Journal of Novel Applied Sciences
Available online at www.jnasci.org
©2017 JNAS Journal-2017-6-2/52-55
ISSN 2322-5149 ©2017 JNAS

ECOLOGICAL FEATURES OF *MIRIDAE* BUGS OF COTTON - ALFALFA BIOCOENOSIS OF UZBEKISTAN

Daminova D.B.

Institute of the gene pool of flora and fauna of the Academy of Sciences of the Republic of Uzbekistan, Senior research officer, Candidate of biological sciences

***Corresponding author*:** Daminova D.B.

ABSTRACT: This article contains the material data on *Miridae*-bugs of cotton-alfalfa biocoenosis species composition, types of *Adelphocoris* and *Lygus* orders which assume great importance as cotton pests nowadays. This article also contains the data on their biological characteristics development, population dynamics and factors contributing to their expansion and development on the cotton-plant.

***Keywords*:** Miridae bugs, cotton, alfalfa, pests, ecology, biology, insect, phytophages, injuriousness.

INTRODUCTION

The intensive development of agricultural production of the republic contributes to pests' concentration on cultivated crops, the pest populations forecast for rational management of their numbers in agrobiocenoses acquires great relevance in order to maintain the sustainable development of ecosystems.

The main specific insect complexes which cause significant harm to cotton in Uzbekistan are aphids, tetranychus, cotton and winter leafworms against which the main means of protecting crops are always directed. However, anthropogenic transformation of the territory of the republic and climate change made significant adjustments to the structure, composition and number of progressively spreading pests.

In recent years, outbreaks of reproduction of *Miridae* bugs, especially field and alfalfa types, have begun to occur on cotton-plant. These pests seemed to be secondary pests whose harmful activity was underestimated as it was considered that due to the low number of *Miridae* bugs crops injuriousness can be insignificant.

In Uzbekistan, originally, the *Miridae* bugs were described as alfalfa pests, and their injuriousness for cotton was considered as a random phenomenon. However, the constant trophic connection of these insects with the country basic economic culture, with cotton-plant, affected their adaptive development mechanisms on cotton-plant.

Despite the fact that the spread of bugs (especially alfalfa) in the cotton fields of Uzbekistan has been worrying for a long time, many authors have repeatedly pointed out they are a serious cotton-plant pests (Alimjanov, 1960; Boltabaev, 1995; Zavadovsky, 1935; Khamraev, 1993; Yakhontov, 1957). But, due to insufficient knowledge of the individual features of development: a secretive way of life, the nature and forms of manifestation of harm to plants, they have always been attributed to the insignificant components of the cotton biocoenosis.

However, the analysis of nutritional data by their generative organs (buds, ovaries, flowers, capsules) of cotton for several years (2005-2010) allowed reconsidering the assessment of damages caused by mirids, which accounted for the loss of cotton crop up to 60% over these years. This suggests that the damage caused by them was largely underestimated, and it was often possible to identify it only after a long time, after the disappearance of the pest.

In this connection, the task of this work was: to determine the species composition of mirids of the cotton-alfalfa biocoenosis with the identification of common species on cotton, the identification of seasonal changes in their numbers during the growing season, and also under the influence of adjacent alfalfa crops.

MATERIALS AND METHODS

The data collection on bugs' species composition of *Miridae* Family and main research were conducted at cotton-alfalfa agrobiocoenosis of the following farm enterprises such as «Mehnat nur» and «Rustamagro» of Urtachirchik region; «Sayfulla-ota» and «Ittifoq» of Zangionta region; «Elikuzi ota» and «Bobur» of Tashkent region.

The research was conducted on "Namangan–77" cotton-plant sort and in the fields of "Tashkent" alfalfa sort. The cotton fields of Bekabad region were located in the rotation with alfalfa unlike the ones of Urtachirchik and Zangionta regions.

The study of the species composition, ecology, and the determination of the injuriousness of mirids were carried out during the period of accounting for the dynamics of their abundance in cotton at fixed sites in farm enterprises and in rout inspections from the beginning of alfalfa and cotton vegetation from February to September.

RESULTS AND DISCUSSION

The registrations, which were held once a week throughout the growing season, were made from the moment the plants reached 10–20 cm in height.

20 samples were taken in a checkerboard pattern (5 plants in each sample) in each field (2ha.). The registrations were taken separately including the calculation of imago and mirid maggots' number. In the process of the research, the mirids species composition was determined at different stages of development during the entire growing season. The collection of mirids was carried out by mowing the entomological nets (25–50 double strokes depending on the site) on alfalfa, weedy and wild plants along the margins of cotton fields.

Currently, the agricultural production of the republic includes farm enterprises with a mosaic placement of crops in crop rotations where the tendencies to saturation with their leading crops remain natural: cotton, wheat, alfalfa, corn; from vegetables: tomatoes, beets, cucumbers, cabbage, dill, coriander and etc.

At the same time, long-time research on cotton protection showed that the conditions for modern reconstruction of agricultural landscapes with a set of different crops are favorable for pest control because of the mutual enrichment of fields by polyphagous predators and parasites due to the variety of crop rotations, especially alfalfa, which in our conditions considered to be a reserve for the accumulation of useful insects fauna and flowering nectar plants.

Collections and observations in the cotton-alfalfa agrobiocoenoses of the Tashkent and Surkhandarya regions served as the material data according to the species composition taking into account our previous studies in the Djizak and Ferghana regions, according to our own and literary data (Blumer, 1988; Kerjner, 1964; Ostanova, 1955; Tuychiev, 1974; Yakhontov, 1957) in cotton fields, on weeds, along the margins of fields and adjacent alfalfa, 19 species of mirids of *Miridae* Family out of 10 orders were recorder.

Table 1. Cotton-alfalfa biocoenosis species composition

Name of the species orders	Cotton-plant	Alfalfa	Weeds
Deraeocoris punctulatus Schill	++	+	+
Polimerus unifasciatus F.		+	+
Polimerus cognatus Fieb.	+	++	+
Polimerus vulneratus Pz.	++	+	+
Lygocoris lucorum M.-D.	++		
Lygus rugulipennis Popp.	++	+	
Lygus pratensis L.	++	++	++
Lygus gemellatus H.-S.	++	+	+
Orthops basalis Costa.		+	+
Orthops kalmi L.		+	+
Adelphocoris seticornis F.		+	+
Adelphocoris lineolatus Gz.	++	++	++
Adelphocoris jacovlevi Reut.		+	+
Stenodema turanicum Reut.		+	+
Stenodema calcaratum Fall			+
Trigonotylus ruficornis Geoffr.	+	+	+
Orthotylus flavosparsus C.Sahlb	+	+	+
Campylomma verbasci M.D.	++	+	+
Campylomma diversicornis Reut.	+	+	+

All the species, except the endemic one for the Central Asia (*Adelphocoris jacovlevi* Reut.), are spread at different CIS territories, in various biotopes.

As a result of the conducted studies, 4 alfalfa species out of 19 founded species (*Adelphocoris lineolatus* and field bugs: *Lygus pratensis, Lygus gemellatus, Lygus rugulipennis*) refer to polyphages found in many crops (alfalfa,

cotton, cabbage, beet, maize, soybean, peanuts, kenaf, cannabis, wild turnip, fruit) and considered to be the pests most frequently encountered in cotton-alfalfa agrobiocoenoses of Uzbekistan.

Out of them *Adelphocoris lineolatus* and *Lygus pratensis* are ubiquitous and in high density. Species *Deraeocoris punctulatus*, *Campylomma verbasci* and *Campylomma diversicornis* are predators that destroy tetranychidae, aphids, tobacco thrips, eggs and caterpillars of young leafworms on alfalfa and cotton-plant. The abundance of mirid imago and maggots on alfalfa during all periods of its growth and development indicates that alfalfa is their constant reservation.

Adelphocoris lineolatus Goeze. – a wide polyphage with a strong preference for legumes. The most massive species on the seed alfalfa (in all areas of its cultivation) is known as an alfalfa, cotton, melilot pest. It infects the weed surrounding of cotton and other crops area. It is widespread everywhere.

The alfalfa mirid hibernates in the egg phase most often inside the stubble of alfalfa and in the stems of other perennial grasses. The hatching from the eggs of the maggots, according to our observations, occurs in early April (2015) – in early March (2016) and continues until the end of April depending on the hydrometeorological conditions, after mating, it starts egg rafting. Eggs are laid in young stems and petioles of leaves. In one egg rafting can be from 3 to 12 pieces.

On average, for one female is up to 24 eggs. Maximum number of eggs laid by one female during its lifetime is from 68 to 100 eggs. The hatching of maggots begins 6–7 days later and lasts 2 days. During their development they pass through 5 stages. The duration of each stage depends on nutrition (leaves, ovaries, capsules, little beans) 5–8 days. They develop within 4–5 generations, each of which, depending on the hydrometeorological conditions, lasts 37–39 days.

The first generation is in May, the second in the period of the formation of generative organs on cotton-plant (mass flowering of cotton-plant) and alfalfa in June, the third is in July during the mass formation of fruit organisms (ovary, flowering, and the formation of capsules), and the fourth is in August. The fourth generation hibernates. In the years of early spring, such as this year (2016), the 5th generation was hibernating.

In farm enterprises of the Urtachirchik region, where alfalfa was absent in crop rotations, the density of mirid bugs was always kept low during the growing season (up to 14–25 per registration), so the damage to cotton-plant was insignificant.

According to research in 2016 in the first half of the vegetation, the alfalfa mirid bedbug appeared in the cotton-alfalfa crop rotation on alfalfa and wild vegetation in early March. Imago since the beginning of April increased in numbers in the first and second decades of May, the development of 1 and 2 generations occurred on alfalfa and on weedy and wild vegetation.

Mirids begin to switch to cotton-plant from the second generation. The weather conditions of this year (early spring) contributed to the rapid distribution of population and increase in the number of mirid bugs in the sown areas, primarily, cotton-plant (from 10 to 15 individuals per record), finding a sufficient food supply – mostly young petioles of leaves and young juicy stems, buds, flowers, ovaries, as well as on alfalfa and various wild composite and cruciferous plants.

Besides the weather conditions, mowing of alfalfa beginning from the first mowings (in early May), and, especially, during the second and third ones when there is a particularly large migration of bugs to nearby fields, primarily to cotton fields, contributed to the accumulation of mirid bugs on cotton-plant. On cotton, bugs feed on its fruit elements which, especially in the initial period of its development, are, undoubtedly, a rich source of nutrition for the alfalfa bedbug.

On average, there were over 40 adult bugs and maggots on over 100 plants in august, on cotton. Bugs, overflown at this time, cause major harm to cotton-plant. At the same time, with the growth of alfalfa, they preferred this crop, on which there were always from 120 to 250 individuals per 50 double mowings. This year, because of early spring, the alfalfa bug developed in 5 generations.

Lygus pratensis L. is a wide polyphage. It strongly damages fruit, grain, legumes, and irrigated crops, especially alfalfa, beet, corn, cotton, pumpkin, kenafu, cannabis, soy, cucumber and etc. It is widespread everywhere. It hibernates in the adult stage. This year, the overwintered individuals came out of hibernation in February and concentrated already in early March on wild and weedy vegetation (wild turnip, sorrel, blind weed, goose foot, licorice etc.)

According to our data, the first and second generation egg rafting, as well as their development, occurred on these same plants, where after additional feeding and mating it laid eggs in alfalfa stems and bracts and other weeds. It already begins to migrate to cotton-plant in the second generation (late April – early May) during the formation from 6 to 8 – 10 of true leaves. The subsequent egg rafting of the third and fourth generations and their development occurs on cotton.

With the transition of cotton-plant (late May – June) to the mass budding, flowering and ovary phase, the density of bugs reached critical number (100 – 120 individuals per 100 plants), in separate fields adjacent to alfalfa, and it was only in «Bobur» farm enterprises. In the same place, on one of the fields, a maximum number was noted up to 150 – 200 individuals per 100 plants during the period of fruit formation (in July – August); also, on the cotton plot adjacent to alfalfa. Buds, damaged by bugs, fell off regardless of age (injections for them are fatal). Damaged ovaries led to a decrease in the size, weight of the capsule and possible necrosis and, accordingly, a decrease in the further development of the capsule.

L. gemellatus H.-S. is wide polyphage. It harms fruit, grain, beans and, especially, alfalfa, cotton-plant and etc. Imago hibernates. Bugs' flight took place in late February, when t –12, 4^0 and 13^0, and was observed until mid-March due to the early spring of this year. After additional feeding, bugs begin to mate. From observations, egg rafting of the wintering generation of this year occurred from the end of March and lasted until early April.

Mass appearance of the field bug was observed in the second decade of April. Eggs were laid scattered in young juicy stalks of alfalfa, separately or together. It took 5–8 days for the development of eggs, and 23–25 days for maggots. However, there was a complete development of it on cotton-plant, in the Ferghana valley (Alti-Aryk), in small amounts, at average decade temperatures $29,8^0$–$30,5^0$ for 31 days, in connection with what, we consider it to be a potential cotton pest. Nevertheless, the sagebrush, due to the low number of individuals, developing on cotton-plant, was not as harmful as, for example, alfalfa, as high air temperatures inhibited its development. The sagebrush bug was in a small amount on cotton-plant while amount registration. The largest number of imago was registered in the middle of June; the rest of the time, no more than 3 individuals were registered.

CONCLUSION

Thus, 19 species out of 10 genera of mirid bugs were identified in the agrobiocoenosis of cotton-alfalfa crop rotation of Uzbekistan. Out of them, only 3 types were notable for the number and injuriousness: *A. lineolatus,* and field bugs: *Lygus pratensis, Lygus gemellatus*.

The studies of the biology of these species for 2 years have revealed that their development during the growing season occurs in 4–5 generations; hibernation in egg or imago stage depending on species: embryonic development 4–6 days, maggot – 12–14 days, period preceding egg rafting up to 6 days, duration of imago – 15–20 days.

From the studies conducted in 2016 on the formation of the density of mirid bugs in the cotton-alfalfa biocoenosis of the Tashkent region, it was established that the formation of population dynamics occurred as follows. In the Urtachirchik region, where there is no alfalfa in the cotton crop rotation of «Mekhnat-Nur», there was no mass infection of cotton either by alfalfa or field bugs, since their numbers were so low (14–25 individuals per 100 plants in June–July), that the harm was insignificant.

At the same time, in the Bekabad region, where the cotton fields were spread alongside the alfalfa (the favorite plant of the majority of the mirid bug species up to 20 – 30 species), during mowing period, especially, during 2 and 3, in rare cases, are strongly subjected to bugs settling. During this period, bugs always occur on cotton-plant and feed on its generative organs (flowers, ovaries, and young capsules), especially, during their development (3 – 4 generations) which are a rich source of nutrition for many insects.

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