Agric. Res J. Kerala, 1987, 25 (1) 103—107

RELATIVE TOXICITY OF THE NUCLEAR POLYHEDROSIS VIRUS OF *SPODOPTERA MAURITIA* (Biosduval) TO DIFFERENT LARVAL INSTARS OF THE HOST

K. P. Vasudevan Nair and Abraham Jacob
College of Agriculture, Trivandrum 695 522, India

The present investigation was taken up to study the dosage-mortality relationships of the nuclear polyhedrosis virus of *Spodoptera mauritia* (Biosduval) with different larval instars of the host by employing bioassay technique. Bioassay technique has been widely used to express precisely the pathogenicity of insect viruses (Morris, 1962; Ignoffo, 1965; Doane, 1967; Magnoler, 1974, 1975; Capinera and Canost, 1979).

Materials and Methods

The test larvae were drawn from the disease free laboratory stock of S. *mauritia.* The second, third, fourth, fifth and sixth instar larvae were used in the bioassay. Larvae of uniform age and size were used in each assay.

Six serial dilutions of the virus viz., 48×10^6, 48×10^5, 48×10^4, 48×10^3, 48×10^2, 48×10 PIBS/ml were prepared from the stock suspension. Larvae were inoculated with the virus following the technique standardised by Lathika and Jacob (1974). After feeding on the treated leaves, fresh grass terminals were supplied to each larva which was reared individually in specimen tubes. The experiment was replicated thrice with 10 larvae in each replication. An equal number of healthy untreated larvae was kept as control. Observations were recorded on larval mortality till pupation. In doubtful cases mortality due to nuclear polyhedrosis was confirmed by microscopic examination of smears from dead larvae.

Results and Discussion

The percent mortality and LT_{50} values of various instars of *S. mauritia* inoculated with different doses of NPV are furnished in Table 1. The LC_{50} values are furnished in Table 2.

It can be seen from the data presented in Table 1 that the mortalities of the various larval instars ranged between 13.33 percent and 42.30 percent for the lowest dose and 66.66 percent and 95.45 percent for the highest dose. The various intermediary doses also showed the same trend with maximum mortality for the early instars. The mortality gradually declined with the maturity of the larvae. In general, there was an increase in mortality of larvae with increase in concentration of the virus as all the instars tested.

PIBS = Polyhedral inclusion bodies
NPV = Nuclear polyhedrosis virus

An inverse relationship between LT_{50} values and concentration of the virus is evident from the results. Even within the same concentration prolongation of LT_{50} values was noticed with advancement in the age of test larvae. These were more distinct at lower doses of the virus than at higher doses. The LT_{50} values tended to be closer at higher concentrations. It is indicated that the higher concentrations of the virus initiated the disease earlier and inflicted heavy mortality within a shorter span of time interval than the lower concentrations. The same trend has been observed in *Holiothis zea* (Ignoffo, 1965) *Porthetria dispar* (Doane, 1967), *Spodoptera litura* (Pawar and Ramakrishnan, 1975) and in *Malacosoma neustria* (Mangnoler, 1975).

The LC_{50} values given in Table 2 ranged from 3558 PIBS/ml for the second instar to 808700 PIBS/ml for the sixth instar. The LC_{50} values for the second third and fourth instars did not show significant differences as evidenced by the

Table 1

Percent mortality and LT_{50} of different larval instars of *S. mauritia* inoculated with NPV

	Concentration of the virus in PIBS/ml					
	48×10^6	48×10^5	48×10^4	48×10^3	41×10^2	48×10
Second instar						
Per cent mortality	95.45 (95.28)	82.22 (81.74)	73.20 (72.51)	59.50 (58.46)	55.50 (54.35)	42.30 (40.32)
LT_{50} (days)	4.11	4.79	4.63	5.82	7.09	—
Third instar						
Per cent mortality	90.00 (89.83)	78.33 (77.96)	70.00 (69.46)	61.66 (61.01)	55.00 (54.24)	41.66 (40.67)
LT_{50} (days)	4.44	5.46	6.75	6.91	9.32	—
*Fourth instar**						
Per cent mortality	73.33	60.00	63.33	58.10	45.40	33.33
LT_{50} (days)	5.46	6.08	6.67	6.32	—	—
*Fifth instar**						
Per cent mortality	73.33	60.00	53.33	43.33	40.00	20.33
LT_{50} (days)	5.34	5.88	7.18	—	—	—
Sixth instar						
Per cent mortality	66.66 (65.51)	60.00 (58.62)	50.00 (48.33)	43.33 (41.37)	33.33 (31.03)	13.33 (10.34)
LT_{50} (days)	5.51	5.89	7.66	—	—	—

Figures in parenthesis are those corrected for control mortality using Abbots formula

* No mortality in control

LT_{50} = Time required to give 50 per cent mortality of larvae

Table 2

LC_{50} of NPY to different larval instars of 5. *mauritia*

Instar	Heterogeneity*	Regression equation	LC_{50} PIBS/ml	Fiducial limits (PIBS/ml)
Second	1.705	Y = 0.3171 x + 3. 873	3558	466.7 — 13480
Third	1.055	Y = 0.276 x + 4.0126	3771	531.1 — 13770
Fourth	1.517	Y = 0.1817x + 4.1957	26540	3312 — 31250
Fifth	1.033	Y = 0.2529 x + 3.6339	251200	384200 — 2061000
Sixth	2.366	Y = 0.2892 x + 3.2914	808700	166600 — 6463000

LC_{50} = Concentration required to give 50 per cent mortality of larvae

* In all these cases the data were homogeneous at p = 0.05

overlapping of their fiducial limits. The LC_{50} values for the fifth and sixth instars showed significant difference from those of the second, third and fourth instars, but there was no significant difference between the LC_{50} values of the fifth and sixth instars. The LC_{50} for the fifth instar was about 70 times of those for second and third instars while the LC_{50} of the sixth instar was 225 times those for the second and third instars. Similarly the LC_{50} of fifth and sixth instars were about 10 and 30, times that of the fourth instar. It is evident from these results that the susceptibility to virus infection decreased with age of larvae. This progressive decrease in susceptibility was manifested more in the last two instars and it was dose dependent. Studies reported earlier on dosage-mortality relationships of other insect viruses have shown similar results (Tanada and Reiner, 1962; Stairs, 1965; Ignoffo, 1966; Doane, 1967; Pawar and Ramakrishnan. 1975). The increase in resistance to infection with age of larvae was regarded as maturation immunity by Tanada (1956) but Ignoffo (1966) attributed this partly to normal increase in body weight which might dilute a constant virus dose.

From the practical stand point the present observations suggest the necessity for application of the virusto early instar larvae to get economic control of the pest under field conditions with low dosages of the virus. Application of even higher doses to larvae beyond third instar will not give the desired results.

Summary

Bioassay of the NPV of *Spodoptera mauritia* (Biosduval) showed that LC_{50} increased with larval age. The LC_{50} ranged from 3558 PIBS/ml for the second instar to 808700/ml for sixth instar. An inverse relationship between LT_{50} and concentration of the virus was observed.

Acknowledgement

The authors are thankful to the Dean, College of Agriculture, Trivandrum, for providing facilities for the work.

References

Capinera, J. L. and Canost, R L. 1979. Susceptibility of zebra caterpillar to *Autographa californica* polyhedrosis virus. *J. econ. Ent.* ***72;*** 570-572

Doane, C. C. 1967. Bioassay of nuclear polyhedrosis virus against larval instars of gypsy moth. *J. Invertbr. Pathol.* 9: 376-386

Ignoffo, C. M. 1965. The nuclear polyhedrosis virus of *Heliothis zea* (Boddie) and *Heliothis virescens* (Fabricius) IV. Bioassay of viral activity. *J. Invertebr. Pathol.* 7: 315–319

Ignoffo, C. M. 1966. Effects of age on mortality of *Heliothis zea* and *Heliothis virescens* larvae exposed to a nuclear polyhedrosis virus. *J. Invertebr. Pathol.* 8: 280-282.

Lathika, P. and Jacob, A. 1974. Investigations on a nuclear polyhedrosis of *Spodoptera mauritia* (Boisduval) (Noctuidae : Lepidoptera). *Agri. Res. J. Kerala* 12: 1-6

Magnoler, A. 1974. Bioassay of a nuclear polyhedrosis virus of the gypsy moth *Porthetria dispar. J. Invertebr. Pathol.* 23: 190-196

Magnoler, A. 1975. Bioassay of polyhedrosis virus against larval instars of *Malacosoma neustria* L. *J. Invertebr. Pathol.* 25: 343-348

Morris, 0. N. 1962. Quantitative infectivity studies on the nuclear polyhedrosis of western oaklooper *Lambdina fiscellaria somniaria* (Hulst.). *J. Insect Pathol.* 4: 207-215

Pawar, V, M. and Ramakrishnan, N. 1975. Investigations on the nuclear polyhedrosis of *Spodoptera (prodenia) litura* (Fabricius) III. Bioassay of viral activity. *Indian J. Ent.* 37: 367-374

Stairs, G. R. 1965. Quantitative differences of susceptibility to nuclear polyhedrosis virus among larval instars of forest tent caterpillar *Malacosoms distria. J. Invertebr. Pathol. 7:* 427-429

Tanada, Y. 1956. Some factors affecting the susceptibility of armyworms to virus infections. *J. econ. Ent.* 49: 52-57

Tanada, Y. Reiner, C. 1962. The use of pathogens in the control of the corn earworm *Meliothis zes* (Boddie). *J. Insect. Pathol.* 4: 139-154