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EFFICACY OF INSECTICIDES AGAINST FRUIT BORER, *HELICOVERPA ARMIGERA* (HUBNER) INFESTING CHILLI UNDER LABORATORY CONDITIONS

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Abstract

A laboratory experiment was conducted to test the efficacy of some insecticides against fruit borer, *Helicoverpa armigera* (Hubner) infesting chilli. The data on mean corrected mortality (%) of third instar larvae of *H. armigera* at 24, 48 and 72 hours after treatment (HAT) were recorded. The result at 24 HAT revealed that the treatment emamectin benzoate (0.002 %) recorded 36.67 per cent corrected mortality of fruit borer, *H. armigera* and was found to be the best treatment which was at par with spinosad (0.014 %) by recording 30.00 per cent corrected mortality, while zero per cent corrected mortality was recorded in azadirachtin (0.003 %), *Bacillus thuringiensis* (Berliner) *var. kurstaki* (2 g/lit.) and untreated control. The observations recorded at 48 HAT revealed that the highest corrected mortality (76.67 %) of fruit borer, *H. armigera* was recorded in the treatment of emamectin benzoate 0.002 per cent. The lowest corrected mortality (0.00 %) was recorded in the treatment of azadirachtin 0.003 per cent which was at par with untreated control (0.00 %). After 72 HAT, it was revealed that the highest corrected mortality (96.30 %) was recorded in the treatment of emamectin benzoate 0.002 per cent which was at par with spinosad (0.014 %) by recording 92.59 per cent corrected mortality. The lowest corrected mortality (0.00 %) was recorded in azadirachtin 0.003 per cent and untreated control.

***Key words*:** Efficacy, insecticides, fruit borer, *Helicoverpa armigera*, chilli, laboratory.

Introduction

Chilli (*Capsicum annuum* L.) is the most important spices in Konkan region of Maharashtra. It is also called as hot pepper, cayenne pepper, sweet pepper, bell pepper, etc. The world's hottest chilli 'Naga Jolokia' is cultivated in hilly terrain of Assam in a small town Tezpur, India. Among the spices consumed per head, dried chilli fruits constitute a major share. Some varieties of chillies are famous for red colour because of the pigment 'capsanthin'. (Anonymous, 2012). Pungency in chilli is due to the alkaloid 'capsaicin' contained in the pericarp and placenta of fruits; it produces mild to intense spice when eaten. Capsaicin is a potent inhibitor of substance P, a neuropeptide associated with inflammatory processes. The hotter chili pepper contains more capsaicin. Jalapenos are next in their heat and capsaicin content, followed by the milder varieties, including Spanish pimentos, and Anaheim and Hungarian cherry peppers. Capsaicin is being studied as an effective treatment for sensory nerve fiber disorders, including pain associated with arthritis, psoriasis and diabetic neuropathy. When animals injected with a substance that causes inflammatory arthritis were fed a diet that contained capsaicin, they had delayed onset of arthritis and also significantly reduced paw inflammation (Anonymous, 2009). The productivity of chilli is very low due to several factors. Among them, losses caused by insect pests are major one. It is attacked by various major pests like thrips, *Scirtothrips dorsalis* (Hood); aphid, *Aphis gossypii* (Glover) and *Myzus persicae* (Sulzer); fruit borer, *H. armigera* and *Spodoptera litura* (Fabricius) and mite, *Polyphagotarsonemus latus* (Bank) from seedling to fruiting stage. The damage caused by *H. armigera* during flowering and fruit formation is the most concern. The young larvae of *H. armigera* feed on flower buds and young fruits by making a circular hole. Later, the larvae feed on internal contents usually with its head inside the fruit and rest of the body outside. As reported by Reddy

and Reddy (1999) due to severe attack of *H. armigera* lead to 90 per cent flower and fruit drop in chilli.

The several insecticides are being used to manage this pest. But because of development of many fold resistance to existing insecticides, it has become difficult to manage the fruit borer effectively. Considering the seriousness of fruit borer, *H. armigera*, some new molecules and biopesticides need to evaluate against the pest so that these pesticides can be incorporated in the spray schedule for management of *H. armigera*.

Chilli is one of the important spice crops and severely infested by fruit borer, *H. armigera*. Since few years, considerable research work on efficacy of insecticides against fruit borer, *H. armigera* infesting chilli has been done in abroad and India, but comparatively less work on efficacy of insecticides against the pest has been carried out under Konkan region of Maharashtra. Hence, the present investigation was planned and conducted at the Biocontrol laboratory, Department of Agricultural Entomology, College of Agriculture, Dapoli.

Materials and methods

A laboratory experiment was conducted at the Biocontrol laboratory of Department of Agril. Entomology, College of Agriculture, Dapoli from November to December, 2014 to study the effectiveness of some insecticides against fruit borer, *H. armigera* infesting chilli. The solution of test insecticides were prepared in distilled water with desired concentration and the fruits of chilli were dipped in the test solution for 30 seconds. Such treated chilli fruits were allowed to air dry on clean cloth. Further they were transferred to the individual small plastic vial. The single third instar larva was transferred to each plastic vial containing treated chilli fruit. Each treatment was replicated three times alongwith an untreated control. The complete experiment was run under controlled laboratory conditions at 27 ± 2°C temp. and 75 ± 5 per cent relative humidity.

Experimental details

The details of experiment are given below:

Location	: Biocontrol Laboratory, Department of Agricultural Entomology, College of Agriculture, Dapoli
Period of study	: November to December, 2014
Variety	: Sarang Local
Design	: R.B.D.
Number of replications	: Three
Number of treatments	: Eight

Method of recording observations

The mortality of third instar larvae of *H. armigera* was assessed after 24, 48 and 72 hours exposure of the larvae to the treated chilli fruit. The larvae were considered dead if they gave no response to stimulation by touch. The results were expressed as per cent mortality with correction for untreated control mortality using Abbott's formula (Abbott, 1925). Data thus obtained were analyzed statistically.

Results and Discussion

A laboratory experiment was conducted at the Biocontrol laboratory of Department of Agril. Entomology, College of Agriculture, Dapoli from November to December, 2014 to study the effectiveness of some insecticides against fruit borer, *H. armigera* infesting chilli. The data recorded on corrected mortality (%) of fruit borer, *H. armigera* are presented hereunder.

The data recorded on the corrected mortality (%) of fruit borer, *H. armigera* in various insecticidal treatments at 24, 48 and 72 hours after treatment (HAT) are presented in table 1. The result at 24 HAT revealed that the treatment emamectin benzoate (0.002 %) recorded 36.67 per cent corrected mortality of fruit borer, *H. armigera* and was found to be the best treatment which was at par with spinosad (0.014 %) by recording 30.00 per cent corrected mortality. The treatments indoxacarb (0.0096 %) was at par with lambda cyhalothrin (0.0025 %), with mean corrected mortality of 20.00 and 16.67 per cent, respectively. The treatment deltamethrin (0.0028 %) recorded 13.33 per cent corrected mortality, while 0.00 per cent corrected mortality was recorded in azadirachtin (0.003 %), *Bacillus thuringiensis* (Berliner) *var. kurstaki* (2 g/lit.) and untreated control. The observations recorded at 48 HAT revealed that the highest corrected mortality (76.67 %) of fruit borer, *H. armigera* was recorded in the treatment of emamectin benzoate 0.002 per cent. The next best treatments were spinosad (0.014 %), indoxacarb (0.0096 %), lambda cyhalothrin (0.0025 %), deltamethrin (0.0028 %) and *B. thuringiensis var. kurstaki* (2 g/lit.) which recorded 63.33, 43.33, 33.33, 20.00 and 10.00 per cent corrected mortality, respectively. The lowest corrected mortality (0.00 %) was recorded in the treatment of azadirachtin 0.003 per cent which was at par with untreated control (0.00 %). After 72 HAT, it was revealed that the highest corrected mortality (96.30 %) was recorded in the treatment of emamectin benzoate 0.002 per cent which was at par with spinosad (0.014 %) by recording 92.59 per cent corrected mortality. The next best treatment was indoxacarb (0.0096 %), which recorded 62.96 per cent corrected mortality.

The treatments lambda cyhalothrin (0.0025 %) and deltamethrin (0.0028 %) were at par with each other and recorded 37.03 and 22.22 per cent corrected mortality, respectively. *B. thuringiensis var. kurstaki* (2 g/lit.) recorded 11.11 per cent corrected mortality. The lowest corrected mortality (0.00 %) was recorded in azadirachtin 0.003 per cent and untreated control.

Table 1: Corrected mortality of fruit borer, *H. armigera* at 24, 48 and 72 hours after treatment

S. No.	Treatments	Conc. used (%) or Dose	Corrected mortality (%)		
			24 h	48 h	72h
1	Azadirachtin 1 EC	0.003	0.00 *(0.00)	0.00 (0.00)	0.00 (0.00)
2	*Bacillus thuringiensis* (Berliner) *var. kurstaki*	2 g l^{-1}	0.00 (0.00)	10.00 (18.43)	11.11 (19.47)
3	Emamectin benzoate 5 SG	0.002	36.67 (37.22)	76.67 (61.22)	96.30 (83.51)
4	Indoxacarb 14.5 SC	0.0096	20.00 (26.57)	43.33 (41.15)	62.96 (52.55)
5	Lambda cyhalothrin 5 EC	0.0025	16.67 (23.86)	33.33 (35.22)	37.03 (37.44)
6	Deltamethrin 2.8 EC	0.0028	13.33 (21.14)	20.00 (26.57)	22.22 (28.13)
7	Spinosad 45 SC	0.014	30.00 (33.21)	63.33 (52.78)	92.59 (77.02)
8	Untreated control	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	S. Em. ±	**-**	**1.58**	**1.54**	**3.36**
	CD (P=0.05)	**-**	**4.87**	**4.74**	**10.34**

The present findings are in conformity with reports of Babar *et al.* (2012) who evaluated the ovicidal and larvicidal action of emamectin benzoate and spinosad against *H. armigera* and recorded more than 90 per cent larval mortality in laboratory experiment and found it as the most effective as larvicide. Hamed *et al.* (2007) also tested various concentrations of indoxacarb *viz*., 50, 100, 200, 300 and 500 ppm against different larval instars of *H. armigera*. The results showed that mortality of second instars varied significantly in between treatments after 12 hours but non - significantly with per cent mortality after 24 and 48 hours. Third and fourth instars exhibited variable mortality range after 12, 24 and 48 hours. It was 46–73 per cent, 47–80 per cent and 13–100 per cent in third instar and 33 per cent, 13–40 per cent and 20–100 per cent in fourth instar after 12, 24 and 48 hours, respectively. Ramasubramanian and Regupathy (2004) evaluated spinosad against *H. armigera* in laboratory and reported that the corrected per cent mortality was in the range of 51.3 to 52.5 even at the lowest rate of 6 g.a.i.ha^{-1} and the per cent survival was in the range of 20.0 to 22.5 at recommended dose of spinosad. Meena and Raju (2014) tested the bio efficacy of newer insecticides *viz.* spinosad (45% SC), fipronil (5% SC), profenofos (5 % EC), indoxacarb (14.5% SC), NSKE (5% w/w) and NPV against *H. armigera* and found that spinosad was the most effective insecticide and fipronil, profenofos and indoxacarb were also found effective for fruit borer management.

Conclusion

It can be concluded from the present investigation that the insecticides emamectin benzoate 0.002 per cent, spinosad 0.014 per cent and indoxacarb 0.0096 per cent were found effective for the highest corrected mortality (%) of fruit borer, *H. armigera* infesting chilli. Hence, these insecticides can be used for the effective management of the pest. However, it is felt necessary to test the efficacy of these insecticides against fruit borer, *H. armigera* under field conditions.

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