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**The head and alimentary canal of a larva of
Byturus tomentosus DeGeer, 1774
(Coleoptera, Byturidae)**

by Jiří Kolibáč

Abstract. The ventral side of the cranium, the mouth parts (maxilla, mandible, labium, labrum) and alimentary canal of a larva of *Byturus tomentosus* DeGeer, 1774 were studied. Ink drawings and photographs of the body parts are provided. The relations of the observed structures to those in Cleroidea larvae are briefly discussed.

Keywords. Coleoptera – *Byturus tomentosus* – larva – morphology

Introduction

The family Byturidae used to be classified within the traditional superfamily Cucujoidea and considered a relative of Biphyllidae, often placed near Erotylidae (CROWSON 1955; LAWRENCE & NEWTON 1982, 1995). In a recent phylogenetic study based on molecular data (HUNT *et al.* 2007), the authors classify Byturidae and Biphyllidae as basal taxa of Cleroidea, together with Phloiophilidae. This means that a morphology of Byturidae is important to the future study of relations among families of Cleroidea and Cucujoidea (see also BEUTEL & POLLOCK 2000, BEUTEL & SLIPINSKI 2001, LESCHEN *et al.* 2005).

The larva of the raspberry beetle *Byturus tomentosus* DeGeer, 1774 is well known and has been studied several times (e.g., BÖVING & CRAIGHEAD 1931, KLAUSNITZER 2001, LAWRENCE 1991, VAN EMDEN 1942). In this communication, some body parts are examined in detail.

Larva of *Byturus tomentosus* DeGeer, 1774

(Figs 1–9)

Description. Head prognathous and protracted, distinctly pigmented, transverse, sides rounded, with about 20 long setae on the dorsal surface (Fig. 6) and about 12 shorter setae on the ventral surface (Fig. 7).

Cranium (Figs 6, 7, 8): frontal arms curved (lyriform), contiguous at base (Fig. 6); endocarina and epicranial stem absent; five ocelli in pattern 3–2; frontoclypeal suture absent, clypeus protracted (Fig. 6); gular sutures distinct; gular area with two apodemes; hypostomal rods as long as half of cranium; paragular sclerites absent; hypostomal bracon absent (Fig. 7); socket and short, stout seta (Fig. 8) situated in anterior corner of hypostomal margin near ventral mandibular articulation (term after LAWRENCE 1991).¹⁾

¹⁾The “ventral mandibular articulation” is the site in the hypostomal area of the ventral surface of the cranium where the mandible is joined to the cranium.

Antenna (Figs 4, 8): first antennal segment transverse, second and third elongate; sensory appendix nearly as long as third segment.

Maxilla (Figs 2, 9): cardo transverse, triangular, much smaller than stipes; stipes elongate, coalescent with mala; maxillary palpi 3-segmented, first and second segments weakly transverse, third elongate; apex of lacinia with about 9 stout, pale setae and 3 blunt, dark-pigmented thorns (Fig. 2: several pale setae covering the thorns removed); pedunculate seta absent.

Labium (Fig. 2): ligula membranous, semitransparent in upper portion and pigmented at base, with fine setae along margin; prementum well-developed; mentum fused with prementum or reduced in size; setose, pigmented and sclerotized band situated along each side margin of anterior part of labium (marked as “band” in Fig. 2); two long setae occur in membrane between postmentum and prementum; postmentum elongate, weakly sclerotized, with four long setae.

Labrum (Fig. 1): strongly transverse, anterior margin rounded; setae variable in length, irregularly arranged; basal 2/3 of labrum weakly pigmented. Torma composed of single heavily sclerotized complex formation; torma is figured together with labrum in Fig. 1 but is attached between mandibles and hypopharynx, not to epipharynx (hypopharyngeal sclerome?).

Mandible (Fig. 5): symmetrical; bidentate, ventral apical tooth situated next to the dorsal tooth but at a slightly lower level; medial tooth absent; mola large, tuberculate, with hyaline setose lobe at base; protheca absent; ventral condyle situated approximately halfway along mandibular base; basal notch shallow, sinuate.

Alimentary canal (Fig. 3): surface of ileum and ventriculus smooth, without papillae or net-like structure; six Malpighian tubules present, all of same length; pyloric valve not visible, without outer lobes; recurvation of ileum weak; ileum relatively long, approximately as long as ventriculus.

Remarks. When compared with known larvae of Cleroidea, the following similarities in selected characters appear (references marked by a superscript number are listed at the end of the section):

- (1) Gula with two anteriorly-situated apodemes. This state also occurs in *Thymalus limbatus* Fabricius, *Peltis ferruginea* Linnaeus, *Phloiophilus edwardsi* Stephens, *Protopeltis viridescens* Broun, *Larinotus umblicatus* Carter et Zeck (all Phloiophilidae, Trogossitidae¹). This feature is considered a plesiomorphy. It also occurs, for example, in *Elateroides dermestoides* Linnaeus and *Lymexylon navale* Linnaeus (Lymexylidae⁴; referred to as “tentorium” by KOLIBÁČ 2002). It has never been found in families of Cleroidea other than Trogossitidae.
- (2) Hypostomal bracon or hypostomal margin (in anterior part of cranium) absent, cranium ventrally “open”. The same state can be found in the Melyrid branch of Cleroidea, especially in Malachiidae⁷.
- (3) Clypeus protracted. This state is unknown in Cleroidea, in which the clypeus is absent and the anterior dorsal (epistomal) margin of the cranium is mostly straight or concave (emarginate)^{2,6}.

- (4) Socket and short, stout seta situated in protracted anterior corner of hypostomal margin near ventral mandibular articulation. This character is unknown in Cleroidea, in which the ventral condyle of the mandibles is jointed in the ventral mandibular articulation in the cranium^{2,6}. In *Byturus tomentosus*, the ventral condyle is shifted towards the middle of the mandibular base and touches the seta in the socket when the mandible moves (observed in an undissected specimen).
- (5) Ventral condyle situated near the middle of mandibular base: a state unknown in Cleroidea, in which a differently-shaped condyle is always situated at the outer edge of the mandibular base and is jointed to the cranium by the ventral mandibular articulation^{2,3,6}.
- (6) Setose lobe beneath mandibular mola. This character is unknown in mandibles of Cleroidea, whether the taxa are with or without mola^{2,3,5,6}.
- (7) The formation shown together with the labrum (Fig. 1) is very similar to that found in *Idgia* sp. (Prionoceridae)³; however, the sclerite in *Byturus tomentosus* is attached between the mandibles and hypopharynx and it is probably homologous with a “hypopharyngeal sclerome”⁸. A torva or tormal sclerite with various apodemes should be attached to the epipharynx^{2,3,6}. This state can be found in all known cleroid larvae; it should, however, be checked.
- (8) Maxillary mala with two large thorns and one small, pigmented thorn. Such thorns are unknown in Cleroidea. However, the bidentate projection of the mala (*Thymalus limbatus* Fabricius, *Phloiophilus edwardsi* Stephens, *Protopeltis viridescens* Broun) may be derived from these thorns^{1,6}.
- (9) Labium without mentum, only “prementum” and postmentum developed. This state is common in all Trogossitidae⁶ and some Cleridae². Separation of prementum, mentum and postmentum is developed in Thanerocleridae⁵, Metaxinidae⁵ and some Cleridae².
- (10) Sensory appendix large, nearly as long as the third antennal segment. This state is known in *Thymalus limbatus* Fabricius (Trogossitidae)⁶ and *Phloiophilus edwardsi* Stephens (Phloiophilidae)⁶; the sensory appendix is also large in *Melyris scutellaris* Mulsant (Melyridae)⁷ and *Lophocateres pusillus* Klug (Trogossitidae)⁶.

Literature. CROWSON 1964¹; KOLIBÁČ 1997², 1999³, 2002⁴, 2004⁵, 2006⁶; KOLIBÁČ *et al.* 2005⁷; LAWRENCE 1991⁸.

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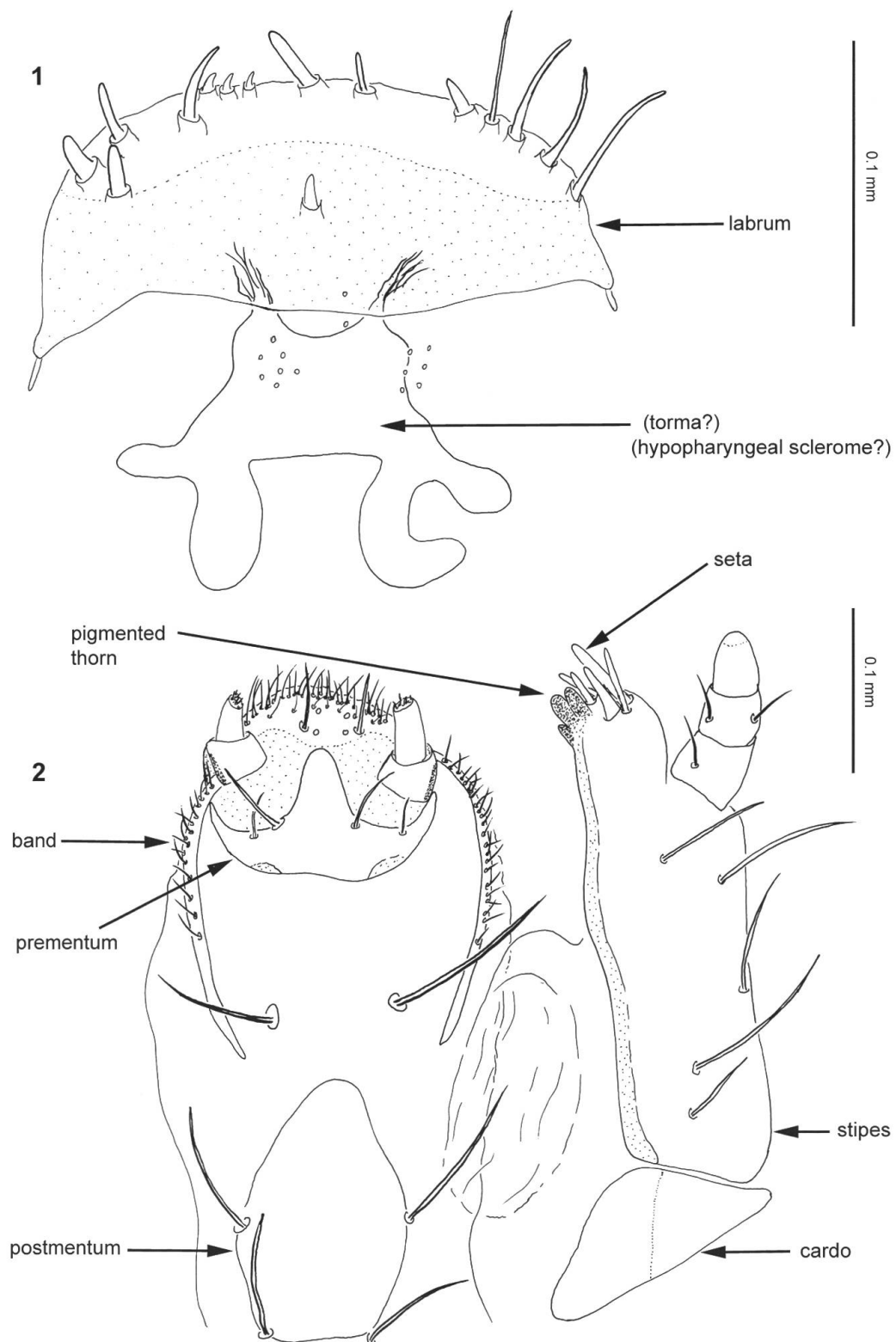
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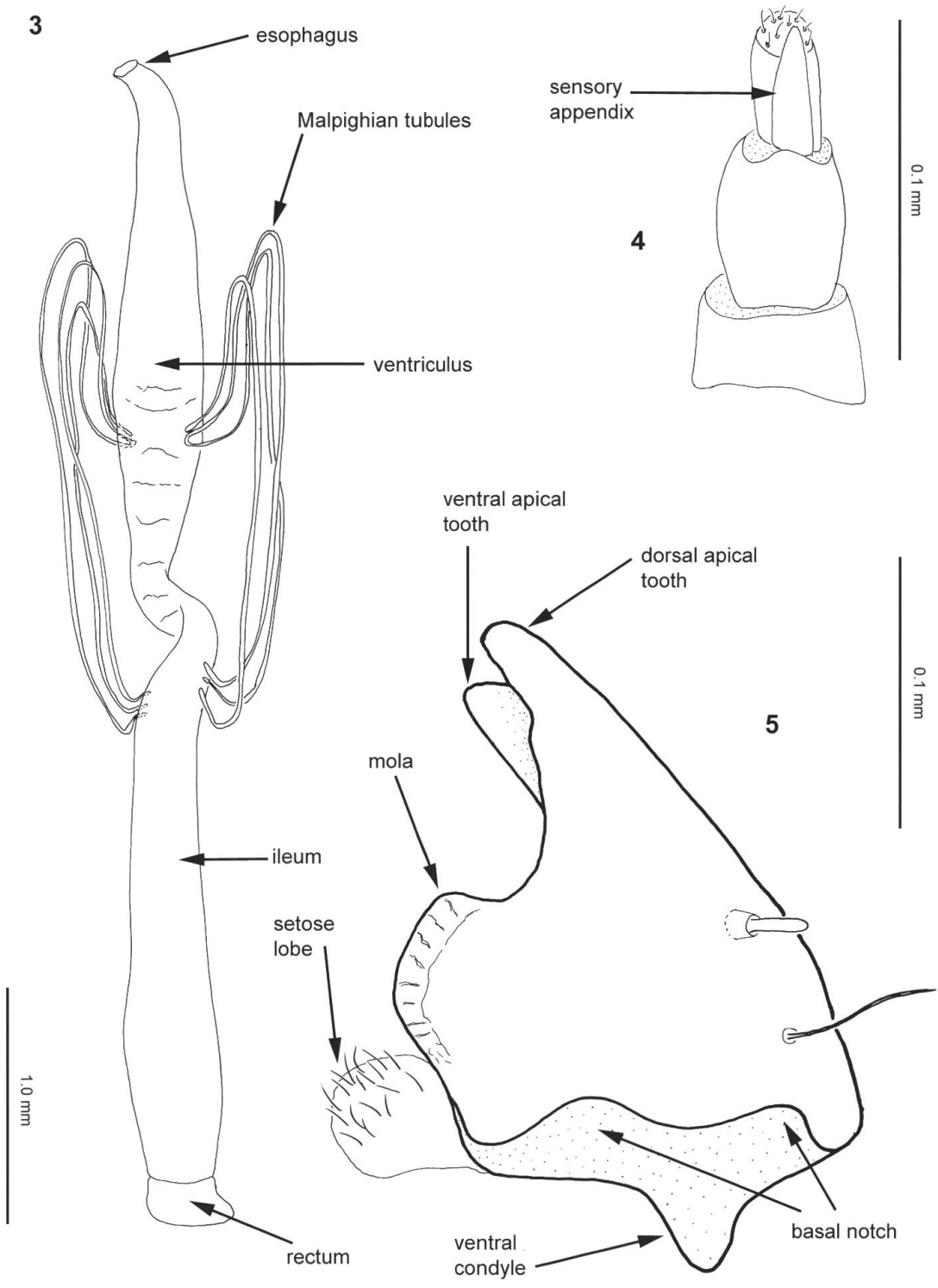
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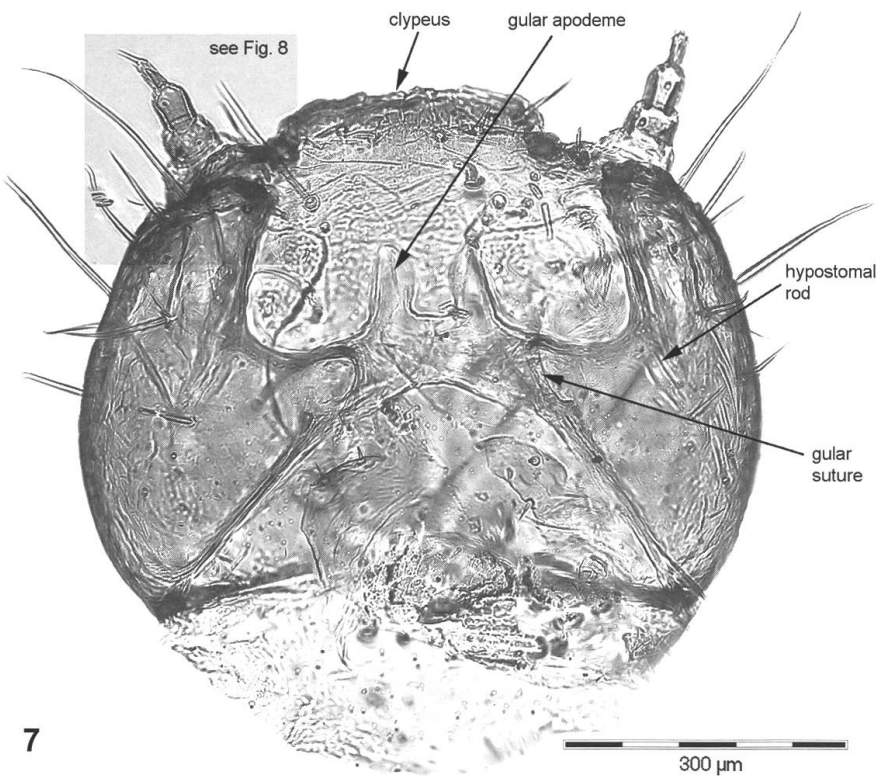
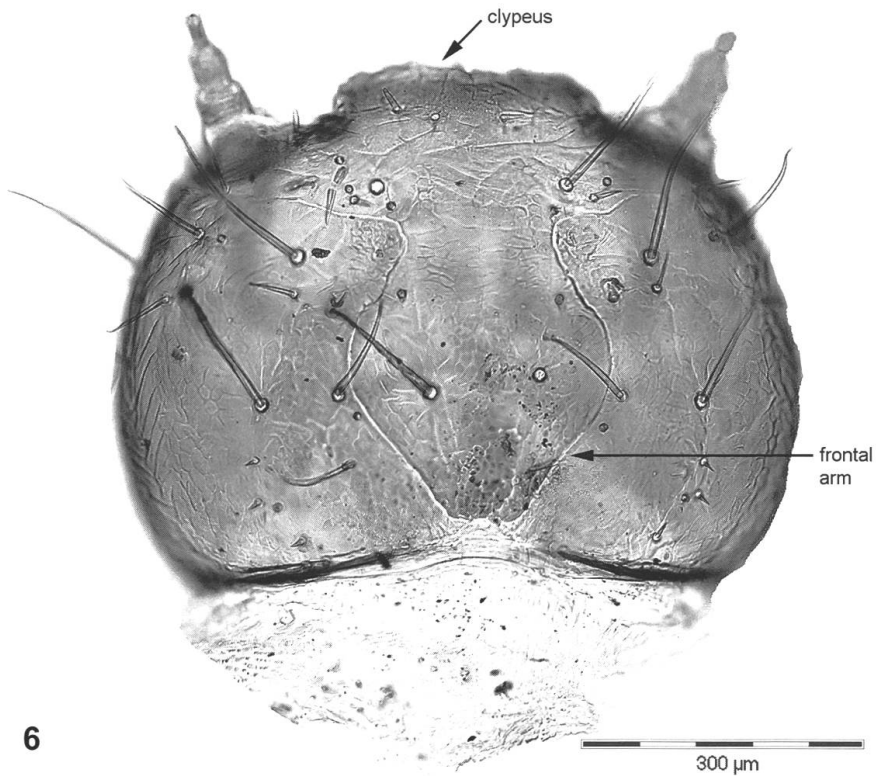
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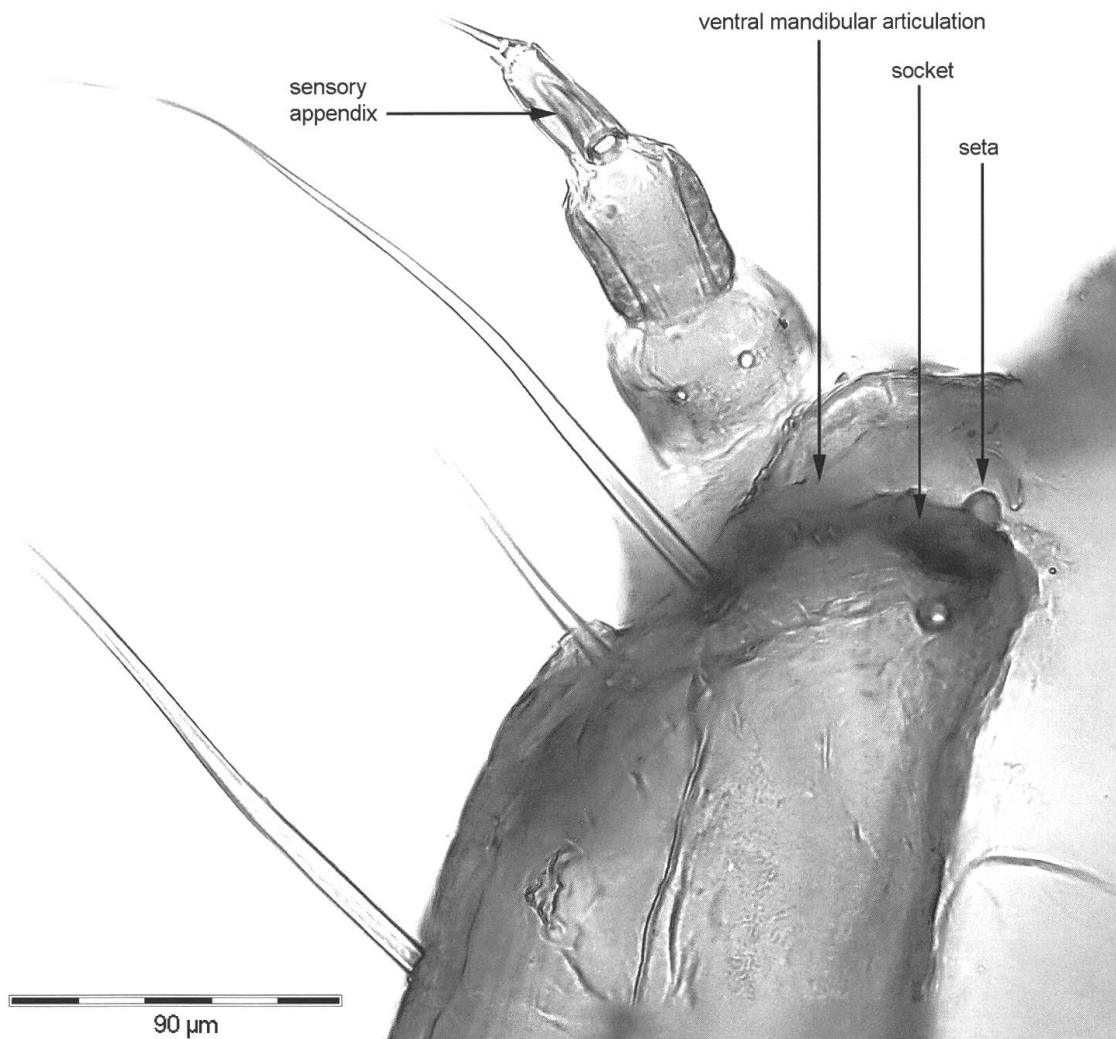
Figs 1–2. 1 – labrum and hypopharyngeal sclerome or torma, 2 – maxillolabial complex (left maxilla removed, setae covering pigmented thorns in mala removed).



Figs 3–5. 3 – alimentary canal, 4 – antenna, 5 – right mandible dorsally.

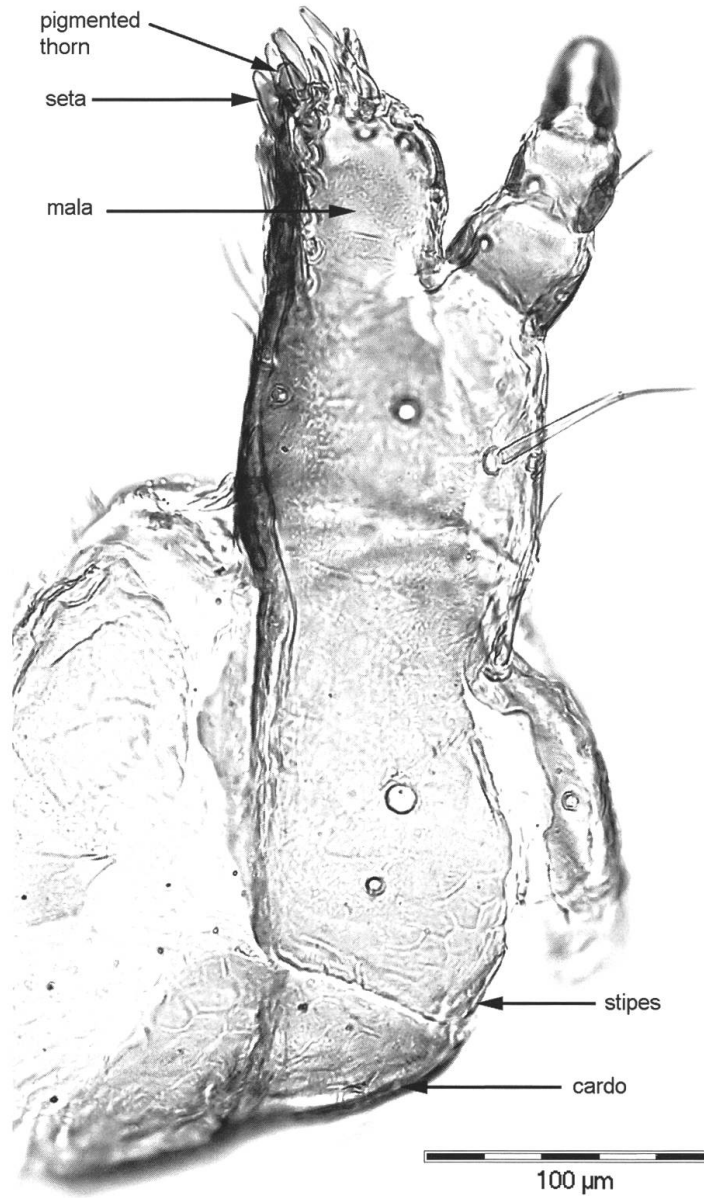


Figs 6–7. 6 – Cranium dorsally (labrum, mandibles, maxillolabial complex removed); 7 – Cranium ventrally (labrum, mandibles, maxillolabial complex removed). Photo by I. Malenovský and J. Kolibáč (Olympus BX41 + C 5060, Helicon Focus 4.21©).



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Fig. 8. Cranium and antenna, ventral view. A detail of the ventral mandibular articulation area. Photo by I. Malenovský and J. Kolibáč (Olympus BX41 + C 5060, Helicon Focus 4.21©).



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Fig. 9. Right maxilla (including all setae in mala). Photo by I. Malenovský and J. Kolibáč (Olympus BX41 + C 5060).

