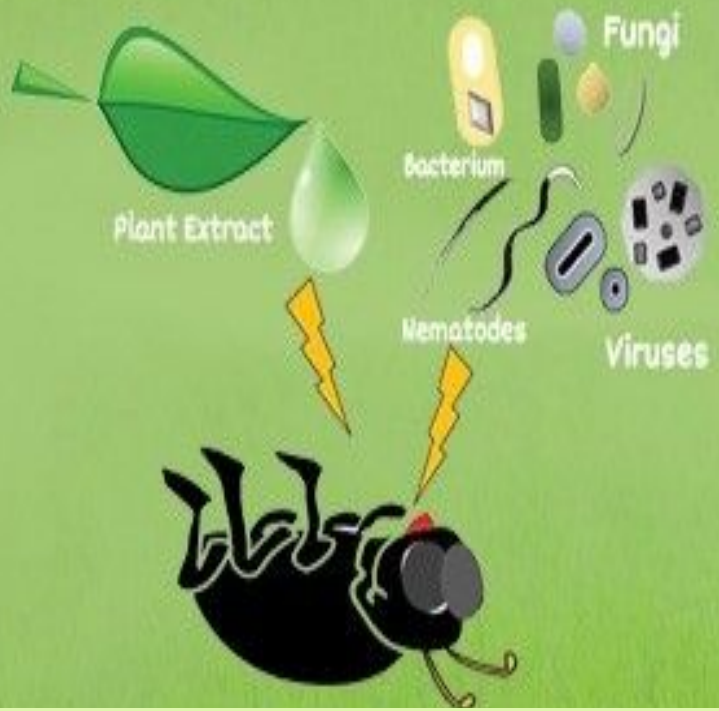
Biopesticides



Biopesticides: Definitions and classification of bio pesticides viz.Microbial pesticides, Plant-incorporated-protectants, Biochemical pesticides, Botanical pesticides, Biotic agents and commerce of biopesticide

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Introduction

- Bio pesticides are certain types pesticides derived from such natural materials as;
    1. animals
    2. plants(botanical origin)
    3. bacteria, fungi, virus(microbial origin)
    4. minerals
- For example : canola oil and baking soda
- These are do not damage the soil , water supply or any other wildlife including the beneficial insects.
- Fewer risks than conventional chemicals.

Note:
Canola oil repels insects by altering the outer layer of the leaf surface or by acting as an insect irritant. **Baking soda** is an amphoteric, biopesticide; non-toxic fungicide

What is BIOPESTICIDE?

- Bio pesticides are biochemical pesticides that are naturally occurring substances that control pests by nontoxic mechanisms.
- Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.
- All the living organism which are cultivated in the laboratory on large scale and are used and exploited experimentally for the control of harmful organism.

Characteristics of bio pesticides

- They have a narrow target range and highly specific mode of action.
- they are slow acting.
- They suppress pest populations.
- Timing of application is relatively critical.
- There is limited field persistence and shelf life.
- They are often used as part of integrated pest manageme programs (IPM).
- They are generally safer to humans and the environment than conventional pesticides.
- They usually present no residue problems.

Bio pesticides vs. conventional pesticides

Bio pesticides

- Friendly to non- target species
- Do not cause pollution
- Relatively cheaper
- Pests never develop resistance
- Growing market preference

Chemical pesticides

- Harmful to non-target species
- Serious pollution to the environment
- Relatively expensive
- Pests eventually became resistant
- Diminishing market

Types of biopesticides

- Microbial pesticides
- Plant-incorporated-protectants (PIPs)
- Biochemical pesticides
- Botanical pesticides
- Biotic agents (parasitoids and predators)

Microbial pesticides

Microbial pesticides consist of a microorganism as the active ingredient.

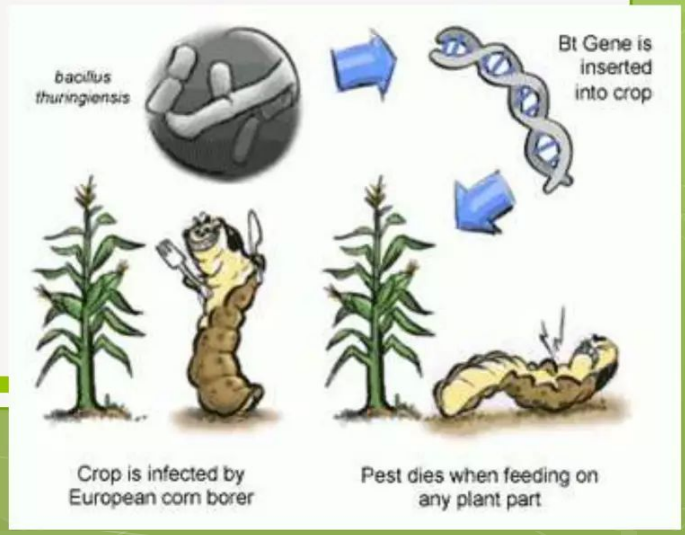
- are products derived from various microscopic organisms. Microbial products may consist of the organisms themselves and/or the metabolites they produce.
- It divided into six different subcategories of products:

1. Bacteria
2. Fungi
3. Protozoa
4. Viruses
5. Yeast

Bacteria

- The most well-known and widely used of all biopesticides are insecticides based on *Bacillus thuringiensis* "Bt."

Bt produces insecticidal proteins (know as delta-endotoxins) that kill pests.



Fungi

- They have the ability to attack and parasitize plant pathogens under certain environmental conditions.
- Two of the most common commercial fungal biopesticides are ***Trichoderma* spp. and *Beauveria bassiana***
- *Trichoderma* have the ability to readily colonize plant roots, without harming the plant.
- *Beauveria bassiana* is a fungus that acts as a parasite on many insect species.

Protozoa

- The protozan ***Nosema locustae*** is known to be a natural biocontrol agent of many grasshopper species.
- *Nosema* infects at least 90 species of grasshoppers. It is non-toxic to humans and other mammals
- it infects and weakens young grasshoppers and adversely affects female grasshoppers' ability to reproduce.

viruses

- ***Baculoviruses*** : is a microbial pesticide. They are a family of naturally-occurring viruses known to infect only insects.

- They are so specific in their action that they infect and kill only one or a few species of caterpillars.

- The infected insect stops feeding; within a few days, dies and disintegrate.

Yeast

- Non-pathogenic ***Cryptococcus*** and ***Candida*** species naturally occur on plant tissues and in water.

- The yeast serves as an antagonist to fungal pathogens such as gray mold (*Botrytis cinerea*) and blue mold (*Penicillium expansum*), which cause post-harvest decay.

Plant –incorporated protectants (PIPs)

- PIPs are pesticidal substances that plants produce from genetic material that has been added to the plant.
- For ex; the gene for the Bt pesticidal protein and introduce the gene into the plants own genetic material.
- Then the plant , instead of the Bt bacterium , manufactures the substances that destroys the pests.

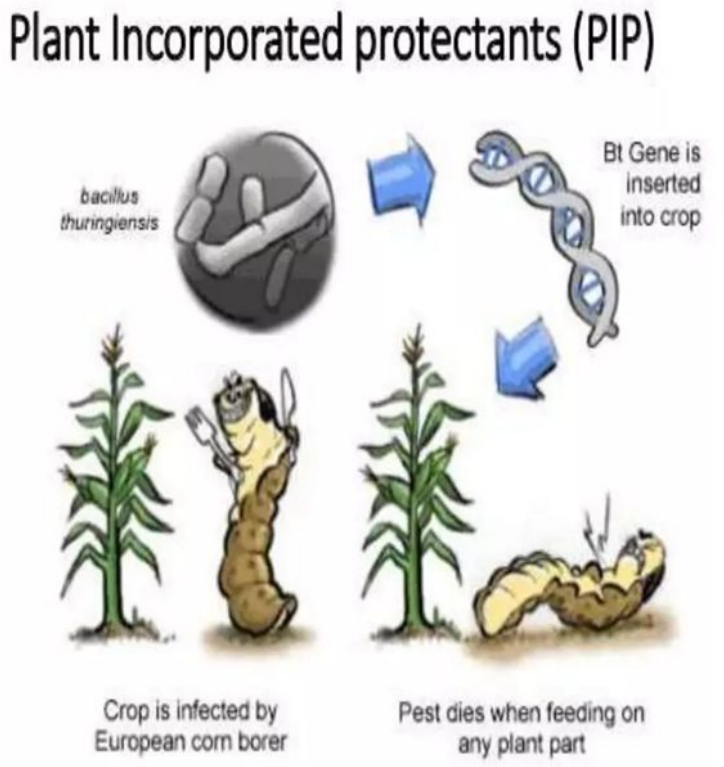


Fig. Showing the mode of action of cry protein crystal produced by genetically modified plant

1. http://permaculturenews.org/2012/08/14/bt-toxicity-confirmed-flawed-studies-exposed/

Botanical pesticides

- These are occurring substances that control pests by non –toxic mechanisms.
- It include substances that interfere with growth, feeding , development or mating of insect pests or other disease causing organisms.
- Ex; Neem oil extract.

- Botanical Pesticides or natural insecticides are organic and natural pesticides that are derived from plants and minerals, that have naturally occurring defensive properties.
- These types of pesticides have become more popular since they do not release toxins as they decompose.

Important botanical pesticides

Fig: Neem oil

Fig: Rotenone

Fig: Tobacco suspension

Biochemical Pesticides

- They are naturally occurring substance to control pest by non-toxic mechanisms.
- Biochemical pesticides include substances as insect sex pheromones, that interfere with mating that attract insect pest to traps.

Fig:weevil pheromone trap

- The synthetic attractants- are used in one of four ways:

i. As a lure in traps used to monitor pest populations;

ii. As a lure in traps designed to “trap out” a pest population;

iii. As a broadcast signal intended to disrupt insect mating

iv. As an attractant in a bait containing an insecticide

Biotic agents / Natural enemies

Predators

- They consume several to many prey over the course of their development, they are free living and they are usually as big as or bigger than their prey.
  lady beetles, rove beetles, many ground beetles, lacewings, true bugs such as Podisus and Orius, syrphid fly larvae, mantids, spiders, and mites such as Phytoseiulus and Amblyseius.
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Fig:lady bird beetle

Fig: Lacewings

Parasitoids

- Parasitoids are almost the same size as their hosts, and their development always kills the host insect.
- An adult parasitoid deposits one or more eggs into or onto the body of a host insect or somewhere in the host's habitat.
- The larva that hatches from each egg feeds internally or externally on the host's tissues and body fluids, consuming it slowly.
- Later in development, the host dies and the parasitoid pupates inside or outside of the host's body.
- Bathyplectes, trichogramma, encarsia, muscidifurax etc.

Fig: Trichogramma

Advantages of bio pesticides

1. These are usually less toxic than conventional pesticides.
2. It affect only the target pests and closely related organisms.
3. Bio pesticides often are effective in very small quantities.
4. Decompose quickly.
5. Largely avoiding the pollution problems caused by conventional pesticides.
6. Bio pesticides can greatly reduce the use of conventional pesticides, while crop yields remain high.
7. No harmful residues
8. Environmental friendly.
9. Cost effective.
10. Improve food quality.
11. High specific activity.

DIADVANTAGES OF BIOPESTICIDES

1. Biopesticides are high specific in action that it require an exact identification of the pest.

2. Slow speed of action that is unsuitable in an immediate treatment of crops.

3. Biopesticides are derived from natural material like plant bacteria which might have Eco ethical issues.

4. Difficulty in culturing in a large quantity.

APPLICATION OF BIOPESTICIDES

1. Biopesticides are usually applied in a similar manner to chemical pesticides but in Environmental friendly way.

2. For effective control, microbial agent require appropriate formulation.

3. Biopesticides used to control internal seed Borne fungal pathogens.

Conclusion

- Biopesticides are typically microbial biological pest control that are applied in a manner similar to chemical pesticides.
- Available in different formulations
- Also used to control soil borne and seed borne fungal pathogens
- Disadvantages of them are, high specificity, slow speed of action and their requirement of suitable condition for their survival.
- Eventhough, biopesticides are best for controlling the pests of agriculture then the chemicals
- Therefore there should be more works on production on biopesticides and encourage people to use biopesticides to control the pests.