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Studies on the Control of Redgram (*Cajanus cajan* L.) Pod Borers

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Three field experiments were conducted during 1976-77 to study the relative efficacy of certain insecticides (granule, spray and dust formulations) *Bacillus thuringiensis* (B. t) and Nuclear Polyhedrosis Virus (NPV) in the control of redgram pod borers. Among the spray formulations, chlorphenamidine 0.1 per cent, endosulfan 0.07 per cent and carbaryl 0.25per cent were effective. In the dust formulations tried, endosulfan was oustanding, followed by phosalone, carbaryl and quinalphos. Endosulfan and carbaryl dusts were effective in the order, in significantly reducing the grain damage. In the combination experiment with dust, granule, *B. t* and NPV, endosulfan dust at 0.5 and 1.5 kg a. i./ha were superior followed by disulfoton granule (1.0 kg a. i/ha). The grain damage was substantially reduced by endosulfan dust 0.5 and 1.0 kg a.i/ha and disulfoton granule followed by *B. t* treatment. Though *B. t* and NPV were able to reduce the infestation by the pod borers, they were not as effective as endosulfan dust.

In redgram, pod borers cause heavy damage to flower buds, flowers and pods resulting in extensive loss in grain yield. In order to evolve suitable control measures, field experments were conducted with certain insecticides (granule, spray and dust formulations), *Bacillus thuringiensis* Berliner (*B.t*) and Nuclear Polyhedrosis Virus (NPV) and the relative efficacy of insecticides and biocides presented.

MATERIALS AND METHODS

Three field experiments were conducted during 1976-77 in a randomized, replicated design to evaluate the efficacy of several insecticides, *B. t* and NPV in the control of pod borers on red gram variety Co. 2. In the first experiment, 10 emulsifiable insecticides were tested and three replications were maintained. In the second experiment, there were four replications; five insecticidal dust formulations were evaluated. The efficacy of granular insectide, dust formulation, *B. t* and NPV were tested alone or in combination, in the third field experiment against the pod borers. The treatments were replicated thrice.

The emulsifiable concentrates (spray fluid 800-1000 lit/ha) and dust formulations at 1 kg a.i/ha were applied once at the pod formation stage and again 15 days later. The granules were applied once in the soil on the 45th day after sowing. *B. t* and NPV

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were applied at weekly intervals, four times, the first round having been given at the pod formation stage.

In all the experiments, the pods were infested by *Helicoverpa* (Heliothis) *armigera* Hb., *Exelastis atomosa*, W. *Maruca testulalis* G and *Melanagromyza obtusa* (Malloch). The infestation by pod borers on pod basis was observed in six plants selected at random from each experimental plot before, one week and two weeks after each round of treatment and at harvest by counting the total and affected pods. The infestation on grain basis was also assessed from damaged pods collected from six plants selected at random from each plot. The grain yield in different treatments was recorded and presented in Tables I, II and III.

RESULTS AND DISCUSSION

In the first experiment, there was significant difference in the infestation, between the treatments, on pod

TABLE I Efficacy of spray formulation in the control of red gram pod boreas.

Treatment		Pod borer infestation %		Yield	
		Pod	Grain	Kg/plot	kg/ha
Endosolfan (Thiodan)	0.07%	20.89 (12.7)	39.90 (41.1)	1.818	909
Carbaryl (Sevin)	0.25%	23.16 (15.5)	39.80 (40.9)	1.313	657
Formothion (Anthio)	0.1%	40.37 (42.0)	47.80 (54.9)	1.798	899
Phosalone (Zolone)	0.07%	39.35 (40.2)	34.57 (32.2)	1.933	967
Dimethoate (Rogor)	0.03%	44.53 (49.2)	57.90 (71.8)	1.605	803
Monocrotophos (Nuvacron)	0.04%	31.01 (26.6)	29.80 (24.7)	2.248	1124
Chlorphenamidine (Fundal)	0.1%	20.49 (12.3)	32.50 (28.9)	2.142	1071
Quinalphos (Ekalux)	0.05%	35.27 (33.4)	38.50 (38.7)	1.670	835
Fenitrothion (Folithion)	0.04%	29.43 (24.1)	32.70 (29.2)	2.045	1023
Leptophos (Phosvel)	0.07%	34.12 (31.5)	37.20 (36.5)	2.032	1016
Control		50.26 (59.1)	58.90 (73.3)	1.393	697
C.D. (P=0.05		7.14	N.S.		

(Figures in parentheses are actual percentage)

TABLE II Efficacy of dust formulations in the control of red gram pod borers

Treatment	Mean % of damage by pod borers		Mean yield in kg/plot	Yield in kg/ha
	Pod	Grain		
Endosulfan 4%	20.6 (26.9)	45.40 (42.4)	1.32	660
Carbaryl 5%	47.8 (43.8)	37.0 (37.5)	1.18	590
Malathion 5%	73.0 (58.7)	73.3 (58.9)	0.88	440
Quinalphos 5%	48.6 (44.2)	34.3 (35.9)	0.98	490
Phosalone 4%	45.0 (42.2)	53.7 (47.1)	1.01	500
Control	72.7 (58.2)	80.4 (63.7)	0.85	425
C.D. (P=0.05)	5.6	10.6	N.S.	

(Figures in parentheses are transformed values)

basis and all the insecticides were effective in reducing the infestation significantly. The infestation percentage ranged from 12.3 (chlorphenamidine) to 59.1 (control) (Table I). Among the treatments, spraying with chlorphenamidine (Fundal) 0.1%, endosulfan (Thiodan) 0.07% and carbaryl (Sevin) 0,25% were effective recording 12.3, 12.7 and 15.5 per cent infestation. The percentage of infestation on grain basis ranged from 24.7 to 73.3 among the treatments. However, the difference between treatments was not significant statistically. Although there was difference in yield among the treatments numerically, statistical scrutiny revealed that the difference was not significant.

In the second experiment, there was 20.6 to 72.2 per cent infestation on pod basis, in different treatments and the difference was significant statistically (Table II). Endosulfan 4 percent dust was outstanding and independent to other treatments in reducing the infestation. Phosalone, carbaryl and quinalphos were on par in their efficacy. Malathion was ineffective in controlling the pod borers infestation. The infestation on grain basis was also observed to differ significantly between treatments. Quinalphos, carbaryl and endosulfan were most promising in reducing the infestation in grains. There was no significant difference in grain yield between treatments.

In the third experiment, the percentage of pod borer infestation ranged from 11.2 (endosulfan) to 21.3 (control) (Table III). Endosulfan 0.5 and 1.0 kg

TABLE III Relative efficacy of certain insecticides, *Bacillus thuringiensis* and Nuclear Polyhedrosis virus in the control of red gram pod borers.

Treatment	Pod borer infestation		Yield	
	Pod	Grain	g/plot	Kg/ha
Disyston 1.0 kg a.i/ha followed by B.t.2 gm/lit	13.9 (21.9)	35.2 (36.4)	322	859
Disyston 0.5 kg a.i/ha followed by *B. t.* 2 gm a.i./lit	15.4 (23.1)	41.7 (40.2)	248	661
Disyston 1.0 kg a.i./ha followed by virus 1 ml/lit	15.9 (23.5)	38.3 (38.2)	303	808
Bacillus thuringiensis (Thuricide) 2 gm/lit	13.4 (21.5)	37.1 (37.5)	285	760
Virus 1 ml/lit 10^8 (NPV of (*Heliothis armigera*)	18.5 (25.5)	35.4 (36.5)	290	773
Endosulfan dust 0.5 kg a.i./ha	11.2 (19.6)	28.9 (32.5)	300	800
Endosulfan dust 1.0 kg a.i./ha	11.6 (19.9)	29.0 (32.6)	360	960
Disyston 1.0 kg a.i./ha	12.5 (20.7)	37.4 (37.7)	275	733
Control	21.3 (27.5)	49.5 (44.7)	263	701
C.D. (P=0.05)	3.84	6.32	N.S.	

(Figures in parentheses are transformed values)

a.i./ha, disulfoton (Disyston) 1.0 kg a.i./ha, *B.t.* (Thuricide), disulfoton 1.0 kg a.i./ha followed by *B.t.* and disulfoton 0.5 kg a.i./ha followed by *B. t.* were effective in significantly reducing the pod borer infestation and were on par in effectiveness. The infestation on grain basis was also found to differ significantly, between the treatments. The percentage of infestation ranged from 28.8 in endosulfan dust to 49.5 in control. Endosulfan 0.5 and 1.0 kg a.i./ha, disulfoton 1.0 kg a.i./ha followed by *B.t.*, NPV and *B.t.* alone were effective in reducing the grain damage and were on par in their efficacy. Endosulfan 1.0 kg a.i./ha recorded 37.0 per cent higher yield over control, although the difference between treatments was not significant.

The present studies revealed that sprays of chlorphenamidine, endosulfan and carbaryl were the most effective chemicals in reducing the pod borers infestation and the efficacy of endosulfan spray is in conformity with the findings of Saxena *et al.*, (1971), Saharia and Dutta (1975), Balasubramanian *et al.*, (1977) and Surulivelu *et al.*, (1977). Among dusts, endosulfan was independently superior to

other treatments. The present investigation further indicated that application of endosulfan dust would be more efficaceous than the combination of insecticide and *B.t* or NPV.

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