

On larvae of soft-winged flower beetles (Coleoptera: Melyridae and Rhadalidae) found in oothecae of mantises (Mantodea: Mantidae)

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Abstract

First records of the association between larvae of melyrid and rhadalid soft-winged flower beetles (Coleoptera) and mantid oothecae (Mantodea) are reported: *Anthocomus fasciatus* (LINNAEUS, 1758) (Melyridae: Malachiinae) and *Dasytes aeratus* STEPHENS, 1830 (Melyridae: Dasytinae) were reared from old oothecae of *Hierodula tenuidentata* SAUSSURE, 1869 (Mantidae: Hierodulinae) collected in Romania. *Aplocnemus pectinatus* (KÜSTER, 1849) (Rhadalidae: Rhadalinae) was reared from an ootheca of *Mantis religiosa* (LINNAEUS, 1758) (Mantidae: Mantinae) collected on Gozo (Maltese Archipelago).

Key words: Coleoptera, Mantodea, larvae, microhabitat, oothecae, trophic ecology, *Anthocomus fasciatus*, *Aplocnemus pectinatus*, *Dasytes aeratus*, *Hierodula tenuidentata*, *Mantis religiosa*, Malta, Romania.

Zusammenfassung

Erstmalige Belege für eine Beziehung zwischen Larven von Wollhaar- und Zipfelkäfern (Coleoptera: Melyridae, Rhadalidae) und Fangschrecken-Ootheken (Mantodea: Mantidae) werden mitgeteilt: *Anthocomus fasciatus* (LINNAEUS, 1758) (Melyridae: Malachiinae) und *Dasytes aeratus* STEPHENS, 1830 (Melyridae: Dasytinae) wurden aus alten Ootheken von *Hierodula tenuidentata* SAUSSURE, 1869 (Mantidae: Hierodulinae) gezüchtet, die in Rumänien gesammelt wurden. Aus einer Oothek von *Mantis religiosa* (LINNAEUS, 1758) (Mantidae: Mantinae) von der Insel Gozo im Maltesischen Archipel wurde *Aplocnemus pectinatus* (KÜSTER, 1849) (Rhadalidae: Rhadalinae) gezogen.

Introduction

An association between beetles and oothecae of mantises was heretofore known only for skin beetles (Coleoptera: Dermestidae). The behavioral relationship is usually interpreted as predation (RAMSEY 1990). Species of the genera *Anthrenocerus* ARROW, 1915 (RAMSEY 1990), *Dermestes* LINNAEUS, 1758 (HAWKESWOOD 1988), *Orphinus* MOTSCHULSKY, 1858 (COOMBS 1994), *Thaumaglossa* REDTENBACHER, 1867 (ARROW 1915, HÁVA 2006a, 2006b, HÁVA & MÉRIGUET 2018, HAWKESWOOD 1988, IWASAKI et al. 1994, 1996, 2000, MATSUMURA & YOKOYAMA 1928, PAULIAN 1953, VEER et al. 2004), and *Trogoderma* DEJEAN, 1821 (RAMSEY 1990) have hitherto been reported to feed on oothecae. Species of *Thaumaglossa* exclusively use mantis egg-cases for larval development; the genus evolved from ancestors which retained a “dendrobiotic mode of life but colonized fissures and spaces under the detached bark and tunnels made by xylophagous insects” (ZHANTIEV 2009).

Recently, the interactions between the Romanian local fauna and the neozoon *Hierodula tenuidentata* SAUSSURE, 1869 have been investigated (PINTILIOAIE et al. 2021), as well as the ecology of Maltese mantises (CASSAR 2020). During these studies, not only were two more skin beetle species reported as inhabitants of mantid oothecae (RĂDAC & HÁVA 2021), but larvae and imagines of soft-winged flower beetles were also found.

The aim of the present paper is to report the observations on soft-winged flower beetles (Coleoptera: Melyridae, Rhadalidae) that have been reared from oothecae. A literature review of larval microhabitats and a discussion of the trophic ecology of the soft-winged flower beetles in the larval stage is underway (Plonski, in prep.).

Material and methods

Systematics: Higher classification of the soft-winged flower beetles and the mantises reported below follow GIMMEL et al. (2019) and SCHWARZ & ROY (2019), respectively.

Sampling sites: Oothecae of *Hierodula tenuidentata* were collected from *Platanus* trees in the public park “Parcul Catedralei” (45.750405° N, 21.223345° E) in Timișoara, Romania, on 20.XI.2019 by IAR. One ootheca of *Mantis religiosa* was collected from under a rock in garrigue at “Ta’ Ċenċ” (36.021111° N, 14.259222° E) in Sannat, Gozo (Maltese Archipelago) on 8.II.2015 by TC.

Dissection: The contents of ten fresh and five old oothecae were examined by IAR. Fresh oothecae are herein defined as those laid in the same season as examination, with no signs of emergence of nymphs, while old refers to oothecae laid in a previous season, with signs of emergence.

Rearing: The oothecae of *H. tenuidentata* were kept at room temperature in 50 ml containers. These were opened at 2–3-day intervals to check for the emergence of arthropods and to maintain air ventilation; occasionally, 1–2 drops of water were added to the containers in order to keep a suitable level of humidity inside. The ootheca of *M. religiosa* and the preimaginal beetle found inside were both kept at room temperature in a similar container, whose content was checked from time to time.

Identification: The oothecae were identified by IAR and TC, respectively. The soft-winged flower beetles were identified by ISP based on photographs of the reared vouchers.

Depositories: Four larvae and one imago of *Dasytes*, and one imago of *Anthocomus*, which were found by IAR, are now housed in the private collection of ISP. The unique *Aplocnemus* imago reared by TC is housed in his private collection.

Results

***Anthocomus* (s.str.) *fasciatus* (LINNAEUS, 1758), *Dasytes* (*Mesodasytes*) *aeratus* STEPHENS, 1830, and *Hierodula tenuidentata* SAUSSURE, 1869**

Three larvae of *Dasytes aeratus* (Fig. 1) were found in an old ootheca (most likely laid during the 2018 season, but the possibility that it was laid in the 2017 season cannot be excluded). They were found penetrating some of the multiple layers of the ootheca, tunneling their way into an egg chamber, and were placed in a separate container. The next day, they were found motionless. The larvae did not molt or pupate and eventually died, and were subsequently stored in alcohol.



Figs. 1–6: Soft-winged flower beetles encountered in or reared from mantid oothecae: (1) Two larvae of *Dasytes aeratus*; (2) One female imago of *D. aeratus*; (3) A larva of *Aplocnemus pectinatus* inside an ootheca of *Mantis religiosa*; (4–6) Life stages of the same specimen: (4) larva, dorsal; (5) pupa, ventro-lateral; (6) female imago, dorsal.

Besides the *Dasytes* larvae, some psocids (also in fresh oothecae), diplopods (viz. *Polyxenus lagurus* LINNAEUS, 1758) and mites were also found. Furthermore, besides the empty egg hulls, many unfertilized mantid eggs and nymphs that could not emerge were also observed.

The emergence of the first female specimen of *D. aeratus* (Fig. 2) was observed on the evening of 25.I.2020; the oothecae had last been checked on 22.I.2020. In total, four females emerged from two old oothecae.

One female specimen of *A. fasciatus* was found dead in one container with old oothecae on 6.II.2020; since the last check was on 3.II.2020, the exact date of emergence was not recorded.

***Aplocnemus* (s. str.) *pectinatus* (KÜSTER, 1849) and *Mantis religiosa* (LINNAEUS, 1758)**

The collected ootheca showed no signs of nymphs ever emerging, did not have the weather-beaten appearance of an old ootheca, and looked rather fresh. That being said, the ootheca was under a rock, so it may have been protected from the elements. Unfortunately, the condition and age of the mantid eggs inside were not assessed, to avoid damaging additional larvae.

Upon closer inspection, one single larva was found between outer layers on the ventral side of the ootheca (viz. the one attached to the rock surface), and was successfully reared into a female imago by TC (Figs. 3–6). Pupation of the larva took place around 25.II.2015 (perhaps a day or two earlier at most), and eclosion occurred on 23.III.2015.

Discussion

The principal habitats of Melyridae larvae are: (I) leaf litter and soil, under rocks, moss or lichens; (II) under bark and in dead wood or galleries of wood boring insects; and (III) rarely in carrion (compare FOSTER & LAWRENCE 1991 and LAWRENCE 1991). However, they also utilize plant stems (FIORI 1971, ALEXANDER 1996), old juniper fruits (RIBES ESCOLÀ & ASKEW 2009), plant galls (GIRAUD 1866, CONSTANTIN 1989, BLOOMERS 2008), egg cocoons of spiders (SACHER & KLAUSNITZER 1992), nests of hymenopterans (LICHTENSTEIN 1875), mounds of termites (COSTAS et al. 1988), basidocarps (KOFER 2010), and sometimes bird nests (FOSTER & ANTONELLI 1973). The available literature review (Plonski, in prep.) suggests that larvae of Melyridae feed primarily on detritus, fungi, and small arthropods (compare MAYOR 2002). Very similar habitat observations have been made for some species of the Rhadalidae, and their larvae are assumed to be predacious (LAWRENCE & LESCHEN 2010). We are here reporting the association between melyrid and rhadalid larvae and mantid oothecae for the first time.

Hypothetically, in the case of a fresh mantid ootheca, predation is the likely mode of trophic ecology. But in the case of the melyrid specimens from the oothecae of *Hierodula tenuidentata*, predation on eggs or nymphs is – in our opinion – unlikely, because the beetles were found in old (abandoned) oothecae, which had been collected in the cold season. Therefore, over-wintering and scavenging is probably the most likely scenario for the cases observed herein: It seems unlikely to have many larvae preying upon other inhabitants in such a small microhabitat as an ootheca. Feeding on dead nymphs, egg husks, unfertilized eggs or the ootheca itself (because of its proteinaceous composition) seems more likely, because these represent much more abundant food sources, and do not need to be caught and overwhelmed by the larvae.

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