

- Later in development, the **host dies** and the parasitoid pupates inside or outside of the host's body.

Ex: Bathyplectes, trichogramma, encarsia, muscidifurax etc.

**vi) Bioinsecticide:**

**Definition:**

- Bio-insecticides are organic formulations recommended for the management of insects that feed on crops.
- Certain micro organism or toxins produced by them, which can control insect, are called microbial insecticide or bio-insecticide.
- Bio-insecticides are the best remedies where the growers were not able to control the insects in spite of using heavy doses of chemical pesticides.
- They cure the plant and soil from disease causing pathogens.

**Characteristics of bioinsecticides**

- High specificity
- Virulence
- Persistence
- Viability
- Economic
- Quality control
- Safety
- Stability
- Characteristics of bioinsecticides

**Types of bioinsectisides**

1. Bacterial insecticide
2. Viral insecticide
3. Fungal insecticide
4. Protozoa insecticide

## 5. Nematode insecticide

### 1. Bacterial insecticide:

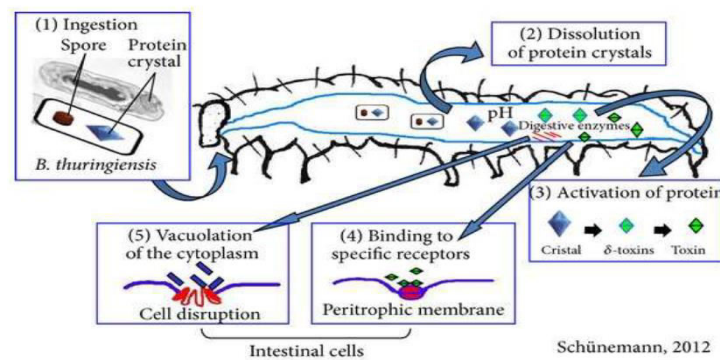
Bacteria is used as the insecticide.

#### Examples:

- *Bacillus thuringiensis*
- *Bacillus popilliae*
- *Agrobacterium radiobacter*

#### Mode of action:

- Produce toxins that are detrimental to certain insect pests when ingested



### 2. Viral insecticide:

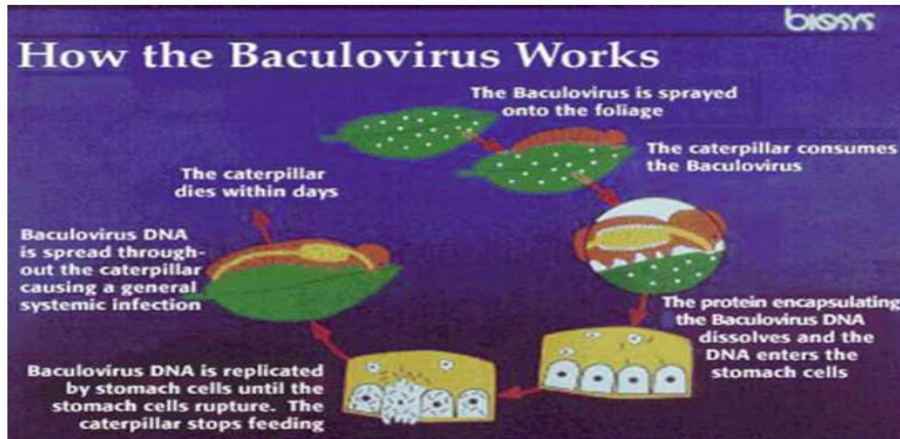
Viruses are used as insecticides

#### Examples:

- Baculoviruses: Nuclear polyhedrosis virus (NPV),
- Baculoviruses: Granulosis virus (GV)
- Baculoviruses: Group C
- Entomopox

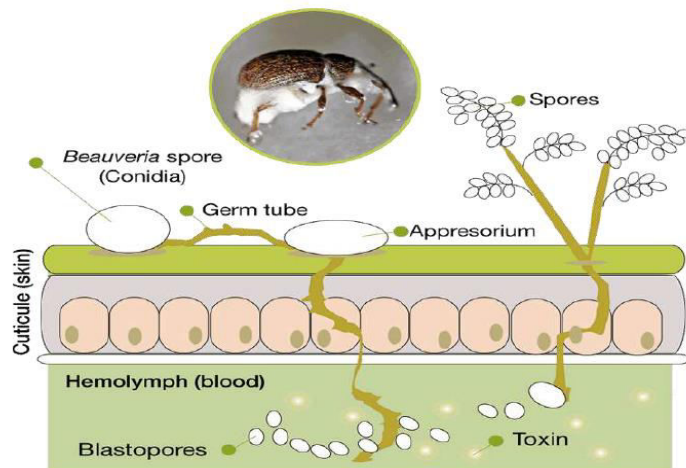
#### Mode of action

- Kills insects when ingested. Insect's feeding behavior is disrupted thus it starves and dies.



### 3. Fungal insecticide

- Fungi are used as insecticide.
- Example: *Entomophaga praxibulli*
- Mode of action
- Controls insects by growing on them secreting enzymes that weaken the insect's outer coat, and then getting inside the insect and continuing to grow, eventually killing the infected pest.



### 4. Protozoa Insecticide

Protozoa is used as insecticide.

Example:

- Nosema
  - Vairimorpha
  - Malamoeba
- Mode of action

- **Kills insects when ingested. Insect's feeding behavior is disrupted thus it starves and dies.**

### 5. Nematode Insecticide:

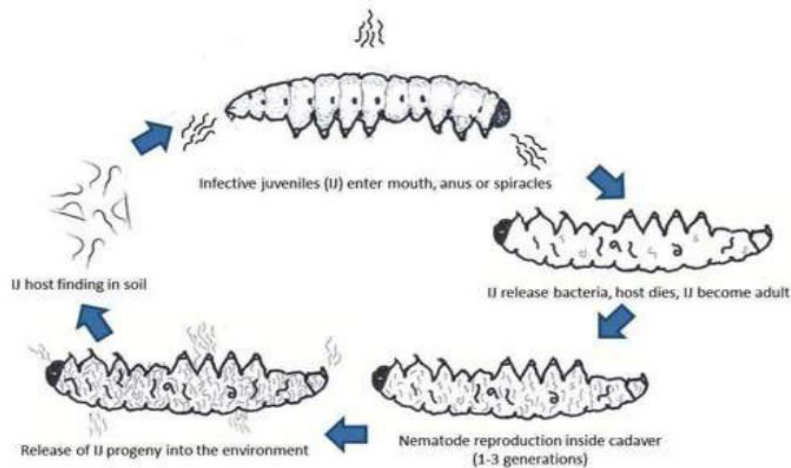
- Nematodes are used as insecticide.

Example:

- *Heterorhabditis bacteriophora*
- *Phasmarhabditis hermaphrodita*
- *Steinernema carpocapsae*

Mode of action

- They kill their target organisms by entering natural body openings or by penetrating the insect cuticle directly.



### ADVANTAGES OF BIOINSECTICIDES:

- They do not persist long in the environment
- They are effective in small quantities
- Safer to humans and animals compared to synthetic insecticides
- They are very specific, often affecting only single species of insect and have a very specific mode of action