BIOPESTICIDES

For Sustainable Agriculture

INTRODUCTION

- Biopesticide is a formulation made from naturally occurring substances that controls pests by non toxic mechanisms and in ecofriendly manner.
- Biopesticides may be derived from animals (e.g. nematodes), plants (Chrysanthemum, Azadirachta) and micro-organisms (e.g. Bacillus thuringiensis, Trichoderma, nucleopolyhedrosis virus), and include living organisms (natural enemies) etc.
- However, biopesticides are generally less toxic to the user and are non-target organisms, making them desirable and sustainable tools for disease management.

Advatages of biopesticides

- ✓ Inherently less harmful and less environmental load,
- ✓ Designed to affect only one specific pest or, in some cases, a few target organisms,
- ✓ Often effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems .
- ✓ When used as a component of Integrated Pest Management (IPM) programs, biopesticides can contribute greatly.

Types of biopesticides

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

Microbial Pesticides

- Microbial pesticides are composed of microscopic living organisms (viruses, bacteria, fungi, protozoa, or nematodes) or toxin produced by these organisms
- Applied as conventional insecticidal sprays, dusts, or granules.
- Their greatest strength is their specificity as most are essentially nontoxic and non pathogenic to animals and humans.
- Microbial pesticides includes insecticides, fungicides, herbicides and growth regulators of microbial origin.

Some of the important microbial pesticides

a. *Bacillus thuringiensis*

- Discovered in Japan in early 20th century and first become a commercial product in France in 1938.
- Control lepidopterous pests like
  American bollworm in cotton
  and stem borers in rice.

Fig: *Bacillus thuringiensis*

- When ingested by pest larvae, Bt releases toxins which damage the mid gut of the pest, eventually killing it.
- Main sources for the production of Bt preparations are the strains of the subspecies *kurstaki, galeriae and dendrolimus*

b. *Agrobacterium radiobacter* (Agrocin)

•*Agrobacterium radiobacter* is used to treat roots during transplanting, that checks crown gall.

•Crown gall is a disease in peaches, grapevine, roses and various plants caused by soil borne pathogen *Agrobacterium tumefaciensm.*

•The effective strains of *A. radiobacter* posses two important features:
✓They are able to colonize host roots to a higher population density.
✓They produce an antibiotic, agrocin, that is toxic to *A. tumefaciens*.

c. *Pseudomonas fluorescens* (Phenazine)

•This bacteria is used to control damping off caused by *Pythium sp.*, *Rhizoctonia solani*, *Gaeumannomyces graminis*.

•It has ability to grow quickly in the rhizosphere

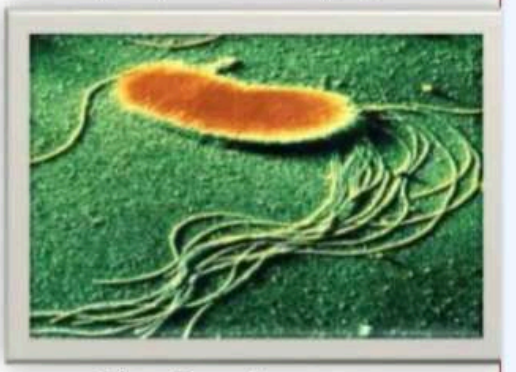

Fig: Pseudomonas

d. *Trichoderma*

•*Trichoderma* is a fungicide effective against soil born diseases such as root rot.

•This is also used against *Necteia galligena,* that causes silver leaf disease of fruit trees by entering through pruning wounds.

Fig. spores of Trichoderma

e. *Metarizium anisopliae*

•It infects spittlegbugs, rhinoceros beetles.

Fig: Metarhizium anisopliae

f. *Beauveria bassiana*

• Controls Colorado potato beetle.

g. *Verticillum lecanii*:

•Controls aphids and whiteflies.

h. *Nomuraea riley*:

• Controls soybean caterpillars.

Fig:Beauveria

i.*Baculoviruses*(Bvs)

• Control lepidopterous and hymenopterous pests.

•Rod shaped, circular double stranded super coiled DNA.

Plant-incorporated-protectants (PIPs)

- Pesticidal substances that plant produce from the genetic material that has been added to the plant.
- As the pest feed on such plants they will eventually die.

Botanical pesticides:

- These are naturally occurring plant material that may be crude preparation of the plant parts ground to produce a dust or powder that can be used in full strength or dilute form in a carrier such as clay, talc or diatomaceous earth.
- "Azadirachtin" effects the reproductive and digestive procees of pest.
- Several plant based insecticides as nicotinoids, natural pyrethrins, rotenoids, neem products etc are used.

Important botanical pesticides

Fig: Neem oil

Fig: Rotenone

Fig: Tobacco suspension

4.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.

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

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.