

## **Some observation on the biology and predaceous behaviour of *Schoenomyza litorella* (FALLÉN, 1823) (Muscidae, Coenosiinae)**

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### Introduction

On 29 November 2004, in a field at Kochendorf (Baden-Württemberg), we were able to observe *Schoenomyza litorella* (FALLÉN, 1823), a small muscid fly only 3 mm in length, catching and feeding on a black fungus gnat (Sciaridae). The behaviour of this species, which can be easily recognised in the male sex by the shining golden-yellow face, was all the more remarkable because the weather at that time of the year would seem to preclude such activity by the flies. It was a damp, overcast and cold November day, with an average temperature of 5.5 °C and 90 % relative humidity.

The fly together with the prey was collected by means of an exhaustor so that it could be identified. Microscopic examination of the proboscis showed that it is adapted for a predaceous way of life. The oral disc and prestomal teeth were compared with species of the genus *Coenosia* MEIGEN, 1826. Net and trap collections made between 1972 and 2004 provided information on the seasonal occurrence of this predaceous species which has in general been rather overlooked in the past.

### Published data on *S. litorella*

*S. litorella* is the only Palaearctic species of the genus *Schoenomyza* HALIDAY, 1833 and belongs to the subfamily Coenosiinae and tribe Coenosiini of the family Muscidae (COURI & PONT 1999).

HENNIG (1961) suggested that the species migrated from America and that it was a relatively recent element of the Palaearctic fauna. Little has been published on its biology. CZERNY (1903) was the first to record that adults of this species can also be found in winter. He also called the flies that he collected during a field trip between 6 and 8 January 1903 the „epiphany flies“ (CZERNY 1903). The species is reported to be polyvoltine in England, flying only from April to October (D'ASSIS FONSECA 1968). Its habitat is strictly hygrophilous, in the vicinity of water-bodies and in marshy sites (HENNIG 1964, SKIDMORE 1985).

It has been suspected though not proved that this is a predaceous species (SKIDMORE 1985), although COURI & PONT (1999) have stated that adults of the entire subfamily Coenosiinae are predaceous because of the presence of strong prestomal teeth.

### Material and methods

#### Dissection of the proboscis

Dissection and examination of the proboscis followed a step-wise procedure. First of all, the dried proboscis from the male was placed in a damp chamber. It was then separated from the head capsule and placed in glycerol on a microscope slide. In order to show the relative sizes of the individual parts correctly in an illustration, a series of digital photographs was taken under a Zeiss stereomicroscope (SV 11) at a magnification of 165 times. Finally, the inner surface of the labella was removed and photographed under a light microscope at 400 times magnification (Fig. 2).

## Results and discussion

### Biology and occurrence, and structure of the proboscis

Our observation of prey capture by *S. litorella* in late autumn (29 November 2004) and the prevailing cool weather conditions (5.5 °C, 90 % relative air humidity) point to a relatively little-known aspect of insect behaviour. The habitat too was not one of those generally recorded in the literature. The locality was the margin of a four hectare cultivated field that was sown with a winter catch crop consisting of a mixture of oats and vetch. It was at least 1 km distant from the nearest water-body or from a wet area. It is conceivable, however, that this polyvoltine and hygrophilous species withdraws to moist areas as the temperature increases and conditions become drier, and then expands the radius of its activity when the seasonal conditions again become cool and damp.

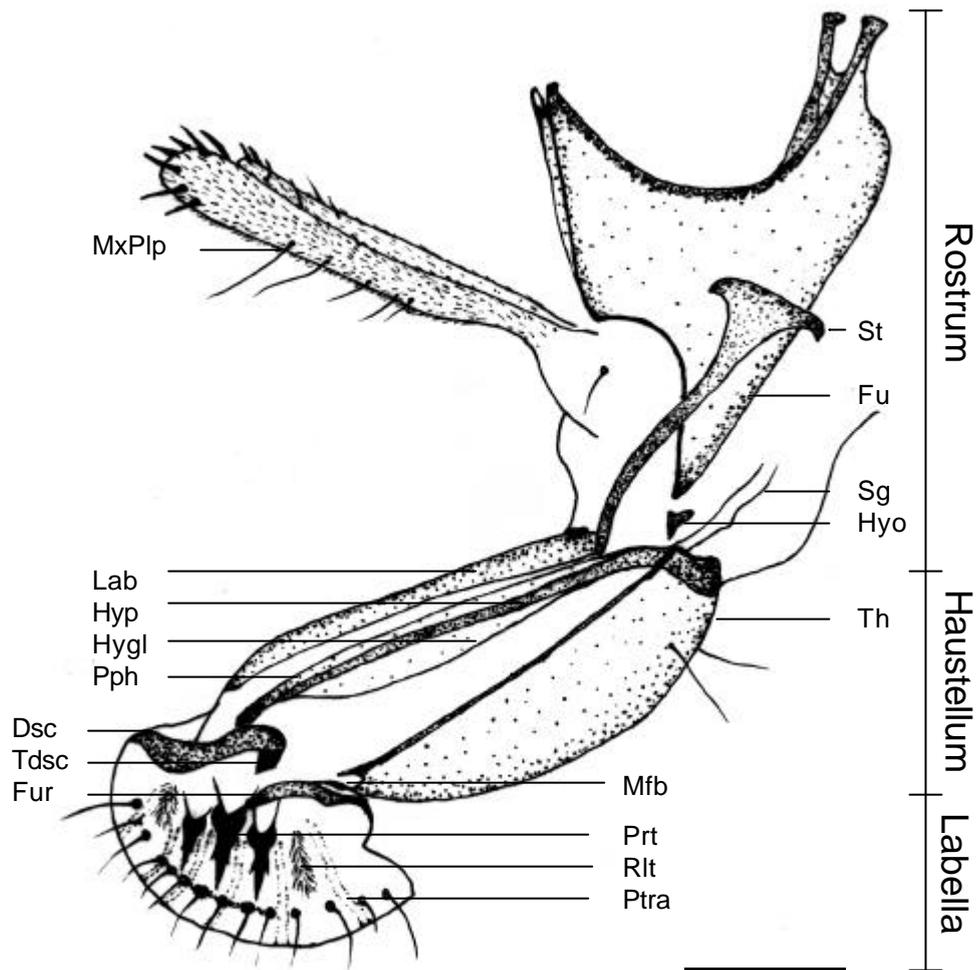
This suggestion receives some confirmation from 116 records of *S. litorella* which were obtained between 1972 and 2004 from the xerothermous grasslands of the middle Saale valley near Jena (Thuringia). Out of 344 individuals, 39% were trapped between October and January, which indicates that the species is active in these dry grasslands especially in autumn but also in winter, so long as winter conditions do not completely curtail the mobility of the flies.

*S. litorella* could be recorded from January to December using sweepnets, pitfall traps, ground eclectors, yellow-tray traps and light traps. Although the maximum seasonal abundance is in the months from spring to autumn, the species is also active during the winter depending on the nature of the biotope.

As observations in the field have demonstrated, *S. litorella* resembles other predaceous Coenosiini (genus *Coenosia*) in being a “highwayman” that lies in wait for its prey (KÜHNE 2000). The prey is caught whilst on the wing, seized by the predator in the air with its legs and then usually taken back to the spot where the predator had been waiting. The prey is then overpowered and sucked dry.

### The morphology of the proboscis

The mouthparts of *S. litorella* are of particular importance for overpowering and killing the prey. Their basic structure (Fig. 1) is the same as in *Coenosia tigrina* (FABRICIUS, 1775), which was described in detail by KÜHNE (1992). The special adaptations for predation can be seen on the internal surface of the labella (Fig. 2). The curved U-shaped discal sclerite forms the secondary mouth-opening and supports the oral disc from the inside. The two distal ends of the lateral wings are anchored to the outer chitinous covering of the haustellum. At the opposite end, at the point where the two sides of the discal sclerite unite, there is a single, ventrally-directed, dagger-like tooth that is placed exactly in the middle of the oral disc. Each of the two rods of the paraphysis grips the middle of each lateral wing of the discal sclerite and forms a pivot. When the paraphysis is pressed downwards, the median tooth is also forced down and is able to stab a hole in the chitinous covering of the prey through which a paralysing salivary fluid is presumably immediately injected. However, this tooth is only weakly developed when compared with other predaceous flies of the *tigrina*-group of the genus *Coenosia* MEIGEN, 1826: *C. atra* MEIGEN, 1830, *C. attenuata* STEIN in BECKER, 1903, *C. humilis* MEIGEN, 1826, *C. strigipes* STEIN, 1916, *C. tigrina* (FABRICIUS, 1775), *C. testacea* (ROBINEAU-DESVOIDY, 1830) (KÜHNE 2000).

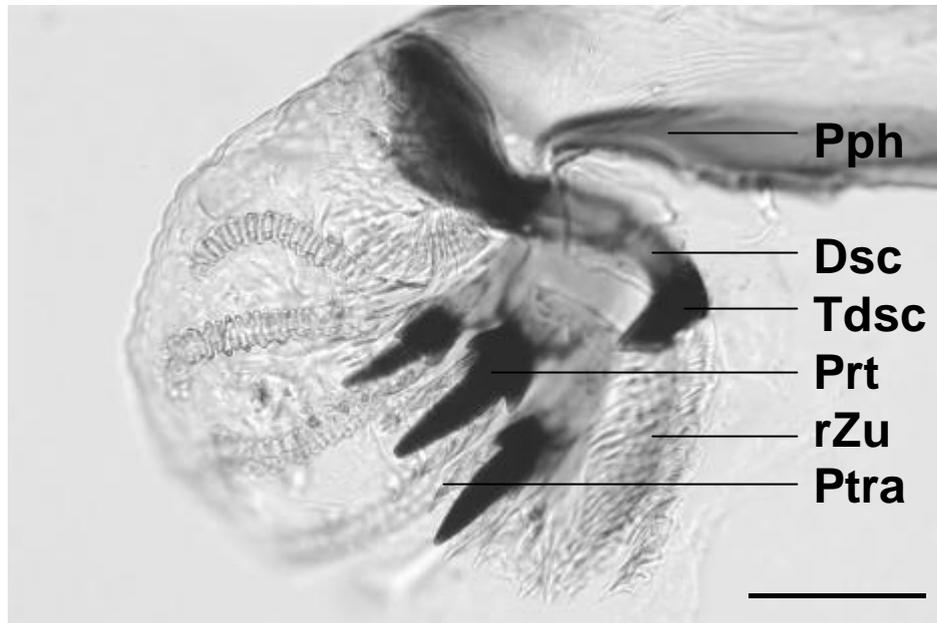


Rostrum		Haustellum		Labella	
<i>Fu</i>	Fulcrum	<i>Th</i>	Theca	<i>Mfb</i>	Mento furca bars
<i>St</i>	Stipes	<i>Lab</i>	Labrum	<i>Fur</i>	Furca
<i>MxPlp</i>	Maxillary palpus	<i>Hyp</i>	Hypopharynx	<i>Tdsc</i>	Tooth on the discal sclerite
<i>Sg</i>	Salivary gland	<i>Hygl</i>	Hypoglossa	<i>Prt</i>	Prestomal teeth
<i>Hyo</i>	Hyoid	<i>Pph</i>	Paraphysis	<i>Rlt</i>	Rasp-like tongue
				<i>Ptra</i>	Pseudotracheae

**Fig. 1:** The proboscis of *Schoenomyza litorella* (FALLÉN, 1823), male, scale-line = 0.1 mm (drawing: Kühne)

On the inner surface of each oral lobe there are three claw-like prestomal teeth. Each tooth has at its base a pair of lateral points. The middle prestomal tooth is the largest, and is flanked on each side by a smaller tooth. The prestomal teeth in *Coenosia* species of the *tigrina*-group (KÜHNE 2000) do not have any lateral points, and this is the most conspicuous difference in the structure of the oral disc between *Schoenomyza* and *Coenosia*. The prestomal teeth can be splayed out sideways, thereby tearing open the chitinous wall of the prey still further so that

the entire proboscis can be inserted. As in the *tigrina*-group, the striking, rasp-like tongues are also present on the inner surface of each oral lobe, close to the prestomal teeth. They consist of numerous tiny bristles which are able to crush and prepare the body contents of the prey still further. The pseudotracheae, which only reach as far as the bases of the prestomal teeth, distribute saliva and ingest the food.



**Fig. 2:** Inner surface of the labella of *Schoenomyza litorella* (FALLÉN, 1823), male. **Pph** paraphysis, **Dsc** discal sclerite, **Tdsc** tooth of the discal sclerite, **Prt** prestomal tooth, **Rlt** rasp-like tongue, **Ptr** pseudotracheae, scale-line = 0.05 mm (Photo: Kühne)

### Summary

Both field observations of prey capture and functional-morphological examination of the proboscis have confirmed the predaceous way of life of *Schoenomyza litorella* (FALLÉN, 1823). The mouthparts are of particular significance for overpowering and killing the prey, which is reflected in the structure of the inner surface of the labella. In addition to three claw-like prestomal teeth, there is a ventrally-directed dagger-like tooth exactly at the middle of the oral disc, which is formed as a projection from the discal sclerite. The structure and function of the various mouthparts is described and compared with species of the genus *Coenosia* MEIGEN, 1826. Long-term observations in Thuringia between 1972 and 2004 have shown that *S. litorella* occurs in xerothermic grasslands particularly during the damp, cool and stormy months from September to December. Although the maximum seasonal abundance is in the months from spring to autumn, the species is also active during the winter depending on the nature of the biotope.

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