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Biochemical Potentiation of Nuclear Polyhedrosis Virus of *Spodoptera litura (F.)*

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ABSTRACT

Studies were conducted to potentiate NPV of *Spodoptera litura* by biochemical adjuvants for maximisation of control of the pest in FCV tobacco nurseries and field crop. The studies established that addition of tannic acid 0.25% and boric acid 0.35 % gave maximum efficacy. The significance of this finding is that boric acid and tannic acid, the commonly used chemicals in tobacco culture, are not only compatible with NPV but also potentiate it, thereby satisfying the basic concept of compatibility of entomoviruses with agricultural chemicals.

Key words : *Spodoptera litura* NPV, potentiation, boric acid, tannic acid

Much progress has been made in the isolation, identification, mass production and field use of insect pathogens in the last few decades. However, much more studies are needed on increasing the virulence of the pathogens (Jayaraj, 1984). Therefore, studies were conducted during 1985-87 on the potentiation of NPV of *S. litura* (F.) for improved efficacy in the control of the pest in FCV tobacco nurseries and field crop. Three types of biochemicals were evaluated for efficacy in enhancing the viral activity against *S. litura* larvae on tobacco: (a) Addition of alkaline compounds; carbonates (Na_2CO_3) naturally occurring in the insect midgut in order to augment their concentration, (b) addition of general proteolytic activators ($CaCl_2$) for improved enzymatic activity, since calcium and magnesium chlorides are generally known as activators or co-factors for many proteolytic enzymes and (c) addition of mildly toxic inorganic compound, boric acid and organic compound tannic acid for any possible synergism due to their stress on the physiology of the insect as well as damage to the gut by their abrasive and astringent action.

MATERIALS AND METHODS

The studies were conducted during 1985-87 on flue-cured virginia tobacco nuseries and tobacco fields. In the nursery study, nursery beds (1m × 1m) were raised with 250 seedlings free from insect damage. When the seedlings were of transplantable age (5-6 weeks old) sprayings were carried out with NPV @ 100 larval equivalents (LE) / acre alone, NPV 100 LE/ acre + boric acid 0.25%, NPV 100 LE/ acre + tannic acid 0.25%, NPV 100 LE/ acre + Na_2CO_3 0.25%, NPV 100 LE/ acre + $CaCl_2$ 0.25% and endosulfan 0.05% (check). The treatments were randomized and replicated four times in simple randomized block design. The sprayings were carried out in the evening and ½ teaspoonful of starch/lit of spray fluid was added to the viral preparations as UV protectant. Soon after spraying, 3-5 day-old laboratory-bred *S. litura* larvae were released in the nursery @ 100 per bed. Observations on the number of seedlings damaged, leaves damaged and dead larvae were recorded seven days after spraying.

In the field study, the plots consisted of 5 × 4 rows and sprayings were carried out with the above given treatments three weeks after transplanting. The treatments were randomized and replicated four times in RBD. Soon after sprayings, 3-5 day old laboratory reared *S. litura* larvae were released @ 30/plant on 5 plants labelled at random in each plot. Observations were recorded on the number of leaves damaged per plant, and number of dead larvae. The data were transformed to $\sqrt{x+1}$ before doing the analysis of variance.

RESULTS AND DISCUSSION

Results of both the nursery as well as field trials showed that addition of boric acid or tannic acid @ 0.25% enhanced the mortality of *S. litura* larvae due to NPV which was however more evident in field trial (Table 1). Between boric acid and tannic acid there were no significant differences. But these two compounds could not improve the efficacy of

Table 1. Synergistic effect of chemical adjuvants for NPV for the control of *Spodoptera litura* larvae on tobacco

TREATMENTS	NURSERY TEST: Damage on 7th day to		NURSERY TEST: No. of dead larvae days after		FIELD TEST: Mean number of leaves damaged/plant days after		FIELD TEST: Mean number of larvae dead/plant days after	
	Seedings/bed	Leaves/plant	2	7	2	7	2	7
NPV 100 LE ac	8.17 ab	9.80 bc	6.60 d	18.69 ab	2.94 b	4.65 b	0.90 c	9.05 b
NPV 100 LE + Boric acid 0.25%	5.14 ab	7.14 ab	11.76 bc	24.19 a	1.68 a	2.03 a	3.14 b	11.00 a
NPV 100 LE + Tannic acid 0.25%	4.66 a	5.83 a	13.91 b	25.83 a	1.52 a	2.35 a	3.05 b	11.64 a
NPV 100 LE + $CaCl_2$ 0.25%	8.41 ab	9.90 bc	7.50 cd	15.97 b	3.52 b	4.69 b	1.39 c	6.40 c
NPV 100 LE + Na_2CO_3 0.25%	9.75 b	12.04 c	8.03 cd	15.97 ab	3.49 b	4.59 b	1.74 c	6.08 c
Endosulfan 0.05% (check)	18.33 c	21.95 d	21.93 a	0.66 c	1.79 a	4.80 b	11.55 a	0.70 d

Means followed by similar letters are not different statistically (P = 0.05) by L. S. D.

NPV in preventing the damage to seedlings. On leaf basis, however, NPV+ tannic acid recorded significantly lower damage than NPV alone. In field trial, both the compounds when applied with NPV could reduce the damage to leaves better than NPV alone. Neither $CaCl_2$ nor Na_2CO_3 @ 0 25% could improve the efficacy of NPV against *S. litura*. Observations on the leaf damage seven days after treatment revealed that applications of NPV was superior to endosulfan against *S. litura* larvae in the nursery, but in the field they were on par.

Boric acid is already known to increase the efficacy of entomopathogens like bacteria and nuclear polyhedrosis viruses, by altering the susceptibility of the host rather than virulence of the pathogen (Aizawa, 1971). Shapiro and Bell (1982) recorded enhanced effectiveness of *Lymantria dispar* NPV when it was formulated with boric acid. Addition of boric acid was found to increase the pathogenicity of *Bacillus thuringiensis* Berliner to larvae of *S litura* by Govindarajan *et al.* (1976). Apart from boric acid, tannic acid, Na_2CO_3 and $CaCl_2$ also enhanced the activity of *B. thuringiensis* (Salma *et al.*, 1984). Incidentally, boric acid and tannic acid are commonly used in tobacco cultivation (Gopalachari, 1984) and their efficacy in increasing the potency of NPV against *S. litura* adds to their usefulness.

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Effect of Host Plants and Site of Application on the Infectivity of Nuclear Polyhedrosis Virus to *Spodoptera litura* Larvae

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ABSTRACT

The effect of eight common host plants on the mortality and incubation period in *Spodoptera litura* (F.) larvae to a constant dose of nuclear polyhedrosis virus (NPV) was studied. Maximum mortalities were obtained on tobacco (96.67%), cauliflower (96.67%) and cabbage (93.33%) with minimum incubation period (7.67 to 8.67 days). Application of NPV to both lower and upper leaf surfaces of tobacco and cotton caused maximum mortality. Application to lower surface alone caused higher mortality than that applied to upper surface only.

Key words : *Spodoptera litura* NPV, infectivity, host plants, site of application

A nuclear polyhedrosis virus (NPV) was reported to infect the tobacco cut worm *Spodoptera litura* (F.) by Ramakrishan and Tiwari (1969). The factors responsible for the mode of action of the virus in *S. litura* were studied by Narayanan and Jayaraj (1978). The virus was found to effectively control the pest on various crops like cotton (Jayaraj *et al.*, 1980),