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EFFICACY OF SOME BOTANICALS IN CONTROLLING BRINJAL SHOOT AND FRUIT BORER, *Leucinodes orbonalis*

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ABSTRACT

Efficacy of some botanicals viz., neem oil, karanja oil and mahogoni oil at different concentrations was determined against brinjal shoot and fruit borer (BSFB). Three botanical oils were evaluated by assessing larval mortality in laboratory. Neem oil at 4% concentration showed lowest larval survivability (26.67%) while mahogoni oil caused highest survivability (68.89%) at 2% concentration. The effect of botanical oils on larval survivability decreased proportionally with the increase of concentrations. Considering the efficacy of all concentrations the order of toxicity was neem oil>karanja oil>mahogoni oil. The effectiveness of the botanicals viz., neem oil (4%), karanja oil (4%), mahogoni oil (4%), neem cake (250 kg/ha), neem oil + neem cake (4% + 250 kg/ha) were evaluated by application at 15 days interval against BSFB in the field. The highest percentage of reduction (70.44% infested shoots/plant) of BSFB was found in neem oil + neem cake. Minimum reduction of shoot infestation by BSFB was observed in neem cake treated plot. Similiar efficacy was found in case of reduction percentage of fruit infestation by BSFB.

Key words : Efficacy, Botanicals, BSFB, Brinjal

INTRODUCTION

Brinjal (*Solonum melongena* Linn.) is the most common, popular and principal vegetable in Bangladesh and other parts of the world (Nonnecke. 1989). Brinjal is locally known as "Begoon" and its early European name is "Egg plant". It is grown extensively in India, Bangladesh, Pakistan, China and the Philippines. It is also popular in other countries like Japan, Indonesia, Turkey, Italy, France, United States, Mediterranean and Balakan area (Bose and Som, 1986). Brinjal belongs to family solanaceae and is normally a self-pollinated annual crop. Brinjal is the second most important vegetable crops after potato in relation to its total production (Anonymous 1996). It is usually grown as seasonal crop and widely cultivated both in rabi and kharif seasons.

Brinjal is susceptible to the attack of various insects from seedling to fruiting stage. In Bangladesh about eight insect species are considered as major pests causing damage to the crops (Biswas *et al.,* 1992). The losses caused by these pests vary from season to season depending upon environmental factors as reported by Gangwar and Sachan (1986) and Patel *et al.* (1988). Among them brinjal shoot and fruit borer (*Leucinodes*

orbonalis, Guen) (Lepidoptera: Pyralidae) is one of the most destructive insect pests of brinjal in Bangladesh (Alam, 1969).

Currently farmers rely exclusively on the application of pesticides to control BSFB and to produce blemish-free egg plant fruit. Surveys conducted in Bangladesh indicated that farmers spray insecticides up to 84 times during a 6-7 month cropping season (Rahman *et al*, 1999). This approach has led to increase dependence on pesticides and consequent adverse effects of higher costs of production, environmental pollution, destruction of natural enemies and development of pesticide resistance in BSFB, toxic residues in fruits and ultimately pest resurgence. The current pesticide use is not only non-sustainable but if continued, it will adversely affect egg plant and other vegetable production. Therefore, it is now an urgent need to use safe but effective, biodegradable pesticides with no or less toxic effects on non-target organisms. Botanical insecticides are broad spectrum in pest control and many are safe to apply, unique in action and can easily be processed and used. The main advantages of botanicals are that they are easily produced by the farmers and small industries and are potentially less expensive. Among them neem oil has extensively been used and has proved its pest controlling efficacy against several insect pests both in field and storage (Saxena *et al.,* 1981; Heyde *et al*., 1983 and Mariappan & Saxena., 1984). Neem oil has no adverse effects in agro-ecosystem and its cost of production is likely to be less compared to that of chemical insecticides (Saxena *et al*., 1981). The present research was undertaken to determine the efficacy of some indigenous plant oils with appropriate dose and to investigate the effectiveness of botanicals ith neem cake against *L. orbonalis*.

MATERIALS AND METHODS

Two experiments were carried out in the IPM Laboratory and Field Laboratory, Entomology Department, Bangladesh Agricultural University (BAU), Mymensingh, during August 2008 to February 2009. The first experiment was conducted in the laboratory to find out the appropriate dose different chemicals against the larvae, *L. orbonalis*. Three oils of indigenous plants like neem (*Azadirachta indica*), karanja (*Pongania pinnata*) and mahogoni (*Swietenia mahogoni)* were used as treatments with 3 concentrations viz. 2%, 3% and 4%. The design of the experiment was CRD with 10 replications. Neem, karanja and mahogoni oil were collected from Neem Foundation, Dhaka. The larvae of *L. orbonalis* collected from farmers' field and were reared in the laboratory on cheap host potato to obtain the next generation. Thirty 1st instar larvae were released in a peeled potato those were treated with 3 different concentrations of each botanical oil. The survivabilty rate of 1st instar larvae were assessed after 7 days of exposure.

Data on survivabilty were corrected by using Abbott's formula (Abbott, 1987). The recorded data were compiled and tabulated for statistical analysis. Analysis of variance was done with the help of computer package MSTAT-C. The mean differences among the

treatments were adjusted with Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

The second experiment was carried out at Entomology Field Laboratory, BAU, Mymensingh to investigate the effect of botanicals in reducing *L. orbonalis* infestation. BARI Begun-8 was used as the variety of brinjal. The treatments used in the study were T_1 = neem oil, T_2 = karanja oil, T_3 = mahagoni oil, T_4 = neem cake, T_5 = neem oil + neem cake, and T_6 = control. It was laid out in the Randomized Complete Block Design (RCBD) with three replications. The botanical oils were sprayed @ 40 ml/L of water with Trix (5 gm/L) and neem cake was applied @ 250 kg/ha. Spraying was done uniformly on the entire plant canopy to get complete spray coverage. Light irrigation was done after applications of neem cake. Two adjacent unit plots and blocks were separated by 60 cm and 80 cm apart, respectively. Twelve seedlings were transplanted in each plot spaced by 80 x 60 cm . Each experimental plot comprised the area about 5.76 sq.m. Spraying was done at 10:00 a.m. after the dew had dried where slow and stable wind velocity prevailed. The treatment was applied at 15 days intervals and a total of five applications were done during study period. The percent shoot and fruit infestation reduction was calculated using the following formula :

% Shoot/ fruit infestation reduction, $P = (P_0-P_r/P_0)*100$

Where, P_0 = Total no. of normal shoot/fruit/ plot

Pr = Total no. of infested shoot/fruit/ plot

RESULTS AND DISCUSSION

The present research work was undertaken to determine the efficacy of some indigenous plant oils against brinjal shoot and fruit borer.

Toxicity of selected botanical oils against brinjal shoot and fruit borer

Relative toxicity of neem, karanja and mahogoni oil were studied by the survivability of brinjal shoot and fruit borer larvae in treated peeled potato. The percentage of larval survivability in different treatments ranged from 26.67 to 75.56%. The lowest percentage of larval survivability (26.67%) was found in 4% neem oil treated host and the highest percentage of larval survivability (68.90%) was observed in 2% mahogoni oil excluding untreated host (Table 1). The mean larval survivability of neem oil, karanja oil and mahogoni oil with different concentrations were significantly different. The results showed that larval survivability in 4% neem oil (26.67%) was lowest which indicates its highest efficacy.

Effect of botanicals on reduction or increase of BSFB infestation

Shoots infestation

The effectiveness of different plant products against brinjal shoot and fruit borer, *L. orbonalis* was assessed by the reduction of damaged twigs and the results were shown in

Table 2. Reduction of twig infestation ranged from 21.02 to 67.75 % at 1st application, 20.05 to 65.25% at 2nd application , 26.38 to70.44% at 3rd application , 25.68 to 68.21% at 4th application and 21.02 to 67.75% at 5th application. Reduction of the BSFB infestation in twig was significantly different with the application of different management approaches at 1st application after transplanting. At first application the highest per cent reduction (67.75%) of BSFB infested twig was observed in neem oil + neem cake plot. The 2nd and 3rd highest percentage of reduction of twig infestation (61.31% and 44.18% respectively) were observed in neem oil and karanja oil treated plots, respectively.

Table 1. Survivability of first instar brinjal shoot and fruit borer larva treated with different botanical oils

Treatments	Concentration (%)	Mean survivability (No.) of BSFB	% survivability
Neem oil	2	16.00	53.33^{d}
	3	12.33	41.10^{g}
	4	8.00	26.67^{h}
Karanja oil	2	17.33	17.33^{i}
	3	14.00	46.67^{e}
	4	11.67	38.90^{f}
Mahogoni oil	2	20.67	68.90^{b}
	3	18.00	60.00^{c}
	4	15.67	52.23^{d}
Control	0	22.67	75.56^{a}
Level of significance		-	**
LSD value		-	2.95

* Different letters in same column represent significant difference (DMRT at 1% level)
* 30 larvae were treated in each replication

The lowest percentage (21.02%) of reduction was found in neem cake treated plot. An increased BSFB infestation of 9.77% was found in the untreated plots. At 2nd application the highest reduction of twig infestation (65.25%) was observed in neem oil + neem cake treated plot. The 2nd (59.87%) and 3rd (41.25%) highest percentage of twig reduction were found in and neem oil and karanja oil treated plots, respectively. The lowest reduction of twig infestation (20.05%) was found in neem cake treated plot. After 3rd application it was observed that the highest percentage (70.44%) of reduction of twig infestation was observed in neem oil + neem cake treated plot. The 2nd (63.78%) and 3rd (41.33%) highest per cent infested twig reduction were observed in neem oil and karanja oil treated plots. The lowest percentage (26.38%) of infested twig reduction was found in neem cake treated plot. The increased twig infestation of 9.07% was found in the untrated plot. In the 4th application the highest per cent reduction (68.21%) of brinjal shoot and fruit borer infested twig was observed in neem oil + neem cake treated plots. The 2nd (63.15%) and

3rd (43.10%) highest percentages of *L. orbonalis* infested twig reduction were observed in and neem oil and karanja oil treated plots, respectively. The lowest reduction of infestation (25.68%) was in neem cake treated plot. Brinjal shoot and fruit borer infestation in twigs rose by 7.62% in the control condition. There was a significant variation in percent reduction of brinjal shoot and fruit borer infested twig among the different treatments at 5th application after transplanting (Table 2). At fifth application the highest percentage of brinjal shoot and fruit borer infested twig reduction (67.75%) was observed in neem oil + neem cake treated plot. The 2nd (61.31%) and 3rd (44.18%) highest percentages of BSFB infested twig reduction were in neem oil and karanja oil treated plots respectively. The lowest percentage (21.02%) of reduction was found in neem cake treated plot. Brinjal shoot and fruit borer infested twig increased by 9.77% in the untreated plot. Neem, karanja, mahogoni oil and neem oil + neem cake treated plots had statistically different effect. They caused significantly different percentage of reduction of twig infestation of brinjal shoot and fruit borer from that of control plot.

Table 2. Effect of some botanicals on brinjal shoot and fruit borer infestation in the twigs of brinjal plant

Botanicals	Dose	% shoot infestation (Percent reduction or increase of BSFB infested twigs/plant)				
		1st application	2nd application	3rd application	4th application	5th application
Neem oil	4%	38.05^{e} (-61.31^{b})	41.24^{f} (-59.87^{a})	36.12^{e} (-63.78^{b})	36.71^{e} (-63.15^{b})	38.35^{e} (-61.31^{b})
Karanja oil	4%	55.74^{d} (-44.18^{c})	59.78^{e} (-41.25^{b})	58.25^{d} (-41.33^{c})	56.32^{d} (-43.1^{c})	55.20^{d} (-44.18^{c})
Mahogoni oil	4%	69.45^{c} (-29.90^{d})	76.54^{d} (-23.84^{c})	61.36^{d} (-38.52^{c})	65.20^{c} (-34.06^{d})	70.65^{c} (-29.90^{d})
Neem cake	250 Kg/ha	78.40^{b} (-21.02^{e})	79.21^{d} (-20.05^{c})	73.40^{c} (-26.38^{d})	74.36^{b} (-25.68^{e})	79.52^{b} (-21.02^{e})
Neem oil + Neem cake	4%+ 250Kg/ha	32.10^{f} (67.75^{a})	34.45^{f} (-65.25^{a})	29.20^{f} (-70.44^{a})	31.00^{f} (-68.21^{a})	32.42^{f} (-67.75^{a})
Control		109.54^{a} (+9.77^{f})	111.25^{a} (+11.35^{d})	109.07^{a} (+9.073^{e})	106.99^{a} (+7.628^{f})	109.45^{a} (+9.77^{f})
Level of significance		**	**	**	**	**
LSD value		5.141 (5.196)	6.254 (6.468)	3.504 (3.570)	3.601 (3.570)	5.203 (5.195)

* Different letters in same column represent significant difference at 1% probability level
* (-) and (+) sign represent percent reduction or increase of BSFB infested twigs/plant, respectively
* Parenthesis ( ) shows percent reduction or increase of BSFB infested twigs/plant

Experimental results showed that the highest percentage of reduction of brinjal shoot and fruit borer infested twig (70.44%) was in neem oil + neem cake treated plants at 3rd

applications, and the lowest (20.05%) reduction was in Neem cake at 2nd applications. The increased infestation of BSFB in twig of brinjal in control treatment was due to not using of any management practices. Neem oil + neem cake was found as most effective botanicals against *L. orbonalis*.

Fruits infestation

The efficacy of the botanicals on brinjal shoot and fruit borer was assessed by the reduction of fruit damage shown in Table 3. Reduction of fruit infestation ranged from 20.74 to 69.44% in number and 20.2 to 66.79% in weight basis at 1st application after fruit setting and 22.47 to 67.97% in number and 27.87 to 68.86% in weight basis at 2nd application. Reduction of the brinjal shoot and fruit borer infestation in fruit was significantly different with the application of different management practices at 1st application after fruit setting.

Table 3. Effect of some botanicals on brinjal shoot and fruit borer infestation in the fruits of brinjal plant

Treatments	Dose	% fruit infestation (Percent reduction or increase of BSFB infested fruits/plant)			
		First application		Second application	
		Number	Weight	Number	Weight
Neem oil	4%	37.56^{e} (-62.54^{b})	37.69^{e} (-62.05^{a})	37.68^{e} (-62.06^{b})	38.89^{e} (-61.26^{b})
Karanja oil	4%	56.56^{d} (-43.27^{c})	52.69^{d} (-47.91^{b})	49.56^{d} (-50.88^{c})	53.64^{d} (-46.46^{c})
Mahogoni oil	4%	73.25^{c} (-26.12^{d})	72.36^{c} (-27.43^{c})	69.58^{c} (-31.17^{d})	65.98^{c} (-34.94^{d})
Neem cake	250Kg/ha	79.69^{b} (-20.74^{e})	80.01^{b} (-20.2^{d})	77.69^{b} (-22.47^{e})	72.69^{b} (-27.87^{e})
Neem oil + Neem cake	4%+ 250Kg/ha	30.28^{f} (-69.44^{a})	33.65^{e} (-66.79^{a})	32.65^{f} (-67.97^{a})	31.29^{f} (-68.86^{a})
Control		110.24^{a} (+10.21^{f})	109.32^{a} (+9.72^{e})	109.58^{a} (+9.03^{f})	111.59^{a} (+11.79^{f})
Level of significance		**	**	**	**
LSD value		5.294 (5.389)	6.269 (6.386)	5.326 (5.494)	3.526 (3.691)

* Different letters in same column represent significant difference at 1% probability level
* (-) and (+) sign represent percent reduction and increase of brinjal shoot and fruit borer population respectively
* Three applications were made during vegetative stage
* Parenthesis ( ) shows percent reduction or increase of BSFB infested fruits/plant

Note: • First application was made immediately after fruit setting
• Second was given after 15 days of first application

The highest percentage of brinjal shoot and fruit borer infested fruit reduction (69.44% in number and 66.79% in weight) was observed in neem oil + neem cake treated plot. The 2nd highest percentage (62.54% in number and 62.05% in weight) reduction of fruits was observed in neem oil treated plots. The lowest percentage of reduction of fruit infestation was 20.7 in number and 20.2 in weight basis was observed in neem cake treated plot. Infestation of brinjal shoot and fruit borer to fruit rose by 10.2I% in number and 9.72% in weight in untreated plots.

There was a significant variation of per cent reduction of brinjal shoot and fruit borer infested fruit among the different treatments at 2nd application after fruit setting. At 2nd application, the highest per cent of reduction (67.97% in number and 68.86% in weight basis) was found in neem oil + neem cake. The 2nd highest percentage of infested fruit reduction (62.06% in number and 61.26% in weight) was observed in neem oil treated plots.

Experimental results showed that the highest per cent reduction of brinjal shoot and fruit borer infested fruit (69.44% in number and 68.86% in weight basis) was found in neem oil + neem cake treated plot at 1st and 2nd application, respectively and the lowest (20.74% in number and 20.20% in weight basis) was found in neem cake treated plot at 1st application. Among the treatments Neem oil + neem cake was most effective against the pest and Neem and karanja oils reduced BSFB infestation in fruit to considerable level while mahogoni oil and neem cake alone had minimum effect against the pest.

The findings of several researchers about neem and other plant products against brinjal shoot and fruit borer are very close to that of the present results. Raja *et. al.* (1999) and Singh (2003) found that neem oil 4% was effective against brinjal shoot and fruit borer. Singh (2003) reported that the neem oil and karanja oil were found as most effective botanicals against brinjal shoot and fruit borer, where neem oil provided 49.1% reduction over control (Anonymous, 1995). The results of the present study may vary from others. However, it is logical because effectiveness of any plant products depends on extraction methods, time of spraying, environmental condition etc. The findings of the present study suggests that neem oil at 4% concentration may be used for the management of brinjal shoot and fruit borer.

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