Environment Conservation Journal 17(3),33-36, 2016
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

Cumulative effect of HaNPV against *Helicoverpa armigera* infesting Chickpea

Divya C.[1]✉, D. M. Jethva[2], H. G. Kanara[3]

Received: 28.07.2016 **Revised: 11.10.2016** **Accepted: 10.11.2016**

Abstract

The instar-wise larval mortality in *H. armigera* due to *Ha*NPV @ 0.500 ml/l showed a consistent decrease in all the five instars and cent per cent larval mortality was recorded in the first instar larvae. Early instar larvae were found to be the most susceptible as compared to later instar larvae. The cumulative (Larval + Pupal) mortality in all the instars ranged from 56.66 to 100.00% with an average of 78.66%.

Key Words: Chickpea; Cumulative effect; HaNPV; Helicoverpa armigera

Introduction

Among the food crops, pulses are an important group which occupies a unique position in the world of agriculture by virtue of their high protein content. In pulses, chickpea (*Cicer arietinum* Linnaeus) is one of the important crops grown in *rabi* season. It is commonly known as "Bengal gram" or "Gram" which is mainly grown in the Indian subcontinent, Western Asia and in many tropical countries. It is a self- pollinated crop and belongs to the sub family *Papilionaceae* of the family *Leguminaceae* (Bentham and Hooker, 1970).The production of cereals has increased manifold in the recent past but that of pulses has remained more or less static. Insect pests are probably the main factor limiting the grain legume yields. More than 150 species of insects are known to attack pulse crops in India and of these, about 25 causes serious damage to monsoon and winter pulse crops (Bindra, 1968). Out of them, the gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is a most cosmopolitan and polyphagous pest which attacks numerous crops of agricultural importance and widely distributed for the tropic and sub-tropic.The indiscriminate use of pesticides for the last 40 years has almost eliminated natural enemies from many crop eco-systems, created complications of environment pollution, pest resurgence and insecticide resistance (Ma *et al*, 2000). This scenario has led to consider the potential of biological control as a component of pest management. Biopesticides based on baculoviruses group especially the nucleopolyhedrosis virus (NPV) offers great scope against *H. armigera.* NPV is known for high epizootic levels and is naturally occurring obligate parasite, self- perpetuating, safe to natural enemies due to host specificity and environmental friendly.

Author's Address
[1]Department of Entomology, Junagadh Agricultural University, Gujarat, 362001, India
[2]Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Gujarat, 362001, India
[3]Grassland Research Station, Junagadh Agricultural University, Dhari, Gujarat, 362001, India
E-mail:divuentomology@gmail.com

Materials and Method

Rearing techniques of test insect on natural diet

The culture of *H. armigera* was maintained in the laboratory for experimental purpose by making initial larval collection of *H. armigera* from chickpea field. The field - collected larvae were reared individually on chickpea pods in plastic vials under laboratory conditions. Fresh food was changed every day in morning. The larvae being pre-pupated were transferred into plastic vial containing sieved moist soil to facilitate the pupation. They were reared until the adult emergence. The newly emerged adults were transferred to a wooden cage measuring 30 cm x 30 cm x 30 cm for oviposition. Five per cent honey solution was provided as food for moths. The freshly laid eggs were collected daily and reared till hatching in petridish (15 cm diameter). The newly hatched larvae were used for the further study

purpose.With a view to evaluate cumulative effect of *Ha*NPV against *H. armigera*, chickpea plants were grown in pots at Biocontrol Research Laboratory, Department of Entomology, J.A.U., Junagadh. The immature pods of chickpea were collected and sprayed with *Ha*NPV @ 0.500 ml/l. After one hour of spray, ten larvae of each instar (I-V instar) were allowed to feed on treated immature pods by exposing them in Petri dishes (15 cm diameter) for 24 hrs of application and then they were reared on fresh untreated immature pods until pupation. Each set was repeated three times (fig.1). The larval mortality was recorded daily up to eight days from the treatment. The larvae which pupated were kept under observation for adult emergence. Number of pupae failed to emerge adults, deformed pupae and deformed adults were also recorded. The data thus obtained were compiled for the instar-wise cumulative effect of *Ha*NPV against *H. armigera* infesting chickpea.

Fig. 1: Treatment procedure for testing cumulative effect

Results and Discussion

Effect on larval survival

Data on instar-wise larval mortality (fig. 2) due to *Ha*NPV are presented in Table 1 and depicted in graph 1 shows the healthy and *Ha*NPV infected instar wise larvae of *H. armigera.* The data showed that on first, second and third day after feeding significantly higher mortality was recorded in the first and second instar larvae as compared to third, fourth and fifth instar larvae of *H. armigera.* The mortality in the first and second instar larvae was recorded to be higher as 40.00 and 20.00% respectively, on first day after feeding, whereas, on the same day there was no mortality was recorded in fourth and fifth instar larvae.

Data revealed that there was a consistent decrease in mortality from first to fifth instar larvae. It can also be seen from the Table 1 that the total larval mortality among instar wise larvae ranged from 26.66 to 100.00% on eighth day after feeding. The highest mortality was recorded in the first instar larvae (100.00%), followed by second (70.00 %), third (56.66 %), fourth (36.66%) and fifth (26.66%). Thus, the results clearly indicated that the first instar larvae proved to be most susceptible to *Ha*NPV followed by larvae of second instar. The third instar was found moderately susceptible, while, the fourth and fifth instar larvae were found to be less susceptible to *Ha*NPV.

Effect on pupal survival

Almost on eighth day after the treatment, larvae escaped *Ha*NPV infection moved into pupal stage. The percentage of instar wise larvae succeeded for pupation was also worked out after their rearing on treated leaves with *Ha*NPV and on next day they were reared on unsprayed fresh leaves. It can be seen from Table 1 that no pupa was recorded in the first instar (0.00%). In case of second and third instar lower pupal percentage was recorded (30.00 to 43.34%). The highest per cent of pupation was recorded in fifth instar (73.34%), which was followed by fourth instar (63.34%). The pupae failed to emerge into adult was also recorded and it was found to be highest in the fourth instar (13.33%) and it was at par with second and fifth instar (10.00%) and third instar (13.33%). Fig. 2 shows the healthy and *Ha*NPV infected pupae of *H. armigera.*

Effect on adult emergence

From the data on percentage emergence of the deformed adult from pupae, indicated that the highest percentage of deformed adults (20.00%) was recorded in fourth and fifth instars which was followed by third instar (13.33%). The lowest emergence of deformed adult was recorded in second instar (10.00%).

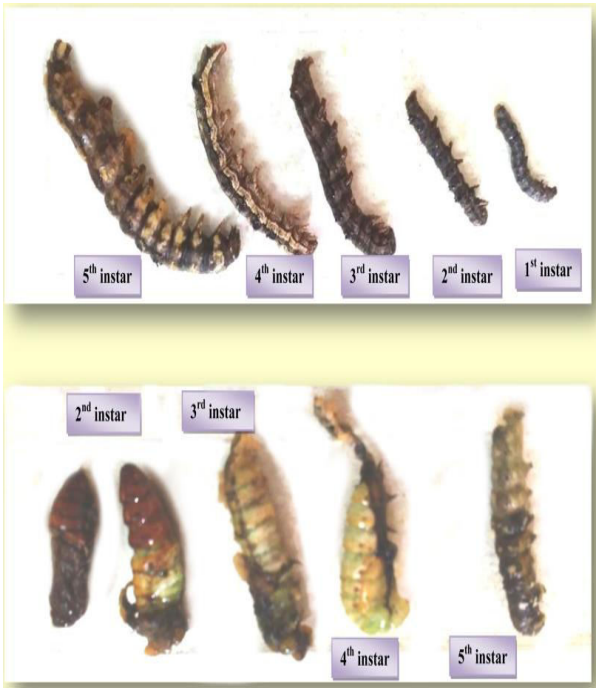
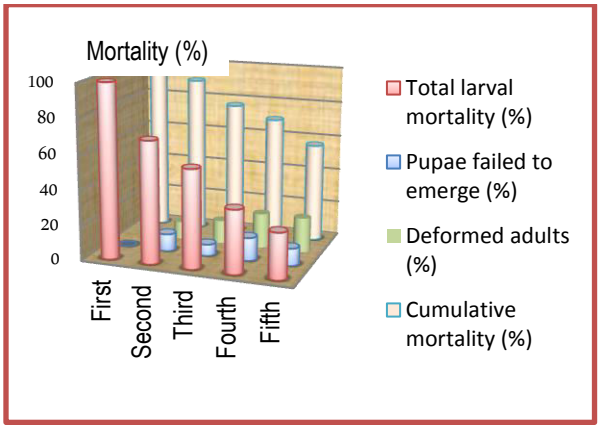


Fig. 2: Instar-wise larva died and malformed pupae due to *Ha*NPV



Graph 1: Larval mortality, failed pupation and adult emergence (%) and cumulative mortality in *H. armigera* due to *Ha*NPV

Data presented in Table 1 showed that the cumulative (Larval + Pupal) mortality due to *Ha*NPV ranged from 56.66 to 100.00% in all the instars. The cent per cent cumulative mortality was recorded in the first instar, followed by second 90.00%), third (76.65%), fourth (69.99%) and fifth instar (56.66%). The cumulative mortality in all the instars averaged 78.66%. The present result on cumulative effect of *Ha*NPV, thus, showed that *Ha*NPV @ 0.500 ml/l caused 56.66 to 100.00% mortality averaging 78.66% mortality in *H. armigera* on chickpea.Present study of cumulative effect of *Ha*NPV against different instars of *H. armigera* showed that there was a consistent decrease in larval mortality in accordance with the five instars from day one to eight of larval rearing after one day feeding on *Ha*NPV treated chickpea leaves and immature pods. The total mortality among larval instars ranged from 26.66 to 100.00% with an average of 58.00% on eighth day after feeding. Data showed that the early instar larvae were found more susceptible than the later instars larvae. These findings are in conformity with the results of Nachimuthu *et al*. (2007), Mahesh *et al*. (2012), Hussain and Singh (2014) and Songdou*et al*. (2015).Here, the larvae according to progress in instars did succeed in ascending order for pupation (0.00 to 73.34%), pupae failed to emerge (6.66 to13.33%) and deformity of the adult (10.00 to 20.00%). This inference was apparently supported by Mahesh et al. (2012) who reported that the percentage mortality of larvae inoculated at 2nd and 3rd instars (93.33% and 78.33%) were more than those inoculated at 4th and 5th instars (51.66% and 15.00%). Data presented in Table 5 also showed that the cumulative (Larval + pupal) mortality due to *Ha*NPV @ 0.500 ml/l ranged from 56.66 to 100.00% with an average of 78.66% in all the five instars. Pourmirza (2000) also obtained the cumulative mortality of 32.5 to 97.5% from 1st to early and late 4th instars at *Ha*NPV @ 24553 POB/larva.

Conclusion

During the study of cumulative effect of *Ha*NPV against *H. armigera*, a consistent decrease in larval mortality in all the five instars was obtained when they fed for one day on *Ha*NPV treated immature pods. It can be seen that (Table 1) cent per cent larval mortality was recorded in the first instar larvae.

Table 1: Larval mortality, Pupation (%) and Cumulative mortality in *H. armigera* due to HaNPV

Instar tested	Larval mortality (%) after days						Total larval mortality (%)	Pupat-ion (%)	Pupae failed to emerge (%)	Deformed adult (%)	Cumulati-ve mortality (%)
	1	2	3	5	7	8					
1st	39.52 (40.00)	33.52(30.00)	18.90(10.00)	18.90 (10.00)	18.90 (10.00)	4.05 (0.00)	90.00 (100.00)	0.00	4.05 (0.00)	4.05 (0.00)	100.00
2nd	26.92 (20.00)	18.90 (10.00)	24.25 (16.66)	21.57 (13.33)	18.90 (10.00)	4.05 (0.00)	57.10 (70.00)	30.00	18.90 (10.00)	18.90 (10.00)	90.00
3rd	13.95 (6.66)	18.90 (10.00)	24.25 (16.66)	21.57 (13.33)	18.90 (10.00)	4.05 (0.00)	49.13 (56.66)	43.34	13.95 (6.66)	21.57 (13.33)	76.65
4th	4.05 (0.00)	9.00 (3.33)	18.90 (10.00)	18.90 (10.00)	21.57 (13.33)	4.05 (0.00)	37.52 (36.66)	63.34	21.57 (13.33)	26.92 (20.00)	69.99
5th	4.05 (0.00)	4.05 (0.00)	18.90 (10.00)	18.90 (10.00)	4.05 (0.00)	13.95 (6.66)	31.32 (26.66)	73.34	18.90 (10.00)	26.92 (20.00)	56.66
S.Em. ±	2.21	2.21	1.69	1.69	1.19	2.21	1.58	-	2.52	1.19	-
C.D. at 5%	6.98	6.98	NS	NS	3.76	6.98	4.99	-	7.93	3.76	-
CV %	21.66	22.72	13.91	14.65	12.56	63.54	5.18	-	28.15	10.52	-

Note: Data in parenthesis are original values, while outsides are angular transformed values ($\sin^{-1}\sqrt{x+0.5}$).

The highest per cent of pupae failed to emerge the adult was recorded in fourth instar and it was at par with second, third and fifth instars.

In all the instars, the deformed adults were recorded. The highest percentage of deformity in adults was recorded in the fourth and fifth instars. The cumulative (Larval + Pupal) mortality in all the instars ranged from 56.66 to 100.00%.Thus, it is concluded from the data that the early instar larvae were found more susceptible than the later instars larvae. Thus, the management of the pest by spraying of *Ha*NPV should be scheduled at earliest, possibly during egg stage or 1st instar larval stage.

Abbreviations:

***Ha*NPV:*Helicoverpa armigera* Nucleopolyhedrosis virus**

References

Bentham G., Hooker J.P. 1970. Genera platinum (Genera of plant), 1: 324.

Bindra O.S. 1968.Insect pests of pulse crops.***India Farming***, 17 (11): 12-14 and 56.

Hussain A., Singh S. 2014effective toxicity of NPV to second and fourth instar larvae of*helicoverpa armigera*(hubner) on tomato. ***Agriculture for SustainableDevelopment,***2 (1): 1-5.

Ma D.L., Gordh G., Zalucki M.P. 2000.Toxicity of biorational insecticides to Helicoverpa spp. (Lepidoptera :Noctuidae) and predators in cotton field***International Journal of Pest Management***, 46: 237-240.

Mahesh K., Sharma M., Sharma P.K. 2012.In vitro evaluation of larval age and dose of virus-inoculum on mortality and NPV-yield from Helicoverpaarmigerahubner***International Journal of Microbial Resource Technology***, 1 (1): 24-27.

Nachimuthu S.K., Murugan K., Zhang W. 2007,Additive interaction of HelicoverpaarmigeraNucleopolyhedrovirus and Azadirachtin. ***BioControl***, 53: 869-880.

Pourmirza A.A. 2000. Relationship between Nuclear Polyhedrosis Virus Susceptibility and Larval Weight in Heliothisarmigera, ***Journal of Agricultural Science and Technology***, 2: 291-298.

Songdou Z., Fengming W., Zhen L., Xiaoxia L. 2015.Effects of Nucleopolyhedrovirus Infection on the Development of *Helicoverpaarmigera* (Lepidoptera: Noctuidae) and Expression of Its 20-Hydroxyecdysone—and Juvenile Hormone—Related Genes, ***Florida Entomologist***, 98 (2): 682-689.