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Tamil Nadu, India.

Programme: M.Sc., Biomedical Science

Course Title : Microbiology

Course Code : BM24AC4

Unit-V

Biopesticides

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BIOPESTICIDES

- Includes naturally occurring substances that control pest (biochemical pesticides), microorganisms that pesticidal substances produced by plants containing added genetic material (plant incorporated protectants or PIPs).

NEED FOR BIOPESTICIDES

- Proper pest management is important factor for healthy and high yielding crop to fulfill the food demand for increasing population.
- Chemical pesticides have accelerated land, air and water contamination.
- They have been the main cause of insect resistance as well as adverse impacts on natural enemies and humans.

ADVANTAGES OF BIOPESTICIDES

- Less toxic than conventional pesticides.
- Effect only the target pest and closely related organisms whereas conventional pesticides are board spectrum pesticides.
- Effective in very small quantities and often decompose quickly resulting in lower exposures and largely avoiding pollution problems caused by conventional pesticides.
- When used as a component of integrated pest management programs, biopeticides can greatly reduce the use of conventional pesticides while crop yields remain high.

CLASSES OF BIOPESTICIDES

1. **Biochemical pesticides**
2. **Microbial biopesticides**
3. **Plant-incorporated protectants (PIPs)**

Microbial biopesticides

- Consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient.
- Active ingredient is relatively specific for its target pest.
- Eg: some Bt ingredients control moth larvae found on plants, other Bt ingredients are specific for larvae of flies and mosquitoes.

- Constitute the largest group of broad-spectrum biopesticides which are pest specific.
- There are atleast 3000 naturally occurring insect-specific microorganisms, 100 of which are insecticidal.
- Bacterial biopesticides
- Viral biopesticides
- Fungal biopesticides
- Protozoan biopesticides

BACTERIAL BIOPESTICIDES

- Mainly 4 categories:
- Crystalliferous spore formers (Bacillus thuringienses)
- Obligate pathogens (Bacillus sphaericus)
- Potential pathogens (Serratia marcesens)
- Facultative pathogens (Pseudomonas aeruginosa)

BACILLUS THURINGIENSIS

- Spore forming, facultative bacterium with nearly 100 subspecies and varieties divided into 70 serotypes.
- Specific, safe and effective tool for insect control.
- Insecticidal property resides in cry family of crystalline proteins that are produced in the parasporal crystals and are encoded by the cry genes.

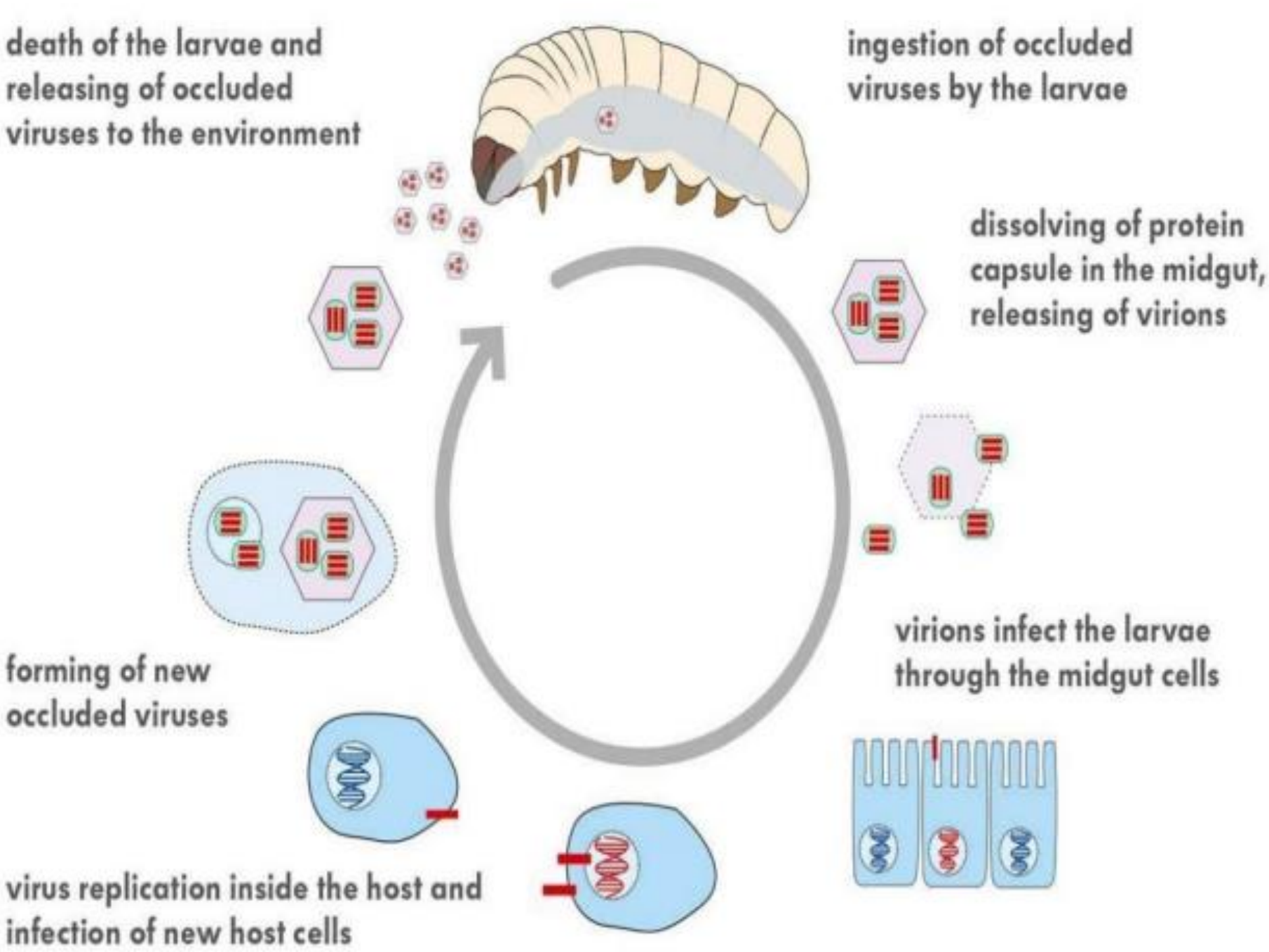
BACILLUS SPHARICUS

- Strict aerobic bacterium, which produces round spores in a swollen club like terminal or subterminal sporangium.
- Produces an intracellular protein toxin and a parasporal crystalline toxin at the time of sporulation.
- The mosquito – larvicidal binary toxin produced by B. sphaericus is composed of Bin A (51.4 kDa) and Bin B (41.9 kDa).

- Bin proteins form a crystal and in solution it can exist as an oligomer containing 2 copies each of Bin A and Bin B.
- Some toxin strains also produces 100 kDa toxins encoded by mtx genens.
- Mainly used for mosquito control.

VIRAL BIOPESTICIDES

- They are narrow spectrum.
- After application to plant surface, baculovirus occulsion bodies (OBs) - are rapidly inactivated by solar UV radiation (280 – 320nm).
- Efficacy can be improved by the use of formulations that include stilbene derived optical brighteners, which increase susceptibility to NPV infection.
- UV inactivation can be controlled by creating systems which filter UV radiation such as plastic greenhouse structures.


death of the larvae and releasing of occluded viruses to the environment
ingestion of occluded viruses by the larvae
dissolving of protein capsule in the midgut, releasing of virions
virions infect the larvae through the midgut cells
forming of new occluded viruses
virus replication inside the host and infection of new host cells

FUNGAL BIOPESTICIDES

- Fungi specifically associated with insects (aphids, thrips, mealy bugs, whiteflies, scale insects, mosquitoes and mites) are known as entomopathogenic fungi.
- Obligate or facultative, commensals or symbionts of insects.

- Belongs to 4 major groups:

- Laboulbeniales
- Pyrenomycetes
- Hyphomycetes
- zygomycetes

PROTOZOAN BIOPESTICIDES

- Although they infect pests, include chronic and debilitating effects on targets, the use of protozoa as biopesticides has not been very successful.
- Microsporan protozoans are used as possible component of IPM.
- Microsporidia are ubiquitous, obligate intracellular parasites.
- Eg: Nosema and Vairimorpha have some potential to attack lepidopteran and orthopteran insects.

DEMERITS OF MICROBIAL PESTICIDES

- Owing to the specificity of the action, microbes may control only a portion of the pests present in a field and may not control other type of pest present in treated areas, which can cause continuous damage.
- As heat, UV light and desiccation reduces the efficacy of microbial pesticides, the delivery systems become an important factor.
- Special formulations and storage procedures are necessary. Shelf life is a constraint, given their short shelf lives.

REFERENCE:

- Microbiology : an introduction., Gerard J.Tortora, 1982.

- https://www.google.com/search?q=applied+microbiology&rlz=1C1YTUH_enIN1010IN1010&biw=681&bih=615&sxsrf=ALiCzsbtvu9k0PB0o1wAPXj31a8pp_AoPw%3A1663220221611&ei=

THANK YOU