



EFFECTIVE TOXICITY OF NPV TO SECOND AND FOURTH INSTAR LARVAE OF *HELICOVERPA ARMIGERA* (HUBNER) ON TOMATO

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ABSTRACT

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Effective toxicity of different doses viz. 1.2×10^7 , 0.9×10^7 , 0.6×10^7 , 0.3×10^7 , 0.15×10^7 , and 0.9×10^6 PIB^s/ ml HaNPV along with distilled water as control was assessed against 2nd and 4th instar larvae of the tomato fruit borer, *Helicoverpa armigera* (Hubner) under laboratory conditions. The LC₅₀ values of HaNPV for 2nd instar larvae of *Helicoverpa armigera* was 0.1603 per cent (0.19×10^7 PIB^s/ ml) with fiducial limit ranged from 0.22758 to 0.11300, while in case of 4th instar larvae, the LC₅₀ value was 0.2225 % (0.26×10^7 PIB^s/ ml) and fiducial limit ranged from 0.29946 to 0.16541.

INTRODUCTION

Tomato, *Lycopersicon esculentum* one of the most important vegetable crop, is attacked by several insect pest from the time of planting to till fruit is harvested. The fruit borer, *Helicoverpa armigera* (Hubner) is important in almost all the tomato producing area causing substantial losses in yield (Jain and Gupta, 1995). As the excessive indiscriminate and continuous use has resulted in the development of insecticidal resistance in the pest, deleterious effect on parasites and predators, residual hazards to men and domestic animals and some other environmental pollution problems, it was desirable to replace them, with some ecofriendly biopesticides (Vyas and Yadav, 1992). The Nuclear Polyhedrosis Virus (NPV) has potential and offers an excellent logical scope in management strategies of *Helicoverpa armigera* on tomato crop. Keeping in view, emphasis is being given particularly on the use of effective dose of NPV, which can be suitably acceptable in pest management programme. Therefore, the present investigation was carried out to evaluate the efficacy of NPV against *H. armigera* under laboratory conditions, to utilize them in IPM modules.

MATERIALS AND METHODS

The experiment was conducted to find out the effective dose, through laboratory studies, of the test component nuclear polyhedrosis virus (NPV). The efficacy of

NPV was tested against 2nd and 4th instar larvae of *H. armigera* by leaf dip method. The stock suspension of HaNPV was obtained from Biotech International Ltd. The formulation was employed against *H. armigera* larvae in laboratory trials. One milliliter of the formulated product contained 1.2×10^9 PIB^s (Polyhedral inclusion bodies). The quantities equivalent to 2.5, 1.875, 1.25, 0.625, 0.325 and 0.1875 ml drawn from the HaNPV solution were diluted in 250 ml distilled water contained in each 1000 ml sterilized Borosil beaker. Thus, each of these suspensions had potency of 1.0, 0.75, 0.5, 0.25, 0.125 and 0.075 per cent of the product equivalent to 1.2×10^7 , 0.9×10^7 , 0.6×10^7 , 0.3×10^7 , 0.15×10^7 , and 0.9×10^6 PIB^s/ ml, respectively. PVC containers of 65 × 55 were disinfected with 1.0 per cent formalin solution and left over night for drying and these dried containers were used for maintaining individually starved (8 h) 2nd and 4th instar larvae of *Helicoverpa armigera* along with treated food. For the experiment fresh tomato leaves of equal size were taken, washed with distilled water, dried and then dipped for 25 sec in respective HaNPV concentrations. The leaves then were air dried and provided to the prestarved 2nd and 4th instar larvae of *H. armigera* for feeding. In case of control, tomato leaves were dipped in distilled water for 25 sec. The larvae were provided with treated food for 24 h, thereafter, fresh untreated food was offered to complete the rearing.

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Twenty larvae, replicated thrice were used for each NPV concentrations. Mortality and deformities consequent to the treatments were recorded in each stage till the emergence

RESULTS AND DISCUSSION

The body symptoms of HaNPV infected larvae were manifested and mortality recorded, the larvae stopped feeding, become somewhat sluggish and yellowish to pale in colour, slightly swelled then become limped and flaccid. Shortly before death the integuments become fragile ruptured emitting the liquefied contents with disintegrating tissues and polyhedral. Prior to death the insect climbed to higher positions and the dead larvae were usually found hanged by their prolegs. The mortality percentage for larvae of *H. armigera* against HaNPV ranged from 35.00 to 83.33% (Table-1) in 2nd instar and 30.00 to 80.00% 4th instar larvae at different doses (0.075 – 1.0 %). The LC₅₀ values ((Table-2) of HaNPV for larvae of *Helicoverpa armigera* were 0.1603% in 2nd instar larvae and 0.2225% in 4th instar larvae.

Manjula and Padmavathamma (1999) evaluate HaNPV against larvae of *Helicoverpa armigera* and reported

of adults. The data on cumulative mortality percentage were statistically analyzed using bioassay and probity analysis.

higher percent larval mortality to early instar larvae as compared to late instar larvae support the present investigation. AbouBakr *et al.*, (1984) evaluate HaNPV against larvae of *Helicoverpa armigera* and reported 66% mortality to early instar larvae as compared to 56% to 4th instar larvae and Odok *et al.* (1984) also reported that the local Jabalpur and Narsinghpur NPV were effectively causing 66.6-72.5% mortality in the laboratory is in agreement with the present findings. Data (Table-3) shows that results on comparative LC₅₀ value, fiducially limit, regression equation and heterogeneity of HaNPV to 2nd and 4th instar larvae of *H. armigera*. The LC₅₀ values of HaNPV for 2nd instar larvae of *Helicoverpa armigera* was 0.19×10^7 PIB/ml (0.1603%) with a fiducial limit ranged from 0.22758 to 0.11300, while in case of 4th instar larvae, the LC₅₀ value was 0.26×10^7 PIB/ml (0.2225 %) and fiducial limit ranged from 0.29946 to 0.16541.

Table 1 Effect of NPV on the biological features to 2nd instar larvae of *Helicoverpa armigera*

NPV Conc. (%)	No. of insect exposed	Larval survival to			Mortality		Corrected % age	LC ₅₀
		Larvae	Pupa	Adult	No.	% age		
0.075	60	20	1	39	21	35.00	35.00	
0.125	60	25	1	33	26	43.33	43.33	
0.25	60	33	3	24	36	60.00	60.00	0.1603
0.50	60	41	2	17	43	71.66	71.66	
0.75	60	47	1	12	48	80.00	80.00	
1.0	60	52	1	7	53	83.33	83.33	
Water	60	60	0	60	0	0.00	--	

Table 2 Effect of NPV on the biological features to 4th instar larvae of *Helicoverpa armigera*

NPV Conc. (%)	No. of insect exposed	Larval survival to			Mortality		Corrected % age	LC ₅₀
		Larvae	Pupa	Adult	No.	% age		
0.075	60	17	1	41	18	30.00	28.81	
0.125	60	22	1	37	23	38.33	37.28	
0.25	60	31	2	27	33	55.00	54.23	0.2225
0.50	60	37	1	22	38	63.33	62.41	
0.75	60	44	1	15	45	75.00	74.57	
1.0	60	47	1	12	48	80.00	79.66	
Water	60	1	0	59	1	1.66	--	

Table 3 Effective LC₅₀, fiducial limit, regression equation and heterogeneity of NPV to 2nd and 4th instar larvae of *H. armigera*

Instar of	Regression equation	Heterogeneity	Fiducial limit		LC ₅₀ (%)
Second instar	Y=5.3040+1.31734 x	0.52021	0.22758	0.11300	0.1603 or 0.19×10^7 PIBs/ml
Fourth instar	Y=5.1578+1.22305 x	0.43077	0.29946	0.16541	0.2225 or 0.26×10^7 PIBs/ml

Abbas and El-Dakrouy (1988) reported that concentration of 2.2×10^8 polyhedral inclusion bodies (PIBs)/ ml of NPV resulted up to 100 and 93% mortality in 2nd and 4th instar larvae, respectively are in agreement with present findings. Vyas and Yadav (1992) reported 80 and 100% mortality having 10^9 and 10^{12} PIBs/ml under laboratory and field conditions, respectively. Similarly, in present findings 83.33% mortality was recorded in NPV treatment having 10^7 PIBs/ml. Jain and Gupta (1995) reported the LC₅₀ value of NPV for 2nd and 4th instar larvae of *Helicoverpa armigera* was 0.1078% and 0.2269% are in agreement with present findings. Tyagi *et al.* (2010) revealed that the overall mean mortality of different concentration was 91.0, 76.3, 64.4, 56.0 and 49.9 per cent in 2, 4, 6, 8 and 12 days old larvae, respectively.

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