

List of species belonging to the family Bethylidae (Hymenoptera) as parasitoids of the family Dermestidae (Coleoptera)

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Abstract: This is the first complete list of Hymenoptera species belonging to the family Bethylidae that parasitise beetle species belonging to the family Dermestidae. New records are presented for *Laelius anthrenivorus* Trani, 1909, a parasite of *Anthrenus verbasci* (Linnaeus, 1767), *Laelius pedatus* (Say, 1836), a parasite of *Trogoderma glabrum* (Herbst, 1783), both of which are from the Czech Republic and *Holepyris sylvanidis* (Brethes, 1913), a parasite of *Trogoderma angustum* (Solier, 1849) from Slovakia.

Keywords: Faunistic, new records, parasitism, Coleoptera, Dermestidae, Hymenoptera, Bethylidae.

Introduction

The Bethylidae are a cosmopolitan family including 11 subfamilies, 131 genera and about 3.200 species (AZEVEDO et al. 2018, LIM & LEE 2024, WANG et al. 2024, SANTOS et al. 2024). Adults are small to medium sized, usually black or brown coloured insects with more or less flattened body and short, stout legs. The head is distinctively prognathous with usually relatively small or reduced eyes and ocelli, prognathous mouthparts. Most of the species have 12 or 13 antennomeres in both sexes. Males are mostly alate, females are alate or with wings reduced (micropterous or brachypterous forms) or absent; females of some species are pterygopolymorphic. The wing venation in some species is strongly reduced. The taxonomic value of many described species is not yet clear, especially due to sexual dimorphism and intraspecific variation (AZEVEDO et al. 2018).

Bethylids are ectoparasitoids of larvae and occasionally of pupae of Coleoptera and Lepidoptera, mostly in concealed situations. The host is usually paralysed (temporarily or permanently), sometimes killed with single or multiple (depending on the size of the host) stings of the female. Poison of bethylids has high efficiency and a sting of some species can be painful as well for humans (MASINI et al. 2025). Females drag the paralyzed larva to sheltered places, in the case of free living hosts or utilize the host shelter in the case of concealed hosts, and oviposit on the surface of the host, one or several eggs depending on size. The hymenopteriform larva develops as an ectoparasite with the

anterior part penetrating the host’s body. Females of some species also delay the oviposition and feed on the haemolymph of the paralyzed host. Females of some species (e.g. *Cephalonomia gallicola* (Ashmead, 1887) attacking large hosts in concealed situations stay on the paralyzed host after oviposition and females of some subsocial species of *Sclerodermus* Latreille, 1809 stay with their larvae throughout the larval stage, providing parental care for their progeny controlling egg numbers, licking larvae and guarding them against predators and parasitoids. Larval development is short, from two to 10 days. Pupation takes place mostly in a cocoon, gregarious larvae often pupate collectively; the pupal period lasts from nine days to two months. Males of gregarious species hatch earlier and mate with mature females within their cocoons helping them to get the cocoons open. Due to the common multiple mating of females, the first inbreeding is compensated by subsequent copulation with unrelated males. Inbreeding is common in species with rapid succession of generations developing on the same host and thus the long surviving female can mate with her sons. The first offspring generation consists only of haploid males and after the inbreeding, the mother oviposits both diploid and haploid eggs, the descendants of which are both males and females. Females of most species hibernate (MACEK et al. 2007).

The Betylidae family is known to parasitise beetles in the Dermestidae family. See the table below for a list of species and the authors who have published on parasitism. This is the first complete list of Bethylidae parasitising Dermestidae.

Table 1: List of recorded species

Bethylidae species	Dermestidae species	References
<i>Holepyris sylvanidis</i> (Brethes, 1913)	<i>Trogoderma angustum</i> (Solier, 1849)	Háva (2020)
<i>Holepyris tricarinatus</i> (Kieffer, 1906)	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Hinton (1945)
<i>Laelius anthrenivorus</i> Trani, 1909	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Vance & Parker (1932); Hinton (1945); Gadallah et al. (2024)
	<i>Anthrenus museorum</i> (Linnaeus, 1761)	Hinton (1945); Gadallah et al. (2024)
<i>Laelius borealis</i> Vikberg, 2005	<i>Anthrenus museorum</i> (Linnaeus, 1761)	Vikberg & Koponen (2005)
	<i>Dermestes lardarius</i> Linnaeus, 1758	Vikberg & Koponen (2005)
	<i>Dermestes murinus</i> Linnaeus, 1758	Vikberg & Koponen (2005)
	<i>Globicornis emarginata</i> (Gyllenhal, 1808)	Vikberg & Koponen (2005)
	<i>Megatoma undata</i> (Linnaeus, 1758)	Vikberg & Koponen (2005)
	<i>Trogoderma glabrum</i> (Herbst, 1783)	Vikberg & Koponen (2005)

<i>Laelius fumimarginalis</i> Vikberg, 2005	<i>Reesa vespulae</i> (Milliron, 1939)	Vikberg & Koponen (2005)
<i>Laelius microneurus</i> (Kieffer, 1905)	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Yamada (1955); Iwata (1941); Gadallah et al. (2024)
<i>Laelius naniwaensis</i> Terayama, 2006	<i>Thaumaglossa rufocapil- lata</i> Redtenbacher, 1867	Wang et al. (2024)
<i>Laelius nigrofemoratus</i> Terayama, 2006	<i>Anthrenus</i> sp.	Wang et al. (2024)
<i>Laelius parcepilosus</i> Vikberg, 2005	<i>Megatoma undata</i> (Linnaeus, 1758)	Vikberg & Koponen (2005)
<i>Laelius pedatus</i> (Say, 1836)	<i>Trogoderma granarium</i> Everts, 1898	Athanassiou et al. (2019); Amante et al. (2017); Gad- allah et al. (2024; May- hew & Heitmans (2000); Amante et al. (2017); Gadallah et al. (2024)
	<i>Trogoderma glabrum</i> (Herbst, 1783)	Mayhew & Heitmans (2000); Amante et al. (2017); Klein & Beckage (1990); Gadallah et al. (2024)
	<i>Trogoderma variabile</i> Ballion, 1878	Klein & Beckage (1990)
	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Mayhew & Heitmans (2000); Mertins (1980); Mertins (1985); Amante et al. (2017); Gadallah et al. (2024)
	<i>Anthrenus flavipes</i> LeConte, 1854	Amante et al. (2017); Gad- allah et al. (2024)
	<i>Anthrenus sarnicus</i> Mroczkowski, 1963	Amante et al. (2017); Gad- allah et al. (2024)
	<i>Reesa vespulae</i> (Milliron, 1939)	Vikberg & Koponen (2005)
	<i>Attagenus unicolor</i> (Brahm, 1790)	Gadallah et al. (2024)
<i>Laelius utilis</i> Cockerell, 1920	<i>Anthrenus fuscus</i> Olivier, 1789	Mertins (1985)
	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Mertins (1985)
	<i>Anthrenus flavipes</i> LeConte, 1854	Mertins (1985)

	<i>Trogoderma variabile</i> Ballion, 1878	Mertins (1985)
	<i>Trogoderma inclusum</i> LeConte, 1854	Mertins (1985)
	<i>Thylodrias contractus</i> Motschulsky, 1839	Mertins (1985)
<i>Laelius versicolor</i> (Evans, 1970)	<i>Trogoderma ornatum</i> (Say, 1825) [as <i>T. tarsale</i>]	Barbosa & Azevedo (2014)
<i>Laelius virilis</i> Vikberg, 2005	<i>Megatoma undata</i> (Linnaeus, 1758)	Vikberg & Koponen (2005)
<i>Laelius voracis</i> Muesebeck, 1939	<i>Anthrenus flavipes</i> LeConte, 1854 [as <i>A.</i> <i>vorax</i>]	Ayyappa & Cheema (1952); Hinton (1945)
<i>Laelius yamatonis</i> Terayama, 2006	<i>Anthrenus verbasci</i> (Linnaeus, 1767)	Wang et al. (2024)
<i>Laelius</i> sp.	<i>Anthrenus scrophulariae</i> (Linnaeus, 1758)	Perkins (1976); Gadallah et al. (2024); Spencer (1942)
	<i>Anthrenus pimpinellae</i> (Fabricius, 1775)	Perkins (1976); Spencer
<i>Sclerodermus domesticus</i> Klug, 1809	<i>Anthrenus museum</i> (Linnaeus, 1761)	Hinton (1945)

Remarks. CAN (2022) mentioned the following species from Turkey as potential prey of *L. pedatus*: *Attagenus unicolor* (Brahm, 1790), *Anthrenus goliath* Saulcy in Mulsant & Rey, 1868, *A. picturatus* Solsky, 1876, *A. scrophulariae scrophulariae* (Linnaeus, 1758), *A. rotundulus* Reitter, 1889, *A. flavidus* Solsky, 1876 and *A. verbasci* (Linnaeus, 1767).

New records

Holepyris sylvanidis (Brethes, 1913) as a parasite for *Trogoderma angustum* (Solier, 1849) from Slovakia: SK, Bratislava env., 15.vi.2008, D.K. lgt., 1 spec. *H. sylvanidis* + 2 spec. *T. angustum*, all on the window sills, observed (pers comm.).

Laelius anthrenivorus Trani, 1909 as a parasite for *Anthrenus verbasci* (Linnaeus, 1767) from the Czech Republic: CZ, Bohemia c., Praha-Krč, 30.viii.2023, Y. Elznicová lgt., 1 spec. *L. anthrenoides* + 3 spec. *A. verbasci*, all on the window sills, author's collection.

Laelius pedatus (Say, 1836) as a parasite for *Trogoderma glabrum* (Herbst, 1783) from the Czech Republic: CZ, Bohemia c., Praha-Suchdol, 6.vi.2021, D. Kmoch lgt., 1 spec. *L. pedatus* + 2 spec. *T. glabrum*, all on the window sills, author's collection.



Fig. 1: *Laelius pedatus* (Say, 1836) alongside an *Anthrenus* sp. larva
(Photo by J.-C. Kommilch)



Fig. 2: *Laelius pedatus* (Say, 1836) alongside an *Anthrenus verbasci* larva
(Photo by M. Schöller)

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