FAUNA OF HETEROPTERA IN ALFALFA FIELDS IN THE REGION OF BAČKA (NORTHWEST SERBIA): PAST AND PRESENT SITUATION

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Abstract. Research *of insect fauna in alfalfa fields in the region of Vojvodina has been neglected for more than twenty years. During the second half of the last century, many authors from former Yugoslavia investigated this topic: JOVANIĆ (1957), PETRIK (1959), BALARIN (1974), PROTIĆ (1987), KEREŠI & SEKULIĆ (1994). Despite rich diversity of insect fauna in alfalfa updated data on this topic are lacking, especially on Heteroptera in this crop. This can be explained by the fact that alfalfa makes only 4% of all crops raised in this region and that mainly pest species of economic importance are emphasized during the years of their mass appearance, exclusively. For this reason the aim of this study was to compare situation on heteropteran fauna diversity in alfalfa fields in the region of Bačka, with reference on investigations during the period 1981-1985 and in 2012. Special attention was paid to changes in bugs' diversity, domination of species and economical threats by certain species. Sampling of Heteroptera was conducted in period from late spring to midsummer, during the period of high activity of bugs with respect of plant-host phenology. Adults were collected with insect net and by hand. Collected specimens were identified in the laboratory at the Faculty of Agriculture Novi Sad according to morphological characters and by using different keys for identification: BEI-BIENKO et al., 1964; PÉRICART, 1987; WYNIGER & KMENT, 2010; PROTIĆ 2011; www.macroID.ru; www.koleopterologie.de, etc. During the five years period of sampling 18 species belonging to six families of Heteroptera were registered, while in 2012 there were 26 identified species belonging to nine families. Dominant species in both periods of sampling were phytophagous species with polyphagous preferences, not strictly related to alfalfa. On the other hand the presence and abundance of predaceous species is also recorded what can be of importance in planning biological control program. Results of this study are an overview of the true bugs fauna present in the region of Bačka and represent the contribution to faunistic knowledge of Heteroptera in Serbia.*

***Key words**: Heteroptera, fauna of true bugs, alfalfa*

INTRODUCTION

Alfalfa is one of the most important forage crops worldwide and together with red clover is one of the two most important perennial legumes in Serbia (KATIĆ *et al.*, 2005). It is a versatile crop which can be used as pasture, hay and silage. It has the highest yield potential and one of the highest feeding values of all adapted perennial forage legumes. The great importance of alfalfa is reflected in fact that this plant is the biggest source of protein per unit area, 2000-2400 kg/ha. Its relatively high levels of calcium, phosphorus and magnesium are important in balancing mineral requirements of livestock. Grown over a wide range of sod and climatic conditions, alfalfa plays an important role in crop rotation. Staying on the same field three to five years alfalfa and other legumes provide highly suitable habitats for the reproduction of a large number of pests, pathogens and weeds, which not only reduce yields, hay and seed quality but also shorten the life spans of forage plants. In the region of Vojvodina Province alfalfa makes only 4% of all crops raised in this

region therefore investigation of insect fauna, especially heteropteran species, were neglected. Data presented in this work are supplement to current knowledge of Heteroptera in Serbia.

MATERIAL AND METHODS

Heteroptera, or true bugs, examined in this study were sampled from late spring to midsummer, through the period of high activity of true bugs with respect of plant-host phenology. During days with warm, calm weather without wind insects were sampled with sweep net and by hand. In such conditions most of the specimens, especially phytophagous one with potential threat of being pests, spend time on vegetation. Therefore this method of collecting is considered suitable. In the first period of sampling from 1981-1985 insects were collected at one locality 15 km western from Novi Sad, in period from April to August. Sampling was conducted periodically in 15 to 20 days intervals with sweeping net, using 5 times 50 sweeps per field, in diagonal direction. Examined alfalfa fields were in size of about 20-30 hectares and highly irrigated during the growing season. In 2012, the second period of true bugs sampling, trial was conducted in 28 localities all over the North West part of the Vojvodina Province, called the Bačka region. Insects were collected with more attention to edges of smaller alfalfa fields. Examined fields were not in irrigation system, plants were grown in regular climatic conditions in the open fields. Collected bug specimens were examined in the laboratory for entomology at the Faculty of Agriculture Novi Sad. Heteropteran specimens were taken from the sampling pools and only adults were identified according to their morphological characteristics, basically to structure of front wings, legs, mouth parts and antennae. Many keys for identification were used: BEI-BIENKO et al., 1964; PÉRICART, 1987; EVANS & EDMONDSON, 2005; WYNIGER & KMENT, 2010; PROTIĆ 2011; www.macroID.ru; www.koleopterologie.de, www.britishbugs.org.uk; etc.

RESULTS AND DISCUSSION

All collected Heteroptera, registered in the region of Bačka, during both periods of sampling, belong to nine families and 33 species. Not all of these species are closely related to alfalfa. Many species reach lucerne fields accidentally or are connected more with the weeds, inside or around the field, than with actual cultivated plants, but their presence is of great importance as contribution to faunistic knowledge of Heteroptera in Serbia.

During five years period of sampling heteropteran species in alfalfa fields, from 1981 to 1985, there were 18 species recorded belonging to six families: Miridae, Rhopalidae, Coreidae, Pentatomidae, Nabidae and Anthocoridae (Graph 1). According to abundance of collected specimens, the dominant were phytophagous specimens belonging to family Miridae, comprising 53% of sampled pool, followed by predaceous family Nabidae which comprised 44% of sampling pool. Other four families were recorded in less than 5%: Anthocoridae almost 2%, Pentatomidae almost 1%, Rhopalidae 0.1% and Coreidae only 0.02% with only one specimen captured.

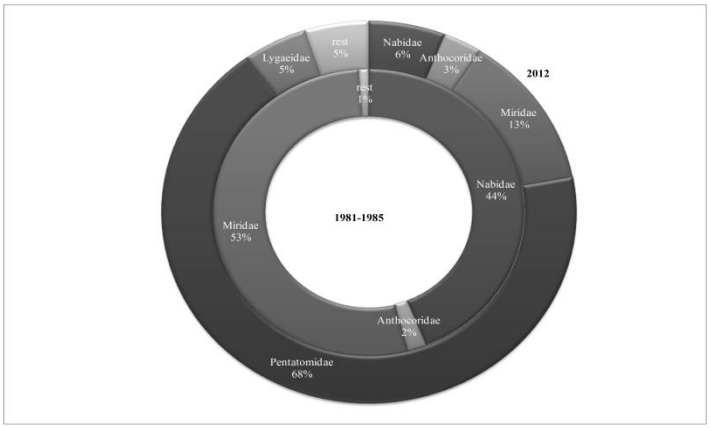

Fig. 1. Composition of Heteroptera families during period 1981-1985 and 2012 in the region of Bačka, Vojvodina Province, Serbia

The dominant family Miridae, plant bugs, represents the largest family in the Heteroptera. About 25% of the true bugs are in this family with 1300 genera and 10.040 species (HENRY, 2009). These are small, terrestrial insects, usually with oval-shape or elongate body measuring less than 12 mm in length. Species composition within the dominant family Miridae, in the study during early eighties, showed huge dominance of *Lygus rugulipennis* Poppius, with 1161 collected specimens (Table 1), comprising more than 28% of all collected heteropteran species. This species often attains strikingly high density and with wide ecological valence it is considered as pest all over the Palearctic region. In the nearby countries, it has been reported in high densities in Hungary (Erdélyi & BENEDEK, 1974), Ukraine (PUCHKOV, 1966 in ERDÉLYI & BENEDEK, 1974), Poland (BILEWICZ-PAWIŃSKA, 1965) and former Czechoslovakia (OBRTEL, 1969). Also numerous species from the same family was *Adelphocoris lineolatus* (Goeze), the alfalfa plant bug, representing 4% of sampling pool. This is the common species all over the area of fodder legumes growing. In Serbia, this species was dominant in alfalfa fields, during 1987, in the vicinity of Belgrade (PROTIĆ, 1987), and it has been reported as numerous in Hungary as well (ERDÉLYI & BENEDEK, 1974). These two species were followed by *A. seticornis* (Fabricius) and *Trigonotylus ruficornis* (Geoffroy), which were represented in sampling pool by 1.33 and 1.14%, respectively. Species *Lygus pratensis* (Linnaeus) and *Stenodema calcaratum* (Fallen) were captured in less than 1%, although they are common part of insect fauna in different crops (PROTIĆ, 1987; KEREŠI, 1993). Nymphs of this family were not identified to species, due to their changeable characters, but their huge number in sampling pool, almost 18%, indicate the dominance of this family in alfalfa fields.

Table 1

List of Heteroptera species captured during two periods of sampling in the region of Bačka, Vojvodina Province, Serbia

		1981-1985		2012	
Family	Species	number	%	number	%
Miridae	*Lygus rugulipennis*	1161	28.13	-	-
	Lygus pratensis	3	0.07	5	3.47
	Lygus wagneri	-	-	1	0.69
	Stenodema calcaratum	1	0.02	2	1.39
	Adelphocoris lineolatus	169	4.09	-	-
	Adelphocoris seticornis	55	1.33	-	-
	Trigonotylus ruficornis	47	1.14	-	-
	Polymerus vulneratus	-	-	2	1.39
	Chlamydatus pullus	-	-	1	0.69
	Chlamydatus pulicarius	-	-	3	2.08
	nymphs	747	18.10	4	2.78
Lygaeidae	*Peritrechus gracilicornis*	-	-	1	0.69
	Metopoplax ditomoides	-	-	1	0.69
	Nysius senecionis	-	-	5	3.47
Pyrrhocoridae	*Pyrrhocoris apterus*	-	-	2	1.39
Rhopalidae	*Rhopalus parumpunctatus*	4	0.10	-	-
	Coryzus hyoscyami hyoscyami	-	-	1	0.69
	Stictopleurus punctatonervosus	-	-	1	0.69
Coreidae	*Coreus marginatus*	1	0.02	2	1.39
Scutelleridae	*Eurygaster maura*	-	-	1	0.69
Pentatomidae	*Dolycoris baccarum*	16	0.39	41	28.47
	Carpocoris pudicus	6	0.15	1	0.69
	Carpocoris purpureipennis	-	-	4	2.78
	Eurydema ornatum	-	-	21	14.58
	Eurydema oleracea	4	0.10	8	5.56
	Piezodorus lituratus	3	0.07	10	6.94
	Aelia acuminata	1	0.02	2	1.39
	Holcostethus vernalis	-	-	8	5.56
	Graphosoma lineatum	-	-	1	0.69
Nabidae	*Nabis ferus*	187	4.53	9	6.25
	Nabis pseudoferus	155	3.75	-	-
	Nabis punctatus	261	6.32	-	-
	females and nymphs	1205	29.19	-	-
Anthocoridae	*Orius niger*	58	1.41	3	2.08
	Orius minutus	19	0.46	1	0.69
	Unidentified Heteroptera	25		3	
Sum		4128		144	

The second heteropteran family according to number of specimens collected during five years period of sampling was family Nabidae, with 1808 specimens captured and three identified species: *Nabis punctatus* Costa, *N. ferus* (Linnaeus) and *N. pseudoferus* Remane, representing 6.3%, 4.5% and 3.7% of sampling pool, respectively. These bugs, named damsel bugs, represent a

relatively small group of generalist predators, important link in a food chain in every ecosystem. Subfamily Nabinae are frequently found on plants and are often used in biological control of crop pests (LATTIN, 1989). In sampling pool the most abundant were females and nymphs which were not identified to species, due to difficulties in their morphological separation, but their abundance, comprising almost 30% of sampling pool, indicate the mass appearance of species from this family in alfalfa. The same species were recorded in former Czechoslovakia (OBRTEL, 1969) in alfalfa, while in central Italy species *N. punctatus* is noted as common in alfalfa, clover, sunflower and many other agricultural and horticultural crops (CZEPAK *et al.*, 1994 in SCHAEFER & PANIZZI, 2000). Many authors indicate that a number of nabid species are predators of Miridae and especially the genus *Lygus* (LATTIN, 1989), what explains their abundance in fields with domination of *Lygus* species. On the other hand, among Coleoptera, species of Chrysomelidae have been reported as prey for nabids, what can also be the explanation of their abundance regarding the high density of *Phytodecta fornicata* Brüggemann in alfalfa fields in this region (KEREŠI & SEKULIĆ, 1994; ČAMPRAG, 2007).

The third family according to abundance of its species was Anthocoridae. These insects, frequently called flower bugs or minute pirate bugs, are generally predatory insects, ranging in size from about 1.5 mm to 4.5 mm. These bugs with their predatory habits are known to occur in managed ecosystems. Most known species belonging to genus *Orius* are predaceous, but some of them include plants in their diet too (LATTIN, 2000; PROTIĆ, 2011). Many data about their plant feeding activities are still lacking. Dominant species in this study, in period from 1981 to 1985, was *Orius niger* (Wolff) followed by *O. minutus* (Linnaeus). They both prey on minute arthropods, such as aphids and mites, and most probably they follow their prey instead the host plants. Anthocoridae were not numerous as damsel bugs, but their presence is of great importance for investigated fauna.

One of the largest families within Heteroptera, Pentatomidae, was represented in alfalfa fields in less than 1% during the sampling period in early eighties. Among species belonging to this family the dominant was *Dolycoris baccarum* (Linnaeus), followed by *Carpocoris pudicus* (Poda), *Eurydema oleracea* (Linnaeus), *Piezodorus lituratus* (Fabricius) and *Aelia acuminata* (Linnaeus), all of them singularly comprising less than 1% of sampling pool. Those species are not strictly in connection to alfalfa, but many of them are common in this crop (POPOVA, 1968; OBRTEL, 1969; PROTIĆ, 1987). The exception is *P. lituratus* which is known as pest in alfalfa and other legumes, but according to Schaefer and PANIZZI (2000) this species is listed as a species of minor economical importance.

Rhopalus parumpunctatus Schilling was the only recorded species belonging to family Rhopalidae, with four captured specimens, while only one specimen of *Coreus marginatus* (Linnaeus), belonging to family Coreidae was captured during the five years sampling period. Both of these species are common and widely distributed phytophagous species occurring mainly on weeds growing in lucerne fields.

Results of survey conducted during 2012 showed minor differences in diversity of heteropteran species: there were 26 identified species belonging to nine families. The dominant was

family Pentatomidae comprising more than 68% of sampling pool (Graph 1). It is followed by family Miridae (13%), Nabidae (6%), Lygaeidae (5%) and Anthocoridae (3%). Families Rhopalidae, Coreidae and Pyrrhocoridae were represented with only few specimens comprising around 1.5% of the sampling pool, singularly, while only one specimen belonging to family Scutelleridae was captured (0.7%).

Species composition within dominant family Pentatomidae (Table 1), indicate dominance of *Dolycoris baccarum* (Linnaeus), which comprised more than 28% of all captured true bugs. *D. baccarum* is hairy, purple brown and greenish species, related to numerous host plants, although they can be zoophagous as well. According to literature in arable crops it can make damages to small grains, sunflower, tobacco, lucerne, clover, sugar beet, potato, corn and similar (PROTIĆ, 2011). In 2012 this species was the most abundant of all sampled true bugs, and recorded in almost every studied alfalfa plot. Although some authors recorded this species in lucerne fields as accompanying weeds (OBRTEL, 1969), many others recorded it as numerous in alfalfa fields (POPOVA, 1968; PROTIĆ, 1987, BABRIKOVA *et al*., 1994). The second numerous species was *Eurydema ornatum* (Linnaeus), making almost 15% of sampled specimens. True bugs in this genus are pests of crucifers, connected to weeds from Brassicaceae family but this species usually is not in connection to alfalfa, more often it is sibling species *E. oleracea* (POPOVA, 1966; PROTIĆ, 1987). The third numerous species in 2012 was *Piezodorus lituratus* (Fabricius), which specimens formed almost 7% of sampling pool. This is the only pentatomid species in this study connected to alfalfa and other legumes, family Fabaceae in general (BEI-BIENKO, 1964; SCHAEFER & PANIZZI, 2000), not polyphagous in the same percent as others.

In dominant family Penatomidae species *Eurydema oleracea* (Linnaeus) and *Holcostethus vernalis* (Wolff) made around 5% of sampling pool, singularly, while species *Carpocoris purpureipennis* (De Geer) formed less than 3% of all sampled true bugs. Species *Aelia acuminata* (L.), also recorded in early eighties, during 2012 comprised less than 2% of sampling pool, is species related to small grains, in our region well known as wheat pest of economic importance (KEREŠI, 1999; KONJEVIĆ, 2009). With its polyphagous preferences for food, this palearctic species can be found on almost every plant in family Poaceae. PROTIĆ (1987) also recorded its presence in alfalfa in the vicinity of Belgrade. The rest recorded penatomids *C. pudicus* (Poda), together with *Graphosoma lineatum* (Linnaeus) were represented with less than 1%, singularly. All species in *Carpocoris* genus are very similar according to its morphology, as well as in biology and feeding preferences. They are phytophagous and they can be, almost regularly, found in wheat, sugar beet and soybean (PROTIĆ, 2011). Their abundance is still not high in our country, but having in mind their permanent presence and phytophagous habits they can certainly be named as potential threat to crops. *G. lineatum* (L.) is common species in Europe, known as bug which is usually feed on seeds of Umbelliferae (NAKAMURA *et al.*, 1996). It is also known as species which shows "recurrent photoperiodic response", phenomenon described also for species *A. acuminata* and *D. baccarum* (HODEK, 1979, 1977 in NAKAMURA *et al.*, 1996) from our samples. This phenomenon enables insect to enter diapauses more than once within its life (HODEK & HODKOVA, 1992 in NAKAMURA *et al.*, 1996), what appears to be essential for the life cycle strategy of long-lived species distributed in the regions with relatively short periods suitable for reproduction.

Although not numerous as in sampling period during early eighties, species from the second dominant family Miridae showed different species composition in 2012. Dominant species was *Lygus pratensis* (Linnaeus), comprising more than 3% of sampling pool, followed by *Chlamydatus pulicarius* (Fallen) (2%), *Stenodema calcaratum* (Fallen) (1.5%), *Polymerus vulneratus* (Panzer) (1.5%), *Chlamydatus pullus* (Reuter) and *Lygus wagneri* (Remane), the last two captured in less than 1% of sampling individuals. Differences in species composition, as well as the absence of *Adelphocoris* species can be explained by the method of sampling: in early eighties inspection of alfalfa fields was conducted mostly in the middle of big fields, while in 2012 samples were taken mostly from smaller plots, close to the edges. The size of arable filed has a great impact on mass appearance of certain pests; mass propagation of pests favors large fields with the same crop. In opposite, domination of small fields of certain crops in arable region enables greater impact of predaceous species (ČAMPRAG, 2010).

The third dominant family Nabidae was represented with only one identified species belonging to predaceous genus *Nabis*: *Nabis ferus* (Linnaeus) which specimens formed 6% of sampling pool. PÉRICART (1987) indicates that nabids do not seem to exhibit an apparent attraction for any host-plant, while according to PAOLETTI (1999) nabids can be attracted to relatively dense, shaded and humid crops, as fodder gramineae or alfalfa. The last author also noted that *N. ferus* appears to be the most common predatory species on all herbaceous crops.

Difference in comparison to early eighties is the presence of specimens belonging to family Lygaeidae, seed bugs. There were three species recorded: *Nysius senecionis* (Schilling), *Peritrechus gracilicornis* Puton and *Metopoplax ditomoides* (A Costa), the first one comprising 3% of samples, and last two less than 1%, singularly. Although they mostly attack seeds neither one of these species is noted as pest of economic importance (SCHAEFER & PANIZZI, 2000).

Scarce specimens belonging to the rest five heteropteran families recorded, although not in great number, are important for the list of present species in alfalfa fields in our region. Among them is also predaceous family Anthocoridae with two species recorded: *Orius niger* (Wolff) and *O. minutus* (Linnaeus), forming only 2% and less than 1% of sampling pool, respectively. Specimens from family Coreidae: *Coreus marginatus* (Linnaeus) and family Pyrrhocoridae: *Pyrrhocoris apterus* (Linnaeus) singularly comprised less than 2% of sampling pool. As already mentioned above, these species scarcely present in sampled material are very likely accompanying any of the weeds growing in alfalfa fields. Presence of single specimen of *Eurygaster maura* (Linnaeus) belonging to family Scutelleridae, as well as specimens belonging to family Rhopalidae: *Coryzus hyoscyami hyoscyami* (Linnaeus) and *Stictopleurus punctatonervosus* (Goeze), all three captured in less than 1% of sampling pool, can be considered as coincidental species in alfalfa fields. Although, all specimens in family Rhopalidae are phytophagous and can feed on amount of different plants, usually they are not named as pests of economic importance (PROTIĆ, 2011).

CONCLUSIONS

In general, sampled Heteroptera in this trial consisted mainly of phytophagous species, while the second most numerous group involved predaceous species. All collected Heteroptera, registered in alfalfa in the region of Bačka, during both periods of sampling, belong to nine families and 33 species. During five years period of sampling in alfalfa fields, from 1981 to 1985, there were 18 heteropteran species recorded, belonging to six families: Miridae, Rhopalidae, Coreidae, Pentatomidae, Nabidae and Anthocoridae. According to abundance of collected specimens, the dominant were phytophagous specimens from family Miridae, forming 53% of sampled heteropteran fauna, followed by predaceous family Nabidae, which comprised 44% of sampling pool. The rest were families recorded in less than 5%: Anthocoridae, Pentatomidae, Rhopalidae and Coreidae. Dominant species were *Lygus rugulipennis* Poppius, followed by *Nabis punctatus* Costa, *N. ferus* (Linnaeus) and *Adelphocoris lineolatus* (Goeze).

During sampling period in 2012 there were 26 identified species belonging to nine families. Dominant was Pentatomidae which formed more than 68% of sampling pool, followed by Miridae (13%), Nabidae (6%), Lygaeidae (5%) and Anthocoridae (3%). The rest were families Rhopalidae, Coreidae, Pyrrhocoridae and Scutelleridae which singularly formed less than 2% of sampling pool. Dominant species were *Dolycoris baccarum* (Linnaeus), *Eurydema ornatum* (Linnaeus) and *Piezodorus lituratus* (Fabricius), all three phytophagous. They were followed by *N. ferus*, dominant species among predaceous ones. By this comparison it can be indicated that heteropteran fauna in alfalfa herbage stratum in the region of Bačka, Serbia, consists chiefly of phytophagous species and their natural enemies.

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