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PARASITOID COMPLEX OF *STEREONYCHUS FRAXINI* (DE GEER) (COLEOPTERA, CURCULIONIDAE) IN SERBIA

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Abstract – The parasitoid complex of the ash weevil *Stereonychus fraxini* (De Geer) (Coleoptera, Curculionidae) from 20 localities in Serbia was studied. Forty-one samples of ash weevil larvae and cocoons were analyzed, and the presence of parasitoids was confirmed in 24 samples. Ten species of hymenopteran parasitoids (Hymenoptera Parasitica) were recorded. The two common eulophid wasps, *Entedon zanara* Walker and *Entedon cionobius* Thompson, were the most abundant. Parasitoids had an insignificant influence on the level of ash weevil population, because the level of infestation did not exceed 20% in 83% of the samples; however infestation above 40% was determined in 12.2% of the samples, indicating that in some cases parasitoids may significantly reduce the ash weevil population.

Key words: Stereonychus fraxini, parasitoids, Serbia

INTRODUCTION

Ash weevil *Stereonychus fraxini* (De Geer) is one of the most important ash defoliators of the common or European ash (*Fraxinus excelsior* L.) and narrow leafed ash (*Fraxinus angustifolia* Vahl.) in Serbia. It is widely distributed in Europe, North Africa and Asia Minor (Wingelmüller, 1921). It causes great damage to ash stands (Максимовић, 1954; Mikloš, 1954; Marović, 1963; Avramović et al., 2008), and it is an important pest present in olive orchards in Sicily (Blando and Mineo, 2005). Defoliation of ash trees can lead to physical and physiological changes that weaken the trees and create preconditions for ash bark beetle attack (Mikloš, 1954; Mihajlović and Ristić, 1995). The basic control measures known so far against ash weevils are focused on the use of pesticides (Mikloš, 1954; Spaić and Mikloš, 1981; Цанков et al., 1990; Liović et al., 2001). The application of insecticides in ash weevil control have often proven to be insufficiently effective on insect life cycle, expensive and to contribute to environmental pollution. Integral protection management of ash with the application of biological and other control measures could be used as an alternative to pesticides. It is necessary to know which factors affecting the level of insect population can potentially be efficient in biological insect control. One of the factors that could significantly influence the insect population level is parasitoid wasps. Parasitoids of *S. fraxini* are mentioned by several authors (Scherf, 1964; Bouček, 1977; Mikloš, 1983; Vidal, 1993; Поўрас, 1993; Markova, 1998; Blando and Mineo, 2005). Our research in Serbia aimed at recording and identifying the significance of the ash weevil parasitoids.

MATERIALS AND METHODS

The study of parasitoids of *S. fraxini* was carried out during 2007 through 2009, and covered 20 lo-

Table 1 - Identified parasitoid species, frequency of appearance, number and total dominance of parasitoids

Species	Frequency		Number of adults	Total dominance
	Number of samples	%		
Eulophidae				
Entedon zanara Walk.	19	42,2	394	61,56 %
Entedon cionobius Thom.	17	37,8	126	19,69 %
Entedon leucocnemis Erd.	8	17,7	34	5,31 %
Eupelmidae				
Eupelmus urozonus Dalm.	1	2,2	1	0,16 %
Pteromalidae				
Pteromalus cioni Thom.	6	13,3	27	4,22 %
Mesopolobus mediterraneus Mayr	2	4,4	28	4,38 %
Eurytomidae				
Eurytoma sp.	4	8,8	4	0,63 %
Braconidae				
Triaspis thoracica Curtis	6	13,3	23	3,59 %
Ichneumonidae				
Gelis sp.	2	4,4	2	0,3%
Itoplectis alternans Grav.*	1	2,2	1	0,16 %

* facultative endoparasitoid and can be a hyperparasitoid

calities in Serbia. A total of 41 samples were taken at the following localities: Odžaci (8 samples), Bač (5 samples), Klenak (2 samples), Kupinovo (2 samples), Morović (4 samples), Apatin (1 sample), Bački Monoštor (1 sample), Rtanj (2 samples); Sokobanja (2 samples), Kruševac (1 sample), Barič (2 samples), Valjevo (2 samples), Jagodina (1 sample), Batočina (2 samples), Stari Lec (1 sample), Loznica (1 sample), Bor (1 sample), Kraljevo (1 sample), Čačak (1 sample) and Zaječar (1 sample).

Samples of leaves with adult larvae and cocoons were collected and placed in entomological cages, where they were fed with fresh leaves until the completion of larval development. Cages were inspected every two days until the eclosion of adult weevils and emergence of parasitoids, and when observed, then counted and conserved for analysis. Collected parasitoids were either mounted or preserved otherwise, and all specimens are deposited in the entomological collection of the Institute of Lowland Forestry and Environment.

The role of parasitoids in reducing host population was analyzed by using two parameters: (1) index of parasitism (i.e. the ratio between number of adults of parasitoid species and the total number of insects emerged, parasitoids and weevils) expressed in percentage, (2) number of samples in which the presence of parasitoids and their total dominance were determined (i.e. ratio between total number of found adults of certain parasitoid species and total number of parasitoids, expressed in percentage). The index of parasitism may contain certain errors due to the presence of gregarious parasitoids and hyperparasitoids and should therefore be conditionally accepted.

RESULTS

Only hymenopteran parasitoids (Hymenoptera Parasitica) from six families were found, and a total of ten species were identified. Their presence was confirmed in 58.5% of the samples. The identified parasitoids, their systematic position, frequency of appearance in studied samples, number of adults, and total dominance are given in Table 1. The names of the localities, dates of sampling, number of parasitoids per each locality and per total, and parasitism index are given in Table 2.

Table 2. Locality, number of adult parasitoids (per species and total) and index of parasitism

Locality	*E. zanara*	*E. cionobius*	*E. leucocnemis*	*E. urozonus*	*H. cioni*	*M. mediterraneus*	*Eurytoma sp.*	*T. thoriaca*	*Gelis sp.*	*I. alternans*	Total number of parasitoid adults	Number of S. fraxini adults	Index of parasitism (%)
	Number of parasitoid adults												
Odžaci 26. 04. 2007.	-	-	-	-	-	-	-	5	-	-	5	97	4,9
Klenak 08. 05. 2007.	32	14	10	-	12	-	1	4	-	1	74	86	46,3
Kupinovo 08. 05. 2007.	-	2	-	-	9	-	-	-	1	-	12	53	18,4
Morović 09. 05. 2007.	74	1	4	-	-	1	-	-	-	-	80	354	17,7
Apatin 10. 05. 2007.	8	13	-	-	-	-	-	1	-	-	22	111	16,5
B. Monoštor 11.05.2007.	67	5	3	-	3	-	-	-	-	-	78	43	64,5
Bač 12. 05. 2007.	1	-	-	-	1	-	-	-	-	-	2	138	1,4
Odžaci 12. 05. 2007.	49	17	5	-	-	27	1	11	1	-	111	224	33,1
Bač 25. 04. 2008.	3	-	-	-	-	-	-	-	-	-	3	112	2,6
Odžaci 26. 04. 2008.	9	1	2	-	1	1	-	1	-	-	15	113	11,7
Loznica 07. 05. 2008.	1	1	-	-	-	-	-	-	-	-	2	62	3,2
Barič 11.05.2008	1	-	-	-	-	-	-	-	-	-	1	73	1,4
Kruševac 15. 05. 2008.	-	2	-	-	-	-	-	-	-	-	2	169	1,2
Odžaci 16. 05. 2008.	5	32	-	-	-	-	-	-	-	-	37	131	22,0
Bač 30. 04. 2009.	1	-	-	-	-	-	-	-	-	-	1	153	0,6
Morović 05. 05. 2009.	-	1	-	-	-	-	-	-	-	-	1	285	0,3
Barič10. 05.2009.	2	-	-	-	-	-	-	-	-	-	2	79	2,5
Stari Lec 07. 05. 2009.	9	4	-	-	-	-	-	-	-	-	13	98	11,7
Odžaci 15. 05. 2009.	47	-	-	1	1	-	-	1	-	-	50	69	42,0
Odžaci 16. 05. 2009.	32	6	4	-	-	-	1	-	-	-	43	64	40,2
Zaječar 19. 05. 2009.	2	-	-	-	-	-	-	-	-	-	2	102	1,9
Bor 19. 05. 2009.	1	15	1	-	-	-	-	-	-	-	17	87	19,5
Sokobanja 20.05. 2009.	46	9	-	-	-	-	-	-	-	-	55	61	47,4
Rtanj 20. 05. 2009.	6	1	5	-	-	-	-	-	-	-	12	178	6,3

The index of parasitism of our samples in which parasitoids were found ranged from 0.3% to 64.5 %. The two species, *E. zanara* and *E. cionobius*, were the most frequent. *E. zanara* was also the most abundant species and it was the dominant species in 68.4% of the samples in which it was found, and in 26.3% of samples with the highest level of infestation (i.e. samples where infestation by parasitoids was above 20%). The infestation by this species in a sample collected at the locality B. Monoštor on May 11th 2007 was as high as 55.8%.

The eulophid parasitoid *E. cionobius* was present in 61.9% of the localities where the samples were collected, being thus the most frequent ash weevil parasitoid. It was the dominant parasitoid species, although in most of the samples, it caused only low infestation (below 5%) and only in two samples was

the level of infestation above 10%. This indicated that *E. cionobius* as an ash weevil parasitoid occurs often, but only rarely in greater numbers. The parasitoid species *E. leucocnemis, M. mediterraneus, P. cioni* and *Triaspis thoracica* were also numerous, but their total dominance was low and ranged from 3.59 to 5.31%. In the other four parasitoids, a very small number of specimens was found and identified, and they had no significant influence on the ash weevil population.

According to our analysis, we conclude that in 83% of our samples the level of infestation by all parasitoids was below 20%, which is not significant for the control of ash weevil. However, in five samples the level of infestation by parasitoids was above 40%, which can be seen as important and the rate of parasitism to be considered for the control of ash weevils.

DISCUSSION

The eulophid parasitoid *E. zanara* was the most frequent and the most abundant among the determined parasitoids. The importance of *E. zanara* in controlling ash weevil larvae was also confirmed by the other studies in Croatia by Mikloš (1983) and in Moldova by Поўрас (1993), who mentioned that ash weevils are one of the most dangerous pests to ash trees and that the eulophid parasitoid *E. zanara* is one of the dominant parasitoids of ash weevils.

Second place in the list of most dominant species of parasitoids is held by another eulophid parasitoid - *E. cionobius*. In Croatia, this species was determined as a parasitoid of *S. fraxini* by Bouček (1977) and Mikloš (1983). Markova (1998) mentioned this species being numerous in samples, along with two pteromalid species *M. mediterraneus* and *P. cioni*, and the level of infestation by all three species ranged from 35.7 do 65.1%.

Apart from the ichneumonid parasitoid *I. alternans* (which is a typical facultative endoparasitoid of Lepidoptera, and in our samples it is likely to be an hyperparasitoid), all determined species were well known as natural enemies of ash weevils (Bouček, 1977; Mikloš, 1983; Vidal, 1993; Поўрас, 1993; Markova, 1998; Blando and Mineo, 2005). *I. alternans* is a solitary, primary or secondary endoparasitoid of pupae (Hirashima et al., 1989), being widely distributed in Europe, Turkey, Caucasus and Altai (Kolarov, 1995). It is known to be associated with the order Lepidoptera, such as *Lymantria dispar* L. (Gupta, 1983), *Aleimma loeflingiana* L. (Triggiani, 1992), and *Tortrix viridana* L. (Betz and Schwerdtfeger, 1970; Mihajlović, 2008). In addition, Iwata (1966) mentioned this species as a parasitoid of *Cionus helleri* Reitter, which is taxonomically close to the ash weevil, which was originally classified as a species of the genus *Cionus*.

In our samples, we had two morphospecies identified as genus level *Eurytoma* sp. and *Gelis* sp., and both were less numerous. The species *Eurytoma verticillata* Fab. (which was not present in our samples) was less numerous as a parasitoid of ash weevil in Croatia (Mikloš, 1983). The same author also determined two other ichneumonid species, *Gelis areator* and *G. monozonius*, which are typical hyperparasitoids. However, Поўрас (1993) mentioned *Gelis agilis, G. hortensis, G. areator, G. instabilis, G. ruficornis* and *G. monozonius* as parasitoids of the ash weevil, and the species *G. agilis, G. ruficornis* and *G. hortensis* as primary parasitoids.

There are various opinions on the significance and potential of parasitoids to reduce populations of ash weevil larvae. Blando and Mineo (2005) determined a high infestation of ash weevil populations by parasitoids ranging from 59.2 and 72%. Markova (1998) also pointed out the great influence of parasitoids on the number of ash weevil. On the other hand, Mikloš (1983) concluded that parasitoids had little influence on the ash weevil population level. High infestation in some of our samples revealed that parasitoids may in some cases significantly reduce the ash weevil population and act toward establishing a biocenotic equilibrium.

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