39 (1899).
14. Zetterstedt J. W.: *Diptera* Scandinaviae. 7, 2581–2583 (1848).

STRESZCZENIE

Przedstawiono dokładne opisy wszystkich stadiów przedimaginalnych muchówki *Platycephala planifrons* (Fabricius), ilustrując je bardzo szczegółowymi rysunkami (ryc. 1–23). Podano także klucz do oznaczania stadiów larwalnych tego gatunku.