Redistribution of Locusts and Prospects for Controlling Them Under the Conditions of The Aral Sea Region

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Abstract

The high effectiveness of ISH insecticides has been established. (chitin synthesis inhibitors) in the fight against all species of locusts. Insecticides: dimilin (30 g/ha) and nomolt (50 g/ha) provide 100% effectiveness against locusts for 10-12 days, provided they are applied within scientifically-based timeframes - during the mass hatching of larvae from the buckets. High efficiency at the beginning of treatment is provided by binary tank mixtures, dimilin+fastak (30+85 g/ha) or nomolt+fastak (30+85 g/ha).

Keywords: Slucerne, fodder, seeds, temperature, pests, range, eggs, larvae, feeding, ecological factors, development, plants, seed damage, leaves, morphology, biology, ecology, insect species, generation.

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1. Introduction

Lucerne is a perennial agricultural crop. Because of this, and due to a number of specific features of its development, it is inhabited by many species of harmful and beneficial arthropod organisms. Certain insect species (monophages) are adapted to feed on lucerne, oligophages feed on leguminous crops, and polyphages are also present.

– For example, locusts can be found in lucerne fields, which are likely associated with grass-like weeds and other plants.

In the list of the entomocenosis of lucerne fields, 12 locust species were reported as being distributed to varying degrees in cultivated habitats, particularly in lucerne fields. However, under the conditions of the Aral Sea region, other authors identified 41 locust species, of which 13 were found in lucerne fields (Khudanov, 1998). It is known that locusts in the post-embryonic phase (larvae and adults) damage the vegetative mass of various plant species, including lucerne, thereby reducing crop productivity. In years of mass outbreaks and in the absence of proper protection, winged locusts (especially gregarious forms) migrate and invade crop fields, rapidly consuming and destroying plantations within a short period, causing irreparable damage to agriculture.

Karakalpakstan, with its vast areas of desert and semi-desert fallow lands, numerous lakes, and major water arteries—the Syr Darya and Amu Darya rivers—as well as extensive adjacent territories with reed beds, has created favorable conditions for locust development.

The reed-covered territories have created favorable conditions for the development of locusts. Historically, the dominant locust species in this region have been the Asian migratory locust (Locusta migratoria migratoria L.), which occupies reed thickets along the shores of large water bodies in the region, and the Italian locust (Calliptamus italicus L.), which prefers warm steppe and semi-desert habitats.

From an evolutionary perspective, under the influence of ecological factors and human activity, the transformations that occurred in the Aral Sea and its coastal territories over the past 50–60 years have also affected the distribution of locusts in this area. In particular, as noted by Khudanov (1998), Gapparov (2002), and Latchininsky et al. (2002), since the 1960s there has been a reduction in the areas occupied by the Asian locust and an expansion of those occupied by the Italian locust.

Currently, the areas occupied by the Italian locust in Karakalpakstan are 6–8 times larger than those of the Asian locust, whereas in the 1950s the situation was the opposite, with the proportion of the Asian locust being ten times higher than that of the Italian locust (Shamuratov, Zubkov, 1976).

The gradual reduction of suitable habitats has had a negative impact on the populations of the Asian locust. Their population density has noticeably decreased.

The population density decreased in all major outbreak areas of the Aral Sea region, and a slight increase in numbers occurred only in years with higher precipitation levels. In contrast, the Italian locust is found not only in typical habitats but also in sand dune zones and saline desert areas, i.e., in habitats where it was previously absent. Its high density was typical in weed-infested, semi-abandoned lucerne fields, from where hopper bands migrated to surrounding agricultural lands.

It should be noted that, due to the widespread cultivation of wheat in irrigated lands, there is an increasing distribution of another representative of the genus Calliptamus—C. barbarus Costa, the desert locust. This species specializes in ephemeral grass-like weeds and cereal crops. This is confirmed by the fact that in 2023 no hectares were treated against the desert locust, whereas in 2024 the treated area reached 24 thousand hectares (8% of the total chemical treatments), and in 2025—30 thousand hectares (12%). Forecasts indicate a possible further increase in the affected areas of this species in Karakalpakstan.

We have results of route surveys conducted in 2023–2025 in permanent locust outbreak areas to assess population density and species diversity of these insects. As shown, most of the territory is occupied by the Italian locust; the Asian locust is more common on the Kalinin Plateau (81.5%) and in Ali-Aul settlement (56.9%). In other outbreak areas, its share does not exceed 27%. In terms of the number of eggs in egg pods, the Asian locust exceeds the Italian locust by almost three times. However, this does not necessarily mean that the fecundity of the Asian locust is higher than that of the Italian locust—the Asian species may have fewer total egg pod formations overall.

The Italian locust overwinters in the egg stage inside egg pods. According to long-term average data, the beginning of spring hatching of larvae occurs in the second to third decade of May. Hatching is not synchronous and extends over several weeks. The transition of larvae from one instar to another occurs every 6–9 days. At high population density, larvae form aggregations called hopper bands, with densities reaching up to 1,000 individuals per m². In the solitary phase, larval density may be 5–10 individuals per m². Hopper bands usually form a living strip up to 500–600 m in length and up to 50 m in width.

They move more actively, and their mobility increases depending on their developmental stage, reaching on average 50–70 m per day.

Winged emergence of the Italian locust in the conditions of the republic begins in mid-June (50–55 days after hatching). After this, the density of hopper bands gradually decreases. After some time, active dispersion is observed.

Migration refers to the flight of insects. During the day, depending on wind conditions and air temperature, young Italian locusts can fly 20–30 km (Vasiliev, 1950). Egg-laying begins 15–28 days after winged emergence.

For this purpose, females find suitable sites—unoccupied light sandy soils—and begin oviposition synchronously. Female fecundity reaches 100–120 eggs, with each egg pod containing 27–38 eggs. Adult Italian locusts may survive until early September and then die. Eggs in deposited pods enter diapause until the spring of the following year. Unlike Asian locust eggs, Italian locust eggs are not dependent on environmental moisture.

The Asian, or migratory locust, has an extensive range among all locust species in the world. It includes almost all temperate and tropical regions of the Eastern Hemisphere. There are nine recognized subspecies of the Asian locust (Latchininsky et al., 2002), but only two of them occur in CIS countries: L. m. rossica Uv. et Zol. and L. m. migratoria L. The latter subspecies is distributed in the territory of Karakalpakstan.

Hatching of Asian locust larvae under the conditions of Karakalpakstan occurs in early May and continues for a relatively short period of 7–8 days. Larvae of the gregarious phase of the Asian locust almost immediately gather into hopper bands with high density. Larval movement occurs in later instars and is quite intensive. The complete larval development takes 37–45 days. Winged emergence begins in mid-June, and adults live until the end of August. During this period, Asian locusts may fly to neighboring crops (including lucerne) when food is insufficient and cause damage.

Egg-laying begins in early August. Each female deposits 2–3, and sometimes up to 5 egg pods, each containing 44–93 eggs.

Of particular interest is the improvement of active protective measures using insecticides, since the chemical control method remains the most effective, especially considering the need to protect large areas of land where other methods are physically impractical. The list of recommended preparations for locust control is extensive (“List…”, 2003). Against locusts, mainly synthetic pyrethroids and, to some extent, organophosphorus compounds (Durspan, Karbofos, Metaphos) are recommended.

In 2025, we organized and conducted a cage experiment to precisely determine the toxic potential of insecticides with hormonal action: Dimilin (Crompton) and Nomolt (BASF) as means of control.

against locusts. The experimental design included variants with binary tank mixtures of IGRs with pyrethroids (to increase the initial effectiveness of treatment during the first 4–5 days). The experimental scheme and obtained results are presented in Table 1, from which the following can be observed:

1. The IGRs Dimilin (30 g/ha) and Nomolt (50 g/ha) show high effectiveness against locusts starting from the early instar stages. Within 15 days after application, 100% effectiveness is achieved.

2. The use of binary tank mixtures of IGRs with pyrethroids provides a high initial level of effectiveness against locusts. The need for repeated treatments is eliminated. It proved to be insufficiently effective against locusts (even at early instar stages).

Table 1. Biological effectiveness of insecticides (IGRs) against the Italian locust. Cage experiment, 27 May 2024

№ p/p	**Variants**	Application rates of preparations,mg (g)/ha	Number of locusts in instars I–II–III						Effectiveness, % on days:				
			Before treatment	After treatment on days:									
				5	15	25	35	45	5	15	25	35	45

1.	Dimilin, 48% SC	30	100	72	3	0			25,8	96,8	100		
2.	Dimilin, 48% SC + Fastac, 10% EC .	30+85	100	11	1	0			88,6	98,9	100		
3.	Nomolt, 15% SC	50	100	68	2	0			29,9	97,8	100		
4.	Nomolt, 15% SC + Fastac, 10% EC	30+85	100	9	0	0			90,7	100			
5.	Adonis, 4% EC (standard)	110,0	100	0					100				
6.	Fastac, 10% EC (standard)	85,0	100	28	23	22	19	17	71,1	75,3	74,7	77,9	78,7
7.	Control (untreated)	-	100	97	93	87	86	80	-	-	-	-	-

3. Fastac, at the recommended application rate according to the "List…" – 85 g/ha

In the following year (2025), a field production experiment was conducted to verify the criteria obtained in the previous year's cage experiment. Due to limited capacity, only one preparation—Dimilin—and its combination were tested (Table 2). The experiment was carried out in the Takhtakupyr district using an OVKh-28 sprayer. The results obtained confirmed the toxic potential of Dimilin.

Table 2.

Biological effectiveness of insecticides (IGRs) against locusts. Field experiment. OVKh-28 – 100 L/ha, 17 May 2025

№ p/p	**Variants**	Application rates of products, mL/ha					
			5	12	20	30	40
			S±m	S±m	S±m	S±m	S±m
1.	Dimilin, 48% SC	30	41,3±3,7	93,2±1,3	100		

2.	Dimilin, 48% SC + Fastac, 10% SC	30+85	86,9±3,5	100			
3.	Fastac, 10% SC (standard)	85	68,9±4,1	75,2±4,7	32,1±3,6	11,3±5,3	0
4.	Control (untreated)	-	Locust population per 1 m²				
			38,5	49,2	40,3	65,3	12,1

In both cases, the preparation showed high effectiveness against the complex of locust species. It should be noted that the treatment was carried out during the period of mass hatching of larvae (68% Italian locust, 27% Asian locust, and 5% other species), when a small proportion of second- and third-instar larvae was also present in the area. Fastac (85 g/ha) again demonstrated unsatisfactory and short-term effectiveness.

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