



FACULTY OF AGRICULTURAL

Characteristics of biopesticides

- Provide protection to the crop throughout their crop growth period.
- Do not cause toxicity to the crop plants
- Provide effective control against disease.
- Ecologically and environmentally safe.
- Easy to apply to the target site.
- Easy to manufacture
- Can be easily mixed with the bio-fertilizer
- Capable to tolerate heat, desiccation

On the basis of origin, biopesticides are classified under

Microbial origin

It contains bacteria, fungus, virus and protozoan as an active ingredient. Various kind of insects, weed, fungal and bacterial diseases are controlled by these pesticides. For specific pest, specific kind of microbial pesticides are available. These days most commonly used microbial pesticides for insect pest is Bt (*Bacillus thuringiensis*) and *Trichoderma* spp. for fungal diseases. Bt releases a toxin which is harmful for insect pest of tomato, Potato, cotton etc. *Trichoderma* sp act through mycoparasitism, competition and antibiosis and quite effective against soil borne pathogen viz Fusarium wilt, *Rhizoctonia solani* etc.

NPV (Nucleo polyhedral virus) is an entomopathogenic virus. It destroys larva of insect belonging to order Lepidoptera. These viruses are highly host specific and environmentally friendly. It is found quite effective against various devastating insect of plant like *Helicoverpa armigera*, *S. litura*, *S. exigua*, *Amsacta moorei*, *Agrotis ipsilon*, *A. segetum*, *Anadividia peponis*, *Thysanoplusia orichalcea*, *Adisura atkinsoni*, *Plutella xylostella*, *Corcyra cephalonica*, *Mythimna separata* and *Phthorimaea operculella*.

Plant origin

Pesticidal substances are produced from a plant which is genetically modified. For example Bt gene from bacteria *Bacillus thuringiensis* into cotton plant against lepidopteran insects. But these plants and genes are regulated by EPA.

Other example plant origin insecticides are Neem based pesticides and Pyrethrum. Neem based pesticides are effective against various insect like Aphid, white fly, brinjal fruit and shoot borer, pod borer etc.

Neem based pesticides are also effective against soil borne plant pathogens like *Ralstonia solanacearum* (bacterial wilt of solanaceous crop). Pyrethrum based insecticides are effective against Fruit and shoot borer of brinjal, pod borer of pulses etc.

Biochemical pesticides

These are naturally occurring substance that interfere in the growth and mating of insects and check their population. These substance can be growth regulator, repellents, attractants, and pheromones.

Insect origin

It includes egg parasitoid, larval parasitoid and predator. Egg and larval parasitoid are those insect which feed on eggs and larva of insect which damage various crops. Predators are those insect which attack other crop damaging insect. Egg parasitoid includes Trichogramma, larval parasitoid includes *Spintherus dubius* and Predator includes beetles.

Major biopesticides produced and used in India are briefly described below (Table 1)

Neem: derived from Neem plant (*Azadirachta indica*). It contains toxic ingredient Azadirachtin which inhibit reproductive and digestive process of number of insect pest.

***Bacillus thuringiensis* (Bt):** Most commonly used pesticides and effective against most of lepidopteran insect like American boll worm and stem borer of rice. Bt releases a toxin which damages gut of an insect and kills them.

HaNPV and NPV-S: These are target specific viruses which are effective in controlling lepidopteran insect. These are insect specific viruses. These biopesticides are not commercially available for the management of *Helicoverpa armigera* and *Spodoptera litura*.

***Trichoderma* spp.:** Trichoderma is a fungal biocontrol agent which is effective against soil borne plant pathogens like wilt, root rot, black scurf etc.

It is useful for dryland crop like Ground nut, chick pea, green gram, black gram which is susceptible to soil borne pathogens.

***Trichogramma* spp.:** minute wasp which parasitize egg. They mainly parasitize on lepidopteran insect's egg like sugarcane shoot borer, pink boll worm and shoot bollworms in cotton and stem borer of rice. They are also used against vegetable and fruit insects and pests.

Some success stories about successful utilization of biopesticides and bio-control agents in Indian agriculture include (Kalra and Khanuja, 2007):

Control of diamondback moths by *Bacillus thuringiensis*

Control of mango hoppers and mealy bugs and coffee pod borer by *Beauveria*

Control of *Helicoverpa* on cotton, pigeon-pea,

and tomato by *Bacillus thuringiensis* Control of white fly on cotton by neem products, Control of *Helicoverpa* on gram by N.P.V., Control of sugarcane borers by *Trichogramma* Control of rots and wilts in various crops by Trichoderma-based products.

Table.1 Biopesticides registered under Insecticide Act, 1968

Serial No	Name of the biopesticides
1	<i>Bacillus thuringiensis</i> var. <i>israelensis</i>
2	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>
3	<i>Bacillus thuringiensis</i> var. <i>galleriae</i>
4	<i>Bacillus sphaericus</i>
5	<i>Trichoderma viride</i>
6	<i>Trichoderma harzianum</i>
7	<i>Pseudomonas fluorescens</i>
8	<i>Beauveria bassiana</i>
9	NPV of <i>Helicoverpa armigera</i>
10	NPV of <i>Spodoptera litura</i>
11	Neem based pesticides
12	Cymbopogon

Biopesticides and their benefits

Factors	Benefits of biopesticides
Cost effectiveness	Costlier but reduced number of applications
Persistence and residual effect	Low, mostly biodegradable and self perpetuating
Knockdown effect	Delayed
Handling and Bulkiness	Bulky: Carrier based Easy :Liquid formulation
Pest resurgence	Less
Resistance	Less prone
Effect on beneficial flora	Less harmful on beneficial pests
Target specificity	Mostly host specific
Waiting time	Almost nil
Nature of control	Preventive
Shelf life	Less