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BIOLOGICAL EFFICACY OF HELITEC IN COMBATING TOMATO PESTS

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Abstract
The article presents the results of experiments conducted to study the efficacy of the Helitec biopreparation (Helicoverpa armigera NPV – 8%, 5x10^12 polyhedra per liter) against the larvae of the cotton bollworm (Helicoverpa armigera). The findings provide insights into the proper selection of biological preparations to combat the pest and identify effective control methods for use in tomato cultivation.

Keywords Cotton bollworm, Helicoverpa armigera, pest, Helitec, biological control, efficacy.

INTRODUCTION

With the growing global population, the demand for food products, including vegetables, is steadily increasing. This necessitates the expansion of tomato cultivation, which is one of the most consumed vegetables, and requires improving its yield and protecting the crops from harmful organisms. Ensuring the production of high-quality tomatoes that meet international standards is crucial. To meet the population's demand for food and produce environmentally clean products that can compete in global markets, experts in the field are implementing various measures.

In Uzbekistan, like in many parts of the world, there is a high demand for tomatoes. Consequently, it is imperative to develop effective pest control methods to protect tomato crops from damage. Tomatoes are affected by various pests, with the cotton bollworm (Helicoverpa armigera) being one of the primary threats. This pest causes significant damage to tomato crops globally and in Uzbekistan. Efforts are ongoing worldwide and locally to manage and reduce the population of this pest.

According to global data from the United Nations, over 30% of agricultural products are lost to harmful organisms annually, with this figure reaching 50% in underdeveloped countries. This highlights the critical importance of plant protection in agricultural production. Timely and effective pest control measures can result in higher and better-quality yields from vegetable and other crops, thereby enhancing economic efficiency .

The utilization of highly effective and safe microbiological preparations for the biological and ecological management of agriculture is a priority in the development of the agro-industrial complex of the Russian Federation. Current research in biological plant protection involves interdisciplinary approaches, including the mass rearing and use of entomophages and acariphages and evaluating the conservation of natural beneficial insects.

Tomato (Solanum lycopersicum L.) In Nepal, tomato cultivation ranks third among the most important vegetable crops. It is grown on 21,389 hectares, producing 400,674 tons with a yield of 18.73 tons per hectare (MoAD, 2016). Additionally, tomato cultivation in Nepal has high potential for providing income and employment for small farmers. However, various biotic and abiotic factors hinder tomato cultivation. The main pests of tomatoes include the cotton bollworm

(Helicoverpa armigera), the leaf miner fly (Liriomyza trifolii), and the tobacco whitefly (Bemisia tabaci), which spreads viruses in tomatoes. Furthermore, the tomato leaf miner (Tuta absoluta) appeared in Nepal in 2016, causing significant losses.

From 2021 to 2023, in the conditions of Andijan region, pests belonging to the Lepidoptera order, such as the cotton bollworm, tomato leaf miner, fall armyworm, and the potato tuber moth, seriously damaged crops like tomatoes, eggplants, and bell peppers. The tomato leaf miner not only heavily infests tomatoes but also damages eggplants and bell peppers. Experiments with the Altacor 35WG pesticide showed a 90% biological effectiveness against members of the Lepidoptera order.

Before combating pest insects in crops belonging to the Solanaceae family, it is crucial to thoroughly study their bioecological characteristics, which accounts for 50% of the success in controlling these pests. Under greenhouse conditions, the threshold for initiating pest control measures against the cotton bollworm is 6 larvae per 100 plants, making it worthwhile to start control measures from this point.

METHODS

The research utilized commonly accepted methods in entomology and agricultural entomology (Bondorenko, 1982; Murodov, 1986) as well as methodological guidelines (2004) and Abbot's formula for calculations.

RESULTS

Laboratory experiments were conducted at the Andijan branch of the Plant Quarantine and Protection Research Institute and the Central Phytosanitary Laboratory of the Plant Quarantine and Protection Agency, Andijan branch. Field experiments were carried out at the Vegetable, Melon, and Potato Research Institute in Andijan district, Andijan region. Our experiment consisted of 5 variants and 4 repetitions: the first variant was the control, the second variant used the biopreparation Havir (Helicoverpa Armigera virus), and the 3rd, 4th, and 5th variants used the biopreparation Helitec (Helicoverpa armigera NPV – 8% with $5x10^{12}$ polyhedra per liter) at application rates of 0.25 L/ha, 0.3 L/ha, and 0.33 L/ha. For laboratory experiments, Petri dishes and plastic containers were used. Containers were thoroughly washed and disinfected, then filled with larvae of different ages collected from the field. Each container was sprayed with Helitec at the aforementioned rates. To create favorable conditions for the action of the microbial agent, the containers were placed in a special Memmert thermostat set at 25°C and 60% relative humidity. The containers were covered with lids with small holes for air circulation and observed on days 3, 7, and 14 (Table 1.).

Table 1
Biological effectiveness of Helitec biological preparation against cotton bollworm larvae in tomatoes.
Laboratory experiments: (Andijan regional branch, 2023) Table 1

№	Field Experiments:	For reference l/ha	The number of larvae before processing, pcs	The number of larvae after processing, pcs (alive)			Biological efficiency %		
				3	7	14	3	**7**	14
1	Control	-	10	10	10	10	-	-	-
2	Havir, (*Helicoverpa Armigera*) em.k.	0,3	10	7,3	5,8	4,1	27	42	59

3	Helitec (*Helicoverpa armigera NPV*) em.k.	0,25	10	8,1	6,4	5,7	19	36	43
4	Helitec (*Helicoverpa armigera NPV*) em.k.	0,3	10	7,2	5,5	3,9	28	45	61
5	Helitec (*Helicoverpa armigera NPV*) em.k.	0,33	10	4,7	2,6	1,4	53	74	86

From the data in the table above, it can be seen that 3 days after the experiment, when the Petri dishes and plastic containers were checked, an average of 7.3 larvae remained alive in Variant 2 compared to the control, with a biological efficiency of 27%. In Variant 3, an average of 8.1 pest larvae remained alive, with a biological efficiency of 19%. In Variant 4, an average of 7.2 pest larvae remained alive, showing a biological efficiency of 28%. In Variant 5, an average of 4.7 pest larvae remained alive, resulting in a biological efficiency of 53%. The containers were then placed back in the thermostat.

7 days after the experiment, when the Petri dishes and plastic containers were checked, an average of 5.8 pest larvae remained alive in Variant 2 compared to the control, with a biological efficiency of 42%. In Variant 3, an average of 6.4 pest larvae remained alive, with a biological efficiency of 36%. In Variant 4, an average of 5.5 pest larvae remained alive, showing a biological efficiency of 45%. In Variant 5, an average of 2.6 pest larvae remained alive, resulting in a biological efficiency of 74%. The containers were then placed back in the thermostat.

14 days after the experiment, when the Petri dishes and plastic containers were checked, an average of 4.1 pest larvae remained alive in Variant 2 compared to the control, with a biological efficiency of 59%. In Variant 3, an average of 5.7 pest larvae remained alive, with a biological efficiency of 43%. In Variant 4, an average of 3.9 pest larvae remained alive, showing a biological efficiency of 61%. In Variant 5, an average of 1.4 pest larvae remained alive, resulting in a biological efficiency of 86%.

When we applied the Havir (Helicoverpa Armigera virus) biopesticide at a rate of 0.25 l/ha in laboratory conditions, it formed 59% biological efficiency. In the laboratory conditions, when the Helitec (Helicoverpa armigera NPV – 8% 1 liter contains 5x10^12 polyhedra) biopesticide was tested at rates of 0.25-0.33 l/ha, it resulted in 43% efficiency at 0.25 l/ha, 61% at 0.3 l/ha, and 86% at 0.33 l/ha.

Using this pesticide against tomato fruit borer achieved good biological efficiency in controlling the pest population, reducing their numbers, and being considered safe for humans and tomato production. Its use during any stage of plant growth distinguishes it from chemical pesticides.

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