SILVA BALCANICA

Silva Balcanica 27(1): 37-41 (2026)
doi: 10.3897/silvabalcanica.27.e186142

RESEARCH ARTICLE

Impact of *Billaea adelpha* (Loew) (Diptera: Tachinidae) as a larval parasitoid of *Prionus coriarius* (L.) in Bulgaria

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Academic editor: Georgi Georgiev | Received 23 January 2026 | Accepted 28 January 2026 | Published 18 March 2026
Citation: Zaemdzhikova G., Doychev D., Lalov P., Bozhilova M. 2026. Impact of *Billaea adelpha* (Loew) (Diptera: Tachinidae) as a larval parasitoid of *Prionus coriarius* (L.) in Bulgaria. Silva Balcanica 27(1): 37-41. https://doi.org/10.3897/silvabalcanica.27.e186142

Abstract
The impact of the dipteran larval parasitoid *Billaea adelpha* on cerambycid species *Prionus coriarius* was studied. Larvae of *P.coriarius* were reared from semi-decayed wood of dry stems of *Carpinus betulus* L. A high rate of parasitism of *B. adelpha* on the cerambycid larvae was observed. It varies from 57 to 100%, and the number of parasitoids per larva can reach up to 17. This study reports, for the first time in Bulgaria, the trophic association between *Prionus coriarius* and *Carpinus betulus.*

Keywords
Dipteran parasitoids, impact, cerambycid species, Bulgaria

Introduction

The Tachinidae is the largest and most important family of insect parasitic flies, with more than 8,500 species worldwide (O'Hara, 2013). Currently, 425 tachinid species are known in Bulgaria (Hubenov, 2021). All of them are endoparasitoids of various insect species, mostly phytophagous. The genus *Billaea* Robineau-Desvoidy, 1830 is represented by 12 species in Europe (O'Hara et al., 2019). Seven of these species

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have been recorded in Bulgaria (*B. adelpha*, *B. irrorata*, *B. fortis*, *B. maritima*, *B. pectinata*, *B. steini* and *B. triangulifera* (Hubenov, 2021). Among them, one species, *Billaea adelpha* (Loew, 1873), preferentially parasitizes coleopteran larvae, mainly cerambycids (Tschorsnig, 2017). In Bulgaria *B. adelpha* is a well-known parasitoid of *Prionus coriarius* (Linnaeus, 1758) (Doychev et al., 2019; Hubenov, 2025). The longhorn beetle *P. coriarius* is a generalist, whose larvae develop in stems, stumps and roots of a wide range of semi-decayed tree species. Its populations have declined in recent decades due to habitat loss and fragmentation (Lindhe et al., 2010; Sarac, 2016). Understanding the impact of natural enemies, including tachinid parasitoids, is therefore critical for assessing population dynamics of this species.

Material and Methods

Larvae of *Prionus coriarius* were collected in March 2024 in a forest stand dominated by *Carpinus betulus* L., located near the Monastery "St. Kiril and Metodii" in Lyulin Mt. For the purposes of the present study, stumps and roots of 25 dry trees were checked for the presence of larvae. The cerambycid larvae were detected exclusively in decaying stumps, occurring in three of the examined trees. The study area and the locations of decayed trees, including those from which samples were collected, are presented in Fig. 1. All cerambycid larvae were transported to the laboratory at room-temperature conditions with natural photoperiod. Each larva was placed individually in a plastic container (100 mm in diameter and 80 mm in height), with ventilation holes. The samples were monitored daily, and the number of emerging parasitoids was recorded.

Results and Discussion

The impact of the dipteran larval parasitoid: In the studied area, the frequency of occurrence of *Prionus coriarius* in dead wood is low – around 12%. Its larvae were detected in 3 of the 25 examined *Carpinus betulus* trees. Observations of reared parasitoids are presented in Table 1. The rate of parasitism in each collected sample is significant, ranging from 57 to 100%. The characteristic larval breathing holes of the parasitoids were observed in the pleural membranes of thorax and abdominal segments of parasitised late-instar larvae of *P. coriarius* (Fig. 2). The number of breathing holes of dipteran parasitoids per larva is varying widely from 1 to 17. Only *B. adelpha* adults were observed in each sample, with an average of 60% of reared parasitoids developing to adults. Parasitoids emergence occurred in the first ten days of May. A high rate of parasitism by *B. adelpha* was reported by Doychev et al. (2019). The authors reported 1–8 parasitoid larvae developing in a single host, which is approximately half the maximum number observed in the present study.

Table 1. Observations of collected samples

No	Geographical coordinates	Altitude, m a.s.l	Number of larvae collected per tree	Parasitized larvae		Number of parasitoids per larva	Reared parasitoids by development stages, number	
				N	%	min/max	pupae	adults
1	42°39′22.1″ N; 23°11′19.7″ E	905	7	4	57.1	1/2	5	2
2	42°39′20.3″ N; 23°11′18.9″ E	917	6	6	100	3/17	19	10
3	42°39′20.3″ N; 23°11′10.9″E	962	9	8	88	2/3	17	15

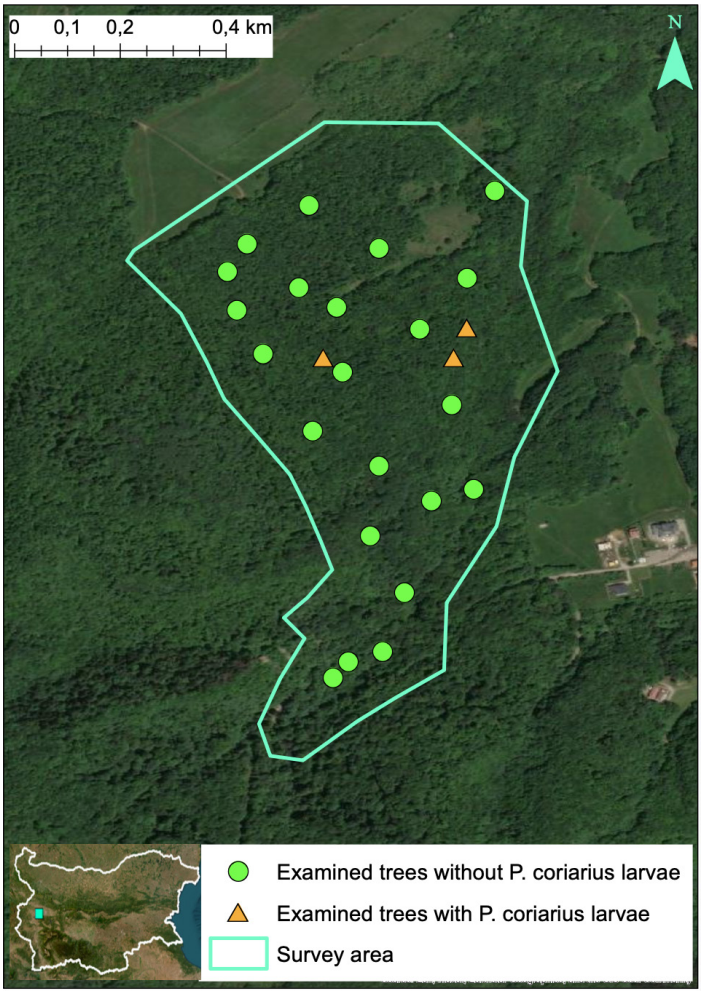


Fig. 1. Study area and spatial distribution of examined trees with and without *Prionus coriarius* larvae



Fig. 2. *P. coriarius* larva parasitized by *B. adelpha* (breathing hole of the parasitoid larva indicated by an arrow on the pleural membrane of the cerambycid mesothorax and abdomen).

Trophic links: *Prionus coriarius* is polyphagous with wide range of coniferous trees (*Pinus, Picea, Abies, Cedrus, Pseudotsuga*) and deciduous trees (*Quercus, Fagus, Alnus, Castanea, Malus, Salix, Fraxinus, Betula, Ulmus, Corylus, Populus, Platanus, Robinia, Acer, Sambucus, Carpinus, Prunus, Tilia*) (Özdikmen, 2021). In Bulgaria, two tree hosts have been previously reported with *P. coriarius – Quercus rubra* L. and *Prunus avium* (L.) (Doychev et al., 2018; 2019). This study reports, for the first time in Bulgaria, the trophic association between *Prionus coriarius* and *Carpinus betulus.*

Acknowledgements

We are grateful to Prof. Dr Zdravko Hubenov (National Museum of Natural History – Bulgarian Academy of Sciences) for the identification of tachinid species.

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