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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),

banana (Santharam *et al.*, 1978), tobacco (Ramakrishnan *et al*, 1981), blackgram (Mahadevan and Kumaraswami, 1980) and cauliflower (Chaudhari and Ramakrishnan, 1980). The present investigation was taken up to determine the influence of host plants and site of application on plants on the infectivity of NPV to *S. litura* larvae.

MATERIALS AND METHODS

Influence of host plants

A pot culture experiment was conducted to find out the effects of host plants on the susceptibility of fourth instar larvae of *S. litura* to NPV. The different host plants *viz.*, tobacco, cotton, *Gossypium barbadense* (cv. Suvin) and *G. hirsutum* (cv. MCU 5), cauliflower, cabbage, knolkhol, beetroot and castor were grown in earthen pots (30 cm). The test plants at the age of 60 days after sowing in the case of knolkhol, beetroot and castor, 75 days in cotton and 45 days after transplanting in tobacco, cauliflower and cabbage, were sprayed with NPV at 2 X 10^6 polyhedral occlusion bodies (POB)/ml using a high volume knapsack sprayer. Teepol was added at 0.05% and the plants were thoroughly wetted with the spray fluid. To avoid migration of the larvae, the treated plants were covered with polyester film cages, open at the top and having three side windows at the middle covered with muslin cloth Fourth instar larvae of *S. litura* were introduced @ 20 per pot immediately after the treatment. Observations were recorded daily on the mortality of larvae due to NPV.

Effect of crop and site of application of NPV

To find out the influence of site of application of NPV, an experiment was conducted under pot culture conditions with cotton and tobacco. The leaves of tobacco 45 days after transplanting and cotton (*G. barbadense*) (cv. Suvin), 75 days after sowing, were sprayed on (i) the upper surface alone, (ii) the lower surface alone and (iii) on both surfaces. Care was taken to treat the leaf surfaces by directing the sprayer nozzle to either surface alone without contaminating the other. The NPV was applied at 2 X 10^6 POB/ml along with a wetting agent (Teepol) using a high volume knapsack sprayer. Calculated quantities of spray fluid per plant based on the 750 litres of spray fluid/ha and a population of tobacco plants spaced at 75 X 75 cm and cotton plants at 90 X 45 cm were used for covering both the surfaces of leaves. Only half of this quantity was used to treat one of the either surfaces. The larvae were confined and mortality was observed as described earlier. Each treatment was replicated four times and 20 larvae were used per replication.

RESULTS AND DISCUSSION

Influence of host plants

The mortality of larvae fed on knolkhol, cotton (*G. hirsutum*) and beet root plants sprayed with NPV @ 2 X 10^6 POB/ml was 75.0 - 78.3% only as against 93.3 to 96.7% observed on cabbage, tobacco and cauliflower. Cotton (*G. barbadense*) and castor plants occupied intermediate positions in producing larval mortality due to virus (Table 1).

The incubation period did not show wide variation among larvae fed on different host plants and it ranged from 7.67 to 10.0 days. Mini-

Table 1. Influence of host plants on the NPV infectivity and incubation period in [illegible] instar larvae of *Spodoptera litura*

Host plant	Mean % mortality	Mean* incubation period (days)
Knolkhol	76.67c	9.00bc
Beetroot	78.33c	8.33a
Tobacco	96.67a	7.67a
Cotton (*G. barbadense*)	85.00b	9.33bc
Cotton (*G. hirsutum*)	75.00c	10.00c
Cauliflower	96.67a	7.67a
Cabbage	93.33ab	8.67ab
Castor	88.33b	9.33bc

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

mum period of 7.67 days was observed on tobacco and cauliflower. On beetroot and cabbage also the incubation period was comparable to the above crops, as the difference was not significant (Table 1). Excepting in the case of beetroot, the incubation time was found to be short wherever the mortality was high.

The larvae of *S. litura* are polyphagous and feed on a variety of crop plants and the efficacy of NPV applied on these may vary Jayaraj *et al* (1976) found variation in the efficacy of NPV on the larvae of *Amsacta albistriga* (Walker) on various plants. While maximum mortality of 91.6% was observed on groundnut, least mortality of 61.3% was observed on sorghum where the feeding efficiency was very poor.

In the present study, the larval mortality due to NPV was significantly higher on tobacco, cauliflower and cabbage than on knolkhol, beetroot and cotton. This may be due to the differential feeding rate *vis-a-vis* acquisition of NPV on these plants. The differential host preference of this polyphagous insect is well understood. Moussa *et al.* (1960) found that berseem is a preferred host over cotton, grapevine and maize for *S. litura*. Mahadevan (1978) reported that mean larval period of *S. litura* on castor and sunflower was shorter compared to that on maize. The growth index was maximum on castor and minimum on maize. Reddy (1981), based on the larval development reported that castor was the preferred host followed by lucerne, tobacco and banana. Similarly, Balasubramanian (1982) found that the larval period was minimum on castor than on sweet potato, sunflower, brinjal, lucerne, tomato, cotton and bhendi which indicated the preference of the host larvae to castor.

The larvae feed more of the leaf matter on the preferred hosts. The inoculum ingestion is influenced by the rate of consumption of leaf matter. When more food material is consumed, the inoculum ingested is also high. Based on the inoculum ingested, the mortality and incubation period vary (Jacob and Subramaniam, 1972). In the present study also the preference

Table 2 Effect of crop and site of application of NPV on larval mortality of *S. litura*

Host plant	Leaf surface **			Mean
	Upper	Lower	Both	
Tobacco*	41.25 a	78.75 a	97.50 a	72.50
Cotton* *(G. barbadense)*	33 75 a	56.25 b	85.00 b	58.33
Mean*	37.50	67.50	91.25	

* Means differ significantly (P=0.01) from each other by L. S. D.

** In a vertical column means followed by same letters are not different statistically (P=0.05) by L. S. D.

of the host plants could have resulted in the differential mortality of the larvae. Further studies on the leaf area consumed in different host plants by *S. litura* larvae may confirm this hypothesis. The present findings lead to the conclusion that the NPV dose has to be fixed after experimentation with each crop for the control of the pest.

The mortality of larvae on tobacco treated on both sides of leaves was higher than that fed on cotton, as was observed in the previous experiment (Table 2). When the leaf surfaces were compared, application on both the surfaces of leaves invariably resulted in higher mortality irrespective of the host plants Application of the virus only on the lower surface resulted in significantly higher mortality than application on the upper surface in both the host plants. Applying NPV on both surfaces of leaf improved the extent of mortality only by 18.7% in tobacco, but in cotton this was by 28.7%

The low mortality in the case of upper surface application of NPV may be due to the fact that the virus applied might have been inactivated quickly by the UV component of the sunlight whereas, that applied on lower surface was protected. The mortalities on both the plants were high when NPV was applied on both the surfaces. This is due to the protection of the NPV applied on the lower surface and also due to combined effect of the total inoculum on both the surfaces.

Yearian and Young (1974) found that the deposits of *Heliothis* NPV persisted for longer periods on the more shaded parts such as squares, calyxes, square bracts, blooms and undersides of leaves of cotton plants compared to more exposed parts such as upper surface of leaves Stacey *et al.* (1977) also reported similar results with *Heliothis* NPV on cotton. Hwang and Ding (1975) found the same phenomenon with the application of NPV on *S. litura*.

The results of this study indicate that for better control of the pest, the virus spray should be applied on both the surfaces of the leaves more particularly on the underside of the foliage.

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