The Effect of Several Profenofos® (EC 50%) Insecticides on Cotton Bollworm *Helivoverpa Armigera* (Hub.) in Golestan Province of Iran.

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Abstract

Cotton Boll Worm, *Helicoverpa armigera* an important pest of cotton in Iran in some areas, causing yield, feeding on buds, flowers and bolls. The most important method for pest control is the use of chemical methods. Approximately 30% of the insecticides used worldwide were against *H. armigera.* In order to compare the effect of commercial formulations of insecticide companies on the control of cotton bollworm, a field experiment was conducted in Hashemabad cotton research station Golestan province on 2019 year. This experiment was used in the form of a randomized complete block design with 10 treatments and 4 replications including 10 formulations of profenofos® from different companies along with the control on the cotton plant as spraying application. Sampling of larvae mortality statistics were determined 3, 7 and 14 days after spraying application and corrected according to Henderson-Tilton formula and analyzed by SAS software. Mean treatments were also compared with Duncan's multiple range tests. According to the results of comparing the average in the Golestan province showed that in 3 days after spraying the profenofos® formulation of Arman Sabz® and Alborz Behsam® companies with 76.7 and 71.5% had the greatest effect. Profenofos formulations of Razi Shimi Khoram® Company and javaneh Rooyesh® with 48.2 and 42% had the least effect. Percentage of effect of Profenofos® poison formulation of other companies in 7 days after spraying the formulation of Sabzavaran® and Bazargan Pars® companies with 83.2 and 81.5% had the highest effect and were in group a. The formulations of Partov Naz® , Arman Sabz® and Glia Shimi® companies with 79, 78.5 and 78% impact were in group b. The formulation of Razi Shimi Khoram® company with 47.5% had the lowest impact and was placed in group c. Therefore, we recommended the formulation of profenofos Sabzavaran® and Bazargan Pars® companies with no significant adverse for controlling of cotton bollworn for the next year.

Introduction:

The most common way to control, *Helicoverpa armigera* is the use of chemical pesticides.In a review on common pesticides against cotton pests in Golestan provice, carbaril® and avant® in comparison with larval and endosulfan® had the greatest effect on the control of cotton bollworm (Mojeni,2005). New tested toxins in cotton fields in Golestan province, toxin Karvin®, with a dose of 1.5 liters per hectare, had more than 90% exposure to bollworm (Mojeni,2015). In a mortality study in the first instar larvae of *Phethorima operculella*, on the potato treated with Lufenorun® were very high in comparison with the control (more than 90%) most of the larval mortality was observed during the first age of ecdysis (Edmvanden,etal., 2000). In order to investigate the susceptibility of bollworm to some common toxins in the Moghan area and to determine the contact toxicity of these toxins, a study was conducted and chlorpyrifos®, atrymphus®, prohenofos® and endosulfan® were superior (Alhayary, 1998). In Khorasan province toxine avant, 300cc per hectare had a modest effect on control of sugar beet leaf worm in comparison with other toxins (Hosseini,2003). In a toxin test, Moghan, Endosulfan® and Thiodicarb® had the most effect on cotton bollworm (Taghizadeh, 2000).

According to the results of the test toxin, lufenorun® 1.5 liter treatment after 7 to 14 days 81.75 and 86.75 percent more with the greatest impact on cotton bollworm common pesticides used to good effect

had (Mojeni,2019).

The results revealed that average percentage of the best treatments for poison Karvin® 1.5 lit/ha in 7 to 10 days after spraying with 81.25–100 % cotton bollworm and impact on the level 5 % were in group A and other treatments karvin® 2 lit/ha with 71.88%, larvin® 1 kg/ha 61.50 % and avant® 250 ml/ha 56.25 % were the next groups (Mojeni, 2019).

Studies have shown that the observed symptoms are the common effects of insecticides of benzoyl phenylureas derivatives. Also, the cause of mortality in larvae of the first age of potato *Phethorima operculella* may be due to the prevention of Lufenorun® insecticide by producing hormone ecdysis or blocking the synthesis of kethin in larvae (Mulder and Gijswijt,2006) .

There was no significant difference in the treatment of potato *Phethorima operculella* eggs with Lufenorun® insecticide at hatching rate between the control and check treatment was higher than 90% (Edmvanden,etal., 2000). Some researchers reported the low contact and low embryo activity Lufenorun® activity and stated that the characteristics of the egg wall affect the penetration of insecticides of benzoylphenyl urea derivatives.(Grousscurt and Jongsma, 1987). Laboratory studies were conducted on the effects of various growth regulators on the third instar larvae of *Helicoverpa armigera*. Six different concentrations were prepared and mortality percent were recorded after 48, 72, 96 and 120 hours. The results showed that 50% of the deaths of larvae of age third *H. armigera* after 120 hours were induced by various Lufenorun®, fluofenoxuron®, chloroflurosarone® and dipflobenzuron® concentrations. The results also showed that all insect growth regulators are effective in controlling *H. armigera* pests. However, Lufenorun® and fluofenoxuron® had the greatest impact (Khatri, etal., 2014).

Material And Methods:

This experiment was performed in Golestan province as a randomized complete block design with 10 treatments (Profenofos®) in 4 replications in Hashemabad cotton research station Golestan province on 2019 year. In each plot, 6 rows of 10 meters with a distance of plants between and on the rows of 80 and 20 cm, the distance of plots from each other was 1 meter and repetitions were 2 meters. For spraying, atomizer sprayer was used. Before spraying, calibration and water consumption were calculated based on 400 liters per hectare. When the pest population reached 3 first instar larvae or 5 eggs per 25 plants, spraying was performed (Razaq, etal., 2005). Sampling the larval stage, 10 plants were randomly selected from each plot, all buds, flowers and bolls of each plant were examined and the number of larvae and age stage were counted. A performance toxin was modified according to Henderson- Tilton formula (Bozsik, 1996). Data analysis was performed using SAS software and the mean of treatments was compared with Duncan's multiple range tests.

Results And Discussion:

According to the results of comparing the average in the Golestan province showed that in 3 days after spraying the profenofos® formulation of Arman Sabz® and Alborz Behsam® companies with 76.7 and 71.5% had the greatest effect. Profenofos® formulations of Razi Shimi Khoram® Company and javaneh Rooyesh® with 48.2 and 42% had the least effect. Percentage of effect of Profenofos® poison formulation of other companies in 7 days after spraying the formulation of Sabzavaran® and Bazargan Pars® companies with 83.2 and 81.5% had the highest effect and were in group a. The formulations of Partov Naz®, Arman Sabz® and Glia Shimi® companies with 79, 78.5 and 78% impact were in group b. The formulation of Razi Shimi Khoram® company with 47.5% had the lowest impact and was placed in group c(Table.1,2).

Table 1. Analysis of variance Profenofos ®efficiency percentage of different companies on cotton bollworm 3, and 7 days after spraying in Golestan province on 2019.

p	F	S.S	df	Sources of changes	The days after spraying
0.001	2.08**	164.59	9	Treat.	3 days
Cv = 17.60%		70.85	33	Erro.	
1.28	4.18**	257.54	9	Treat.	7 days
Cv = 21.84%		89.85	33	Erro.	

Table 2. Comparison of the average percentage of cotton bollworm population mortality in different Profenofos ®treatments in Golestan province on 2019.

Mse. 7 days after spraying	Mse. 3days after spraying	Treat.Profenofos®(EC 50%) Companies formulation
83.2 ± 6.6a	59.5 ± 10.1bc	SabzAvaran®
81.5 ± 5.9a	58.0 ± 8.4bc	Bazargan Pars®
79.0 ± 3.7a	64.2 ± 5.2ab	Partovnaz®
78.5 ± 6.4ab	76.7 ± 6.5a	Armansabz®
78.0 ± 6.4ab	42.2 ± 7.5c	Galian Shimiy®
75.0 ± 8.4ab	51.7 ± 6.6c	Sanaty Farad®
64.5 ± 8.4b	66.2 ± 3.4ab	Golshimiy Sepahan®
61.2 ± 4.4b	71.5 ± 6.4a	Alborz Behsam®
55.0 ± 9.6bc	42.0 ± 7.9c	Javaneh Rooyesh®
47.5 ± 4.8c	48.2 ± 10.4c	Razi Shimiy Khoram®

On the 7th day after spraying, the Karvina® toxin treatment was 1.5 liters with 86.75% and Lufenorun® 1.5 liters with 81.75% and Lufenorun® 2 liters with 77.25% had the highest effect on the pest and at 5% were in group a (Mojeni, 2019).

At the time of 14 days after spraying, Lufenorun® treatment was 1.5 liters (86.75%) and Karvin® (1.5 lit), 86.85% and Lufenorun® (2.9 l) with 85.75% had the greatest effect on cotton bollworm at 5% level in group a (Mojeni, 2019).

Some researchers reported the low contact and low embryo activity Lufenorun® activity and stated that the characteristics of the egg wall affect the penetration of insecticides of benzoylphenyl urea derivatives.(Grousscurt and Jongsma, 1987). The results also showed that all insect growth regulators are effective in controlling *H. armigera* pests. However, Lufenorun® and fluofenoxuron® had the greatest impact (Khatri, etal., 2014).

The poison treatment Karvin® 1 liter in two tests combined analysis significant differences were observed in 5% and the best of its effect in 10 days after spraying on pest bollworm with an average of 68.75 percent and in group **a** was. In treatment Karvin® 1.5 liters in two trials a significant difference was observed and the best of its mortality on pesticide spraying after 10 days and 7 days after spraying with mean 100% of the pest in group **a** were 81.25 %(Mojeni,2019) .

Therefore, we recommended the formulation of profenofos Sabzavaran® and Bazargan Pars® companies with no significant adverse for controlling of cotton bollworn for the next year.

Declarations:

Authors' contributions

Mojeni,T.D. wrote the initial draft of the manuscript. Golmohammadi,Gh made all necessary corrections and carried out final editing of manuscript.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

Authors declare that they have no conflict of interest for the publication of the manuscript.

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