



## New Parasitoids of *Leucoptera sinuella* (Reutti) (Lepidoptera: Lyonetiidae) in Bulgaria

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**Abstract:** In 2018, the parasitoid complex of *Leucoptera sinuella* (Reutti) (Lepidoptera: Lyonetiidae) was studied in two localities (town of Banya and Voinjagovo village) near Striama River in Central South Bulgaria. Larvae and pupae of *L. sinuella* were periodically collected in poplar (*Populus* spp.) plantations and studied in laboratory conditions. As a result, four eulophids (Hymenoptera: Eulophidae) were identified: *Baryscapus endemus* (Walker), *Chrysocharis pentheus* (Walker), *Cirrospilus pictus* (Nees) and *Pediobius bruchicida* (Rondani). Three species (*B. endemus*, *C. pentheus* and *P. bruchicida*) were established for first time in the parasitoid complex of *L. sinuella*. The most abundant species was *B. endemus* (86.1%), followed by *P. bruchicida* (9.7%), *C. pictus* (2.8%) and *C. pentheus* (1.4%). The mortality of the host caused by the parasitoids in different samples varied between 0 and 76.7%, with an average of 10.0%.

**Key words:** parasitoids, Eulophidae, new records, impact

### Introduction

*Leucoptera sinuella* (Reutti, 1853) (Lepidoptera: Lyonetiidae) is one of the most important insect miners on poplars (*Populus* spp.) and willows (*Salix* spp.) in the Palaearctic (ARRU 1967, KUROKO 1964). In 2015, the species was established in Chile (SANDOVAL et al. 2019).

*Leucoptera sinuella* is a polyvoltine species that develops three or four generations per year (BRIOLINI 1961, 1965, JODAL et al. 2002). It overwinters in the pupal stage in bark crevices or on fallen leaves. Parasitoids of four hymenopteran families (Braconidae, Pteromalidae, Chalcididae and Eulophidae) have been reared from larvae and pupae of this host (CELLI 1963, 1964, YU 2012, SANDOVAL et al. 2019). During the period 1961–1965, *L. sinuella* caused severe damages in poplar

plantations in Italy (BRIOLINI 1961, 1965). At the same time, the species was first reported in Bulgaria (syn. *Leucoptera susinella* Herrich-Schäffer, 1855) (HARIZANOV 1963), initially near Kurtovo Konare village, Plovdiv Region, and one or two years later as causing massive damages on poplars along the Danube River (Svishtov, Nikopol, Russe) and other regions in Bulgaria (Gabrovo, Lovech, Pazardzhik, Varna). According to HARIZANOV (1963), *L. sinuella* developed three generations per year in Bulgaria.

Over the next 40 years, *L. sinuella* had a low population density in Bulgaria (GEORGIEV 2005). In 2018, an outbreak of *L. sinuella* was registered in poplar plantations along Stryama River in Central South Bulgaria (DERMENDZHIEV et al. 2019).

This article reports new eulophid parasitoids of *L. sinuella* in Bulgaria.

## Materials and Methods

The studies were conducted in 2018. Biological material (poplar leaves with mines containing *L. sinuella* larvae and pupae) were collected in two localities (town of Banya and Voinjagovo village) near Striama River in Central South Bulgaria from *Populus nigra* L. and *Populus x euramericana* (Dode) Guinier hybrid clones (Table 1). Seven collections were carried out – five in the region of Banya and two in the region of Voinjagovo (Table 3). A total of 718 poplar leaves with *L. sinuella* larvae and pupae were collected.

After collection, infested poplar leaves were studied in a laboratory at room temperature (20–22°C). They were placed in Petri dishes and were observed daily for emergence of *L. sinuella* adults and parasitoids. The emerging insects were separated in test tubes for identification. At the end of the studies, the mines were opened and their contents analysed in order to establish some biological and ecological characteristics of the parasitoids. Emerged hosts and parasitoids were identified and preserved in the entomological collections of Forest Protection Station – Plovdiv, University of Plovdiv and Forest Research Institute, Bulgarian Academy of Sciences.

## Results

In this study, four species were recorded as parasitoids of *L. sinuella*: *Baryscapus endemus* (Walker, 1839), *Chrysocharis pentheus* (Walker, 1839), *Cirrospilus pictus* (Nees, 1834) and *Pediobius bruchicida* (Rondani, 1872) (Hymenoptera: Eulophidae)

(Table 2). Three species (*B. endemus*, *C. pentheus* and *P. bruchicida*) are new records for the parasitoid complex of *L. sinuella*. The most abundant species was *B. endemus* (86.1%), followed by *P. bruchicida* (9.7%), *C. pictus* (2.8%) and *C. pentheus* (1.4%).

The mortality of the host caused by parasitoids in different samples varied between 0 and 76.7%, with an average of 10.0% (Table 3).

## Discussion

In Europe, the parasitoid complex of *L. sinuella* includes 10 species of the family Eulophidae (Hymenoptera): *Chrysocharis nephereus* (Walker, 1839), *Cirrospilus pictus* (Nees, 1834), *Closterocerus trifasciatus* Westwood, 1833, *Minotetrastichus frontalis* (Nees, 1834), *Neochrysocharis formosus* (Westwood, 1833), *Diglyphus* sp., *Chrysocharis (Kratochviliana)* sp., *Pediobius pyrgo* (Walker, 1839), *Pnigalio agraulis* (Walker, 1839), *Pnigalio pectinicornis* (L., 1758) (CELLI 1963, 1964). Six species of the Eulophidae were also established in Chile: *Horismenus nigrocyaneus* (Ashmead, 1894), *Horismenus* sp., *Closterocerus* sp., *Cirrospilus* sp., *Elachertus* sp. and *Proacrias xenodice* (Walker, 1842) (SANDOVAL et al. 2019).

The four parasitoids recorded by the present study (*B. endemus*, *C. pentheus*, *C. pictus* and *P. bruchicida*) are polyphagous species that attack many insect hosts belonging to the orders Coleoptera, Lepidoptera, Hemiptera, Diptera or Hymenoptera; *B. endemus*, *C. pictus* and *P. bruchicida* are also known as hyperparasitoids of hymenopteran or dipteran hosts (NOYES 2018).

**Table 1.** Main characteristics of the studied localities

Locality	Altitude (m a.s.l.)	Coordinates	Tree species	Age (years)
Banya	285	N42°32'35.6" E24°49'19.1"	<i>Populus nigra</i> L.	3
			<i>Populus x euramericana</i> cl. I-214	7
			<i>Populus x euramericana</i> cl. I-45/51	6
Voinjagovo	317	N42°35'00.6" E24°45'29.1"	<i>Populus x euramericana</i> cl. I-214	2-4
			<i>Populus x euramericana</i> cl. I-45/51	5

**Table 2.** Parasitoid complex of *Leucoptera sinuella* in Bulgaria

Species	Number			Emergence, date	Percentage in the complex
	Males	Females	Total		
* <i>Baryscapus endemus</i> (Walker, 1839)	9	53	62	03.09.2018–20.05.2019	86.1
* <i>Chrysocharis pentheus</i> (Walker, 1839)	-	1	1	03.09.2018	1.4
<i>Cirrospilus pictus</i> (Nees, 1834)	-	2	2	03.09.2018–20.05.2019	2.8
* <i>Pediobius bruchicida</i> (Rondani, 1872)	6	1	7	03.09.2018–31.01.2019	9.7
Total	15	57	72		100.0

\* New parasitoid of *L. sinuella*

**Table 3.** Impact of the parasitoids on the host in studied localities

Collection date	Number of hosts studied	Number of parasitoids emerged	Host mortality, %
Banya			
16 Aug 2018	36	5	13.9
22 Aug 2018	395	28	7.1
12 Sep 2018	30	23	76.7
25 Sep 2018	58	7	12.1
16 Oct 2018	22	2	9.1
Average	541	65	12.0
Voinjagovo			
16 Aug 2018	12	0	0
22 Aug 2018	165	7	4.2
Average	177	7	4.0
Total	718	72	10.0

In Bulgaria, *B. endemus* was reported only in faunistic studies (BOYADZHIEV 2003) and, therefore, *L. sinuella* is the only known host of this parasitoid in the country. *Chrysocharis pentheus* has been recorded as a parasitoid of different lepidopteran hosts of the genera *Stigmella*, *Leucoptera*, *Phyllonorycter* and *Tischeria* (TOMOV 2000, KUTINKOVA & ANDREEV 2001) and *Paraphytomyza populi* (Kaltenbach, 1864) (Diptera: Agromyzidae) (GEORGIEV & BOYADZHIEV 2004). *Cirrospilus pictus* has been reared from *Stigmella incognitella* (Herrich-Schäffer, 1855) (Lepidoptera: Nepticulidae) and different *Phyllonorycter* spp. (PELOV & TOMOV 1998, TOMOV 2000). It was also recorded as a hyperparasitoid of *Achrysocharoides (Kratosma) usticrus* (Erdos, 1954) (Hymenoptera: Eulophidae), a primary parasitoid of *Phyllocnistis unipunctella* (Stephens, 1834) (syn. *Phyllocnistis suffusella* Zeller, 1847) (Lepidoptera: Phyllocnistidae) (GEORGIEV & PELOV 1995, 1996). *Pediobius bruchicida* has been reared from eggs of *Thaumetopoea pityocampa* (Denis & Schiffermüller, 1775) (Lepidoptera: Notodontidae) only (MIRCHEV et al. 2011, 2012, 2015).

In conclusion, it is important to note that the new records extend the knowledge on host ranges of the parasitoids and enlarge the parasitoid complex of *L. sinuella*.

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