Зборник Матице српске за природне науке / Proc. Nat. Sci, Matica Srpska Novi Sad, № 110, 267—273, 2006

UDC 633.63:595.763(497.113)

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COMPOSITION OF COCCINELLID COMMUNITIES IN SUGAR BEET FIELDS IN VOJVODINA*

ABSTRACT: This paper presents a synthesis of the results obtained during a long--term investigations conducted on the distribution of aphidophagous coccinellid species and their quantitative and qualitative structure in sugar beet fields in Vojvodina. Composition of coccinellid communities and the annual changes in abundance of species are influenced by many variable environmental factors, but also by the prey availability during the season. Chemical treatments against *flea beetles* in May or/and against noctuid larvae in late July and the type of the adjacent crops may also affect the quantitative composition of adults coccinellid on sugar beet fields. During the season, adults coccinellid are more abundant than larvae. The qualitative structure of coccinellid communities in sugar beet fields is not different than those from other field crops. These communities consist mainly of *Coccinella septempunctata* L.; *Semiadalia undecimnotata* Schn.; *Propylaea quatuordecimpunctata* L.; *Hippodamia (Adonia) variegata* Goeze and *Hippodamia tredecimpunctata* L. Other species are present in a small fractions.

KEY WORDS: Coccinellid communities, composition, aphid density, plant density

INTRODUCTION

Aphids can be considered a major pest of sugar beet crops in Vojvodina. They appear on the crop with a variable intensities every year. Infestation of the plants by aphids differs within a single field and between fields with different locations. Two aphid species feed on and inflict the most damage on sugar beet in Vojvodina. The green peach aphid, *Myzus persicae* Sulz. which occurs on young plants early in the season and the bean aphid, *Aphis fabae* Scop. which occurs all during the season. The crop is more commonly attacked by the bean aphid than green peach aphid. According to Lowe (1975), sugar beet is relatively poor host plant for *M. persicae* and this aphid normally occurs in small populations which increase relatively slowly. These two aphids

* The paper was presented at the first scientific meeting IV INTERNATIONAL SYMPOSIUM ON SUGAR BEET Protection held from 26—28 september 2005 in Novi Sad.

are important in most sugar beet production areas, because they are a vector of *beet yellow virus*. Although sugar beet is commonly attacked by *Aphis fabae*, some aphid species, which are transient on the crop may be found in small numbers during the summer (Čamprag, 1973).

Aphids on field crops are usually attacked by complex of predators. Most of these predators are polyphagous. However, both of predators and their prey form a system of interrelated components. The majority of principal aphid predators enter the fields from outside. Therefore, knowing the sources from which predators are moving is critical. The nature of surrounding habitat, especially the kind of adjacent crops influence not only which species of predators are going to be present in a cultivated field but also the number of each. Innumerable papers have been published on complexes of aphidophagous species associated with various host plant/aphid system (Pruszynski and Lipa, 1971, Hodek, 1973, Honek, 1981, 1982, 1983, Radwan, 1983, Thalji, 1981, 1988; Lazarevska and Thalji, 1997). The aim of this work was to determine the composition of coccinellid communities in sugar beet fields, their abundance, seasonal and annual changes.

MATERIAL AND METHODS

The occurrence and population density of aphids and aphidophagous coccinellids were recorded during long-term investigations every year. The study was carried out at several localities representing the main landscape types in Vojvodina. Depending on weather conditions, sugar beet fields were regularly visited, at two weeks interval, from early May until the late of September each season. At the time of coccinellid settling on the crops (early May), adults coccinellid were visually counted by "walking counts" method (Honek, 1982), along a transect of 100 walks (about 80 meters). At this period, when at least five coccinellid adults were recorded, this indicated that the young plants were occupied by alatae or the first small colonies of aphids especially those of *Myzus persicae*. Later on, the ratio of infested plants was estimated by inspecting of 100 plants. Within a five rows, 20 randomly selected plants, per each were carefully inspected and the numbers of egg batches, larvae and adults of coccinellid were also registered.

RESULTS

Sugar beet fields play an important role in the preservation of coccinellid communities and they may be considered as an ecological reservoir for many species of natural enemies. These findings were confirmed in early studies by Thalji (1994). The author emphasized that sugar beet fields in Vojvodina, annually harboured about 27% of the overall coccinellid populations. On the other hand, coccinellid communities on sugar beet fields are similar to those on other field crops and there are no coccinellid species found to be closely associated with this crop. A wide spectrum of species occurs on all crops infe-

sted by aphids in Vojvodina (Šimić and Pavkov, 1988, Čamprag et al., 1990, Thalji, 1991, 1994).

OCCURRENCE AND SEASONAL VARIATION IN COCCINELLID SPECIES

The occurrence of species and the richness of coccinellid communities varried from year to year and from locality to locality. Seasonal variation in coccinellid numbers was primarily affected by climatic conditions, plant density and the availability of suficient food resources. At the settling time of adults, coccinellid numbers may be affected by the residual effects of earlier treatments with systemic insecticides against the beet weevil or flea beetles. On the other hand, in particular seasons coccinellid populations were also destroyed by spraying against aphids or noctuid larvae. The peak in numbers of active predators on sugar beet crop generally coincided with the peak abundance of their prey. The number of aphid-infested plants in the fields and the aphid populations increased between the mid of May and the late June, or the beginning of July (Čamprag, 1973, Čamprag et al., 1990). Locations of sugar beet fields and the structure of adjacent crops determine the richness and the appearance of species during the season. The most abundant and regularly observed coccinellid species on the crop in all years of investigations were *Coccinella septempunctata* L., *Semiadalia undecimnotata* Schn., *Hippodamia (Adonia) variegata* Goeze., *Propylaea quatuordecipunctata* L., *Scymnus rubrumaculatus* Goeze. and *Hippodamia tredecimpunctata* L. In most seasons, these six coccinellid species represent about 90% of the total number of observed coccinellids on the crops (Figure 1). All coccinellid species, other than those mentioned obove occurred in extremely low numbers. The occurrence of these species which mainly consist of *Adalia bipunctata* L, *Coccinula quatuordecimpustulata* L., *Harmonia quadripunctata* and the mycophagous species *Psyllobora vigintiduopunctata* L. largely depends on the prevailing factors mentioned above. For example, the species *H. variegata* and *H. quadripunctata* were more abundant in dry seasons, especially they influx sugar beet fields after wheat harvesting. The two-spotted lady bird, *A. bipunctata* was frequetly registered in sugar beet fields adjacent to orchards or hop stands. The species *C. 14-pustulata* was recorded in fields adjacent to uncultivated lands or to alfalfa crops. *H. 13-punctata* was frequently observed in fields near channels or within humid places in the fields. In particular years, this species forms small aggregations on the under side of the leaves. The mycophagous species *P. 22-punctata* was usually numerous at the end of the season, especially on plants infected by the *powdery mildew*, *Erysipha betae*, as well as in weedy fields.

In general, observations showed that coccinellid numbers were very low in the earlier stages of aphid colonisations, even in years with high aphid numbers. However, with medium or outbreak numbers of aphids, the numbers of coccinellids increased when aphid numbers were at peak and were the highest when they had fallen.

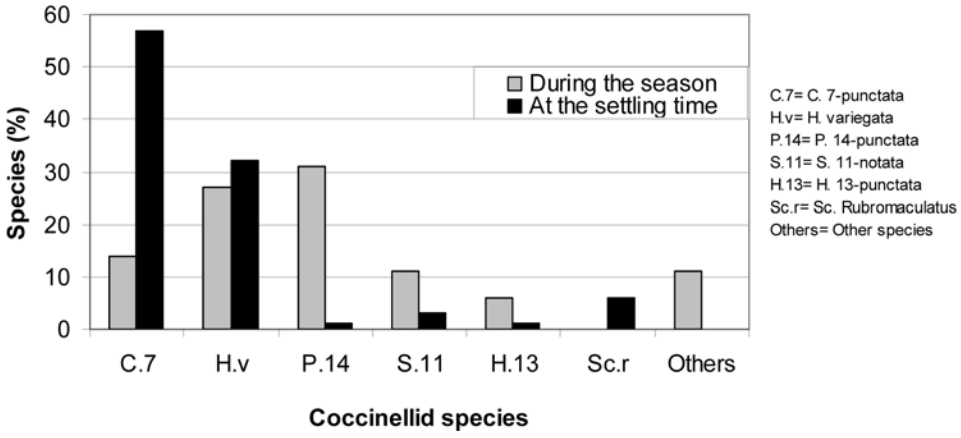

Figure 1. Annual changes in coccinellid communities in sugar beet fields in Vojvodina

Qualitative coccinellids composition was strongly correlated with food availability and plant density. Adults coccinellid spread in sugar beet fields immediately after the settling of aphids. At this time, the sparse stands of young plants with low aphid populations were more convenient for thermophilic species such as *C. Septempunctata, H. variegata* and *S. rubromaculatus*. As the build up of aphids population raise, the quantitative and qualitative composition of coccinellid changes. From the end of May onwards, *S. undecimnotata* and *P. quatruodecimpunctata* were frequently observed and as the stands became denser, the later becomes more dominant on the crop. Our results are in accordance with the results of several authors (I p e r t i, 1965, 1978, H o n e k, 1979, 1982, R a d w a n and L o w e i, 1983)

DEVELOPMENT OF COCCINELLIDS ON SUGARBEET

In the climatic conditions of Vojvodina, sugar beet infestation by aphids varied in intensity from year to year and from locality to locality. Aphid numbers among plants and among leaves within individual plants were highly variable as well. In most cases, young and inner leaves support higher aphid populations.

The spring generation of coccinellids, however, appeared to disperse in early June irrespectively of the numbers of aphids on sugar beet plants, seemingly in search for more suitable egg-laying sites. According to H o n e k, (1980), coccinellid females begin to reproduce after some time spent on feeding on aphid population. The ovarioles do not ripe before the density of aphids increases to certain threshold value, which is greater than that required for settling (H o n e k, 1978). Our observations in sugar beet fields are in accordance with these findings. However, adults coccinellid were more abundant than larvae. Egg batches and larvae of more than one species may be observed on single plants, heavily colonized by aphids. On plants like these, three coccinellid species, *C. Septempunctata, S. undecimnotata and H. variegata* were re-

corded to pass through their developmental stages. On the other hand, a single larvae of *P. quatuordecimpunctata* may be found wandering within plants in summer until the end of season.

DISCUSSION

The complex of coccinellid species is a dynamic unit whose composition is not stable. Both, the absolute numbers and the relative ratios of the species varied during the vegetation period. However, stands of field crops contain similar coccinellid communities in Vojvodina. In previosly published data (Thalji, 1994). Coccinellid communities were analyzed in aphid infested stands of agricultural crops: lucerne, sugar beet and sunflower. Thirteen coccinellid species were found, eight of them were the most abundant and could be observed in the investigated area every year. In the present study, ten species were observed to appear in sugar beet fields, six of them were regularly registered on the crop every year, while the remainder, occasionally appear depending on the prevailing conditions (geographic position, adjacent crops and agricultural practices).

The composition of coccinellid communities is largely determined by environmental factors. Microclimatic conditions influenced through plant density, prey density, annual changes in abundance of species and differences in rate and timing of migration (Iperti, 1965, 1978, Hodek, 1973, Honek, 1979, 1981, Radwan and Lovei, 1983).

At the settling time of adults coccinellid on sugar beet fields, the number of species present is largely determined by the richness of populations which survived from the previous year. In all years of investigations, the first registered species on sugar beet were *Coccinella septempunctata* and *Hippodamia variegata*. At this period, the young plants are low and the stands have a drier and hotter microclimat, which attracts these two thermophilic species (Iperti, 1965, 1978, Honek, 1979). Our studies indicated that the above mentioned species represent about 90% of the overall coccinellids population in early May.

After some time spent on feeding on aphid population, the coccinellid females begin to reproduce. As revealed previously (Honek, 1978) the ovarioles do not ripe before the density of aphids increases to certain threshold value, which is greater than that required for settling. Prolonged feeding on subthreshold density of aphids does not enable the ovariole ripening. On the other hand, if the prey density falls below certain value, the beetles cannot maintain their own body weight and they leave the field (Frazer et al., 1981). Our results also showed that 3—4 coccinellid species pass through their developmental stages on single beet plants heavily infested by *Aphis fabae* during the season. Later on, quantitative and qualitative structure of species mainly changed depending on the prevailing factors. For example, the abundance of *C. septempunctata* decreases with increasing crop density. Dense beet crops, with moist and dark lower strata and completely shaded ground surface are now more suitable for *P. quatuordecimpunctata* and *H. tredecimpunctata*.

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САСТАВ ЗАЈЕДНИЦЕ БУБАМАРА НА ПОЉИМА ПОД ШЕЋЕРНОМ РЕПОМ У ВОЈВОДИНИ

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Резиме

У овом раду презентовани су резултати вишегодишњих праћења сезонских промена, квантитативни и квалитативни састав афидофагних врста бубамара на пољима шећерне репе у Војводини.

Структура заједнице бубамара, као и годишње промене у саставу врсте, зависи од великог броја променљивих фактора. Најважнији фактори који одређују састав врсте унутар заједнице су климатски услови и присуство адекватне хране. Међутим, треба посебно истаћи утицај микроклиматских услова створених променом склопа биљака током вегетационог периода. Наиме, сувљи микроклимати који владају на пољима шећерне репе на почетку вегетације, пре затварања редова, више одговарају термофилним врстама бубамара. У том периоду врста *Coccinella septempunctata* представља више од једне половине целокупне популације бубамаре на том усеву (57%). Током лета, односно после склапања редова, усеви шећерне репе имају влажније микроклимате, те више одговарају хигрофилним врстама бубамара. Током лета и јесени врста представља више од 30% целокупне популације бубамара. С друге стране, у појединим сезонама, појава бубамара зависи од спроведених хемијских мера против буваћа у мају и/или против совице током јула. На квантитативни састав бубамара на пољима под шећерном репом могу утицати и врсте суседних усева.

Током сезоне одрасли инсекти више су присутни у односу на ларве. Ипак, ларве се могу срести на појединим биљкама које су јако нападнуте биљним вашима. Квалитативни састав заједнице бубамара на шећерној репи не разликује се значајно и сличан је саставу на осталим усевима.

На усевима шећерне репе заједнице бубамара углавном се састоје од врста *Coccinella septempunctata* L., *Semiadalia undecimnotata* S c h., *Propylaea quatuordecimpunctata* L., *Hippodamia (Adonia) variegata* G o e z e. и *Hippodamia tredecimpunctata* L. Поред наведених, могу се срести и друге врсте бубамара али оне представљају само један мали фрагмент целокупне популације током сезоне.