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

Cykl życiowy *Platycephala planifrons* (Fabricius, 1798) (*Diptera, Chloropidae*)

The life cycle of *Platycephala planifrons* has not been known so far. The species has been hardly mentioned by several authors of papers on the fauna of reed rushes communities (3, 7, 10). Few references can be found in monographies on ecology and taxonomy of the family *Chloropidae* (1, 2, 4, 5, 9). Most data can be found in the paper by Skuhravý and Skuhravá (8) describing the development of the fly and damages it causes. These findings arouse some reservation, though. There are many doubts as to the hibernating stage of the species. Skuhravý and Skuhravá (8) contend that it is imago that hibernates, whereas Waitzbauer, Pruscha, Picher (10) maintain that the stage which hibernates is the larva. Among the literature data most references pertain to the period of occurrence of imago and larva of the stage III. None of the papers describes the larva of the stages II and III or the term of ovipositing eggs.

I was therefore induced to carry out examinations whose aim was to study the life cycle of the species and find out its relations with the host plant.

I would like to thank the Promoter Prof. dr hab. Zdzisław Cmoluch for his valuable advice and consultations in the course of writing the present paper.

Table 1. Periods of occurrence and duration of different

Location	Year of investigations	O Period of occurrence	O Duration (days)	L_1 Period of occurrence	L_1 Duration (days)		L_2 Period of occurrence	L_2 Duration (days)
Snopków	1982							
	1983							
	1984						3.5–17.6	46
				1.1–29.5	149			
	1985	2.8–12.10	72	19.8–31.12	135	266	5.5–11.6	38
				1.1–11.5	131			
	1986	26.7– 4.10	71	10.8–31.12	144		26.4– 9.6	45
Ćmiłów	1984						4.5– 8.6	36
				1.1–19.5	139			
	1985	2.8– 6.10	66				5.5–20.6	47
				12.8–31.12	142			
				1.1–24.5	144	286		
	1986	30.7– 3.10		10.8–31.12	144		27.4– 8.6	43

MATERIAL AND METHODS

The examinations were carried out in 1982–1986 at two localities in the environs of Lublin — at Snopków and Ćmiłów. The material was collected by means of three methods: 1) observation method, 2) analysis of reed stems and 3) scoop method. In 1982–1983 the samples were collected from May to September and in 1984–1986 from April to October.

Observations were made at different times of day, most often in the afternoon. By means of the first method there were collected 110 adult specimens, 246 eggs and 5,105 common stems at different stages of development.

The reed stems collected in the area were analysed in the laboratory just after bringing the material or within the nearest four days. Ready for preparation stems were kept in the refrigerator in the temperature of 4°C. In the result of analysis 234 larvae of the first stage (L_1) were obtained, as well as 58 larvae of the second stage (L_2), 240 larvae of the third stage (L_3), 163 prepupae (PP), 266 pupae (P) and 63 puparia.

On the searched area 30 scoop samples, which contained 53 adult flies (I), were collected. One sample constituted 200 catches with the entomological scoop which was carried along coastal reed rushes, over the stems not exceeding 1.5 m of height.

During the whole period of investigations there were totally collected 1,433 specimens in different stages of development.

Adult specimens were denoted based on the Duda's key (2). The pre-imago stages were determined on the basis of detailed analysis of their morphology (Grochowska, paper in print).

Detailed terms of occurrence and the duration of development of the particular stages were showed in Table 1. Fig. 1 illustrates the life cycle scheme of the described species.

RESULTS OF EXAMINATIONS

Life cycle

The successive stages in the development of *P. planifrons* are: the egg, larva of the stage I, II, III, pre-pupa, pupa and imago.

developmental stages of *P. planifrons* in 1982–1986

L_3		PP		P		I	
Period of occurrence	Duration (days)	Period of occurrence	Duration (days)	Period of occurrence	Duration (days)	Period of occurrence	Duration (days)
19.5–12.6	25	25.5–14.7	51	5.6–22.7	48	1.7– 9.9	71
8.5–12.6	36	2.6–17.7	46	12.6–31.7	50	30.6–12.9	70
27.5–24.6	29	3.6–22.7	50	17.6–3.8	48	8.7–20.9	73
16.5–21.6	37	5.6–28.7	54	5.6–28.7	54	15.7– 6.10	72
19.5–16.6	29	24.5– 3.7	41	1.6–26.7	46	10.7–17.9	70
29.5–24.6	27	13.6–2.8	47	20.6– 5.8	47	4.7–12.9	71
29.5– 1.7	34	5.6–20.7	46	5.6–28.7	54	19.7– 6.10	80
19.5–23.6	36	1.6–18.7	48	1.6–18.7	48	30.6–15.9	78

The first larval stage appears at the beginning of August and lasts till May next year. Its duration is 226–286 days. It is the longest lasting hibernating stage of development of that species. It was found the earliest at Snopków on 10 August 1986, and the latest — at the same site on 29 May 1985. L_1 goes through an obligatory diapause in late autumn and in winter. It starts on the 7th–11th day after leaving egg chorion. Within few days preceding the diapause the young larva feeds intensively, then it ceases moving, its growth and further development become inhibited during winter. Many specimens do not survive this time of year. The mortality among young larvae reaches ca 20%. Those which survive become active in early autumn, they feed and grow. The size of their bodies increases nearly threefold. At the end of April the specimens appear which shed larval shell and proceed to the second stage.

The second larval stage was observed between the third decade of April and the second decade of June. The earliest occurrence was on 26 April 1986 at both localities, and the latest one on 20 June 1985 at Ćmiłów. The duration of that stage in the area is from 36 to 46 days. At the end of development of the second larval stage one can come across specimens with double head-tharynx skeleton and double spiracles.

The third larval stage is observed from the first decade of May till the first decade of July. It was found the earliest at Snopków on 8 May 1983 and the latest at Ćmiłów on 1 July 1985. The longest duration of that stage, 36 days, was in 1983, and the shortest one, 25 days, in 1982. This larva is the most ponderous and the least mobile of all the stages. At the

end of development it stops feeding, sheds and it proceeds to the prepupal stage.

The pre-pupa was observed from the third decade of May to the first decade of August. The first specimens were collected at Snopków on 24 May 1986 and the last ones at Ćmiłów on 2 August 1984. The duration of that stage in the area is from 41 to 54 days. Single specimens in the prepupal stage occur for 1–5 days. Then they pupate.

The pupal stage lasts from the beginning of June till the first decade of August. The pupa was found the earliest on 1 June at Ćmiłów, and the latest, at the same site, on 5 August 1984. After 8–16 days since the moment of pupation an adult individual comes out of the inside of the puparium.

Adult specimens start occurring at the end of June. The earliest found imago form comes from Snopków, 30 June1983. The period of occurrence lasts 70–80 days. The latest observed occurrence was at Ćmiłów on 6 October 1985. After 4–5 days since the moment of leaving the puparium the adult individuals copulate. From 9th–11th day of life adult females start inserting eggs.

In 1985–1986 eggs were found in the area from the third decade of July to the second decade of October. The period of their occurrence is late summer and early autumn and it lasts from 64 to 72 days. They were found the earliest at Snopków on 26 July 1986 and latest, on 12 October 1985. In August larvae of the stage I come out of egg chorions and life cycle of the species is closed.

Relation between life cycle of *Platycephala planifrons* and common reed

Common reed is the host plant of *P. planifrons*. Synchronization of the life cycle of *P. planifrons* with *Phragmites communis* is showed in Fig. 2.

During the adult specimen's occurrence the reed stems reach the maximum height and are in the flowering stage. At the end of summer and at the beginning of autumn adult females insert eggs in the basal part of stems at the height of 5–12 cm above the ground surface (Fig. 3). After leaving the egg chorion the larva of stage I directs itself to the nearest young reed stem. It pushes itself into closely adjoining leaf blades and stops at one of them (Fig. 4). A detailed analysis of several thousands of stems proved that only one larva feeds inside a single stem.

From August to March next year young reed sprouts do not increase in size. This both refers to the sprouts inside which there are larvae and those

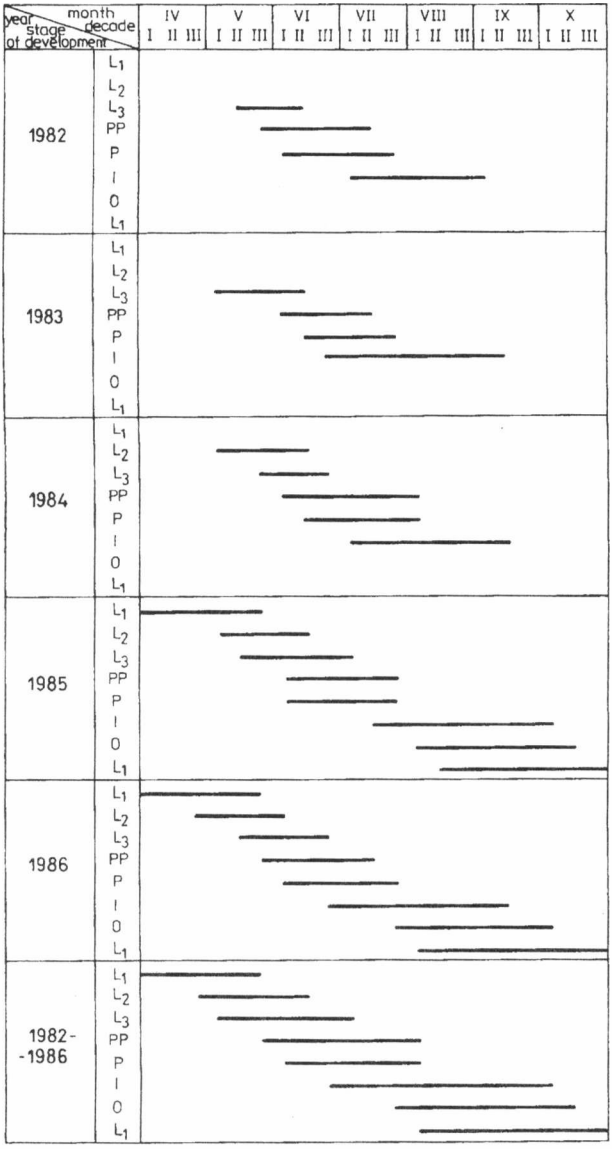

Fig. 1. Scheme of life cycle

which are not populated by them. In April one can observe a rapid growth and development of all reed stems. The larva of the stage I was found in the first place in the outgrowths reaching 1.5–19 cm. In several cases it was found in stems of maximum height of 106 cm and in slightly lower ones. At the beginning of flowering young larvae become active. They come down along straight line towards the basal part of the leaf blade on which they

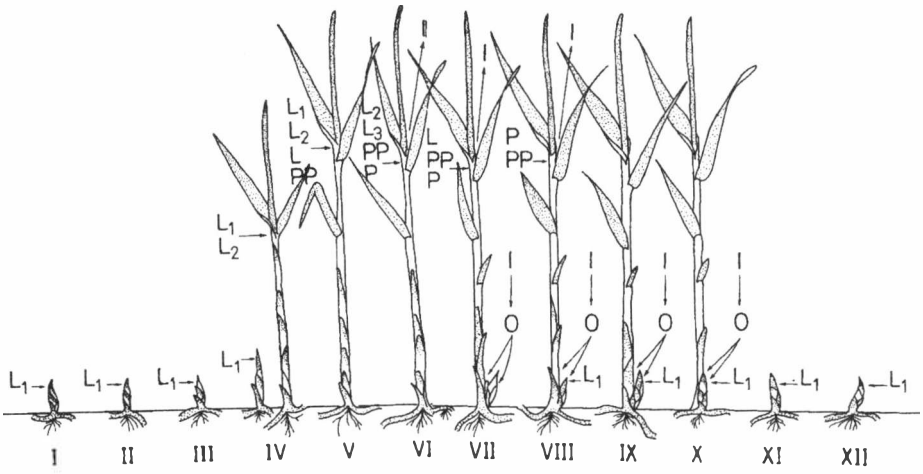

Fig. 2. Synchronization of *P. planifrons* life cycle with host plant

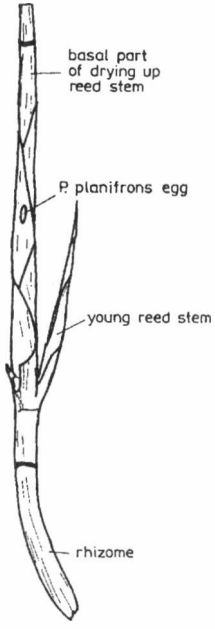

Fig. 3. Fragment of basal part of reed stem with a young stem — the place of inserting eggs

hibernated and at the height of the top of growth they start boring the canal shaped like a spiral (Fig. 5) on the outer side of internodes biting off successive leaf blades. Having circled twice they come back to the trace of the first circle. There they bore out a hole into which they come in and start

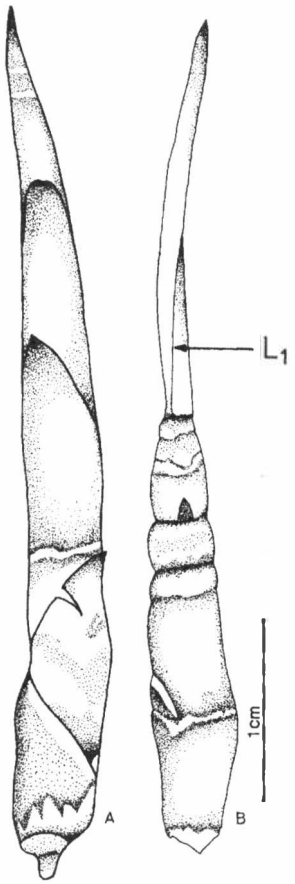

Fig. 4. Young reed stem; A — general habit, B — after removing the outer leaf blades; an arrow indicates place of hibernation of stage I larva

boring the canal towards the top of growth. It has the shape of a straight, slanting line. Having reached the apex they eat it. Here they shed for the first time. From that moment the stem stops growing, and in its top part the creation of the gall begins. The development of the remaining pre-imago stages takes place inside the gall being created.

Short-lasting larval stage II was found in spring over the damaged top of growth, among juicy and very young leaf blades the larva intensively feeds on. When eating up the youngest parts of the plant it starts boring the lower part of the larval chamber. This larva occurs inside the reed stems which reach the height of 23–116 cm. At that time one may observe a slightly faded, but still green median leaf outside the plant. The distinction of attacked stems from healthy ones is possible not earlier than in the period of ravening of the third stage larvae.

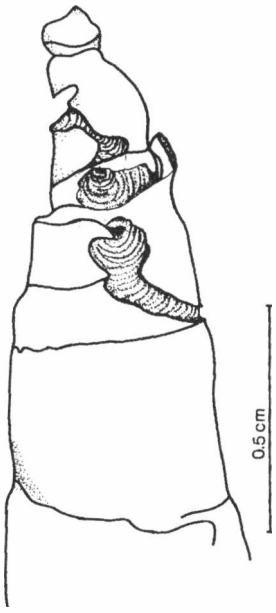

Fig. 5. Top of growth of common reed stem attacked by larva of stage I

At the beginning of the adult larva's feeding on the outer side of the leaf sheath of the third leaf (counting from the outside) one can notice a feed shaped like a delicate spiral. At that time in the sheath of the fourth leaf there is a conspicuous, much bigger recess which spreads into deeper layers of the leaf. After some time, as the feeding goes on, the recess increases and transforms into a chamber of a considerable size. In the final phase of the chamber creation its inside is filled with dead, decaying and very moist remains of the plant, among which is the larva of the third stage, and the pupa. At that time in the basal part of the deformation 3–4 shortened internodes occur, which are lied in telescope fashion. Leaf sheaths grow out of the two highest nodes and form the gall. They resemble a pipe hiding the damaged top of growth as well as the remains of the decaying leaves and the larva in its inside. Such a deformation is barely visible. It is the extension of the lower part of the stem without any distinct border. At its top there is a yellowed and dried top leaf (Fig. 6A) and 3–4 pinnated leaf blades. The affected stems reach the height of 90–130 cm and are shorter than the healthy ones. They never create inflorescence. In several cases stems affected by *P. planifrons* with lateral stems were seen (Fig. 6B).

P. planifrons and common reed stem create a system within which they interact, and the condition of its existence is morphological and biological adaptation of both components. The plant and the insect occur in the

Fig. 6. General habit of reed stems damaged by *P. planifrons*

same habitat. Beyond *Phragmitetum* association *P. planifrons* has not been recorded so far. Generatively grown females being able to oviposit eggs appear together with the autumn new growth of the reed (the phenomenon of phenological adjustment).

The occurrence of short free-living phase is connected with the extension of parasitic period, and thereby, with greater dependence of *P. planifrons* on the host plant and prolongation of mutual relation. Trophic functions are connected with parasitic (larval) phase, and generative functions — with free-living (imago) phase.

In the initial phase the adult larva of the third stage feeds on live, still green and juicy leaves of the top part of the stems, it is thus a typical

phytophage. In the final phase of development it changes into saprophage. It devours dead plant remains filling the inside of the chamber.

During intensive feeding the larva of the stage III is directed head downwards. Very shortly before pupation it turns by 180°. This moment is very significant because it enables the imago form to leave the stem leaving puparium.

FINAL REMARKS

Most of the authors (3, 8, 10) in their hitherto studies on *P. planifrons* agreed up on the fact that the species hibernates either as the imago or pupa. The research carried at that time by the author of the paper of the afore-mentioned developmental stages inside the dried reed stems did not bring the expected results. The larvae of the stage I were found only in winter. This fact contradicts the results of examinations published in the quoted papers.

During the examinations the adult insect occurred from the third decade of June till the first decade of October. The approximate periods of imagines occurrence were recorded in other countries. Narcuk (4) reported this species from Mongolia in the last days of June, the first decade of July and in August. The author, jointly with Elberg (6) also collected adult insects in Estonia from the third decade of June to the middle of September and in Lithuania in the middle of June. Stakelberg (9) observed imagines in 1926, 1956–1957 from the end of June to the first decade of August in the environs of Leningrad.

The carried out research allows for statement that the larva is the longest lasting developmental stage of the species. Within 5 years of investigations it occurred from August till July next year. The remaining developmental stages (pre-pupa, pupa, imago and egg) were reported from May to October. In the course of examinations the overlapping of the particular developmental stages was observed.

Waitzbauer, Pruscha, Picher (10) are of the opinion that *P. planifrons* oviposits eggs in spring on the plants whose stems are 90–120 cm long. Skuhravý, Skuhravá (8) suppose that it lays them inside the top of growth of the reed stems, most probably in May. During the research period already adult larvae of *P. planifrons* were found in reed stems (90–120 cm long), and on their leaves — eggs belonging to different species of *Diptera*, mostly from the family *Chloropidae*, among which there were no eggs of the analysed species. The search for eggs on the top of growth was a failure.

However, they were found on the lower part of the stems, 5–12 cm over the ground surface, close to young stems, inside which young larvae shelter later on.

A detailed analysis of the life cycle of *P. planifrons* has explicitly showed that this insect has one generation in a year, Czech authors assume the same attitude in this respect (8). Lozinskij, Oksjutic (3) suggest that there are as many as three generations. The present paper excludes such an approach.

For quite a long time there was an opinion (2, 11) that *P. planifrons* is an inquiline of the galls created by the species from the genus *Lipara*. The carried out observations showed that larva of the stage I devours the top of growth of the reed stem, due to which the stem stops growing and wastes away. On this basis the species should be included without delay in the group of originators of the galls created on the common reed.

The divergence in observations presented in the above-mentioned publications is probably due to lack of knowledge of the species life cycle, and most of all, lack of data referring to its morphology.

Entomofauna of reed rushes is still very little known. Specially few works are concerned with biology of species related to the prevailing common reed. Some of the species considered to be inquilines are serious destroyers of the stems. Many years' observations allow for a supposition that *P. planifrons*, beside the species of the genus *Lipara*, is a very significant element affecting the regulation of the number of reed rush stems.

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STRESZCZENIE

Ustalono okresy pojawów i czas trwania wszystkich stadiów rozwojowych *Platycephala planifrons* F. Bardzo szczegółowo zanalizowano charakter powiązań tej muchówki z trzciną pospolitą. Badany gatunek, obok niezmiarek z rodzaju *Lipara* Mg., został uznany za istotny czynnik wpływający na regulację liczebności źdźbeł *Phragmites communis*.