



Biopesticides and Its Advantages in Agriculture

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Bio-pesticides are eco-friendly pesticides which are obtained from naturally occurring substances (biochemicals), microbes and plants. Some are chemical pesticides if they act on nervous system of the pest. Through the use of biopesticides in a wider way, agriculture and health programmes can be beneficially affected. There are many disadvantages associated with the use of chemical pesticides like genetic variations in plant populations, reduction of beneficial species, damage to the environment or water bodies, poisoning of food and health problems such as cancer.

What are Biopesticides?

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered biopesticides.

Classes of Biopesticides: Biopesticides fall into three major classes:

1. Microbial pesticides
2. Biochemical pesticides
3. Plant Incorporated protect ants

Microbial pesticides: Microbe based or microbial originated pesticides are known as microbial pesticides. In other word we can say that active ingredient is microbe.

Examples:

- **Fungi:** *Beauveria*, *Bassiana*, *Metarhizium anisoplie*
- **Bacteria:** *Bacillus thuriengensis*
- **Virus:** *Nucleopolyhedrous Virus*
- **Nematodes:** *Steinernema*, *Heterorhabdis*

Biochemical pesticides: Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are generally synthetic materials that directly kill or inactivate the pest. Biochemical pesticides include substances that interfere with mating, such as insect sex pheromones, as well as various scented plant extracts that attract insect pests to traps. Because it is sometimes difficult to determine whether a substance meets the criteria for classification as a biochemical pesticide,

Examples: Plant Growth Regulators

Insect Growth Regulators

Organic Acids

Plant Extracts

Pheromones

Minerals

Microbial pesticides: Microbial pesticides consist of a microorganism (e.g., Bacterium, Fungus, Virus or Protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pests. For example, there are fungi that control certain weeds and other fungi that kill specific insects. The most widely used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or *Bt*. Each strain of this bacterium produces a different mix of proteins and specifically kills one or a few related species of insect larvae. While some *Bt* ingredients control moth larvae found on plants, other *Bt* ingredients are specific for larvae of flies and mosquitoes. The target insect species are determined by whether the particular *Bt* produces a protein that can bind to a larval gut receptor, thereby causing the insect larvae to starve.

S. No.	Microbial pesticides	Target pests and crops
1.	<i>Beauveria bassiana</i>	Aphids in chilli and brinjal (<i>Aphis gossypii</i>), cabbage (<i>Brevicoryne brassicae</i>), cowpea (<i>Aphis craccivora</i>) and rice leaf folder (<i>Cnaphalocrocis medinalis</i>)
2.	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	Fall armyworm (<i>Spodoptera frugiperda</i>) in maize, Legume pod borer (<i>Helicoverpa armigera</i> , <i>Maruca</i> sp.), Diamondback moth (<i>Plutella xylostella</i>), Spotted stem borer (<i>Chilo partellus</i>), Rice leaf folder (<i>Cnaphalocrocis medinalis</i>), Brinjal shoot borer (<i>Leucinodes orbonalis</i>), Red hairy caterpillar (<i>Amsacta albistriga</i>) and <i>Spodoptera litura</i> in soybean
3.	<i>Lecanicillium lecanii</i>	Aphids in chilli and cowpea
4.	<i>Metarhizium anisopliae</i>	White grubs (<i>Holotrichia</i> spp.) in sugarcane, Fall armyworm (<i>Spodoptera frugiperda</i>) in maize and Rice leaf folder (<i>Cnaphalocrocis medinalis</i>)
5.	<i>Pseudomonas fluorescens</i>	Thrips spp. in capsicum and Fusarium wilt of red gram
6.	<i>Bacillus albus</i>	Fall armyworm (<i>Spodoptera frugiperda</i>) of maize, Tomato pin worm (<i>Tuta absoluta</i>) and Fusarium wilt of cucumber (<i>Fusarium oxysporum</i> f. sp. <i>cucumerinum</i>)
7.	<i>Pseudomonas fluorescens</i>	Spot blotch of wheat, Sheath blight of rice and Wilt of tomato/ chickpea
8.	<i>Trichoderma harzianum</i> and <i>Bacillus amyloliquefaciens</i>	Wilt of chickpea, lentil, pea, pigeon pea; damping off/seedling mortality in papaya; <i>Rhizoctonia</i> , <i>Sclerotium</i> , <i>Sclerotinia</i> , <i>Fusarium</i> , <i>Pythium</i> , <i>Ralstonia</i> , <i>Macrophomina</i> , <i>Bipolaris</i> and <i>Phoma</i> Root knot nematode (<i>Meloidogyne incognita</i>)
9.	<i>Trichoderma asperellum</i>	Phytophthora seedling blight, <i>Macrophomina</i> root rot and Fusarium wilt of safflower and Fusarium wilt of castor

Plant-Incorporated-Protect ants (PIPs): Plant-Incorporated- Protect ants are pesticidal substances that plants produce from genetic material that has been added to the plant. For

example, scientists can take the gene for the Bt pesticidal protein and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt. bacterium, manufactures the substance that destroys the pest. The protein and its genetic material, but not the plant itself, are regulated by EPA.

Examples: Bt cotton, Bt corn etc.

Advantages of Using Bio-Pesticides?

- Biopesticides are usually inherently less toxic than conventional pesticides
- Biopesticides generally affect only the target pest and closely related organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects and mammals.
- Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly reduce the use of conventional pesticides, while crop yields remain high.

Conclusion

Microbial pesticides/biopesticides can be an alternative to the chemical pesticides as indiscriminate pesticide use is detrimental to the environment and human health and also increases insect resistance to pesticides. The biopesticides are being used as alternative pest management strategies. The demand for microbial pesticides is rising steadily in all parts of the world. By combining performance and safety, biopesticides perform efficaciously with minimum application restrictions along with human and environmental safety benefits. It is likely that in the future, their role will be more fruitful in agriculture and horticulture.

Status of Biopesticides in India

India Biopesticides represent only 4.2% (as on 2021) of the overall pesticide market in India and is expected to increase drastically in coming years. In India, so far only 12 types of biopesticides have been registered under the Insecticide Act, 1968.

Neem based pesticides, *Bacillus thuringensis*, NPV and Trichoderma are the major biopesticides produced and used in India. Whereas more than 190 synthetics are registered for use as chemical pesticides.