

MONITORING OF THE BENEFICIAL COCCINELLIDS IN ALFALFA AGROCENOSE AND POSSIBILITIES FOR BIOLOGICAL PEST CONTROL

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Abstract. Over the past decade we have become increasingly aware of the strong relationships between the environment and our health. How to avoid the use of pesticides? How to become less dependent on the chemicals? This is the reason to look for some environmentally friendly methods to prevent the adverse effect to our environment. A seasonal monitoring was conducted in alfalfa agroecose to study the population dynamic of the beneficial coccinellids. The observations took place in the period of 1999-2000 in the region of Plovdiv. The aim of the study was to determine the opportunities for pest reduction using the regulatory mechanisms of the beneficial entomofauna and some other biological methods for environmental control. The abundance and distribution of aphids attacking alfalfa were examined. The following species were identified: *Aphis medicaginis* K o c h and *Acyrtosiphon pisi* K a l t. The aphids population showed two peaks during the vegetation period. The following aphidophagous coccinellids associated with alfalfa were found: *Adonia variagata* G z., *Coccinella septempunctata* L., *Propylaea quatuordecimpunctata* L., and *Adalia bipunctata* L. The coccinellids refer to the most effective entomophagous of many pest species. Their density was strongly correlated with the prey density. The conducted study reveals an opportunity for biological pest control in alfalfa agroecose.

Keywords: beneficial coccinellids, alfalfa agroecose, pest control.

AIMS AND BACKGROUND

Biological control for a long-term regulation of pest species is unlikely to be effective in conventional agroecosystems because many factors interact to reduce efficiency of natural enemies, i.e. pesticides application is disruptive to the presence of natural enemies.

The beneficial coccinellids (Coleoptera, Coccinellidae) refer to the most effective entomophagous of many crop pests. Their use as pest regulators is especially considerable in nowadays, when alternative ways to control pests have been searching. There is a considerable bulk of literature which analyses their pest regulation mechanisms in different cropping systems¹⁻⁷.

This paper presents results concerning the abundance of predatory coccinellids and their preys in alfalfa fields.

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EXPERIMENTAL

The observations were conducted in 1999/2000 in the region of Plovdiv. Three alfalfa plots were monitored during the vegetation period – from March to October – to study the population dynamic of the pest and beneficial insects. The plots were not treated with chemicals. The crop was checked weekly. For scouting alfalfa insects, two methods of sampling were used: 1) sweep net sampling; 2) stem sampling. In order to obtain a representative sample, the “W”-shaped pattern was used (Fig. 1).

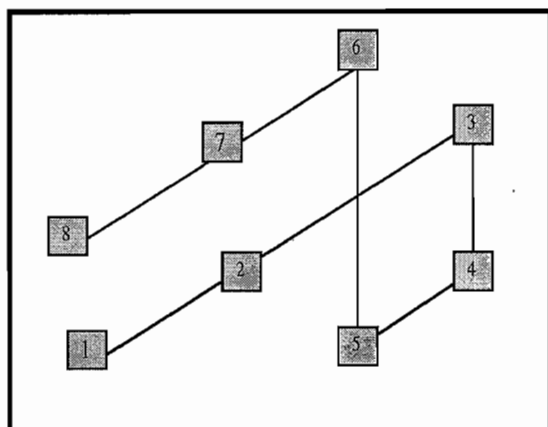


Fig. 1. Sampling plan for obtaining representative samples of alfalfa insect populations

Sweep net sampling. This method was used to estimate the populations of coccinellids in alfalfa. Although it provides only a relative estimate of insect density, it is sufficient for most above ground insects of alfalfa. The caught beneficial insects were identified and counted in the field, and then released. However, the sweep net is also used for detecting initial low density populations of aphids.

Stem sampling. This method was used for monitoring tip injury in alfalfa, and obtaining more accurate estimates of aphid abundance than from sweep samples. A tray was used onto which the aphids were shaken from the stems.

RESULTS AND DISCUSSION

Alfalfa is a crop inhabited by many beneficial insects. Predators are found among the Coleoptera, Neuroptera, Diptera, and Hemiptera, but more than half of all predators are coleopterans (Fig. 2). In 1999, their percentage is 58.4%, and in 2000 – 61.9% from the total number of the beneficial insects found in alfalfa agrocenoses (Fig. 2).

The most important family within the Coleoptera for biological control have been the Coccinellidae. Lady beetles (coccinellids) are important natural enemies of aphid pests in alfalfa and they play sufficient role for their regulation. In the period of 1999-2000, there were found 8 species of coccinellids. Figure 3 presents the percentage of the found coccinellid species.

The most abundant was *Adonia variegata* (30.8%), followed by *Coccinella septempunctata* L. (23.3%). Along with the mentioned two species, the following

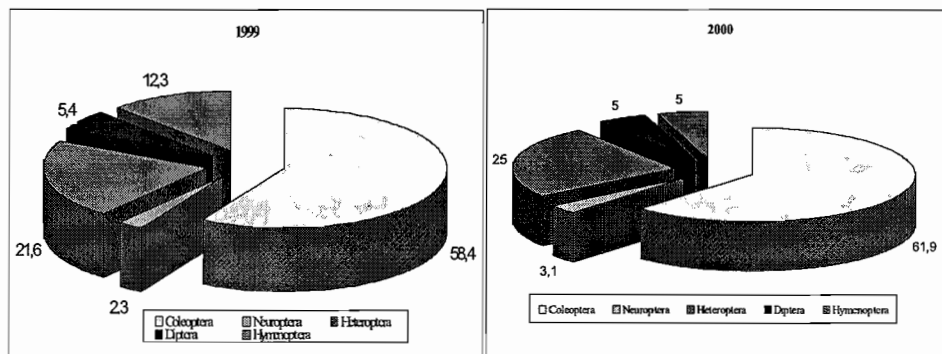


Fig. 2. Percentage proportion of the beneficial insect orders found in alfalfa fields in the region of Plovdiv in 1999-2000

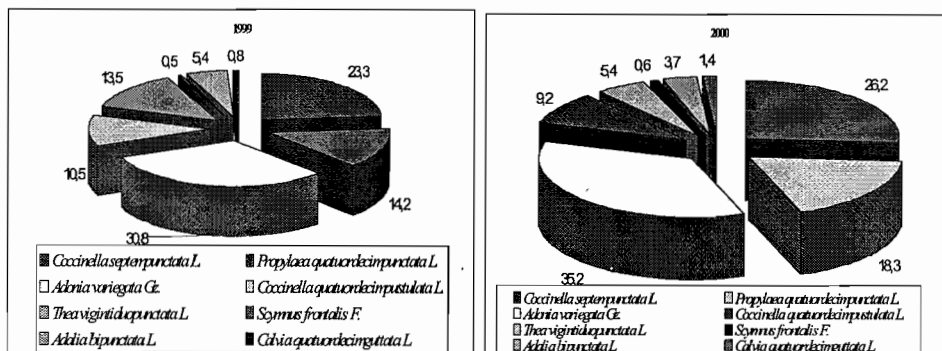


Fig. 3. Percentage of the coccinellids found in alfalfa agrocenoses in 1999-2000

coccinellids were established in sufficient numbers during the vegetation season of alfalfa: *Propylaea quatuordecimpunctata*, *Coccinella quatuordecimpustulata* and *Adalia bipunctata*, *Thea vigintiduopunctata*, *Scymnus frontalis* and *Calvia quatuordecimguttata*.

In Bulgaria, *Adonia variegata* inhabits the alfalfa fields annually. It develops 1-4 generations and overwinters in an adult stage in the soil. The first appearance of the species was registered at April 24th in 1999, and at April 17th, 2000. *Adonia variegata* was observed in the highest number from the first days of July to the middle of the same month. It coincides with the peak of the aphid population.

Coccinella septempunctata is another valuable predator in alfalfa fields. During the period of the study, it was observed from the middle of April to the end of August. The species has seven spots (three on each elytron with a shared spot). The head is black with two separated white spots. Its maximum appearance was observed at the end of May to the middle of June.

The two-spotted lady beetle, *Adalia bipunctata* L. was found to comprise

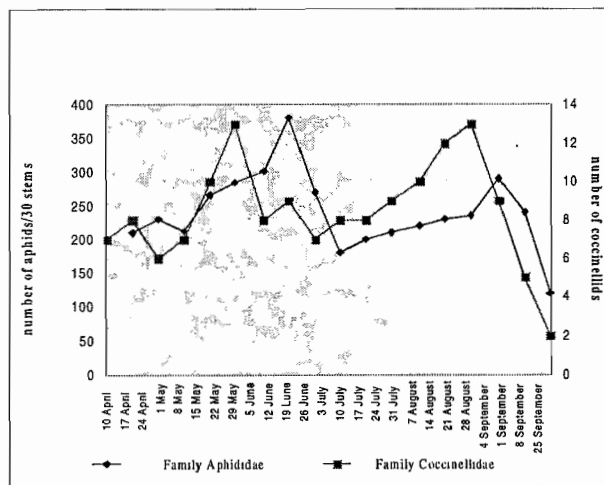


Fig. 4. Population dynamic density of the aphids (Aphididae) and lady beetles (Coccinellidae) in 2000

5.4% in 1999 and 3.7% in 2000 of all coccinellids. It is one of a small number of lady beetle species found in alfalfa. The two-spotted lady beetle is reddish with a black spot in the middle of each elytron (wing cover). Adults have an oval shape, with the head often hidden past the eyes. The lateral edge of the pronotum (shield between the head and wings) is white. Adults are 3.5-5.2 mm long and 2.8-4.0 mm wide.

Aphids belong to the order Hemiptera, family Aphididae. Pea aphid (*Asyrthosiphon pisum* K a l t.) and cowpea aphid (*Aphis cracivora* K o c h.) are the most important economic aphids of alfalfa, although other aphid species do occur.

In the period of 1999-2000, the population dynamic of the aphids was followed in different alfalfa fields parallel with the population dynamic of the coccinellids (Fig. 4).

CONCLUSIONS

Alfalfa is a crop inhabited by many beneficial insects. The most important families within the Coleoptera for biological control have been the Coccinellidae - 58.4% in 1999 and 61.9% in 2000 from the total number of the beneficial insects found in alfalfa agrocenoses. There were found 8 different species of the family - *Adonia variegata*, *Coccinella septempunctata*, *Thea vigintiduopunctata*, *Adalia bipunctata*, *Propylaea quatuordecimpunctata*, *Coccinella quatuordecimpustulata*, *Scymnus frontalis* and *Calvia quatuordecimguttata*. The most abundant species was *Adonia variegata*, followed by *Coccinella septempunctata*. They keep the population density of aphids below the economical threshold in alfalfa fields untreated with pesticides.

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