Madras agric. J. 68 (6) : 417-420, June 1981

Control of Heliothis armigera (Hubner) *on Redgram (Cajanus cajan* L.) *with a unclear polyhedrosis virus and insecticides**

The gram pod borer, *Heliothis armigera* (Hb) causes heavy damage by feeding on the developing grains in redgram. The control of the pod borers with chemical insecticides in redgram has already been reported by various workers (Saharia and Dutta, 1975; Balasubramanian *et al.* 1977; Chelliah *et al.* 1978). The utility of nuclear polyhedrosis virus (NPV) in the control of H. *armigera* on bengalgram has been reported by Narayanan (1979) and Santharam and Balasubramanian (1981). Hence an attempt was made in the present study to evaluate the efficacy of NPV of H. *armigera* and insecticides alone and in combination for the control of *H. armigera* on redgram in pot culture and field conditions.

A pot culture study was conducted with 11 treatments and three replications (Table 1). Variety Co. 3 was raised and three plants per pot was maintained. Disease-free fourth instar larvae from laboratory culture were introduced before treatment at the rate of 20 per pot. One round of treatments was given at the time of pod formation (90 days after germination). The mortality of larvae was recorded daily upto 10 days after treatment.

A field experiment with the same 11 treatments and three replications in a randomised blocks design was laid with a plot size of 20 M^2. The variety Co3 was used. The NPV was propagated in the fourth instar larvae of H. *armigera* reared on a semi-synthetic diet. Semi-purified suspension was used after standardisation of polyhedral inclusion body (PIB) counts in a Neubauer haemocytometer. A wetting agent (Teepol) was added to NPV treatment at 0.05%. The spray fluid used was 600 litres/ha and the dust was applied at 20 kg/ha. Two rounds of treatments were given once at 50 per cent flowering and repeated a fortnight later. All the treatments were given in the evening hours after 5 p. m. to avoid photoinactivation of NPV due to sunlight. Pod damage due to pod borers was assessed at the time of harvest from ten plants per plot. The yield of grains was also recorded.

In the pot culture study, the per cent mortality varied from 11.67 to 100.0%. The maximum mortality of 100% was observed in treatments with insecticides alone, *viz.*, endosulfan 0.07% and monocrotopos 0.04% sprays and endosulfan 4% dust. Significant mortality was also obtained by the use of NPV. When NPV was used either alone or in combination with insecticides at sub-normal concentration, the mortality was delayed and varied from 21.67 to

75.00%. Among NPV treatments, at 375 larval equivalents (LE) ha recorded maximum mortality of 71.67% and was on par with 312.5 LE/ha and combination sprays of monocrotophos 0.02% plus NPV 125 LE/ha and endosulfan 0.035% plus NPV 125 LE/ha. NPV alone at 250, 187.5 and 125 LE/ha were less effective.

Since the NPV and its combination with the insecticides at sub-normal concentration were found to be effective under pot culture conditions, it was test-verified under field conditions. In the field experiment, the pod damage varied from 32.60 to 58.75 in different treatments. However, the differences among the treatments in pod damage and yield of grains were not significant.

The NPV and its combination with insecticides were not as effective as insecticides alone in causing mortality to *H. armigera* larvae. In case of *Spodoptera litura* F. better control of the larvae has been achieved on banana (Santharam *et al.* 1978) and tobacco (Santharam and Balasubramanian, 1980) with the use of the NPV of *S. litura*. The low mortality in case of *H. armigera* may be due to its feeding behaviour which feeds on developing grains inside the pod after making a hole and thereby ingesting lenser inoculum compared to S. *litura* which is a leaf-feeder.

In the field, significant results were not observed in NPV and it may be due to the occurence of other pod borers *viz.*, *Maruca testulalis* *G. Exelatis atomosa* W. *Melanagromyza obtusa*(M.) which were not controlled effectively by the treatments, since the NPV of *H. armigera* is very specific. Further the damage by *H. armigera* was not separated out from other borers based on the symptoms of damage. Chelliah *et. al.* (1978) also reported that the NPV was less effective in checking the pod damage in redgram when they used ca. 1×10^{11} PIB/ha.

Considering the occurrence of a complex of pod borers on redgram and the feeding behaviour of *H. armigera*, the utility of the NPV as a control agent in redgram is limited, compared to broad spectrum activity of chemical insecticides.

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Table 1. Control of Gram Pod Borer, *Heliothis armigera* on Redgram (Means of 3 observations)

Treatments		Pot culture Experiment Mortality of larvae £	Field Pod damage %	Experiment Yield of grain in kg/plot (20 M^2)
NPV 125 LE/ha (7.5×10^{11} PIB/ha)	Spray	21.67 (4.69)	40.51	1.050
NPV 187.5 LE/ha (11.25×10^{11} PIB/ha)	,,	36.67 (6.08)	32.60	1.393
NPV 250 LE/ha (15.0×10^{11} PIB/ha)	,,	53.33 (7.32)	42 90	1.066
NPV 312.5 LE/ha (18.75×10^{11} PIB/ha)	,,	66.67 (8.17)	47.39	1.073
NPV 375 LE/ha (22.5×10^{11} PIB/ha)	,,	71.67 (8.48)	41.39	1.320
Endosulfan 0.07%	,,	100.00 (10.02)	40.48	1.466
Monocrotophos 0.04%	,,	100.00 (10.02)	44.23	1.573
Endosulfan 0.035% + NPV 125 LE/ha	,,	66.67 (8.15)	37.50	1.533
Monocrotophos 0.02% + NPV 125 LE/ha	,,	75.00 (8.66)	34.46	1.310
Endosulfan 4% dust 20 kg/ha		100.00 (10.02)	39.29	1.450
Control		11.67 (3.47)	58.75	1.346
SE		(0.264)**	NS	NS
CD		(0.82)		

£ Percent mortality P : Values of $\sqrt{P + 0.5}$ in parentheses

** Significant at 1% level; NS=Non significant : LE: Larval equivalents; PIB: Polyhedral inclusion body