Laboratory evaluation of available commercial formulations of HaNPV against *Helicoverpa armigera* (Hub.)

M. Srinivasa, C.S. Jagadeesh Babu, C.N. Anitha and G. Girish

ABSTRACT

In vitro studies on dosage mortality response of *Helicoverpa armigera* (Hub.) to different commercial formulations of HaNPV showed the lowest LC_{50} value (3.12 X 10^4 POBs per ml) for BPMS formulation, which indicated its higher virulence compared to other formulations. The HaNPV of PCI, MBP and ZARS-G were on par with each other with $9.5X10^5$, $9.4X10^5$, $15.6X10^5$ POBs per ml and highest LC_{50} value was recorded with HaNPV formulations of PDBC ($11.42X10^6$ POBs/ml).

Keywords : HaNPV, *Helicoverpa armigera,* Mortality, LC_{50}

INTRODUCTION

The gram pod borer, *Helicoverpa armigera* (Hub.) has recorded to feed on more than 181 cultivated and wild species belonging to 45 botanical families (Manjunath, *et al*., 1992). The damage on pigeonpea by this pest has assumed a special significance due to its wide spread occurrence in all the pigeonpea growing regions. Of the total pesticides consumption in India, 4.00 per cent is applied on pulses in which 80 per cent is used on pigeonpea alone. In pigeonpea, the insecticide usage accounts for nearly 50 per cent of the cost of cultivation (Odek, 1990). Large-scale overuse and frequent misuse of insecticides has led to problems like development of resistance and elimination of natural enemies, besides posing the problem to humans. Safer, effective and economical options are therefore desirable in the integrated approach to manage pod borer complex. Biopesticides based on baculovirus group, the nucleopolyhedrosis (NPV) offers great scope against *H. armigera* (Jayaraj, 1985; David, 2008). Baculoviruses are known to be highly variable, with isolates collected from the same species in different geographical locations frequently showing genetic variation and differences in their biology (Cory *et al*., 2005). Short persistence in the field and susceptibility to ultra-violet radiation from sunlight are some of the reasons for moderate levels of pest control by these viruses. Shapiro *et al*. (2002) studied the effects of virus concentration and UV irradiation on the activity of corn earworm (*Helicoverpa zea*) and beet armyworm (*Spodoptera exigua*) NPVs are found a positive relationship between virus concentration (=virus rate) and virus persistence. To overcome this, viral isolates with greater virulence and increased persistence in the environment can be selected. Keeping these in view, investigations were carried out on the comparative efficacy of different commercial formulations of *H. armigera* nucleopolyhedrol virus isolates (HaNPV).

MATERIAL IS AND METHODS

The experiment was conducted at ZARS, GKVK, Bangalore with available commercial HaNPV formulations. The laboratory-reared culture of *H. armigera* was subjected to the bioassay to assess the efficacy of different commercial HaNPV formulations. Different formulations used for study are given in Table 1.

Five to six concentrations in geometrical proportion were selected for the preliminary trials. The mortality data of the larvae obtained in the preliminary trial was used for determining the concentrations for the detailed bioassay. The concentrations that gave 90 per cent mortality in the preliminary bioassay were considered as the highest concentration for the detailed bioassay. Separate

Table 1. Details of Polyhedral Occlusion Bodies (POBs) of commercial formulations of HaNPV tested.

Source/Organization	POB load indicated on the container(POBs/ml)	Actual POB load (POBs/ml)
Pest Control India, Pvt Limited, Bangalore (PCI)	$1X10^9$	$4.68X10^8$
Project Directorate of Biological Control, Hebbal, Bangalore (PDBC)	100LE	$2.18X10^9$
Margo Bio Pesticides, Bangalore (MBPS)	100LE	$5.65X10^9$
Biopest Management Services, Bangalore	$1X10^{11}$	$2.91X10^9$
ZARS, Gulbarga (ZARS-G)	$6X10^9$	$3.74X10^9$

Table 2. Probit analysis for dose- mortality response of *H. armigera* to commercial formulations of Nuclear Polyhedrosis Virus

Source of HaNPV formulation	LC_{50}POBs/ml	Fiducial Limits POBs/ml	Regression equation	Chi square(n=5)
PCI	$9.5X10^5$	4.70 – 15.03	Y= -3.094 + 0.817X	1.71
PDBC	$11.42X10^6$	6.08 – 21.60	Y= -4.197 + 0.595X	0.26
MBP	$9.4X10^5$	4.80 – 19.41	Y= -3.031 + 0.49X	1.44
BPMS	$15.6X10^5$	7.50 – 33.75	Y= -4.063 + 0.528X	1.09
ZARS (G)	$3.12X10^4$	2.35 – 11.17	Y= -1.711 + 0.387X	1.15

bracketing or preliminary studies were carried out before bioassay for each of the commercial HaNPV formulation. Stock solution for higher concentrations was prepared initially and then serially diluted to get the required lower concentrations. Five concentrations were used in each bioassay along with an untreated control.

Bioassays were conducted by diet surface contamination method. Each concentration had three replications of twenty larvae each. 10 micro litre of predetermined concentration of released and allowed to feed for 72 hours. Then they were replaced with normal diet. The larvae in untreated check were dipped in 0.05% Triton-X-100 solution.

Observations on larval mortality were recorded from third day to eighth day. The mortality data recorded were corrected depending upon the mortality in the control following Abbots formula and subjected to probit analysis for determination of median lethal concentrations. The LC_{50} values thus obtained from the assay were utilized for comparing the efficacy of different commercial HaNPV formulation against *H. armigera.*

RESULTS AND DISCUSSION

Commercial formulations of the HaNPV were evaluated against third instar larvae of *H. armigera* under laboratory conditions. Probit analysis to determine LC_{50} of different formulation of HaNPV on third instar larvae is given in Table 2.

Cumulative mortality of larvae increased with an increase in the concentrations. The median lethal concentration of HaNPV from PCI was $9.5X10^5$ POBs per ml followed by $9.4X10^5$ POBs per ml with that of MBP and $15.6X\ 10^5$ POBs per ml with that of HaNPV of ZARS-G. HaNPV of PDBC recorded the highest LC_{50} of $11.42X10^6$ POBs per ml. The lowest LC_{50} was in case of HaNPV of BPMS ($3.12X10^4$ POBs per ml) proving that virulent formulation among the different formulation tested.

Rabindra and Subramanian (1974) reported the LC_{50} values for first and third instar larvae of *H. armigera* as $8.3X10^3$ and $28.6X10^5$ POBs per ml, respectively. Teakle *et al*. (1985) reported that the LC_{50} value for the commercial nuclear polyhedrosis virus (NPV) "Elcar" was $1.4X10^6$ POBs/ml. Variability in LC_{50} values of different commercial HaNPV formulations was observed in the present investigation.

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M. Srinivasa, C.S. Jagadeesh Babu*, C.N. Anitha and G. Girish

All India Coordinated Research Project (Pigeonpea), UAS, GKVK, Bangalore 560 065, Karnataka, India, *Communication author, E-mail: aniramu@gmail.com.