

The Fauna of Insects of Vegetables and Melons of Central Fergana, Especially Its Distribution and Ecology

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Abstract: *I.I.Zokirov, D.A.Azimov – for the first time the entomofauna of vegetables and melons of Central Fergana was determined, consisting of 149 species and 6 subspecies belonging to 113 genera, 32 families and 7 orders. 2 species (*Trifidaphis phaseoli* (Passerini, 1860), *Eurydema oleracea* (Linnaeus, 1758)) and one subspecies (*Aphis frangulae beccabungae* Koch, 1855) are new for the entomofauna of Uzbekistan, 19 species for the entomofauna of Central Fergana. 18 invasive species have been found that are found on more than 20 species of cultivated plants, of which 3 species (*Phthorimaea operculella* (Zeller, 1873), *Tuta absoluta* (Meyrick, 1917), *Myiopardalis pardalina* Bigot, 1891) are serious quarantine pests. The main directions of functioning of the phytophagous host system in the following ecological groups were identified: rhizophages — 34 species (21.9%), phyllophages and lymphophages — 120 species (77.4%), anthophages — 32 species (20.6%), carpophages - 15 species (9.7%) and holofagi - 7 species (4.5%). These groups are formed due to trophic competition and existing ecological niches.*

Keywords: Insects, fauna, distribution, ecology, vegetable-melons, Central Fergana, Uzbekistan

1. Introduction

The analysis of the insect fauna of vegetables and melons of the Fergana Valley was made almost half a century ago. In particular, the studies of T.Tursunkhodzhayev (1971), conducted in 1960–70, were aimed at studying the entomofauna of East Fergana. These sources have so far been adopted as a preliminary review for conducting ecological-faunistic studies in this region, which are quite outdated.

Climate change that has been occurring in recent years, the renewal of the country's agricultural crops and the specialization of new varieties and species has an impact on the entomofauna of the region. This, in turn, requires a comprehensive study of the pest fauna of agricultural crops grown in Central Fergana, their distribution and ecology.

On this basis, the purpose of the study is to determine the fauna of insects of vegetables and melons of Central Fergana, analysis and ecological-faunistic rationale for the characteristics of their distribution.

2. Material and Methods of Research

The study was conducted during 2012-2018 on the fields of farmer and household farms of Central Fergana and adjacent territories, where the main part of the vegetable and gourd crops of Uzbekistan is grown.

The study used the methods of general and agricultural entomology, as well as a number of determinants (Bei-Bienko, Mishchenko, 1951; Vinokurov, Kanyukova, Golub, 2010; Golub, Koloseva, 1980; Kopaneva, 1982; Paly, 1966; Plavilshikov, 1950; Polyakov, 1982; Fasulati, 1971).

3. Results and Discussion

In the course of faunal studies, it was determined that 149 species and 6 subspecies of insects belonging to 7 orders, 32 families and 113 genera are found in vegetable-melon cultures of Central Fergana (Tables 1, 2).

In the taxonomic composition of the entomofauna of vegetables and melons, the most of the representatives of the order Homoptera (49 species) make up 31.6% of the taxa of the fauna. The 8 families belonging to this order (25%) and 38 genera (33.6%) also dominate over the representatives of other orders. This is due to the wide distribution of sucking insects, in particular, cicadas, aphids and whiteflies.

The next place in the entomofauna is occupied by the detachments Coleoptera and Lepidoptera. They include, respectively, 7 (21.9%) and 5 (15.6%) families, 21 (18.6%) and 20 (17.7%) genera, each group includes 29 (18.7%) species.

The remaining taxa are reduced in the order of Orthoptera, Hemiptera, Diptera and Thysanoptera. It should be noted

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that the only species (*Thrips tabaci*) (0.65%) belonging to the same genus (0.9%) and one family (3.1%) of the order

Thysanoptera (Table 1) are found in vegetables and melons.

Table 1: Distribution of insects of vegetables and melons of Central Fergana by orders, families and genera

Orders	Number of families	Share in entomofauna, %	Number of genera	Share in entomofauna, %	Number of species (subspecies)	Share in entomofauna, %
Orthoptera	5	15,6%	15	13,3%	11(5)	11,6%
Homoptera	8	25%	38	33,6%	48(1)	31,6%
Hemiptera	2	6,3%	12	10,6%	17	10,9%
Thysanoptera	1	3,1%	1	0,9%	1	0,65%
Coleoptera	7	21,9%	21	18,6%	29	18,7%
Lepidoptera	4	12,5%	20	17,7%	29	18,7%
Diptera	5	15,6%	6	5,3%	12	7,7%
Total:	32		113		149(6)	

When analyzing the distribution of insects by family, it became known that 10 of them (Pyrgomorphidae, Tetrigidae, Aphryphorida, Dictyoparidae, Thripidae, Coccinellidae, Meloidae, Pyraustidae, Ephydriidae, Tephritidae) are considered monotypic, 6 families (Gryllotalpidae, Issidae, Curculionidae, Pieridae, Syrphidae, Anthomyiidae) - bitypic, and the rest (Cixiidae, Aleyroididae, Gelechiidae, Delphacidae, Gryllidae, Scarabaeidae, Tenebrionidae, Agromyzidae, Elateridae, Chrysomelidae, Pentatomidae, Acrididae, Miridae) are typical. The Central Fergana dominated by Aphididae (14 species) and 2 families Cicadellidae (21 species) and Noctuidae (23 species).

High indicators of species diversity of the scoop of the Noctuidae family are also confirmed in the works of other researchers (Tursunkhodzhayev, 1971; Rashidov, 1988; Akromov, 2007; Sulaimonov, 2010). In our studies, 19 species of scoops on tomatoes and 14 on beets were found. Four species (*A.segetum*, *A.ipsilon*, *H.armigera*, *A.gamma*) are widely distributed in all agrocenoses of Central Fergana. Representatives of this family can be characterized as a group with high polyphagy, acquired in the process of evolution.

It should be noted that other authors (Dubovsky, 1966; Tursunkhodzhayev, 1971; Mukhamediev, 1979; Kozhevnikova, 2000) identified 18 species (11.6%) of insects on melons and vegetables in Central Fergana.

In Central Fergana, 19 species of insects were first identified (12.3%). Among them, *Eurydema oleracea* (Linnaeus, 1758) (Baghdad, Shark Yulduzi, 09.15.2016; plant: Brassica oleracea) is a representative of the Pentatomidae family, and from the Aphididae family the subspecies *Aphis frangulae beccabungae* Koch, 1855 (Yazyavan, Chuligulistan, 08.20.2015; plant: Brassica oleracea), which were not previously mentioned in the entomofauna of Uzbekistan.

Until now, invasive and quarantine species common in some regions of the Republic - *Phthorimaea operculella* (Zeller, 1873) (potato moth), *Tuta absoluta* (tomato moth) and *Myiopardalis pardalina* Bigot, 1891 (melon fly) were first found in Central Fergana. In general, as of today, 6 species of pests have been recorded, which are found on vegetables and melons of Central Fergana.

The entomofauna of the vegetable-melon agrocenoses of Central Fergana differ somewhat from the common insect fauna of Uzbekistan. That is, there are many species typical of the desert, due to the location in the center of the high-mountain valley a large proportion of native species, a slow change of invasive or allochthonous species is clearly manifested.

Vegetation of vegetables and melons in open fields begins in early spring and lasts until the second half of autumn. Some members of the family (Brassicaceae, Apiaceae, Alliaceae, etc.) serve as a source of food and wintering grounds for wintering insect species. At this time, some periods of the life cycle of various insects are associated with certain plants.

The expansion of insect ecological capabilities arises primarily from the restriction of food resources and efforts to preserve the stability of species in nature (Bigon, Harper et al., 1987; Cloudsley Thompson, 1982; Makarova et al., 1994; Odum, 1986; Johnson, 1969; Rainey, 1985). This process occupies an important place in the spread of pests in the agrocenoses of the studied region.

According to ecological laws, the inclusion of new organisms from outside into a given biotope biocenosis undoubtedly entails serious relocation and regrouping in populations of many species (Chernyshev, 2012). This is especially noticeable in invasive species. From this point of view, based on the features of the immigration of insects to the region of Central Fergana, their distribution and adaptation can be divided into the following three ecological groups:

- Species perfectly adapted to forage plants with resistant populations. These include *A.fabae*, *A.solani*, *T.vaporariorum*, *H.adspersa*, *L.decemlineata*, *A.sputator*, *L.oleracea* and *D.platura* having a wide range in Central Fergana. They lead in harming vegetables and melons;
- Species that first entered the region, easily adapting to feed plants and having the ability to occupy a dominant position in a short time. This group will include *P.operculella*, *T.absoluta* and *M.pardalina* species, which have appeared in the study area over the past three years;
- Species with a narrow range of distribution, not fully adapted to fodder plants, whose population dynamics

fluctuate and stability is not fully ensured. This group includes the species *A.insubricus insubricus*, *H.adspersa*, *T.bolivari*, *A.frangulae beccabungae*, *F.marginata*, *T.phaseoli*, *E.oleracea*, *A.errans* and *L.oleracea*.

Along with the fact that these species appeared as allochtons, some of them, during observations, met by chance (*F.marginata*, *A.frangulae beccabungae*), and others (*T.bolivari*, *A.insubricus insubricus*, *A.errans*) did not completely switched to eating vegetables and melon crops or formed a population only in a single territory (*T.phaseoli*, *E.oleracea*). For example, *A.frangulae beccabungae* is essentially an Eurasian boreo-montany meso-xerophilic subspecies. A sample of viviparous female *A.frangulae beccabungae* (Chuligulistan) on 20.08.2015 was noted in the Yazyavan district on the plant *Brassica oleracea*. As R.Kh.Kadyrbekov (2013) noted, it is this species that lives in southeastern Kazakhstan on plants belonging to the Brassicaceae, Lamiaceae, Polygonaceae and Scrophulariaceae families.

From this it is obvious that migration is observed in any species that promote distribution. The spread and sedentary nature of the Colorado potato beetle (*L. decemlineata*), onion fly (*D.platura*) and the greenhouse whitefly (*T.vaporariorum*) in Central Fergana has a significant impact on crop yields. They prevent an increase in the number of previously immigrated adventive species (*A.fabae*, *A.solani*, *H.adspersa*, *A.sputator*, *L.oleracea*), which also caused damage to the population of local dominants of vegetables and melons, which were constantly stable.

According to A.M.Gilyarov and other authors (1970, 1990), migration impedes the growth of the number of species typical of this region. However, the development of species of any region is necessary for their preservation, because as a result of changes in the biocenosis, environmental conditions change, succession occurs, and the distribution of species creates an excellent opportunity for falling into more comfortable conditions.

Adaptation of insects to chaotic, daily, seasonal and annual changes in the environment was analyzed using the example of aphids (Akhmedov, 1995; Zokirov, 2009). If these conclusions are applied to insects of vegetables and melons, then the possibility arises for a broader

interpretation of migration processes, based on the ecological and behavioral properties of individuals. When this occurs, the impact of environmental factors on insects and their adaptive responses. The end result is the migration and changes in the composition of entomocomplexes, which cause disturbance of the food chain of individual ecosystems and re-form it. Most importantly, this process changes the status of a species in the biogeocenosis (Zokirov, 2009).

Several years ago, dangerous pests such as beet aphid (*A.fabae*), potato aphid (*A.solani*), greenhouse whitefly (*T.vaporariorum*), Colorado potato beetle (*L.decimlineata*) and onion fly (*D.platura*), as well as the potato moth (*P.operculella*), tomato moth (*T.absoluta*) and melon fly (*M.pardalina*), which have rapidly spread over the past five years, belong to the species that caused the change in the composition of the region's ethnocomplex. Over the past period, each of these insects has taken a special place in the food chain of the relevant ecosystems and a place in the range of agrocenosis with high economic danger.

Thus, the wide distribution of these pests and their development of new ecological niches are interpreted as a separate biological phenomenon (Akhmedov, 1995).

In terms of feeding habits, the following ecological groups of insects are distinguished: monophages, oligophages, and polyphages. During the season, they, in addition to the main fodder plants, may use additional plants as a temporary food (Bigon-Harper, Townsend, 1989). In addition, during the season, several species of insects that feed and breed on it are observed on a single food plant. However, the limited research on interspecific competition on one food plant, in particular, research on the use of food plants by representatives of several families, points to the important scientific and practical significance of a comprehensive analysis of the phytophage-host relationship.

The results of the eco-faunistic study of insects were analyzed on the example of 20 types of vegetables and melons in the conditions of Central Fergana. According to the nutrition on vegetable and melon crops, phytophages are divided into the following ecological groups: rhizophages, phylophages and lymphophages, anthophages, carpophages and gollophages (Table 2, Fig. 1.).

Table 2: Ecological and faunistic characteristics of insects of vegetables and melons of the studied region

Species	Trophic specialization			Specialization of insects to plant organs										
	Monophagous	Oligophagous	Poliphagous	Risophagous		Phyllophages and lymphophages			Antophagous		Carpophagous		Holophagous	
				5	6	7	8	9	10	11	12	13		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
ORTHOPTERA														
Gryllidae														
<i>Gryllus bimaculatus</i>			+			+	+							
<i>Melanogryllus desertus</i>			+			+	+	+		+				
<i>Tartarogryllus tartarus</i>			+			+	+							
<i>Eumodicogryllus bordigalensis</i>			+			+	+							
<i>Oecanthus turanicus</i>			+			+	+	+						
Gryllotalpidae														

Brevicoryne brassicae		+					+													
Myzus persicae			+				+	+	+	+										
Aulacorthum solani			+				+	+	+	+										
Acyrtosiphon gossypii			+				+	+												
Macrosiphum euphorbiae			+				+	+	+	+										
Forda marginata		+		+																
Trifidaphis phaseoli		+		+																
HEMIPTERA																				
Pentatomidae																				
Carpocoris fuscispinus			+					+								+				
Graphosoma lineatum		+							+							+				
Dolycoris penicillatus			+				+	+	+							+	+			
Palomena prasina			+					+	+							+	+			
Eurydema oleracea		+					+	+	+											
Eurydema ornate		+						+								+				
Eurydema ventralis		+														+				
Eurydema maracandica		+					+	+								+				
Miridae																				
Adelphocoris lineolatus			+				+	+	+							+				
Campylomma verbasci			+					+								+	+			
Orthotylus flavosparsus			+					+								+				
Lygus gemellatus			+																	
Lygus pratensis			+				+	+	+											
Polymerus cognatus			+					+	+											
Polymerus vulneratus			+					+								+				
Trigonotylus ruficornis		+						+								+				
Stenodema turanica			+					+								+				
THYSANOPTERA																				
Thripidae																				
Thrips tabaci			+					+	+								+			
COLEOPTERA																				
Coccinellidae																				
Epilachna chrysomelina		+						+								+				
Scarabaeidae																				
Polyphylla adspersa			+	+			+	+	+	+	+					+				
Anomala errans			+	+	+															
Melolontha afflicta			+	+	+			+												
Melolontha melolontha			+	+	+		+	+												
Melolontha hippocastani			+	+	+		+	+												
Elateridae																				
Agriotes lineatus			+	+			+									+				
Agriotes meticulosus			+																	+
Agriotes caspicus			+	+			+									+				
Agriotes obscures			+	+			+	+								+				
Agriotes sputator			+	+			+	+								+				
Clon cerambycinus		+		+	+		+													
Melanotus acuminatus		+		+	+		+													
Tenebrionidae																				
Opatroides punctulatus			+	+	+		+	+	+	+	+					+				
Opatrum sabulosum			+	+			+													
Gonocephalum pusillum		+		+	+		+													
Oodescelis polita			+		+		+	+												
Blaps lethifera			+	+			+			+										
Blaps halophila			+	+			+			+										
Meloidae																				
Mylabris frolovi		+														+				
Chrysomelidae																				
Acanthoscelides obtectus		+															+	+		
Gastroidea polygona			+						+	+						+				
Cassida viridis		+							+											
Chaetocnema tibialis		+							+											
Chaetocnema hortensis		+							+											
Phyllotreta atra	+								+											
Leptinotarsa decemlineata		+						+	+	+	+						+			
Curculionidae																				
Tanymecus palliatus			+						+											
Bothynoderes punctiventris	+								+											

LEPIDOPTERA														
Pyraustidae														
<i>Loxostege nudalis</i>	+					+	+							
Noctuidae														
<i>Agrotis segetum</i>			+	+	+	+	+							
<i>Agrotis exclamationis</i>			+	+				+						
<i>Agrotis obesa</i>			+	+										
<i>Agrotis ipsilon</i>			+	+	+		+							
<i>Agrotis xanthographa</i>			+	+										
<i>Mamestra brassicae</i>		+				+	+			+				
<i>Mamestra suase</i>			+	+		+	+							
<i>Xestia c-nigrum</i>			+	+			+							
<i>Diachrysia chrysis</i>		+				+	+	+						
<i>Euxoa agricola</i>			+											+
<i>Euxoa tritici</i>			+				+				+			
<i>Euxoa cursoria</i>		+		+										
<i>Ochropleura flammata</i>		+		+	+									
<i>Helicoverpa armigera</i>			+											+
<i>Autographa gamma</i>			+											+
<i>Heliothis virescens</i>			+											+
<i>Hadula trifolii</i>		+						+						
<i>Noctua orbona</i>			+											+
<i>Noctua pronuba</i>		+		+	+	+	+							
<i>Spodoptera exigua</i>			+				+							
<i>Hydraecia micacea</i>		+					+							
<i>Syngrapha circumflexa</i>			+											
<i>Lacanobia oleracea</i>			+				+	+						
Pieridae														
<i>Pieris brassicae</i>		+				+	+	+						
<i>Pieris rapae</i>		+				+	+	+						
Gelechiidae														
<i>Phthorimaea operculella</i>		+				+	+	+			+	+		
<i>Tuta absoluta</i>	+					+	+	+						+
<i>Plutella maculipennis</i>		+				+	+	+						+
DIPTERA														
Agromyzidae														
<i>Liriomyza brassicae</i>		+					+							
<i>Liriomyza cepae</i>		+					+	+	+					
<i>Liriomyza bryoniae</i>			+				+							
<i>Liriomyza sativae</i>			+				+			+				
<i>Liriomyza strigata</i>			+				+							
<i>Phytomyza horticola</i>		+					+							
Syrphidae														
<i>Eumerus strigatus</i>			+				+							
<i>Eumerus tuberculatus</i>			+				+			+				
Anthomyiidae														
<i>Delia platura</i>		+												+
<i>Delia radicum</i>		+					+	+	+					
Ephydriidae														
<i>Hydrellia griseola</i>		+											+	+
Tephritidae														
<i>Myiopardalis pardalina</i>		+												+

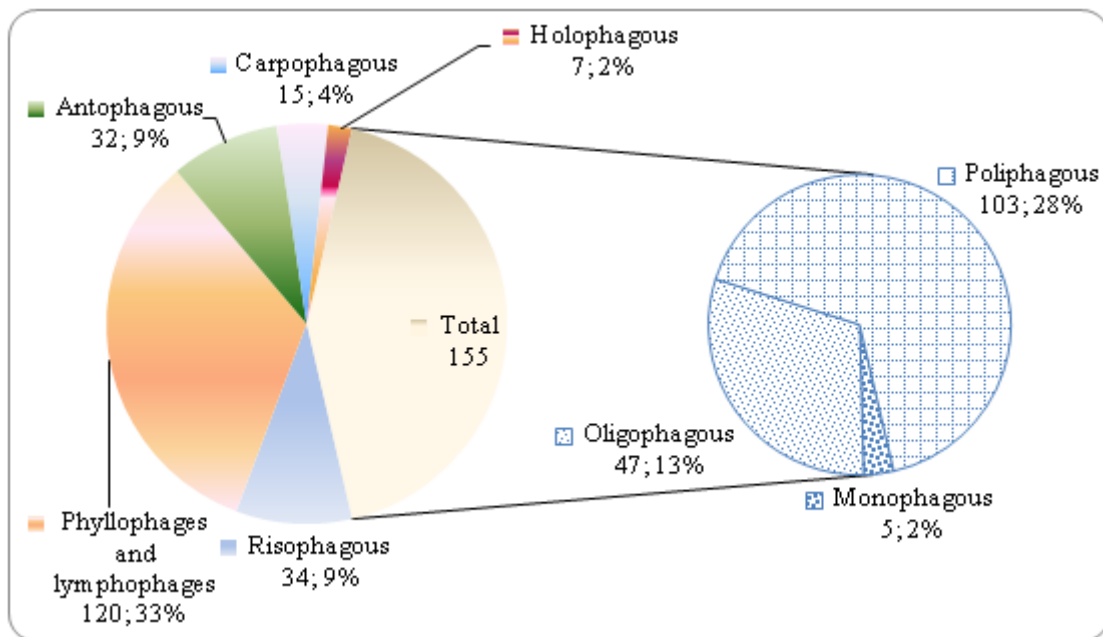


Figure 1: Indicators of insect specialization to plant organs

It should be noted that among the species of entomofauna 71 are represented by polyphages specific for vegetables and melons, of which 19 species (12.3%) are insects, fully repeating in all genocenoses, 78 species (50.3%), peculiar to only vegetables and 6 species (3.9%) found only on melon crops.

4. Conclusions

According to the results of the faunal analysis, the insects of vegetables and melons of Central Fergana are represented by 149 species and 6 subspecies belonging to 7 orders, 32 families and 113 genera. The species richness is probably associated with the peculiar conditions of the biocenoses of the desert landscapes of Central Fergana. The number of species of insect orders under consideration is not equivalent: Homoptera (49 species, 31.6%), Coleoptera (7 species, 21.9%), Lepidoptera (5 species, 15.6%), Orthoptera (18 species, 11.6%), Hemiptera (17 species, 10.9%), Diptera (12 species, 7.7%) and Thysanoptera (1 species, 0.65%).

In the entomofauna of Uzbekistan, 2 species (*Trifidaphis phaseoli* (Passerini, 1860), *Eurydema oleracea* (Linnaeus, 1758)) and 1 subspecies (*Aphis frangulae beccabungae* Koch, 1855) of insects were observed for the first time, and 17 species and 2 subspecies belonging to 14 genera in the region of Central Fergana. Also, 3 quarantine species (*Phthorimaea operculella* (Zeller, 1873)), *Tuta absoluta* (Meyrick, 1917) and *Myiopardalis pardalina* Bigot, 1891) were identified on vegetables and melons of the studied region.

According to the peculiarities of insect migration to Central Fergana, distribution and their adaptation, we determined three ecological groups.

Based on the ecologo-faunistic analysis, 34 species of rhizophages and 120 species (77.4%) of phyllophages and lymphophages, which form ecological niches, were

identified. Anthophages 32 species (20.6%), carpophages 15 species (9.7%) and halophages 7 species (4.5%). In ecological niches, insects form a special guild and, although the parameters of their ecological niches are sometimes close, they do not overlap and do not overlap, with the exception of holophages. In general, at the present time, significant changes in the formation of the entomofauna of the vegetable and melon agrocenoses of Central Fergana are outlined.

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