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Description of the mature larvae of eight *Phyllobius* Germar, 1824 species with notes about life cycles, host plant use and vertical distribution (Curculionidae: Entiminae: Phyllobiini)

by

Rafał Gosik[1] & Peter Sprick[2]

with **67** photos and **88** drawings

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[1]Department of Zoology and Nature Protection, Maria Curie-Skłodowska University, Akademicka 19, 20-033 Lublin, Poland, cossonus@gmail.com
[2]Curculio-Institut e.V., Weckenstraße 15, 30451 Hannover, Germany, psprickcol@t–online.de
Both authors are members of the Curculio Institute.

Abstract. The mature larvae of eight *Phyllobius* species are described using advanced optical methods. The larvae of *P. pomaceus* Gyllenhal, 1834, *P. pyri* (Linnaeus, 1758), *P. virideaeris* (Laicharting, 1781), and *P viridicollis* (Fabricius, 1792) are re-described, and the mature larvae of *P. arborator* (Herbst, 1797), *P. argentatus* (Linnaeus, 1758), *P. maculicornis* Germar, 1824, and *P. roboretanus* Gredler, 1882 are described for the first time. In *P. viridearis* only an unillustrated description was available. A key including other species of the genus *Phyllobius* with sufficient description is given. We used our data and from the literature as well to review and update two special features of *Phyllobius* biology: the general life cycle and aspects of host plant use and vertical distribution of selected *Phyllobius* species.

Keywords. *Phyllobius*, Central Europe, weevil biology, illustration, key, bionomics, larvae biology.

Introduction

In this contribution about premature stages of Central European Entiminae we deal for the first time with larvae of the genus *Phyllobius* Germar, 1824 from the tribe Phyllobiini. This tribe contains around 28 genera, and it is distributed over great parts of the northern hemisphere (Alonso-Zarazaga et al. 2017), but the isolated distribution of some genera creates the impression of a provisional assignment of some genera in this tribe. In Central Europe there is only *Phyllobius*, *Pseudomyllocerus* Desbrochers, 1872 and *Argoptochus* Weise, 1883 with several well-characterized subgenera and *Oedecnemidius* K. Daniel, 1903 in the southern periphery. In addition, *Parascythopus* Desbrochers, 1875 was introduced to Western, Central, and Northern Europe (Heijerman et al. 2000, Bahr et al. 2012, Ødegaard & Berggren 2012).

The genus *Phyllobius* comprises small and medium-sized species (4.0 – 10.0 mm), usually densely covered with green-metallic scales and whitish or black hairs, in some species with dark scales. In a few cases hairs and scales are very distantly placed, so that the dark colour of the derm determines the appearance. As in other Entiminae, larvae inhabit the soil and feed from the roots of their host plants. Several species are very frequent and occasionally become noxious so that there is basic or even more information about the biology of these species. There are two studies that include larval descriptions: from Kerr (1949) on *Phyllobius intrusus* Kôno, 1948 and from Vollmann (1954) on *Phyllobius oblongus* (L., 1758). Larval descriptions were also provided by Roberts (1926) on *Phyllobius pomaceus* Gyllenhal, 1834 and *P. pyri* (Linnaeus, 1758), and of Lekander (1973) on *Phyllobius pyri* and *P. viridicollis* (Fabricius, 1792). In the work of van Emden (1952) there are descriptions of several species, but it is low illustrated, and in Scherf (1964) there is mainly summarizing information from the earlier work.

So we describe in this paper 8 species from 6 subgenera, the mature larva of *Phyllobius arborator*, *P. argentatus*, *P. maculicornis* and *P. roboretanus* for the first time. – And we re-describe the mature larvae of *Phyllobius pomaceus, P.*

pyri and *P. viridicollis*, using better optical methods with special reference to chaetotaxy and an updated denotation of setae, sensilla and microstructure. The larva of *P. virideaeris* is re-described, as the first description of van Emden (1952) does not contain any illustration.

Materials and methods

All specimens studied were fixed in 75% ethanol and examined under an optical stereomicroscope (Olympus SZ60 and SZ11) with calibrated oculars. Measurements of larval instars were taken for: body length (BL), body width (BW) (usually at abdominal segment I or II), and width of the head capsule (HW).

To prepare the slides, we followed May (1994): a larva was decapitated, and the head was cleared in a 10% potassium hydroxide solution (KOH) and then rinsed in distilled water. After clearing, the mouthparts were separated from the head capsule, and the head capsule and all mouthparts were mounted on permanent microscope slides in Euparal. All other body parts were mounted on temporary microscope slides in 10% glycerine.

The observations and measurements were conducted using a light compound microscope with calibrated oculars. Drawings and outlines were made using a drawing tube (MNR–1) installed on a stereomicroscope (Ampliwal) and processed by computer software (Corel Photo–Paint X7, Corel Draw X7). General terminology and chaetotaxy follow Anderson (1947), May (1994) and Marvaldi (1997, 1998, 1999), and antennae terminology follows Zacharuk (1985).

Insect collection

All larvae are deposited in the collection of Department of Zoology and Nature Protection, Maria Curie–Skłodowska University (Lublin, Poland).

Results

The description of the species is illustrated by detail drawings arranged on 16 plates – for each of the eight species of head, mouthparts and antennae and of thorax and abdominal segments. For the abbreviations of setae, sensilla, antennae, thorax and chaetotaxy of the abdominal part see Figures 1–88. Sampling and habitats are documented by 67 photos on further 18 plates.

General description of the mature larva of the genus *Phyllobius* Germar, 1824

Considering the characters given by van Emden (1952) and some recorded by us the set of features typical for the genus *Phyllobius* can be given as follows:

Body elongate, slender, rounded in cross section. Head oval or slightly flattened laterally, endocarinal line absent. Frontal sutures mostly well developed, extended to antennae (weak only in *P. pyri*). Stemmata (st) usually absent, rarely one pair of small, pigmented spots. *Des*$_1$, *des*$_3$ and *des*$_5$ elongate, *des*$_2$ as long as *des*$_1$ or shorter, *des*$_4$ usually absent or minute. *Des*$_1$ and *des*$_2$ placed medially on epicranium, *des*$_3$ on frontal suture, *des*$_4$ below *des*$_3$, *des*$_5$ anterolaterally. Frons with 2 or 3 setae (both *fs*$_4$ and *fs*$_5$ as long as *des*$_1$), *fs*$_3$ usually absent or minute. Head also with 1-2 *les* (usually slightly shorter than *des*$_1$) and 0-2 minute *ves*. Epicranial area with 0-4 *pes* and 2–3 sensilla. Antennae located at the end of the frontal suture on each side, membranous and distinctly convex; basal article bearing one reniform, more or less asymmetric sensorium, from medium size up to long; basal membranous article with some sensilla basiconica and ampullacea. Clypeus trapezoidal, approximately 2.5–3.0 times as wide as long with 1-2 *cls*, and 1 sensillum (clss) between setae; all very close to margin of frons. Labrum with 3 capilliform *lrs*; anterior margin rounded or sinuate. Epipharynx with three finger-like *als*; with 2-3 *ams* (*ams*$_1$ very small, *ams*$_2$ robust, *ams*$_3$ thin, finger-like – sometimes absent) and 2 *mes*; labral rods (lr) small, rounded. Mandibles broad, slightly bifid, truncate, with 1-2 capilliform setae. Stipes of maxilla with 1 *stps*, 2 *pfs*, 1 *mbs* and 0-1 sensilla; mala with 7-8 finger-like *dms*, almost equal in length; 4 *vms*; all *vms* shorter than *dms*. Maxillary palpi with two palpomeres; basal palpomere with 1 short *mxps* and two sensilla; distal palpomere with 1 sensillum and a group of microcuticular apical processes. Praelabium cup-like, with 1 *plbs*; ligula with sinuate margin and 2 *ligs*; premental sclerite well visible, usually Q-shaped. Labial palpi elongate, with two palpomeres; each of palpomeres with 1 sensillum, distal palpomeres with cuticular apical processes. Postlabium with 3 *pslbs*, all located laterally. Prothorax slightly smaller than meso- and metathorax. Thoracic spiracle annular. Prothorax with 9–12 *prns*, 2 *ps* and 1 *eus*. Mesothorax with 1 *prs*, 4 *pds*, 1 *as*, 1 long and 3 minute *ss*, 1 *eps*, 1 *ps* and 1 *eus*. Chaetotaxy of metathorax almost identical to that of mesothorax. Each pedal area of thoracic segments well separated, with 5–6 *pda* of various length. Abdominal segments I–VI of almost equal length, next abdominal segments decreasing gradually to the terminal parts of the body. Abdominal segment X reduced to four anal lobes of unequal size, the dorsal lobe being distinctly the largest, the lateral equal in size, and the ventral lobe very small. Anus located terminally. Spiracles of abdominal segments I-VIII unicameral, all placed medially. Ab-

dominal segments I–VII with 1 *prs*, 5 *pds*, 1 long and 1 minute *ss*, 2 *eps*, 2 *ps*, 1 *lsts* and 2 *eus*. Abdominal segment VIII with 0-1 *prs*, 4-5 *pds*, 1 *ss*, 2 *eps*, 2 *ps*, 1 *lsts* and 2 *eus*. Abdominal segment IX with 3 *ds*, 1–2 *ps* and 2 *sts*. Abdominal segment X with mostly with 2 minute setae.

Description of the mature larvae of the species

***Phyllobius* (*Phyllobius*) *arborator* (Herbst, 1797)** [Plates 1-2], [Figures 1-11]
Specimens examined: 5

Germany, Sachsen-Anhalt, National Park Harz, Schierke, along the Von Eichendorff-Stieg, wayside and forest margin of a spruce forest, between the roots of *Rubus fruticosus* L. species aggregate, 780 m, leg. P. Sprick and A. Marten, 30.04.2015: 2 ex.; 15.05.2015: 3 ex. Two further larvae from 30.04.2015 were reared to adults until 22.05.2015. *Additional material:* Germany, Niedersachsen, National Park Harz, forest edge of a montane *Picea* A. Dietr. forest with species of *Rubus fruticosus* aggregate below Rehberger Grabenhaus, 650 m, leg. P. Sprick and Andreas Marten, 25.04.2018: 4 ex., 18.05.2018: 1 ex.

Plate 1. Andreas Marten supported the search for *Phyllobius arborator* larvae in the National Park Harz. Above the site at the von-Eichendorff-Path near the former ski slope Hohnekopf at around 740 m a.s.l. and below at the montane forest near Rehberger Grabenhaus at 625 m a.s.l. - In both cases larvae were found under *Rubus fruticosus* s.l.

Plate 2. Habitat of *Phyllobius arborator* in the Harz Mountains, valley of Wormke creek with typical mountain vegetation in the National Park Harz, e.g. stands of *Petasites albus* (L.) Gaertn. Due to its rather cold local climate the locality is called 'Eiskeller' (= 'ice cellar'). The weevil inhabits *Rubus idaeus* and species of the *Rubus fruticosus* aggregate at this site.

Measurements (in mm). Body length: 5.10–7.50. Body width (metathorax or abdominal segments I–II) up to 1.75. Head width: 1.00–1.30.

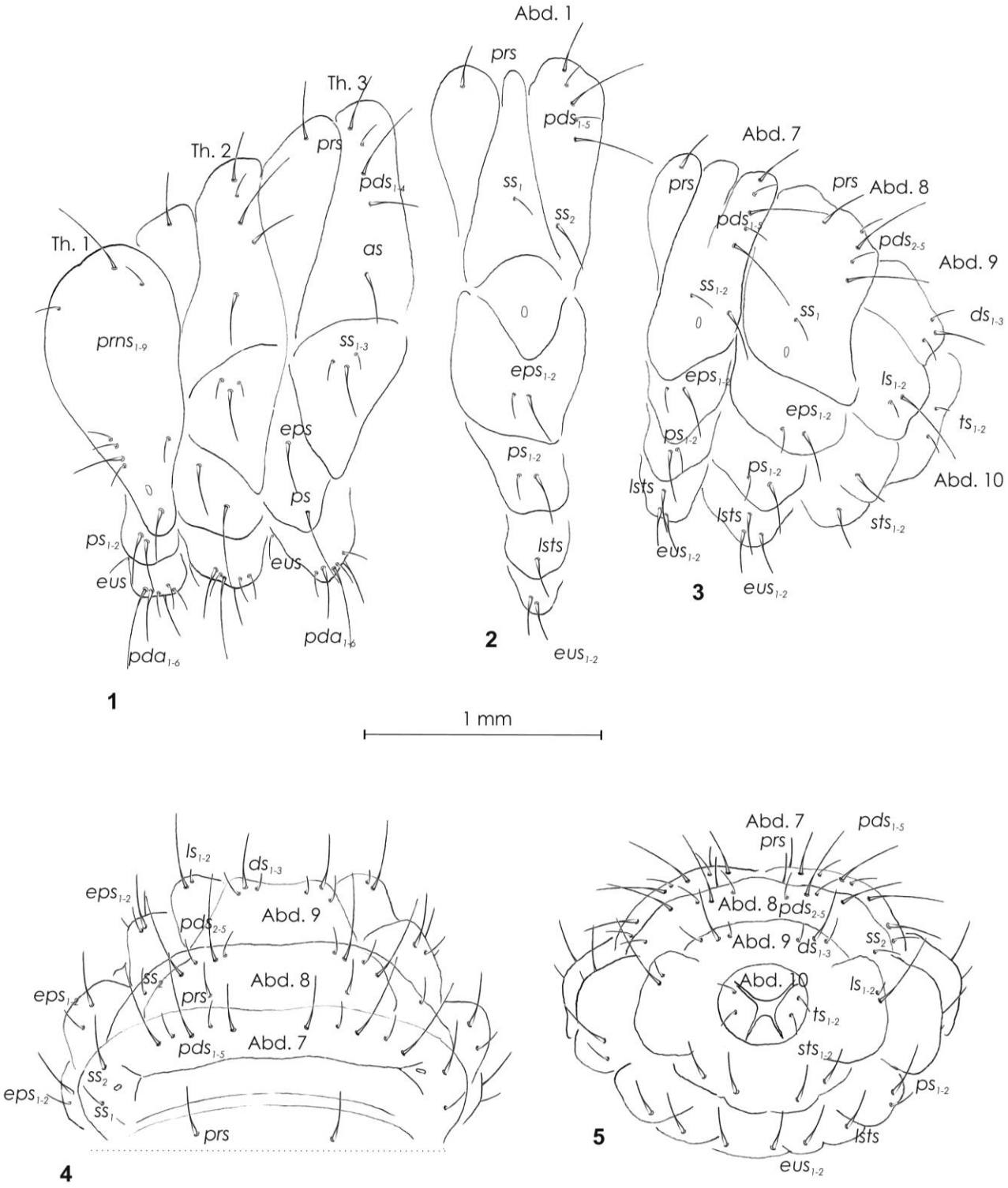
Colouration. Dark yellow head. All thoracic and abdominal segments from distinct white to slightly yellowish.

Vestiture. Setae on body thin, capilliform, transparent to light yellow, distinctly various in length (minute to very long).

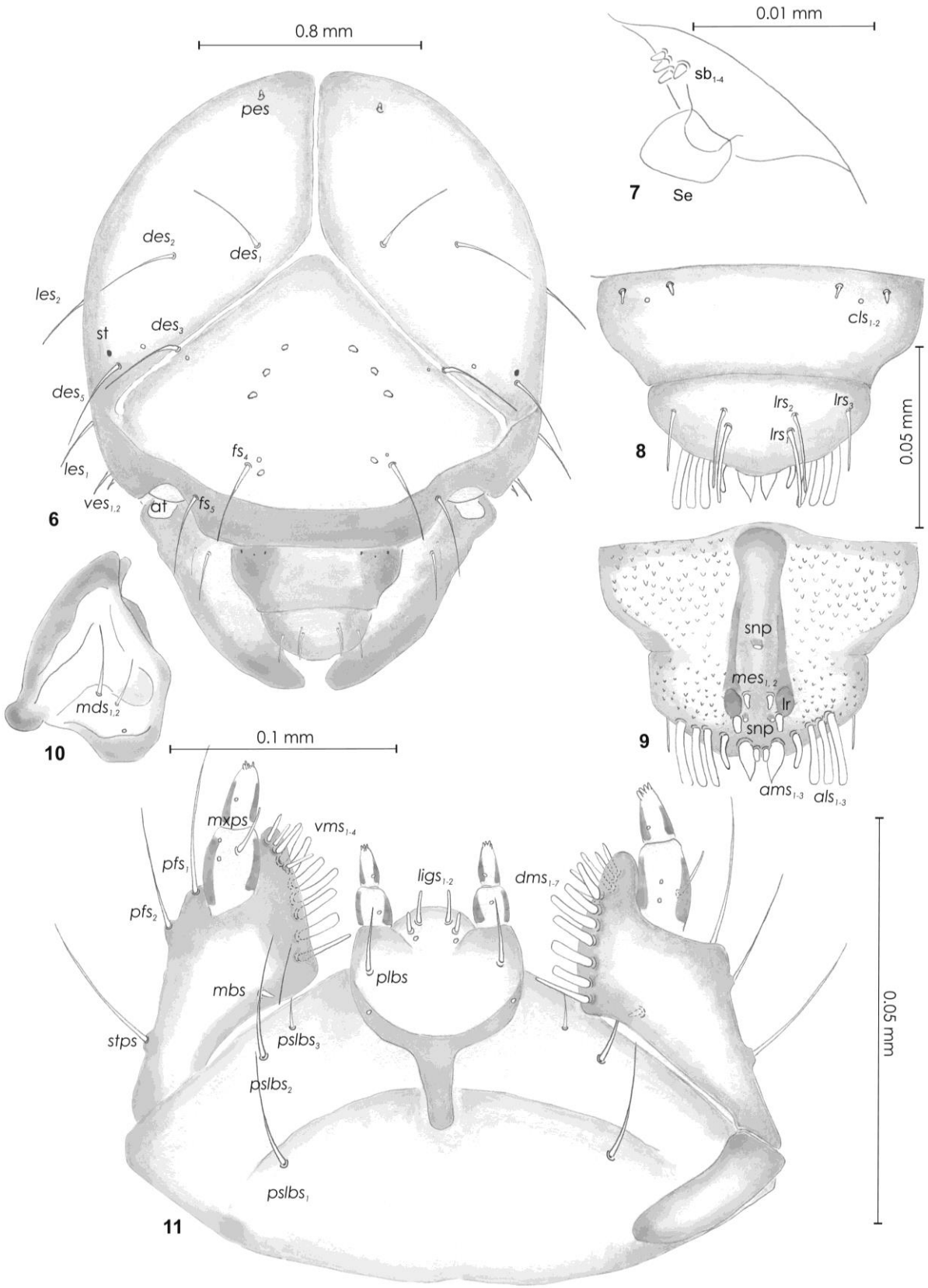
General habitus. Body elongate, slender, curved, rounded in cross section. Abdominal segment X divided into four anal lobes of various size: the dorsal lobe biggest, the two lateral lobes of the same size, the ventral very small.

Thorax. Prothorax [Fig. 1] with 9 *prns* of various length, 2 medium *ps* and 1 short *eus*. Mesothorax [Fig. 1] with 1 long *prs*, 4 *pds* (order: long, short, very long, medium), 1 long *as*, 1 long and 2 minute *ss*, 1 long *eps*, 1 long *ps* and 1 very short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 2 - 5] with 1 medium *prs*, 5 *pds* (order: medium, short, long, short, long), 1 very long and 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment VIII [Figs 3 - 5] with 1 medium *prs*, 4 *pds* (order: short, long, short, long), 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment IX [Figs 3 - 5] with 3 *ds* (order: short, medium, short), 1 long and 1 minute *ps* and 2 short *sts*. Abdominal segment X [Figs 4, 5] with 2 minute terminal setae.



Figures 1-5. *Phyllobius arborator.* Mature larva, habitus and chaetotaxy. **1** – lateral view of thoracic segments, **2** – lateral view of abdominal segment 1, **3** – lateral view of abdominal segments 8–10, **4** – dorsal view of abdominal segments 7–9, **5** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 6-11. *Phyllobius arborator.* Mature larva, head and mouthparts. **6** – head, frontal view, **7** – antenna, **8** – clypeus and labrum, dorsal view, **9** – epipharynx, **10** – left mandible, **11** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Head capsule [Fig. 6]. Head suboval, slightly flattened laterally. Frontal sutures on head distinct. Anterior stemmata (st) in the form of a small, pigmented spot close to des_5. Des_1 and des_2 long, located in the central part of epicranium, long des_3 located in the anterior part of the epicranium on the frontal suture, des_4 absent, long des_5 located anterolaterally [Fig. 6]. Fs_1-fs_3 absent, fs_4 long, located anteromedially, long fs_5 located anterolaterally, close to antenna [Fig. 6]. Les_1 and les_2 as long as des_1, both ves_1 *and* ves_2 short. Epicranial area with 1 *pes.* There is a pair of very small stemmata placed laterally, close to des_5. Each antenna [Fig. 7] bearing 1 relatively elongate, reniform, asymmetric sensorium (Se); basal membranous article with 4 sensilla basiconica (sb), various in length.

Clypeus [Fig. 8]. Approximately 3 times as wide as long with 1 sensillum and 2 very short *cls*, equal in length, located posterolaterally and posteromedially; anterior margin slightly concave.

Mouthparts. Labrum [Fig. 8] almost 2 times as wide as long, with 3 capilliform *lrs*, almost equal in length, lrs_1 and lrs_2 located medially (lrs_2 directly above lrs_1), lrs_3 laterally, all protruding labral margin. Epipharynx [Fig. 9] with 3 relatively elongate, finger-like *als*, all similar in length; with 3 *ams*, various in shape and size: ams_1 very small, ams_2 robust, ams_3 thin, finger-like; 2 small, finger-like *mes*; labral rods (lr) short, rounded, slightly convex. Surface of epipharynx covered with asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair anteromedially. Anterior margin almost convex. Mandibles [Fig. 10] slightly bifid, cutting edge with a blunt tooth; 2 setae of long and medium size, capilliform, located laterally. Maxillary stipes [Fig. 11] with long *stps* and both, *pfs* and minute *mbs*; mala with 7 relatively elongate, finger-like *dms* and 4 *vms*, various in length. Maxillary palpi narrow and elongate: basal palpomere with 1 relatively long *mxps* and two sensilla; distal palpomeres with 4-5 medium-sized cuticular apical processes. Basal palpomere slighty wider than distal. The length ratio of basal and distal palpomeres is 1 : 0.8. Prelabium [Fig. 11] with 1 medium *plbs*; ligula with 2 *ligs*: 1 minute and 1 medium; premental sclerite narrow, cup-like. Labial palpi with two palpomeres. Basal palpomeres slightly wider than distal. The length ratio of basal and distal palpomeres is 1 : 1; each palpomere with 1 sensillum, distal palpomeres with medium-sized cuticular apical processes. Postlabium [Fig. 11] with elongate $pslbs_1$ and $pslbs_2$, located basolaterally, and very short $pslbs_3$, located apically; membranous area basolaterally smooth.

***Phyllobius* (*Dieletus*) *argentatus* (Linnaeus, 1758)** [Plates 3-5], [Figures 12-22]
Specimens examined: 8

Germany, Niedersachsen, Deister Mountains, Bredenbeck-Steinkrug, beech forest, Luzulo-Fagetum, between the roots of young *Fagus sylvatica* L. shrubs and small trees (up to 2.50 m), 170 m, leg. P. Sprick, 27.03.2014: 5 ex. and 12.03.2016: 3 ex.; together with larvae of *Strophosoma capitatum* (Deg., 1775), see also Gosik et al. (2017).

Measurements (in mm). Body length: 4.50–5.50. Body width (metathorax or abdominal segments I–II) up to 1.50. Head width: 0.90–1.00.

Colouration. Light brown head. All thoracic and abdominal segments from white to light yellow.

Vestiture. Setae on body thin, transparent, distinctly various in length.

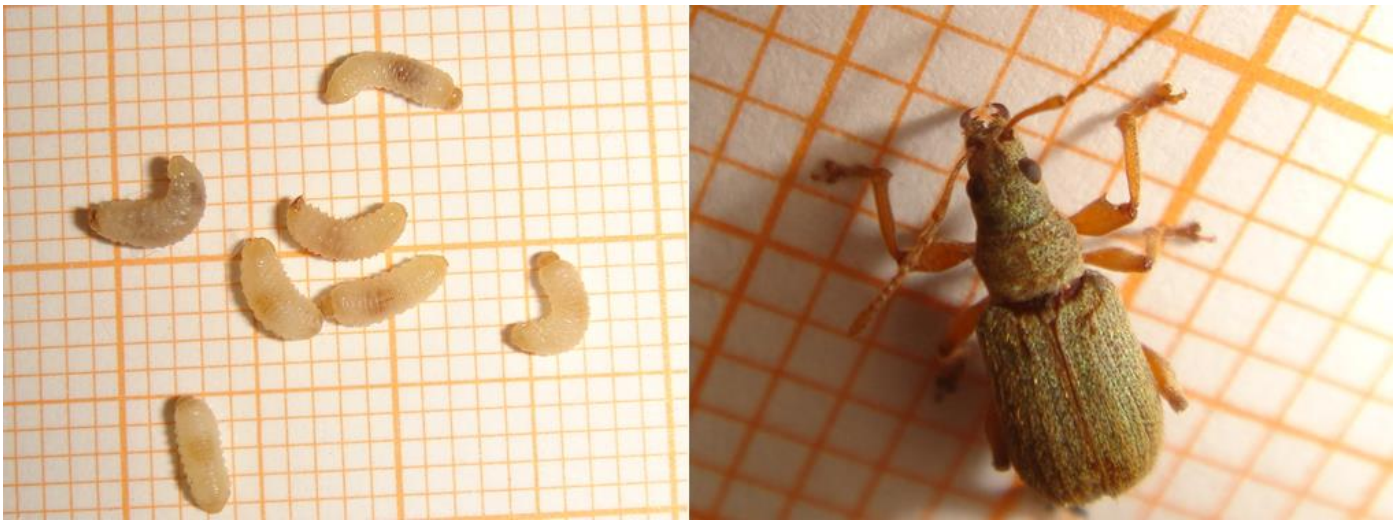


Plate 3. Larvae of *Phyllobius argentatus* from field search and a just hatched immature weevil with the two characteristic mandible appendages, as present in most Entiminae (except e.g. in *Sitona* Germ., 1817).

Plate 4. Typical habitats of *Phyllobius argentatus*: beech forests in the National Park Harz (above), in the Deister Mts near Hannover and in an old forest near Schneeren near Nienburg.

General habitus. Body elongate, only slightly curved, rounded in cross section.

Thorax. Prothorax [Fig. 12] with 10 *prns* of various length, 2 long *ps* and 1 short *eus*. Mesothorax [Fig. 12] with 1 medium *prs*, 4 *pds* (ordered: medium, medium, long, medium), 1 long *as*, 1 long and 2 minute *ss*, 1 very long *eps*, 1 long *ps*, and 1 short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

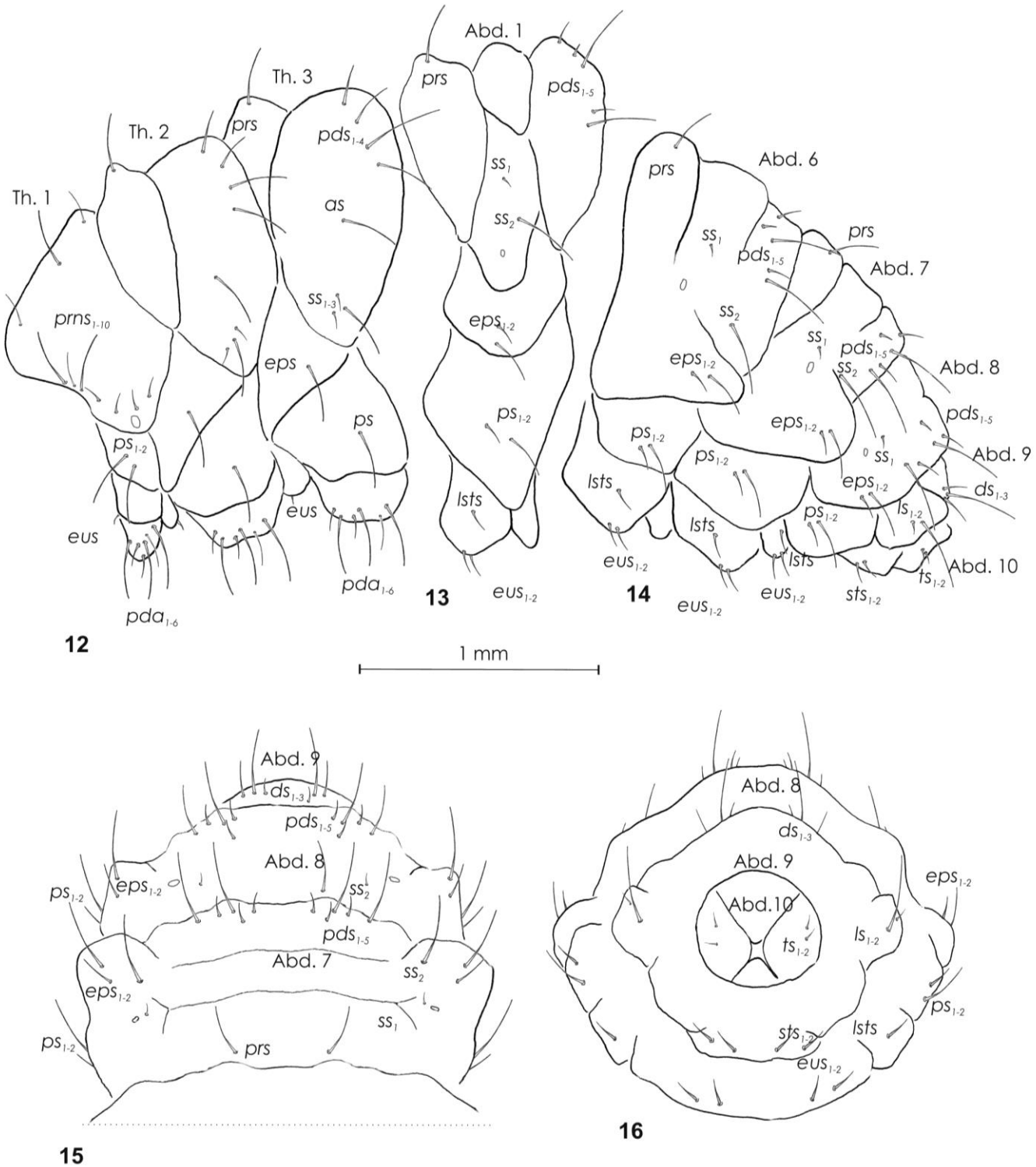
Abdomen. Abdominal segments I–VII [Figs 13 - 16] with 1 long *prs*, 5 *pds* (order: short, short, long, short, long), 1 very long and 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment VIII [Figs 14 - 16] with 5 *pds* (order: short, short, long, short, long), 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment IX [Figs 14 - 16] with 3 *ds* (order: short, medium, short), 1 long and 1 minute *ps*, and 2 short *sts*. Abdominal segment X [Figs 14 - 16] with 2 minute terminal setae.

Head capsule [Fig. 17]. Suboval, slightly flattened laterally. Frontal sutures on head distinct. Des_1 long, des_2 medium, both located in the central part of epicranium, long des_3 located in the anterior part of the epicranium on the frontal suture, des_4 absent, long des_5 located anterolaterally [Fig. 17]. Fs_1 - fs_3 absent, fs_4 medium, located anteromedially, and medium fs_5, located anterolaterally, close to antenna [Fig. 17]. Les_1 and les_2 as long as des_5, 1 *ves* very short. Epicranial area with 3 sensilla and 4 *pes* placed in a vertical line above des_2. Anterior stemmata absent. Each antenna [Fig. 18] bearing 1 relatively large reniform sensorium, and basal membranous article with 5 sensilla basiconica, equal in length.

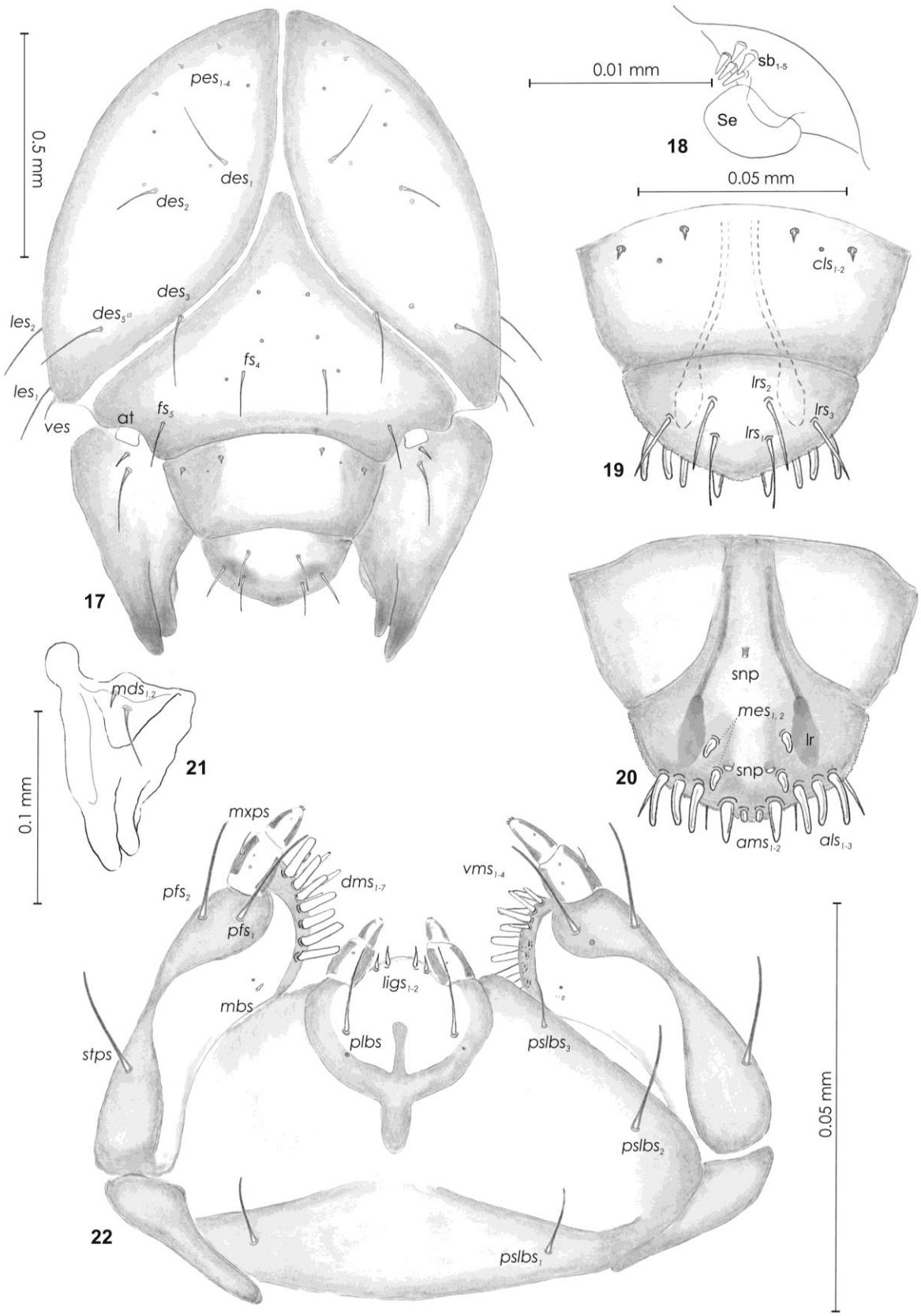
Clypeus [Fig. 19] approximately 2.5–3 times as wide as long with 2 very short *cls*, located posterolaterally, and 1 sensillum; anterior margin almost straight.

Mouthparts. Labrum [Fig. 19] less than 2 times as wide as long, with 3 capilliform *lrs*, almost equal in length, located laterally or anterolaterally, all protruding labral margin. Epipharynx [Fig. 20] with 3 long finger-like *als*, all of identical length, with 2 *ams,* different in length and shape: ams_1 short and ams_2 robust, 2 *mes* short, finger-like; labral rods (lr) rather small, oval. Surface of epipharynx covered with asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair antero-medially. Anterior margin convex. Mandibles [Fig. 21] distinctly bifid; mds_1 and mds_2 of various size, capilliform, and both located basally. Maxillary stipes [Fig. 22] with long *stps*, long pfs_1 and pfs_2, minute *mbs* and a sensillum close to *mbs*, mala with 7 elongate, finger-like *dms*; 4 *vms*, different in length. Maxillary palpi: basal palpomere with 1 short *mxps* and 2 sensilla. Distal palpomeres with some cuticular apical processes. Basal palpomeres slightly wider than distal. The length ratio of basal and distal palpomeres is 1 : 0.8. Prelabium [Fig. 22] with 1 long *plbs*, ligula with 2 short *ligs* of various length; premental sclerite broad, Q-shaped. Basal labial palpomeres wider than distal, with two palpomeres. The length ratio of basal and distal palpomeres is 1 : 0.6, each palpomere with 1 sensillum, distal palpomeres with cuticular apical processes. Postlabium [Fig. 22] with medium $pslbs_1$, located basally, very long $pslbs_2$, located mediolaterally and very short $pslbs_3$, located apically. Membranous area basolaterally smooth.

Plate 5. Search for larvae of *Phyllobius argentatus* in the Deister Mountains. Young *Fagus* L. trees with leaves and feeding tracks of the last year were preferred sites for larvae search.



Figures 12-16. *Phyllobius argentatus.* Mature larva, habitus and chaetotaxy. **12** – lateral view of thoracic segments, **13** – lateral view of abdominal segment 1, **14** – lateral view of abdominal segments 8–10, **15** – dorsal view of abdominal segments 7–9, **16** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 17-22. *Phyllobius argentatus.* Mature larva, head and mouthparts. **17** – head, frontal view, **18** – antenna, **19** – clypeus and labrum, dorsal view, **20** – epipharynx, **21** – left mandible, **22** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

12 Description of the mature larvae and aspects of biology of eight *Phyllobius* species

***Phyllobius* (*Pterygorrhynchus*) *maculicornis* Germar, 1824** [Plates 6-8], [Figures 23-33]
Specimens examined: 10

Germany, Sachsen-Anhalt, National Park Harz, Schierke, 'Feuersteinwiese', grazed mountain meadow, 610 m, from under young *Populus tremula* L. plants, leg. P. Sprick and A. Marten, 30.04.2015: 5 ex., 15.05.2015: 1 ex.; Germany, Hannover-Groß Buchholz, fallow grassland, 55 m, from under *Arrhenatherum elatius* (L.) Beauv. tussocks and small *Corylus avellana* L. bushes, leg. P. Sprick, 28.03.2019: 4 ex.; 2 pupae collected at same date and site were reared to adults until 05.04.2019. At both sites occurring together with *P. viridicollis*. At the site near Schierke both species inhabited young *Populus tremula* plants, but *P. maculicornis* was much more frequent. At the site in Hannover, *P. maculicornis* was the only species present on *Corylus avellana* and *Arrhenatherum elatius*.

Plate 6. Habitats for *Phyllobius maculicornis* larvae search: a meadow with dominance of *Arrhenatherum elatius* and many *Elymus repens* (L.) Gould plants in Hannover-Groß Buchholz (above), and the 'Feuersteinwiese', a pasture with large stones in the National Park Harz (below). The picture at bottom left shows the regularly browsed *Populus tremula* plants, which were used by *P. maculicornis* and very favourable for searching larvae.

Measurements (in mm). Body length: 5.50–6.20. Body width (metathorax or abdominal segments I–II) up to 1.80. Head width: 0.90–1.10.

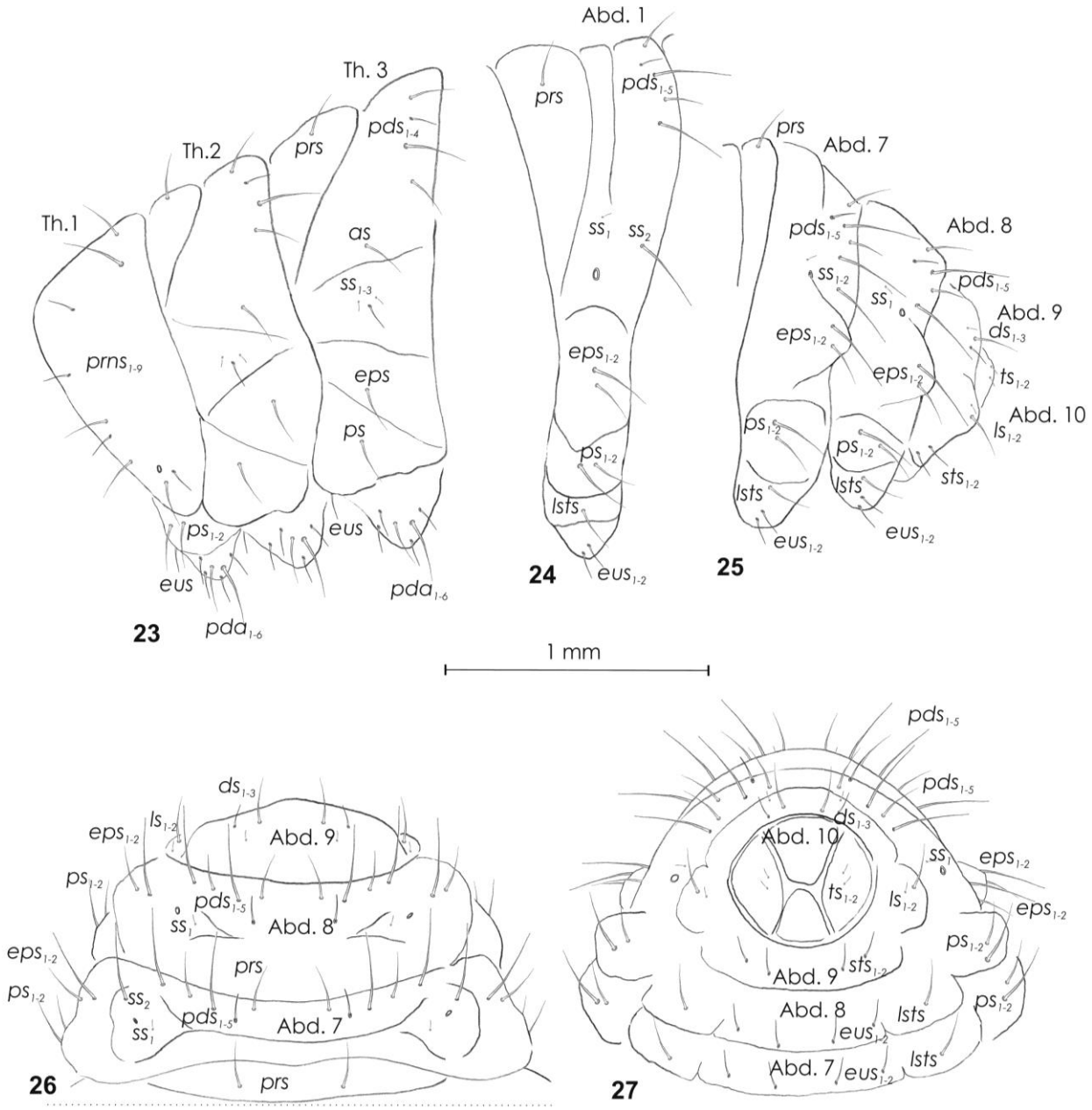
Colouration. Head yellowish. All thoracic and abdominal segments from white.

Vestiture. Setae on body thin, transparent, various in length (minute to very long).

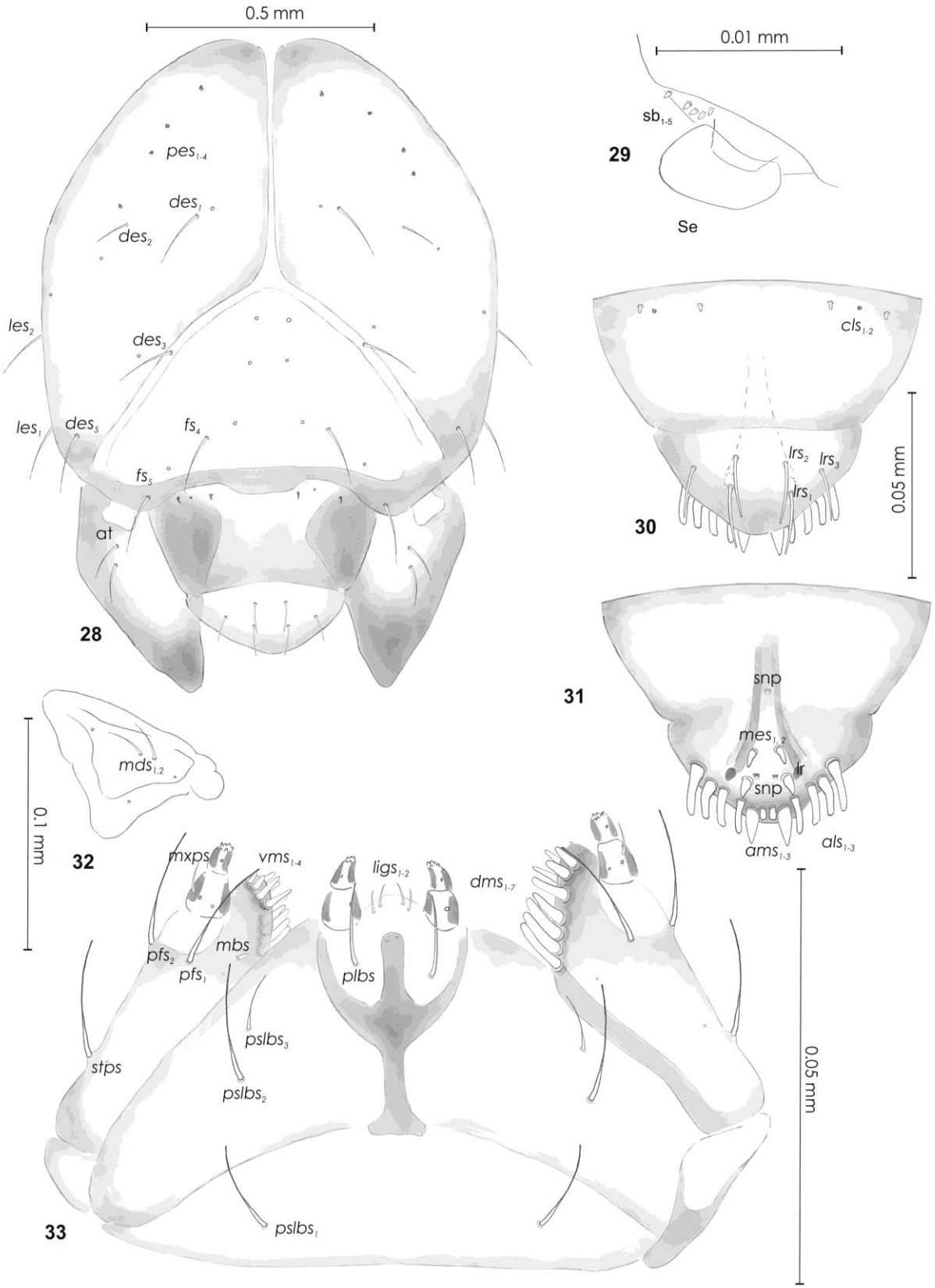
General habitus. Body elongate, slender, curved, rounded in cross section. Abdominal segment X divided into four anal lobes of various size: the dorsal lobe biggest, the two lateral lobes of the same size, the ventral very small.

Thorax. Prothorax [Fig. 23] with 9 *prns* of various length, 2 medium *ps* and 1 short *eus*. Mesothorax [Fig. 23] with 1 long *prs*, 4 *pds* (long, short, long, medium), 1 medium *as*, 1 medium and 2 minute *ss*, 1 long *eps*, 1 long *ps* and 1 short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 24 - 27] with 1 medium *prs*, 5 *pds* (order: medium, short, long, medium, long), 1 very long and 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment VIII [Figs 25 - 27] with 5 *pds* (order: medium, short, long, medium, long), 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment IX [Figs 25 - 27] with 3 *ds* (order: minute, medium, short), 1 long and 1 minute *ps* and 2 short *sts*. Abdominal segment X [Figs 26, 27] with 2 minute terminal setae.



Figures 23-27. *Phyllobius maculicornis.* Mature larva, habitus and chaetotaxy. **23** – lateral view of thoracic segments, **24** – lateral view of abdominal segment 1, **25** – lateral view of abdominal segments 8–10, **26** – dorsal view of abdominal segments 7–9, **27** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 28-33. *Phyllobius maculicornis.* Mature larva, head and mouthparts. **28** – head, frontal view, **29** – antenna, **30** – clypeus and labrum, dorsal view, **31** – epipharynx, **32** – left mandible, **33** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Head capsule [Fig. 28]. Head suboval, flattened laterally. Frontal sutures on head distinct. *Des*$_1$ long, *des*$_2$ medium, both located in the central part of epicranium, long *des*$_3$ located on the frontal suture, *des*$_4$ absent, long *des*$_5$ located anterolaterally [Fig. 28]. *Fs*$_1$-*fs*$_3$ absent, *fs*$_4$ long, placed anteromedially, long *fs*$_5$ located close to antenna [Fig. 28]. *Les*$_1$ and *les*$_2$ as long as *des*$_1$. Epicranial area with 4 *pes* in a vertical line above *des*$_2$. Each antenna [Fig. 29] bearing 1 relatively wide, reniform, slightly asymmetric sensorium (Se); basal membranous article with 5 sensilla basiconica (sb), equal in length.

Clypeus [Fig. 30]. Approximately 3 times as wide as long, with 1 sensillum and 2 very short *cls*, located posterolaterally and posteromedially; anterior margin almost straight.

Mouthparts. Labrum [Fig. 30] almost 2 times as wide as long, with 3 capilliform *lrs*, equal in length, *lrs*$_1$ and *lrs*$_2$ located medially (*lrs*$_2$ directly above *lrs*$_1$), *lrs*$_3$ laterally, *lrs*$_1$ and *lrs*$_3$ reach labral margin. Epipharynx [Fig. 31] with 3 elongate, finger-like *als*; 3 *ams*, various in shape and size: *ams*$_1$ very small, *ams*$_2$ robust, *ams*$_3$ thin, finger-like; and 2 short, conical *mes*; labral rods (lr) short, rounded, slightly convex. Surface of epipharynx smooth and with 3 sensillum pores (snp), one placed posteromedially and a pair antero-medially. Anterior margin rounded. Mandibles [Fig. 32] not bifid, cutting edge with a small, blunt tooth; 2 setae of medium size, capilliform, located laterally. Maxillary stipes [Fig. 33] with long *stps*, 2 long *pfs* and minute *mbs*; mala with 7 finger-like *dms*, various in length, and 4 *vms* (2 short and 2 medium). Maxillary palpi moderately elongated: basal palpomere with 1 long *mxps* and two sensilla; distal palpomeres with 4-5 medium-sized cuticular apical processes. Basal palpomeres distinctly wider than distal, the length ratio of basal and distal palpomeres is 1 : 0.5. Prelabium [Fig. 33] with 1 long *plbs*; ligula with 2 medium *ligs*; premental sclerite narrow, cup-like. Labial palpi with two palpomeres. Basal palpomeres wider than distal. The length ratio of basal and distal palpomeres is 1 : 0.7; each palpomere with 1 sensillum, distal palpomeres with medium-sized cuticular apical processes. Postlabium [Fig. 33] with medium *pslbs*$_1$, elongate *pslbs*$_2$ and very short *pslbs*$_3$; membranous area basolaterally smooth.

Plate 7. Larva, pupa, immature and old adult of *Phyllobius maculicornis*.

Plate 8. Successful search for *Phyllobius maculicornis* immatures under the tussock-like root stocks of *Arrhenatherum elatius* in a green belt in the city of Hannover.

***Phyllobius* (*Metaphyllobius*) *pomaceus* Gyllenhal, 1834** [Plates 9-11], [Figures 34-44]
Specimens examined: 23

Germany, Niedersachsen, Hannover-Stöcken, bank of Leine river, mainly from under *Urtica dioica* L., 45 m, leg. P. Sprick, 02.04.2013: 1 ex., 25.03.2014: 4 ex., 19.11.2015: 2 ex., 30.12.2015: 6 ex., 03.02.2016: 4 ex., 05.01.2017: 4 ex. and 12.01.2018: 2 ex.

Plate 9. Habitats of *Phyllobius pomaceus* in and around Hannover in the Leine river valley and along the riverside. *P. pomaceus* is a very frequent species in this area.

Measurements (in mm). Body length: .12.0–14.0. Body width (abdominal segments I–III) up to 2.65. Head width: 1.45–1.50.

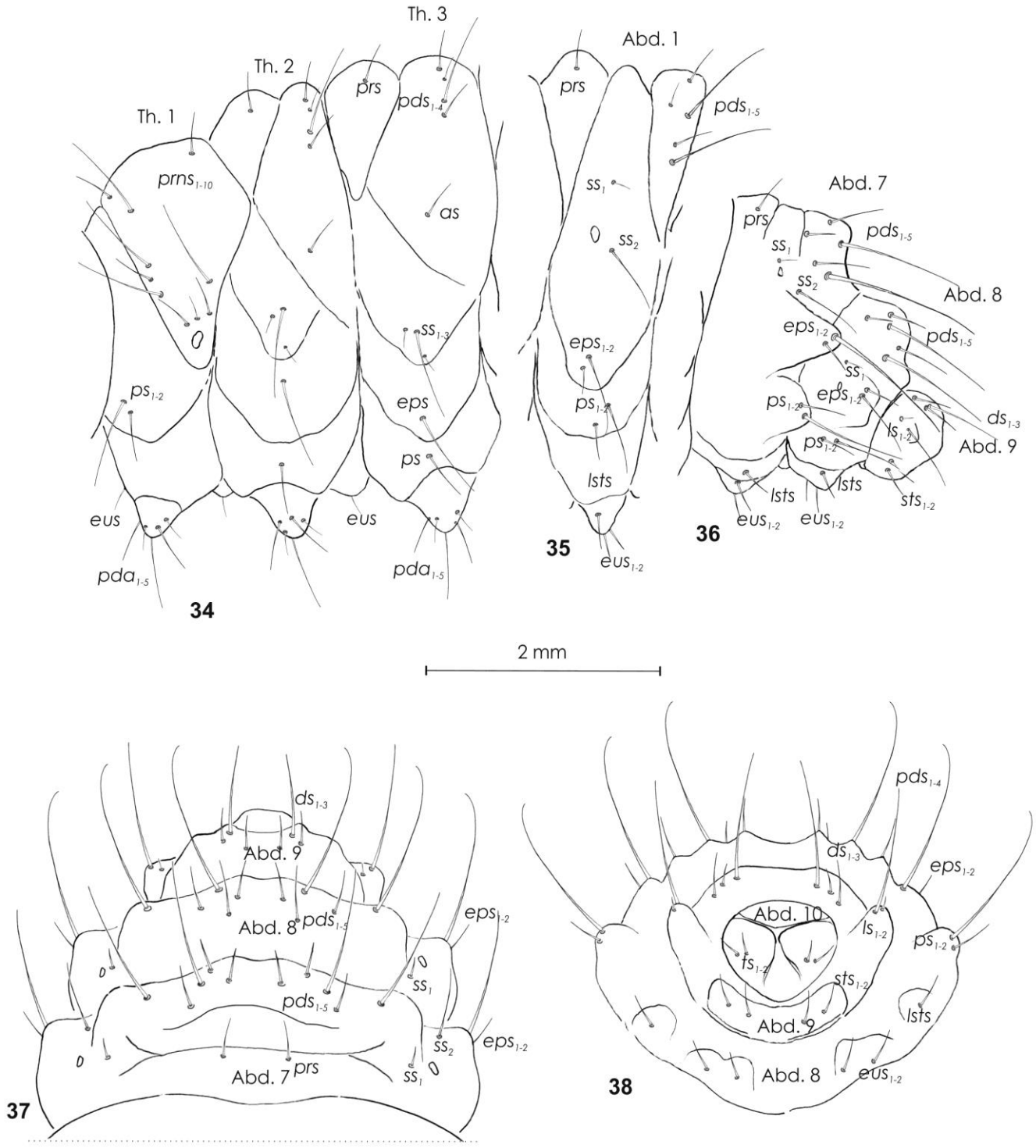
Colouration. Head pale brown. All thoracic and abdominal segments from white to slightly yellowish, pronotum usually more pigmented than rest of the body.

Vestiture. Setae on body thin, transparent or greyish, various in length (minute to very long).

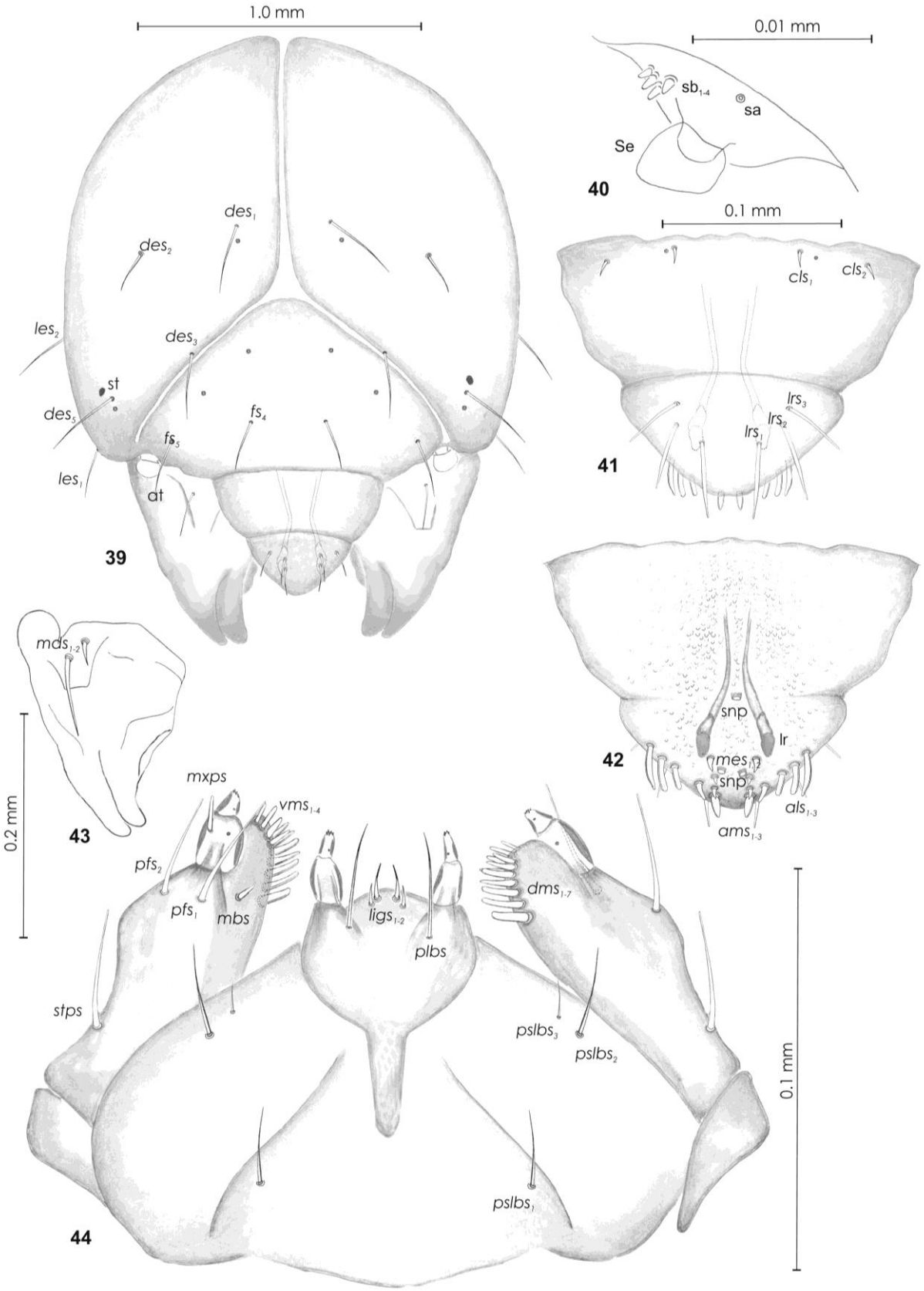
General habitus. Body very elongate, slender, slightly curved, rounded in cross section.

Thorax. Prothorax [Fig. 34] with 10 *prns* of various length, 1 long and 1 medium *ps*, and 1 short *eus*. Mesothorax [Fig. 34] with 1 medium *prs*, 4 *pds* (order: medium, short, long, medium), 1 long *as*, 1 very long and 2 very short *ss*, 1 long *eps*, 1 long *ps*, and 1 short *eus*. Each pedal area of thoracic segments with 5 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 35 - 38] with 1 medium *prs*, 5 *pds* (order: short, medium, long, medium, long), 1 long and 1 minute *ss*, 1 long and 1 short *eps*, 1 long and 1 short *ps*, 1 short *lsts* and 2 short *eus*. Abdominal segment VIII [Figs 36 - 38] with 1 medium *prs*, 4 *pds* (order: short, long, medium, long), 1 minute *ss*, 1 long and 1 short *eps*, 1 long and 1 short *ps*, 1 short *lsts* and 2 short *eus*. Abdominal segment IX [Figs 36 - 38] with 3 *ds* (order: long, short, medium), 1 long *ps* and 2 short *sts*. Abdominal segment X [Figs 37, 38] with 2 minute *ts*.



Figures 34-38. *Phyllobius pomaceus.* Mature larva, habitus and chaetotaxy. **34** – lateral view of thoracic segments, **35** – lateral view of abdominal segment 1, **36** – lateral view of abdominal segments 8–10, **37** – dorsal view of abdominal segments 7–9, **38** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 39-44. *Phyllobius pomaceus.* Mature larva, head and mouthparts. **39** – head, frontal view, **40** – antenna, **41** – clypeus and labrum, dorsal view, **42** – epipharynx, **43** – left mandible, **44** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Head capsule [Fig. 39]. Head oval, slightly flattened laterally. Frontal sutures on head distinct. A single stemma (st) in form of a small, pigmented spot close to des_5. Long des_1 and medium des_2, located in the middle part of epicranium, long des_3 located in the anterior part of epicranium on the frontal suture, des_4 absent, long des_5 located anterolaterally [Fig. 39]. Fs_1-fs_3 absent, fs_4 long, located anteromedially, long fs_5 located anterolaterally, close to antenna. Les_1 and les_2 slightly shorter than des_5, 2 *ves* short. Epicranial area with 1 sensillum close to des_1, next close to des_5; *pes* absent. Each antenna bearing 1 relatively large-sized, reniform, asymmetric sensorium (Se), basal membranous article with 4 sensilla basiconica (sb), equal in length and 1 sensillum ampullaceum (sa) [Fig. 40].

Clypeus [Fig. 41] approximately 2.5 times as wide as long with 2 short *cls*, located posteromedially; anterior margin of clypeus almost straight.

Mouthparts. Labrum [Fig. 41] almost 2.5 times as wide as long, with 3 capilliform *lrs*, equal in length, lrs_1 located anteromedially, lrs_2 medially, and lrs_3 located posterolaterally, all reaching the labral margin. Epipharynx [Fig. 42] with 3 long, finger-like *als* of equal length; 3 *ams,* different in length and shape: ams_1 very small, ams_2 robust, ams_3 thin, finger-like; 2 *mes* short, finger-like; labral rods (lr) small, oval. Surface of epipharynx covered with fine asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair antero-medially. Anterior margin almost convex. Mandibles [Fig. 43] bifid, mds_1 relatively long, mds_2 medium-sized, both capilliform, located basally. Maxillary stipes [Fig. 44] with long *stps* and a pair of long $pfs_{1\text{-}2}$ and medium *mbs*, mala with 7 relatively elongate, finger-like *dms* and 4 *vms*, different in length. Maxillary palpi elongate: basal palpomere with 1 *mxps* and two sensilla; distal palpomeres with one sensillum and cuticular apical processes. Basal palpomeres distinctly wider and longer than distal; the length ratio of basal and distal palpomeres is 1 : 0.4. Prelabium [Fig. 44] with 1 medium *plbs*, ligula with 2 *ligs*, different in length; premental sclerite narrow, cup-like. Labial palpi elongate, with two palpomeres. Basal wider and longer than distal; the length ratio of basal and distal palpomeres is 1 : 0.5. Each palpomere with 1 sensillum, distal palpomeres with short, cuticular apical processes. Postlabium [Fig. 44] with medium $pslbs_1$, located basally, very long $pslbs_2$, located medially and short $pslbs_3$, located apically. Membranous area basolaterally smooth.

Plate 10. Successful search for *Phyllobius pomaceus* larvae and pupae at the bank of Leine river in Hannover-Stöcken.

Plate 11. *Phyllobius pomaceus* on its host plant, *Urtica dioica*.

***Phyllobius* (*Phyllobius*) *pyri* (Linnaeus, 1758)** [Plate 12], [Figures 45-55]
Specimens examined: 15

Germany, Sachsen-Anhalt, National Park Harz, Ilsenburg, birch pioneer forest following a broken-down spruce forest (former plantation), between the roots of young *Betula pendula* Roth trees and bushes, 380 m, leg. P. Sprick & A. Marten, 30.03.2015: 8 ex., 11.09.2015: 1 ex., 12.11.2015: 6 ex.

Measurements (in mm). Body length: 4.20–5.50. Body width (abdominal segments I–III) up to 1.80. Head width: 0.85–1.00.

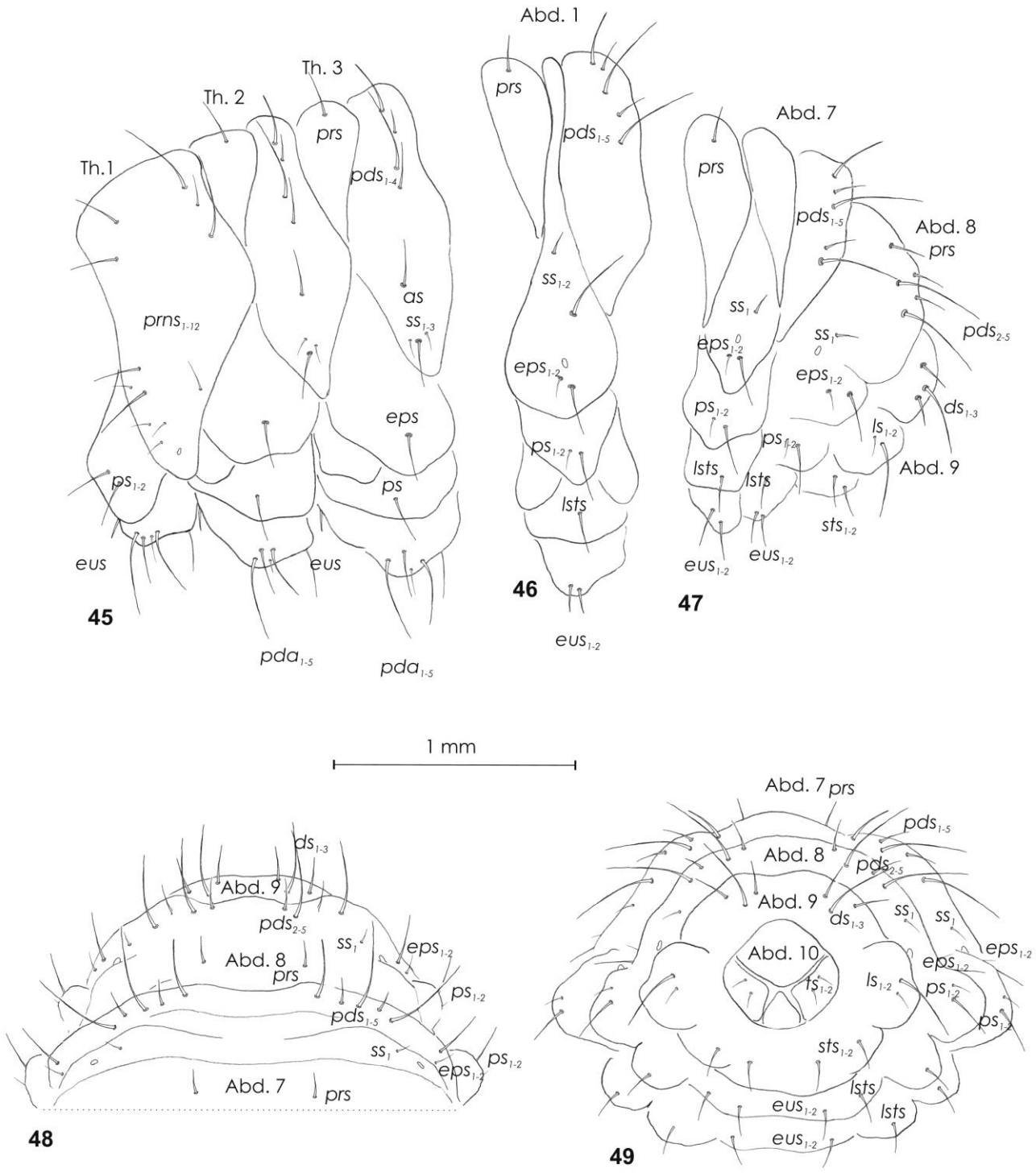
Colouration. Head brown. All thoracic and abdominal segments from white to yellowish.

Vestiture. Setae on body thin, transparent to light yellow, various in length (minute to very short or long to very long), cuticle slightly asperate.

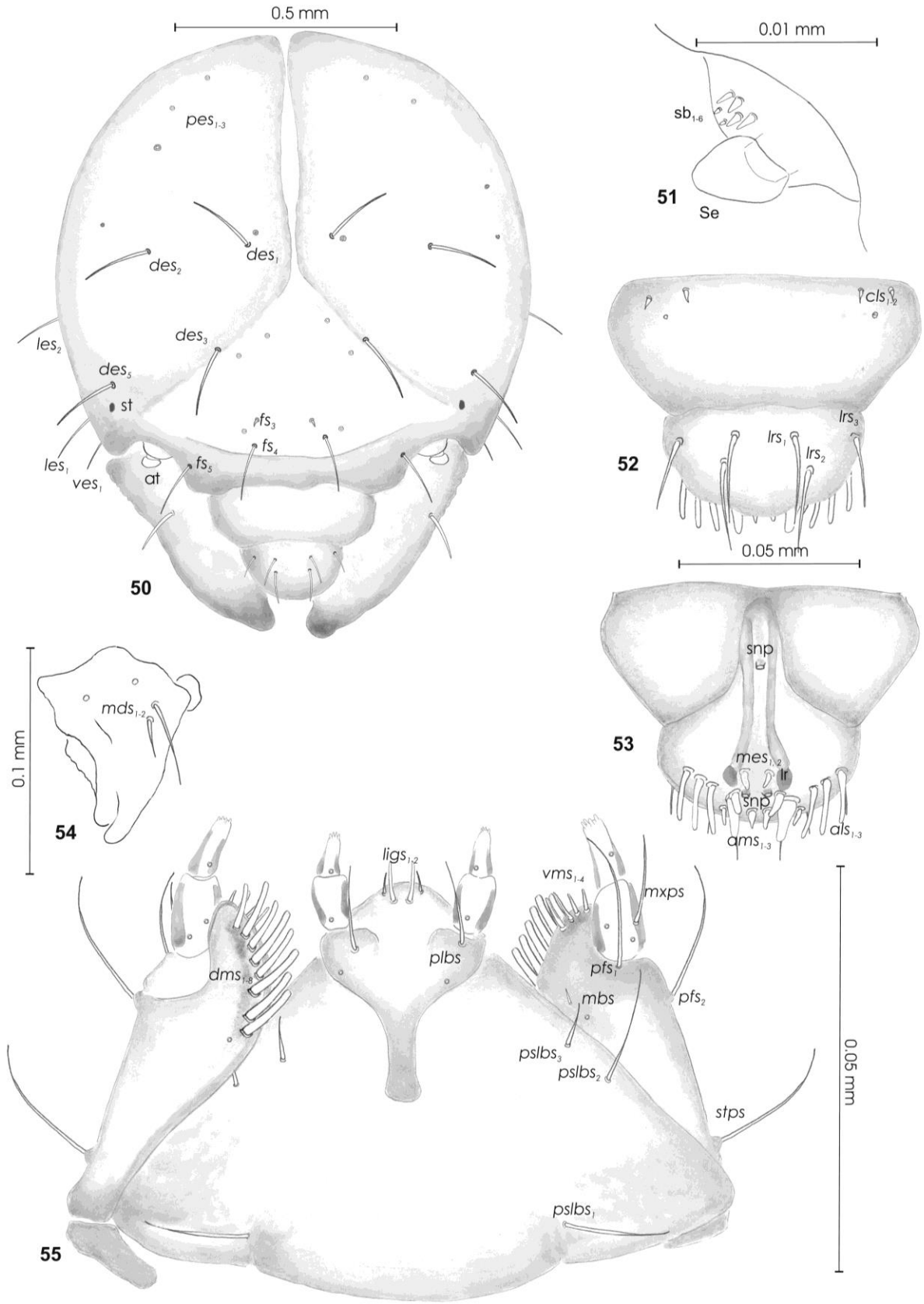
General habitus. Body moderately elongate, curved, rounded in cross section.

Thorax. Prothorax [Fig. 45] with 12 *prns* of various length, 2 medium *ps* and 1 short *eus*. Mesothorax [Fig. 45] with 1 medium *prs*, 4 *pds* (order: medium, long, short, medium), 1 medium *as*, 1 medium and 2 minute *ss*, 1 medium *eps*, 1 medium *ps* and 1 short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 46 - 49] with 1 short *prs*, 5 *pds* (order: medium, short, long, short, long), 1 long and 1 minute *ss*, 1 medium and 1 short *eps*, 1 medium and 1 short *ps*, 1 medium *lsts* and 2 medium *eus*. Abdominal segment VIII [Figs 47 - 49] with 1 short *prs*, 4 *pds* (order: short, long, short, long), 1 minute *ss*, 1 medium and 1 short *eps*, 1 medium and 1 short *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment IX [Figs 47 - 49] with 3 *ds* (order: medium, long, short), 1 long and 1 minute *ps* and 2 short *sts*. Abdominal segment X [Figs 48 - 49] with 2 very short setae (*ts*).



Figures 45-49. *Phyllobius pyri.* Mature larva, habitus and chaetotaxy. **45** – lateral view of thoracic segments, **46** – lateral view of abdominal segment 1, **47** – lateral view of abdominal segments 8–10, **48** – dorsal view of abdominal segments 7–9, **49** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 50-55. *Phyllobius pyri.* Mature larva, head and mouthparts. **50** – head, frontal view, **51** – antenna, **52** – clypeus and labrum, dorsal view, **53** – epipharynx, **54** – left mandible, **55** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Head capsule [Fig. 50]. Head almost oval. Frontal sutures on head indistinct. Small stemmata close to des_5. Des_1 elongate, des_2 shorter then des_1, both located in the middle part of epicranium, long des_3, located in the anterior part of epicranium on the frontal suture, des_4 absent, long des_5, located anterolaterally [Fig. 50]. Fs_1 and fs_2 absent; fs_3 minute, placed medially; fs_4 long, located anteromedially, and long fs_5, located anterolaterally, close to antenna [Fig. 50]. Les_1 and les_2 as long as des_5, single *ves* medium. Epicranial area with 3 *pes* in a vertical line above des_2, and 2 sensilla. Each antenna [Fig. 51] bearing 1 medium-sized, reniform, strongly asymmetric sensorium (Se); basal membranous article with 5 sensilla basiconica (sb), various in size.

Clypeus [Fig. 52] approximately 2.2 times as wide as long, with 2 short *cls*, located posterolaterally, and 1 sensillum.

Mouthparts. Labrum [Fig. 52] less than 2.5 times as wide as long, with 3 capilliform *lrs*, equal in length, lrs_1 located anteromedially, lrs_2 medially, and lrs_3 located posterolaterally, all reaching the labral margin. Anterior margin rounded. Epipharynx [Fig. 53] with 3 long, finger-like *als* of equal length, 3 *ams*, different in length and shape: ams_1 finger-like and short, ams_2 much bigger than others, ams_3 short, capilliform; 2 *mes* short, finger-like; labral rods (lr) small, oval. Surface of epipharynx smooth, with 3 sensillum pores (snp), one placed posteromedially and a pair antero-medially. Mandibles [Fig. 54] bifid, mds_1 relatively long, mds_2 of medium size, both capilliform, located basally. Maxillary stipes [Fig. 55] with 1 very long *stps* and 2 *pfs*; very short *mbs* and a single sensillum close to *mbs*; mala with 8 long, finger-like *dms*; 4 *vms*, different in length. Maxillary palpi: basal palpomere with 1 short *mxps* and two sensilla. Distal palpomeres with cuticular apical processes. Basal palpomere distinctly wider than distal; the length ratio of basal and distal palpomeres is 1 : 0.8. Prelabium [Fig. 55] with 1 relatively long *plbs*, ligula with 2 *ligs*, various in length; premental sclerite broad, cup-like. Labial palpi elongate, with two palpomeres. The length ratio of basal and distal palpomeres is 1 : 0.6. Each palpomere with 1 sensillum, distal palpomeres with short, cuticular apical processes. Postlabium [Fig. 55] with long $pslbs_1$, located basally, very long $pslbs_2$, located medially, and very short $pslbs_3$, located apically. Membranous area basolaterally smooth.

Plate 12. Habitat, host plant (*Betula pendula*), searching place and a larva of *Phyllobius pyri* at the Meineberg in the National Park Harz. The numerous feeding notches on the birch leaves were made by *P. pyri* adults.

***Phyllobius* (*Parnemoicus*) *roboretanus* Gredler, 1882** [Plates 13-14], [Figures 56-66]
Specimens examined: 4

Germany, Sachsen-Anhalt, National Park Harz, Schierke, Drei Annen Hohne, meadow at Hohnehof, from under *Vicia sepium* L., leg. P. Sprick and A. Marten, 25.04.2018: 4 ex. There were even more pupae than adults. The identity of *P. roboretanus* was confirmed by barcoding of a damaged pupa by Andreas Marten.

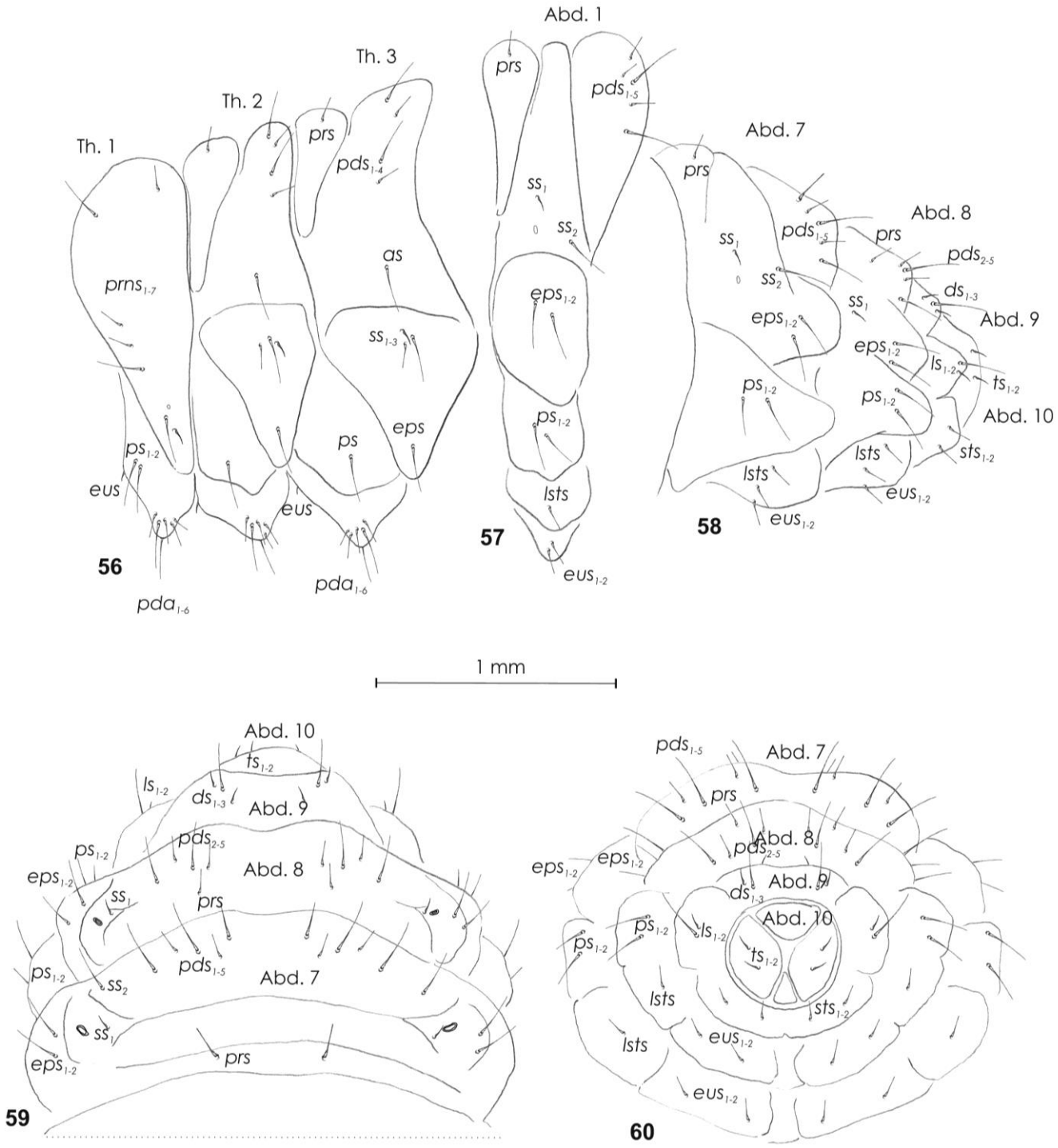
Plate 13. Host plant, hedge vetch (*Vicia sepium* L.) and locality of *Phyllobius roboretanus* at Hohnehof near Drei Annen Hohne in the National Park Harz. Unexpectedly, in 2020 the habitat was destroyed by the construction of a new building of the National Park.

Measurements (in mm). Body length: 4.30–5.20. Body width (metathorax or abdominal segments I–II) up to 1.50. Head width: 0.80–1.00, dark brown.

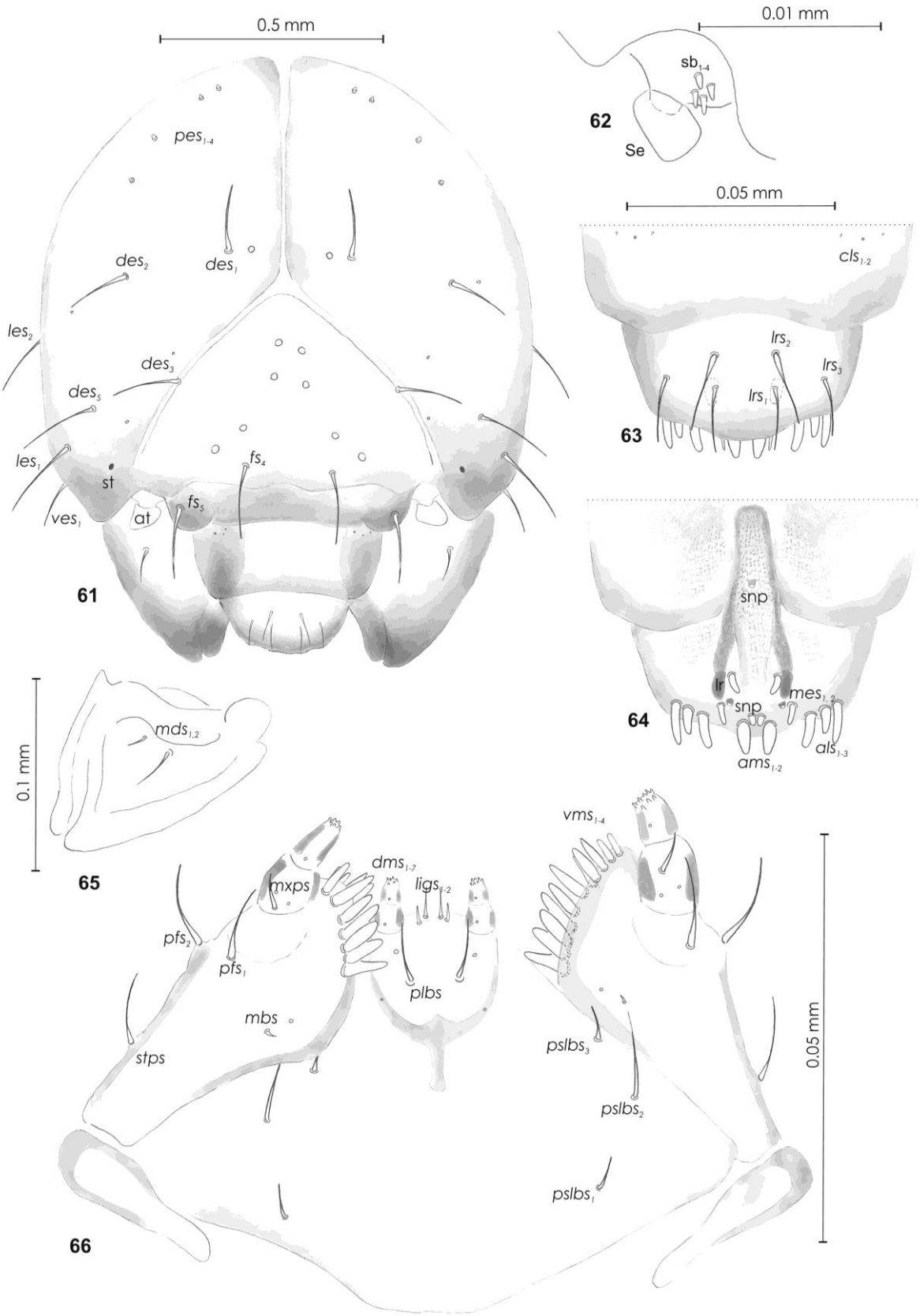
General habitus. Body elongate, only slightly curved, rounded in cross section.

Thorax. Prothorax [Fig. 56] with 7 *prns* of various length, 2 medium *ps* and 1 short *eus*. Mesothorax [Fig. 56] with 1 short *prs*, 4 *pds* (ordered: medium, short, medium, short), 1 medium *as*, 1 medium and 2 minute *ss*, 1 long *eps*, 1 long *ps*, and 1 short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 57 - 60] with short long *prs*, 5 *pds* (order: short, short, long, short, long), 1 long and 1 minute *ss*, 2 medium *eps*, 1 long and 1 medium *ps*, 1 short *lsts* and 2 short *eus*. Abdominal segment VIII [Figs 58 - 60] with 1 medium *prs*, 4 *pds* (order: medium, long, medium, long), 1 minute *ss*, 2 medium *eps*, 2 medium *ps*, 1 short *lsts* and 2 short *eus*. Abdominal segment IX [Figs 58 - 60] with 3 *ds* (order: short, medium, short), 1 long and 1 minute *ps*, and 2 short *sts*. Abdominal segment X [Figs 58 - 60] with 2 minute terminal setae.



Figures 56-60. *Phyllobius roboretanus.* Mature larva, habitus and chaetotaxy. **56** – lateral view of thoracic segments, **57** – lateral view of abdominal segment 1, **58** – lateral view of abdominal segments 8–10, **59** – dorsal view of abdominal segments 7–9, **60** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 61-66. *Phyllobius roboretanus.* Mature larva, head and mouthparts. **61** – head, frontal view, **62** – antenna, **63** – clypeus and labrum, dorsal view, **64** – epipharynx, **65** – left mandible, **66** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Head capsule [Fig. 61]. Head almost rounded. Frontal sutures on head distinct. Anterior stemmata (st) in the form of a small, pigmented spot close to antenna. *Des$_1$* and *des$_2$* long, located in the central part of epicranium, long *des$_3$* located on the frontal suture, *des$_4$* absent, long *des$_5$* located anterolaterally [Fig. 61]. *Fs$_1$-fs$_3$* absent, *fs$_4$* long, located anteromedially, long *fs$_5$* located anterolaterally. *Les$_1$* and *les$_2$* as long as *des$_1$*; single *ves* short. Epicranial area with 4 *pes.* Each antenna [Fig. 62] bearing 1 elongate, reniform, strongly asymmetric sensorium (Se); basal membranous article with 4 elongate sensilla basiconica (sb).

Clypeus [Fig. 63]. Approximately 3.5 times as wide as long, with 1 sensillum and 2 minute *cls*; anterior margin distinctly concave.

Mouthparts. Labrum [Fig. 63] almost 2 times as wide as long, with 3 capilliform *lrs*, almost equal in length, *lrs$_1$* and *lrs$_2$* located medially (*lrs$_2$* directly above *lrs$_1$*), *lrs$_3$* laterally, all reaching labral margin. Epipharynx [Fig. 64] with 3 finger-like *als*, various in length, and 2 *ams*: *ams$_1$* very small and *ams$_2$* robust, finger-like; 2 thin, finger-like *mes*. Labral rods (lr) rounded, slightly elongate. Surface of epipharynx covered with fine asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair anteromedially. Anterior margin sinuate. Mandibles [Fig. 65] slightly bifid, 2 setae (one medium and one short), capilliform, located laterally. Maxillary stipes [Fig. 66] with 1 long *stps*, 2 long *pfs* and minute *mbs*; mala with 7 robust, finger-like *dms* and 4 *vms*, various in length. Maxillary palpi elongate: basal palpomere with 1 relatively long *mxps* and two sensilla; distal palpomeres with 5 medium-sized cuticular apical processes. Basal palpomeres wider than distal. The length ratio of basal and distal palpomeres is 1 : 0.8. Prelabium [Fig. 66] with 1 long *plbs*; ligula with 2 *ligs*: 1 minute and 1 medium; premental sclerite narrow, cup-like. Labial palpi with two palpomeres. Basal palpomeres slighty wider than distal. The length ratio of basal and distal palpomeres is 1 : 1; each palpomere with 1 sensillum, distal palpomeres with medium-sized cuticular apical processes. Postlabium [Fig. 66] with short *pslbs$_1$* and elongate *pslbs$_2$*, located basolaterally, and short *pslbs$_3$*, located apically; membranous area basolaterally smooth.

Plate 14. Newly hatched (reared) and mating *Phyllobius roboretanus* weevils from the mesophilous meadow at Hohnehof.

***Phyllobius* (*Subphyllobius*) *virideaeris* (Laicharting, 1781)** [Plates 15-16], [Figures 67-77]
Specimens examined: 7

Germany, Niedersachsen, Hannover, Elze-Bennemühlen, fallow land on sandy soil, between the roots of *Tanacetum vulgare* L., 40 m, leg. P. Sprick, 01.05.2013: 3 ex., 05.05.2013: 4 ex. – 2 further larvae, collected on 01.05.2013, were reared to adults until 17.05.2013.

Plate 15. Habitat and searching site of *Phyllobius virideaeris* larvae under *Tanacetum vulgare* near Elze-Bennemühlen in the north of Hannover.

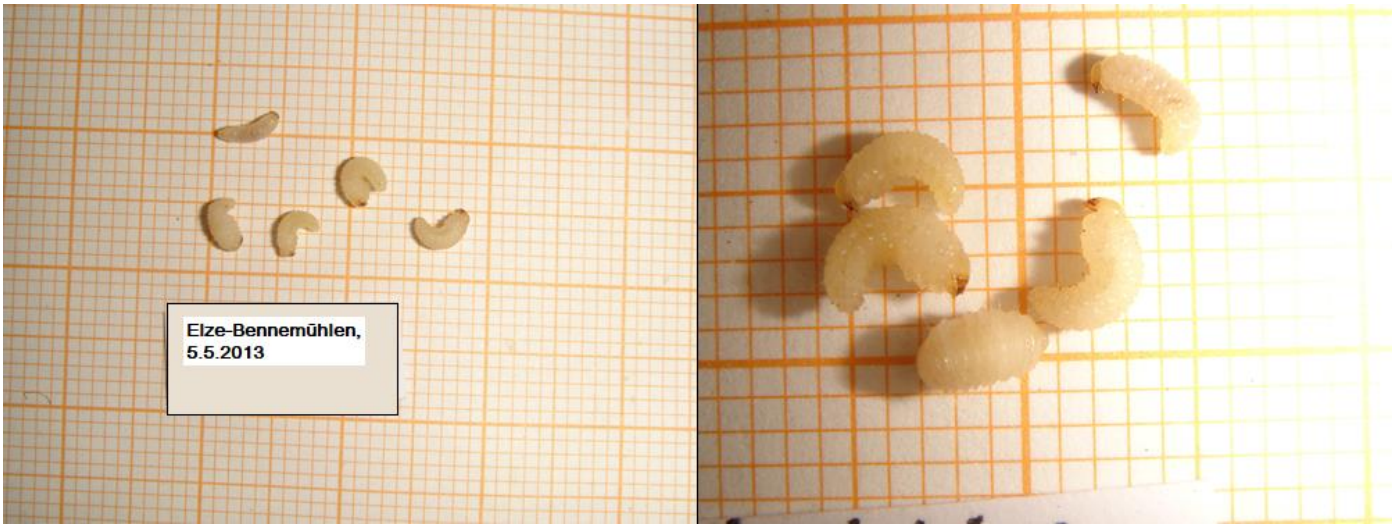


Plate 16. Several *Phyllobius virideaeris* larvae, found at the site in Elze-Bennemühlen under *Tanacetum vulgare*.

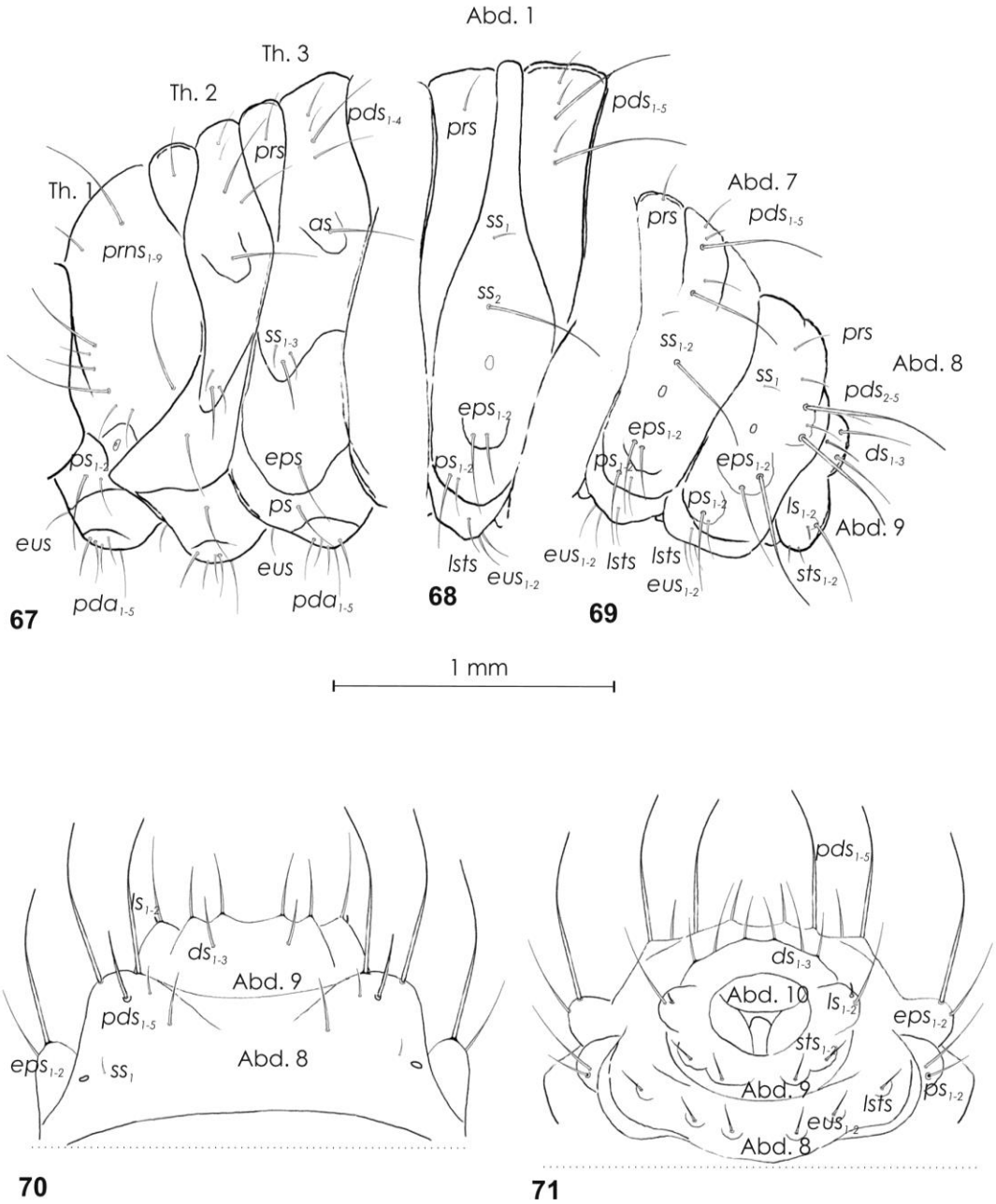
Measurements (in mm). Body length: 5.00–6.00. Body width (metathorax or abdominal segments I–II) up to 2.00. Head width: 0.95–1.05.

Colouration. Head yellow. All thoracic and abdominal segments yellowish.

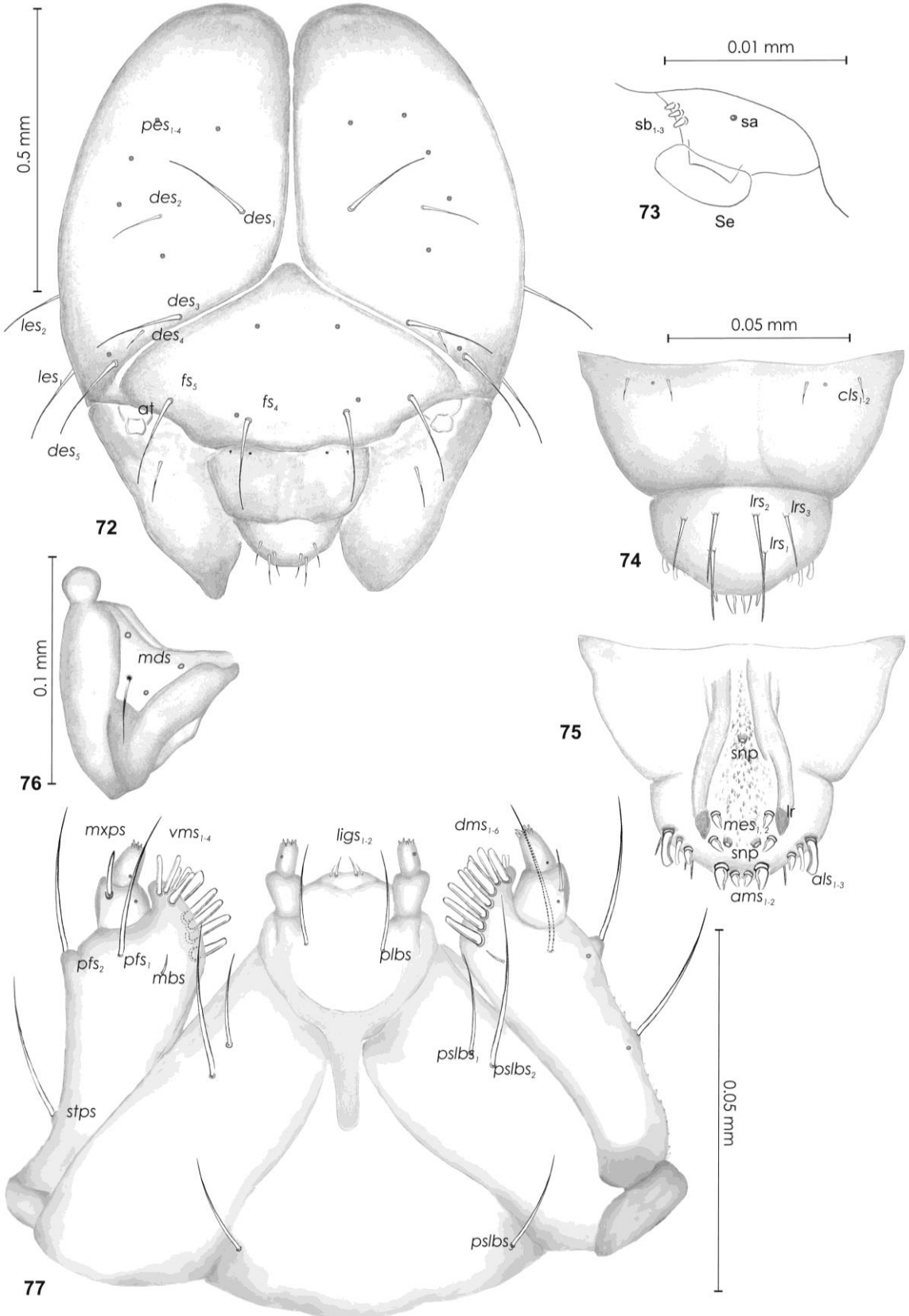
Vestiture. Setae on body thin, light yellow, distinctly various in length (minute to very short or long).

General habitus. Body elongate, slender, weakly curved, rounded in cross section.

Thorax. Prothorax [Fig. 67] with 9 *prns*, 1 long and 1 medium *ps* and 1 short *eus*. Mesothorax [Fig. 67] with 1 medium *prs*, 4 *pds* (order: medium, short, long, medium); 1 long *as*, 1 long and 2 minute *ss*, 1 medium *eps*, 1 medium *ps* and 1 short *eus*. Each pedal area of thoracic segments with 5 *pda*, different in length.



Figures 67-71. *Phyllobius virideaeris.* Mature larva, habitus and chaetotaxy. **67** – lateral view of thoracic segments, **68** – lateral view of abdominal segment 1, **69** – lateral view of abdominal segments 8–10, **70** – dorsal view of abdominal segments 7–9, **71** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 72-77. *Phyllobius virideaeris.* Mature larva, head and mouthparts. **72** – head, frontal view, **73** – antenna, **74** – clypeus and labrum, dorsal view, **75** – epipharynx, **76** – left mandible, **77** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Abdomen. Abdominal segments I–VII [Figs 68 - 71] with 1 short *prs*, 5 *pds* (order: short, short, long, short, long), 1 long and 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 medium *eus*. Abdominal segment VIII [Figs 69 - 71] with 1 short *pds*, 4 *pds* (order: short, long, medium, long), 1 minute *ss*, 1 long and 1 medium *eps*, 1 long and 1 medium *ps*, 1 medium *lsts* and 2 short *eus*. Abdominal segment IX [Figs 69 - 71] with 3 *ds* (order: short, medium, short), 1 long *ps* and 2 short *sts*. Abdominal segment X [Figs 69, 71] without setae.

Head capsule [Fig. 72] Head slightly narrowed laterally, frontal sutures on head distinct. Stemmata (st) absent. Des_1 elongate, des_2 shorter than des_1, both located in the middle part of epicranium; long des_3 located in the anterior part of epicranium on the frontal suture, very short des_4, located laterally to des_3, very long des_5, located anterolaterally. Fs_1 - fs_3 absent, fs_4 long, located anteromedially, and long fs_5, located anterolaterally, close to antenna [Fig. 72]. Les_1 and les_2 as long as des_5; *ves* absent. Epicranial area with 4 *pes* in a vertical line above des_2 and 2 sensilla. Each antenna [Fig. 73] bearing 1 very wide, symmetric, reniform sensorium (Se), basal membranous article with 3 sensilla basiconica (sb), almost equal in length, and 1 sensillum ampullaceum (sa).

Clypeus [Fig. 74] approximately 2.25 times as wide as long, with 2 short *cls*, located posterolaterally, and 1 sensillum; anterior margin almost straight.

Mouthparts. Labrum [Fig. 74] 1.75 times as wide as long, with 3 capilliform *lrs*, equal in length; lrs_1 placed anteromedially, lrs_2 medially, and lrs_3 anterolaterally; only lrs_1 exceed distinctly the margin of labrum. Epipharynx [Fig. 75] with 3 finger-like *als*, various in length; 2 *ams*, various in size; 2 *mes* short, finger-like. Labral rods (lr) slightly elongated. Surface of epipharynx covered with fine asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair anteromedially. Mandibles [Fig. 76] only slightly bifid, 1 seta medium-sized, capilliform, located basally. Maxillary stipes [Fig. 77] with 1 long *stps*, 2 long *pfs* and minute *mbs*. Mala with 7 medium-sized, finger-like *dms* and 4 finger-like *vms*, various in length. Maxillary palpi: basal palpomere with 1 short *mxps* and two sensilla. Distal palpomeres with cuticular apical processes. Basal palpomares much wider than distal; the length ratio of basal and distal 1 : 0.6. Prelabium [Fig. 77] with 1 long *plbs*; ligula with 2 short *ligs*, various in length. Premental sclerite broad, ring-shaped. Labial palpi elongate, with two palpomeres. The length ratio of basal and distal palpomeres is 1 : 0.8. Each palpomere with 1 sensillum, distal palpomeres with short, cuticular apical processes. Postlabium [Fig. 77] with long $pslbs_1$, located basally, very long $pslbs_2$, located medially and long $pslbs_3$, located apically. Membranous area basolaterally and stipes fine asperate.

***Phyllobius* (*Parnemoicus*) *viridicollis* (Fabricius, 1792)** [Plates 17-18], [Figures 78-88]
Specimens examined: 8

Germany, National Park Harz, Schierke, 'Feuersteinwiese', grazed mountain meadow, between the roots of browsed, small *Populus tremula* L. bushes, 610 m, 17.04.2015: 4 ex.; dto., under small *Populus tremula* bushes and from mixed stands of *Urtica dioica* L. and *Rubus idaeus* L., 610 m, 30.04.2015: 4 ex., all leg. P. Sprick and A. Marten.

In May and June adults were seen in great numbers on small *Populus tremula*, *Rubus idaeus* and *Urtica dioica* at this locality. *P. viridicollis* and *P. maculicornis* inhabited *Populus tremula* and *Urtica dioica* by at this site, but they used different plants.

Plate 17. Two habitats of *Phyllobius viridicollis* in the Feuersteinwiese near Schierke in the National Park Harz: a rarely grazed site with *Meum athamanticum* Jacq., where *Urtica dioica* and *Rubus idaeus* is inhabited, and a regularly grazed site with the browsed *Populus tremula* plants.

Plate 18. Site of *Phyllobius viridicollis* under low (regularly browsed) *Populus tremula* plants in the Feuersteinwiese near Schierke. *P. maculicornis* was present in the Feuersteinwiese, too, and used in part the same host plants, but usually different subsites. The species were distinguished later.

Measurements (in mm). Body length: 4.00–5.50. Body width (abdominal segments I–III) up to 1.50. Head width: 0.90–1.05.

Colouration. Almost greyish or light yellow. All thoracic and abdominal segments from white to slightly yellow.

Vestiture. Setae on body thin, slightly from orange to pale brown, distinctly various in length (minute to very short or long to very long), body distinctly asperate.

General habitus. Body elongate, slender, weakly curved, rounded in cross section.

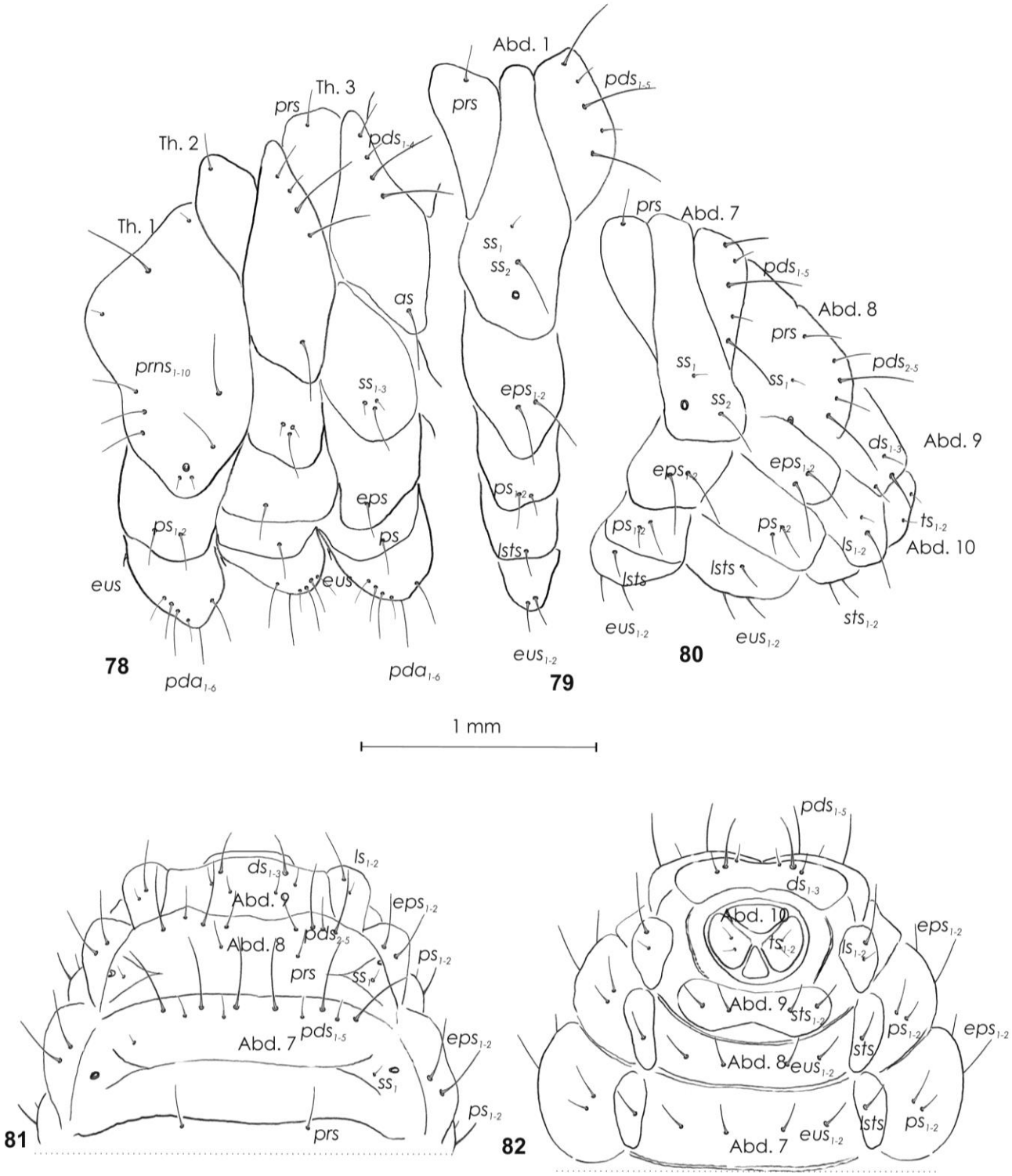
Thorax. Prothorax [Fig. 78] with 10 *prns* of various length, 2 long *ps* and 1 short *eus*. Mesothorax [Fig. 78] with 1 long *prs*, 4 *pds* (order: medium, short, long, medium), 1 long *as*, 1 very long and 2 minute *ss*, 1 long *eps*, 1 long *ps* and 1 short *eus*. Each pedal area of thoracic segments with 6 *pda* of various length.

Abdomen. Abdominal segments I–VII [Figs 79 - 82] with 1 medium *prs*, 5 *pds* (order: medium, short, long, short, long), 1 long and 1 minute *ss*, 2 long *eps*, 1 medium and 1 short *ps*, 1 short *lsts* and 2 relatively short *eus*. Abdominal segment VIII [Figs 80 - 82] with 1 medium *prs*, 4 *pds* (order: medium, long, medium, long), 1 minute *ss*, 2 long *eps*, 1 medium and 1 short *ps*, 1 short *lsts* and 2 short *eus*. Abdominal segment IX [Figs 80 - 82] with 3 *ds* (order: medium, short, medium), 1 relatively long and 1 minute *ps* and 2 short *sts*. Abdominal segment X [Figs 81, 82] with 2 minute setae (*ts*).

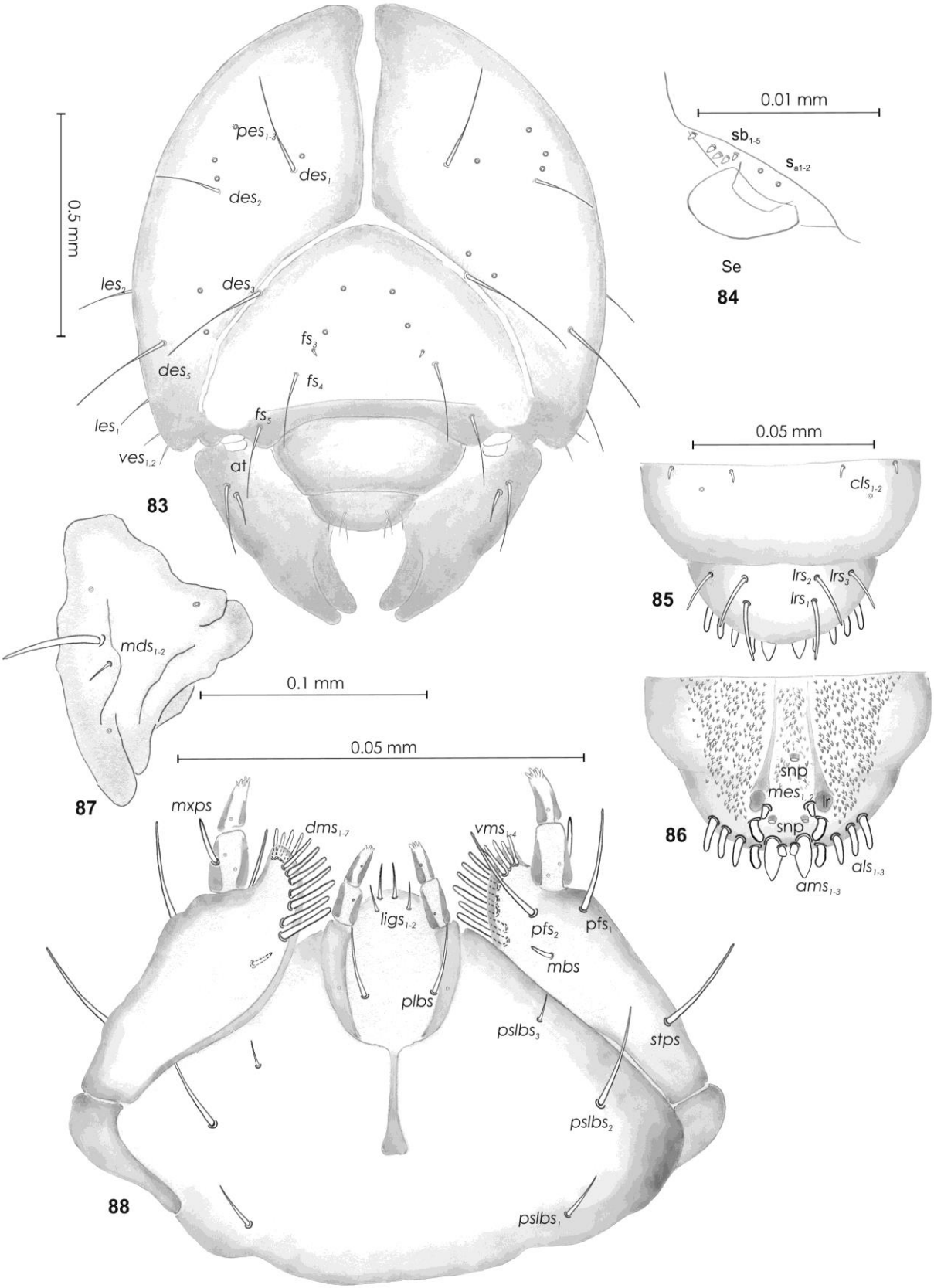
Head capsule [Fig. 83] Head almost oval, frontal sutures well developed. Des_1 and des_2 very long, both located in the middle part of epicranium, des_3 located on the frontal suture, des_4 absent, des_5 very long, located anterolaterally. Fs_1 and fs_2 absent, fs_3 minute, fs_4 long, located anteriorly, fs_5 long, located anterolaterally, close to antenna [Fig. 83]. Les_1

and *les*$_2$ slightly shorter than *des*$_5$; single *ves* medium-sized. Epicranial area with 3 *pes*, placed above *des*$_2$. Each antenna [Fig. 84] bearing 1 reniform, asymmetric sensorium (Se); basal membranous article with 7 sensilla: 5 basiconica (sb) and 2 ampullacea.

Clypeus [Fig. 85] approximately 3 times as wide as long, with 2 minute *cls*, located posterolaterally, and 1 sensillum; anterior margin straight.



Figures 78-82. *Phyllobius viridicollis.* Mature larva, habitus and chaetotaxy. **78** – lateral view of thoracic segments, **79** – lateral view of abdominal segment 1, **80** – lateral view of abdominal segments 8–10, **81** – dorsal view of abdominal segments 7–9, **82** – ventral view of abdominal segments 7–10 (Th. 1–3 – number of thoracic segments, Abd. 1–10 – number of abominal segments, setae: *as* – alar, *ds* – dorsal, *eps* – epipleural, *eus* – eusternal, *lsts* – laterosternal, *pda* – pedal, *pds* – postdorsal, *prns* – pronotal, *prs* – prodorsal, *ps* – pleural, *ss* – spiracular, *sts* – sternal, *ts* – terminal).



Figures 83-88. *Phyllobius viridicollis.* Mature larva, head and mouthparts. **83** – head, frontal view, **84** – antenna, **85** – clypeus and labrum, dorsal view, **86** – epipharynx, **87** – left mandible, **88** – maxillolabial complex, ventral aspect (at – antenna, clss – clypeal sensorium, lr – labral rods, sb – sensillum basiconicum, Se – sensorium, snp – sensillum pores, st – stemmata, setae: *als* – anterolateral, *ams* – anteromedial, *cls* – clypeal, *des* – dorsal epicranial, *dms* – dorsal malar, *fs* – frontal, *ligs* – ligular, *lrs* – labral, *les* – lateral epicranial, *mbs* – malar basiventral, *mds* – mandibular, *mes* – median, *mxps* – maxillary palp, *pes* – postepicranial, *ves* – ventral, *pfs* – palpiferal, *plbs* – prelabial, *pslbs* – postlabial, *stps* – stipal, *vms* – ventral malar).

Mouthparts. Labrum [Fig. 85] less than 2.5 times as wide as long, with 3 capilliform *lrs*, equal in length: lrs_1 located medially, lrs_2 posteromedially and lrs_3 laterally, all slightly reaching the rounded margin of labrum. Epipharynx [Fig. 86] with 3 medium-sized, finger-like *als* and with 3 *ams* of different shape: ams_1 very short, ams_2 finger-like, robust, and ams_3 capilliform, slightly elongate; 2 *mes* finger-like, various in length. Labral rods (lr) small, oval. Surface of epipharynx densely covered with asperities and with 3 sensillum pores (snp), one placed posteromedially and a pair anteromedially. Mandibles [Fig. 87] slightly bifid, cutting edge with small protuberances additionally; 2 mandibular setae of various size, capilliform, both located basally. Maxillary stipes [Fig. 88] with 1 long *stps*, 2 long *pfs* and 1 minute *mbs*; mala with 7 long, finger-like *dms* and 4 *vms*, different in length. Maxillary palpi very long: basal palpomere with 1 short *mxps* and two sensilla, distal palpomeres with some, cuticular apical processes. The length ratio of basal and distal palpomeres is 1 : 0.8. Prelabium [Fig. 88] with 1 long *plbs*, ligula with 2 *ligs*, various in length, premental sclerite well visible, cup-like. Labial palpi elongate, with two palpomeres. The length ratio of basal and distal palpomeres is 1 : 1. Each palpomere with 1 sensillum; distal palpomeres with short, cuticular apical processes. Postlabium [Fig. 88] with medium $pslbs_1$, located basally, long $pslbs_2$, located medially and short $pslbs_3$, located apically. Membranous area basolaterally smooth.

Biology of the species

Bionomics

The life cycle of *Phyllobius* species is rather simple and comparatively well known. There are detailed studies about the development of *Phyllobius intrusus* (Kerr 1949), *P. oblongus* (Vollmann 1954), *Phyllobius viridicollis* and *P. pyri* s.l. (Axelsson et al. 1973), *P. argentatus* (Schauermann 1973), and *P. pyri* form *vespertinus* (Tischler 1985). Dieckmann (1980) summarized his observations on the presence of immature specimens, specimens with eggs in the abdomen and first and last occurrence of adult weevils and used these data for the description of life cycles. The general life cycle is approximately as follows: after emergence of the adults in spring (key activity in May and June, in a few species from mid-April), the weevils move to the leaves of their host plants and start maturation feeding. Then they lay eggs in soil crevices or between leaves and plant debris usually on the ground, and rarely in the shrub layer. First instar larvae have to move to fine roots and pass through several instars until pupation that occurs between winter and spring.

The larvae of four *Phyllobius* species (*P. arborator, P. argentatus, P. maculicornis, P. oblongus*) were unanimously found at soil depths of 10 to 20 cm and in no case below 25 cm, usually close to roots of the host plants (Ioannisiani et al. 1970, Vollmann 1954, Schauermann 1973). As larvae grew, they moved closer to the soil surface, so that mature larvae and pupae were found only at soil depths less than 10 cm. Kerr (1949) stated when describing the feeding habit of *P. intrusus* that the maximum of arborvitae roots was found ‘within 9 inches’ (around 23 cm). And Axelsson et al. (1973) took samples to determine the abundance of *P. pyri* s.l. and *P. viridicollis* larvae at soil depths not exceeding 20 and 25 cm, respectively. The data of Tischler (1985) from salt meadows of the North Sea are differing as he found larvae (and pupae) of *P. vespertinus* (Fabricius, 1792) (= *P. pyri* form *vespertinus*) between soil depths of only 1 to 5 cm, maybe due to the high water level of the coastal area.

In *Phyllobius pyri* sensu lato pupation takes place very early (winter to early spring), in *P. argentatus, P. maculicornis, P. pomaceus, P. roboretanus, P. virideaeris*, and *P. viridicollis* from beginning or end of March, until May and June. Axelsson et al. (1973) reported about a difference of 2 - 4 weeks concerning the emergence of *P. pyri* (s.l.) and *P. viridicollis*, and in their northern area (Sweden: Uppsala region) *P. pyri* appeared as adult not earlier than mid-May.

In *Phyllobius argentatus* the life table of Schauermann (1973) shows that larvae overwinter only in the final (5^{th}) instar and pupate in the Solling Mts in May. He found the highest food uptake at the beginning of winter. Some authors counted or determined the number of larval instars: 5 in *P. argentatus, P. oblongus, P. pyri* sensu lato, *P. pyri* form *vespertinus* and *P. viridicollis* (Vollmann 1954, Lekander 1973, Schauermann 1973, Tischler 1985), and 7 in *P. intrusus* (Kerr 1949). The complementation and verification or falsification of these data will be part of a separate paper.

At two study sites in the Harz Mts at around 600 m - 800 m a.s.l. we found mature larvae but not any pupae of *Phyllobius arborator* between end of April and mid-May. Franz (1974) reported about adults from May to October with maximum in June and July. These data correspond with results of Dieckmann (1980) who recorded immature specimens between mid-May and mid-June (9.5. - 24.6.) and late pregnant specimens between July and mid-August (5.7. - 11.8.). His postulation of a different life cycle is based predominantly on an immature specimen from 13^{th} August and on the assumption of Franz (1974), who found adults until October.

But it is not necessary to propose a different life cycle for *Phyllobius arborator*. The findings of Dieckmann and Franz can be sufficiently explained by the occurrence of belated specimens. The probability to find such specimens is linked on the one hand with the number of immatures studied and on the other hand with the geographical position, e.g. far

in the north or high in the mountains. Jackson (1920) found several belated specimens in *Sitona lineatus* (Linnaeus, 1758): in Ross-shire (northern Scotland) pupation took place from 24th July with a maximum in August and still to be found in the beginning of September. Two pupae that were recorded in January did not achieve the adult stage probably due to low temperatures in this part of the season. The development of this species is obviously delayed until late summer and early autumn in cool environments such as mountain and continental areas with cold climate. Ioannisiani et al. (1970) stated that *Phyllobius maculicornis* needed the highest temperature (sum) for its development, compared with *P. arborator* and *P. argentatus*.

In warm regions and in the lowlands adult *Phyllobius* weevils usually disappear (usually die) much earlier than in the mountains or at higher altitudes, most extreme in *P. pyri* that disappears in many regions until end of June, in most other species until the end of July (later only in the mountains and in cool and fresh biotopes). *Phyllobius* species overwinter only in the larval or pupal stage. It seems noteworthy that the life span of a single adult is apparently rather low. Adults of *P. arborator*, *P. pomaceus* and *P. roboretanus*, which were held in captivity, often died within a few days and achieved rarely an age of more than 1 or 2 weeks.

Feeding plants including aspects of vertical distribution

Phyllobius species are more or less polyphagous and usually feed on lignified plants, on perennial herbs or both. Grasses are apparently an exception in most species treated here. *P. argentatus* prefers forests with deciduous trees, such as *Fagus sylvatica* L., *Quercus robur* L., *Carpinus betulus* L. and *Betula pendula*, and it inhabits *Salix* L. and *Populus* L. species and tree rows. Obviously old and young plants are used equally. According to the current survey *Pyllobius arborator* inhabits in the National Park Harz preferably *Rubus idaeus* and species from the *R. fruticosus* complex along or inside forests. In the Tatra Mountains it was also observed on *Rubus idaeus* and in the herb layer on young deciduous trees such as *Acer pseudoplatanus* L. (P. Sprick, own observation; Knutelski & Sprick 2007). But this species enters tree crowns in high numbers as it was found by several hundred or thousand specimens in the Białowieza National Park (Poland) on deciduous trees such as common oak, silver birch, hornbeam and Norway maple trees by fogging which allows to collect species from the canopy (Sprick & Floren 2007 and unpublished data about tree use).

Phyllobius maculicornis usually lives on shrubs, bushes and young trees, which are well insolated, in light tree stands and forest edges on Rosaceae (e.g., *Crataegus* L., *Malus* Mill.) and several other deciduous trees like *Alnus* Mill., *Acer* L., *Betula* L., *Tilia* L., *Salix* and *Populus*, but rarely in the tree crown. In the National Park Harz many specimens were observed in the 'Feuersteinwiese' near Schierke on singularly growing *Crataegus monogyna* Jacq. bushes, regularly browsed low *Populus tremula* brushwood, and occasionally on *Urtica dioica* L. and browsed, low-growing *Sorbus aucuparia* L. plants. A few specimens were also seen on *Meum athamanticum* Jacq., a perennial herb, in rather good distance to the next tree or bush. This is not sufficient to propose *Meum* Mill. as host plant, but in a green belt in Hannover larvae were collected from the roots of *Corylus avellana* and under the tussock-like root stocks of the sweet grass *Arrhenatherum elatius*, which was obviously never reported previously.

With respect to host plant use a similar situation is true for *Phyllobius pyri*, if the form *vespertinus* is not to be regarded a separate species. *P. pyri* feeds on *Betula pendula, Carpinus betulus, Quercus robur,* broad-leaved *Salix* species, *Populus tremula, Rosa* L.*, Rubus* L. and on strong perennials such as *Cirsium arvense* (L.) Scop. and *Epilobium angustifolium* (L.) Holub (Axelsson et al. 1973) and the – slightly different – form *vespertinus* more or less exclusively on grasses and perhaps perennial herbs growing nearby. From habitat characterisation in Axelsson et al. (1973) it can be supposed that Lekander (1973) described in fact the larva of the form *vespertinus* (instead of *pyri* s.str.) which were not distinguished at that time. The grass *Elymus repens* (L.) Gould contained over 88% of the biomass of the field where the *P. pyri* (s.l.) larvae had been found. Tischler (1985) had already noticed this.

As in *P. viridicollis*, *Phyllobius roboretanus* inhabits usually low-growing plants or the parts of shrubs and young trees, which grow more or less close above the ground. It is found on Rosaceae such as *Prunus spinosa* L., *Rosa* and *Crataegus* as well as on *Quercus* L., *Corylus* and *Acer*, and on perennial herbs. In the National Park Harz where this is a rare species it was found one time in a mesophilous, speciose meadow in rather high numbers on *Vicia sepium*. No other plant was inhabited at this site and in the nitrogen-poorer meadows around, where *Vicia sepium* was present, too, this plant was only inhabited by *P. viridicollis*, a very abundant species in that area.

Phyllobius pomaceus has a distinct preference for *Urtica dioica*. Morris (1997) listed also *Filipendula ulmaria* (L.) Maxim.. *P. virideaeris* inhabits exclusively perennial herbs mainly from the Asteraceae family such as *Tanacetum vulgare, Achillea millefolium* L. and *Artemisia vulgaris* L.. Once this species was found in the moist vegetation around a pond where none of these Asteraceae species occurred. Likely, a non-lignified herbaceous plant, such as *Vicia cracca*, could be a host plant, too.

Phyllobius viridicollis uses a wide range of perennial herbs and deciduous shrubs and trees even if they are still part of the herb or shrub layer. Opposite to species like *P. argentatus, P. arborator* or *Strophosoma melanogrammum* (Forster, 1771) this species usually does not climb tree crowns or the higher parts of shrubs and trees.

KEY TO MATURE LARVAE

This key can be used for all species that were described or re-described in this paper and two further *Phyllobius* species with sufficient characterisation of chaetotaxy: *P intrusus* (Kerr 1949) and *P. oblongus* (Vollmann 1954). For identification of mature *Phyllobius* larvae specimens have to be prepared as described above.

1. All dorsal setae of abdominal segment VIII ordered in line close to posterior margin of the segment (sometimes pds_2 somewhat more medially) **2**

– First dorsal seta (prs/pds_1) placed distinctly more medially than the rest of *pds* **4**

2. Head width over 1.45 mm, body length over 12 mm, basal maxillary palpi two times or more longer than distal ..... ***P.* (*Metaphyllobius*) *pomaceus***

– Head width under 1.07 mm, body length under 9 mm, basal maxillary palpi 1.5 times or less longer than distal **3**

3. Pronotum with 10 setae, basal membranous setae with 6 relatively elongate sb, labrum with 2 pairs of *ams* ..... ***P. (Dieletus) argentatus***

– Pronotum with 9 setae, basal membranous with 5 short sb, labrum with 3 pairs of *ams* ..... ***P.* (*Pterygorrhynchus*) *maculicornis***

4. Head with 1 *ls* only, clypeus without setae ..... ***P.* (*Nemoicus*) *oblongus***

– Head with 2 *ls*, clypeus with 2 pairs of *cls* **5**

5. Head narrowed laterally, sensorium only slightly asymmetric, des_4 present, labrum with 2 pairs of *ams*, mandible with 1 *mds*, mala with 6 *dms* ..... ***P.* (*Subphyllobius*) *virideaeris***

– Head almost oval, sensorium distinctly asymmetric, des_4 absent, labrum with 3 pairs of *ams*, mandible with 2 *mds*, mala with 7 or 8 *dms* **6**

6. Fes_3 present, des_2 distinctly shorter than des_1, stemmata absent ..... ***P.* (*Parnemoicus*) *viridicollis***

– Fes_3 absent, des_2 as long as des_1, stemmata present **7**

7. Pronotum with 7 *prns*, labrum with 2 pairs of *ams* ..... ***P.* (*Parnemoicus*) *roboretanus***

– Pronotum with 9 or 12 *prns*, labrum with 3 pairs of *ams* **8**

8. Des_4 present ..... ***P.* (*Phyllobius*) *intrusus***

– Des_4 absent **9**

9. Frontal suture indistinct, pronotum with 12 *prns*, head with 1 *ves*, mala with 8 *dms* ..... ***P.* (*Phyllobius*) *pyri***

– Frontal suture distinct, pronotum with 9 *prns*, head with 2 *ves*, mala with 7 *dms* ..... ***P.* (*Phyllobius*) *arborator***

Systematic problems

The study of the description of the larva of *Phyllobius intrusus* by Kerr (1949) did not provide significant features to place this species in the genus *Parascythopus* (see Alonso-Zarazaga et al. 2017). We regard this placement as provisional as the genus *Parascythopus* is of Southeast European and Near Eastern and *P. intrusus* of East Asian origin. The larva of *P. intrusus* is trouble-free keyed out between *Phyllobius* species, but the placement in the subgenus *Phyllobius* is doubtful, as des_4 is absent. The isolated position of *P. intrusus* is supported by its particular host plant use, coniferous trees from the Thujaceae family.

The elementary work of van Emden (1952) still remains the most comprehensive source of information about *Phyllobius* larvae. Besides a general description, it contains descriptions and a key to mature larvae of *P. arborator*, *P. glaucus* (Scopoli, 1763) (as *P. calcaratus* (Fabricius, 1792)), *P. intrusus*, *P. oblongus*, *P. pomaceus* (as *P. urticae* (DeGeer, 1775)), *P. pyri*, and *P. virideaeris*, and additionally a key to first instar larvae of *P. argentatus, P. glaucus, P. maculicornis*, *P. oblongus, P. pyri*, *P. virideaeris*, and *P. viridicollis*. Van Emden emphasized the general uniformity of *Phyllobius* larvae and revealed only a low number of distinguishing characters (e.g. proportion of setae, presence or lack of some microsetae). At the same time van Emden (1952) reported about differences between young and mature instars and about intraspecific variety. But in some passages text and figures do not correspond: spiracular setae of thoracic segments are not mentioned in the general description, but shown on some figures. Furthermore, van Emden (1952) reported about 4 - 5 postdorsal setae on abdominal segment VIII, but he did not describe the position of the pronotal setae.

It seems to be very important and should be taken into consideration that all dorsal folds of abdominal segment VIII are fused. For example, in the description of *Ph. glaucus* seta "*a*" = *prs* on abdominal segment VIII is still present, and seta "*c*" = pds_2 is vanished. But the respective figure shows in fact the absence of seta "*a*" = *prs* and the presence of five *pds* (with still existing seta "*c*" = pds_2). In addition, Kerr (1949) reported inconclusive about the medial position of the first dorsal seta (*prs* or pds_1?). Finally it was not expressed unambiguously, if the reduction of the number of setae on abdominal segment VIII (designated by van Emden as typical for *Phyllobius*) is caused by the lack of either *prs* or pds_1. The material analyzed during our study confirmed all difficulties described before by van Emden (1952). Only a rather small number of species (e.g., *Ph. pomaceus* or *Ph. pyri*) can be easily distinguished from other described *Phyllobius* species due to the presence of some well visible features (e.g., absence of the frontal suture or large body size).

The description of the *Phyllobius arborator* larva by van Emden (1952) has apparently to be referred to another species (or even genus), as this species does not occur at the west coast of Schleswig-Holstein („Friedrichskoog") or in Denmark („Amager"), the origin of the larvae (see Palm 1996). Van Emden (1952) himself had some doubts and marked the description of the *P. arborator* larva with an asterisk.

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