Field evaluation of plant products and microbial formulations against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee under semi-arid conditions of Rajasthan

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ABSTRACT

Studies were conducted to evaluate the efficacy of plant products *viz.*, neem oil (2%), iluppai oil (2%), pungam oil (2%), combination of iluppai and pungam (1 : 1) and microbial formulations *viz.*, entomopathogenic fungi, *Beauveria bassiana* and *Verticillium lecanii* against the brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee. The results revealed that newer plant products *i.e*. oils of *iluppai* and pungam were at par with standard check endosulfan and were found to be significantly superior than microbial formulations and also showed better efficiency than neem oil in the suppression of BSFB infestation with significant insecticidal property. The yield data also revealed that the maximum yield of marketable fruits was obtained using iluppai oil (202.75 q/ha) ; the percent gain over control was least with *V. lecanii* followed by *B. bassiana*, neem oil, combination of iluppai and pungam oil, pungam oil, iluppai oil (77.8%), and maximum with endosulfan (83.3%). The results thus suggest that newer plant products such as oils of iluppai and pungum are promising botanicals in the integrated pest management strategy against BSFB.

Key words: Botanicals, brinjal, integrated pest management, *Leucinodes orbonalis*, microbial pesticides

INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important and indigenous vegetable crop of India, often known as the cash crop for the farmers. It contributes 9% of the total vegetable production of the country (Sidhu and Dhatt, 2007). Among the pests attacking brinjal crop, *Leucinodes orbonalis* Guenee also known as Brinjal shoot and fruit borer (BSFB), (Lepidoptera: Pyraustidae) is the most noxious and destructive. The yield loss was reported to be as high as 70 - 92 per cent (Nair, 1995; Dhandapani *et al*., 2003). It inflicts damage to both shoots and fruits (Srinivasan, 2008). With the pros and cons of genetically modified food crops still doing the rounds, integrated pest management (IPM) comes as a direct tool that includes array of alternatives like exploration of botanicals and microbial formulations. IPM strategy for the control of BSFB has been developed earlier (Alam *et al*., 2003; Alam *et al.*, 2006). Ecofriendly and cost effective measures like use of botanicals in IPM are more advantageous over insecticides and fit well in IPM (Prakash *et al.*, 2008). Since, IPM is a continuum that will change with time, present study aims at evaluation of newer botanical oils, like oil of *iluppai* (*Madhuca indica*), pungam (*Pongamia pinnata*), neem (*Azadirachta indica*) and microbial formulations like entomopathogenic fungi, *Beauveria bassiana* and *Verticillium lecanii* for the effective management of BSFB.

MATERIALS AND METHODS

The field experiments were conducted at Agricultural Research Station (ARS), Durgapura, Jaipur (Rajasthan), during Rabi 2009-2010 and 2010-2011 with eight treatments including control in Randomized Block Design (RBD) with three replications per treatment for the management of BSFB. The brinjal variety was Krishna Gold. The plot size was 2m × 2m having row to row spacing of 50cm × 50cm. *Madhuca indica* oil (MIO) (2%), *Pongamia pinnata* oil (PPO) (2%), PPO (1%) + MIO (1%), *Azadirachta indica* oil (2%), *B.*

bassiana @ 750 mL/ha, *V. lecanii* (5g/L) and Endosulfan 35 EC (0.07%) as check insecticide along with control were used as treatments. A knapsack sprayer was used for spraying and insecticides were applied @ 500-700 L/hectare according to the growth stage of the plants. In all treatments there were three foliar sprays in each season, starting after 25 days of transplanting and repeated subsequently at 15 days interval. Care was taken to avoid drifting of insecticides to neighboring plots.

The borer infestation was recorded on shoot and fruits on five plants from each replication. The borer damage in shoot was assessed on five tagged plants by counting the number of damaged shoots per plant to total number of shoots of the plant and expressed in percentage. Finally damaged shoots were taken alone for estimation. Fruit borer incidence was estimated by recording the total number as well as weight of the affected and unaffected fruits from each plot separately at every picking and the cumulative per cent damage was worked out. The percentage data for the damaged shoots and fruits were converted into its angular transformation and data was subjected for statistical analysis using ANOVA for test of significance.

RESULTS AND DISCUSSION

The management of insect pests using botanicals and biopesticides are proving to be a cornerstone in integrated pest management and newer products are introduced to overcome the pesticide resistance problem. When compared to the standard check endosulfan that recorded a mean shoot damage of 4.31 percent, both iluppai oil and pungam oil were significantly at par in controlling the shoot damage recording 4.72 and 4.64 percent, respectively. While neem oil was also found effective, microbial formulations, *B. bassiana* and *V. lecanii* were next in the order of efficacy with 8.52 and 10.25 percent shoot damage, respectively. Percent protection against control was high with endosulfan than iluppai oil and pungam oil. The data presented in Table 2 revealed that both the plant products, iluppai oil and pungam oil were significantly effective in controlling shoot and fruit borer with 15.93 percent and 16.3 percent fruit damage, respectively followed by neem oil with 19.9 percent fruit damage as compared to endosulfan with 14.23 percent fruit damage. *B. bassiana* and *V. lecanii* were not found to be quite effective, and gave only 37.7 and 38.7 percent protection against control. The data of fruit yield showed that both iluppai oil (202.75q/ha) and pungam oil (198.13q/ha) were able to increase the yield significantly over control (114.00q/ha) and were found to be at par with endosulfan (209.00q/ha). The pooled data of 2009-2011 also reveals that neem oil (183.03q/ha), and combination of PIO and MIO (186.83q/ha) and fungi (180.089q/ha) increased the fruit yield.

Among newer botanicals, iluppai oil proved to be a potent alternative along with pungum oil. Both these plant products were found to be significantly effective in management of *L. orbonalis*, followed by neem oil as compared to check insecticide, endosulfan. Efficacy of iluppai oil and pungum oil In the management of BSFB was also shown by

Table 1. Bioefficacy of botanicals and microbial formulations against shoot damage by *L. orbonalis* (Pooled data of 2009-2010 and 2010-2011)

Treatment	Mean	%protection against control
Neem Oil	5.69^{ab}	63.2
Iluppai Oil (2%)	4.72^{a}	69.5
Verticillium	10.25^{d}	33.8
PPO (1%) + MIO (1%)	7.64^{bc}	50.7
E. Fungi	8.52^{cd}	45.0
Pungam Oil (2%)	4.64^{a}	70.0
Endosulfan	4.31^{a}	72.19
Control	15.50^{e}	-

Figures in parentheses are angular transformed values; In a column means followed by a common letter are not significantly different at 5% level

Table 2. Bio-efficacy of botanicals and microbial formulations against fruit damage by *L. orbonalis* (Pooled data of 2009-2010 and 2010-2011)

Treatment	Mean	%protection against control
Neem Oil	19.98[bc]	46.36
Iluppai Oil (2%)	15.93[ab]	57.25
Verticillium	23.18[c]	37.77
PPO (1%) + MIO (1%)	19.88[bc]	46.8
E. Fungi	22.83[c]	38.71
Pungam Oil (2%)	16.30[ab]	56.24
Endosulfan	14.23[a]	61.79
Control	37.25[d]	-

Figures in parentheses are angular transformed values; In a column means followed by a common letter are not significantly different at 5% level

Adiroubane and Raghuraman (2008). Safer plant products proved useful in developing sound pest management strategy (Gupta and Singh, 2002). Earlier workers have demonstrated the effectiveness of neem oil alone (Udaiyan, and Ramarathinam 1994) and also in combination with endosulfan (Wargantiwar *et al*., 2010), while other neem formulations were also found to be effective against *L. orbonalis* (Murugesan and Murugesh 2009). The microbial insecticides *B. bassiana* and *V. lecanii* were found effective only for the control of shoot borer at early stage of plant growth. The high efficacy of microbial formulations of fungi was not observed probably due to lack of high humidity conditions in field as required for the growth of fungus which was probably not suitable owing to the semi-arid conditions in the current study area. Thus use of newer botanical oils of iluppai and pungam proved to be effective in suppressing the BSFB damage with significant insecticidal property.

The present study thus revealed that newer botanicals such as oils of iluppai and pungum were quite effective in bringing down the damage by *L. orbonalis* and increasing the fruit yield, and can prove to be potent alternatives other than neem oil.

ACKNOWLEDGEMENT

The first author is thankful to University Grants Commission, New Delhi for the financial support given as UGC Research Award.

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Manuscript history

Received : 02.11.2011

Revised : 28.02.2012

Accepted : 10.05.2012