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Biological Efficacy of the Insecticide Benzalife Bereke V.R.G. Against Cotton Bollworm on Medium-Fiber Cotton

Mamedova Visola Najmiddinovna
Lecturer at Asia International University
visola.0418@mail.com

Annotation: The cotton bollworm (Helicoverpa armigera Hübner) belongs to the order Lepidoptera, family Noctuidae. This pest develops in large numbers in cotton fields during the growing season, causing significant crop damage, reducing the technological properties of cotton fiber, and degrading the quality of seed.H. armigera is considered one of the most dangerous cotton pests.

Furthermore, Helicoverpa armigera is one of the most destructive insect pests in the world, causing estimated global economic losses exceeding $3 billion annually. The most susceptible crops are cotton, tomato, soybeans, grains (corn, sorghum), chickpeas, and other legumes.

This article presents the results of a field experiment evaluating the biological efficacy of the insecticide "Benzalife Bereke vrg" (emamectin benzoate + lufenuron) against cotton bollworm on medium-fiber cotton.

Keywords: Helicoverpa armigera, cotton bollworm, insecticides, Benzalife Bereke, emamectin benzoate, lufenuron, biological efficacy, cotton, agricultural pests.

INTRODUCTION: Cotton production is a major agricultural sector, spanning over one hundred countries worldwide. Major cotton-producing countries, including India, China, the United States, Brazil and Pakistan, grow cotton on approximately 35 million hectares and produce about 27 million tonnes of cotton fiber annually. Effective pest and disease control using biological, chemical and agronomic methods is crucial to ensure high-quality and abundant cotton yields and the protection of various other crops. However, the growing insect population worldwide poses a serious problem for the environment and biodiversity.

Cotton is also one of the most important commercial crops in Uzbekistan. This important fiber crop provides livelihoods for millions of people and plays a crucial role in the country's economy. However, the problem with this type of crop is that it attracts various types of pests and weeds. As a result, crop protection has become an integral part of cotton production. Cotton bollworms are the most common pests in cotton production.

Modern agricultural production in various countries around the world is faced with the need to solve two major problems: guaranteed protection of agricultural crops from pests, diseases and weeds, and, at the same time, protection of the environment from pollution. Of course, the tasks of obtaining a high-quality, full-fledged, environmentally safe harvest and increasing the level of competitive products are closely interrelated with this. In agriculture, attention will need to be paid to combating crop pests and diseases. The primary focus in addressing these issues is chemical plant protection.

LITERATURE REVIEW. The cotton bollworm (Helicoverpa armigera Hübner) belongs to the order (Lepidoptera), or butterflies. Family (Noctuidae). The cotton bollworm develops in large numbers in cotton fields during the growing season, causing serious damage to the cotton crop, reducing the technological parameters of cotton fiber and deteriorating the quality of seed material. It is considered one of the most serious pests of cotton and also damages more than 120 plant species (Khasanov et al. 2002).

H. armigera is one of the world's most destructive insect pests, causing estimated global economic losses of over USA $3 billion annually. The most affected crops include cotton, tomato, soybean, cereals such as corn and sorghum, chickpeas and other legumes.

Adults of this species have strong migratory capabilities (>2000 km), high fecundity and rapid reproductive rates; completing 4–6 generations per year in most agricultural regions.

In addition, the larvae are polyphagous, with a wide and diverse host range, and have the ability to enter diapause to survive in unfavorable climatic conditions (Riaz S. et al.-2021). The cotton bollworm is a highly destructive polyphagous pest that causes severe damage to many economically important crops, including soybean, in Iran and elsewhere in the world (Reddy et al. 2004; Subramanian и Mohankumar 2006; Mironidis и Savopoulou-Soultani 2008). It is a major pest of 181 cultivated and non-cultivated plant species, distributed in 45 families in India, and causes serious problems in tomato (Moral Garcia 2006), legumes (Singh and Mullick 1997), cotton (Kranthi et al. 2002) and pigeon pea (Kumari et al. 2006). Each year, the larvae of this species cause significant economic losses to cotton, corn, tomatoes, legumes and vegetable crops (Liu et al. 2004). The outbreak of this pest has been attributed to the development of insecticide resistance and the use of broad-spectrum insecticides, which are known to have detrimental effects on populations of its natural enemies, as well as nutritional and bioclimatic factors in host plants (Naseri et al. 2009). Therefore, research is increasingly being conducted to identify alternative measures to chemical control (Naseri et al. 2010).

The chemical composition of host plants significantly influences the survival, growth, and reproduction of phytophages. Food consumption and utilization link plant properties to insect performance. For polyphagous insects, the availability of diverse host plants plays a significant role in triggering population outbreaks. Insect growth, development, and reproduction are highly dependent on the quality and quantity of food consumed (Naseri et al. 2010).

Among pest control tools, host plant resistance is important for both economic and environmental reasons. Therefore, as a pest control method, host plant resistance is not only beneficial for the environment but also reduces costs for producers. Factors that determine the availability of nutrients for growth and maintenance during a given developmental period are the amount and type of food consumed and the efficiency of its utilization (Naseri et al. 2010).

Currently, chemical pest control is the primary method for cotton pest control. Despite its high biological effectiveness, under current cotton growing conditions, the loss of raw cotton crop remains significant. Furthermore, the widespread use of chemical methods is associated with a number of undesirable consequences. Therefore, it is necessary to improve the set of measures for protecting cotton from pests, taking into account current agricultural conditions (Bainiyazova, 2023).

Emamectin benzoate, 4′-deoxy-4′-epimethylamino-4′-deoxyavermectin B1 benzoate, is a semi-synthetic derivative of abamectin B1 and was originally developed as a pesticide for the control of lepidopteran larvae, particularly cutworms (Kuo et al. 2010).

Emamectin benzoate is currently widely used against Lepidoptera, scale and Coleoptera insect pests on a range of crops including celery, lettuce, cabbage and tomato (Kondo et al. 2009).

Emamectin benzoate is a mixture of active compounds: 4′-deoxy-4′-(epimethylamino) avermectin B1a and 4′-deoxy-4′-(epimethylamino) avermectin B1b (B1a/B1b ≥ 9:1) (Li et al. 2011). Its oral LD50 in rats is 76–89 mg kg−1 (Wang et al. 2012), indicating that emamectin benzoate is a highly toxic insecticide.

Lufenuron ((RS)-1-[2,5-dichloro-4-(1, 1, 2, 3, 3, 3-hexafluoropropoxyl)phenyl]-3-(2,6-difluorobenzoyl)urea) is a benzoylphenyl urea class insecticide that acts as an inhibitor of chitin synthesis in the cuticle of insect pests (Dong et al. 2015).

METHODOLOGY. Benzalife Bereke vr., sold by 1-AGRO BEREKE LLC, Uzbekistan, is an insecticide recommended for testing against cotton bollworm on medium-fiber cotton. The drug was tested in the fields of a large-plot experiment at the Faradis Khirmoni farm in the Yukarychirchik district of the Tashkent region. The experimental design included the tested preparation Benzalife Bereke w.r.g. at a rate of 0.15 kg/ha against cotton bollworm on medium-fiber cotton; the preparation Emamatch 15% w.d.g. - 0.2 kg/ha was used as a standard, as well as a control variant without treatment. Spraying was carried out using a K-90 motor sprayer with a calculated spray rate of 300 l/ha. The plot size was 0.5 hectares, with three replicates for each treatment.

The treatment was carried out in the morning hours, when the temperature was no higher than 25°C and the wind speed was 1-2 m/sec. The experimental methodology, subsequent records, and calculation of biological effectiveness were carried out in accordance with the Methodological Guidelines (2004) approved by the State Chemical Commission of the Republic of Uzbekistan. The calculation of biological effectiveness was carried out using Abbott's formula (1925).

Trials testing Benzalife Bereke v.r.g. were conducted in early June 2024 during the cotton growing season. The results of the study on the biological efficacy of Benzalife Bereke v.r.g. against cotton bollworm at a rate of 0.15 kg/ha are presented in Table 1.

When spraying with the insecticide Benzalife Bereke v.r. at a rate of 0.15 kg/ha, an average of 1.5 larvae per 100 plants were detected after 3 days, with a biological effectiveness of 85.7%. After 7 days, 1.5 larvae were detected, with a biological effectiveness of 87.0%, and after 14 days, 1.5 larvae were detected, with a biological effectiveness of 87.5%.

In the reference variant, when spraying with the insecticide Emamatch 15% w.d.g. at a rate of 0.2 kg/ha, after 3 days the biological efficiency was 85.7%, after 7 days 86.1%, and after 14 days 88.3%.

In the violated terms, when spraying with the insecticide Benzalife Bereke w.r.g. at a rate of 0.15 kg/ha, after 3 days, an average of 1.5 larvae per 100 plants were detected, the biological efficiency was 86.4%. After 7 days, 1.4 larvae were detected, the biological efficiency was 86.0%, and after 14 days, 1.0 larva was detected, the biological efficiency was 90.0%.

Thus, the study results show that Benzalife Bereke v.r.g., at a rate of 0.15 kg/ha, can be used against cotton bollworm on medium-fiber cotton.

CONCLUSIONS. Benzalife Bereke v.r.g. proved effective in controlling cotton bollworm on medium-fiber cotton at a rate of 0.15 kg/ha for this crop. At this rate, Benzalife Bereke v.r.g. has no toxic effect on plant growth and development.

When administered within the specified timeframe (June 14–27), Benzalif Bereke also maintained a high level of activity:

on the 3rd day – 86.4%,

on the 7th day – 86.0%,

on the 14th day – 90.0%.

These data indicate the stability of the drug's action even with deviations from the recommended treatment periods.

Compared with the reference drug, the efficacy of Benzalif Bereke remained at a similar or higher level, especially on the 14th day after treatment (90.0% versus 85.0%).

In the control variants (without treatment), the number of cotton bollworm caterpillars increased: on the 3rd day – 10.5 specimens, on the 7th day – 11.5 specimens, on the 14th day – 12.0 specimens, which confirms the high level of harmfulness in the absence of insecticidal protection.

The insecticide "Benzalife Bereke vrg" can be recommended as an effective cotton bollworm protection product. The product demonstrates reliable and long-lasting effectiveness not only when applied at the optimal time but also when not applied at the optimal time. Its comprehensive action against caterpillars of different ages makes it particularly valuable for integrated crop protection systems.

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