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WEEVILS (Coleoptera: Curculionoidea) – IMPORTANT MEMBERS OF RAPESEED ENTOMOFAUNA IN VICINITY OF NOVI SAD

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ABSTRACT. The area under rapeseed is increasing in the world as well as in Serbia, which makes appearance and harmfulness of some insects more important. Weevils (Coleoptera: Curculionoidea) are group of insects whose presence and destructiveness on oilseed rape are not explored enough. Results of rapeseed entomofauna exploration at site Rimski Šančevi during 2008 are presented in this paper. Insects were collected using yellow traps method, also known as Moericke's dishes, which can be considered as one of the most appropriate methods for this kind of research. During spring, 433 adult specimens were collected (all belong to five genera and ten species). More than tenfold less specimens were collected in autumn - 42 (seven genera and 11 species). The most abundant genus was *Ceutorhynchus*, and species *Ceutorhynchus pallidactylus* (Marsham) (=*quadridens* Panzer).

INTRODUCTION

Rapeseed (*Brassica napus* L.) is one of the most important oil crops in temperate climates. In some countries it is the only source of edible oil. The largest areas under this crop are in China, India, Canada and Western Europe. Usage of rapeseed is various. It is usually grown for seed which contains 40-48% of oil and 18-25% protein. This crops takes third place considering oil production in the world (after soybean and palm tree), and second place, after soybean, according to protein production (SOVERO, 1993; MARINKOVIĆ *et al*., 2007; MARJANOVIĆ-JEROMELA *et al.,* 2008).

Rapeseed is interesting in Serbian agriculture mainly because of increasing demand for biodiesel. In the last few years, there was an increase in rapeseed acreage, which makes the knowledge of production technology even more significant. Although this crop is present for several decades as a cultivated plant in Serbia, there is an objective need for further research in this area.

Production of rapeseed in Serbia is deeply depending from insects which often represent limiting agents. At a global level, different rapeseed pests decline yield of this crop for 13%, while in Europe this percentage is even higher, 15 (CRAMER, cit. ČAMPRAG *et al*., 2007). In Hungary,

yield loss is between 15 and 20% (ČAMPRAG, 2000). Pollen beetle (*Meligethes aeneus* F., Coleoptera: Nitidulidae) can decline yield for 50% or even more (MACELJSKI, 2002).

Weevils (Coleoptera: Curculionoidea) on rapeseed are specific group of pests, because of time of their activity and different ways they damage plants. They can be found in every area of production. When 40% of plants are infected with larvae of rape stem weevil (*Ceutorhynchus napi* Gyllenhal), yield can be declined up to 20%. This damage can be made by 6-12 larvae/m^2. There can be found up to 70% of rapeseed plants which are inhabitated with larvae of cabbage stem weevil (*Ceutorhynchus pallidactylus* Marsham) with up to 15 larvae per stem. At some occasions completely yield loss can be registered (MACELJSKI, 1999). It is not rare for all plants to be infected and number of larvae/plant can grow up to 46 (MITROVIĆ *et al*., 2009).

Although rapeseed is present for few decades in Serbia, insects of this crop are not investigated properly. Greater knowledge of this issue, especially about species from weevils' superfamily, can help in preventing yield loss, protection of unharmful, particularly pollinating insects, which are present at the time of pesticide treatment, and in understanding of appearance of some other insects which are trophically connected to weevils.

MATERIAL AND METHODS

Collecting of weevils was conducted in 2008, from 18 March to 24 June and from 25 September to 17 November, at site Rimski Šančevi (19°49'31" E, 45°19'48" N, altitude 84 m). Rimski Šančevi is placed 10 km north from Novi Sad (Fig. 1). At this location, rapeseed is grown for several years so entomofauna is rich and represented with many weevils. Investigation was conducted during the period when insects are the most active.

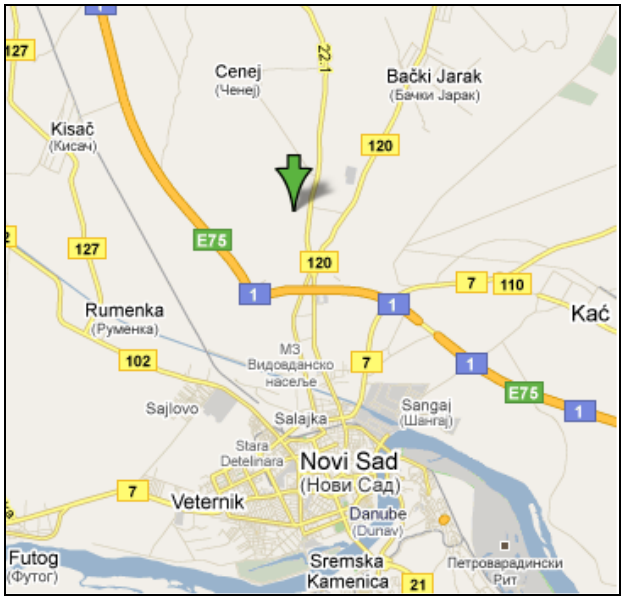

Fig. 1. Position of the site (Rimski Šančevi)

Yellow traps (Moericke's dishes) were used for attracting insects. Those traps are used for collecting insects for more than 50 years and were first described by German scientist Moericke (SEKULIĆ & KEREŠI, 2007) who investigated aphids in potato with them. Later was discovered that yellow color is attractive for many species from numerous insect orders (Heteroptera, Hemiptera, Thysanoptera, Coleoptera, Diptera, Hymenoptera, Lepidoptera etc.). This phenomenon was used for designing different types of traps (rectangular, round, sheets with sticky surface etc.) for numerous insect species in many crops, but first of all, in rapeseed.

Dishes are placed on stakes with changeable height. This is important because traps have to be seen from the proper distance. Further, in spring rapeseed is very fast growing so it is very often for plant branches to cover dish and prevent insects from seeing or falling into it. Those dishes should be slightly higher placed than crop.

For this experiment four round, yellow traps with diameter of 21 cm and depth of 10 cm were used. They were placed at every side of parcel, 10 m from its border. Monitoring location was near parcel where rapeseed was sown in previous years. This is important due to the fact that some of insect species overwinter in soil of the parcel where this crop was or in its close neighbourhood. There were water and detergent in dishes in order to break surface pressure and prevent escape of trapped insects. Insect material was collected from the dishes once in a week and put in into marked (date, number of dish, location and crop) containers with 70% ethyl alcohol.

Species identification was carried out in entomological laboratory at Faculty of Science in Kragujevac. For the identification many keys were used: ALONSO-ZARAZAGA, 1990; АНГЕЛОВ, 1976, 1978, 1979; DIECKMANN, L., 1977, 1980; FREUDE *et al.*, 1981, 1983; EHRET, 1990; HOFFMANN, 1950; SMRECZYŃSKI, 1965, 1968, 1972, 1974; ZASLAVSKII, 1956.

The list of taxa was prepared according to the newest nomenclature and can be found in Tab. 1 (ALONSO-ZARAZAGA & LYAL, 1999; ALONSO-ZARAZAGA, 2005)

RESULTS AND DISCUSSION

During the investigated period a total of 475 adult weevils' specimens were collected. The identification confirmed presence of two families: six genera with 13 species belong to fam. Curculionidae, while two genera, represented by one species each, are from Apionidae.

Table 1. Taxonomy of weevils found at Rimski Šančevi during 2008.

	A p i o n i d a e Schönherr, 1823
	Apioninae Schönherr, 1823
	O x y s t o m a t i n i Alonso-Zarazaga, 1990
	Oxystomatina Alonso-Zarazaga, 1990
	Holotrichapion Gyorffy, 1956
	(*Apiops* Alonso-Zarazaga, 1990)
1	*pisi* (Fabricius 1801)
	Subtrib. **Sinapiina** Alonso-Zarazaga, 1990
	Stenopterapion Bokor, 1923
2	*tenue* (W. Kirby, 1808)
	C u r c u l i o n i d a e Latreille, 1802
	Baridinae Schoenherr, 1836
	B a r i d i n i Schoenherr, 1836
	Baridina Schoenherr, 1836
	Aulacobaris Germar, 1824
3	*coerulescens* (Scopoli, 1763)
	Ceutorhynchinae Gistel, 1856
	C e u t o r h y n c h i n i Gistel, 1856
	Ceutorhynchus Germar, 1824
4	*asimillis* (Paykull, 1800)
5	*minutus* (Reich, 1797) (=*contractus* Marsham, 1802)
6	*napi* Gyllenhal, 1837
7	*pallidactylus* (Marsham, 1802) (=*quadridens* Panzer, 1795)
8	*picitarsis* Gyllenhal, 1837

9 *sulcicollis* (Paykull, 1800)
10 *typhae* (Herbst, 1795) (=*floralis* Paykull, 1792)
Coeliastes Weise, 1824
11 *lamii* (Fabricius, 1792)
Stenocarus C.G. Thomson, 1859
12 *ruficornis* (Stephens, 1831) (=*fuliginosus* Marsham, 1802)
Entiminae Schönherr, 1826
S i t o n i n i Gistel, 1856
Sitona Germar, 1817
(*Sitona* Germar, 1817)
13 *macularius* (Marsham, 1802) (=*crinitus* Herbst, 1795)
14 *lineatus (Linnaeus*, 1758)
Hyperinae Lacordaire, 1863
H y p e r i n i Lacordaire, 1863
Hypera Germar, 1817
(*Hypera* Germar, 1817)
15 *postica* (Gyllenhal, 1813) (=*variabilis* Herbst, 1795)

During the spring of 2008, presence of 422 specimens of Curculionoidea superfamily was recorded, with five genera and 10 species (Tab. 2). The most abundant was genus *Ceutorhynchus* thanks to species *Ceutorhynchus pallidactylus* (with 314 specimens, which is 74.4% of total number). By the way, his species was present during almost whole period of investigation (except 20 May), with two peaks, 16 April - 57 and 11 June - 125 specimens.

Rape stem weevil, *Ceutorhynchus napi*, appeared only at the beginning of research period, from 25 March till 16 April, with 27 specimens (Tab. 2).

In total, 341 specimens of both, *C. pallidactylus* and *C. napi*, were collected which is 80.8% of all specimens collected in spring. This percentage is much higher than 54.5% in Plandište, 1995, which was recorded by STEFANOVSKI (2000). This data indicates that those two species are dominant. It is very important for rapeseed protection because of their harmfulness.

Species *C. asimillis* for the first time was detected on April the 1st. The most specimens of this species were collected till the beginning of the third decade in April. This is a little surprising, because females of this pest lay eggs in rapeseed pod (KEREŠI *et al*., 2007) which in Serbia usually happens in the middle of May. During the spring, 19 specimens were collected (it presents 4.5% of total number of specimens). In the investigations conducted by STEFANOVSKI (2000) that percentage was more than double, 10.51%.

Beside that, some other species were present, such as *C. typhae*, *C. picitarsis* and *C. Sulcicolis* but their number was significantly less - nine, five and one specimen, respectively (Tab. 2).

Genus *Sitona* was presented with two species, *Sitona macularius* and *S. lineatus*, with only seven specimens (Tab. 2).

Aulacobaris coerulescens (from subfam. Baridinae) and *Hypera postica* (from subfam. Hyperinae) were presented with 11 and one specimen, respectively.

During the autumn 2008, presence of 42 *Curculionoidea* superfamily specimens was recorded, with eight genera and 11 species (Tab. 3). Genus *Ceutorhynchus* again was the most abundant (23 specimens, 54.8% of total number of weevils in autumn), as well as the species *C. pallidactylus* with 11 specimens (26.2% of total number).

Rape stem weevil, *C. napi*, presence was not recorded which is in accordance with the data about this pest mentioned as spring weevil (KEREŠI *et al*., 2007).

Table 2. - Data of weevils collected during the spring of 2008.

Month	III	IV					V				VI				Σ
Species Date	**25**	**1**	**8**	**16**	**22**	**29**	**6**	**13**	**20**	**28**	**3**	**11**	**17**	**24**	
Apion spp.					1										**1**
Aulacobaris coerulescens	2	2	1	3		1				2					**11**
Ceutorhynchus assimilis		7	2	8	1					1					**19**
C. napi	1	9	8	9											**27**
C. pallidactylus	2	17	31	57	15	9	1	1		13	15	125	21	7	**314**
C. picitarsis										5					**5**
C. sulcicolis	1														**1**
C. typhae		3				1				5					**9**
C. spp.	1	6		18									2		**27**
Sitona macularius		1													**1**
Sitona lineatus		2													**2**
Sitona spp.				1									1	2	**4**
Hypera postica					1										**1**
Total	**7**	**47**	**42**	**96**	**18**	**11**	**1**	**1**		**26**	**15**	**125**	**24**	**9**	**422**

Other members of genus *Ceutorhynchus* only with few specimens were presented: *C. sulcicolis* four, *C. picitarsis*, three, *C. assimilis*, two and *C. minutus*, one specimen (Tab. 3).

From the other genera, further species were presented with only one specimen: *Holotrichapion pisi*, *Stenopterapion tenue*, *Coeliastes lamii*, and *Hypera postica*. From *Stenocarus ruficornis* three specimens were cathched. *Aulacobaris coerulescens* with eight specimens, was the second most present species, after *C. pallidactylus.*

Table 3. - Data of weevils collected during the autumn of 2008.

Month	IX	X				XI			Σ
Species Date	**25**	**3**	**10**	**20**	**27**	**3**	**10**	**17**	
Holotrichapion pisi			1						**1**
Stenopterapion tenue			1						**1**
Aulacobaris coerulescens		2	3	1		2			**8**
Ceutorhynchus assimilis			2						**2**
C. pallidactylus			1	1		8	1		**11**
C. minutus				1					**1**
C. picitarsis		1	2						**3**
C. sulcicolis						4			**4**
C. spp.			1				1		**2**
Coeliastes lamii				1					**1**
Stenocarus ruficornis			1			2			**3**
Sitona spp.		1	1		1	1			**4**
Hypera postica				1					**1**
Total		**4**	**13**	**5**	**1**	**17**	**2**		**42**

Generally speaking, during the autumn 2008 much less weevils were collected than during the spring - more than ten times. This is not surprising, because of several reasons. First of all, period of research was shorter in autumn, eight times (exactly seven, because the first was without weevils) taking samples against 14 in the spring. The second, more important reason is connected with biology of those insects – they are more active in spring, while in autumn they are preparing

for the hibernation, especially specimens hatched during the spring which passes diapauses as adults. In the spring, during the flowering, rapeseed is much more attractive as a food source in the weevils' reproductive period and greater number of insects can be found then.

Sexual ratio

For the most of the registered weevils' species sexual ratio has been determined. This is important from the point of view concerning mating, copulation and laying eggs. Data like this should help in making decisions about adequacy of pesticide use and proper time for that. Sexual ratio for some species is given in Table 4 and represents ratio between number of males and females.

Table 4. Sexual ratio of some weevil species

Vrsta	**SR (No. ♂/ No. ♀)**
Ceutorhynchus pallidactylus	2,2
C. sulcicolis	4,0
C. assimilis	1,2
C. picitarsis	1,0
C. napi	2,6
C. typhae	2,0
Stenocarus ruficornis	0,5
Sitona lineatus	1,0
Aulacobaris coerulescens	0,4

This data consider much more and could be very helpful in better understanding of bilogycal cycles of found weevils as the rapessed pests. Finding of more males probably is not real. It could be connected with collecting technique, i.e. yelow dishes, or their position in the field space, particularly depending from that how high they are in the relation to the plants in the different plant developing stages. Except it, using of more other methods for adults' collecting will give more precise results. This give many possibilities for future experimental work.

CONCLUSION

This work should be continue, particularly in the careful comparative analysis of influence of ecological conditions (particularly climatological complex) during the longer period and biology of registered weevils through the light of rapeseed damages caused by them. It could be a base for more careful planing and protecting crop.

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