Distribution of coccinellidae in agrocenoses of Kashkadarya

Khurshida Burieva[1*], *Nodira* Arabova[2], *Alisher* Muxamedjanov[2], and *Khasan* Akhmedov[3]

[1]Karshi State University, Karshi, 180100, Uzbekistan
[2]Alfraganus University, Tashkent, 100000, Uzbekistan
[3]Tashkent State Agrarian University, Tashkent, 100140, Uzbekistan

Abstract. This article is devoted to the study of the level of distribution of coccinellids in agrocoenoses, in which the static distribution of coccinellids in agricultural crop fields: corn fields, winter wheat fields, cotton crops, sugarcane crops, pea crops and alfalfa fields is analyzed. As a result of the research, the effect of corn planting periods on the number of coccinellids, the dynamics of reproduction of pests and coccinellids depending on the varieties of winter wheat were also studied. The sowing time of corn plant is also found to affect the number of coconans, while in the early stages of the crop, one plant contains up to 89 coccinellids during the flowering of corn. Coccinellids were found in large numbers in cultivated fields, and the following 18 types of coccinellids were identified. Correlative analysis of changes in predator:prey ratio in the process of study of reproduction dynamics of coccinellids and aphids depending on the periods of growth and development of maize planted in May: earing, fertilization, flowering, milk-wax ripening. According to the results, the ratio of coccinellid: aphid during the tuber period of corn was on average 4.96:11.68, and the correlation index was found to be very low (0.15446). According to the results of the analysis, there is a weak correlation between coccinellid: aphids during the fruiting period of the corn plant, and their correlation was shown in the correlation indicators during the flowering period. 6 species of predatory coccinellids were recorded during the research conducted in winter wheat fields. 10 types of coccinellids were recorded in cotton and cotton fields, 15 types of coccinellids in alfalfa fields, and 5 types of predatory coccinellids in pea fields. According to the obtained results, the highest number of coccinellids was recorded in the fields planted with corn.

1 Introduction

Today, as a result of the intensive increase in the demographic state on a global scale, the negative impact of urbanization processes and anthropogenic factors on the development of agriculture is growing. In particular, human agricultural activity and the intensive development of new areas for agriculture lead to changes in the environment, a decrease in insect diversity, and a reduction in their habitats. Therefore, determining the species composition of ladybirds (Coleoptera, Coccinellidae) found in agrocenoses, analyzing

* Corresponding author: xurshida362@gmail.com

controversial species using morphological and molecular methods, grouping ladybirds into ecological groups based on their way of life, as well as developing recommendations for improving biological effectiveness, is of significant scientific and practical importance.

In the world, research is being conducted to improve biological methods for controlling harmful insects, which are effective and economically inexpensive, particularly for the mass breeding of promising ladybird species in biolaboratories to combat plant aphids (Homoptera, Aphidoidea) and methods for their use.

G. Iperti [1] emphasizes that, in the context of biological control, coccinellids play a significant role in the mortality of coccids, aphids, and mites. The unique aggregation behavior of coccinellids has yet to be fully leveraged for the acclimatization of new species in different countries. Their migratory abilities present both challenges and opportunities for the development of effective biological control programs targeting aphids. Future research on the genetics, physiology, and behavior of coccinellids, combined with studies on their flight aerodynamics and interactions with agricultural ecosystems, will undoubtedly contribute to advancements in coccinellid-based aphid control programs [1].

According to the data provided by I.G. Bokina [2], predatory coccinellids (Coccinellidae), which are one of the most widespread and effective groups of entomophages, are found in the forest-steppe zone of Western Siberia. Among the 17 species of predatory coccinellids identified in the agrocenoses of cereal crops and cherry trees, the species *Propylea quatuordecimpunctata*, *Coccinella septempunctata*, *Hippodamia tredecimpunctata*, *H. variegata*, and *H. arctica* are the most widespread and have been recorded as dominant species. The author's studies include information on the species composition and ecological characteristics of coccinellids in the agrocenoses of winter rye (*Secale cereale*), spring wheat (*Triticum durum*), and oats (*Avena sativa*), as well as the effects of agronomic practices (main soil tillage, use of chemicals, and preceding crops) and cultivation technology on the number of coccinellids. B.A. Ahmadov and S.Sh. Hasanova [3] studied certain bioecological and ethological characteristics of the seven-spotted coccinellid (*Coccinella septempunctata*), which plays a key role in regulating the population of cotton aphids (*Aphis gossypii*) and chickpea aphids (*Aphis craccivora*) in the cotton-growing regions of Azerbaijan. They recorded ten species of predatory coccinellids and parasites that participate in limiting the number of aphids in agrocenoses: *Coccinella septempunctata* and *Adonia variegata G.*; *Chrysopa carnea St.*, *Syrphus corollae F.*, *Scaeva albomaculata M.*; aphid parasitoids from the family *Aphidiidae* such as *Aphidius ervi Hal.*, *Praon volucre H.*, *Diaeretiella rapae M.*, and others. Among the predatory insects, coccinellids are the most widespread and effective, with *Coccinella septempunctata* holding a leading position. The high level of predation by coccinellid larvae and adults is crucial in reducing the population of cotton and chickpea aphids. The research findings demonstrate that the use of coccinellids against aphids has significant ecological and economic importance.

M. Kehat and S. Greenberg [4] studied the importance of Coccinellidae species found in citrus orchards in Israel, their prey, frequency of encounters, and distribution. Dense populations of aphidophagous coccinellids have also been recorded in citrus orchards, where they feed on scale insects. Therefore, they may also be of significant importance as predators of scale insects. While some species are evenly distributed across all regions of the country, others have been found to occur more frequently in warmer areas [5, 6].

The species composition of Coccinellidae (lady beetles) found in agrobiocenoses of the Kashkadarya region and their occurrence levels across different agrocenoses were studied. The regions of Coccinellidae distribution, characterized by specific ecological conditions, are referred to as habitats or beetle stations. The spatial distribution of Coccinellidae across various field crops and fruit trees was analyzed (Table 2). Our future studies will focus on Coccinellidae stations in agrocenoses. Due to the unique climatic conditions in our research area, it is crucial to adhere to optimal planting times for agricultural crops. Crops sown at the

appropriate time require minimal additional resources and are more resistant to stress factors, such as pests and plant diseases.

2 Materials and methods

Research on coccinellids was carried out in agricultural agrobiocenoses in Nishon, Kasbi, Mirishkor districts of Kashkadarya region during 2020-2023 yy. Studies on the accounting of coccinellids in agrobiocenoses G.I. Savoyskaya [7] and V.P. It was carried out according to the methods of Semyanov [8]. The number of plant saps in agrocenoses A.K. Calculated according to the formula of Fasulati [9]. In addition, the number of aphids was studied on a 5-point scale [10].

3 Results

3.1 Coccinellidae in corn fields

Lady beetles were abundant in corn fields within the study area. Eighteen species of Coccinellidae were identified in this field, including *Hippodamia variegata* (10%), *Oenopia conglobata contaminata* (14%), *Coccinella septempunctata* (18.5%), *Adalia bipunctata* (4.5%), *Propylaea quatuordecimpunctata* (11.5%), *Hippodamia tredecimpunctata* (5%), *Coccinella undecimpunctata* (4.5%), *Exochomus flavipes* (5.5%), and *Stethorus punctillum* (6%). Other species found included *Chilocorus bipustulatus* (1.5%), *Platynaspis luteorubra* (1%), and *Scymnus rubromaculatus* (2%), totaling 200 Coccinellidae individuals on 10 corn plants.

Our observations indicate that, during different phases of crop ontogenesis in agrobiocenoses, lady beetles are present in varying densities or may be absent altogether. In corn fields, the research subjects began to appear in late spring and early summer. Initially present in small numbers, their population and diversity increased as the number of individuals and species grew. During the peak growth period of corn, over 300 beetles of various Coccinellidae species were found on 10 plants. As corn ontogenesis progressed quantitatively, both the population and diversity of Coccinellidae increased. Lady beetles were particularly abundant as vegetation transitioned to qualitative changes. During this period, between 350 to 400 beetles were found on 10 plants. The number of Coccinellidae sharply increased during the flowering stages of row crops and other plants.

This led to an increase in the population of plant aphids (*Dactynotus tanaceti* L.), which are a preferred food source for Coccinellidae. The highest quantity of plant sap was observed during the reproductive organ development phase of corn, with sap levels corresponding to grades II-III on the scale; approximately 850-1000 plant saps were found in 10 plants. The peak abundance of Coccinellidae corresponded to the milky ripeness phase, with their population reaching 600-730 individuals per 10 plants. During the milky and waxy ripening phases of corn, the sap is reduced by predatory Coccinellidae, which consume the sap even within the inflorescences. Toward the end of corn ontogenesis, as their food sources diminished, the Coccinellidae migrated to other habitats. During this period, 20-30 Coccinellidae were found in 100 plants. Our observations established that the increase in Coccinellidae population correlates with the rise in plant sap, which serves as their primary food source.

3.2 Impact of corn sowing time on Coccinellidae population

From 2020 to 2023, we conducted studies on corn fields in the Kasbi and Nishan districts of Kashkadarya region. We observed the effect of Coccinellidae on pests populating the following corn varieties planted at different times: Esdalik-80 and Kelajak-100. The study included the following planting times: early (second decade of March), optimal (first decade of May), and late (second decade of June). One of the corn pests, plant aphids, is preyed upon by Coccinellidae, which feed on the aphids. Our observations included assessing the Coccinellidae population, species composition, and the relationship between their abundance and plant sap levels. From the ontogenesis phase of the first 4-5 leaves, Coccinellidae appeared in significant numbers. Notably, when we artificially opened the plant's leaf axil, numerous Coccinellidae were found there.

At the early growth stages of corn crops, the density of Coccinellidae averaged 35 per plant. The peak density coincided with the corn flowering period, with 425 Coccinellidae observed on a single plant. From May to August, a high occurrence of Coccinellidae, both in species and numbers, was recorded in corn crops compared to other crop types. Aphids, which serve as food for Coccinellidae, began to appear during the dusty flowering stage of corn, and their population gradually increased. Initially, pest occurrence was classified as level I, but due to rapid population growth, it soon matched levels II and III on the scale. A decrease in the number of Coccinellidae was noted at the full ripening stage of corn, with an average of 25 Coccinellidae recorded per plant.

Our observations confirmed that changes in Coccinellidae density are primarily related to their food availability. It was noted that Coccinellidae density decreased with reduced plant sap content in corn. Additionally, Coccinellidae numbers varied depending on the planting time of the corn and the amount of plant sap. The highest Coccinellidae density was observed in corn varieties planted during the optimal period. For early corn varieties, the Coccinellidae population ranged from 10 to 50 per plant during the growing season, while for corn planted at the optimal time, the range was 20 to 90, and for late plantings, it was 20 to 70 over the growing season.

The dynamics of Coccinellidae and aphid reproduction were studied in relation to the growth stages of corn planted during the optimal period, including the stages of heading, fruiting, flowering, and milky-wax ripening. For this study, 10 fields covering 50 hectares were selected. Samples were collected from 10 points along the diagonal of each field, examining 10 plants per point and 100 corn plants across the 10 fields.

Changes in the predator-prey ratio in this process were analyzed using correlation methods. The results indicated that the average ratio of Coccinellidae to aphids during the tuber formation stage of corn was 4.96:11.68, with a correlation index of 0.15446. As aphid numbers increased during corn fertilization, the population of Coccinellidae also rose. During this period, their average ratio was 30.1:108.55, with a correlation index of 0.456236. The highest populations of Coccinellidae and aphids corresponded to the flowering stage, with an average ratio of 45.11:439.68 and a correlation index of 0.995338 (Table 1). A decline in aphid numbers was observed during the milky-waxy maturity stage of corn, with an average ratio of 22.87:9.85 and a correlation index of 0.21711. The findings indicate that the correlation between Coccinellidae and aphids during the fertilization period of corn is weak, with a stronger correlation observed during the flowering stage.

Table 1. Quantities of Aphids and Coccinellidae during Corn Flowering Period

S/n	Quantities of Coccinellidae and Aphids in Research Fields (units)											Average	Correlation (C/A)
№1	Coccinellidae	36	39	42	38	49	55	62	78	83	64	54,6	
	Aphids	400	250	385	400	405	559	537	800	1005	721	546,2	**0,94465**

№2	Coccinellidae	35	48	46	39	47	46	58	69	60	75	52,3	
	Aphids	521	563	632	365	486	475	582	560	509	638	533,1	**0,556693**
№3	Coccinellidae	51	76	48	59	47	76	42	46	48	42	53,5	
	Aphids	463	609	561	586	483	751	360	451	475	501	524	**0,849904**
№4	Coccinellidae	63	49	46	43	39	61	89	43	37	39	50,9	
	Aphids	785	498	482	362	406	618	836	329	365	348	502,9	**0,927091**
№5	Coccinellidae	49	35	36	38	37	39	34	35	36	55	39,4	
	Aphids	426	347	391	365	342	365	321	342	326	629	385,4	**0,916172**
№6	Coccinellidae	36	38	39	34	35	36	38	45	46	78	42,5	
	Aphids	348	369	401	254	342	348	375	423	423	736	401,9	**0,978053**
№7	Coccinellidae	39	34	56	35	34	37	39	38	39	34	38,5	
	Aphids	365	331	531	326	312	362	365	348	349	328	361,7	**0,987165**
№8	Coccinellidae	36	34	39	52	45	43	39	41	46	37	41,2	
	Aphids	305	342	409	514	423	507	347	407	409	356	401,9	**0,822578**
№9	Coccinellidae	32	51	43	41	35	39	29	45	47	38	40	
	Aphids	315	486	417	405	324	384	235	482	408	348	380,4	**0,938512**
№10	Coccinellidae	39	35	46	32	42	49	34	32	39	34	38,2	
	Aphids	356	298	427	329	402	475	326	318	348	314	359,3	**0,950319**
Average	Coccinellidae	54,6	52,3	53,5	50,9	39,4	42,5	38,5	41,2	40	38,2	45,11	
	Aphids	546,2	533,1	524	502,9	385,4	401,9	361,7	401,9	380,4	359,3	439,68	**0,995338**

An inverse correlation was noted at the milky-waxy maturity stage. Based on our observations and literature analysis, no insecticide treatment is necessary for aphids when the ratio of plant aphids to predatory Coccinellidae is 1:30. Regarding corn planting times, the population of predatory Coccinellidae is insufficient to control aphids when pest numbers reach their peak in early-planted crops.

Based on the findings of this study, early corn varieties require protective measures due to their higher susceptibility to pest infestation. In contrast, late-planted corn varieties did not experience simultaneous high pest pressure, though they did not achieve the necessary biomass due to delayed growth and development. The results indicate that aphid populations can be managed with the assistance of Coccinellidae by carefully selecting planting fields and adhering to recommended planting times for corn. This approach enables a natural reduction in pest levels, promoting sustainable crop health and yield.

As a result, protective measures are necessary for these corn varieties. Late-planted corn did not experience simultaneous or subsequent high pest pressures. However, due to delays in growth and development, the required biomass was not achieved. The findings of this study suggest that aphid populations can be controlled with the help of Coccinellidae by selecting appropriate fields for corn cultivation and adhering to recommended planting times. This approach supports natural pest management and enhances crop health and yield potential.

3.3 Winter wheat

During research conducted in winter wheat fields, six species of predatory Coccinellidae were recorded: *Coccinella septempunctata* (39.3%), *Oenopia conglobata contaminata* (28.5%), *Propylaea quatuordecimpunctata* (7.9%), *Scymnus frontalis* (5%), *Hippodamia variegata* (15%), and *Exochomus nigromaculatus* (4.3%). On average, 140 beetles were captured per 10 sweeps of the entomological net (Table 2).

Most Coccinellidae departing from settlements begin to move into agrocenoses in search of food. These beetles actively migrate to winter wheat fields from late March to early April. The highest abundance of Coccinellidae on plants of the Poaceae family was observed during the milk maturation stage. At this stage in the ontogeny of winter wheat, an average of 140 beetles were captured per 10 sweeps of the entomological net. By the wax maturation stage, the number of Coccinellidae observed had declined. The number of honeydew droplets was recorded by shaking 10 times, resulting in an average of 25 droplets. The amount of plant sap during the tuber formation phase averaged 50 grains per 1 m² of wheat. The highest level of plant sap (1100 units/m²) was noted during the budding and flowering phases.

3.4 Growth of aphids and Coccinellidae in relation to winter wheat varieties

Between 2020 and 2023, the interactions within the "winter wheat – aphids – Coccinellidae" tri-trophic system were studied in wheat fields of the Kasbin and Nishon districts in the research area. The following winter wheat varieties were selected for study: Shukrona, Uzbekistan-25, Nasaf (durum), Bunedkor, Semrug, Amira, Navbakhor, Akmarvarid, Sarbon, and Hamkor.

Our findings indicate that the grain aphid (*Schizaphis graminum* Rond.) has become a significant pest in winter wheat varieties. The average number of aphids per plant during the milk-wax maturation stage ranged from 50 to 1000 across these 10 wheat varieties over the three years of study. According to other researchers, aphid populations initially concentrate along the field edges, then gradually spread inward as their numbers increase [11, 12]. Generally, aphid abundance in cereal crops is related to the plant's growth stage, remaining low during flowering, increasing sharply afterward, and then declining towards the wax maturation stage [11]. Seasonal aphid dynamics vary primarily due to feeding conditions, pest species and population characteristics, and the features of the host plant [12].

The highest aphid population was recorded in the Shukrona and Uzbekistan-25 winter wheat varieties. Due to their high nutritional value and morphological structure, these varieties support larger populations of aphids (*Sitobion avenae* F.), leading to a reduction in the efficiency of Coccinellidae in neutralizing plant sap. The lowest aphid populations were observed in the Bunedkor, Semrug, Amira, Navbakhor, Akmarvarid, Sarbon, and Hamkor varieties. The characteristics of winter wheat varieties play a significant role in shaping the aphid-to-Coccinellidae ratio. These results demonstrate that variety-specific traits influence both aphid and Coccinellidae populations, leading to a unique aphid-to-Coccinellidae ratio for each variety.

3.5 Cotton Crops

In cotton fields, 10 species of Coccinellidae were identified: *Coccinella septempunctata* (20%), *Coccinella undecempunctata* (13.3%), *Chilocorus bipustulatus* (6%), *Stethorus punctillum* (20%), *Scymnus frontalis* (4.7%), *Scymnus syriacus* (3.3%), *Hippodamia variegata* (12%), *Oenopia conglobata contaminata* (8%), *Propylaea quatuordecimpunctata* (6.7%), and *Exochomus flavipes* (6%). On average, 150 beetles were captured per 10 sweeps of the entomological net (Table 2).

Cotton fields occupy most of the arable land in the Kashkadarya region, serving as a primary food source for insect pests, particularly *Aphis gossypii*. This also attracts Coccinellidae. *Stethorus punctillum*, specializing in feeding on spider mites, is the dominant species. However, the prevalence of chemical pest control over biological methods restricts the large-scale migration of Coccinellidae to cotton fields. Consequently, in our studies, we found Coccinellidae on cotton fields primarily during the appearance of 5-6 rows of leaves in cotton plant ontogeny [13].

3.6 Melon crops

In fields sown with Melon crops, 10 species of Coccinellidae were observed (Table 2): *Henosepilachna elaterii* (25%), *Propylaea quatuordecimpunctata* (12.5%), *Exochomus undulatus* (3.125%), *Hippodamia tredecimpunctata* (5.625%), *Adalia bipunctata* (5%), *Chilocorus bipustulatus* (5%), *Coccinella septempunctata* (15.65%), *Oenopia conglobata contaminata* (12.5%), *Hippodamia variegata* (9.375%), and *Scymnus frontalis* (6.25%). An average of 160 beetles were captured per 10 sweeps of the entomological net (Table 2).

As summer begins, *Henosepilachna elaterii* and its overwintered larvae, which reproduce in the first generation, start to damage crops. In June, an average of 4.5 Coccinellidae per m² were observed, increasing to an average of 35 adults per m² by the end of July.

The beetle population exceeded 1000 in some polyculture fields, causing extensive damage by feeding on melons, pumpkins, watermelons, cucumber leaves, and especially melon fruits. Additionally, June saw a significant increase in the population of agriculturally beneficial predatory Coccinellidae, such as *Coccinula quatuordecimpustulata*, *Coccinella septempunctata*, and *Oenopia conglobata contaminata*.

3.7 Alfalfa

Fifteen species of Coccinellidae were identified in clover fields: *Coccinella septempunctata* (21.7%), *Coccinella undecimpunctata* (14.7%), *Propylaea quatuordecimpunctata* (8.7%), *Oenopia conglobata contaminata* (11.7%), *Coccinula sinuatomarginata* (5.7%), *Hippodamia variegata* (5.7%), *Adalia decempunctata* (3.7%), *Scymnus frontalis* (3%), *Scymnus (Pullus) subvillosus* (2.3%), *Hippodamia tredecimpunctata* (2%), *Adalia bipunctata* (4.3%), *Chilocorus bipustulatus* (2.7%), *Platynaspis luteorubra* (3%), *Scymnus rubromaculatus* (2%), and *Exochomus undulatus* (1.3%). During the early flowering stage of alfalfa, over 350 beetles were caught with 100 sweeps of an entomological net (Table 2).

Coccinellidae in alfalfa fields become active from April, with an average of 9 beetles per m² observed during the regrowth stage. By May, their numbers begin to increase. In the early budding and flowering stages, their population averages 35 per m² of primary habitat. During the alfalfa seed maturation period, a decrease in caterpillar numbers was observed. The population density of plant aphids (*Therioaphis trifolii* Mon and *Aphis pisum* Harr) in alfalfa fields begins to increase during the stem elongation phase, averaging 150.6 per m². When the plant enters the flowering stage, aphid numbers reach a peak, averaging 300.8 per m². During the late development of alfalfa, the aphid population gradually decreases.

3.8 Pea

In pea fields in the study area, five species of predatory Coccinellidae were recorded: *Coccinella septempunctata* (43%), *Propylaea quatuordecimpunctata* (26%), *Hippodamia variegata* (15.38%), *Oenopia conglobata contaminata* (10.77%), and *Hippodamia tredecimpunctata* (4.6%) (Table 2).

Coccinellidae began to appear in pea fields in May, with an average density of 10.5 beetles per m². As the pea plants progressed through growth and development, both the diversity and abundance of Coccinellidae increased. Initially, *Coccinella septempunctata* was present in low numbers. During the budding and flowering stages of the pea plants, plant sap became evident, with an average of 60.1 units of sap per m². During the full flowering stage, the aphid population increased significantly, with an average of 825.4 aphids per m².

Table 2. Coccinellids distributed in agrobiocenoses of Kashkadarya region

№	Species name	Cotton	Alfalfa	Pea	Winter Wheat	Corn	Melon crops
1	*Coccinella septempunctata*	+	+	+	+	+	+
2	*Coccinella undecimpunctata*	+	+	-	+	+	-
3	*Adonia variegate*	+	+	+	+	+	+
4	*Exochomus flavipes*	+	-	-	-	+	-
5	*Exochomus melanocephalus*	+		-	-	-	-
6	*Stethorus punctillum*	+	-	-	-	+	-
7	*Scymnus frontalis*	+	+	-	+	+	+
8	*Coccinula sinuatomarginata*	-	+	-	-	+	-
9	*Scymnus (Pullus) subvillosus*	-	+	-	-	+	-
10	*Adalia decempunctata*	-	+	-	-	+	-
11	*Oenopia conglobata contaminata*	-	+	+	+	+	+
12	*Exochomus undulatus*	-	+	-	-	+	+
13	*Propylaea quatuordecimpunctata*	+	+	+	+	+	+
14	*Hippodamia tredecimpunctata*	-	+	+	-	+	+
15	*Adalia bipunctata*	-	+	-	-	+	+
16	*Anisosticta novemdecimpunctata*	-	-	-	-	+	-
17	*Chilocorus bipustulatus*	+	+	-	-	+	+
18	*Henosepilachna elaterii*	-	-	-	-	-	+
19	*Platynaspis luteorubra*	-	+	-	-	+	-
20	*Scymnus rubromaculatus*	+	+	-	-	+	-
	Total	**10**	**15**	**5**	**6**	**18**	**10**

A corresponding increase in the population of predatory Coccinellidae was observed in response to the increase in available food, reaching an average of 30.2 beetles per m². During the fruiting period of pea plants, a sharp decline in plant sap levels was noted, leading to a significant reduction in Coccinellidae numbers. During this period, an average of 15.6 beetles per m² was recorded [14].

4 Discussion

The research results show that coccinellids, especially *Coccinella septempunctata*, which belong to the Coccinellidae family, have significant ecological and economic importance in reducing the number of harmful aphids in agriculture. In the agroecosystems of the study area, 20 species of coccinellids were identified, and their distribution ratio varied depending on the crop fields. The highest number of coccinellid species was found in corn fields (18 species; 90%), while the fewest species were observed in chickpea fields (5 species; 25%). This demonstrates that the growth stages of plants and the ecological conditions directly affect the number and species composition of coccinellids. The analysis showed that the

growth processes of crops - corn pollination, the milky ripening stage of winter wheat, and the budding and flowering phases of legumes and peas - are closely associated with the peak increase in the coccinellid population. It is during these stages that the number of plant aphids also increases, thereby providing more food sources for predatory coccinellids. This demonstrates the effective functioning of the natural biological control mechanism. Based on the results, the ratio between coccinellids and plant aphids was found to be as follows: 1:40 in corn, 1:30 in cereal crops, 1:35 in peas, 1:35 in vegetable crops, and 1:40 in legume fields. In cases where this ratio is lower, the use of chemical agents is not recommended, as the coccinellid population is naturally sufficient to limit the harmful insect population. Therefore, to improve the effectiveness of coccinellids in agrocenoses, it is important to plant beneficial crops in parallel, create favorable environments for coccinellids around the fields, and protect their overwintering habitats from chemical treatments. Many researchers [1-14] have conducted studies on the bioecology and distribution of coccinellids. B.A. Ahmadov and S.Sh. Hasanova [3] have deeply studied the coccinellid species found in Azerbaijani agrobiocenoses and their role in controlling crop pests. In these studies, the interaction between *Coccinella septempunctata* from the Coccinellidae family and the pest species *Aphis gossypii* (cotton aphid) and *Aphis craccivora* (leguminous plant aphid) in the predatory-prey system has been extensively explored. However, our research was conducted on a wide scale in the agrocenoses of the Kashkadarya region, focusing on the species of coccinellids found in corn fields, wheat fields, vegetable crops, cotton fields, legume fields, and chickpea fields. The study examined the dynamics of their population growth in relation to the ontogenesis of agricultural crops and their parasites. The growth and development stages of corn crops planted at different times-such as the tasseling, flowering, budding, and milky-waxy ripening stages-were explored for the first time in our research, as well as the dynamics of coccinellid and aphid population growth and their correlation. In contrast to the results of other authors' studies, the fact that coccinellid species were more frequently identified in agrocenoses indicates the significant importance of our research.

5 Conclusion

Based on the analysis of the study results, the following findings were established:

1. In the agrocenoses of the study area, 20 species of Coccinellidae were found: in maize fields, 18 species were observed over the growing season, representing 90% of the study area's Coccinellidae species composition; 15 species were recorded in meadows, comprising 75% of the species composition; 10 species (50%) were identified in cotton fields, while winter wheat fields contained 6 species (30%). The lowest diversity was observed in peas, with 5 species (25%).

2. The studies showed that the population of Coccinellidae and aphids peaked during the bud formation and flowering phases of pea plants. Population growth coincided with key developmental phases in the agrocenoses, such as ear formation in maize and sorghum, milk stage in winter wheat, and flowering in alfalfa.

3. Practical results suggest that the ratio of Coccinellidae to plant sap in agrobioceonoses is as follows: 1:40 in corn, 1:30 in cereal crops, 1:35 in peas, 1:35 in polycultures, and 1:40 or below in alfalfa. When this ratio falls within or below these levels, chemical control methods should be avoided. Instead, it is recommended to establish parallel planting of Coccinellidae-supportive crops in agrocenoses, plant beneficial trees and shrubs around crop fields, and protect overwintering sites from chemical treatments to enhance Coccinellidae effectiveness.

Reference

1. G. Iperti, Agriculture, Ecosystems & Environment **74,** Issues 1–3, 323-342 (1999)
2. I.G. Bokina, Entmol. Rev. **98**, 663–673 (2018). https://doi.org/10.1134/S0013873818060027
3. BA Ahmadov, S Sh. Hasanova, J. Entomol. Zool. Stud. **4(3):** 234-237 (2016)
4. M. Kehat, S. Greenberg, Entomophaga **15**, 275–280 (1970). https://doi.org/10.1007/BF02371004
5. V. Barkar, O. Molchanova, Visnyk agrarnoi nauky **98(10):** 57-64 (2020) DOI:10.31073/agrovisnyk202010-08
6. G.I. Savoyskaya, Coccinellidae (systematiss, use in pest control in agriculture), 210, (1983).
7. V.P. Semyanov, On the methodology of accounting for coccinellids, their parasites, pathogens and predators, 71-73 (1984).
8. K.K. Fasulati, Field study of insect invertebrates, 10 (1971).
9. A.A. Bekuzin, D.A. Azimov, A.G. Davletshina, M.K. Kadyrova, Insects of Uzbekistan, 340 (1993).
10. K.E. Voronin, Biological protection of grain crops from pests, 198 (1988).
11. O.R. Aleksandrovich, I.K. Lopatins, A.D. Pisanenko, Catalog of Coleoptera (Insecta) of Belarus, 103 (1996).
12. A.V. Blekhman, Ecological Genetics, **5(2),** 25-36 (2007).
13. A. Biranvand, O. Nedved, W. Tomaszewska, C. Canepari, J. Shakarami, L. Fekrat, M. Khormizi, ZooKeys, **587**, 37–48 (2016)
14. N. Namozov, M. Tursinbaev, I. Yuldoshev, S. Yuldasheva, E3S Web of Conferences, **244**, 02007 (2021)