Insect Community Structures of Bird's – Foot Trefoil (*Lotus Corniculatus* L.) Inflorescences Along the Seed Dispersal

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Abstract

Bird's – foot trefoil (*Lotus corniculatus* L.) is an abundant *Fabaceae* species of grassland, which is also used as forage plants. *Lotus corniculatus* is an indeterminate flowering herbaceous perennial that, through the vegetative season, produces a great number of inflorescences. A long flowering period is a major factor limiting seed production in this plant. Despite the fact that these periods of flowering and seed dispersal are relatively short, the inflorescences at this period host the most abundant insect fauna. This present study was carried out with the objective to identify the commonly occurring insect's fauna and workout their abundance, diversity, habitat and food in *Lotus corniculatus* crop field from Banat (Timis, Romania): only *Heteroptera* are discussed. Insects were collected at monthly interval from May 2010 to September 2012 between 7.00 to 10.00 a.m. Extensive investigation was carried out in two localities, Timişoara and Gătaia, where 25 species of *Heteroptera* were identified in 29 samples containing 478 specimens. *Miridae* family was numerically the most abundant families constituting of 44.14% of all insects collected. *Orius niger* and *Orius minutes* is mentioned for the first time in the fauna of West Romania, as predators consuming thrips. The examined material includes six species of *Heteroptera*: *Xylocoris galactinus* Fieb., *Cymus melanocephalus* Ham., *Geocoris grylloides* L., *Lioceris tripustulatus* F., *Orthops basalis, Orthops campestris* L. that are relatively new for the fauna of Banat Region. Species diversity and evenness indices fluctuated from month to month and from one sampling site to other, and its abundance increases with the decreasing altitude of the locality.

Keywords: *abundance, Heteroptera, inflorescences, Lotus corniculatus, species diversity*

INTRODUCTION

The *Heteroptera*, or true bugs, is a highly diverse insect taxon with aproximately 42300 described species worldwide, separated into seven infraorders and 75 – 89 families (Rabitsch, 2010; Schuh and Slater, 1995).

Investigations of the *Heteroptera* of Banat were initiated by Hungarian naturalists and entomologists during the second half of the 19th century. Janos Frivaldszky (1877) recorded *Heteroptera* in some localities that today lie within the Hungarien – Serbian and Romanien borders (Banat region). In 1897 and 1907, Geza Horvath (a noted entomologist and one of the greatest heteopterologist of Europe) published data on the disribution of *Heteroptera* in a number of localities in Banat.

As *Heteroptera* show a considerable differentiations in food diets, they can offer a good measure of biodiversity; the richness in species in this order is strongly related to the total insect diversity (Limonta *et al.*, 2004; Duelli and Obrist, 1998). Most species are phytophagous, some feed exclusively on particular plant species, genera or

families, whereas others are polyphagous species feeding on dozens to hundeds of different host plant (Schaefer and Panizzi, 2000).

Previous publications of this paper underlined species considerated harmful in various agricultural crops, so standing out the numerous information related to the environment and feeding spectrum of their lives (Beldean, 2004; Popov and Rosca, 1991; Rosca 1984; Perju and Schneider, 1972; Torma, 2009). One of the favorite crops of this *Heteroptera* is the birds – foot trefoil crop.

Bird's – foot trefoil (*Lotus corniculatus*) is one of the important and perspective crop in Romania, especially in recent years in relation to climate changes. This is an abundent perennial herbaceous plant that regularly produces many more flowers than mature fruits, and is native to Europe. It colonizes disturbed sites, pastures and temporary meadows, being cultivated both in pure culture and in different types of mixtures (Dragomir, 2005; Stephenson, 1984, 1986).

All of this requires enrichment and updating of knowledge for the Heteroptera species diversity and population density and also their predators. The purpose of the present contribution is to identify the commonly occurring insect's fauna and workout their abundance, diversity, habitat and food in *Lotus corniculatus* crop field from Banat (Timis, Romania): only *Heteroptera* are discussed.

MATERIALS AND METHODS

Insects in the present study were collected in 2010 – 2012 period, at monthly interval from May to September, between 7.00 to 10.00 a.m. Extensive investigation was carried out in two localities, Timişoara and Gătaia. Insects were colected with the help of sweep net method and some are hand picked. The heteroptera bugs were narcotized by using killing bottle and brought to the laboratory and preserved by dry preservation method. The adults were identified under stereozoom microscope with the use of various keys, the most important beeing the work of Cantoreanu (2007). During the period of investigation, 25 species of *Heteroptera* were identified in 29 samples containing 478 specimens; a sample represents the insects collected in 25 double mowings.

Study region

The Timisoara locality is located in the western part of Romania (45°74′ latitude, 21°22' longitude), in the region called Banat. From a geomorphological point of view, the area is part of the great unit of the Banato – Crisane Plain, the territory belongs to the low plain sector, and is 89 m above sea level. The experience has been located on a brown – eutricambic soil, strong gleizat, gummy, with a pH = 5,6, hummus content of 2,56%, cell phosphorus content of 24 ppm, cell potassium of 89 ppm and nitrogen of 2,01%.

The Gataia locality is located about 52 Km of Timisoara (45°43′ latitude, 21°43' longitude). The investigated region consist of farmland intersected in places by canals. The experience has been located on a gleizat aluviosoil, with a pH = 6,35, hummus content of 1,73%, cell phosphorus content of 6,3 ppm, cell potassium of 50 ppm and nitrogen of 1,63%.

The Banat region has a temperate continental climate-moderate, with an average annual temperature of 10.6°C and with a mean value of rain of 631mm (Meteorological Station from Timisoara).

RESULTS AND DISCUSSION

The investigation of biodiversity of a group of insects is important because it establishes not only their numbers, but also the changes in the number of species in certain habitats (Protic, 2000).

The agroecosystems, particularly those in which is practiced an intensive agriculture have been changing fast during the last decades, affecting in that way the insect fauna structure, not only insects ar included, but also all living organisms.

In this context, our research will point out the structure of birds – foot trefoil insects fauna: only *Heteroptera* are discussed.

Heteroptera was the dominant insects group damaging birds – foot trefoil inflorescences.

The insects collected at Timisoara and Gataia represents a typical exemple of *Heteroptera* fauna present at sites of Banat region, western Romania. The sample of 2010 – 2012 when all individuals were identified to species (n = 478) contained adults of 25 species, divided in 8 families (Tab. 1) of which the most abundent was the *Miridae* species *Lygus pratensis* L., 1758 (n = 68) which represents 14,23% of the total insects collected. Further dominant were one *Anthocoridae* specie,

Tab. 1. Species of Heteroptera and number of specimen collected from birds – foot trefoil crops in the two localities

Family	Species	Timisoara	Gataia	Total number of specimen
Nabidae	*Nabis ferus* L., 1758	5	3	8
Anthocoridae	*Orius minutus* L., 1758	25	10	120
	Orius niger Wolff, 1811	8	17	
	Anthocoris nemorum L., 1758	34	23	
	Xylocoris galactinus Fieber, 1861	-	3	
Cymidae	*Cymus melanocephalus* Fieber, 1861	1	2	3
Lygaeidae	*Geocoris grylloides* L., 1758	4	-	4
Miridae	*Liocoris tripustulatus* Fabricius, 1781	4	2	211
	Halticus aptrus L., 1758	9	6	
	Adelphocoris lineolatus Goeze, 1778	16	32	
	Adelphocoris seticornis Fabricius, 1775	16	3	
	Lygus pratensis L., 1758	46	22	
	Lygus rugulipennis Poppius, 1911	8	9	
	Orthops basalis Costa, 1834	17	10	
	Orthops campestris L., 1758	3	8	
Coreidae	*Centrocoris spiniger* Fabricius, 1781	1	6	11
	Coreus marginatus L., 1758	4	-	
Pentatomidae	*Palomena prasina* L., 1761	1	-	53
	Palomena viridissima Poda, 1761	5	2	
	Eurydema ornata L., 1758 – larve	1	-	
	Dolycoris baccarum L., 1758	1	5	
	Eurydema oleracea L., 1758	16	12	
	Eurydema oleracea L. - larvae	1	3	
	Piezodorus lituratus Fabricius, 1794	3	3	
Scutelleridae	*Eurygaster maura* L., 1758	2	15	68
	Eurygaster austriaca Schranck., 1778	21	16	
	Eurygaster austriaca Schranck.- larvae	9	5	
		261	217	478

Anthocoris nemorum L., 1758 (*n* = 57) which represents 11,92% and one *Miridae* specie, *Adelphocoris lineolatus* Goeze, 1778 (*n* = 48) which represents 10,04%.

Dominant were also the *Scutelleridae* species, *Eurygaster austriaca* Schranck., 1778 (*n* = 51), *Pentatomidae* species, *Eurydema oleracea* L., 1758 (*n* = 32), *Miridae* species, *Orthops campestris* L., 1758 (*n* = 27) and two *Anthocoridae* species, *Orius minutus* L., 1758 (*n* = 35) and *Orius niger* Wolff, 1811 (*n* = 25).

One *Scutelleridae* (*Eurygaster maura* L., 1758) and four *Miridae* species were medium abundet (*n* = 10 – 23), while thirteen remaining species were rare (*n* = 1 – 8).

The examined material includes six species of *Heteroptera*: *Xylocoris galactinus* Fieb., *Cymus melanocephalus* Ham., *Geocoris grylloides* L., *Lioceris tripustulatus* F., *Orthops basalis, Orthops campestris* L. that are relatively new for the fauna of Banat Region.

Adults of four species: *Geocoris grylloides* L., 1758; *Coreus marginatus* L., 1758, *Palomena prasina* L., 1761 and *Eurydema ornata* L., 1758 were found only in Timisoara locality, while one specie - *Xylocoris galactinus* Fieber, 1861 were found in Gataia.

During this study, larvae of several species of the family *Pentatomidae* and *Scutelleridae* were observed feeding in birds – foot trefoil inflorescences.

Current knowledge on the zoogeographical distribution of the Banat *Heteroptera* can be considerated satisfacatory and the data lend themselves to same simple zoogeographical considerations excluding from the latter the 25 morphospecies.

Overall *Heteroptera* fauna of the area under study are characterized from the point of view zoogeographical as shown in Tab. 2.

Chorological categories were referred to the species level and based on classification proposed by Rabitsch and Waitzbauer (1996). The

Tab. 2. Main characteristics of *Heteroptera* collected from birds – foot trefoil crops in Banat region, 2010 – 2012 period

Classification	Food		Zoogeographic distribution	Locality	
	Zoo	Ph		Timisoara	Gataia
Nabidae					
Nabis ferus L., 1758	Pr, P		N-Anatolian - European	*	*
Anthocoridae					
Orius minutus L., 1758	Pr, P		Palearctic	*	*
Orius niger Wolff, 1811	Pr, P		Holopalearctic	*	*
Anthocoris nemorum L., 1758	Pr, P		Euro - siberian	*	*
Xylocoris galactinus Fieber, 1861	Pr, P		Holopalearctic		*
Cymidae					
Cymus melanocephalus Fieber, 1861		P	Palearctic	*	*
Lygaeidae					
Geocoris grylloides L., 1758		P	Holomediterranean	*	
Miridae					
Liocoris tripustulatus Fabricius, 1781		M	Euro - Siberian	*	*
Halticus apterus L., 1758		O	Euro - Siberian	*	*
Adelphocoris lineolatus Goeze, 1778		P	Holopalearctic	*	*
Adelphocoris seticornis Fabricius, 1775		O	Paleartic	*	*
Lygus pratensis L., 1758		P	Holopalearctic	*	*
Lygus rugulipennis Poppius, 1911		P	Holopalearctic	*	*
Orthops basalis Costa, 1834		O	Holomediterranean	*	*
Orthops campestris L., 1758		O	Palearctic	*	*
Coreidae					
Centrocoris spiniger Fabricius, 1781		P	Euro - Mediterranean	*	*
Coreus marginatus L., 1758		P	Palearctic	*	
Pentatomidae					
Palomena prasina L., 1761		P	Holopalearctic	*	
Palomena viridissima Poda, 1761		P	Euro - Siberian	*	*
Eurydema ornata L., 1758		O	Holopalearctic		*
Dolycoris baccarum L., 1758		P	Holopalearctic	*	*
Eurydema oleracea L., 1758		O	Euro - Siberian	*	*
Piezodorus lituratus Fabricius, 1794		P	Palearctic	*	*
Scutelleridae					
Eurygaster maura L., 1758		O	Euro - Siberian	*	*
Eurygaster austriaca Schranck., 1778		O	Mediterranean witch also occurs in Central Europe	*	*

Explanations: Zoo – zoophagous, Ph – Phytophagous, Pr – predator, P – polyphagous, O – oilgophagous, M – monophagous

Tab. 3. Occurrence of Heteroptera species in birds – foot trefoil crop with respect to zoogeographical regions

Zoogeographic distribution	No. species	Occurrence %
Euro - Mediterranean	7	1,46%
N-Anatolian - European	8	1,67%
Holomediterranean	31	6,49%
Mediterranean	51	10,67%
Palearctic	78	16,32%
Euro - Siberian	134	28,03%
Holopalearctic	169	35,36%

distribution are deduced from Linnavuori (2011), Ghahari *et al.* (2009) and others more recent reviews above mentioned.

As far as chorology is concerned there are 8 Holopaleartic species, 6 Paleartic species, 6 Euro – siberian species, 2 Holomediterranean species, 1 Mediterranean species, 1 Euro – mediterranean species and 1 N – Anatolian – European species.

Considering the type of diet, the are 5 predator species, 11 phytophagous species, 8 oligophagous species and 1 monophagous species.

In both locality, Timisoara and Gataia, the minute pirate bugs *Orius minutus* L., 1758 and *Orius niger* Wolff, 1811, and common flowerbug *Anthocoris nemorum* L., 1758, predators of insects and mites, was frecquently collected oh birds – foot trefoil inflorescences. *Orius niger* and *Orius minutes* is mentioned for the first time in the fauna of West Romania, as predators consuming thrips. The presence in both environments is due to the ability of *Anthocoridae* to tolerate pesticides, probably thanks to the high mobility and to the large number of generations (Fauvel, 1999).

Other predators present in both locality are field damsel bug *Nabis ferus* L., 1758, species not infuenced by intensive management og birds – foot trefoil crops (Limonta *et al*., 2004), it is spread all over Banat region on birds – foot trefoil plants and also on herbs.

Mirids are more abundent in Timisoara and in fact they seem to be more linked to the host plant and more susceptible to the effect of chemical sprays than anthocorids (Limonta *et al*., 2004; Fauvel, 1999). Among phytophagous mirids, *Halticus apterus* L., 1758 is a common species, that colonize besides *Lotus corniculatus* inflorescences, other *Fabaceae* and *Galium* species.

Adelphocoris lineolatus, Lygus pratensis, Lygus rugulipennis, Palomena prasina, Dolycoris baccarum, Piezodorus lituratus, all phytophagous, are common species and they can be pests of many crops (Balarin, 1978; Southwood and Leston, 1959).

An analysis of the zoogeographical distribution of the Heteroptera of birds – foot trefoil crops from Banat region (Tab. 3) shows at the first evaluation that the species with great ranges (Paleartic, Euro - Siberian and Holopaleartic), comprise 381 species, or 79,71% of the total Heteroptera fauna. Also typical of the Heteroptera fauna of birds – foot trefoil crop is a great number of the Mediterranean species, which comprise both exclusively Mediterranean species, and those whose ranges include a Mediterranean element. So, a total of "Mediterraneans" is estimated at 89 species, or 18,62% of the total Heteroptera fauna from brird – foot trefoil crops in Banat regions.

CONCLUSION

1. Heteroptera was the dominant insects group damaging birds – foot trefoil inflorescences.

2. During the two yeares 478 adults of Heteroptera were colected. They belong to 25 species, divided in 8 families.

3. The most abundent was the *Miridae* species *Lygus pratensis* which represents 14,23% of the total insects collected.

4. Six species of *Heteroptera*: *Xylocoris galactinus* Fieb., *Cymus melanocephalus* Ham., *Geocoris grylloides* L., *Lioceris tripustulatus* F., *Orthops basalis, Orthops campestris* L. are relatively new for the fauna of Banat Region.

5. As far as chorology is concerned there are 8 Holopaleartic species, 6 Paleartic species, 6 Euro – siberian species, 2 Holomediterranean species,

1 Mediterranean species, 1 Euro – mediterranean species and 1 N – Anatolian – European species.

6. Considering the type of diet, the are 5 predator species, 11 phytophagous species, 8 oligophagous species and 1 monophagous species.

7. Species diversity and evenness indices fluctuated from month to month and from one sampling site to other, and its abundance increases with the decreasing altitude of the locality.

REFERENCES

8. Alzugaray Rosario (2003). Insect pests damaging *Lotus corniculatus* L. flowers and seeds in Uruguay, *Lotus* Newsletter, 33:11 – 18
9. Balarin I., 1978 – Prilog poznavanju Heteroptera u fauni lucerista jadranskog podrucja, Poljoprivredna Znanstvena Smotra, 45 (55): 119 – 129 (english summary)
10. Beldean P.V., 2004 – Studiul faunistic, ecologic si zoogeografic al suprafamiliei Pentatomoidea (Heteroptera, Insecta) in zona localitatii Rimetea (jud. Alba), Bul. inf. Entomol., 14 – 15:147 – 155 (in Romanian)
11. Cantoreanu M., 2007 – Ordinul Hemiptera – In: Moldovan O.T. (ed.): Lista Faunistica a Romaniei (specii terestre si de apa dulce), Casa Cartii de Stiinta, Cluj – Napoca, 237 – 262 pp (in Romanian)
12. Dragomir N., 2005 – Pajişti şi plante furajere. Tehnolgii de cultivare, Ed. Eurobit, Timişoara
13. Duelli P., Obrist M.K., 1998 – In search of the best correlates for local organismal biodiversity in cultivated aeas, Biodiversity and Conservation, 7:297 – 309
14. Fauvel G., 1999 – Diversity of Heteroptera in agroecosystems:role of sustainability and bioindication. – Agriculture, Ecosystem and Environment, 74: 275 - 303
15. Frivaldszky J., 1877 – Adatok Temeseskrassimegyek Faunajahoz. Közlemenyek, 13:371 – 377 (in Hungarian)
16. Ghahari H., Carpintero D.L., Ostovan H., 2009 – An annotated catalogue of the Iranian Anthocoridae (Hemiptera: Heteroptera: Cimicomorpha), Acta Entomologica Musei Nationalis Pragae, 49 (1): 43 - 58
17. Horvath G., 1897 – Fauna regni Hungariae. Animalium Hungariaehucusque cogitorum enumeratio systematica 111. Arthropoda ordo: Hemiptera, Budapest, 72 pp. (in Hungarian and Latin)
18. Horvath G., 1907 – Supplementum ad Faunam Hemipterorum regni Hungariae. Annales Musei Nationalis Hungarici, 5:500 – 506 (in Hungarian)
19. Limonta L., Dioli P., Bonomelli N., 2004 – Heteroptera on flowering spontaneous herbs in differently managed orchards, Boll. Zool. agr. Bachic., ser. II, 36(3):355 – 366
20. Linnavouri R.E., 2011 – Studies on the Cimocomorpha and Pentatomorpha (Hemiptera: Heteroptera) of Khuzestan and the adjacent provinces of Iran, Acta Entomologica Musei Nationalis Pragae, 51 (1): 21 - 48
21. Perju T., Schneider E., 1972 – Contributii la cunoasterea faunei de Heteroptere din culturile de legumionase perene din Transilvania de Nord – Vest. Muzeul Brukenthal – Studii si comunicari – Stiintele Naturii, 17:277 – 289 (in Romanian)
22. Popov C. And Rosca I., 1991 – Recent research regarding cereal bugs (*Eurigaster ssp.*) in Romania, Revue Roumaine de Biologie, Ser. Biol. Anim., 36(1 - 2):51 – 56
23. Protic L.J., 2000 – Biodiversity of the Heteroptera of Serbia, Acta ent. Serb., 5 (1/2): 1 – 12
24. Rabitsch W., 2010 – True bugs (Hemiptera, Heteroptera). Chapter 9.1, BioRisk 4(1):407 – 433
25. Rabitsch W., Waitzbauer W., 1996 – Beitrag zur Wanzenfauna (Insecta: Heteroptera) von Xerothermstandorten im östlichen Niederösterreich, Verh. Zool. – Bot. Ges. Österreich 133: 251 - 276
26. Rosca I., 1984 – Zoogeographic analysis of the fauna of terrestrial Heteroptera from Romania. Revue Roumaine de Biologie, Ser. Biol. Anim., 29(1):77 - 80
27. Schaefer and Panizzi, 2000 – Heteroptera of economic importance. Boca Raton, Florida: CRC Press, 828 pp.
28. Schuh R.T., Slater J.A., 1995 – True bugs of the world (Hemiptera: Heteroptera) classificaion and natural history. Cornell Unive. Press, Ithaca, NY and London, 336 pp.
29. Southwood T.R.E., Leston D., 1959 – Land and water bugs of the British Isles. Frederick Warne and Co. LTD, London and New York, 544 pp.
30. Stephenson A. (1984). The regulation of maternal investment in an interdeterminate flowering plant (*Lotus corniculatus*), Ecology, 65(1): 113 – 121
31. Stephenson A. and Winsor J. (1986). Lotus corniculatus regulates offspring quality through selective fruit abortion, Evolution, 40(3): 453 – 458
32. Torma A., 2009 – Data to the terrestrial Heteroptera fauna of Moldova, Acta Scientiarum Transylvanica, 17(1): 105 - 118