



Evaluation of fresh and stored HaNPV formulations on *Helicoverpa armigera* (Hubner) larval population and production of *Cajanus cajan* (L. Mill)

Amrapali T Ramteke and Sarwshri V Gangurde *

ABSTRACT

Pigeonpea is an important pulse crop damaged mainly by pod borers causing serious losses in pigeonpea yield. Investigations were carried out through field evaluation conducted at the research farm to evaluate the efficacy of stored HaNPV formulations [1- fresh HaNPV (2×10^9 POBs/ml@250 ml/ha and 1×10^9 POBs/ml@500 ml/ha.); 2 - stored HaNPV for 1 year (2×10^9 POBs/ml@250 ml/ha and 1×10^9 POBs/ml@500 ml/ha)] were found effective in larval reduction and keeping population of *Helicoverpa armigera* Hubner at its minimum levels and obtaining higher yields of pigeon pea. Despite longer storage of HaNPV for 2 years it is comparatively more effective in reducing *H. armigera* larvae than the 3 year old formulations.

Keywords: *Helicoverpa armigera*, larvae, population, HaNPV, Pigeonpea (*Cajanus cajan*), Maharashtra- India.

INTRODUCTION

Cajanus cajan (L. Mill), commonly known as pigeonpea all over the world, is an important pulse crop in South Asia which serves a major source of protein in the vegetarian Indian population. In the Indian subcontinent, it is now widely grown on over 3.82 million hectares contributing more than 90 per cent of the world production (Durairaj, 1999). Recently prices in India have reached peak levels due to economy and market downturn. However, productivity is not at that extent due to the pest problem on this crop. Although many insects feed upon pigeonpea starting from the seedling stage, major economical damage is caused by the pests feeding on the flowers and pods. Among these pigeonpea pod borer *Helicoverpa armigera* (Hubner) is one of the most important pests infesting from the bud formation to the maturity of the crop (Patil *et al.*, 1990). It is a polyphagous pest occurring on a variety of crops (Mehrvar *et al.*, 2009; Chari *et al.*, 1990). It occurs all the way from Himachal Pradesh to Kanyakumari in different agroecosystems of India. All over the world an estimated loss due to this pest is found to be exceeding US \$ 300.00 million, forcing several research groups to investigate various strategies to control this pest. It is a matter of concern as it is inflicting 56.22 per cent damage in India alone (Sharma *et al.*, 1991). Indiscriminate and excessive use of chemicals all over the world leads to develop resistance against various insecticides by this pest (Rao *et al.*, 2000). In view of the global concern on harmful impact of pesticides, the use of biopesticides has been insisted upon by the governments of various countries all over. Efforts need to be taken to keep a

balance between the pest and its natural enemies present in the ecosystem.

Vidarbha, a backward region under the Western Indian State of Maharashtra, where farmers have been committing suicide since the past five years due to poor yields and increasing external debts on them, the promotion and the use of biopesticides among rural Indian population is of utmost importance for the soil health as well as for the health and well being of the people of the region. The present investigation was carried out to evaluate the efficacy of stored HaNPV formulations stored for more than a year to judge the quality of the product in *H. armigera* control and to examine the possibilities of stocking such a product upto 3 years.

MATERIAL AND METHODS

Field experiment was conducted at the research farm of the Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, India, during the monsoon season of 2006 located 20°42' North and 77°02' latitude at an altitude of 307 meters above mean sea level.

Materials such as HaNPV with (2×10^9 POBs/ml@250 ml/ha – T1 and 1×10^9 POBs/ml@500 ml/ha – T2) fresh and stored formulations for 1 (2×10^9 POBs/ml@250 ml/ha – T3; 1×10^9 POBs/ml@500 ml/ha – T4), 2 (2×10^9 POBs/ml@250 ml/ha - T5, 1×10^9 POBs/ml@500 ml/ha – T6), 3 (2×10^9 POBs/ml@250 ml/ha - T7, 1×10^9 POBs/ml@500 ml/ha – T8) years respectively were used from the Biocontrol Laboratory Dr. PDKV, Akola), HaNPV formulations was stored in the laboratory for 3 years with ideal storage conditions. Experiment was conducted under

the randomized block design with 9 treatments and one treatment kept as untreated control and replicated thrice in a total area of 35.0 x 13.8 m² with a plot size of 10.8 m² and marginal spacing was left (1.5m) between replication and 1.0 m between the treatments. Pigeon pea variety TAT-10 was dibbled on 9 July 2005 with a spacing of 60x30cm² and the crop was harvested on 11 January 2006.

The spraying of each treatment was initiated at the stage of bud initiation when the incidence was above economic threshold level (5% damage), subsequent sprays were made at an interval of 15 days. At the time of each spraying 1ml Ranipal® (against UV radiation) 10% solution was added in 1 L of HaNPV solution. Spraying was done with the knapsack sprayer. After each treatment spray the sprayer was thoroughly washed and flushed with clean water.

Five plants were randomly selected from each net plot and labelled for recording the observations. The observation was recorded 24 hours prior to and 3, 7 and 10 days after each spray. First spraying was done on 2 December 2005 (specified days after seedling showing), second spraying on 17 December 2005 (specified days after seedling showing) and the third spraying was carried out on 1 January 2006 (specified days after seedling showing). The 14th day observation was considered as pre-treatment observations for the next application. Total number of larvae was recorded 24 hr prior to and 3, 7 and 10 days after application of treatment. From this data per cent larval reduction was worked out.

RESULTS AND DISCUSSIONS

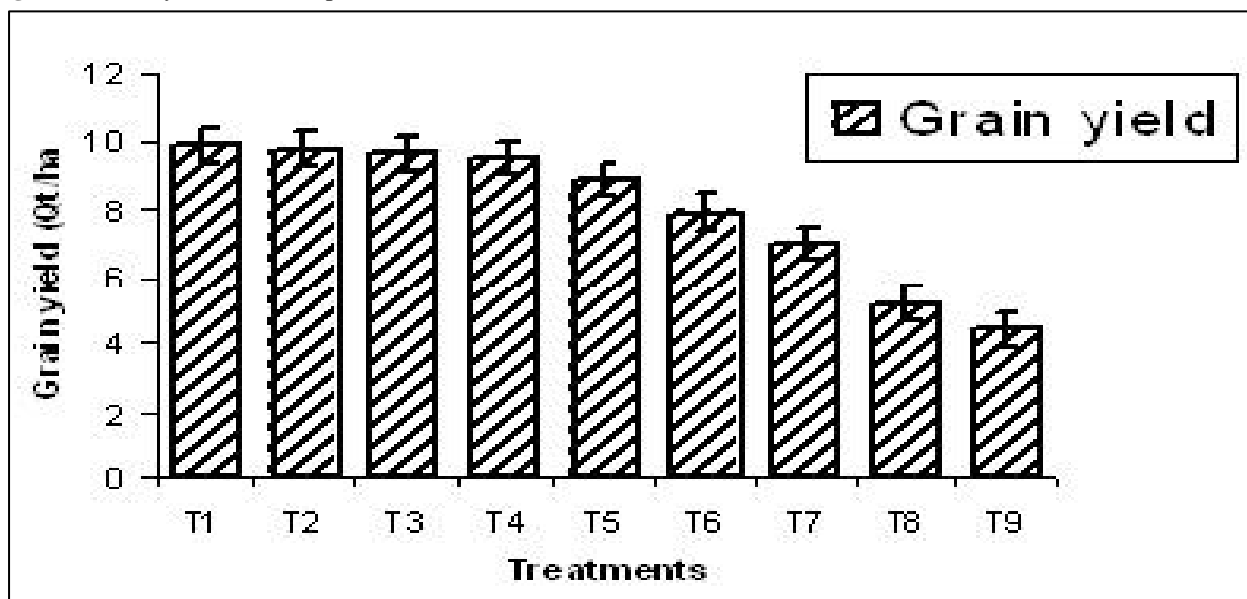
Successful use of nuclear polyhedral viruses against *H. armigera* has been practised in pigeonpea (Muthiah and Rabindra, 1991). Pigeonpea was subjected to various treatments of polyhedral virus with varied concentration of fresh as well as stored products. Regular observations were recorded from the initiation of pod borer infestation in the experimental plots. As soon as the ETL of 5 % pod damage was reached on buds, the superiority of HaNPV in reducing the population of *H. armigera* in pigeonpea ecosystem (Gopali, 1998) was found to be in accordance with the present findings.

From Table 1 it is evident that the *H. armigera* population was highly reduced 7 days after HaNPV spray. Least reduction was recorded from the untreated control (water spray) rather than HaNPV categories. Among the nine treatments tested, maximum *H. armigera* population reduction was recorded in fresh HaNPV rather than 1 year stored HaNPV, 2 years stored HaNPV and 3 years stored HaNPV (Table 1). This difference on larval population indicate that freshness of the product

Table 1. Effect of various treatments on larval reduction of *H. armigera* on three, seven, and ten days after spraying

Treatment	% days of spraying		
	3 days	7 days	10 days
Fresh HaNPV 2x10 ⁹ POBs/ml@250ml/ha (T1)	35.57	69.18	61.28
Fresh HaNPV 1x10 ⁹ POBs/ml@500ml/ha (T2)	35.42	68.5	61.08
Stored HaNPV for 1 year 2x10 ⁹ POBs/ml@250ml/ha (T3)	35.37	68.45	60.79
Stored HaNPV for 1 year 1x10 ⁹ POBs/ml@500ml/ha (T4)	35.32	68.12	60.39
Stored HaNPV for 2 year 2x10 ⁹ POBs/ml@250ml/ha (T5)	34.3	67.32	59.62
Stored HaNPV for 2 year 1x10 ⁹ POBs/ml@500ml/ha (T6)	33.32	66.28	58.34
Stored HaNPV for 3 year 2x10 ⁹ POBs/ml@250ml/ha (T7)	31.55	65.3	57.36
Stored HaNPV for 3 years 1x10 ⁹ POBs/ml@500ml/ha (T8)	30.69	64.51	56.57
Untreated control (water spray) (T9)	3.83	8.44	6.78
F test	Sig.	Sig.	Sig.
SE (m)+-	0.09	0.15	0.12
CD at 5%	0.27	0.44	0.36

could enhance significantly the reduction of larvae and fresh product would be more efficient as compared to stored products. However, previously commercial formulation was recommended for the management of *H. armigera* (Srinivasa *et al.*, 2008; Jeyarani and Karuppuchamy, 2010). Parasnath and Chakravorthy (2004) also found the lowest average population of *H. armigera* of the fresh NPV formulations. From the observed results it can be seen that fresh formulations were effective in larval reduction and in maximum yield. However other factors such as surrounding environment, cultivation history, soil quality, climatic factors and crop variety potential cannot be neglected. Under the field experiment all other variables were kept under control, and it was found that the weather had little effect during the data collection and pest monitoring. This might be the reason in some treatments. Since *H. armigera* has a vast host range, there is a wide variation among the different isolates which is mainly attributed to great selection pressure between the host and the pathogen (Kambrekar *et al.*, 2009) resulting in variation in the larval reduction in all the treatments.

Figure 1. Grain yield of the crop under the various treatments**Grain yield**

Significantly maximum yield was recorded with fresh HaNPV 2×10^9 POBs/ml@250 ml/ha (T1) was 9.85 q/ha and it was followed by fresh HaNPV 1×10^9 POBs/ml@500 ml/ha (T2), 9.75 q/ha. Stored HaNPV for 1 year (T3 and T4) also gave satisfactory results, which were 9.65 and 9.5 q/ha respectively as shown in Figure 1, while 2-3 year old formulations yielded significantly lesser than above treatments with significant differences with the fresh product which was 8.79, 7.93, 6.95, 5.18 q/ha in T5, T6, T7, T8 respectively. However, it produced higher yield than the untreated control which was only 4.4 q/ha in T9.

From the results it was found out that, as stored formulation gets stored for a longer duration it loses its viability as an effective biopesticide; thus it is not feasible to store the NPV formulation for a longer duration. Stocking the product for more than 2 years should be avoided. For obtaining better control of *H. armigera* and higher yield of pigeonpea, fresh HaNPV. HaNPV stored for 1 year can be used for reducing larval population of *H. armigera* and obtaining higher yields of pigeonpea which is statistically equal in effect to fresh HaNPV at both the dosages.

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Amrapali T Ramteke and Sarwshri V Gangurde*

Marotrao Wadafale College of Agriculture, Department of Entomology and Agronomy, Godhani Road , Yavatmal - 445 001, M.S., India. Phone: +91 7232 244925; Fax: +91 7232 245484, *Corresponding author E-mail: svngangurde@rediffmail.com

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