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Age related response of tobacco caterpillar, *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae) to Biovirus-S, a commercial formulation of nuclear polyhedrosis virus

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ABSTRACT: **Laboratory tests were carried out to evaluate the effectiveness of Biovirus-S, a commercial formulation of nuclear polyhedrosis virus (*Sl* NPV) against the different age groups of *Spodoptera litura* (Fabricius) larvae. The susceptibility of the larvae correlated negatively with the larval period of development. LC_{50} values of one day old larvae were found 2.7, 277.0 and 61951.2 times more susceptible than three, five and eight day old larvae, respectively. Ten-day-old larvae required comparatively higher concentrations of Biovirus-S ($1.39x10^{10}$ POBs/ml), thereby indicating decreased susceptibility.**

KEY WORDS: Bioefficacy, Biovirus-S, *Sl* NPV, *Spodoptera litura*, susceptibility

Spodoptera litura (Fabricius), the tobacco caterpillar, is a polyphagous pest attacking 65 plant species belonging to 22 families (Moussa *et al.*, 1960; Prasad and Bhattacharya, 1975) and is reported to have developed resistance to decamethrin, fenvalerate, endosulfan, cypermethrin, lindane and malathion (Singh and Singh, 1998). This led to search for an alternate strategy for the management of this pest. One such envisaged method is the use of microbial pesticides, particularly nuclear polyhedrosis virus (NPV). The NPV of *S. litura* (*Sl* NPV) has been used for the management of this pest during the last few decades with encouraging results (Sachithanandam, 1988; Yi and Li, 1989). Since all larval instars of tobacco caterpillar occur on crops simultaneously, as such the bioefficacy of commercial *Sl* NPV will be desired on age related larval susceptibility which will be helpful in developing an effective control schedule on crops. This prompted to study the age ralated bioefficacy of *S. litura* to the Biovirus-S (*Sl* NPV).

MATERIALS AND METHODS

Commercial formulation of *Sl*NPV, Biovirus-S (Biotech International Limited, New Delhi) with $1x10^9$ POBs/ml concentration was used as a stock solution to conduct the study. The culture of *Spodoptera litura* (Fabricius) was maintained on castor (*Ricinus communis*) leaves at 27±1°C temperature and 70±5 percent relative humidity (RH). However, the test insects were maintained on artificial diet (Shorey and Hale, 1965) in order to eliminate the natural occurrence of disease, if any.

Bioassay was conducted using seven concentrations of Biovirus-S, *viz.*, $1x10^2$, $1x10^3$, $1x10^4$, $1x10^5$, $1x10^6$, $1x10^7$, and $1x10^8$ POBs/ml prepared by serial dilutions of stock solution containing $1x10^9$ POBs/ml with distilled water. Each treatment had three replicates with ten larvae each. A control was also maintained on untreated diet. One, three, five, eight and ten day old *S. litura*

larvae (Starved for 2h) were fed on *Sl*NPV impregnated artificial diet for 24 hours and then transferred on fresh diet. Mortality was recorded after every 24 hours of treatment for an extended period of ten days. The cumulative mortality in three replicates was pooled together and corrected percent mortality was calculated using Abbott's formula (Abbott, 1925). The data obtained were then subjected to Probit analysis (Finney, 1971).

RESULTS AND DISCUSSION

The LC_{50} values obtained for 1, 3, 5, 8, and 10-day-old larvae were $8.2x10^3$, $2.22x10^4$, $2.273x10^6$, $5.08x10^8$ and $1.39x10^{10}$, POBs/ml, respectively (Table 1). The data revealed that one day old larvae were 2.707, 277.00 and 61951.22 times more susceptible than 3, 5 and 8 day old larvae, whereas, the second instar larvae were reported to be 3.5, 92 and 2314 fold more susceptible than the third, fourth and fifth instar larvae (Monobrullah and Nagata, 2000). However, Evans (1981) observed the LD_{50} values for third, fourth and fifth instar larvae 5, 50 and 250 times that of second instars of *Mamestra brassicae*.

The Probit dose mortality line for ten-day-old larvae had slope that was significantly lower than that of younger larvae (Fig. 1). The shift in position of the Probit lines reflected that the older larvae displayed greater variation in response to *Sl*NPV. The decrease in 'a' value denoted an overall reduction in mortality due to *Sl*NPV with increasing host age. The downward shift of the line resulted in an increase in LC_{50}. The drop in 'b' value showed that the increase in mortality due to increased dosage decreased with host age. However, quantitative differences in LC_{50} values were observed between different age groups of *Trichoplusia ni* (Milks *et al.*, 1998) and *S. litura* (Kamala Jayanthi, 1992; Tuan *et al.*, 1998). The negative correlation between susceptibility was attributed to increase in biomass with advancing age, which is in agreement with the findings of Evans (1981, 1983) and Teakle *et al.* (1985). Ten-day-old larvae were found to be more resistant to *Sl*NPV because the physiological changes associated with pupation might not allow infection at this late developmental stage. The possibility of biovirus not getting sufficient time to replicate and/or kill the larvae may not be ruled out. Such a suggestion gets support from the findings of Whitlock (1977), Evans (1981) and Teakle *et al.* (1986).

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Table 1. LC_{50} values of *Sl* NPV for different age groups of *S. litura* larvae

Age of larvae (in days)	LC_{50} (POBs/ml)	Fiducial limit (95 %)		Slope (b)	Intercept (a)
		Lower	Upper		
1	8.2×10^3	1.14×10^3	9.462×10^3	0.739	2.1035
3	2.22×10^4	8.67×10^3	3.35×10^4	0.826	1.407
5	2.273×10^6	3.13×10^4	5.5×10^6	0.635	0.950
8	5.08×10^8	8.03×10^7	5.78×10^9	0.472	0.888
10	$1.39\times10^{10\#}$	4.03×10^8	1.46×10^{11}	0.278	-0.888

Value obtained by extrapolation

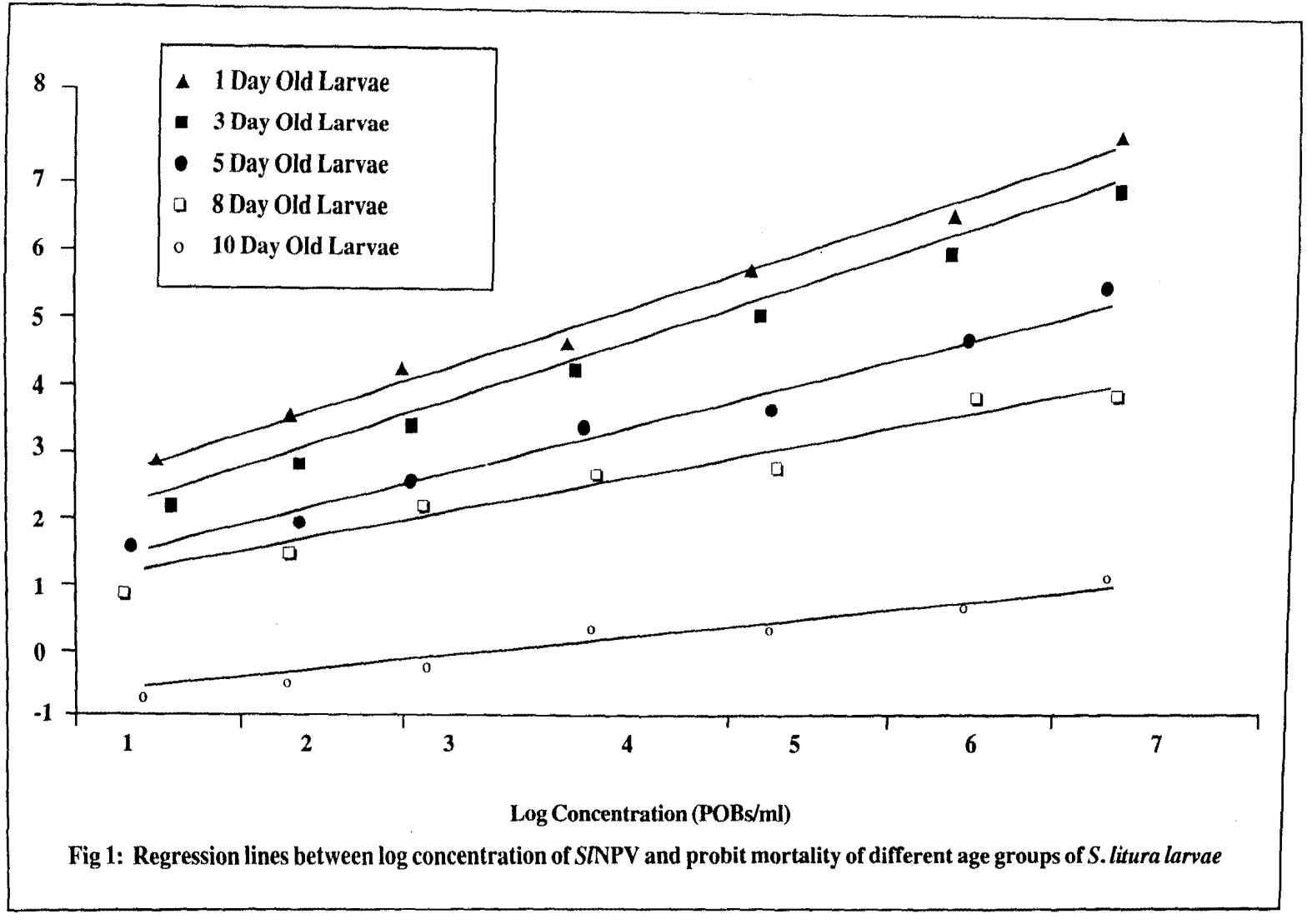

Fig 1: Regression lines between log concentration of *SI*NPV and probit mortality of different age groups of *S. litura larvae*

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