Occlusion bodies of nucleopolyhedrovirus (NPV) of various moths (PC codes 107300; 107302; 107303; 127885; 129078) Occlusion bodies of granulovirus (GV) of codling moth and Indian meal moth (PC codes 129090 and 108896, respectively) Fact Sheet

Summary

These insect viruses kill various larval pests that feed on food crops and certain other plants. Susceptible insect larvae ingest the active ingredient, which has been sprayed on leaves during plant growth or on the food commodity after harvest. The virus interferes with the function of several larval organs, including food absorption in the gut. Larvae die after a few days. These viruses occur naturally and present no known risks to humans, other non-target organisms, or the environment.

I. Description of the Active Ingredient

Granuloviruses (GVs) and nucleopolyhedroviruses (NPVs) belong to a family of insect viruses called baculoviruses. Baculoviruses infect insects, such as moths and beetles, and certain closely related species. Most of the research on GVs and NPVs has involved viral species that infect insect larvae that harm plants; all of the baculovirus species approved as of October 2002 for use in pesticide products act against moth larvae. Some baculoviruses, such as the gypsy moth NPV, are relatively specific regarding their target insect host. Other baculoviruses, such as the celery looper NPV, display a broader host range. Researchers are sequencing the DNA of various species of NPVs and GVs to learn which sequences are important in infection and host specificity. [See Table below for list of baculoviruses registered for use in pesticide products.]

GVs and NPVs have a more complicated structure than most viruses. Most known viruses exist as individual viral particles, with each particle consisting of viral nucleic acid surrounded by a protein shell. By contrast, GVs and NPVs are complex viruses, protected by a protein overcoat. For NPVs, within the overcoat, there are usually several membrane envelopes that enclose one or more DNA-containing viral particles. GVs, by contrast, have one envelope per protein overcoat, and the structure of their protein overcoat is different from that of the NPVs. For both kinds of insect viruses, the protein overcoat and everything within it is called an “occlusion body.” It keeps the virus particles occluded, or separate, from the outside environment. Because the occlusion bodies are the actual structural units that infect larvae, EPA has registered the occlusion bodies of individual viruses as the pesticide active ingredient.

These insect viruses become active only after susceptible larvae ingest the occlusion bodies. In the larval gut, the protein overcoat quickly disintegrates, and the viral particles proceed to infect digestive cells. A few days after ingesting the viral occlusion bodies, the larvae stop eating, weaken, and die.

To produce occlusion bodies for use in pesticide products, producers grow the viruses in living host larvae. Several days after infection, the larvae are homogenized and the occlusion bodies separated from other materials. Although the viruses can also be grown in cell culture, use of insect larvae is less expensive and leads to fewer complications than using cell culture.

II. Use Sites, Target Pests, and Application Methods

- **Use Sites:** Various plants; nuts and dried fruit; food storage sites (see Table below).

- **Target pests**: Specific moths, including gypsy moth, codling moth, Indian meal moth

- **Application Methods:**
  1. Plants: Spray water suspension of product on leaves soon after the target larvae emerge from eggs. Larvae are more susceptible to viral infection in their early developmental stages. This timing helps minimize the damage the pests cause.

  2. Certain food commodities and storage/packaging facilities (Only for Indian meal GV): Apply as dry powder or water suspension directly to nuts or dried fruit on conveyor belt just before packaging. Spray suspension along floor and wall joints, in cracks and crevices, and in similar places at facilities where specified commodities are processed, stored, and packaged.

III. Assessing Risks to Human Health

Whether a substance poses a risk to humans or other organisms depends on two factors: how toxic the substance is, and how much of it an organism is exposed to. Therefore, the EPA considers toxicity data and exposure data in deciding whether to approve a pesticide for use.

These viruses infect only the target insect larvae and closely related species. Toxicity tests show that the viruses pose no risk to the public. Workers wear protective clothing to prevent possible irritation from handling and applying the products.

IV. Assessing Risks to the Environment

Tests show that the GVs and NPVs that EPA has registered as pesticide active ingredients infect only certain species of moth larvae. The viruses do not harm other organisms, including plants, beneficial insects, other wildlife, or the environment. These viruses occur naturally in their insect hosts.

V. Regulatory Information

The first two NPVs that EPA registered (licensed for sale) were occlusion bodies from the Douglas fir tussock moth (1976) and from the gypsy moth (1978). These two NPVs were reassessed, found eligible for reregistration in 1996, and reregistered in 1998. As of October 2002, EPA had registered occlusion bodies from five NPVs and from two GVs as pesticide active ingredients; ten pesticide products contained these active ingredients (see Table below).

VI. Additional Contact Information

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