Notes on the biology of *Pterophorus volgensis* (Möschler, 1862) with description of the larval stage (Lepidoptera, Pterophoridae)

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A population of *Pterophorus volgensis* (Möschler, 1862) was found at the end of May 1998 at Mount Verbljushka in the Orenburg oblast in the southern Ural Mountains. In the next spring, 22 larvae of this rare taxon were found on *Rindera tetraspis* (Pallas) in the same locality, and 11 moths were bred. The biology and the distribution of the species are discussed. The larva of *P. volgensis* is described on the basis of material preserved in ethanol. Some drawings of mouthparts and chaetotaxy are given.

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1. Introduction

Pterophorus volgensis (Möschler, 1862) (Fig. 1) is one of the rarities in the European pterophorid fauna. The species is only known from a few localities in the southeastern part of European Russia, and the majority of existing specimens were collected in the 19th century. The biology of the taxon has never been studied. Early stages and host plant were unknown until now. Even the flight period of the species has been more or less doubtful (e.g. Arenberger 1995), because the old material was labelled incompletely; according to Zagulayev (1986) the adult occurs from May to July.

2. Material

In the beginning of June 1998, a few moths of *P. volgensis* were collected from the Orenburg oblast in the southern Ural mountains. In the middle of May 1999, 22 full-grown pterophorid larvae were found in the same locality. 11 adults of *P. volgensis* were bred confirming the determination of the larvae. In addition, 8 specimens of Braconidae emerged from parasitized caterpillars, 1 larva was preserved in ethanol and 2 larvae died for unknown reasons.

P. volgensis: 18 exx. Russia, southern Urals, Orenburg oblast, 51°23´ N, 56°49´ E, 160 m a.s.l., Donskoje village 6 km W, Mount Verbljushka, 30.V.–02.VI.1998, leg. J. Junnilainen, K. Nupponen & T. Nupponen; 2 genitalia preparations preserved in glycerol. 22 larvae, same locality, 12.–14.V.1999, emerged 1 ♂, 10 ♀♀ 28.V.–01.VI.1999, leg. K. Nupponen; 1 full-grown larva preserved in ethanol.

3. Description of larva

The larva preserved in ethanol was studied. The head of the larva was cut off and both body and head were prepared and mounted in euparal on one slide labelled "M. Ahola, larval prep. 1/ 15.XII.1999". The map of the chaetotaxy of the larva was drawn before preparation and some

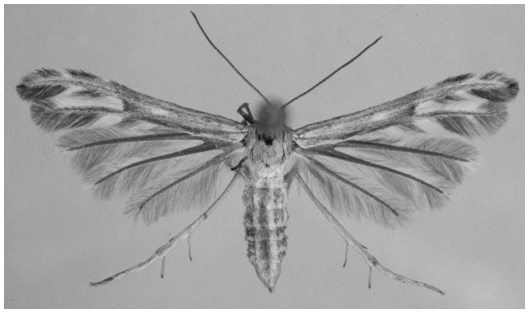

Fig. 1. Imago of *Pterophorus volgensis* (Möschler, 1862), reared on *Rindera tetraspis* in May 1999.

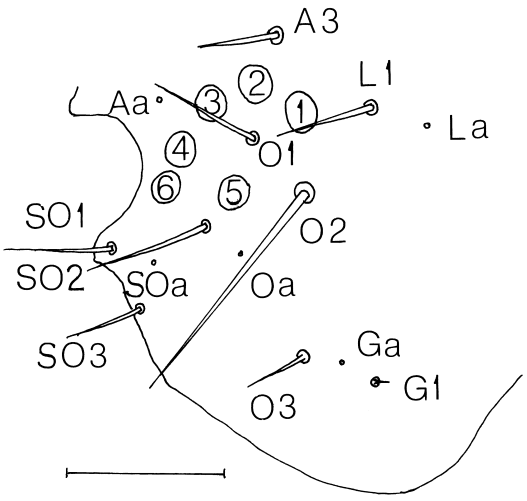

Fig. 3. *P. volgensis*: map of larval chaetotaxy, ocellar area of head. Scale 0.1 mm.

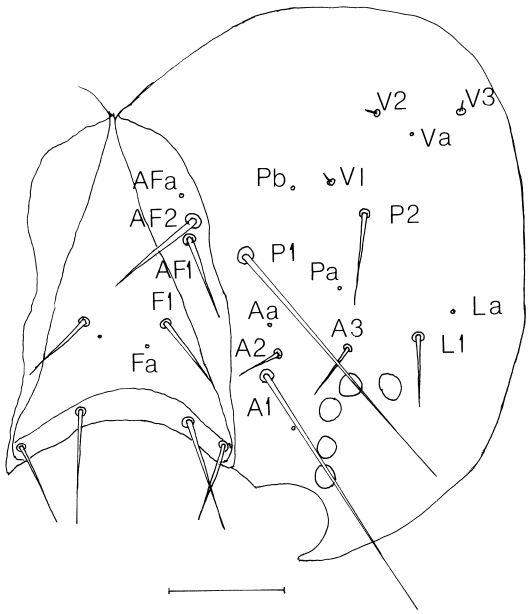

Fig. 2. *P. volgensis*: map of larval chaetotaxy, head in frontal view. Symbols of setae and pores according to Hinton (1946). Scale 0.1 mm.

colour photographs were also taken. Other drawings were made from the slide. Hinton's (1946) nomenclature of setae is used for the chaetotaxy.

Chaetotaxy of head and body (Figs. 2–4) shows the following significant characters: P1 and A1 longest setae on head, P1 situated cephalad from both AF setae, P2 laterad from P1 on level of AF2.

A2 and A3 short, A2 located close to A1. AF1 and AF2 on adfrons situated close together. A1, A3 and L1 forming row, distance between A3 and A1 about the same as A3–L1. All segments of body covered by secondary setae, all of them arising from low warts. Setae long, spined and projecting in every direction from warts. Prothoracic and anal plates sclerotized, bearing secondary setae. On prothorax, D1 and D2 on prothoracic plate longer than others and therefore stand out, multisetose XD and SD groups arise from this plate. Setae of L-group of prothorax arise from wart on level of spiracles, SD-group above thoracic leg. Single V1-seta on coxa, microsetae MV2 and MV3 cephalad from thoracic leg, MXD1 on dorsal region caudad from prothoracic plate. On meso- and metathorax 4 warts (D-, SD-, L- and SV-warts) and usual microsetae. Abdominal segments I–VIII bearing same warts as follows: D-, SD-, L1–2 together and L3 separate. SD-group includes SD2 usually being minute setae. Single SV-seta occurs on abdominal segments I–VI and again on IX, but group bisetose on VII–VIII. V-group bisetose on abdominal segments I–II but unisetose on III–X; On segment IX D-, SD- and single L-warts. Microsetae MD1 and MV1 occur on abdominal segments I–IX as usual.

Other characters: Head semiprognathous but rounded in lateral view. Epicranial suture on vertex absent, frontal and adfrontal sutures reaching vertical notch, frons triangular, frontoclypeal suture between frons and clypeus weak, adfrons rather broad (Fig. 2). Six rather large stemmata, 4th and 6th ocelli close together, 5th ocellus cau-

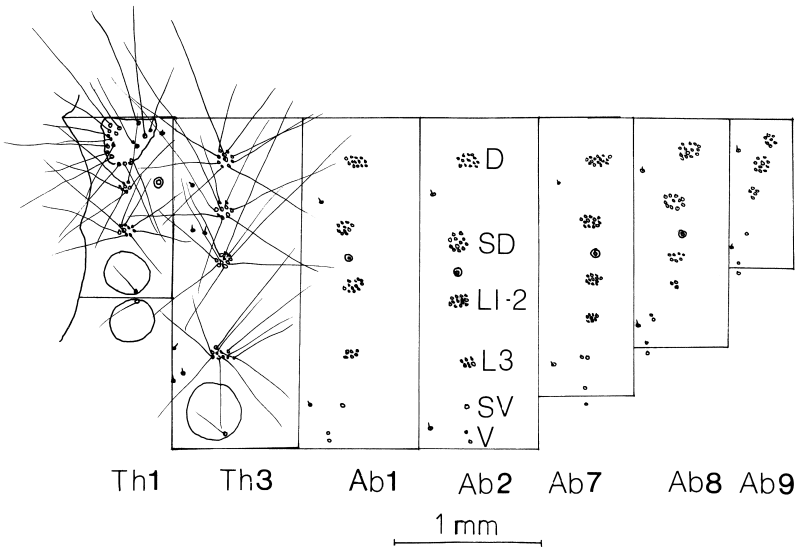

Fig. 4. *P. volgensis*: map of larval chaetotaxy, segments of body. Th1–3 = thoracic segments, Ab1–9 = abdominal segments I–IX. Scale 1 mm.

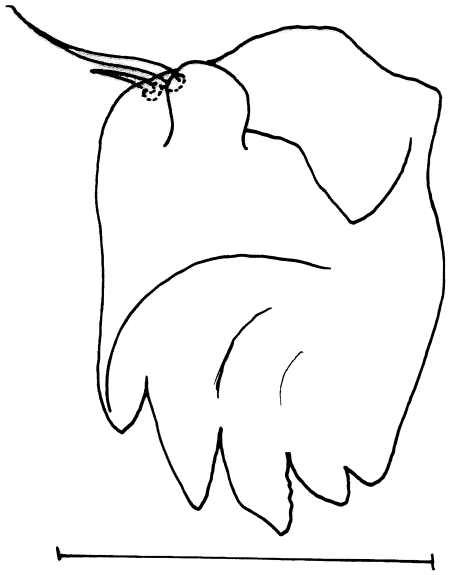

Fig. 5. *P. volgensis*: inner surface of left mandible. Scale 0.1 mm.

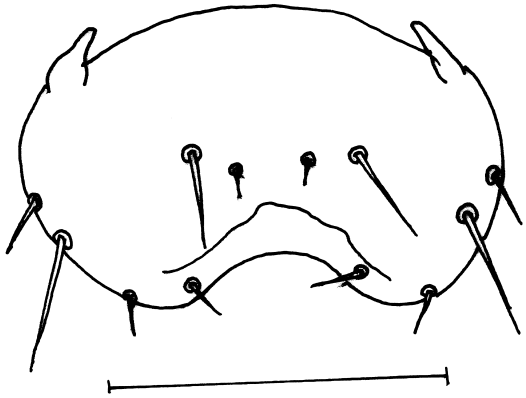

Fig. 6. *P. volgensis*: labrum in frontal view. Scale 0.1 mm.

dad from these. Distance between setae O1 and Oc1 equals that of O1–Oc2 and O1–Oc3. O2 longest seta of O-group (Fig. 3). Hypopharyngeal complex bears tubular, rather short and stout spinneret not extending beyond labial palps, Lp2 shorter than Lps1 in labial palps and densely spined proximal region of hypopharynx. Mandibles with only 5 teeth on cutting margin and two weak ridges on inner surface (Fig. 5). Labral notch large and low, lateral setae separated (Fig. 6), epipharynx with three stout setae on longitudinal row on both sides. Body cylindrical. Abdominal prolegs well developed on segments III–VI and X, long and slender with 5–7 crochets uniordinal and in short mesopenellipses.

Colour: Live larva yellowish green, slightly suffused with pale grey; warts brownish green; head dark brown. Specimen in ethanol (Fig. 7) has lost this colour, but head dark brown and both prothoracic and anal plates brownish. Larval skin granulated except around low warts of body. Thoracic legs brownish, abdominal prolegs with brownish cuff and brown crochets.

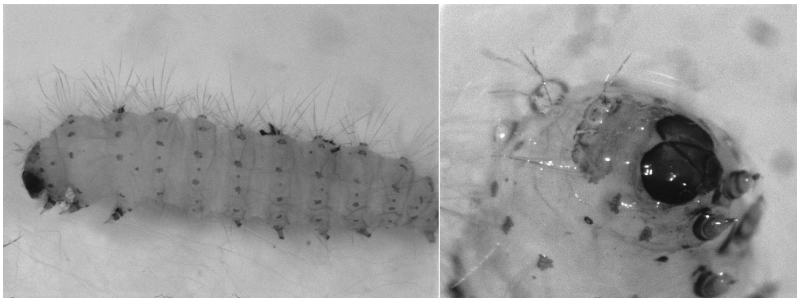

Fig. 7. Larva of *P. volgensis*. — Left: lateral view. — Right: head.

Fig. 8. The habitat of *P. volgensis* in Mount Verbljushka.

Fig. 9. Larval mines of *P. volgensis* on *Rindera tetraspis*.

4. Biology

The habitat of *P. volgensis* is a steep, hot, calcareous southern slope of Mount Verbljushka, a 200 m high hill in the Ural River bank with very rich flora (Fig. 8). The host plant of *volgensis* is *Rindera tetraspis* (Pallas) (Boraginaceae), which was one of the dominant plants in the lower part of the slope. The larvae feed in daylight, freely on both the upperside and underside of the leaves producing moderately small, distinct, roundish mines (Fig. 9). The larva occur early in the spring and pupate as early as the first half of May. Despite a late and cold spring, the majority of larvae had already left the feeding place for pupation by 12.–14.V. and all of the 22 recorded larvae were full-grown. Probably the small or half-grown larva hibernates, but this has not been confirmed. Pupation takes place on the ground near the host plant and the pupal stage lasts 9–12 days. The moths emerged at the end of May within a few days of each other.

Adults occur at the end of May and beginning of June. The moths are active at sunset and come to artificial light just after dark. They sit willingly on the hostplant and are rather easy to collect by netting. After the experience of the year 1998, we concluded that *P. volgensis* has a relatively short flight period, because one week after the best occurrence the moths were already absent in the same locality.

P. volgensis larvae seem to become attacked rather often by parasites, as not less than 35% of larvae found were infected. The high portion of

parasitized larvae is possibly due to the late collecting date, because the development of such larvae usually takes more time and they remain on the leaves while healthy larvae have already pupated. The parasite was *Illidops* sp. (Braconidae, Microgastrinae) (Fig. 10), probably an undescribed taxon belonging to the critical *Apanteles butalidis* species group and being a close relative to *I. naso* (Marshall, 1885) (Veli Vikberg, pers. comm.). The parasites (1 ♂, 7 ♀♀) emerged a few days later than the moths: 1 ex. 01.VI.1999, 3 exx. 02.VI.1999, 4 exx. 03.VI.1999. More detailed data of the braconid taxon will be published later (V. Vikberg in prep.). Members of the genus *Illidops* Mason, 1981 have not been recorded previously as parasites on Pterophoridae, though they are known to use several other families of Lepidoptera.

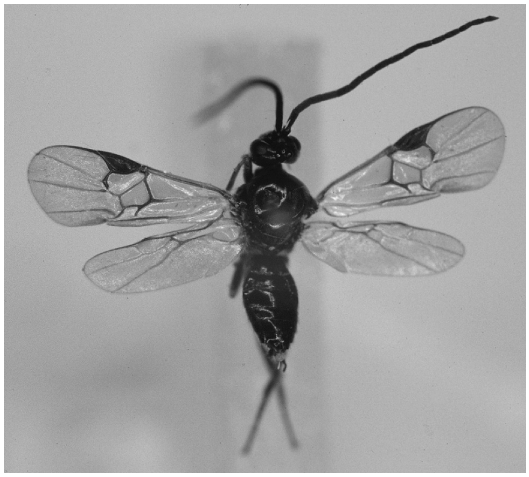

Fig. 10. *Illidops* sp. (Braconidae, Microgastrinae), a parasite of *P. volgensis*.

5. Discussion

Rindera tetraspis is distributed in the steppe and semidesert regions of Moldavia, Crimea, southern Ukraine, Caucasus, and from southern Ural to the Aral Sea. In the east, the plant is known in western Siberia up to the Altai and Sajan Mountains. *P. volgensis* is known only from the southeastern part of European Russia: Sarepta (the type locality), Orenburg, Uralsk, northern Caucasus. Thus, the host plant has a much more widely known distribution range than the moth; both taxa preferring hot, calcareous slopes. *P. volgensis* is a very local species and easy to be overlooked despite its characteristic habitus. These facts might indicate that *volgensis* occurs in some areas where it has not yet been recorded, for example in the regions north of the Black Sea. The taxon is not mentioned in the new book of European Pterophoridae (Gielis 1996), neither are many other eastern European pterophorid species.

No other species of Pterophoridae is known to feed on plants belonging to the family Boraginaceae. However, early stages of the Palaearctic species belonging to the genus *Pterophorus* are poorly known. Of the 11 species of this genus recorded in the Palaearctic region, only three are known in the larval stage (Arenberger 1995). Two of them are western European taxa (*P. ischnodactylus* (Treitschke, 1835) and *P. pentadactylus* (Linnaeus,1758)) and one is widely distributed in tropical and subtropical regions (*P. albidus* (Zeller, 1852)). All of them feed on Convolvulaceae.

The larva of *P. volgensis* differs from that of *P. albidus* presented by Yano (1963) as follows: Adfrontal area of head is large, adfrons not straight, adfrontal setae AF1 and AF2 are close together, pore AFa situated posterior from AF2. Position of seta L1 is close to A3, therefore distance L1–A3 is about same as A1–A3. Fourth and sixth ocelli are situated close together. Warts D1 and D2 are joined together on abdominal segments 1–9. SV-group is unisetose on abdominal segments I–II and IX and bisetose on segments VII–VIII.

On the basis of external appearance, a long, strongly curved aedeagus in the male genitalia, chaetotaxy of larva and the hostplant belonging to Boraginaceae we consider that *volgensis* forms a separate group among the genus *Pterophorus*, probably together with *P. taklamakanus* Arenberger, 1995, a species recently described from Tibet. The two taxa clearly differ from all other known species in this genus both by habitus and by the shape of aedeagus (*see* Arenberger 1995). Both of them have brownish grey forewings with a slight bluish tone and indistinct whitish markings, as well as a long and strongly curved aedeagus. In the other species of *Pterophorus* the forewings are paler — whitish or yellowish —

with small, distinct, more or less numerous black spots, and aedeagus is moderately short, straight or slightly tapered. According to Arenberger (1995), the ground colour of *P. volgensis* is brownish grey; probably the bluish tone appearing in fresh moths has disappeared from the old specimens.

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