THE IMPORTANCE OF PREDATORS IN CEREAL CROP AGROBIOCENOSIS IN LESKOVAC

Katerina Nikolić[1], Nadica Tmušić[1], Slaviša Gudžić[1], Branislav Knežević[1]

[1]University of Priština, Faculty of Agriculture, Kosovska Mitrovica - Lešak, Serbia

Corresponding author: katerina_nikolic@yahoo.com

Abstract

The monocultural way of grain crop production may cause the massive emergence and development of both harmful and useful organisms in agrobiocenosis. Predators as natural enemies give a significant contribution to the reduction of pest population. The aim of the research was to monitor the biodiversity of predators and establish the differences in their faunistic composition, with regard to the agrobiocenosis of both spring and winter crops. The following standard entomological methods were used throughout the research: visual inspection, examination of above-ground parts of a plant, the sweep net method and laboratory processing of gathered material. The research was carried out from 2011 to 2013 on the experimental plot of the Agricultural High School in Leskovac. The research shows that the diversity maintenance and natural bioregulatory mechanisms are the basic rule in preservation of the grain agrobiocenosis against harmful insects. The predatory activities towards aphids were registered among the following five species of ladybirds belonging to the family of Coccinellidae: *Coccinella septempunctata* L., *Adalia bipunctata* L., *Hippodamia variegata* Goeze, *Propylea quatourdecimpunctata* L. and *Calvia quatourdecimpunctata* L. and 2 predators of family Chrysopidae**:** *Chrysopa perla* L. and *Chrysopa carnea* Steph. The research results showed similarity among ogranisms present in respective agrobiocenoses of spring and winter crops that were compared.

Keywords: bioregulatory mechanisms, Coccinellidae**,** Chrysopidae**,** spring crops, winter crops.

Introduction

Cereal growing had already been taking place when our ancestors inhabited these areas. The leading cereal variety in Serbia is wheat, followed by barley. Long-term cereal production in Serbia enabled the creation of specific conditions in agrobiocenosis and reproduction of various beneficial and harmful insects. Those are primarily the insects that attack small grains and some polyphagous insect species (Čamprag, 2000). Mineral nutrition of high-yield plants (Savić et al., 2007) strengthens their protection mechanisms against various unfavourable ecological factors. Dense plantations and monoculture are the inevitability of contemporary crop production. Modern cereal growing and the use of agrochemicals often harm the natural balance by exterminating beneficial insects, predators and pests. Although the pesticide use in cereal production is not as widely spread as in the production of fruit, vegetables and vineyard crops, it still involves the use of soil insecticides before sowing, as well as the use of herbicides in early spring and insecticides against *Lema melanopus* L. in the dough developing stage of cereal growth (Spasov et al., 2014).

Aphids (Aphididae) are among the leading members of harmful cereal entomofauna, as they appear every year and cause harm usually after the ear formation phase (Petrović-Obradović, 2003). Predatory species that are natural part of cereal agrobiocenosis have a significant role in number reduction of aphids (Lazarevska, 1998). Out of all natural autochthonous aphids predators that have a significant bioregulatory effect on cereal agrobiocenosis in Leskovac, the most numerous ones are the ladybird populations (Coccinellidae) (Nikolić et al., 2016). Insects belonging to the family Chrysopidae (green lacewings) have a special place in integral protection. Members of this family have great consumptive power, high biological potential and a significant role in the biological battle all over the world (Krsteska et al., 2005).

Chemical protection measures against aphids are not extensively used in the production of small grains in Serbia. Therefore, cereal fields can be enormous ecological reservoirs for the preservation of beneficial insects and their natural populations. Due to all previously mentioned, grain crops provide ideal ecological conditions for the entomofauna preservation of the agroecosystem (Thalji et al., 2005).

The more complex and diverse agrobiocenosis is, the more resilient it is, thus having more efficient mechanisms for natural pest regulation (Čamprag, 2000). Specific conditions present in an agrobiocenosis lead to the emergence of numerous beneficial and harmful insects. This further leads to the basic goal of the reasearch, aiming to monitor the biodiversity of predators and determine the differences in thier respective faunistic composition in the agrobiocenosis of spring and winter grain crops.

Material and methods

The research was carried out in the territory of Leskovac from 2011 to 2013. The research facilities were set up on the research plot of Agricultural High School in Leskovac. The research included:

- The micro-plot experiment with spring crops (set up on 19/04/2011) and the varieties of Vojvoda, Smaragd, Jadran, Slavuj, Rajac, Lovcen and Vranac.
- The micro-plot experiments with winter crops (set up on 18/11/2011 and 27/11/2012) and the varieties of Zemunska Rosa, Aleksandra, Srma, Janja, Zenit, Nirvana, Cipovka, 34/D-durum).

The following standard entomological methods were used for the emergence detection of beneficial and harmful organisms in natural agrobiocenosis:

- Visual method – used for monitoring the presence of beneficial and harmful insects. The examinations were carried out every 7-10 days during the entire research period, depending on the insect population dynamics and in accordance with the variability of meteorological conditions.
- Examination of above-ground plant organs – used for the estimation of aphids population number and the number of beneficial insects. The examinations were carried out after the ear formation phase.
- Hand reaping – used for monitoring the presence of beneficial insects (ladybirds and green lacewings) among densely planted crops.
- Laboratory treatment – the material gathered during the entire research period was subjected to taxidermy, labelling, determination and collection creation.

Results and discussion

The research carried out from 2011 to 2013 provided a diversity review of the most prevalent aphids predators found in cereal crops. The awareness that natural bioregulatory mechanisms exist is the basic rule for the preservation of cereal crop agrobiocenosis from harmful insects. To preserve the complexity of bioregulatory mechanisms, it is necessary to conduct the appropriate monitoring procedures in the agrobiocenosis of cereal crops (Nikolić et al., 2012). Čamprag (2000) stated that the more complex and diverse the agrobiocenosis is, the more resilient it is; thus, its mechanisms for natural pest regulation are more efficient.

The presence of aphids (Aphididae) was determined during all the research years. Their number was the highest after the ear formation phase. In 2011 and 2013, the degree of the pest attack (Kolektiv autora, 1983) was labelled as a very weak infection (the emergence of a small colony). In 2012, the degree of the pest attack was labelled as a weak infection (a small number of small colonies present among plants). The meteorological conditions during the research period (high temperatures and dry weather) had the greatest influence on aphids development in 2012.

Predatory species that are naturally found in the agrobiocenosis of cereal crops play a significant role in the reduction process of aphids. The efficiency of natural predators, i.e. the quantity of aphids that predators can possibly eat, depends on the food availability from other sources (from nearby

plots). The unfavourable weather conditions and the lack of primary food sources may force ladybirds (or other predators) to feed from secondary food sources that are insufficient to provide for the species reproduction, but sufficient enough to enable the species survival (Lazarevska, 1998).



Picture 1. *Hippodamia variegate* Goeze on a leaf

During the research in Leskovac, the predatory activity against aphids was registered among the following five ladybird species belonging to the family Coccinellidae (Coleoptera): *Coccinella septempunctata* L., *Adalia bipunctata* L., *Hippodamia variegata* Goeze (Figure 1), *Propylea quatuordecimpunctata* L. and *Calvia quatourdecimpunctata* L. Two species of green lacewings belonging to the family Chrysopidae (Neuroptera), namely *Chrysopa perla* L. and *Chrysopa carnea* Steph. were also registered as predators (Picture 2).



Picture 2. *Chrysopa perla* L. on a ear

C. septempunctata had the greatest prevalence and activity during all three research years, whereas *P. quatuordecimpunctata* had the least. Classified by the research years, ladybirds displayed the

greatest predatory activity in 2012, when the greatest number of aphids was also recorded. The increased presence of weeds was registered in the peripheral parts of the research plots, where the increased number of aphids and ladybirds was also registered during all visual examinations. The most prevalent weeds were: *Chenopodium album* L. (Chenopodiaceae), *Atriplex patula* L. (Chenopodiaceae), *Convolvulus arvensis* L. (Convolvulaceae), *Sorghum halepense* L. (Poaceae), *Cichorium intybus* L. (Asteraceae) and *Polygonum persicaria* L. (Polygonaceae). The greatest number of aphids colonies was registered among weed species belonging to the family Chenopodiaceae (Picture 3).

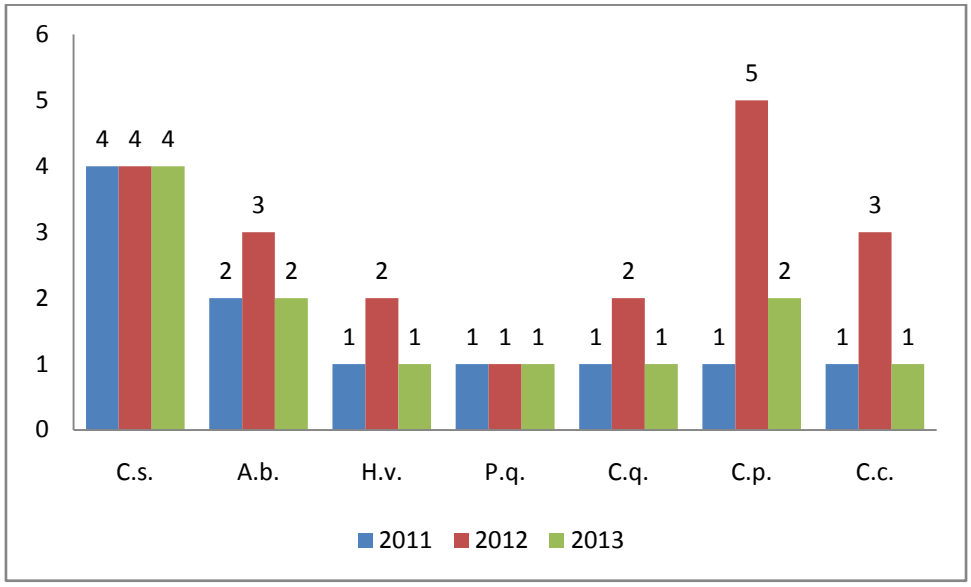


Picture 3. Aphids colonies and larvae *C. septempunctata* L. on a Chenopodiaceae

The research results showed the similarity among the registered predators present in the compared agrobiocenoses of spring and winter grain crops (Graph 1).

Throughout all three reseach years, the members of registered predatory species were found during four visual examinations. The greatest prevalence and activity during all three research years was exhibited by *C. septempunctata* and *C. perla*, which are cosmopolitan species and play a significant role in the biological battle all over the world (Krsteska et al., 2005).

During the research on wheat and weed vegetation belonging to the family Poaceae which was carried out in Strumica (Republic of Macedonia), Spasov et al. (2013) determined the presence of five predatory species: *C. septempunctata* L. (Coccinellidae, Coleoptera), *Adonia variegata* Gz. (Coccinellidae, Coleoptera), *A. bipunctata* L. (Coccinellidae, Coleoptera), *C. carnea* Steph. (Chrysopidae, Neuroptera) and *Scaeva pirasti* L. (Syrphidae, Diptera).



Graph 1. The prevalence of predators among cereal crops in Leskovac from 2011 to 2013
C.s. - Coccinella septempunctata L.
A.b. - Adalia bipunctata L.
H.v. - Hippodamia variegata Goeze
P.q. - Propylea quatourdecimpunctata L.
C.q. - Calvia quatourdecimpunctata L.
C.p. - Chrysopa perla L.
C.c. - Chrysopa carnea Steph.

Thalji et at. (2009) recorded the predatory activity of seven ladybird species during the research carried out in the surroundings of Novi Sad in 2008. Five out of seven ladybird species that they recorded were also found in our research: *C. septempunctata*, *A. bipunctata*, *H. variegata*, *P. quatouredecimpunctata* and *C. quatourdecimpunctata.* The remaining two ladybird species that were recorded by Thalji et al. but were not found in our research were *Hippodamia tredecimpunctata* L. and *Hippodamia undecimnotata* Schn. These authors claim that ladybirds are far more efficient in comparison to other predatory species, as both larvae and imagoes feed on aphids and thus act as active predators. Since the production of cereal crops does not use extensive chemical measures in the battle against aphids, cereal fields are an enormous ecological reservoir for the preservation of beneficial insects and their natural populations, leaf lice predators in particular. Our research on both spring and winter grain crops carried out from 2011 to 2013 reached the same conclusion.

Conclusions

The basic rule for the preservation of cereal crop agrobiocenosis from harmful insects is diversity maintenance and the existence of natural bioregulatory mechanisms among harmful and beneficial insects. The presence of aphids (Aphididae) was registered in the cereal crop entomofauna after the ear formation phase throughout all the research years. The greatest number of aphids was recorded in 2012, when the meteorological conditions contributed the most to their development.

The research (2011-2013) carried out in Leskovac determined the predatory activity against aphids exhibited by five ladybird species: (Coccinellidae, Coleoptera): *C. septempunctata* L., *A. bipunctata* L., *H. variegata* Goeze, *P. quatuordecimpunctata* L. and *C. quatourdecimpunctata* L. Two species of green lacewings, namely (Chrysopidae, Neuroptera) *C. perla* L. and *C. carnea* Steph, also displayed predatory activity against aphids. *C. septempunctata* and *C. perla* displayed the greatest prevalence and activity during all three research years. Classified by the research years, the greatest predatory activity was registered in 2012, when aphids were also the most numerous.

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