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"Determination of the insecticidal activity of the chemical preparation tranil 20% sc, received for testing against cotton bollworm on cotton crops."

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Abstract: To determine the insecticidal activity of TRANIL 20% EC against the cotton bollworm (Helicoverpa armigera Hbn), which causes significant damage to cotton crops in our country, field trials were conducted using a dosage rate of 0.2 liters per hectare. The results of the trial showed that by the 7th day, the effectiveness of the preparation reached 89.1%.

Keywords: Cotton, egg, larva, polyphagous, pest, formulation, insecticide, insecticidal activity.

Introduction: Uzbekistan produces approximately 3.5 million tons of raw cotton annually (ranking sixth in the world) and 1–1.2 million tons of cotton fiber. About 40% of the produced cotton fiber is exported. To increase the production and improve the quality of raw cotton in Uzbekistan, it is essential to utilize all available resources. In particular, protecting cotton crops from pests plays a crucial role in enhancing both yield and fiber quality [1].

The chemical method of protecting various agricultural crops from their primary pests is an integral part of the

Integrated Pest Management System (IPMS), as it occupies a central position in this strategy. Gradual changes in Uzbekistan's climate—such as increased precipitation and humidity in the spring, changes in the accumulation of effective temperatures, and the redistribution of climatic parameters during autumn and winter-have led to significant changes in plant diseases and the development patterns of various insects. Notably, there has been a marked increase in fungal diseases that thrive in high-humidity environments [11].

Globally, cotton bollworms cause annual agricultural crop losses exceeding $2 million in crops such as cotton, maize, vegetables, legumes, and others. Meanwhile, control measures amount to nearly $1 million. In countries like China and India, nearly 50% of all insecticides are used against cotton bollworm. Among the chewing pests of cotton, the cotton bollworm holds a particularly significant role [12].

Another critical reason for conducting such research is the gradual decrease in the effectiveness of previously recommended insecticides against target pests. This is particularly evident in pyrethroids, where group and cross-resistance has developed in pests such as aphids, whiteflies, and cotton bollworms [6]. Subsequently, new classes of chemical compounds have gained popularity, including representatives of neonicotinoids-such as imidacloprid, acetamiprid, thiamethoxam well as oxadiazines (e.g., Avaunt), carbamates (e.g., Lannate), emamectins (e.g., Carrageenan), emamectin benzoates, and others, which are now widely used against cotton bollworms.

The cotton bollworm was first described in the early 19th century. Its main scientific name is Helicoverpa armigera Hbn. (Hübner, 1805). Synonyms include Chloridea obsoleta, Chloridea armigera, Helicoverpa obsoleta, Helicoverpa barbara, Helicoverpa conferta, Helicoverpa pulverosa, Helicoverpa uniformis, and Helicoverpa rama [10].

The cotton bollworm (Helicoverpa armigera Hübner) is a polyphagous pest, damaging nearly 120 plant species, with primary hosts including cotton, maize, tomato, sunflower, soybean, chickpea, and others [13;14]. The pest possesses high ecological plasticity, allowing it to easily adapt to changing environmental conditions and reach high population densities [15]. The cotton bollworm is widely distributed across Central Asia, southern Kazakhstan, Transcaucasia, the North Caucasus, the Lower Volga region, southern Ukraine, and Far Eastern countries. In plantations, it typically develops through 3–4 generations. The most damaging stage is the larval stage, particularly the first instar, which feeds on apical buds and leaf tissues. From the second instar onward, larvae bore into fruiting bodies [7].

Biological characteristics: In spring, moth emergence begins when the soil temperature at a 10 cm depth reaches 15–16 °C and the average daily air temperature is 18–20 °C. Moth flight continues for over a month. The flight periods of different generations usually overlap and may last until late October. Depending on the air temperature, adult moths live from 20 to 40 days. In autumn, pests accumulate in underdeveloped cotton fields, late-season maize, tomatoes, and other crops, where most pupae overwinter [8].

METHODS

Field trials were conducted when the infestation level of cotton bollworm reached 9–10 larvae per 100 cotton plants. The tests of the TRANIL 20% SC formulation, containing the active ingredient Chlorantraniliprole, were carried out in the cotton field (And-36 variety) of the “Yangi Diyor Fayzi” farm located in the Guliston district, Sirdarya region. The treatment was applied during the cotton budding and peak fruiting stages, under early morning conditions with a temperature of up to 23°C, wind speed of 1.0–1.3 m/s, and relative humidity of 55–60%. The working solution was applied at a rate of 300 liters per hectare using a battery-powered sprayer (PT-16AC).

The distribution and damage caused by the pest were determined based on generally accepted methods [2;3;4;5]. The experiment included three variants: experimental, control, and reference (standard), each replicated three times. Pest population counts were recorded before treatment, and on the 3rd, 7th, and 14th days after treatment. The effectiveness of the tested formulation was evaluated in comparison with the control variant. Field trials were conducted following the methodology of Khodjaev Sh.T. (2023) [9], and biological efficacy was calculated using the formula developed by Püntener V. (1981) [16].

RESULTS

The experimental trials of TRANIL 20% SC at a dose of 0.2 litrs against the second and third generations of cotton bollworm were conducted in July 2024. As a reference sample, KORAGEN SC (Chlorantraniliprole 200 g/l) was used at the same dose (0.2 litr). The results obtained from the experimental trial of TRANIL 20% SC are presented in Table-1. As shown, the pre-treatment pest counts in the experimental and standard variants were 9.8 and 10.3 larvae per 100 plants, respectively—exceeding the established Economic Threshold of Pest (ETP) for this cotton pest species. The control variant had a count of 10.6 larvae. After treatment, the number of pests per 100 plants in the experimental (TRANIL 20% SC) variant was reduced to 2.2, 1.0, and 1.3 on the 3rd, 7th, and 14th days, respectively. In the reference variant (KORAGEN 20% SC), the corresponding counts were 2.1, 1.1, and 1.4. Meanwhile, in the untreated control variant, pest counts remained nearly unchanged: 10.6 before treatment and 10.0 and 8.4 on the 7th and 14th days, respectively.

Subsequent calculations of biological efficacy, adjusted relative to the control variant, demonstrated a high level of effectiveness for the test formulation. The insecticidal activity of TRANIL 20% SC was recorded at 77.5%, 89.1%, and 83.2% on the 3rd, 7th, and 14th days post-treatment, respectively. Similarly, the reference product KORAGEN 20% SC showed a positive efficacy of 79.6%, 88.6%, and 82.8% for the same observation periods. These results clearly indicate that chemical formulations containing 20% Chlorantraniliprole exhibit high activity against cotton bollworm.

CONCLUSION

When tested against cotton aphids, TRANIL 20% SC demonstrated 89.1% insecticidal activity by the 7th day when applied at a rate of 0.2 liters per hectare. This formulation is convenient to use; when mixed with water, it quickly forms a working solution. No phytotoxic effects were observed on the cotton plants.

Table-1

Biological efficiency of insecticide TRANIL 20% c.k. against cotton bollworm on cotton crops

(Syrdarya region, Gulistan district, farm "Yangi Diyor Fayzi", July 10, 2024).

№	Experience options	Active ingredient	Consumption rates of preparations	Average number of cotton bollworm caterpillars per 100 plants, specimens								Biological efficiency, % per days:		
				Before treatment (number of caterpillars by age)					After the treatments have been carried out					
				Eggs	I-II	III-VI	V-VI	Total	3	7	14	3	7	14
1.	TRANIL 20% с.к.	*Chlorantraniliprole 200 gr/l.*	0,2	10	4,2	3,3	2,3	9,8	2,2	1,0	1,3	77,5	89,1	85,2
2.	KORAGEN, с.к. 200 g/l	*Chloratraniliprole 200 gr/l.*	0,2	8	6,0	2,3	2,0	10,3	2,1	1,1	1,4	79,6	88,6	82,8
3.	Control (without processing)	-		12	5,4	4,0	1,2	10,6	10,6	10,0	8,4	-	-	-

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