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STUDIES ON THE CROSS-INFECTIVITY OF NUCLEAR POLYHEDROSIS VIRUS OF *ADISURA ATKINSONI* MOORE (NOCTUIDAE: LEPIDOPTERA)

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GENERALLY insect viruses are considered to be relatively species-specific or at least have a limited host range¹. However, cross-infection of insect viruses between closely related as well as unrelated lepidoptera have increased recently^{2,3}. Though, an occurrence of a nuclear polyhedrosis virus (NPV) in *Adisura atkinsoni*⁴, a major pod borer on field beans, *Lab-lab purpureus* (Linn) Sweet and its field efficacy⁵ has been reported, mass production of NPV for further field study is limited since it undergoes a pupal diapause⁶. Hence, a study was conducted to find out the cross-infectivity of NPV of *A. atkinsoni* to four insects viz, (i) tobacco leaf caterpillar, *Spodoptera litura* Fabricius (Noctuidae), (ii) gram caterpillar, *Heliothis armigera* Hübner (Noctuidae) which were reared on artificial diet⁷ (iii) jute caterpillar, *Spilosoma obliqua* Walker (Noctuidae) and (iv) plume moth, *Sphaenarches anisodactylus* Walker (Pterophoridae) which were also reared on artificial diet^{6,9}. These insects are chosen because although they belong to different species and genus, they are found mostly on the same host crop viz., field beans. Therefore, if the cross infectivity NPV of *A. atkinsoni* proves positive to any of the alternate hosts the same host can be used both for mass production of virus as well as for the control of both the pests occurring simultaneously on the field beans. One to seven-day-old larvae of varying number, in each of the four species were surface contaminated with 0.1 ml of NPV of *A. atkinsoni*, containing 1×10^6 polyhedral inclusion bodies (PIB) per container. The cause of the death was diagnosed microscopically and

positive cross-infection was considered following the criteria suggested by Tanada and Chang¹⁰, viz, (i) the reciprocal transmission of two viruses to the two insects, (ii) the infectivity of the virus to the host after the passage through the alternate host (iii) the symptom and pathology on the two hosts, which are essential characteristic for each host species, regardless of whether the virus had been obtained from the original or alternate host and (iv) that the activation of a latent infection was unlikely as shown by the test-feeding the larvae with normal midgut and a third virus, the cytoplasmic virus of the silkworm.

The study revealed that NPV of *A. atkinsoni* was not cross-infective to other test insects except to that of *H. armigera*, although high dose of inoculum was used. There was no death with typical symptoms and they have completed their larval and pupal development and emerged as normal adults. Similarly no mortality was observed in the control. But, in the case of *H. armigera*, all the different stages of the larvae were found dead, showing typical symptoms of NPV infection, within 4–9 days after inoculation period depending upon the stage of the insect tested. Since NPV of *A. atkinsoni* was cross-infective to *H. armigera*, a study was also conducted to determine its infectivity to the original host viz. *A. atkinsoni*, after passing it through alternate host viz. *H. armigera*. Further, a cross-infectivity test was also carried out with NPV isolated from *H. armigera* against *A. atkinsoni*. The test was conducted according to the method described above using 0.1 ml of respective NPVs, containing 1×10^6 PIB container.

The results revealed (table 1) that NPV of *H. armigera* was cross-infective to *A. atkinsoni* and only 40 to 50% mortality was recorded over an incubation period ranging from 5 to 11 days although a high dose of virus was used. Most of them died of bacterial and other unknown causes whereas the NPV of *A. atkinsoni* after passing through its alternate host viz, *H. armigera*, was found to be highly effective causing 100%

Table 1 Effect of heterologous virus on *A. atkinsoni* and *H. armigera*

Name of the Test insect	Inoculum virus	Incubation period (range in days)	% mortality (range)
<i>A. atkinsoni</i>	<i>H. armigera</i> NPV	5–11	40–50
<i>H. armigera</i>	<i>A. atkinsoni</i> NPV	4–9	100

mortality over an incubation period of 4 to 9 days. However, activation of latent *H. armigera* NPV by the heterologous NPV of *A. atkinsoni* may be possible in the present study, since non-infective virus is reported to be potent stressor for the activation of latent occluded virus¹⁰.

In order to find out the activation, if any, a further test was conducted by way of subjecting *H. armigera* as well as *A. atkinsoni* with a morphologically distinct heterologous virus, isolated from Indian rice moth, *Corcyra cephalonica*¹² so that, if there is any cross infection or activation, the progeny virus can be examined accurately. Since there was no death of *H. armigera* as well as *A. atkinsoni* by the inoculation of heterologous NPV of *C. cephalonica*, the possibility of activation of latent into a frank infection by the NPV of *A. atkinsoni* in *H. armigera* has been ruled out. Therefore, it is evident that a true cross transmission of *A. atkinsoni* NPV to *H. armigera* had occurred because of the following considerations. (i) The reciprocal transmission of two viruses to the two insects (ii) the infectivity of *A. atkinsoni* NPV to *H. armigera* after passing through the alternate host *viz.* *H. armigera*, (iii) the symptoms and pathologies on the two hosts which are essentially characteristic of each host species regardless of the viruses had been obtained from the original or alternate hosts and finally (iv) that the activation of latent infection was unlikely by the test feeding of the larvae with morphologically distinct virus of *C. cephalonica*. Further, the results of a small preliminary field plot study revealed that the field populations of *H. armigera* were highly susceptible to the NPV of *A. atkinsoni*¹³.

A. atkinsoni has a very long larval period (20–22 days), lesser in mean weight, (350 mg)⁹ and the mean number of PIB recovered from fully grown diseased caterpillar was also less (12200×10^6 PIB/larva) (Narayanan, unpublished data) when compared with *H. armigera* whose larval developmental period was quick (12–14 days), bigger in size (407 mg) and harvest of PIB was greater (18422.33×10^6 PIB/larva) when it was administered with the same dose of virus⁷ *H. armigera* larvae can therefore be suitably used for large scale propagation and standardization of NPV of *A. atkinsoni* to control both *A. atkinsoni* and *H. armigera* occurring in a cropping situation.

The author thanks Shri. D. L. Shetti for technical assistance and to Dr S. P. Singh for a critical reading of the manuscript.

23 August 1985; Revised 12 December 1985

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DETERRENT EFFECT OF SYNTHETIC PYRETHROIDS ON THE OVIPOSITION OF MOSQUITOES

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SYNTHETIC pyrethroids have recently been considered as new/alternate insecticides for induction in vector control programmes, both as larvicides^{1, 2} as well as adulticides^{3, 4}, against organochlorine, organophosphate and carbamate-resistant vector populations, due to their high toxicity to target organisms and wide safety margins to non-target subjects, without leaving any harmful residue under normal conditions. Fales *et al*⁵ noticed the repellent action of synthetic pyrethroids, while evaluating the smoke of insecticide coils containing synthetic pyrethroids against mosquitoes.