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Entomopathogenic Virus against Crop Pests

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Abstract

Baculoviruses are occluded DNA viruses that are lethal pathogens to larval stages of several lepidopterans, mosquitoes, sawflies with the peculiar nature that they are host specific. The entry of this virus into an insect is *per os* and both virus types enter midgut cells (primary site of infection) by membrane fusion and the virions are liberated by the action of alkaline digestive juice and finally lead to a systemic infection of the hemocoel which ultimately leads to the death of the insect. As baculoviruses are host specific the much preferred in integrated pest management.

Introduction

Insect Viruses are submicroscopic, obligate, intracellular, pathogenic entities, the viruses belonging to 11 families which are pathogenic to insects. Baculoviruses are associated with the orders of Lepidoptera, Hymenoptera, Diptera, Neuroptera, Coleoptera, Trichoptera, Crustacea and mites (The virions are rod-shaped, 40-70 nm × 250-400 nm, comprising a lipoprotein envelope around a protein capsid containing DNA-protein core. The capsid and core is known as the nucleo-capsid. These viruses are specific and often highly virulent to their hosts. They are restricted in their pathogenicity to the class insecta; they are often genus or species specific. Approximately 60 percent of the 1200 known insect viruses belong to the family Baculoviridae and it is estimated that such viruses could be used against nearly 30 percent of all the major pests of food and fibre crops. Dose of the virus is expressed as Larval Equivalent (LE) (Erayya *et al.*, 2013).

Mode of Entry

The virus should be ingested to produce the disease. Due to alkaline gut juice, the virions are liberated from the polyhedral coat and passes through the peritrophic membrane to reach the columnar cells of midgut epithelium where it starts to replicate in the nucleus in case of NPV or in the cytoplasm in case of CPV. Budded viruses are produced during initial round of replication which circulate in the hemolymph and causes secondary infection and ultimately leads to death of the insect (Figure 1 and Table 1).

Incubation period: four to six days lapse between the time of insertion of virus and death of the host (Table 2).

Advantages

- Baculoviruses viruses are highly host specific and non-pathogenic to beneficial insects as well as other non-target organisms.
- Low toxic residual effect and low pest resistance development is the advantage over conventional pesticides.

Table 1: Entomopathogenic virus shape, site of the multiplication and symptoms

Name of the Virus	Shape of inclusion body	Site of the multiplication	Symptoms
NPV	Singly (rod shaped) (or) groups in Polyhedral.	Nucleus of epidermis, fat bodies, blood cells and trachea.	Larvae become pinkish white especially in ventral side due to accumulation of polyhedral. Diseased larvae hang upside down from the plants. This is called tree top disease (or) Wipfelkrankheit.
CPV	Singly in Polyhedral	Cytoplasm of midgut epithelium.	The small size of the larvae disproportionately large heads and loss of appetite.
GV	Singly in small inclusion bodies called capsules.	Either cytoplasm (or) nucleus of epidermis, trachea and fat body.	The larvae become sluggish, yellowish or pinkish in colour, swell and become flaccid, integument become very fragile, and rupture to release the polyhedral. Dead larvae are found hanging by their prolegs from the top of the host plant. Dead cadaver is black.

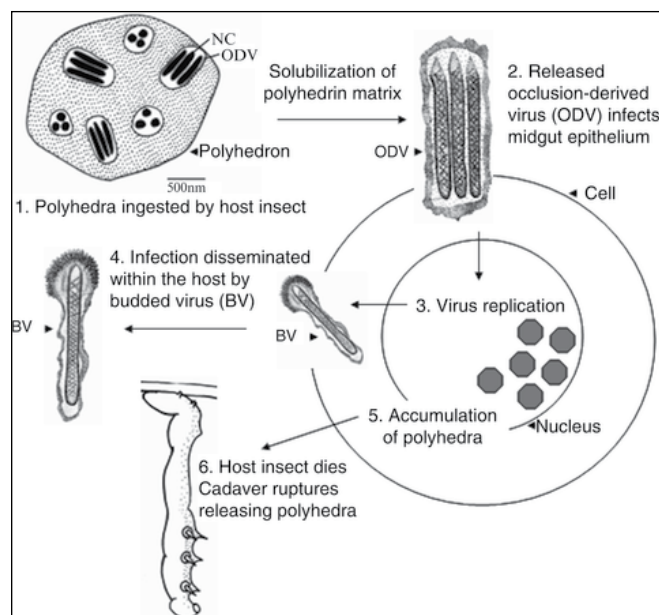


Figure 1: Life cycle of baculovirus (Popham et al., 2013)

Table 2: Most commonly used entomopathogenic virus against crop insect pests

Types of virus	Pest	Crop
NPV	<i>Helocoverpa armigera</i>	Chickpea, cotton and others
	<i>Spodoptera litura</i>	Tobacco, cotton and others
	<i>Amsacta moorei</i>	Ground nut
CPV	<i>Trichoplusia ni</i>	Cabbage
GV	<i>Chilo infuscatellus</i>	Sugarcane

Increase Bio-Control Efficacy

- Virus preferably has to be used in evening hours to protect from UV light.
- Addition of optical brighteners, tannic acid, boric acid, jaggery improves the effectiveness of NPVs.

Conclusion

Thus, baculovirus is an effective tool in the management of insect pest and can be included as a component in integrated pest management as they are not harmful to natural enemies and they are highly beneficial virus since they do not infect man or plants. The formulations are easy for application as like chemical insecticides.

References

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