

# The Tömösváry organs are absent in flat-backed millipedes (Diplopoda: Polydesmida)

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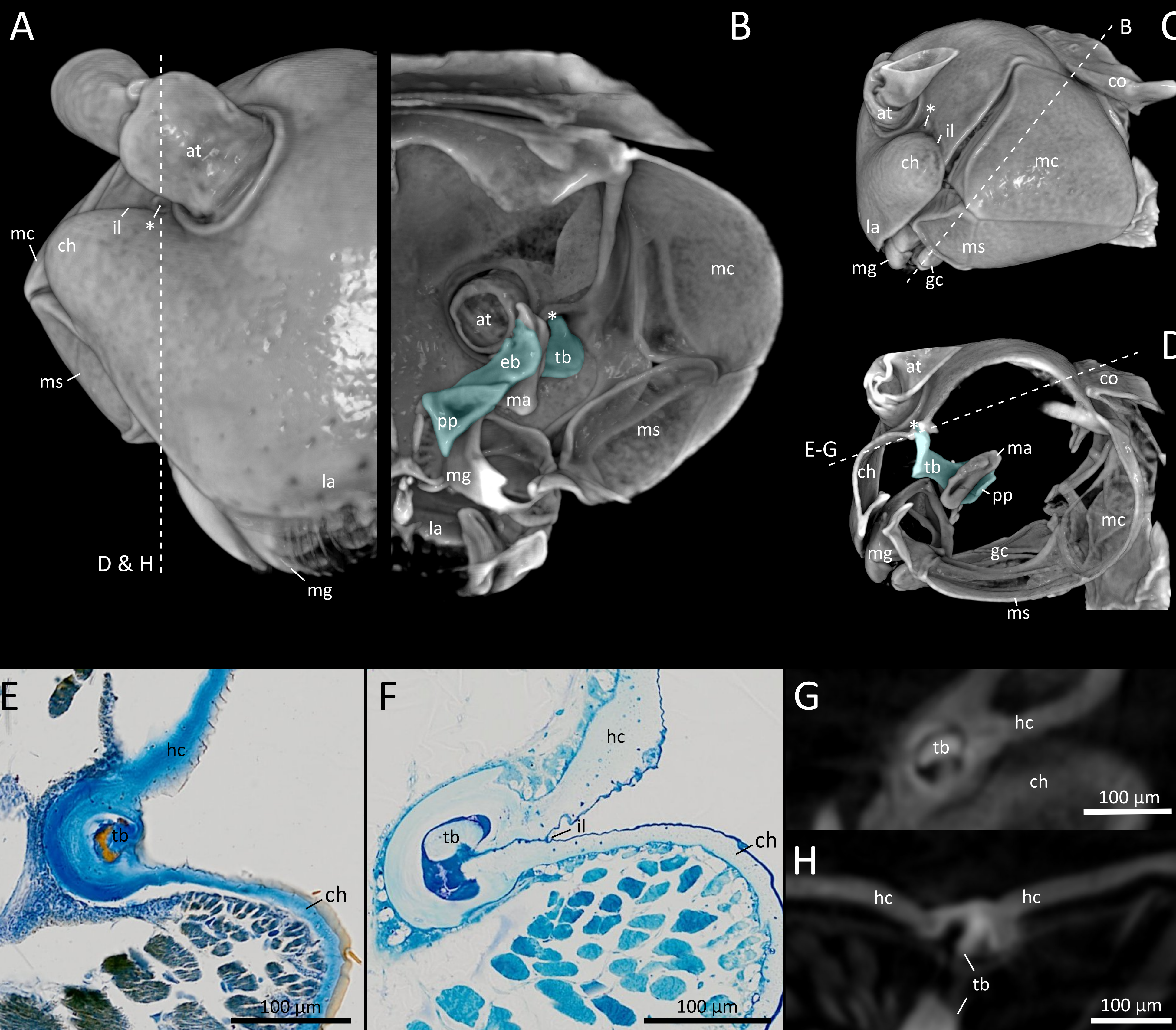
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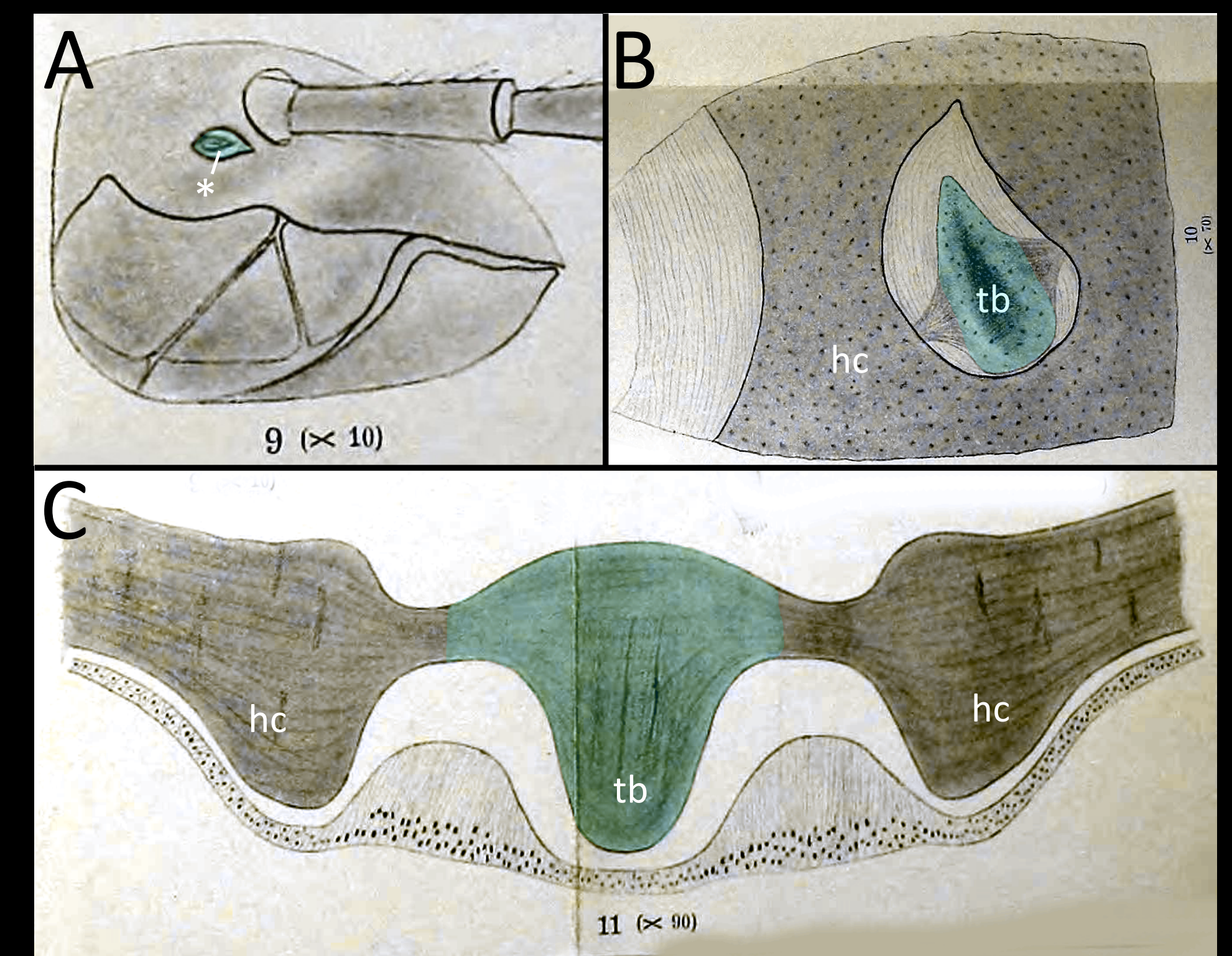
**INTRODUCTION** The Tömösváry organ (TO) is a sensory structure on the head of millipedes (Diplopoda) and other terrestrial Mandibulata, although its homology and function is uncertain. The TO is often used as character (absence/presence, position, shape) in taxonomic descriptions and phylogenetic analyses. For the Polydesmida, the most diverse millipede order, the presence of a TO is frequently stated in recent publications with reference to Attems (1898) and Hennings (1906, Fig. 1), the latter giving the only detailed description of the organ for the Polydesmida. Its presence in the Polydesmida, however, was refuted by Seifert (1932), and some myriapodologists accordingly consider its absence as being "common knowledge". We reconsider the alleged TO in the polydesmids to clarify the issue.



**Figure 2:** *Polydesmus angustus*, head. A–D Volume rendering based on  $\mu$ CT-data (blue = tentorium). A Frontal view. B Internal view from posterior, cutting plane as indicated in C. C Lateral view. D Internal view from lateral, cutting plane as indicated in A. E–H Detail of connection of tentorial transverse bar to head capsule at incisura lateralis, cutting planes as indicated in A&D. E Histological section (Paraffin, Azan-staining). F Histological section (Araldite, Toluidine). G&H Virtual section from  $\mu$ CT-scan. **Abbreviations:** at = antennae, ch = "cheek", co = collum, eb = epipharyngeal bar of tentorium, gc = gnathochilarium, hc = head capsule, il = incisura lateralis, la = labrum, ma = mandible apodeme, mc = mandibular cardo, mg = mandibular gnathal lobe, ms = mandibular stipes, pp = posterior process of tentorium, tb = transverse bar of tentorium. Asterisk (\*) indicates structure previously interpreted by Hennings (1906) as TO in the Polydesmida.

**DISCUSSION** Hennings (1906) described the alleged Tömösváry organ of the Polydesmida as a pear-shaped pit covered by a membrane with a median hard swelling. In our studies these structures do not reveal any characteristics of sensory organs. The pit proved to be a part of the incisura lateralis (compare Figs 1B to 2G & Figs 1C to 2H) and the median swelling as a part of the tentorial complex projecting through the head capsule. The absence of the TO in the Polydesmida is a character shared with the Colobognatha, Stemmliulida (?) and Juliformia (Fig. 3) with which they variably cluster in some phylogenetic studies based on molecular data. The absence of the TO in the Polydesmida does not alter the phylogenetic hypothesis inferred from morphology by Blanke & Wesener (2014).

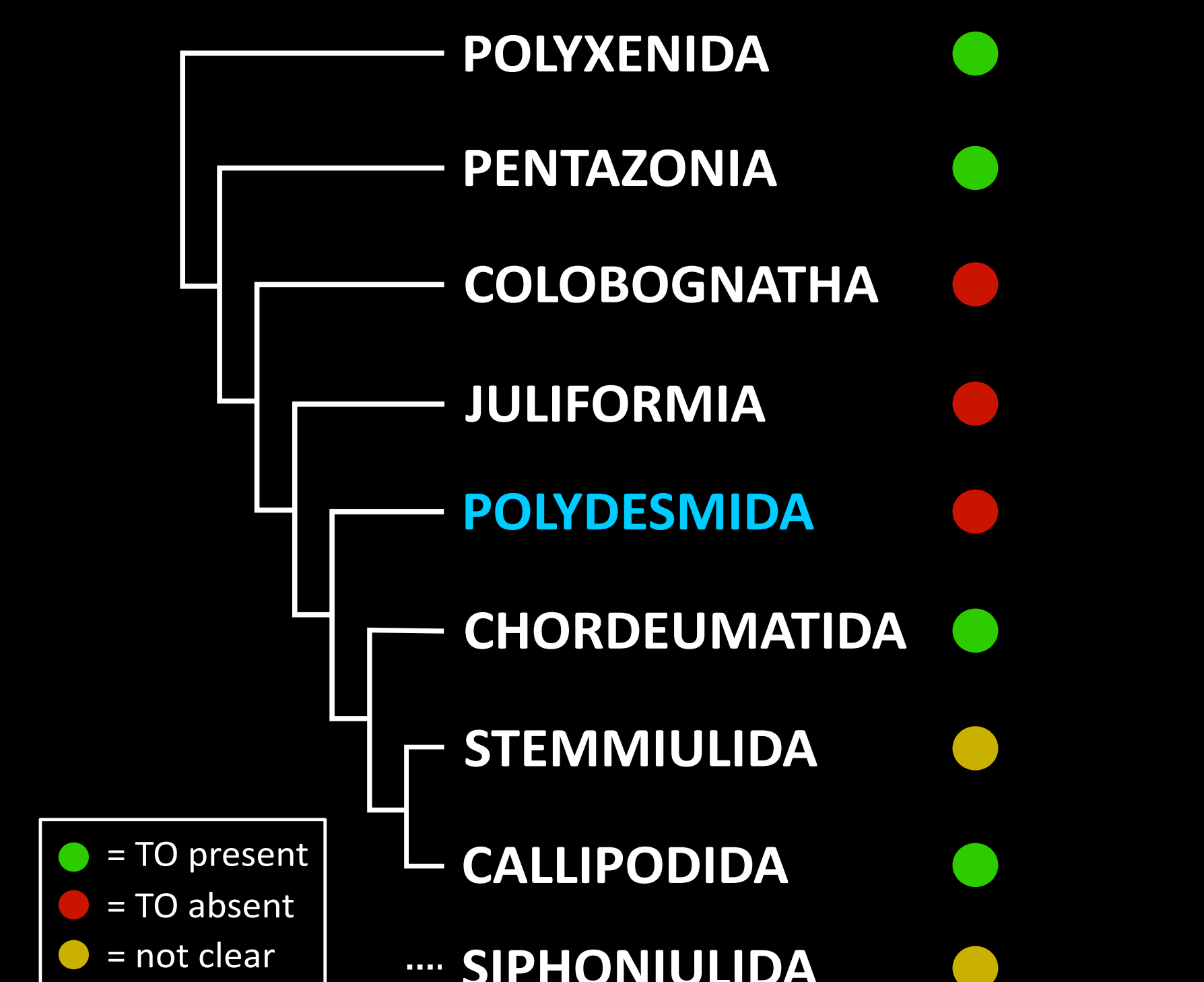
**ACKNOWLEDGEMENTS** We thank Christiane Wallnisch and Tatjana Bartz for their assistance with the histological work at the IEZ.  $\mu$ CT-Scans have been made at the ZFMK. We are grateful to Thomas Bartolomaeus, Thomas Wesener, Jörn von Döhren, Patrick Beckers and Peter Rühr for discussions and support.



**Figure 1:** The Tömösváry organ of the polydesmidan *Eurydesmus laxus*? Modified from Hennings (1906; Tafel XXXLI 9-10). A Head lateral view. B Detail of organ after mazeration with KOH. C Cross-section through organ. Abbreviations: hc = head capsule, tb = tentorial transverse bar, \* = structure formerly described as TO.

**MATERIAL & METHODS** *Polydesmus angustus* (Latzel, 1884) was investigated with micro-computer tomography (SKYSCAN1272) and histology (Paraffin (as done by Hennings 1906) & Araldit). Volume rendering was performed in Drishti 2.6.3 (Fig. 2A-D).

**RESULTS** At the position of the structure formerly interpreted as Tömösváry organ (Fig. 1A), the tentorial transverse bar projects through the open incisura lateralis. From the outside the transverse bar appears oval in shape (Figs 2A-D). The cuticle of the head capsule surrounds the transverse bar completely, but remains separated from it by the thin epicuticle (Figs 2E-G). No nervous tissue is associated to the structure.



**Figure 3:** The distribution of the Tömösváry organ across the Diplopoda according to the literature (phylogenetic hypothesis modified from Blanke & Wesener 2014).

**REFERENCES** Attems C (1898) System der Polydesmiden 1. Theil. *Denkschr.-Österr.Akad.Wiss.Math.-Naturwiss.Kl.*, 67: 1-262  
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