

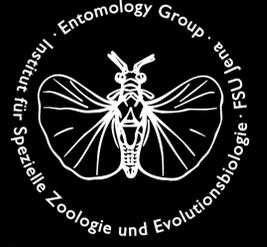


Raptorial phantom midges

The larval head morphology of *Chaoborus crystallinus*

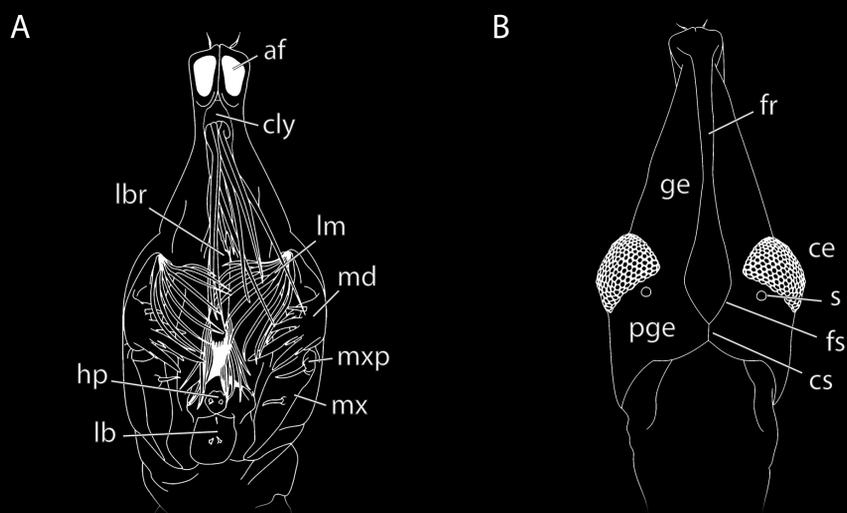
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Introduction

The larvae of phantom midges or Chaoboridae are nearly non-pigmented and only weakly sclerotized. They exclusively live in standing water feeding on copepods and water fleas. They capture the prey with their raptorial antennae, a unique snatching mechanism within Diptera. The homology of the larval head structures has not been completely resolved up to now. A closer analysis of inner structures and mouthparts of *Chaoborus crystallinus* De Geer 1776 contributes to answer questions of homology and the understanding of the functional morphology of the feeding mechanism.



Chaoborus crystallinus head. A) ventral view. B) dorsal view.

Results and Discussion

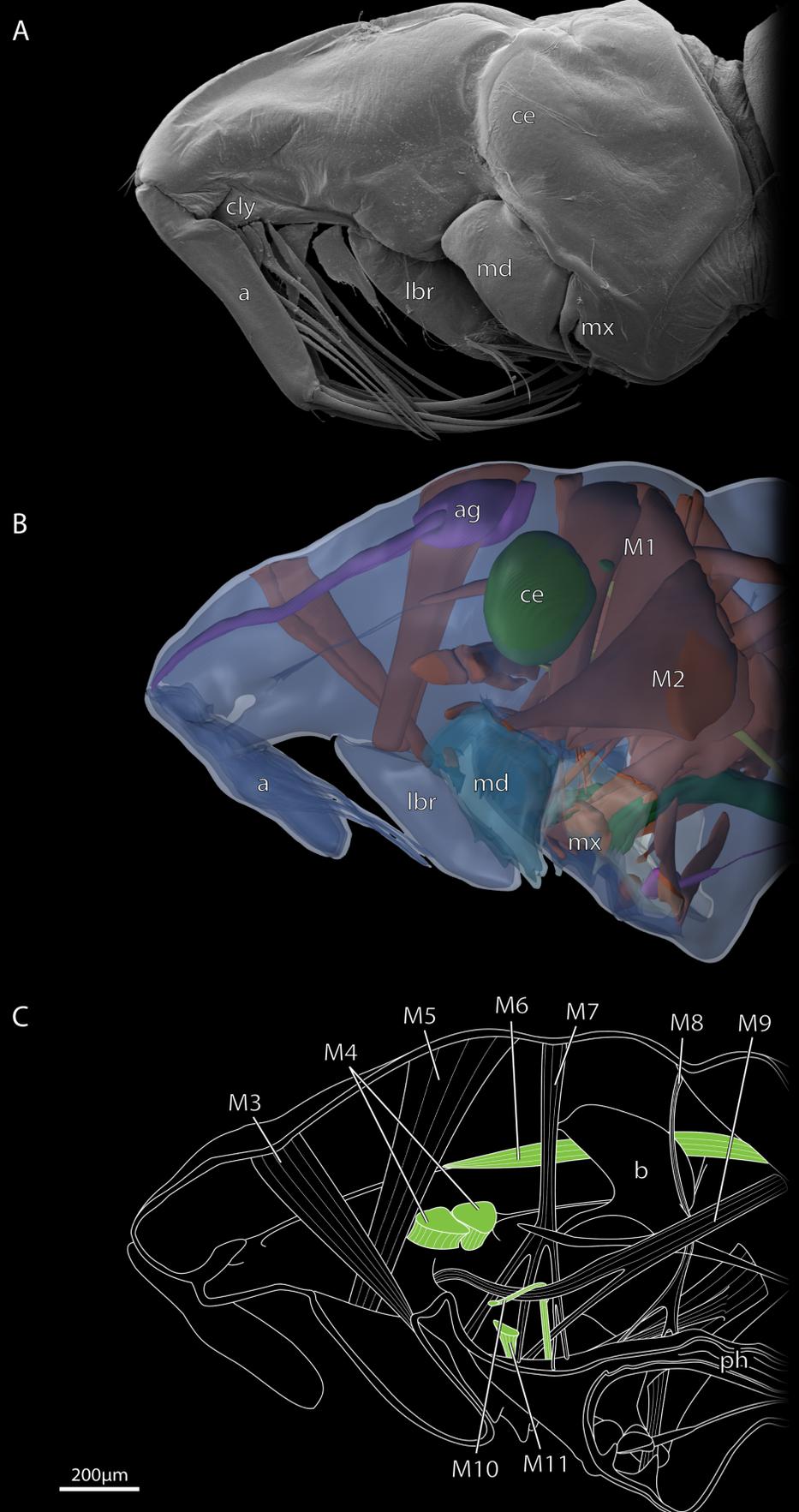
The close-set antennae can be regarded analogous to the mantid raptorial forelegs. They are monadic, elongated and highly sclerotized. Located in front of the compound eyes, they provide improved catching coordination.

Their abduction is caused indirectly by the contraction of M4 increasing the haemolymph pressure in the head capsule. M10 and M11 also contribute to this function by stabilizing the membranous mouth region. The mouthparts are located more ventrally. The labrum is narrow, highly elongated and largely sclerotized. Its non-sclerotized parts are equipped with brushes. The labium and the

maxillae are greatly reduced. The mandibles are abducted by M2 and the labrum depressed by M3, they are specialized in fastening the prey.

During the snatching process, M6 accomplishes the adduction of the antennae. The labrum is elevated by M5 and the mandibles adducted by M1. Thus, the lacinia mobilis forms a rake confining the prey.

Nevertheless, the homologization of some head structures is very problematic and further studies are necessary. It may give a better understanding of phylogenetic relationships of the Chaoboridae and the evolution of this unique snatching apparatus.



Lateral view of the head of *Chaoborus crystallinus*. Antennae in resting position. A) scanning electron microscopy. B) 3D reconstruction, cuticula transparent. C) morphological scheme of inner head structures, sagittal section, mandibular and maxillary muscles removed, focused muscles colored in green. M4, M10, M11, are not homologized yet.

Abbreviations

a, antenna; af, antennal fossa; ag, imaginal anlage; b, brain; ce, compound eye; cly, clypeus; cs, coronal suture; fr, frons; fs, frontal suture; ge, gena; lb, labium; lbr, labrum; lm, lacinia mobilis; md, mandible; mx, maxilla; mxp, maxillary palp; hp, hypopharynx; pge, postgena; s, stemma.

M1/M2, M. craniomandibularis internus/externus; M3, M. frontoepipharyngalis; M5, M. frontolabralis; M6, M. tentorioscapalis posterior; M7, M. frontobuccalis anterior/posterior; M8, M. verticopharyngalis; M9, M. retractorcibarum.

Acknowledgements

Suggestions and comments made by R. G. Beutel and H. Pohl have greatly helped to improve the poster. We thank Patrick Arnold and Jan Wölfer for their support.