Morphology of preimaginal stages of *Incertella zuercheri* Duda 1933 (Diptera: Chloropidae) – an inquiline in galls formed by *Lipara* flies on common reed (*Phragmites australis* (Cav.) Trin.)

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**Abstract.** The complete description of the morphology of the preimaginal stages of *I. zuercheri* is illustrated with 39 figures. All stages are described for the first time. In descriptions of the larval stages, particular attention is given to the cardinal diagnostic characters: facial mask, cephaloskeleton, anterior and posterior spiracles, and locomotory structures. The paper forms a basis for understanding the biology and life cycle of this fly, for which correct identification and discrimination of the preimaginal stages is a prerequisite.


**Keywords:** *Incertella zuercheri*, morphology, *Phragmites australis*.

*Incertella zuercheri* (Duda 1933) is one of ten Palaearctic species of the genus *Incertella* (Nartshuk 1996). The species was originally described by Duda (1933) under the name *Tropidoscinis zuercheri*. In subsequent publications, it has been referred to as *T. zuercheri* (Nartshuk 1962), *T. zuercheri* (Nartshuk et al. 1970) and *T. zuercheri* (Kloet & Hincks 1976). In 1962, Nartshuk synonymised it with *T. scotica* Collin 1946, but in 1984, she restored both species as separate taxa. In 1980, Sabrosky changed the name to *Incertella zuercheri* placing the species in the genus *Incertella* Sabrosky, which he had also erected.

*I. zuercheri* occurs in Finland, Great Britain, Germany, Switzerland, Hungary, Czech Republic, Slovakia, Bulgaria, former Yugoslavia, Poland, Estonia, Lithuania, Latvia, Belarus, Ukraine, European part of Russia, Moldova, Kazakhstan and Mongolia (Nartshuk 1984).

There is scarce information regarding its biology. The imagines are known to occur in marshy areas in June (Nartshuk 1962), and the preimaginal stages develop in galls of *Lipara* on common reed (Duda 1933; Nartshuk 1972, 1972a, 1987, 1996; Abraham and Carstensen 1982; Wolf 1991; Tscharntke 1999). The morphology of the preimaginal stages is not known.

The aim of the present study was to describe the morphology of all preimaginal stages of *I. zuercheri*. The paper provides groundwork information for understanding the life cycle of *I. zuercheri*, the relations between insects inhabiting the apical part of common reed stems and how these insects influence the host plant.

**Materials and Methods**

The materials included all stages of *I. zuercheri* obtained from the apical part of common reed stems. The stems were obtained from reed beds in and around Lublin (central-eastern Poland) in the years 2002–2005. Fresh stems were randomly collected in May and June, and stems bearing visible galls in the apical part were collected outside of this period. The stems were subsequently sectioned in the laboratory under a stereoscopic microscope. The sectioning of stems yielded all larval stages and pupae. Eggs were obtained from the apical parts of rolled leaves found in the central part of galls and from sectioned abdomens of females. First-instar larvae were also reared from eggs removed from stems or laid by females in the laboratory. Imagines were captured in the field with a sweeping net and obtained by rearing larvae and pupae in Petri dishes lined with filter paper.

Overall, the study material comprised 30 eggs, 18 first-instar larvae, 11 second-instar larvae, 20 third-instar larvae, 15 pupae, and 19 imagines.
The specimens chosen for detailed study were macerated in 10% KOH for 24 hours at room temperature, washed in distilled water, cleared in chloral hydrate and chloral phenol, and preserved in glycerol. Drawings were based on the microscopic preparations.

Larvae of *I. zuercheri* were identified among all larvae obtained from the apical part of common reed stems in the following way. First-instar larvae were compared with larvae reared from eggs laid by *I. zuercheri* females. Second-instar larvae were identified as those possessing anterior spiracles with short and closely spaced lobes, three oral teeth at exterior border of mouthhook, and posterior spiracles with a small and round spiracular plate. The outlines of the cephaloskeleton and posterior spiracles of the third-instar larvae are known to become visible under the cuticle of second-instar larvae towards the end of the second instar, i.e. shortly before the cuticle is shed. Those characters were therefore used to confirm the correct identification of second-instar larvae. Third-instar larvae were identified on the basis of similarities between their characters and those of puparia from which adult *I. zuercheri* flies emerged. Other larvae isolated from the stems shall be discussed in subsequent publications.

Imagines of *I. zuercheri* were identified according to a key (Nartshuk *et al.* 1970). The descriptions of larvae follow the terminology of Courtney *et al.* (2000). Parts of the larval body not defined in Courtney *et al.* (2000) are named according to Nye (1957) and Nartshuk (1987).

**Results**

Egg (Figs.1–4), 0.57–0.60 mm long, 0.20–0.21 mm wide, mat, milky white, barrel-shaped, slightly rounded at both ends (Fig. 1). Length-to-width ratio 3:1. Ventrally flat, dorsally arch-like (Fig. 2). Surface covered with mesh of longitudinal and transverse ribs (Figs. 3, 4). Cells of mesh smaller and more numerous at...
both ends, long and narrow in central part. Surface covered throughout with delicate points formed by apices of microscopic closely-spaced processes.

First-instar larva (Fig. 5–15), 0.88–1.5 mm long, 0.18–0.33 mm at widest diameter. Body milky white, long, slender, oval in cross-section, with slightly rounded posterior end (Fig. 5). Facial mask with a pair of two-segment antennae, maxillary and frontal palpi (Fig. 6). Basal antennal segment ring-like, slightly smaller in diameter than apical segment. Apical segment dome-shaped, elongated. Maxillary palpi with two sensilla. Frontal palpi over mouthhooks, each with one sensillum. Oral ridges not branching, form symmetrical pattern on both sides of mouth opening. Cephaloskeleton (Fig. 7) light-amber in colour, 0.22–0.23 mm long, including 0.05–0.06 mm long mouthhooks. Behind apical tooth six oral teeth in two rows, with three teeth in each row (Fig. 8). Basal tooth massive, in middle of mouthhook, continuous with base of mouthhook. Base of mouthhook tapering posteriorly (Fig. 9). Intermediate sclerite connected with basal sclerite. Basal sclerite divided into ventral and dorsal cornua. Ventral cornu longer and wider than dorsal cornu. Both cornua poorly sclerotised, mostly membraneous. Dorsal cornu tapering posteriorly, pointed anteriorly. Hypopharynx with prominent longitudinal ventral cibarial ridges extending into lumen of cibarial pump. Posterior spiracles on stigmatophores, with

Figures 16–25
Incertella zuercheri second stage larva: 16, lateral view; 17, facial mask; 18, cephaloskeleton; 19, mouthhook, ventro-lateral view; 20, anterior spiracle; 21, posterior spiracle; 22, posterior segment, ventral view; 23, spinules on ventral intersegmental regions of abdominal segments seventh and eighth; 24, spinules on ventral intersegmental regions of abdominal segments second and third; 25, anal spinules.
two spiracular openings and two pairs of bifurcating spiracular hair (Figs. 10–12). Spiracular trunk long (0.05 mm) and thin (0.005 mm). Distance between spiracles 0.025 mm. Numerous spinules at segment borders and around anal opening (Figs. 13–15).

Second-instar larva (Figs. 16–25) 2.03–2.80 mm long, 0.38–0.48 mm at widest diameter. Body milky white, long, slender, oval in cross-section, posterior end slightly rounded (Fig. 16). Facial mask with a pair of antennae, maxillary and frontal palpi (Fig. 17). Basal segment of antenna ring-like, creamy, much larger in diameter than apical segment. Apical segment light amber in colour, dome-shaped, elongated, cylinder-like at base. Maxillary palpi with numerous sensilla.

Figures 26–37

*Incertella zuercheri*, third-stage larva: 26, lateral view; 27, facial mask; 28, cephaloskeleton; 29, mouthhook ventro-lateral view; 30, anterior spiracle; 31, anterior spiracle, lower part of spiracular trunk, lateral view; 32, posterior spiracle, dorsal view; 33, posterior spiracle, lateral view; 34, posterior segment, ventral view; 35, spinules on ventral intersegmental regions of abdominal segments second and third; 36, spinules on ventral intersegmental regions of abdominal segments seventh and eighth; 37, anal spinules.
Morphology of Incertella zuercheri

Frontal palpi with two sensilla. Anterior and prefrontal papillae present. Oral ridges on both sides of mouth opening and over mouthhooks. Cephaloskeleton partly sclerotised, 0.31–0.36 mm long, including 0.058–0.068 mm long mouthhooks (Fig. 18). Three oral teeth behind apical tooth (Fig. 19). Basal tooth in middle of mouthhook, massive, continuous with long and narrow base of mouthhook. Dental sclerite behind basal tooth on ventral side of mouthhook. Intermediate sclerite elongated, triangular, connected with basal sclerite. Basal sclerite divided distally into ventral and dorsal cornua. Ventral cornu longer than dorsal cornu. Dorsal cornu wide, tapering posteriorly, pointed anteriorly. Rod-shaped parastomal bar projecting anteriorly from basal sclerite on dorsal side of intermediate sclerite. Hypopharynx with prominent longitudinal ventral cibarial ridges extending into lumen of cibarial pump. Anterior spiracle with 4–7 lobes (number variable in same larva) (Fig. 20). Posterior spiracle with three oval spiracular openings (Fig. 21). Spiracular plate oval. Spiracular hair bifurcating (Fig. 21). Spiracular trunk long (0.05 mm), narrow (0.005 mm). Distance between posterior spiracles 0.05 mm (Fig. 22). Small spinules at ventral segment borders and around anal opening (Figs. 23, 24, 25).

Third-instar larva (Figs. 26–37) 3.20–5.12 mm long, 0.56–0.88 mm at widest diameter. Body milky white, long, slender, oval in cross-section, with slightly rounded posterior end (Fig. 26). Facial mask with pair of two-segment antennae, maxillary and frontal palpi (Fig. 27). Basal segment of antenna ring-like, creamy, much larger in diameter than apical segment. Apical segment light amber in colour, elongated, dome-shaped. Maxillary palpi with numerous sensilla. Frontal palpi over mouthhooks, each with two large sensilla. Anterior and prefrontal papillae present. Oral ridges on both sides of mouth opening and over mouthhooks. Cephaloskeleton partly sclerotised, 0.51–0.60 mm long, including 0.10–0.11 mm long mouthhooks (Fig. 28). Very small oral teeth behind apical tooth along lateral sides of mouthhook. Oral teeth occupy anterior part of mouthhook, not reaching basal tooth (Fig. 29). Basal tooth in middle of mouthhook, massive, continuous with broad base of mouthhook. Dental sclerite on ventral side of mouthhook, behind basal tooth. Intermediate sclerite elongated, triangular, connected with basal sclerite. Basal sclerite divided into dorsal and ventral cornua. Ventral cornu longer and wider than dorsal cornu. Dorsal cornu tapering posteriorly, pointed anteriorly. Rod-shaped parastomal bar projecting anteriorly from basal sclerite on dorsal side of intermediate sclerite. Hypopharynx with prominent longitudinal ventral cibarial ridges extending into lumen of cibarial pump. Anterior spiracle with 4–7 lobes, the number variable in same larva (Fig. 30). Spiracular trunk basally narrowed and bending spoon-like at base (Fig. 31). Posterior spiracle with three oval spiracular openings (Fig. 32). Spiracular plate oval. Spiracular hair bifurcating (Fig. 32, 33). Spiracular trunk 0.10 mm long and 0.015 mm wide. Distance between spiracles 0.125 mm (Fig. 34). Small spinules at segment borders ventrally (Figs. 35, 36). No spinules around anal opening (Fig. 37). Ring of small spinules present at anterior border of first thoracic segment, covering one-third of its width.

Puparium (Figs. 38–39) 2.22–3.00 mm long, 0.60–0.78 mm at widest diameter, elongated, flattened ventrally, convex dorsally, straw-coloured to light brown. Posterior part tapering considerably, slightly rounded anteriorly (Fig. 38). Pair of anterior spiracles with 4–7 lobes at anterior border of puparium. Spiracles project above cuticular surface. Lobes of anterior spiracles positioned in one plane, parallel to dorso-ventral plane of puparium. Posterior spiracles on stigmatophores, forming obtuse angle. Folds of cuticle found throughout surface of puparium, more numerously ventrally (Figs. 38, 39).

Discussion

I. zuercheri is one of the 27 species of Chloropidae whose larvae have been found on stems of Lipara species (Nartshuk 1996). Larvae and pupae of this...

The genus Incertella is very poorly known. Of the ten species described, I. zuercheri is the only one with a known host plant (Nartshuk 1996). Neither has it been ascertained whether I. zuercheri and I. scotica are two different species or synonyms. I. scotica was described by Collin (1946) on the basis of two females, with leg colouring as the main character distinguishing I. scotica from I. zuercheri. Leg colouring was later analysed in 46 museum specimens of I. zuercheri by Nartshuk (1962), who showed considerable variability of this character. The low number of individuals investigated by Collin (1946) and the high variability in the character Collin had considered significant led to the establishment by Nartshuk (1962) of I. scotica as a synonym of I. zuercheri. Nartshuk's decision was also supported by the finding of both species in the same habitat types at the same time. In 1984, Nartshuk re-ejected them as separate species. The reasons for the latter decision are not known. In this situation, it is clearly necessary to examine the morphology of the genitalia of adults with differently coloured legs, which will most probably suffice to confirm or disprove possible differences between the two species.

This study of the morphology of the preimaginal stages of I. zuercheri from galls of Lipara flies found in apical parts of common reed stems has revealed the presence of only one Incertella species. If the I. scotica described by Collin is a genuine species, which is yet to be established, it most probably does not develop in stems of common reed. The morphology of the preimaginal stages of I. zuercheri presented in this paper will allow identification of this species at early developmental stages, leading to an understanding of its life cycle and relationships with other insects found inside galls on common reed stems.

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References


