Entomology for Beginners

General Entomology ENT 100

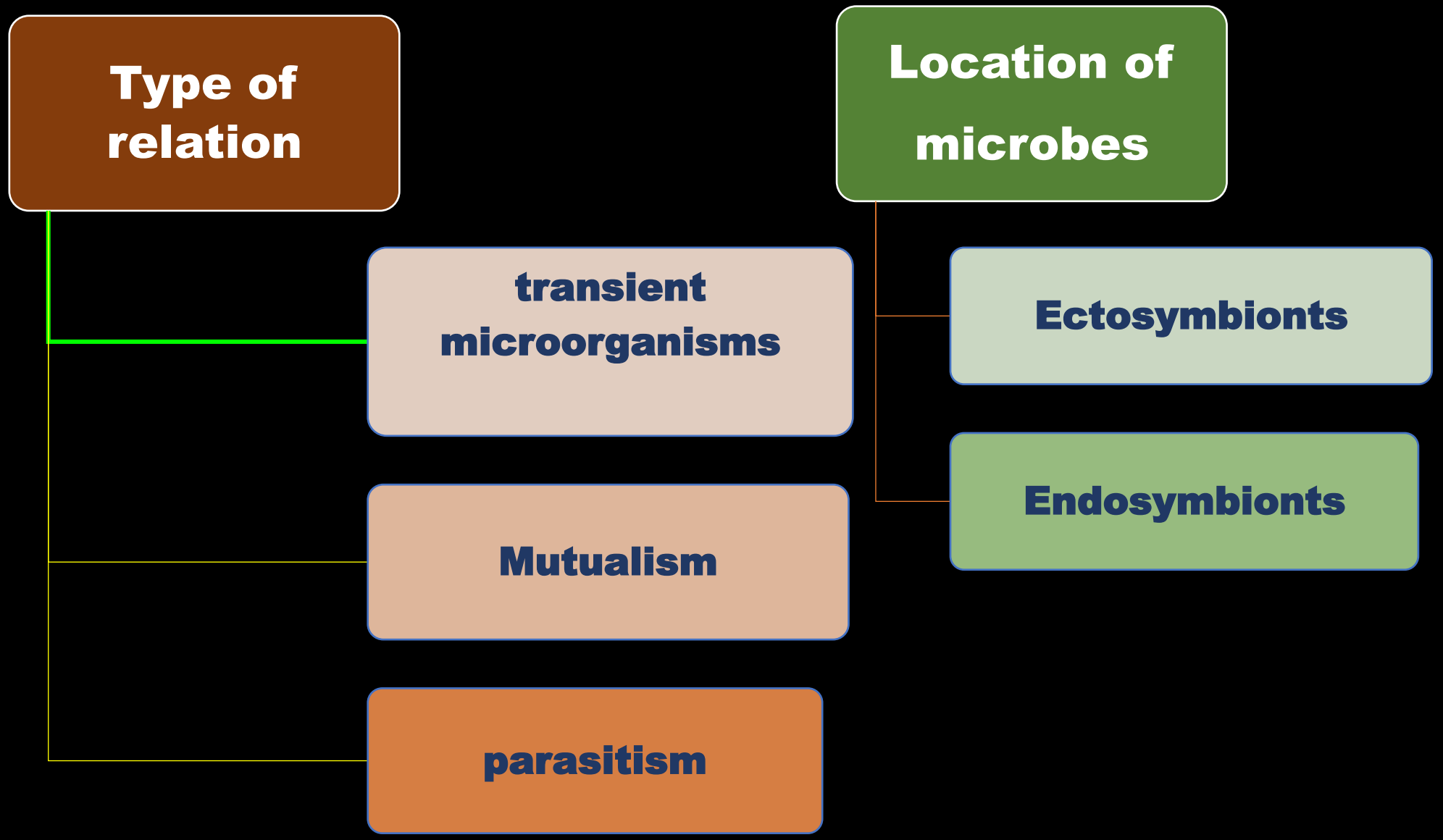

بسم الله الرحمن الرحيم

Insects-microbes interaction

Insects-microbes interaction

- Microorganisms including **bacteria, fungi, viruses**, and **protozoa**, are in close association with insects.
- The relationships between insects and microorganisms may be **mutualistic and beneficial** to **neutral** or **pathogenic and harmful.**

The relationship between insects and microbes is classified according to:

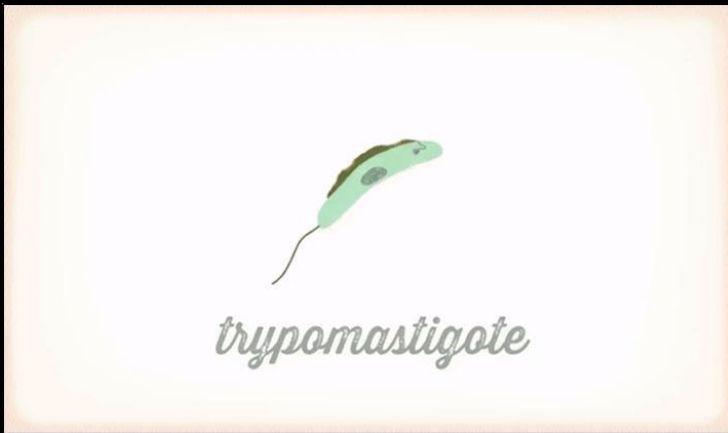


Transient microorganisms

- EX1: Bacteria on the external body surface of the housefly (**Ectosymbionts**) can be transmitted to human food and cause illness.
- Ex2: Aphids harbor pathogenic plant viruses inside their gut (**Endosymbionts**) and transmit them to plants during feeding.”

- **Blood-feeding bugs** can pass the parasitic protozoan **Trypanosoma** to human host.

- During the blood meal, the infected bug deposits its feces on the skin, this allowing the parasite to enter the host's body.



Mutualism

- In mutualism, Insects and microbes get **benefits**
- Benefits provided by microbes to insects:

1. **Nutrient supplementation**
2. **Help in food digestion**

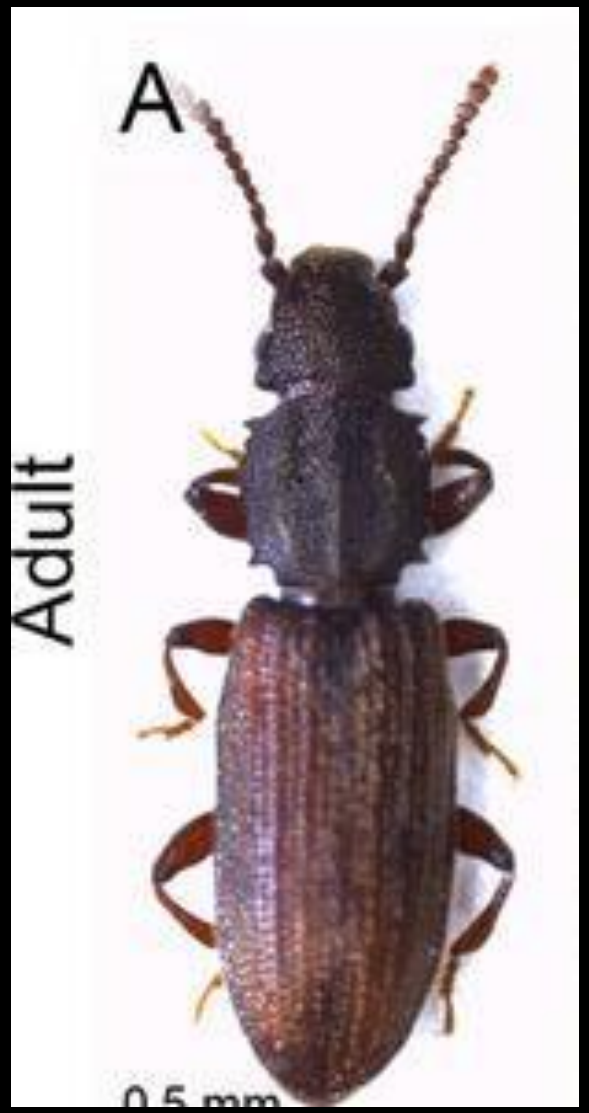
- Benefits provided by insects to microbes:

1. **Protected Habitat**
2. **Facilitation of Reproduction**

- The mutualistic microbes are often associated with insects which possess specialized feeding habits.

Ex1: The saw-toothed grain beetle harbors type of bacteria in the abdomen. This bacteria support their host by:

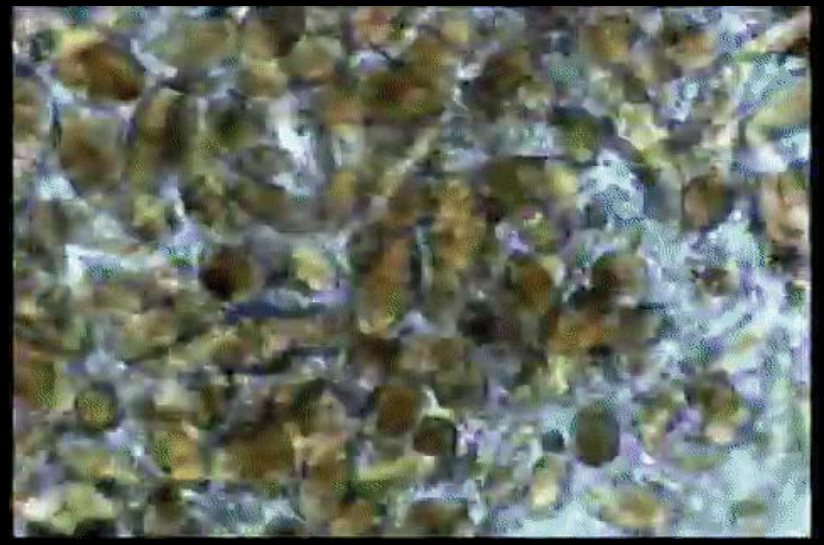
- Enhanced desiccation resistance, which is important for survival in the dry environments.
- Hardening the cuticle.
- protect the insects from pathogenic fungi.

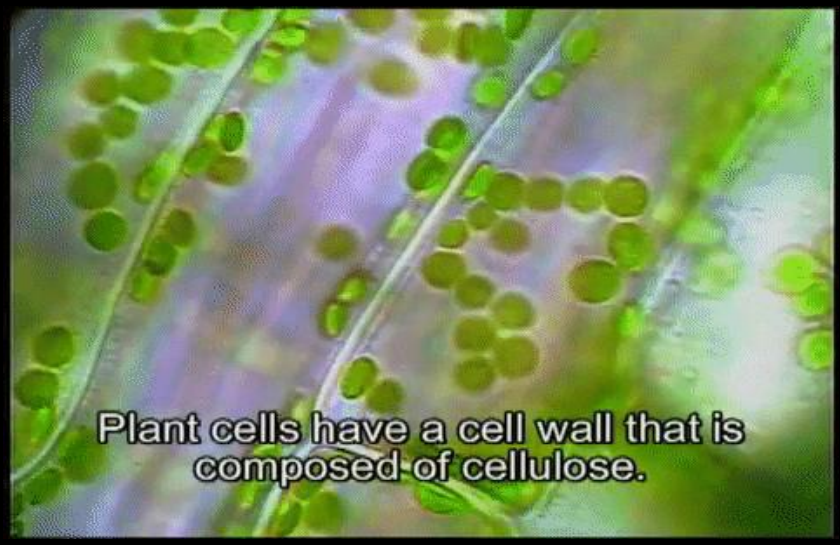


Ex2: the leaf-cutting ants are mutualists with fungi.

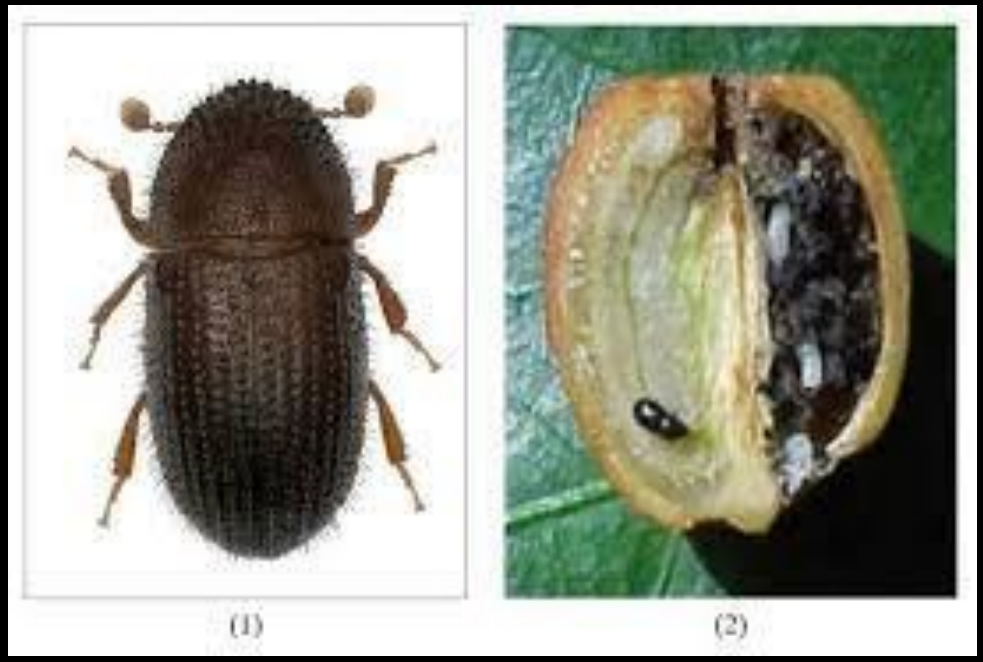
- **These insects are completely dependent on fungi for their food. Also, these fungal species are found only in association with their insect "farmers" .**

Ex3: The cellulose-feeding termite harbor endosymbionts in the hindgut for the digestion of lignocellulose.





Ex4: The bark beetle, coffee berry borer (CBB) spends its life cycle inside of the coffee fruit, feeding on the coffee seed while exposing itself doses of the toxic alkaloid, caffeine.

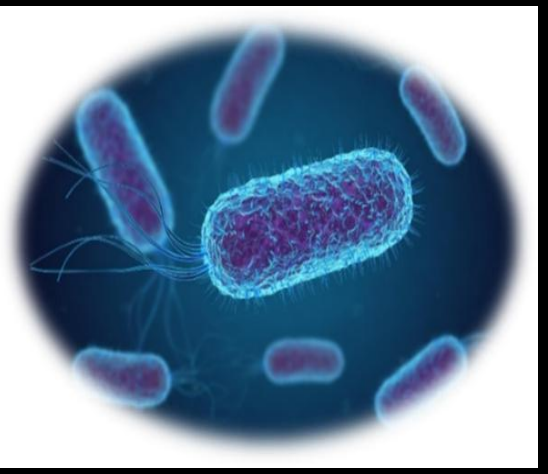


CBB's associated bacteria help CCB to survive toxic caffeine levels by detoxifying the toxic secondary metabolites.

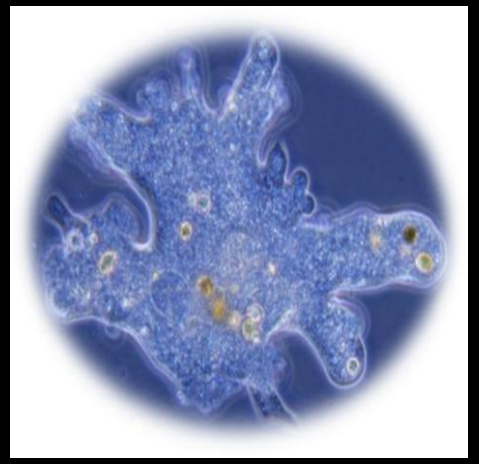
Parasitism

- Parasitism or pathogenic interactions arise when microorganisms damage or kill their insect hosts.
- Numerous microbial species are capable of infecting and finally destroying insects.

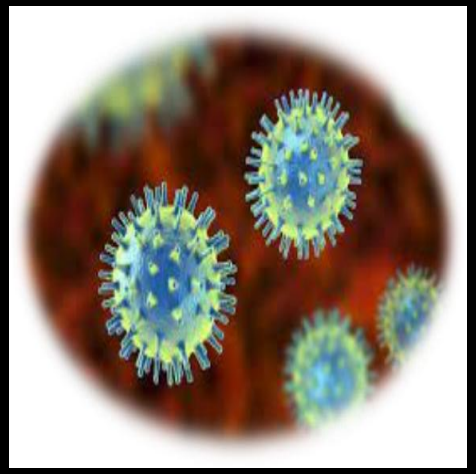
Bacteria



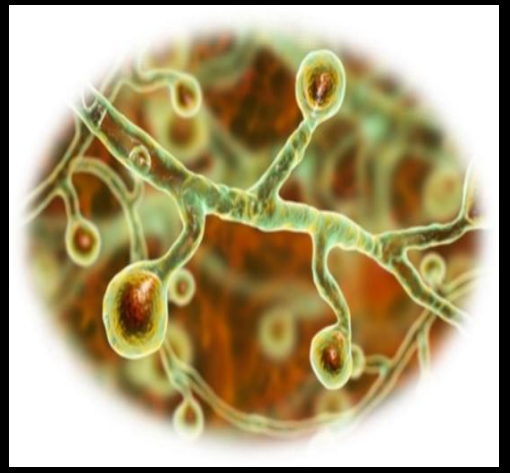
Protozoa



Viruses



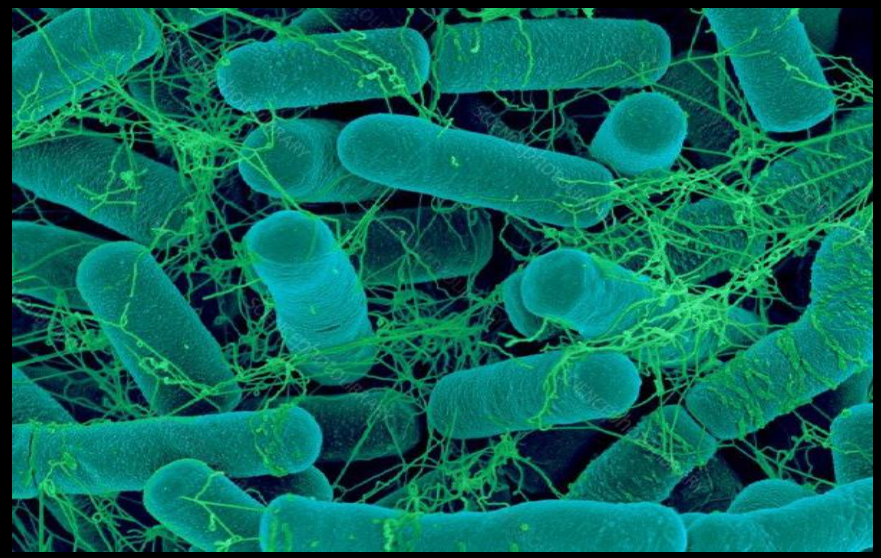
Fungi



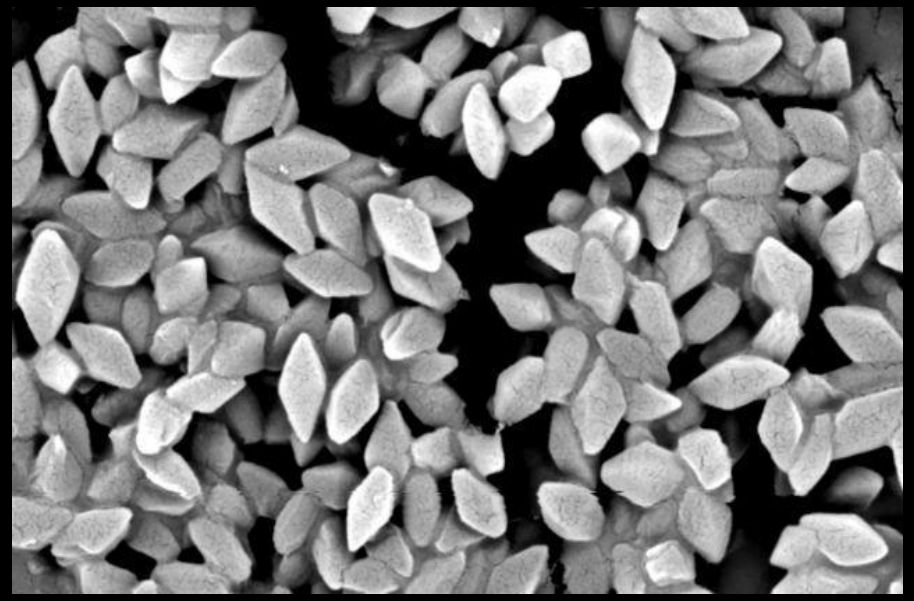
Nematodes

Ex: Bacteria

- ***Bacillus thuringiensis*** **(Bt) have a wide range of hosts, including moths, butterflies, housefly and mosquitoes.**
- **The Bt toxin kills victims by first paralyzing their mid-gut, then their entire bodies.**
- **Bt, is the most widely applied biological control agent.**



Bacillus thuringiensis **(Bt)**



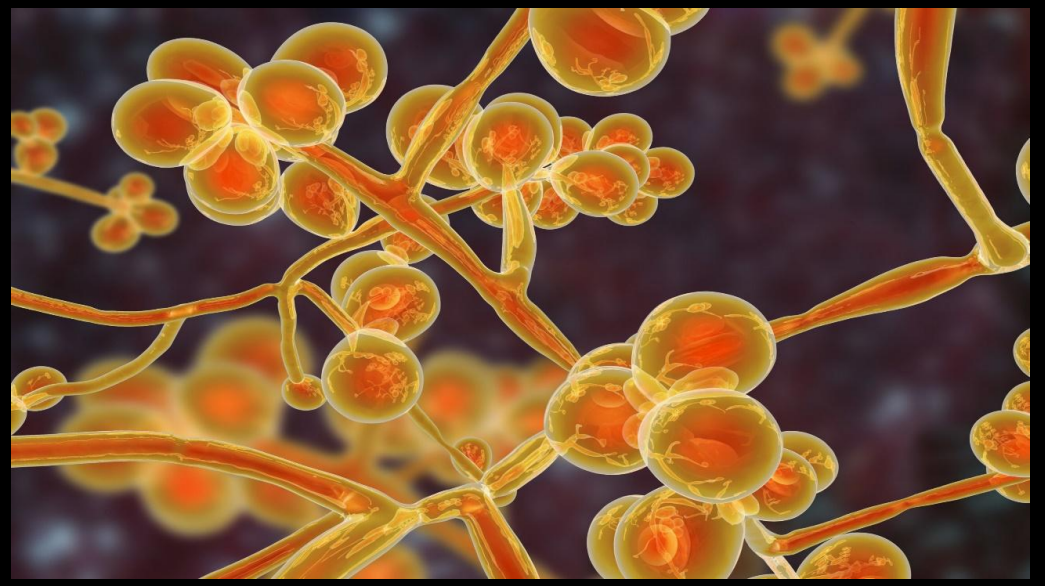
protein crystal

- Bt is the most widely applied biological control agent against insects.

Insect larvae killed by Bt

Fungi:

- Fungi are the most common disease-causing agents of insects.
- They play a crucial role in natural ecosystems



Fungal pathogens

produces spores

dispersed to new hosts.

Insects killed by fungal pathogens

Thank you