

A Case of Pupa Adheraena in *Amphiops mater* Sharp (Coleoptera: Hydrophilidae)

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Abstract: The pupae of *Amphiops* were often observed attached horizontally to twigs or floating objects. In the present paper, the author reports a case of pupa adheraena in *A. mater* Sharp, 1873, which was hanging under a plastic cover under artificial conditions. Furthermore, the potential morphological adaptations for the floating behavior in *Amphiops* pupae are discussed.

Keywords: Pupation, behavior, water scavenger beetle, immature stage

Pupation is a crucial stage for holometabolous insects in which morphology and internal anatomy transforms from larval to adult. *Amphiops* beetles form the basal clade of the family Hydrophilidae (Short & Fikáček, 2013), implying that understanding their biology will improve our knowledge of the evolution of the family. Furthermore, the pupation behavior of *Amphiops* is unique in the family. Their pupae either attached their head to twigs (Watts, 2002) or float on the water after pupation (Kuwabara & Hayashi, 2022), in contrast to most other aquatic hydrophilid larvae which build a pupal chamber on the ground. In the present paper, the author reports an observation of pupa adheraena in *Amphiops mater* Sharp, 1873 under artificial conditions.

The larvae of *A. mater* were obtained during captive breeding. The beetle larvae were kept in a small plastic cup with tissue paper at the bottom and shallow water at room temperature. In addition, the frozen larvae of *Chironomus* sp. were provided for the beetle larvae as a food source.

Most individuals ($n > 20$) pupated on the surface of tissue paper or attached to the plastic wall of the cup. A single individual attached its exuvia to the plastic cover of the cup, and pupated partly enclosed in the larval exuvia, with the larval head attached to the pronotal part of the pupa (Fig. 1). After two days, the beetle failed to eclose and died.

The Australian *A. queenslandicus* Balfour-Browne used their head attached to the twigs when pupating, but how they attached to the surface remains unknown (Watts, 2002). The pupae of *A. mater* can be easily removed from the twigs on which they pupate (Kuwabara & Hayashi, 2022). It remains unclear whether the different pupation behavior is due to variation between species or other factors. Regarding the pupa adheraena of *A. mater*, it is possible that the larva failed to remove the head exuvia, leading to it not easily leaving the larval exuvia like other individuals. The unusual morphology of the pupa of *Amphiops* was noticed by Watts (2002). The absence of setae and the presence of flaky appendages along the lateral side of the abdomen may provide an advantage for floating and the shield-like dorsal surface may help the beetles evade predators. Both characters are considered as potential morphological adaptations for the floating behavior observed in Kuwabara & Hayashi (2022). Further observations of the pupation of *Amphiops* are needed to understand the pupation biology and survival strategy of the beetles.

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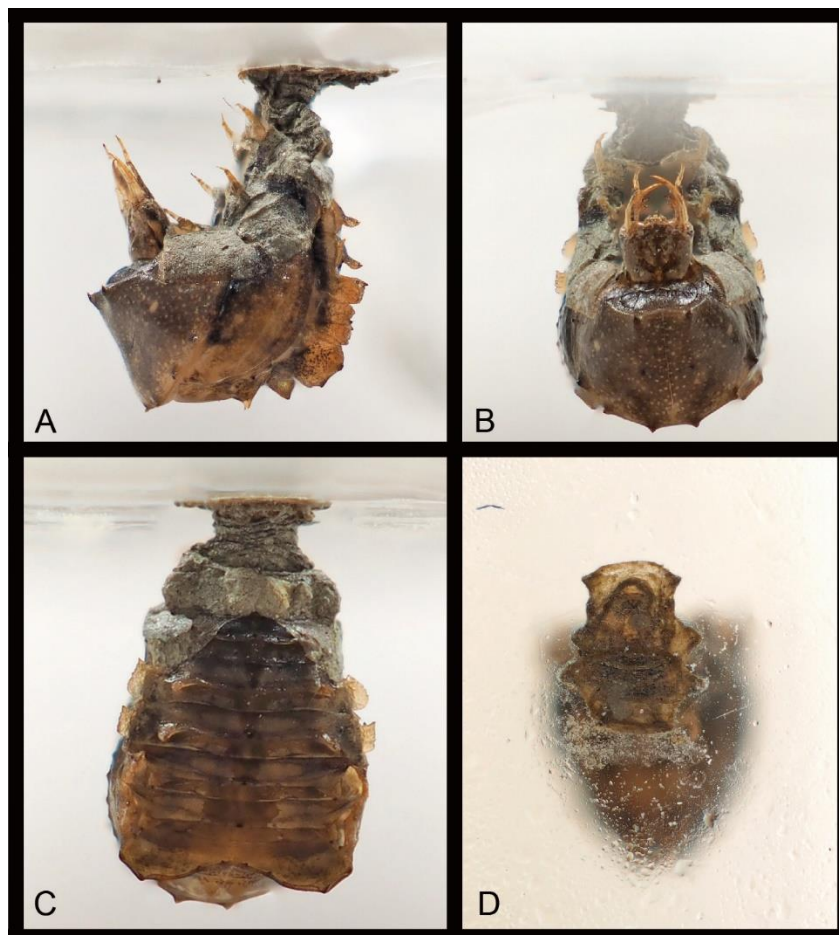


Figure 1. The pupa adhaena of *Amphips mater* Sharp, 1873. A, lateral view; B, anterior view; C, posterior view; D, the attached point of the larval exuvia.

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瑪球牙蟲吊蛹案例（鞘翅目：牙蟲科）

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摘要：大多數球牙蟲屬 (*Amphips*) 化蛹時多被觀察到水平依附在枝條或漂浮物上，本文作者報導瑪球牙蟲 (*A. mater* Sharp) 吊蛹的紀錄，其在人工環境下懸掛於塑膠蓋下方。本文亦討論球牙蟲的蛹對於漂浮行為可能地形態適應。

關鍵字：化蛹、行為、牙蟲、幼生期