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LEAF-EATING INSECTS (Coleoptera: Chrysomelidae) DAMAGED TO SUGAR BEET

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ЛИСТОГРЫЗУЩИЕ ЖУКИ (Coleoptera: Chrysomelidae), ПОВРЕЖДАЮЩИЕ САХАРНУЮ СВЕКЛУ

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Abstract. Provides information on pests belonging to the Chrysomelidae family of the Coleoptera order based on the research conducted in the farms of Imishli district, which is one of the main sugar beet growing regions of Azerbaijan. During the research years, 3 species (*Chaetocnema concinna* (Marsham, 1802), *Ch. breviscula* (Faldermann, 1837), *Cassida nebulosa* Linnaeus, 1758) belonging to 2 genera (*Chaetocnema* Stephens, 1831, *Cassida* Linnaeus, 1758) of the Chrysomelidae family of the Coleoptera order were found in the stationary fields was observed. Information about some bioecological and phenological characteristics of the mentioned species is reflected in the article.

Аннотация. Представлены сведения о вредителях, принадлежащих к семейству Chrysomelidae, отряда Coleoptera, полученных на основе исследований, проведенных в хозяйствах Имишлинского района, который является одним из основных регионов выращивания сахарной свеклы в Азербайджане. За годы исследований выявлено 3 вида (*Chaetocnema concinna* (Marsham, 1802), *Ch. breviscula* (Faldermann, 1837), *Cassida nebulosa* Linnaeus, 1758), принадлежащих к родам (*Chaetocnema* Stephens, 1831, *Cassida* Linnaeus, 1758). В статье отражены сведения о некоторых биоэкологических и фенологических характеристиках указанных видов.

Keywords: Coleoptera, Chrysomelidae, *Chaetocnema concinna*, *Chaetocnema breviscula*, *Beta vulgaris*.

Ключевые слова: жесткокрылые, листоеды, обыкновенная свекловичная блошка, южная свекловичная блошка, сахарная свекла.

Insects are the most numerous groups of living organisms, mainly within the Insecta class. Currently, it is noted that more than 400,000 species are known in the world and hundreds of new species are added every year (<https://kurl.ru/PRzfb>).

Insects play an important role in people's lives and farms. So, most of them are pests of plants, food resources and various foods and cause serious damage. Even in our republic, representatives belonging to this order (Coleoptera) are one of the main pests that cause serious damage to garden, melon and field plants, including beet fields every year.

About 4,000 species of the Chrysomelidae family of the Coleoptera order are known. Of them, 1,400 species have been recorded in the CIS, 500 in the Caucasus, and more than 400 in Azerbaijan. Body lengths 2-12 mm. Varies between the family of leaf-eating insects is one of the

largest groups among herbivorous arthropods, second only Curculionidae in terms of species richness. In Azerbaijan, the systematic and planned study of leaf-eating insects, studies on the biology and ecology of pests of agricultural plants, and the scientific development of measures to combat dangerous pests began in 1966 [1].

According to the author's information, more than 100 harmful leaf-eating insects in different areas can damage agricultural plants to varying degrees every year [2].

As a result of our research, we have determined that among the common pests in agroecosystems, the group of insects has a special place both in terms of the number of species and the degree of damage. Thus, 45.8% of the 48 species found in agroecosystems belong to the representatives of the group of insects, and their pest percentage is also high compared to other groups. Taking into account the above, we found it necessary to study the bioecological and phenological characteristics of 3 species belonging to the Chrysomelidae family, which are often found in agroecosystems and cause serious damage to plants. The results of the research are reflected in the article.

Material and method

Research was conducted in field and laboratory conditions. Laboratory experiments were carried out in the laboratory of ecology and physiology of animals of the Institute of Zoology of ANAS and in the Center of Applied Zoology in special automatically controlled thermostats and room conditions. The field work was carried out in special stationary and private backyard areas where sugar beet is grown in Imishli region (39°52'29" N; 48°5'14" E). The methods of K. K. Fasulati, I. Y. Polyakov and A. Z. Zlotin were used during the research [3-5].

Various determination sources were used when specifying the taxonomic affiliation of the species [6, 7].

Mathematical processing of materials is based on G. F. Lakin and N. A. Plokhinsky methods [8; 9].

Results and their analysis

Common beet weevil (Chaetocnema concinna Marsham, 1802)

Ch. concinna is a polyphagous pest. Its food consists of plants belonging to the Amaranthaceae, Asteraceae, Brassicaceae, Cannabaceae, Chenopodiaceae, Fabaceae, Poaceae, Polygonaceae, Rosaceae and Salicaceae families. In different years, it was registered as a dangerous pest of sugar beet in Poland, Russia, Great Britain, France, Belarus, Uzbekistan, Slovakia, Ukraine, Japan and other countries [10, 11].

This pest is spread not only in the sugar beet growing areas of Azerbaijan, but also in other regions.

The length of the pest's body is equal to 1.5-2.5 mm, its body is dark bronze or greenish in color. The body is oval in shape. There are small dot-shaped depressions arranged in a row in the longitudinal direction. Claws are usually black.

Chaetocnema concinna in the mature stage. The imagoes that have come out of winter diapause are first fed with weeds in the spring, especially whitish sedge, sedge, black sedge, etc. feeds on plants. Therefore, the pests are more common in sugar beet fields with a lot of listed weeds. The beetles then move to sugar beet seedlings that have just emerged from the soil. In addition to damaging leaves, they also damage the terminal shoots of the plant. Insects feed on parenchyma and epidermal tissues of beet leaves, making small holes of regular shape.

In May, females lay eggs in groups in the soil — around the root of a food plant (beet or weeds). Each group contains 2-6 eggs. The productivity of one female individual is equal to 40-50 eggs. The incubation period is 2-3 weeks. Hatched larvae are white, with black head, abdomen, legs and ventral sclerites. The length of well-developed larvae is 4-5 mm. The larvae feed on the root

and create a ‘tunnel’ in the root of the food plant. After about a month, the larvae pupate in the soil. Pupation occurs at a depth of 10-15 cm in the soil. Pupated adults feed on beet and weed leaves as imagoes emerging from hibernation in the spring.

As can be seen from Table 1, the common beet plant produces 2 generations per year in the study area. The development of the first generation is observed from the end of April to the third decade of August, and the development of the second generation is observed from the second half of July to the middle of October. At the end of September, in October, adult insects collect winter reserves and go to diapause.

Table 1

PHENOLOGICAL CALENDAR OF COMMON BEET WEEVIL (IMISHLI, 2020-2022)

<i>Months</i>																											
<i>March</i>			<i>April</i>			<i>May</i>			<i>June</i>			<i>July</i>			<i>August</i>			<i>September</i>			<i>October</i>			<i>November</i>			
(8.9°)			(12.5°)			(20.5°)			(25.1°)			(26.9°)			(27.5°)			(24.0°)			(16.1°)			(10.4°)			
<i>Decades</i>																											
<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>I</i>	<i>II</i>	<i>III</i>	
<i>I Generation</i>																											
(i)	(i)	i	i	i	i	i	i	i																			
						y	y	y	y																		
										s	s	s	s	s													
															p	p	p	p									
																			i	i	i	i	i				
<i>II Generation</i>																											
															y	y	y	y									
																			s	s	s	s	s	s			
																									p	p	p
																									i	i	i
																									(i)	(i)	(i)
																									(i)	(i)	(i)
																									(i)	(i)	(i)

Note: (i) — hibernating insects, y — eggs, s — larva, p — pupa, i — active insects

The common beet weevil gnaws and damages the leaves and tall shoots of the plant during the first vegetation period, and then moves to the root system, opens various holes there and destroys its internal tissues. During the years of research, it was determined that these mites spread massively in the fields and are seriously damaging. Even in recent years, the infestation of the plant in private farms in the territory of Imishli district has increased to 4-5 points (Table 2).

Table 2

THE DEGREE OF INFECTION OF PLANTS WITH MITES

<i>Observation date</i>	<i>Common beet weevil (Imishli, 2021)</i>		
	<i>Total number of plants (in numbers)</i>	<i>Number of uninfected plants (in numbers)</i>	<i>Percentage of infection (in %), $P=(n \times 100)/N$</i>
23.04	96	9	9.4
28.04	94	11	11.7
07.05	96	19	19.8
13.05	88	22	25.0
23.05	86	24	27.9
03.06	92	27	29.3
10.06	87	18	20.7

As can be seen from the Table 2, the mass growth and damage of pests in agroecosystem is mainly observed in the period from May to the second decade of June. Therefore, this fact should be taken into account when preparing measures to combat this pest.

Southern beet weevil — (*Chaetocnema breviscula* (Faldermann, 1837))

The southern beet weevil is one of the main pests of beet in Belarus, it is widespread and causes serious damage to farms [12].

According to Markov, *Chaetocnema breviscula* (Faldermann, 1837) and *Chaetocnema tibialis* (Illiger, 1807) species have been widespread in Kyrgyzstan and Kazakhstan since the 60s of the last centuries, causing huge damage to beet farms every year. According to the author, both species produce two incomplete generations in these areas. The development of the first generation lasts from May to July, and the development of the second generation continues from July to the end of autumn. Mass flight of insects of the first generation is observed in the third decade of June and July, and of the second generation from the last decade of August to the end of vegetation [13].

This species belongs to the family of leaf-eating insects, the body size varies between 1.6-2.2 mm. During mass growth, it seriously damages the productivity of the beet plant.

Table 3

PHENOLOGICAL CALENDAR OF THE SOUTHERN BEET WEEVIL (IMISHLI 2020-2022)

Months																								November (10,4)
March (8,9°)			April (12,5°)			May (20,5°)			June (25,1°)			July (26,9°)			August (24,0°)			September (24,0°)			October (16,1°)			
Decade																								
I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
<i>I Generation</i>																								WINTERING
(i)	(i)	i	i	i	i																			
			y	y	y	y	y	y																
						s	s	s	s	s	s													
									p	p	p	p	p											
												i	i	i	i	i	i							
<i>II Generation</i>																								
												y	y	y	y	y	y							
															s	s	s	s	s					
																		p	p	p	p	p		
																					i	i	i	
																					(i)	(i)	(i)	
																					(i)	(i)	(i)	

Note: (i) — hibernating insects, y — eggs, s — larvae, i — active insects, p — pupa

Development dynamics, biological indicators, etc. of the southern beet root (Table 3) in agroecosystem, which is widespread in the beet-growing areas of Azerbaijan. Characteristics have been investigated in detail. During the research, it was observed that this pest emerges from hibernation at the end of March and the beginning of April. The insects that come out of hibernation first feed on some representatives of the family of spp. and at the same time some representatives of spp. After fertilization, the female individuals 1-3 cm into the moist part of the soil near the plants. They lay 4-6 eggs in depth. It should be noted that females repeat the egg-laying process several times (3-5) with an interval of 3-4 days. Usually, 1 female individual can lay 80-120 eggs during the reproductive period. Embryonic development lasts 10-16 days, depending on temperature, and larval development lasts up to 1 month. Larvae are very active, they eat the roots of plants in the soil, and then they destroy their leaves. The damage caused by the larvae is more dangerous in the early stages of sprouting. Thus, they gnaw the tall shoot of the sprout, causing the complete stop of

the plant's development and its destruction. During the research conducted in stationary areas in Imishli district, it was clarified that this pest gives 2 generations in the areas. The development of the first generation begins in April and continues until the second decade of August. The development of the second generation continues from the end of June to the end of September. During this period, adult insects actively feed and hibernate in those areas, either in the soil layer or among thick plant remains (Table 4).

Looking at Table 4, we see that the period when the leek causes the most damage to plants is observed from the first decade of May to the second decade of June, as in the case of the previous pest.

Table 4

DYNAMICS OF DEVELOPMENT

Observation date	Southern beet weevil (<i>Imishli</i> , 2021)		
	Total number of plants (in numbers)	Number of uninfected plants (in numbers)	Percentage of infection (in %), $P=(n \times 100)/N$
25.04	98	8	8.2
30.04	96	11	11.5
05.05	96	17	17.7
10.05	94	21	22.3
15.05	89	24	26.9
20.05	90	26	28.9
30.05	88	29	32.9
05.06	91	31	34.0
10.06	86	27	31.4
15.06	84	22	26.2

It should also be noted that since the development period of the first generation coincides with the first growth period of the plant, the damage to the crops is more. During the development period of the second generation, as the leaves of the plant become coarser, the aphids lay their eggs on other weeds with juicier and younger leaves (mainly weeds belonging to the family of sedges, alfalfa, fall crops, etc.).

Shield beet leaf-eater — (*Cassida nebulosa* Linnaeus, 1758)

This species is found in all grassland regions of Europe: Denmark, Great Britain, Germany, Switzerland, Poland, Czech Republic, Slovakia, Austria, France, Spain, Italy, Hungary, Romania, Croatia, Bulgaria, Albania, Greece, Lithuania, Belarus, Ukraine, Moldova; It is found in North America, Japan, and northeastern China [14].

In Azerbaijan, this pest is also often found in the research areas. During the research, the first flight of insects was found at the end of April and the first decade of May. First, they move to weeds and then to sugar beets. After some time, the mating process takes place in them. Egg-laying of females starts from the middle of May and lasts for about 1 month. A female can lay up to 200 eggs. Eggs are laid in groups on the top or bottom of the leaves. Embryonic development takes 5-10 days. Hatched larvae are yellowish green. They are easily seen on the leaves. It feeds on sugar beet leaves and pupates on the leaf as well. Larvae change their shell 4 times. Larvae usually spend their lives on beet leaves, only at certain moments they are forced to move to other plants. They migrate from plant to plant when there is excessive moisture and nutrient deficiency in sugar beet fields. The pupal stage lasts 5-8 days. It gives two generations a year. The development of the first generation takes 30-35 days. Beetles of the second generation are found in August-September, and then they hibernate. At this time, they do not lay eggs. They hibernate under plant debris, on weeds.

Although polyphagous is a pest, it is known as a major pest of sugar beet and is widespread in all sugar beet growing regions. It damages sugar beet in both imago and larval stages. Adult individuals of the pest eat from the edge of the beet leaf to the middle and make holes in the leaf axil. Larvae in the upper age period can destroy 80% of the plant. As the larvae feed on the parenchyma tissue of the leaf, only the tubular-fibrous tissue remains.

While monitoring the development of the pest on the beet plants in private yards, it was determined that they are really harmful.

The results obtained during the research can be used in the preparation of a plan of comprehensive control measures against these pests.

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