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BIOLOGICAL AND PHENOLOGICAL CHARACTERISTICS OF THE MOROCCAN LOCUST (*Dociostaurus maroccanus* (Thunberg, 1815)) IN THE SOUTHERN ZONES OF AZERBAIJAN

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БИОФЕНОЛОГИЧЕСКИЕ ОСОБЕННОСТИ *Dociostaurus maroccanus* (Thunberg, 1875) В ЮЖНЫХ РЕГИОНАХ АЗЕРБАЙДЖАНА

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Abstract. In the years 2021-2023, as a result of the research conducted in Masalli district, located in the southern zone of Azerbaijan, it was found that the Moroccan locust gives one full generation in these areas. Hibernation takes place in the egg stage in the carp. Larvae emerge from the eggs in the second half of April. The results obtained during the research can be used when developing measures to combat this pest.

Аннотация. Проведенные трехлетние наблюдения (2021–2023 гг.) в южном регионе Азербайджана (Масаллинский район) показали, что в этих условиях *Dociostaurus maroccanus* развивается в одном полном поколении. Зимовка вредителя происходит в стадии яиц внутри кубышек. Выход личинок из яиц наблюдается во-второй половине апреля. Результаты исследований могут быть использованы при разработке плановых мероприятий против этого вредителя.

Keywords: Azerbaijan, Massalli, Moroccan locust, phenology.

Ключевые слова: Азербайджан, Масаллинский район, марокканская саранча, фенология.

Locusts are a large group of insects of the order of Orthoptera and they cause a great deal of damage to agricultural, medicinal and other plants every year. According to their way of life, these creatures are divided into two groups: those who live in herds and migrate to new areas for food and reproduction, and those who carry out the same goal individually, that is, individually. Currently, in almost every part of the Earth (except Antarctica), especially in Africa, vast agricultural fields are attacked by swarms of locusts and hundreds of hectares of land are destroyed every year.

The first mass attack of a swarm of locusts in the history of mankind occurred in 1875 in the United States. Swarms of locusts appeared in Texas and quickly spread to the western parts of the state, turning it into a desert. However, for an unknown reason, the further development and growth of locust flocks did not take place, and they were never found again in this region. Later, it became known that those areas where the locusts laid their eggs were utterly destroyed and destroyed by people who cultivated the land without their knowledge. Thus, the development of the next generation did not occur, and this was the last attack of the locusts, and now these pests are not found in North America. The first “attack” of locusts in Russia was recorded in 1788 in its southern

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territories. In recent years, these pests have become more intense in most of its regions, and every year a lot of labor and chemical preparations are spent on fighting these pests [1].

As early as 1961, the London Center for Locust Scientific Research investigated the foci where the Moroccan locust was abundant and settled in the territory of Iran and determined that 5 of them were in Northern Iran and 3 in Southern Iran [2].

Without a doubt, it can be assumed that migrations will take place from those areas to suitable regions of our Republic. According to E. M. Shumakov [3], one of the main breeding habitats of this species is the northern regions of Afghanistan and most regions of Iran. It should also be noted that in Iran these pests are mostly 500m. above sea level and 1500 m. common in the lowlands. Probably, this also happens depending on the distribution of moisture in these areas in spring [4].

According to the author's results, the reproduction and development of Moroccan locusts depended on spring (March-May) precipitation, which is about 100 mm. In such humid conditions, the development of locust eggs is accelerated and the yield % is high. The fact that the humidity is too low and above this limit also has a negative effect on the reproduction of the locusts themselves. Spring ephemerals complete their development and fruiting very quickly in spring. It is during this period that there is sufficient moisture in the soil.

It is during this period that the larvae of the Moroccan locust develop and reproduce. L. L. Mishenko [5] notes that the Moroccan locust is widespread in Central Asia, South Kazakhstan, Georgia, Azerbaijan, the Caucasus, Southern Ukraine, North Africa, Asia Minor, Iran and Afghanistan. In Ukraine, they mainly damage grain crops, legumes, tobacco, melons and vegetables, grapes, fruit trees, forest and ornamental trees. Depending on the density of the population, the development of the larvae goes either in the direction of the swarm or individual phases. In Crimea, larvae hatch in early May. Adults appear in early June. Depending on the temperature, the larvae begin to lay eggs two weeks after hatching. They lay their eggs (in sacks) mainly in dry, intensively grazed areas, in steppes with bulbous sedges (*Ficinia bulbosa*).

In Azerbaijan, there are very few detailed and extensive research works on the fauna of Orthoptera, mainly locust. It is noted that the first information about this group (Orthoptera) was found in the works of Menetrie and Uner-Battenville, who conducted certain research in Lankaran zone of the republic [6].

In 1909, Ya. P. Shchelkanovtsev [7], in 1917, B. P. Uvarov [8], in 1940, S. P. Tarbinski [9], and in 1958, G. Y. Bey-Bienko [10] gave various information about the fauna of the Homoptera mainly in Talish and its surrounding areas of Azerbaijan. After a big break from Hagverdiyev's research, in recent years, information on the research of locusts in Azerbaijan can be found only in the works of I. Safarova [11-14].

In different years, in the Karasu steppe, Padarchol, Jeyranchol, Harami plain, Khachinchay, Eldar plain areas of our Republic, damage was prevented to a certain extent as a result of the measures taken against these pests by the Republican Plant Protection station using modern preparations. However, despite these measures, it is still possible for the pest to multiply in some regions of our Republic. As a result of our research in recent years (2021-2023), it was found that the Moroccan locust, along with a number of species, is increasing and causing damage to farms in the southern regions of our Republic.

Taking these into account, we aimed to investigate some bioecological and phenological characteristics of this pest in Masalli district, which is one of the main districts of that zone.

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Material and methods

In nature, phenological observations and studies were carried out using the methods and methods accepted in entomology [15, 16].

Special cages with dimensions of 50×50×45 cm was used in laboratory conditions to investigate some biological characteristics of the pest. The edges of the cages were covered with a metal mesh (1.5×1.5mm), and the top side was covered with a glass plate with a window that could be opened and closed to provide food to the locusts. A mixture of soil and sand is poured on the floor of the cage. In laboratory conditions, locusts were fed mainly wheat and barley sprouts.

For this, wheat and barley were germinated in small pots (15×10×10 cm) to a height of about 10-12 cm. For free movement and feeding of locusts, several cardboard egg trays (cassettes) were placed on the floor and outside of the cage (in a vertical position).

For locusts to lay eggs, special containers with width and length of 15-17 cm and height of 10-12 cm are placed in the cage, filled with a mixture of soil and sand with a thickness of 6-8 cm. Experiments in the laboratory were carried out from March to the end of September in an environment adapted to natural conditions as much as possible.

Analysis of the obtained results

Adult individuals of the Moroccan locust are gray chestnut with dark spots. Males reach 20-28 mm, and females reach 28-30 mm. The X-shaped pattern on the front back is clearly visible. The wings are transparent (colorless) and extend beyond the top of the thigh. These locusts are mostly found in areas with ephemeral plants in dry-desert areas, and after the plants dry up, they move to other cultivated areas, mainly grain agrocenosis, causing damage to farms.

It should also be noted that the larvae of Moroccan locusts appear earlier in nature than other species, that is, from the second decade of April (Table 1).

Table 1

DEVELOPMENT TIMES OF THE MOROCCAN LOCUST IN NATURE

Age stages	*Times of appearance in the nature*	*Mass molting days*	*Age stage development time (days)*
II	15-20.04	21-25.IV	10-12
III	01-03.05	04-06.V	09-11
IV	12-15.05	15-19.V	13-16
V	25-30.05	01-03.VI	14-16
Imago	8-12. VI		45-55

Depending on the temperature, the larval stage lasts up to 2 months. They go through five stages. Adult individuals mate 6-12 days after the last molt, and egg-laying begins after 8-14 days. Females lay 3-5 clutches, each of which can contain up to 40 eggs (Table 2).

As can be seen from the second table, the wintering of the locust takes place in the egg stage inside the locust. The first larvae are observed in the second half of April (15-20. IV.).

In nature, it is possible to encounter larvae until the beginning of June. The first adult individuals (imagoes) can be found from the beginning of June to the third decade of July. At the end of June, females lay their eggs 2-3 cm deep in the soil. Those eggs go to diapause and hibernate at this stage until the spring of the next year.

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Table 2

PHENOLOGICAL CALENDAR OF THE MOROCCAN LOCUST (MASALLI, 2021-2023)

Stages of development	*March*	*IV*			*V*			*VI*			*VII*			*Diapause and hibernation*
		1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	
Egg	●●●	●	●	●										
The larva			–	–	–	–	–	–						
Imago								+	+	+	+	+		
Egg										●	●	●	●	●●●●

Note: ● — egg, – — larva, + — imago

During our research, it was determined that the Moroccan locust produces one full generation per year in the southern regions of Azerbaijan.

Considering that the development of the larvae of the pest mainly coincides with the second half of April and May, it would be more appropriate to carry out chemical control measures against it in the hearths during those periods.

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