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Laboratory evaluation of certain insecticides against pigeonpea pod borer, *Maruca vitrata* Geyer

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ABSTRACT

The relative efficacy of selected new and eco-friendly insecticides against the 3rd instar larvae of *Maruca vitrata* showed that indoxacarb and spinosad were highly effective and were at par with conventional insecticide, endosulfan. The two bio pesticides, namely *Bacillus thuringiensis* and *Metarhizium anisopliae* were moderately effective while botanical pesticide, neem fruit extract was ineffective against *M. vitrata.*

Key words: Efficacy, Insecticides, *Maruca vitrata*

Pigeonpea, [*Cajanus cajan* (L) Millsp.] is an important grain legume and occupies the second largest area among various pulses grown in India. In recent years, due to introduction of short duration cultivars, the incidence of *M. vitrata* has been aggravated as flowering of these varieties occur during period of high humidity and moderate temperature which are congenial for the development of this pest (Sharma *et al.* 1999). Presently, *M. vitrata* is controlled primarily through the use of chemical insecticides. Several insecticides have been tested and a few are effective against the pest (Sahoo and Senapathi 2000). Repeated use of these chemicals resulted in development of resistance to insecticides. Use of new chemical molecules with high insecticidal properties, lower dosage application and lower mammalian toxicity fits very well in the present day Integrated Pest Management (IPM) concept. Now-a-days, attempts are also being focused on the use of safer chemicals like plant products and microbial pesticides to reduce the toxic effect of chemicals on non target organisms and prevent the environmental pollution. Hence, in the present study, some promising newer insecticides and biopesticides were tested against *M. vitrata.*

MATERIALS AND METHODS

The experiment was conducted under laboratory conditions with seven treatments consisting of two novel insecticides (indoxacarb14.5SC, spinosad48 SC), one each of conventional insecticide (endosulfan 35 EC), botanical insecticide (Azadirachtin 5%NFE), bacterial insecticide, (*Bacillus thuringiensis* 6.7x1011*)* and entomopathogenic fungi (*Metarhizium anisopliae* 1X106*)* and control. Each treatment was tested at five concentrations (one being the recommended dose, two each of below and above the recommended dose) and each concentration was replicated four times. Studies were conducted using the third instar larvae of *M. vitrata* during 2005 at ICRISAT, Patancheru. The unsprayed pigeonpea genotype (ICPL 88034) twigs with 7 leaves and young buds were collected and made in the form of flower bouquets and were kept in conical flask containing water and the mouth of the conical flask was plugged with cotton. Ten third instar larvae were released on each flower bouquet and then sprayed with the chemicals by using small Ganesh sprayer. The flower bouquets sprayed with water was kept as control. The larval mortality was recorded at 24, 48 and 72 hrs after treatment and the per cent mortality was calculated and subjected to ANOVA with angular transformed values.

RESULTS AND DISCUSSION

The results showed that among the different insecticides tested, two newer insecticides, indoxacarb and spinosad were superior to other treatments. Conventional insecticide, endosulfan was also equally effective and showed higher mortality at 48 hrs after treatment with all the concentrations. Though indoxacarb resulted in less mortality (50%) at 24 hrs after treatment even with higher concentration, it showed maximum mortality (80%) at 48 hrs after treatment with lower concentrations (0.5 ml/l). Spinosad caused more than 50% mortality at recommended dose (0.3 ml/l) at 24 hrs after treatment.

Because of very favourable mammalian toxicity and environmental profiles, spinosad has already been registered by EPs for use against lepidopteran pests on cotton (Graves *et al.* 1999). Indoxacarb is an oxadiazine group of reduced risk broad spectrum stomach poison with little contact action which causes paralysis and death within 4-48 hours. Thus, the two insecticides spinosad and indoxacarb not only act as effective larvicides but also found to have moderate ovicidal action (Rao *et al.* 2001) and hence can be safely incorporated in the IPM programme for *M. vitrata*. The results are in agreement with the findings of Yelshetty *et al.* (1999) and Bheemanna and Patel (1999) who reported the supremacy of indoxacarb over other pesticides against *H. armigera* in pigeonpea and cotton, respectively. Khalid *et al.* (2001)

Table 1. Effect of selected insecticides against *Maruca vitrata*

Chemical	Dosage (ml/lit)	% larval mortality of *M. vitrata*		
		24 hrs	48 hrs	72 hrs
Indoxacarb 14.5SC	0.5	15.00 (22.50)	80.00 (63.43)	97.50 (85.39)
	0.75	22.50 (28.22)	82.50 (65.83)	97.50 (85.39)
	1.00	30.00 (33.05)	85.00 (67.50)	100.00 (90.00)
	1.25	40.00 (39.23)	90.00 (71.56)	100.00 (90.11)
	1.50	50.00 (45.00)	92.50 (78.75)	100.00 (90.00)
	CV	0.120	0.102	0.006
	SE	2.02	3.55	2.91
	CD (0.05)	6.10	10.71	NS
Spinosad 48 SC	0.10	42.50 (40.67)	60.00 (50.76)	97.50 (85.39)
	0.20	55.00 (47.88)	65.00 (53.77)	97.50 (85.39)
	0.30	80.00 (63.43)	82.50 (65.46)	97.50 (85.39)
	0.40	82.50 (65.46)	90.00 (71.56)	100.00 (90.00)
	0.50	92.50 (76.47)	100.00 (90.00)	100.00 (90.00)
	CV	0.083	0.003	0.008
	SE	2.45	1.195	3.56
	CD (0.05)	7.40	3.60	NS
Endosulfan 35 EC	1.00	40.00 (39.23)	80.00 (63.43)	95.00 (80.78)
	1.50	55.00 (47.88)	90.00 (74.14)	95.00 (80.78)
	2.00	60.00 (50.76)	92.50 (76.17)	97.50 (85.39)
	2.50	65.00 (53.77)	97.50 (85.39)	100.00 (90.00)
	3.00	72.50 (58.45)	100.00 (90.00)	100.00 (90.00)
	CV	0.05	0.009	0.009
	SE	1.30	3.84	3.94
	CD (0.05)	3.94	11.60	NS
Metarhizium anisopliae $1X10^6$	1.00	0.00 (0.00)	17.50 (24.53)	22.50 (24.90)
	1.50	0.00 (0.00)	12.50 (20.46)	25.00 (29.73)
	2.00	0.00 (0.00)	17.50 (24.53)	32.50 (34.55)
	2.50	0.00 (0.00)	17.50 (24.53)	35.00 (36.22)
	3.00	17.50 (0.00)	35.00 (24.53)	50.00 (45.50)
	CV	0.37	0.1517	0.2579
	SE	0.908	1.97	4.39
	CD (0.05)	NS	5.95	4.39
Bacillus thuringiensis **$6.7X10^{11}$**	0.50	0.00 (0.00)	10.00 (18.43)	35.00 (36.22)
	0.75	7.50 (13.82)	32.50 (34.71)	57.50 (49.38)
	1.00	15.00 (22.50)	35.00 (36.22)	67.50 (55.28)
	1.25	20.00 (26.56)	40.00 (39.23)	75.00 (60.11)
	1.50	40.00 (39.23)	47.50 (43.55)	85.00 (67.50)
	CV	0.226	0.007	0.007
	SE	2.31	1.21	2.11
	CD (0.05)	6.97	3.65	6.37
Neem fruit extract 5%	3%	0.00 (0.00)	0.00 (0.00)	17.50 (24.53)
	4%	0.00 (0.00)	0.00 (0.00)	20.00 (26.56)
	5%	0.00 (0.00)	0.00 (0.00)	30.00 (33.21)
	6%	0.00 (0.00)	0.00 (0.00)	35.00 (36.22)
	7%	0.00 (0.00)	0.00 (0.00)	40.00 (39.23)
	CV	--	--	1.195
	SE	--	--	0.07
	CD (0.05)	--	--	3.60
Control		0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

observed highest mortality of *S. litura* eggs with indoxacarb (86.66%), followed by spinosad (73.33%) under laboratory conditions. Gopalaswamy *et al.* (2000) found spinosad and indoxacarb as equally promising for the control of pink boll worms at par with commonly used quinalphos and cypermethrin. According to Dey and Somchoudhury (2001), spinosad provided effective control of all the lepidopteron pests at a dose level of 15 – 25 g ai/ha and showed very little adverse effect on the important parasitoids of diamond back moth. Though endosulfan was highly effective in controlling the pest in the present study, it is known to affect some of the natural enemies of the insect pests (Wiktelius *et al.* 1999) and there are reports of *H. armigera* resistance to pyrethroids and endosulfan in India (Lateef 1991). Hence, it is advisable to alternate the conventional pesticides with newer chemicals not only between seasons but also reasonably between two or three sprays within the season to minimize the tendency of pests developing resistance to a particular chemical.

Among the biopesticides used in the present study, *Bt* was found superior to *M. anisopliae*. The mortality of the larvae was slow up to 48 hours after treatment and maximum mortality (75 & 85%) was observed with higher concentrations (1.25 and 1.5 g/lt, respectively) after 72 hours of treatment and was not as effective as the newer and conventional insecticides used in the present study. The present study also supports the findings of Rahman (1988) who stated that *Bt* was inferior to chemical insecticides against *H. armigera* on cotton. The results are, however, at variance with those of Purohit and Deshpande (1991) who obtained 90% mortality of *H. armigera* at 96 hours of post treatment with 2% concentration of *Bt* in the laboratory. The biopesticides act slowly and have to be ingested by the insect to become toxic. Another biopesticide, *M. anisopliae* was less effective than novel and conventional insecticides and did not cause the mortality at 24 hours after treatment and the mortality was very low (less than 50%) even at 48 and 72 hrs after treatment except at higher concentration (3.00 g/lt) which resulted in 50% mortality. The results are in contrary to the findings of Kulat *et al.* (2003) who found the highest larval mortality (97.50%) of 2nd instar larvae of *H. armigera* with 2.28 x 10^{10} conidia/ml of *M. anisopliae.* Gopalakrishnan and Narayanan (1989) also reported pathogenicity of *M. anisopliae* to larval instars, pre pupa and pupae of *H. armigera* at 1.8 x 10^{9} conidia /ml. The reason for less pathogenicity of the fungus against the test insect in the present study could be attributed to the method of application of fungus on the insect. The germination of fungal spores and subsequent mycelial growth on the insect would take place if it comes in direct contact with the larval body. But the pest used in the present study is a hidden pest and the fungal suspension was applied on the flower bouque in which the pest was hiding. Hence, there is less chance of direct contact of the fungus with the insect body and causing subsequent infection. The previous studies were conducted by applying the fungus directly on the insect body which might have resulted in effective control.

The botanical insecticides neem fruit extract was found least effective. There was no mortality of the treated larva even after 24 and 48 hours of treatment. The mortality was also less (40%) even at higher concentration after 72 hrs of treatment showing its inefficacy against *M. vitrata.* The results are in accordance with the findings of Minja *et al.* (2000) who indicated that neem extract and *B. thuringiensis* were not as effective as the synthetic insecticides against pod borers on pulses.

Based on the present study, it is evident that the pest can be effectively controlled by selecting the new generation chemicals like indoxacarb and spinosad in view of the favourable mammalian toxicity, ovicidal action and safety to natural enemies. Since *M. vitrata* is a hidden pest and is very difficult to control once it enters the web and feed inside, future insecticide spraying studies should focus on economic thresholds and timing of application.

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