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SUGAR BEET PESTS

Abstract

The studies have been taken in condition of laboratory and in suburbs in 2014-2018. The laboratory experiences have been carried out in the automatic-controlled specific thermostats and in room condition at the Applied Zoology Center of the Institute of Zoology of ANAS. The suburb practices were held in the specific stationary fields, in the agriculture of Imishli and Aghdash in which the sugar beets were planted. As a result of a comprehensive study carried out on stationary fields and adjacent territories, it was determined that 22 species, 18 genus, 4 families from the order Coleoptera, 5 species, 5 genus, 3 families from the order Hemiptera, 8 species, 7 genus, 3 families from the order Orthoptera, 1 species, 1 genus, 1 family from the order Diptera, 12 species, 8 genus, 4 families from the order Lepidoptera live in the beetroot agrocenosis at different times of the year and are subject to subsistence farming.

Keywords: *sugar beet, pests, agrocenosis, Coleoptera, Hepimtera, Diptera, Orthoptera, Lepidoptera*

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Şəkər çuğunduru aqrosenozlarının zərərvericiləri

Xülasə

Tədqiqatlar 2014-2018-ci illərdə laboratoriya şəraitində və şəhərətrafı ərazilərdə aparılmışdır. Laboratoriya təcrübələri AMEA Zoologiya İnstitutunun Tətbiqi Zoologiya Mərkəzində avtomatik idarə olunan xüsusi termostatlarda və otaq şəraitində, çöl təcrübələri isə şəkər çuğunduru əkilən İmişli və Ağdaş rayonlarının xüsusi stasionar sahələrində keçirilmişdir. Stasionar əkin sahələri və ona bitişik ərazilərdə aparılmış kompleks tədqiqatlar nəticəsində müəyyən edilmişdir ki, 22 növ, 18 cins, 4 fəsilə Coleoptera, 5 növ, 5 cins, 3 ailə, 8 növ, 7 cins Hemiptera, 3 fəsilə, 1 növ, 1 cins Diptera, 1 fəsilə, 12 növ, 8 cins, 4 fəsilə isə Lepidoptera dəstələrinin nümayəndələri ilin müxtəlif vaxtlarında çuğundur aqrosenozunda yaşayır.

Açar sözlər: *şəkər çuğunduru, zərərverici, aqrosenoz, Coleoptera, Hepimtera, Diptera, Orthoptera, Lepidoptera*

Introduction

Since the first-half of XX century the sugar beet pests and the preventive measures against them have been investigated thorough in the various areas of Former Soviet Union. The investigations of Y.V.Zverozomb - Zubovskiy take an important role in this field. The researcher investigated the insect fauna that harms the sugar beet comprehensively in Ukraine, enrolled the species of pests, and prepared the preventive measures for the dangerous species (Vasilyev, 1906: 68).

Vasilyev Y.M. investigated the pests spreading over the agro-ecosystem of sugar beet in different areas of Russia and the woodworms harming seriously that plant in Ukraine (Brunner, 1947: 7).

Brunner Y.N. gave extensive information about brassy flea beetles spreading over the sugar beet fields in Kirghizstan and harming mainly this plant and about the preventive measures against these pests (Saghfi, Valizadegan, 2014: 310-311).

A.A.Migulin and G.Y.Osmolovskiy indicated that the sugar beet was damaged by 300 species of pests during the period of vegetation and among the species, 130 of them included in Beetles, 60 of them included in Lepidoptera and 40-50 of them included in aphids (Lakin, 1990: 348).

Later S.M.Pospelov, N.G.Berim, Y.D.Vasilyeva and M.P.Persov have indicated that total 400 species of insects and others damage sugar beet and among them 40 species are more dangerous pests (Polyakov, 1958: 640).

The fauna of harmful and useful insects of sugar beet plantations was studied in Van Centre, Ercish, Gevash, Gurpinar and Muradiye districts of Turkey in 1999-2000. As a result of investigation, 29 species of useful insects and 31 species of harmful insects belonging to different families were observed (Atlikhan, Ozgokcha, 2003: 9).

In Bulgaria, Marinova Z., Raikov S., Arnaudov V. and Tanova K. learned the fauna of harmful insects of sugar beet plantations in 2012-2013. The researchers calculated the harm degree of 14 species of pests belonging to 6 families damaged the sugar beet. 17 species were observed in Kazakhstan as the sugar beet and its seeds pests (Khalilov, Ibrahimov, 2010: 16-17).

Harry Lange V. showed that seeds, leaves and root of sugar beet "suffered from" more than 150 pests along with bacterial diseases, viral diseases such as decay and wriggle in California (Hatem, El-Hady, Sherief, 2012: 164).

Hatem Fouad indicated the pests such as *Pegomia mixta* (Vill.), *Cassida vittata* (Vill.) and *Myzus persicae* (Sulzer) species turned down the productivity of sugar beet in Egypt (Lange, 1987: 341-360).

Mahsa Saghfi and Oruj Valizadegan showed *Spodoptera exigua* H. Species as a main sugar beet pest in Iran (Mammadova, Khalilov, 1986: 372).

J.A.Hidayatov (1964) discovered that 9 species of beetles damaged sugar beet in Former Soviet Union. 8 species spread in Azerbaijan (Hasanov, Hasanova, 2010: 75).

Although the fauna of sugar beet pest is not learned thorough in Azerbaijan, there is short information about it in different literatures (Hidayatov, 1964: 34; Marinova, Raikov, Armandov, Tanova, 2015: 106-109).

The mass of roots of sugar beet continues to grow in all periods of vegetation until the new harvest. The growth of leaf mass stops after it reaches to a certain extent. Usually this case occurs near the end of the vegetation, so in early September (Harry Lange, 1987: 341-360). At the beginning of vegetation, the mass of leaves prevail the mass of root fruit, but at the end of vegetation the opposite occurs (table 1).

For this reason, sugar beet is damaged by pests in all stages of vegetation. Every year, relating to the improvement of the sugar beet harvest in our Republic, it is very important to study the components of the species of sugar beet pests in this agro-ecosystem. Thus, the study of pests in sugar beet plants is very important for the detection of agricultural species led to serious loss of harvest and spread in area and preventive measures for them (Sablyk, Doronin, Grishenko, 2014: 36-38).

Just for this reason, in 2014-2018, the expeditions were carried out periodically and real materials were collected along with the route experiences in farms of Imishli and Aghdash region of Republic where the sugar beet was planted, as well as, in individual plant areas of people from the beginning of March.

Table 1
Vegetation period of sugar beet

Month / decade	March (5°C)			April (12°C)			May (15°C)			June (28°C)			July (30°C)			August (35°C)			September (20◦C)				October (18◦C)			November (15◦C)
	I	I	II		I	II		I	II		I	II		I	II		I		II		I	II		I	II	I
Vegetation period of sugar beet	Seed			Sprout			Leaf						Root fruit						Maximal rate of Sugar				Harvest			

Material and methods

The studies have been taken in condition of laboratory and in suburbs in 2014-2018. The laboratory experiences have been carried out in the automatic-controlled specific thermostats and in room condition at the Applied Zoology Center of the Institute of Zoology of ANAS. The suburb practices were held in the specific stationary fields, in the agriculture of Imishli and Aghdash in which the sugar beets were planted.

Specific entomological nets were used in the collection of fast moving insects. For this purpose specific areas were selected and insects were quickly collected by means of mowing over all plants in diagonal areas, were placed into test tube and into the specific jars from there, and were carried to laboratory for next experiences and appointment.

In order to define the species-component of low moving insects, the plants were overviewed in diagonal areas; the encountered insects were collected into specific vessels and were directed for the further operations. During the collection of the insects, the encountered eggs, larvae and caterpillars were fed in laboratory condition up to the stage of imago and species relations were defined.

Bio ecological characteristics, phenological calendars, damage degrees etc. characteristics of overspread and agricultural pests were investigated in both stationary areas and in laboratory condition.

The damage of plants is calculated as following:

$P=\frac{n*100}{N}$

Here, P-Percentage of damage of plants in area

N - total number of reviewed samples

n - number of damaged plants

100 - converting rate into percentage.

Some methods received in entomology were used in the studies (Zverezomb-Zubovskiy, 1956: 276; Pospelov, Berim, Vasilyeva, Persov, 1986: 222-231; Migulin, Osmolovskiy, Litvinov, 1983: 436).

Results and discussion

In the route experiments, species damaged the plant in the areas of sugar beet, were studied, species-component of the pests spread in agro-ecosystem and serious agricultural species were defined.

48 species of pests belonging to 5 order, 15 families and 42 genus were discovered in agro-ecosystem during the experiment and studies carried in agriculture (table).

According to the comprehensive studies taken in the stationary fields and nearby areas, it has been defined that 22 genus of 18 species of 4 families of Coleoptera (Beetle) order, 5 genus of 5 species of 3 families of Hemiptera order (or true bugs), 8 genus of 7 species of 3 families of Orthoptera order, 1 type of 1 species of 1 family of Diptera order, 12 genus of 11species of 4 families of Lepidoptera order harm the agriculture in some extent settling in agro-ecosystem of sugar beet in different periods.

As indicated in the table, there are pests belonging to beetles (Coleoptera), hemipterans (Hemiptera), orthoperans (Orthoptera), dipterans (Diptera), lepidopterans (Lepidoptera) order in agro-ecosystem of sugar beet.

Among these species, *Oxythyrea funesta*, *Pentodon idiota*, *Epicometis hirta*, *Cetonia aurata*, *Polyphylla olivieri*, *Rhizotrogus aestivus*, *Anisoplia austriaca* and *Anisoplia segetum* species of Lamellicornia family are rare, but their larvae gnaw the sprouing roots and decelerate their growth or cease this process completely.

Table 2
Species-component of pests spread in beet agro-ecosystem

s/s	Order	Family	Type	Species	Spread
1	2	3	4	5	6
	Coleoptera (Beetles or bugs)	Scarabaeidae (Leaf-horned beetles)	Oxythyrea Muls., 1842	*O.funesta* Poda, 1761 (flower scarab)	+
			Pentodon Hope, 1837	*P. idiota* Herbst, 1789 (hard-back beetle)	+
			Miltetrogus Ret, 1902	*M.aeguinoctialis* Herbst, 1790 (April beetle)	+ +
			Epicometis Burn, 1842	*E.. hirta* Poda, 1761 (green rose chafer)	+
			Cetonia F., 1833	*C. aurata* L, 1758 (rose chafer)	+
			Polyphylla Harris, 1841	*P. olivieri* Cst, 1840 (white chafer)	+
			Amphimallon Berth, 1825	*A. solstitialis*, 1758 (June chafer)	+ +
			Rhizotrogus Latr, 1825	*R. aestivus* Ol, 1789 (Summer chafer)	+
			Melolontha L, 1775	*M.melolontha*, 1758 (May chafer)	+ +
			Anisoplia Sern, 1824	*A.austriaca* Herbst, 1783 (cereal chafer)	+
				A.segetum Herbst, 1783 (grain beetle)	+
		Elateridae (Click-beetles)	Agriotes Eschscholtz, 1829	*A.sputator L*, 1787 (cropping click-beetle)	+ +
				A.lineatus L,1767 (stripped click-beetle)	+
			Athous Eschscholtz, 1829	*A.hirtus* Hbst, 1784 (chaetiferous cllick-beetle)	+
				A.niger L.1778 (black click-beetle)	+
		Curculionidae (weevil beetles)	Tanymecus Germar,1817	*T.palliatus* Fabr, 1787 (gray beet weevil)	+ +
			Psalidium İlliger, 1807	*P .maxillosum* F, 1772 (black beet weevil)	+
			Bothynoderes Schönheer, 1826	*B. punctiventris* Gyll, 1824 (common beet weevil)	+ + +
		Chrysomelidae Latreille 1802	Chaetocnema Stephens, 1831	*Ch.concinna* March, 1802 (common beetle)	+ + +

		(leaf beetles)		*Ch.breviuscula* Fald, 1884 (south beetle)	+ + +
			Phyllotrata Chevrolat in Dejean, 1836	*Ph.atra Fabricius*, 1775 (black beetle)	+
			Cassida Linnaeus, 1758	*A.cuperteata* Dust, 1758 (root beetle)	+
II	Hemiptera (Homopter) Linneus, 1758 yarımsərt qanadlılar	Miridae Latreille, 1810 (woodworms)	Polymerus Hahn, 1831	*P. cognatus* Fleb,1810 (rove beetle)	+
			Orthotylus Fieber, 1858	*Orthotylus flavosparsus* C. R. Sahlberg, 1841 (plant-eating beetle)	+
		Piesmatidae Amyot & Audinet-Serville, 1843	Piesma Lepelitier Servilla, 1825	*P. quadrata*, Ferb.1929 (leaf beetle)	+
		Aphididae Latreille, 1802 (aphids)	Aphis Linnaeus, 1758	*A.fabae* Scopoli, 1763 (leaf beetle a)	+ + +
			Pemphigus Hartig, 1839	*Pemp. fuscicornis* Koch, 1857 (sugar beet aphids)	+
III	Orthoptera Latreille, 1793 (orthopterans)	Gryllotalpidae Laicharting, 1781 (crickets)	Gryllotalpa Latreille, 1802	*G. gryllotalpa* Linnaeus, 1758 (mole cricket)	+ + +
			Gryllus Linnaeus, 1758	*Gr.discitus* Pall. (field cricket)	+
		Tettigoniidae Krauss, 1902 (bush crickets)	Tettigonia Linnaeus, 1758	*T.caudata* ch, Emerton, 1884 (caudates grasshopper)	+
				T.viridissima L, 1758 (green grasshopper)	+
		Acrididae MacLeay, 1819 (grasshoppers)	Heteracris (Walker, 1870)	*H.pterusticha* Fil (Serville, 1838) (grasshopper)	+ +
			Galliptamus Serville, 1831	*G.İtalicus* L. (Italian grasshopper)	+
			Locusta Linnaeus, 1758	*Locusta migratoria* Linnaeus, 1758 (Asian grasshopper)	+
			Dociostaurus Fieber,1853	*D. maroccanus* Thumb,1815) (Moracco grasshopper)	+
IV	Diptera Linnaeus, 1758 (dipterans or flies)	Anthomiidae Loew, 1862 (leaf-mining insects)	Pegomiya, Robineau Desvoidu, 1830	*P.betae* Curtis, 1847 (beet fly)	+
V	Lepidoptera Linnaeus, 1758 (mothsor butterflies)	Noctuidae Latreille, 1809 (cutworm)	Phytometra Haworth, 1809	*Ph.gamma* L. Clerck, 1758 (gamma moth)	+
			Chloridea Duncan & Westwood, 1841	*Chl.armigera* Hb. (Hübner, (1805) (cotton moth)	+ +
			Lacanobia Billberg, 1820	*L.oleracea* (garden moth)	+
			Barathra	*B.brassicae* L.	+ +

			(Mamestra) Van Der Goot, 1915	(Linnaeus, 1778) (cabbage moth)	
			Agrotis Eschscholtz, 1829	*A.exclamationis* L. Campion, 1778 (higher moth)	+
				A.segetum She Denis & Schiffermüller, 1775 (autumn moth)	+ + +
			Graphiphora Ochsenheimer, 1816	*G. nigrum* L. Fabricius, 1758 (black spotted moth)	+
			Noctua Linnaeus, 1758	*Noc.pronuba* L. Linnaeus, 1758 (large ribbon moth)	+
		Pieridae Latreille, 1829	Pieris D.Don,1834	*P. brassicae* L., 1758 (cabbage moth)	+ +
		Pyralidae Latreille, 1809 (moths)	Syllepte Hübner, 1823	*Syllepte derogata* Fabricius, 1775 (cotton-leaf moth)	+ +
			Pyraustidae Meyrick, 1890	*P. sticitialis* L 1750 (lawn moth)	+
		Gelechiidae Stainton, 1915	Scrobipalpa Janse, 1951	*S. ocollatella* Boyd, 1858 (beet beetle)	+ +

Note: + - seperately encountered species.
++ - common species.
+++ - the most common and serious pest species.

Miltetrogus aeguinoctialis (April chafer), *Amphimallon solstitialis* (June chafer) and *Melolontha melolontha* (May chafer) species of this family are observed almost in sugar beet agro-ecosystem and along with their larvae, the imagoes harm various organs of plants seriously in the mass growth..

Among the members of Click-beetles (Elateridae) family such as *Agriotes lineatus* (stripped click-beetles), *Athous hirtus* (chaetiferous click-beetles) and *Athous niger* (black click-beetles) species are rare, but *Agrioitus sputator* (cropping click-beetles) species are seen in both sugar beet plants, also in suburb areas, in other areas, and these species harm the plant in all phases from the seeding process to the root formation.

Bothynoderes punctiventris (common beet weevil) species belonging to Weevil beetles (Curculionidae) family are one of the most common pests in the cropping areas, and damage the plants considerably. The second member of this family- Tanymecus *palliatus* (gray beet weevil) species are observed in agro-ecosystem and they harm mainly the roots of plant. It should be mentioned that a number of this pest are not more than common beet weevil. Also, there is black beet weevil in the areas very rarely.

Beginning from the first leafing period of beet, leaf-beetles, especially brassy flea beetle (*Chaetocnema concinna*), southern flea beetle (*Ch. breviuscula*), black beetle (*Phyllotrata atra*) and root beetles (*Assylliodescup cuperteata*) begin to operate actively in agro-ecosystem. Among these species, common beetle and southern flea beetle overspread more, and they devastate the leaves of the plant, as a result, the process of photosynthesis is disrupted and the plant is destroyed.

There are members of three families of hemipterans (Hemiptera) order in the beet plants. The rove beetle (*P.cognatus*) belonging to Polymerus species of Miridae family, plant-eating beetle (*O.Flavosparsus) of* Orthotylus species and beaver beetle (*P.guadrata*) belonging to Piesma species of Piesmatidae family are rare in agro-ecosystem, but they are seen over the plants. One of the known species is leaf beetle aphid (*A.fabae* Scop) belonging to Aphididae (aphids) family, so it acts in areas

from the first sprouts of the plant until time the leaves become hard and harms the plants significantly. At the same time, sugar beet aphids (*Pemphigus fuscicornis* Koch.) can be observed in the areas rarely.

2 genus of (*Gryllotalpa gryllotalpa*-mole cricket and *Gryllus discutus*-field cricket) of two species (*Gryllotalpa L*; and *Gryllus L*.) of mole crickets (Gryllotalpidae) family of orthopteran (Orthoptera) order, two genus (longhorn grasshoppers and meadow grasshoppers) of Tettigonia species belonging to bush crickets (Tettigonidae) family, 4 genus (*H.pterusticha*-meadow grasshopper; *G.italicus*-Italian grasshopper; *L.migratoriya*-Asian grasshopper; *D.maroccanus*-Morocco grasshopper;) of four species (Heteracris; Galliptamus; Locusta and Dociostaurus) belonging to the grasshoppers are observed in the fresh and juicy period of leaves especially in May. Among these species, meadow grasshoppers prevail mostly in agro-ecosystem. However, other species are observed as casual pests indicated in those areas and not damaged the agriculture seriously. If there is a food shortage in the suburb areas, the damage done by these species can be excessive.

In case of dipterans or flies (Diptera) order, it should be mentioned that one type of Pegomiya species belonging to only one family of this order- sugar beet root aphid (*P.betae*) is observed. Although its spreading over agro-ecosystem is not mentioned, there are its larvae and pups in the roots rarely.

The members of lepidopterans or butterflies (Lepidoptera) order were the most common pests after the beetles in the area and had large numbers for their species.

Thus, 12 genus of 11 species belonging to this order are activated in different times in agro ecosystem, leading to serious damage to both overland and underground organs of the plants.

Autumn moth (*A.segetum*) belonging to Agrotes species of the order takes a special place for its damage degree among these species. Thus, the caterpillars of this species become active from the seed germination and early germination process, and devastate the underground organs of the plant.

Syllepta derogata (cotton leaf moths) type belonging to Syllepte (Haritalodes) species of Pyralidae (grass moths) family were recorded in both cotton fields and in sugar beet plants for the first time in our Republic. These species were polyphage, fed with different plants. Its bio ecological specifications are not investigated widely, but The fact that plants are growing in the field, means that the leaves of plants will turn into a dangerous pest in the future.

Cabbage butterfly (*B.Brassicae*) and sugar beet beetle (*S.ocullatella*) were the common species, and can damage the agriculture in some extent.

Thus, according to the results of the studies, it was defined that 48 genus belonging to 42 species, 15 families, 5 order spread in sugar beet agro-ecosystem.

31 of these species are seen separately and do not lead to economic harm in farms.

11 species are species that are constantly encountered in agro eco-system and can cause significant damage during mass growth.

6 species are permanent participants of agro eco-system and harm seriously each year.

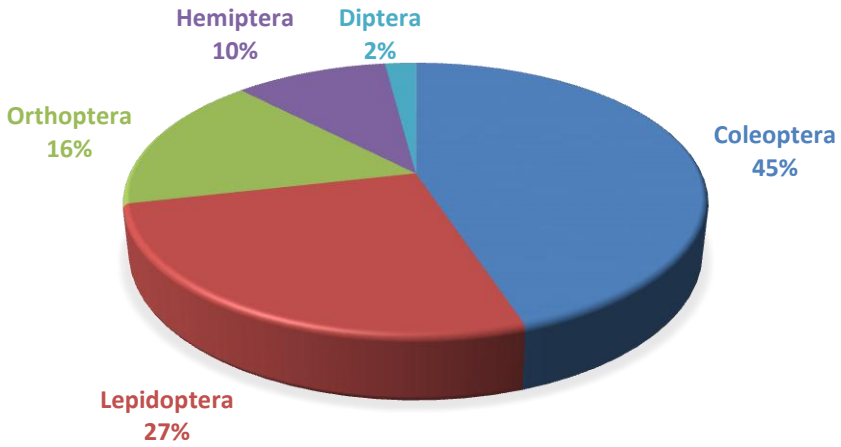

Fig: 1. Proportion of groups according to the number of species

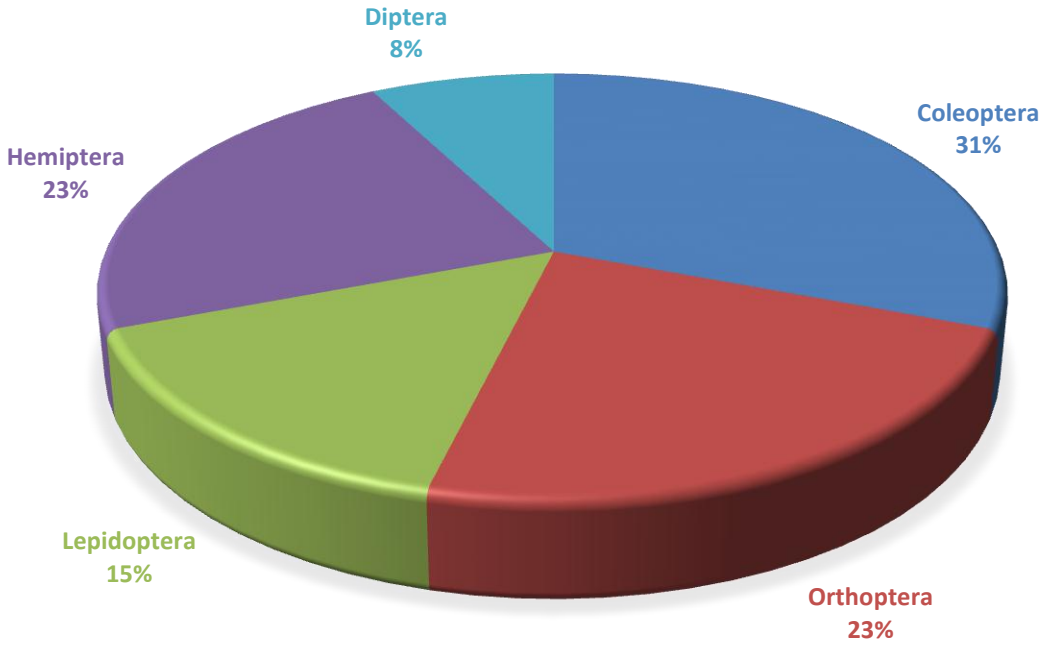

Fig: 2. Proportion of groups according to seasons

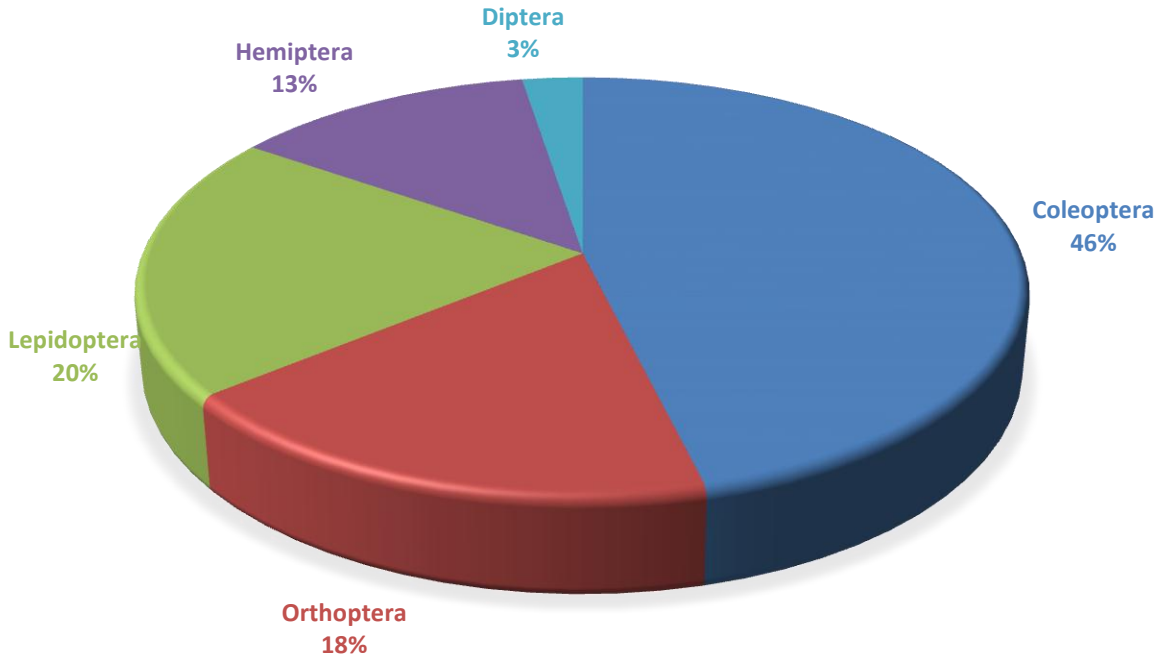

Fig: 3. Number of groups according to species

It is known that there are a lot of pests belonging to different groups which harm plants and reduce productivity in sugar beet agrocenosis.

At the same time, there are other living organisms which regulate the number of these pests and prevent their massive growth in sugar beet agrocenosis. The study of these species is, theoretically and practically, very useful.

In spring these entomophages are mainly fed by pest insects living in the soil, but in summer, various life stages of insects (larvae, pupae, etc.), which live in the soil according to their biology, are main food.

Complex entomophages play a major role in reducing the number of turnip moth (Agrotis segetum) which is the main pest of sugar beet. Thus, 35-45% of the pest population per year is destroyed by entomophages (Ichneumonidae and Braconidae – 5-10%, Trichogramma – 0-15%, tachinid flies – 5-7%, predator beetles – 18-20%).

Diaderma fenestralis Holm parasite is closely involved in the regulation of the number of beet moth (Scrobipalpa ocellatella) which is the second dangerous pest of sugar beet. Thus, every year 55-60% of beet moth's catepillars is destroyed by this parasite. This parasite plays an important role not only in the regulation of the number of sugar moth's, but also in the regulation of other pests' catepillars.

Aphidius ervi Hol. and Diaeretiella rapae M. have a great role in the reduction of the number of bean aphid (Aphis fabae Scopoli, 1763) which is the serious leaf pest in the sugar beet agrocenosis. Thus, in spring and autumn these parasites infest 70-80% of aphids (sometimes 90-95%) and reduce their damage almost to zero.

Orius niger W. is one of the effective predators and spread in all of sugar beet agrocenosis. This species is nourished with first larval instars and eggs of aphids and thrips. Sometimes the number of these predators reaches to 25-30 individuals per plant and it shows that Orius niger is an effective entomophage.

Predators such as Calosoma auropunctatum Hbst (Coleoptera: Carabidae), Harpalus distinguendes Daft (Coleoptera: Carabidae), H.affinis Schruk (Coleoptera: Carabidae) and Pterostichus crenuliger Ch. (Coleoptera: Carabidae) play an important role in reduction of number of larvae of click beetles, snout beetles and owlet moths by destroying them.

In the sugar agrocenosis Coccinellla septempunctata Linnaeus, 1758, Adalia bipunctata (Linnaeus, 1758) and Hippodamia variegata (Goeze, 1777), belonging to family Coccinellidae, are sometimes found massively. These predators are also closely involved in the destruction of aphids, thrips, owlet moths and small caterpillars.

It should be noted that the dynamics of entomophages in sugar beet agrocenosis changes depending on the species diversity, spreading of insect pests and the vegetation period of the plant.

Conclusion

Thus, according to the results of the studies, it was defined that 48 genus belonging to 42 species, 15 families, 5 order spread in sugar beet agro-ecosystem.

31 of these species are seen separately and do not lead to economic harm in farms.

11 species are species that are constantly encountered in agro eco-system and can cause significant damage during mass growth. 6 species are permanent participants of agro eco-system and harm seriously each year. Almost all activities of the polyphage entomophages in the agrocenosis are practically valuable. Thus, they are closely involved in regulating the number of insect pests in the sugar beet fields and minimizing their harmful activities.

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