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Combined Use of Nuclear Polyhedrosis Virus with Certain Botanicals for the Control of *Helicoverpa armigera* on Chickpea *

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ABSTRACT

Results of field experiments on the control of *Helicoverpa armigera* (Hbn.) on chickpea (*Cicer arietinum* L.) with nuclear polyhedrosis virus @ 250 larval equivalents /ha in combination with 10 per cent aqueous extract of leaves of *Vitex negundo, Prosopis juliflora, Tagetus patula* and *Argemone mexicana* showed that the botanicals did not increase the efficacy of the virus in reducing the larval population. However, a combination of NPV + *V.negundo* was significantly more effective than virus alone in reducing the damage to flowers and pods.All the botanicals when combined with the virus recorded significantly more number of healthy pods than virus alone. But NPV + *V.negundo* showed higher yield of grain than NPV alone.

KEY WORDS : *Helicoverpa armigera,* Nuclear Polyhedrosis virus, chickpea, *Vitex negundo, Prosopis juliflora, Tagetus patula, Argemone mexicana*

The gram pod borer, *Helicoverpa armigera* Hbn. a serious pest of several crops including chickpea is reported to have developed resistance to several chemical insecticides. The nuclear polyhedrosis virus (HaNPV) has been successfully used for the control of the gram pod borer on chickpea (Rabindra and Jayaraj, 1988 a). Several adjuvants were found to be effective in increasing the efficacy of the virus in the laboratory (Rabindra and Jayaraj, 1988 b) and field (Rabindra *et al.*, 1989). While screening some botanicals capable of increasing the efficacy of HaNPV, Rabindra and Jayaraj (unpublished data) found that aqueous extracts of certain plants like *Vitex negundo* L. and *Prosopis juliflora* Sw. enhanced the mortality associated with HaNPV in larvae of *H.armigera*. Hence, field experiments were taken up in a farmer's field to evaluate the combined use of NPV and certain botanicals in the control of *H.armigera* on chickpea.

MATERIALS AND METHODS

HaNPV was propagated in fourth instar larvae of *H.armigera*. The virus was harvested in distilled water from fresh virosed cadavers and partially purified by filteration through a muslin and then by differential centrifugation. The polyhedral pellet was resuspended in distilled water and stored in a refrigerator at 4°C. Before use, counts of polyhedral inclusion bodies (PIB) were made with a haemocytometer and the concentration of the virus in the stock suspension was assessed. Leaves of *V.negundo, P. juliflora, Tagetus patula* L. and *Argimone mexicana* L. were ground separately in an all-glass pestle and mortar along with minimum quantity of water and a small quantity of acid treated and washed sand. The crude extract was passed through a muslin and then the final volume made up with water so that the concentration would be 10 per cent (W/V fresh weight basis).

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Table 1. Efficacy of nuclear polyhedrosis virus in combination with certain botanicals on the larval population of *H. armigera* on chickpea

Treatments*	No. of Larvae $ /5 plants days after spray								
	I			II			III		
	3	5	7	3	5	7	3	5	7
NPV	4.7 b	4.3 ab	5.0 a	4.7 b	6.7 a	4.3 a	6.0 ab	4.7 a	3.3 a
NPV + *V.negundo*	5.3 b	3.0 a	3.7 a	3.7 ab	5.3 a	3.0 a	4.7 a	3.7 a	2.7 a
NPV + *P.julifora*	3.3 a	3.0 a	3.7 a	3.7 ab	5.7 a	3.3 a	5.7 ab	3.3 a	2.7 a
NPV + *T.patula*	5.7 b	4.7 b	5.0 a	3.0 a	4.0 a	3.0 a	6.3 b	4.0 a	3.7 a
NPV + *A.mexicana*	4.7 b	4.3 ab	4.7 a	4.3 ab	5.7 a	3.3 a	4.3 a	3.7 a	3.0 a
Endosulfan 350 g.a.i / ha	3.7 a	3.0 a	4.7 a	3.3 ab	5.0 a	3.0 a	4.3 a	4.0 a	3.3 a
Control	7.7 c	8.0 c	9.7 b	10.3 c	10.3 b	10.7 b	10.3 c	9.7 b	10.0 b

* NPV @ 250 LE / ha ; botanicals @ 10% aqueous extract

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

The experiment was conducted in a farmer's field of chickpea (cv.Shoha) at Pudupalayam of Coimbatore district in a randomised block design with a plot size of 5 x 4 m. The treatments were replicated three times. A backpack hand compression sprayer with a hollow cone nozzle was used for applying the different treatments (Table 1). The virus was applied at the rate of 250 larval equivalents (LE)/ha. Endosulfan 350 g a.i./ha was included as an insecticide check. Care was taken to avoid spray drift from one plot to the other by holding a cloth screen around the plot. Three rounds of treatments were applied at 10 days interval commencing the first spray 58 days after sowing. Triton X 100 was added at 0.01 per cent as a surfactant to all treatments except endosulfan. The spray fluid used was 500 litres/ha. Larval populations were recorded three, five and seven days after each spray in five randomly selected plants in each plot. Damage to flowers and pods was recorded in five randomly selected plants. Yield of grain in the different plots was recorded at harvest.

The data on larval population was converted to $\sqrt{x}$ +0.5 and the percentages to angles before analysis of variance. The means were compared by Duncan's multiple range test.

RESULTS AND DISCUSSION

The incidence of *H.armigera* on chickpea was fairly heavy during the season; ranging from 2-10 per 5 plants. The data on the larval population in different treatments revealed that all the treatments were more or less equally effective in reducing the larval population of *H.armigera* (Table 1). The aqueous extracts of the different botanicals did not seem to increase the efficacy of the virus in reducing the larval populations. However, a combination of NPV and *V. negundo* recorded significantly lower flower and pod damage than NPV alone. The other botanicals did not seem to be effective. Eventhough the total number of healthy pods per plant in the different treatments of NPV + botanicals was significantly higher than in NPV, significantly higher yield than in NPV was obtained only in NPV - *V.negundo* combination (Table 2).

These data indicate the scope for using aqueous extracts of leaves of *V.negundo* for increasing the efficacy of NPV against *H.armigera* on chickpea. Leaf extracts of *V.negundo* were reported to show toxic effects against lepidopterous larvae (Abraham *et al.*, 1972; Bai and Kandasamy, 1985) and compounds like terpenes, cinole, 1 sabinene and

Table 2. Field efficacy of NPV in combination with plant extract in the control of *H.armigera* on chickpea - damage and yield $

Treatments*	Mean % damage to		Number of healthy pods / plant	Grain Yield Kg/ha
	Flowers	Pods		
NPV	9.2 ^{b}	25.52 ^{b}	26.6 ^{b}	541.67 ^{b}
NPV + *V.negundo*	6.6 ^{a}	16.48 ^{a}	42.3 ^{a}	645.8 ^{a}
NPV + *P.julifora*	8.11 ^{ab}	20.4 ^{ab}	35.0 ^{a}	541.66 ^{b}
NPV + *T.patula*	8.12 ^{ab}	22.02 ^{ab}	37.6 ^{a}	412.3 ^{c}
NPV + *A.mexicana*	9.2 ^{b}	21.00 ^{ab}	34.0 ^{a}	433.33 ^{c}
Endosulfan 350 g.a.i / ha	6.60 ^{a}	20.95 ^{ab}	38.3 ^{a}	445.83 ^{c}
Control	16.20 ^{c}	48.00 ^{c}	13.3 ^{c}	329.17 ^{d}

* NPV @ 250 LE / ha ; botanicals @ 10% aqueous extract

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

sesquiterpenes occurring in *V.negundo* (Itikawa and Yamasita, 1940; Manalo, 1982) might have weakened and predisposed the larvae of *H. armigera* to the action of NPV. The inefficacy of the other botanicals *viz., P. juliflora, T.patula* and *A. mexicana* in enhancing the efficacy of the virus in the field may be due to the instability of the active principles due to degradation by sunlight. Use of suitable adjuvants possessing UV protectant and antioxidant properties might enhance the activity of these substances.

REFERENCES

Abraham, C.C., Thomas, B., Karunakaran, K. and Gopalakrishnan, R. 1972. Relative efficacy of some plant products in controlling infestation by the Angoumois grain moth, *Sitotroga cerealella* Oliver (Gelechiidae, Lepidoptera) infesting stored paddy in Kerala. *Agri.Res.J. Kerala*, **10**, 59-60.

Bai, K.S. and Kandasamy, C.1985. Laboratory-induced mortality of *Spodoptera litura* F. fed on the leaf discs of castor treated with the extracts of *Vitex negundo* Linn. and *Strachytarpheta urticaefolia* (Salish) Sims. *Indian J. agric Sci.*, **55**, 760-761.

Itikawa, N. and Yamasita, Y. 1940. Essential oil of *Vitex negudo* Linn. *J. Chem. Soc. Japan*, **61**, 787-792.

Manalo, B.J. 1982. A study on lagundi oil. The essential oil from *Vitex negundo* growing in the Philippines. *Philip. J. Sci.*, **111**, 79-97.

Rabindra, R.J. and Jayaraj, S. 1988 a. Efficacy of NPV with adjuvants as high volume and ultra low volume applications against *Heliothis armigera* (Hbn.) on chickpea. *Trop. Pest Mgmt.*, **34**, 441-444.

Rabindra, R.J. and Jayaraj, S. 1988 b. Evaluation of certain adjuvants for NPV of *Heliothis armigera* (Hbn.) on chickpea. *Indian J.Exptl. Biol.*, **26**, 60-62.

Rabindra, R.J., Sathiah, N., Muthiah, C. and Jayaraj, S. 1989. Controlled droplet application of nuclear polyhedrosis virus with adjuvants and UV protectants for the control of *Heliothis armigera* (Hbn.) on chickpea. *J.Biol. Control*, **3**, 37-39.