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BIO-INTENSIVE MANAGEMENT OF TOBACCO CATERPILLAR, *SPODOPTERA LITURA* FAB. IN KARNATAKA LIGHT SOILS

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Four bio-agents, two botanicals and two chemical pesticides were evaluated for two consecutive years (2008-09 and 2009-10) against tobacco caterpillar, *Spodoptera litura* which is an important pest in FCV tobacco nursery (var. Kanchan) in Karnataka Light Soils. Two sprays were given at 45 and 55 days of sowing. Observations on infested seedlings in each treatment were recorded before spraying, five and ten days after each spray. Per cent reduction of damaged seedlings over control after ten days of second spray was calculated for each treatment. The pooled data of two years revealed that except EPN, remaining treatments were significantly superior over control in reducing the damage at ten days of second spray. Lowest seedling infestation (2.50%) was recorded in chlorpyriphos 20 EC applied plot followed by novaluron 10 EC (5.66%). Among the bio-agents tested, *Sl* NPV and *Bacillus thuringiencis var. Kurstaki* proved better with 8.16 and 8.33% infestations, respectively. Both the botanicals also proved better with 10.66 (NSKS) and 12% (*Calotropis*) seedling infestations. The remaining two bio-agents, *Nomuraea rileyi* and EPN were least effective with 21.66 and 29.33% infestations, respectively. In control plot, the infestation was 30.66%. Similarly, per cent reduction of damaged seedlings over control was more (89.66) in chlorpyriphos 20 EC and less (9.16) in EPN applied plot. In the remaining treatments, it ranged from 28.33 to 83%. There was no significant difference between the two seasons. Hence, it is concluded that two bio-agents, viz., *Sl* NPV and *Bacillus thuringiencis Var. Kurstaki* proved better after chemical pesticides against tobacco caterpillar, *Spodoptera litura* in KLS.

INTRODUCTION

Tobacco caterpillar, *Spodoptera litura* Fab. is an important pest in both nursery and transplanted tobacco. The caterpillar feeds voraciously along the veins of leaves and also cuts the stems of small and tender seedlings, particularly during nights. The prolonged drought situation during nursery period may cause more damage. In severe cases, there is about 80 to 100% loss of nurseries due to this pest. Indiscriminate use of chemical pesticides for the past four decades in Indian agriculture has undoubtedly harmed the bio-diversity and environment as a whole. There has been a drive to overcome reliance on chemical pesticides and use non-chemical, eco-friendly approaches which can drastically reduce the pesticide consumption in the agricultural crops. The search for new solutions to control insect pests is currently gaining momentum (Scott *et al.*, 2003). Today over 2000 species of plants and bio agents are known that possess some insecticidal activity (Jacobson, 1989). Hence, keeping in view the concern on pesticide residues in tobacco, it is planned to evolve management practices involving safe and viable bio-agents and botanicals against the pest.

MATERIALS AND METHODS

Four bio-agents *viz.*, *Nomuraea rileyi*, *Bacillus thuringiencis var. Kurstaki, EPN (Steinernema carpocapsae)* and *Sl* NPV; two botanicals *viz.*, *Calotropis* spp. leaf extract and neem seed kernel suspension and two chemical pesticides, novaluron 10 EC and chlorpyriphos 20 EC were evaluated for two consecutive years (2008-09 and 2009-10) against tobacco caterpillar, *Spodoptera litura* in FCV tobacco nursery (var. Kanchan) along with untreated control. Two sprays were given at 45 and 55 days of sowing. Observations on infested seedlings in each treatment were recorded before spraying, five and ten days after each spray. Per cent reduction of damaged seedlings over control after ten days of second spray was

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calculated for each treatment. The data on to total seedlings and transplantable seedlings were recorded. From this, per cent transplantable seedlings and per cent increase of transplantable seedlings over control were calculated.

RESULTS AND DISCUSSION

Pooled data of two years revealed that except EPN, remaining treatments were significantly superior over control in reducing the damage at ten days after second spray (Table 1). Lowest seedling infestation (2.50%) was recorded in chlorpyriphos 20 EC applied plot followed by novaluron 10 EC (5.66%). Among the bio-agents tested, *Sl* NPV and *Bacillus thuringiencis var. Kurstaki* proved better with 8.16 and 8.33% infestations, respectively. Both the botanicals also proved better with 10.66 (NSKS) and 12% (*Calotropis*) seedling infestations. The remaining two bio-agents, *Nomuraea rileyi* and EPN were least effective with 21.66 and 29.33% infestations, respectively. In control plot, the infestation was 30.66%. Similarly, per cent reduction of damaged seedlings over control was more (89.66) in chlorpyriphos 20 EC and less (9.16) in EPN applied plot. In the remaining treatments, it ranged from 28.33 to 83%. There was no significant difference between the two seasons.

Corresponding to the seedling infestation, transplantable seedlings were more (54.33) in chlorpyriphos 20 EC treatment followed by novaluron 10 EC (53.33), NSKS (51.33), *Sl* NPV (51), *Bacillus thuringiencis var. Kurstaki* (50.66), *Calotropis* (50), *Nomuraea rileyi* (48.33) and EPN (48). In control plot, transplantable seedlings were 45.33% (Table 2). Similarly, the increase in transplantable seedlings over control was more (19.33%) in chlorpyriphos 20EC treatment and less (5%) in EPN applied plot. Binage *et al.* (2004) reported that 5% neem seed extract along with 0.33% endosulfan showed the lowest infestation of diamondback moth larvae (0.4 per plant),

Table 1: Efficacy of bio-agents against *S. litura* in FCV tobacco nurseries

S. No.	Treatments	Per cent seedlings infested					Per cent reduction of damaged seedlings over control
		Pre-count	5 days after 1st spray	10 days after 1st spray	5 days after 2nd spray	10 days after 2nd spray	
1	*Nomuraea rileyi* @ 10^{13} spores/ha	1.30	9.33	13.66	16.33	21.66	28.33
2	*B.t. Kurstaki* @ 2kg/ha	1.60	2.66	4.00	6.00	8.33	71.66
3	EPN (*S. carpocapsae*) @ 2 billion IJ/ha	1.83	12.66	18.00	23.66	29.33	9.16
4	NPV @ $1.5x10^{12}$ PIBs/ha	1.73	3.00	4.16	6.66	8.16	72.00
5	*Calotropis* spp. leaf extract @ 2%	1.63	3.00	6.66	9.33	12.00	58.66
6	NSKS @ 2%	1.56	2.83	5.66	7.66	10.66	64.33
7	Novaluron 10 EC @ 50g a.i./ha	1.26	2.50	3.50	4.16	4.66	83.00
8	Chlorpyriphos 20 EC @ 500 g a.i./ha	1.40	1.33	2.16	2.50	2.50	89.66
9	Control	1.63	13.00	17.33	23.00	30.66	——
	SEm±	**0.14**	**0.63**	**0.48**	**0.66**	**0.66**	**1.88**
	CD (P=0.05)	**NS**	**1.89**	**1.44**	**1.99**	**1.98**	**5.73**
	CV (%)	**15.83**	**10.39**	**6.21**	**6.07**	**5.75**	**5.49**
	Seasons						
	2008-09	**1.60**	**6.71**	**8.95**	**11.42**	**14.49**	**61.46**
	2009-10	**1.62**	**6.32**	**8.69**	**11.15**	**14.59**	**59.14**
	SEm±	**0.20**	**0.79**	**0.63**	**0.86**	**0.73**	**2.32**
	CD (P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

cabbage aphids (11.6 per leaf) and tobacco caterpillar (0.5 per plant). Present study indicated that among the bio agents tested, entomopathogenic fungi and nematode were least effective. This is in conformity with the findings of Devi (1994) who reported that *Nomuraea rileyi* applied @ $2X10^{11}$ conidia/l was least effective against *Spodoptera litura* in castor with 50-60% larval mortality even after 12 days of spraying. In Gujarat, Sl NPV applied @ 750, 1000 and 1500 ml/ha ($1X10^{9}$ POB/ml) was most effective in reducing *S. litura* damage and increasing healthy transplantable seedlings of *bidi* tobacco (Bhat *et al.*, 2008). Similarly, the incidence of *S. litura* was significantly low in trap crop plus NPV applied plot than in natural or chemical control plots (Zhou Zhongshi *et al.*, 2011). The caterpillar exhibited poor response to low concentration of *Bt* and the mortality rate increased with the increase of bacterial concentration.From the present study it is concluded that chemical pesticides proved better against tobacco caterpillar, *Spodoptera litura* in reducing the damage and increasing the transplantable seedlings. After chemicals, the two bio-agents viz., *Sl* NPV and *Bacillus thuringiencis Var. Kurstaki* proved better. Botanicals were moderately effective. Two bio-agents viz., *Nomuraea rileyi* and EPN were least effective.

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Table 2: Effect of different bio-agents on total transplantable seedlings

S. No.	Treatments	Total seedlings/ m^2	Transplantable seedlings/ m^2	Transplantable seedlings (%)	Increase in trans-plantable seedlings over control (%)
1	*Nomuraea rileyi* @ 10^{13} spores/ha	583	285	48.3	6.33
2	*B.t. Kurstaki* @ 2kg/ha	583	299	51.7	11.00
3	EPN (*S. carpocapsae*) @ 2 billion IJ/ha	573	277	48.0	5.00
4	NPV @ $1.5x10^{12}$ PIBs/ha	577	297	51.0	11.66
5	*Calotropis* spp. leaf extract @ 2%	597	302	50..0	9.66
6	NSKS @ 2%	578	295	51.3	12.00
7	Novaluron 10 EC @ 50 g a.i./ha	575	313	53.3	18.00
8	Chlorpyriphos 20 EC @ 500 g a.i./ha	578	319	54.3	19.33
9	Control	592	288	45.3	--
	SEm±	**16.7**	**6.0**	**0.90**	**2.21**
	CD (P=0.05)	**NS**	**16.85**	**2.71**	**6.41**
	CV (%)	**4.98**	**5.59**	**4.12**	**25.90**
	Seasons				
	2008-09	**592.3**	**299.8**	**51.8**	**11.93**
	2009-10	**583.3**	**294.8**	**50.0**	**11.12**
	SEm±	**12.13**	**8.06**	**1.17**	**2.58**
	CD (P=0.05)	**NS**	**NS**	**NS**	**NS**

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