J. Biol. control, 3 (1), 37 - 39, 1989

Controlled Droplet Application of Nuclear Polyhedrosis Virus with Adjuvants and UV Protectants For The Control of *Heliothis armigera* Hbn. on chickpea

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ABSTRACT

In a field experiment, addition of whole milk 20 percent, whole egg homogenate 10 percent, Ranipal 0.5 percent, Robinblue 0.5 percent and cotton seed oil 5 percent to nuclear polyhedrosis virus (NPV) in ULV sprays effectively controlled the gram pod borer *Heliothis armigera* (Hbn.) on chickpea, reduced the damage to pods and increased the yield significantly. The virus was applied three times with a controlled droplet applicator. Addition of crude sugar to NPV gave the highest yield; milk, whole egg homogenate and cotton seed oil being equally effective. In two other experiments, the different adjuvants tested could not improve the efficacy of the virus and prevent the damage and loss in yield since the larval population at the time of spraying consisted mostly of grownup stages.

KEY WORDS : NPV, controlled droplet application, adjuvants, UV protectants, *Heliothis armigera*, chickpea

Controlled droplet application of nuclear polyhedrosis virus (NPV) in 20 per cent crude sugar has been shown to effectively control *Heliothis armigera* (Hbn.) on chickpea (Rabindra and Jayaraj, 1988a) and in laboratory tests, several other adjuvants like milk, egg, larval extract of *H. armigera* and UV protectants like Ranipal and Robin blue were found to increase the efficacy and persistence of the virus (Rabindra and Jayaraj, 1988b). With a view to evaluate these substances as adjuvants for NPV of *H. armigera*, field trials were conducted and the results are presented in this paper.

MATERIALS AND METHODS

The virus used in the field trials was propagated in the fourth instar larvae of *H. armigera*, harvested in distilled water and semipurified by filtration and differential centrifugation. Counts of the polyhedral occlusion bodies (POB) were made with a new improved Neubaur haemocytometer and the standardised virus suspension was stored at 4° C until use.

Three field experiments, one during the 1986-87 and the other two during the 1987-88 Rabi seasons, were conducted on 'Shoba' chickpea at Keranatham Pudupalayam Village of Coimbatore district to evaluate the efficacy of various adjuvants like milk, egg, Ranipal, Robinblue, cotton seed oil and crude sugar either alone or in combination of two or three. In the first trial conducted in the *Rabi* season of 1986-87, the plot size was 8 x 5m with gangway of one metre all around and the treatments randomised and replicated thrice were applied three times with a controlled droplet applicator except the high volume treatment of NPV for which a backpack hydraulic sprayer was used. The first spray was given 36 days after sowing and the next two rounds 50 and 77 days after sowing. A cloth screen held all around the plots at the time of spraying, prevented the spray drift to adjacent plots. The different adjuvants (Table 1) were homogenized well before mixing with the virus suspension. Triton X-100 was added to all the treatments as a surfactant at 0.1 per cent for controlled droplet application and 0.01 per cent for high volume treatments. The treatments were applied in the evening hours to minimise the photoinactivation of the virus.

Observations on the larval number were recorded eight days after each spray on ten randomly selected plants in each plot leaving the border rows. Similarly pod damage was recorded in 10 randomly selected plants. At the time of harvest, grain yield in the different plots was recorded.

The other two experiments to evaluate the adjuvants (Table 2) and UV protectants (Table 3) were also conducted in a farmer's field at Pudupalayam and the plot size was 5 x 4 m with a gangway of 1.5 m inbetween the plots. Cotton seed kernel powder was ground in a pestle and

TABLE 1. Field evaluation of adjuvants for ULV application of NPV for the control of *H. armigera* on chickpea

Treatments*	Larval No./10 plants 8 days after spray			% pod damage	Yield of grain kg / ha
	I	II	III		
NPV + Crude sugar 20%	2.3[a]	1.0[ab]	1.3[a]	3.6[a]	796.8[a]
NPV + Milk 20%	1.0[a]	2.0[ab]	1.3[a]	4.7[a]	780.3[a]
NPV + Whole egg homogenate 10%	1.7[a]	3.0[bc]	1.7[a]	5.2[a]	762.2[a]
NPV + Ranipal 0.5%	2.7[a]	3.0[bc]	2.7[ab]	5.0[c]	714.4[b]
NPV + Robin blue 0.5%	2.3[a]	2.7[ab]	2.3[a]	5.7[a]	635.8[c]
NPV + Cotton seed oil 5%	3.3[a]	1.7[ab]	1.7[a]	4.7[a]	773.3[a]
NPV + Triton X-100 0.1%	3.7[a]	1.7[ab]	2.0[a]	4.4[a]	595.1[d]
NPV (High Volume) in 0.01% Triton X-100	2.3[a]	3.7[c]	1.0[a]	4.1[a]	588.0[d]
Endosulfan 350g a.i./ha	2.3[a]	0.7[a]	0.7[a]	3.7[a]	770.9[a]
Control	9.7[b]	12.3[d]	5.7[b]	14.1[b]	372.0[e]

* All treatments contained NPV @ 250 LE / ha

In vertical columns, means followed by similar letters are not different statistically (P = 0.05) by D. M. R. T.

mortar and extracted with small quantities of water and mixed well. The different adjuvants were homogenised well and passed through a muslin and applied with a controlled droplet applicator as described for the first experiment. Endosulfan alone was applied with a high volume sprayer. In this trial only one spray could be given at pod formation stage and the larval population was recorded from 10 randomly selected plants 3, 5, 7 and 10 days after treatment. Pod damage was also assessed on 10 randomly selected plants. The data were subjected to analysis of variance after applying suitable transformations and means were compared with Duncan's multiple range tests.

RESULTS AND DISCUSSIONS

The data on larval population showed that all the treatments could effectively check the larval

TABLE 2. Field efficacy of ULV application of nuclear polyhedrosis virus with adjuvants in the control of *H. armigera* on chickpea

Treatments@	Number of larvae/10 plants* days after				Mean (%) pod damage**
	0	5	7	10	
NPV	9.0	3.3[b]	2.3[ab]	2.0[b]	21.3
NPV + 20% crude sugar (CS) - ULV	7.3	2.0[ab]	1.3[a]	1.3[ab]	16.5
NPV + 15% CS + 5% Cotton seed kernel extract (CSKE)	7.3	2.7[ab]	2.3[ab]	2.0[b]	19.9
NPV + 10%CS + 15% whole egg homogenate (WEH) + 5% CSKE	6.0	1.3[ab]	1.3[a]	1.0[ab]	21.4
NPV + 10% milk + 5% WEH +5% CS	6.3	2.3[ab]	2.3[ab]	1.3[ab]	22.1
Efndosulfan 350g a.i. / ha	8.3	1.0[a]	1.0[a]	0.7[a]	16.9
Control	6.7	6.3[c]	4.7[b]	4.3[c]	23.6

@ All treatments contained NPV @ 250 LE / ha

* In vertical columns, means followed by similar letters are not different statistically (P = 0.05) by D. M. R. T.

** Difference between the means not significant.

TABLE 3. Fi[illegible] ULV application of NPV in combination with UV protectants in the control of *H. armigera* on chi[illegible]

	Number of larvae/10 plants* days after				Mean % pod damage**
	0	5	7	10	
NPV - ULV	11.3	4.3[b]	2.0[a]	2.0[a]	20.4
NPV + 20% Crude Sugar(CS) - ULV	9.7	4.0[b]	1.7[a]	1.7[a]	25.9
NPV + 10% CS + 1% Ranipal - ULV	13.7	3.3[b]	2.3[a]	2.0[a]	27.3
NPV + 5% CS + 5% CSKE + 1% Ranipal - ULV	12.3	3.0[b]	1.3[a]	1.0[a]	19.7
NPV + 5% CS + 1% Ranipal + 1% Robin blue - ULV	9.0	3.0[b]	1.3[a]	1.0[a]	21.5
Endosulfan 350g a.i./ha - High volume (HV)	13.7	1.3[a]	1.3[a]	0.7[a]	28.7
Control	9.0	8.3[c]	6.7[b]	5.7[b]	28.1

@ All treatments carried NPV @ 250 LE / ha

* In a vertical column, means followed by similar letters are not different statistically (P = 0.05) by DMRT.

** Difference between the means not significant

population and were as good as endosulfan Between the adjuvants, there were not much significant differences (Table 1-3). In the first trial, all the treatments were significantly effective in reducing the pod damage. Adjuvants such as crude sugar 20 per cent, milk 20 per cent, whole egg homogenate 10 per cent and cotton seed oil 5 per cent gave significantly higher grain yields than Robin blue or Ranipal. ULV application of NPV along with 20 per cent crude sugar was significantly better than high volume application of NPV.

The efficacy of ULV application of NPV for the control of *H. armigera* on chickpea has already been reported by Rabindra and Jayaraj (1988a) and in laboratory studies, adjuvants like egg. particularly the egg white at 10 per cent and milk at 20 per cent were found to increase the efficacy of NPV against *H. armigera* larvae (Rabindra and Jayaraj 1988b). They also found that Ranipal and Robin blue were not as effective as the other adjuvants but in pot culture tests they increased the persistence of the virus. Ranipal and Robin blue are whitening agents and probably reduced the UV inactivation of the virus by acting as UV screens. Several substances including some whitening agents which protect the virus from the UV inactivation of sunlight have been reported earlier (Ignoffo and Batzer, 1971; Ignoffo *et al.*, 1972; Bull *et al.*, 1976).

In the second (Table 2) and third (Table 3) experiments , the differences in pod damage in the different treatments were not significants and the possible reason may be that only one round of treatment was applied which obviously was not able to control the grownup caterpillars. Due to continuous light showers, spraying could not be taken up when the larvae were in the early stages. This emphasises the need to apply the virus when the pests are in the early stages so as to kill them before they assume damaging proportions.

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