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Field Efficacy of Some Pesticides for the Management of Shoot and Fruit Borer, *Leucinodes orbonalis* Guenee

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Abstract The present study was undertaken during *rabi* 2014–15 to study the effect of different border crops on natural enemies on okra under field condition. The data on the occurrence of natural enemies on main crop revealed that maximum number of lady beetle adults were recorded in sweet corn (8.42) which was followed by ambadi (6.58). The maximum numbers of lady beetle grubs were recorded in sweet corn (7.67) which was significantly superior over rest of the treatments. As far as syrphid maggots and spiders were concerned, the maximum numbers were observed in marigold (5.67) and sweet corn (3.42) as a border crop, respectively. The results on the occurrence of different natural enemies on border crops revealed that maximum numbers of lady beetle adults (10.00) and grubs (17.00) were recorded in sweet corn. Also the maximum numbers of syrphid maggots (3.00) and spiders (4.17) were recorded in corn. The present study was undertaken during *rabi* 2008-09and 2009-10 to study the efficacy of some pesticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee under field condition. The overall efficacy of pesticides from all the four sprays revealed that the treatment of emamectin benzoate 0.0033% was effective (17.21%) in reducing the fruit damage and was at par with carbaryl 0.1% (17.76%), endosulfan 0.05% (20.26%), methomyl 0.06% (21.84%) and indoxacarb 0.02% (23.77%). The next best treatments were econeem plus 0.004% (26.39%), spinosad 0.0035% (26.67%), novaluron 0.015% (27.07%), cypermethrin 0.0075% (27.58%), *B. bassiana* @ 5 g L^{-1} (28.19%) and lambda cyhalothrin 0.003% (31.80%). Considering the effectiveness of the treatments, the treatment of emamectin benzoate 0.0033%, carbaryl 0.1% ensodulfan 0.05%, methomyl 0.06%, indoxacarb 0.02%, spinosad 0.0035%, *B. bassiana* @ 5 g L^{-1} and econeem plus 0.004% were found effective in reducing the fruit damage and obtaining higher yield. On the basis of the findings the treatments with emamectin benzoate, econeem plus, *B. bassiana* and spinosad could be preferred as ecofriendly at beginning of the pest attack and as a component of IPM strategy for brinjal.

Keywords Brinjal, Emamectin benzoate, Fruit and shoot borer, Indoxacarb, Spinosad.

Introduction

Brinjal (*Solanum melongena* L.) known as eggplant and aubergine in North America and Europe, respectively, is very important common man's vegetable in India. It is often described as a poor man's vegetable because it is popular amongst small scale farmers and low income consumers. A poor man's crop it might

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be, but brinjal is also called as the king of vegetables. It is featured in the dishes of virtually every household in India, regardless of food preferences, income levels and social status. In India, it is consumed in a variety of ways depending upon the eating habits of the different parts of the country. It is also used for frying, roasting, stuffing. Low in calories and high in nutrition, the vegetable has very high water content and is a very good source of fiber, calcium, phosphorus, folate and vitamin B and C. It is also used in ayurvedic medicine for curing diabetes, hypertension and obesity. It is also known for decreasing blood cholesterol.

In India, it is grown over 6.0 lakh ha with annual production of 10378 million tonnes of fruits. Brinjal occupies 28.9 thousand hectares in Maharashtra and produces about 471.1 million tonnes of fruits annually [1]. It is usually grown in *kharif-rabi* and summer season in major parts of the state. It has occupied prominent place among the popular vegetables grown in Konkan and is sold in daily market. In Konkan, brinjal cultivation is scattered and is mainly grown as a past rice crop.

Among all pests, the most important and ubiquitous pest is the shoot and fruit borer *L. orbonalis*. It is the most destructive and regular pest, causing considerable loss in crop yield and also responsible for deterioration of fruit quality which ultimately affect the market value of the fruits.

Farmers resort to frequent insecticide applications to counter the threat of brinjal shoot and fruit borer, even though there are huge losses caused by the shoot and fruit borer. Since shoot and fruit borer larvae are concealed within shoots and fruits, the pest normally escapes insecticides sprays. Therefore, farmers tend to over spray insecticides, because they rely mainly on the subjective assessment of the visual presence of the pest. In addition to financial cost associated with indiscriminate insecticide applications and its negative effects on the environment, high pesticide residues in vegetables and fruits pose serious risk to consumers' health and safety. The research on the different non-chemical aspects like cultural, mechanical, biological, host plant resistance undertaken by the researchers throughout the world is fragmentary. Thus, the use of chemical insecticides is still the main practice to combat this pest and their use cannot be ignored in pest management strategies. Several pesticides have already been suggested for the management of brinjal shoot and fruit borer. However, with the space and time, new molecules of the pesticides are introduced in market, which are supposed to be comparatively softer than older pesticides in relation to residue. Therefore, it was thought essential to study the efficacy of some newer insecticides to find out the effective, economical and best-suited insecticides to control the shoot and fruit borer under agro-climatic conditions of the Konkan region.

Materials and Methods

To study the efficacy of some pesticides, a statistically designed field experiment with randomized block design, was conducted during *rabi* season of 2008-09 and 2009-10 at Horticulture Nursery, College of Agriculture, Dapoli.

Details of the experiment.

1.	Location	:	Horticulture Nursery, College of Agriculture, Dapoli
	Year of experiment	:	2008-09 and 2009-10
2.	Design	:	Randomized Block Design (RBD)
3.	No. of replication	:	Three
	No. of treatment	:	Twelve
	plot size	:	3 × 3m
4.	Spacing	:	60 cm × 60 cm
5.	Variety	:	CHES–309
7.	Date of sowing	:	2008-09 : 30.10.2008 2009-10 : 31.10.2009
8.	Date of transplanting	:	2008-09 : 15.12.2008 2009-10 : 15.12.2009

Treatment details.

Treatments No.	Treatments	Concentration (%) /Dose
1	Spinosad 2.5 SC	0.0035
2	Indoxacarb 14.5 SC	0.02
3	Emamectin benzoate 5 SG	0.0033
4	Methomyl 40 SP	0.06
5	Cypermethrin 10 EC	0.0075
6	Endosulfan 35 EC	0.05
7	Novaluron 10 EC	0.015

Treatment details: Continued.

Treat-ments No.	Treatments	Concentration (%) /Dose
8	Carbaryl 50 WDP	0.1
9	Lambda cyhalothrin 5EC	0.003
10	*Beauveria bassiana* Vuilemin	5 gm/lit.
11	Econeem plus (10000 ppm)	0.004
12	Control	

The details of the pesticides used for the management of brinjal shoot and fruit borer are given as above. The recommended package of practices was followed for successful cultivation of brinjal crop.

Method of application

Sprayings were undertaken by using knapsack sprayer. Total four sprays were taken for the management of brinjal shoot and fruit borer. Care was taken to wash the spray pump with water and soap thoroughly well before using other pesticide.

Method of recording observations

Five plants per plot were selected for recording observation. Since there was no infestation on shoots, the observations on shoot damage could not be recorded.

The pretreatment observations were recorded one day before each spray and subsequent post-treatment observations were recorded at 4th, 8th and 14th day after each spraying. The observations on healthy and infested fruits from each plot were recorded at every picking on number basis. The per cent fruit infestation was worked out on the basis of healthy and damaged fruits collected at each picking. The data were analyzed statistically and presented.

Results and Discussion

The data on pooled mean of the year 2008-2009 and 2009-2010 of each spray pertaining to fruit damage by *L. orbonalis* are given in Table 1. The data revealed that after first spray, the treatment of emamectin benzoate 0.0033% was found effective in reducing the fruit damage and recorded 19.68% fruit damage. It was at par with carbaryl 0.1% (25.13%), lambda cyhalothrin 0.003% (26.02%), methomyl 0.06% (26.90%) and endosulfan 0.05% (28.83%). The next best treatments were indoxacarb 0.02%, novaluron 0.015%, cypermethrin 0.0075%, econeem plus 0.004% and spinosad 0.0035% which recorded 31.13 to 42.67% fruit damage. The treatment of *B. bassiana* @ 5 g L^{-1} was found less effective by recording 44.63% fruit damage and the maximum fruit damage (67.88%) was recorded in control.

After second spray also minimum (15.30%) fruit damage was noticed in the treatment of emamectin benzoate 0.0033% which was at par with all other treatments except the treatment of lambda cyhalothrin 0.003% and control which recorded 31.06 and 76.65% fruit damage, respectively.

The same trend was observed in the pooled mean of per cent fruit damage after third spray where 14.10% fruit damage was noticed in the treatment of emamectin benzoate 0.0033% which was found at par with remaining all the treatments except lambda cyhalothrin 0.003% (35.98%) and untreated control (73.34%).

The data on pooled mean of per cent fruit damage after fourth spray also revealed that the treatment of emamectin benzoate 0.0033% recorded minimum (18.47%) fruit damage. It was at par with the other treatments by recording the per cent fruit damage in the range of 19.32 to 24.96. The treatment of lambda cyhalothrin 0.003% was found less effective by recording 34.37% fruit damage. The maximum (78.08%) fruit damage was noticed in untreated control.

Overall mean percentage of fruit damage from all the four sprays in *rabi* (2008-2009 and 2009-2010 is given in Table 1. The data in Table 1 revealed that the treatment of emamect in benzoate 0.0033% was effective (17.21%) in reducing the fruit damage and was at par with carbaryl 0.1% (17.76%), endosulfan 0.05% (20.26%), methomyl 0.06% (21.84%) and indoxacarb

Table 1. Pooled mean of per cent fruit damage by brinjal shoot and fruit borer in different treatments under field conditions (2009 and 2010). Figures in parentheses are arc sin transformed values.

Sl. No.	Treatments	Pooled mean First spray	Second spray	Third spray	Fourth spray	Overall mean
1	Spinosad 2.5 SC 0.0035%	42.67 (40.78)	26.16 (30.76)	19.40 (26.13)	20.20 (26.71)	26.67 (31.10)
2	Indoxacarb 14.5 SC 0.02%	31.13 (33.92)	20.59 (26.99)	23.36 (28.90)	20.47 (26.90)	23.77 (29.18)
3	Emamectin benzoate 5 SG 0.0033%	19.68 (26.33)	15.30 (23.02)	14.10 (22.06)	18.47 (25.45)	17.21 (24.51)
4	Methomyl 40 SP 0.06%	26.90 (31.24)	25.61 (30.40)	17.01 (24.36)	20.08 (26.62)	21.84 (27.86)
5	Cypermethrin 10 EC 0.0075%	34.15 (35.76)	29.04 (32.61)	22.57 (28.37)	24.96 (29.97)	27.58 (31.68)
6	Endosulfan 35 EC 0.05%	28.83 (32.47)	16.15 (23.69)	17.40 (24.65)	19.50 (26.20)	20.26 (26.75)
7	Novaluron 10 EC 0.015%	34.10 (35.73)	30.19 (33.33)	23.69 (29.13)	20.92 (27.22)	27.07 (31.35)
8	Carbaryl 50 WDP 0.1%	25.13 (30.08)	15.31 (23.03)	15.15 (22.90)	19.32 (26.07)	17.76 (24.92)
9	Lambda cyhalothrin 5 EC 0.003%	26.02 (30.67)	31.06 (33.87)	35.98 (36.86)	34.37 (35.90)	31.80 (34.33)
10	*B. bassiana* 5 g/lit	44.63 (41.92)	27.58 (31.68)	22.58 (28.37)	19.65 (26.31)	28.19 (32.07)
11	Econeem plus 10000 ppm 0.004%	37.56 (37.80)	25.61 (30.41)	22.93 (28.61)	20.36 (26.82)	26.39 (30.91)
12	Control	67.68 (55.36)	76.65 (61.10)	73.34 (58.92)	78.08 (62.08)	74.03 (59.37)
	SE ±	2.46	2.95	3.26	2.33	1.67
	CD at 5%	7.20	8.66	9.55	6.83	4.79

0.02% (23.77%). The next best treatments were econeem plus 0.004% (26.39%), spinosad 0.0035% (26.67%), novaluron 0.015% (27.07%), cypermethrin 0.0075% (27.58%), *B. bassiana* @ 5 g L^{-1} (28.19%) and lambda cyhalothrin 0.003% (31.80%). The highest (74.03%) fruit damage was recorded in the untreated control.

Singh et al. [2] reported that the neem products such as multineem, NSKE and soil application of neem cake did not provide satisfactory control of *L. orbonalis*. Cypermethrin at 30 g a.i./ha was superior (6.7) and 21.64% shoot and fruit damage, respectively over other treatments while average damage by the borer in control plot was 25.37 and 63.49% on shoot and fruit basis, respectively.

Yadav and Sharma (3) found that the bio agents and neem products were less effective in suppressing borer infestation. Deshmukh and Bhamare [4] found spinosad 45 EC (0.01%) effective in reducing borer infestation and in increasing fruit yield. Further, cypermethrin 25 EC (0.006%) was found to be superior in terms of efficacy and yield. Jena et al. [5] revealed that the application of carbaryl, endosulfan, diflubenzuron, azadirachtin at 1.0, 0.07, 0.007 and 0.075% concentration at 30, 45, 60, 75 and 90 days after transplanting (DAT), respectively reduced shoot and fruit infestation. Patil [6] reported that endosulfan 40 SG (0.05%) was the most effective with significantly lower overall mean per cent fruit infestation of 13.77 on number basis than rest of the treatment, except 5% NSKE which was at par. It was followed by 0.01% Neemazal with 18.97% fruit infestation. However, among the treatment of bio-pesticides, 5% NSKE was proved to be the best treatment (15.29% fruit infestation) followed by 0.1% Neemazal (18.93%) and 0.015% diflubenzuron (22.45%)0 which were at par to it. The treatment of *B. bassiana* was found to be less effective against *L. orbonalis*. Dutta et al. [7]

observed that emamectin benzoate 5 SG was moderately effective against the pest providing 62.8% reduction of population over control. Mishra and Dash [8] reported that application of cypermethrin @ 0.150 kg a.i./ha and azadirachtin 1500 ppm @ 1 lit/ha were most effective against the borer. Singh et al. [9] revealed that endosulfan 35 EC @ 1000 ml/ha proved to be the most effective treatment against *L. orbonalis* and it was at par with Vijayneem (Azadirachtin 0.015%) @ 1500 ml/ha. Adiroubane and Raghuraman [10] reported that spinosad 45 SC (225 g/ha) was effective against the pest. The highest percentage reduction of shoot damage was observed in spinosad which was also effective at fruiting stage. The results of the present findings are more or less in conformity with the findings of earlier research workers.

References

1. Anonymous (2010) Area and production of different crops in India. Report published by National Horticulture Board, Ministry of Agriculture, Government of India.
2. Singh HS, Sridhar V, Naik G (2005) Evaluation of some alternative measures against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. under Bhubaneshwar climatic conditions. J Appl Zoo Res 16 : 123—125.
3. Yadav DS, Sharma MM (2005) Comparative efficacy of bio agents, neem products and malathion against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Pesticide Res J 7 : 46—48.
4. Deshmukh RM, Bhamare VK (2006) Field evaluation of some insecticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Int J Agric Sci 2 : 247—249.
5. Jena BC, Srihari B, Mohapatra R (2006) Pesticidal management practices to control brinjal shoot and fruit borer. Ind J Ent 68 : 193—196.
6. Patil SS (2006) Eco friendly approaches for the management of pests infesting brinjal (*Solanum melongena* L.). MSc (Ag) thesis. Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
7. Dutta NK, Alam MS, Nasiruddin M, Das AK, Munmun TS (2007) Efficacy of some new chemical insecticides against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guen). J Subtropical Agric Res Dev 5 : 301—304.
8. Mishra NC, Dash D (2007) Evaluation of synthetic and neem based pesticide schedules against shoot and fruit borer (*Leucinodes orboinalis* (Guen.) on brinjal. J Pl Prot Environ 4 : 93—96.
9. Singh KI, Athokpam S, Singh MP, Devi PS (2007) Comparative efficacy of certain bio rational insecticides and endosulfan against *L. orbonalis* in brinjal crop. Ind Ent 69 : 250—255.
10. Adiroubane D, Raghuraman K (2008) Plant products and microbial formulation in the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee). J Biopesticides 1 : 124—129.