NEW ERA AGRICULTURE MAGAZINE

MICROBES AS BIO-CONTROL AGENTS

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Introduction

Small, single-celled organisms are known as microbes or microorganisms. They are too little for our naked eyes to see. While certain bacteria are beneficial to human welfare, others are poisonous, destructive, and sicken us. Let's take a quick look at how microbes function as biocontrol agents.

The term “biological control” was first used by Harry Scott Smith at the 1919 meeting of the Pacific Slope Branch of the American Association of Economic Entomologists, in Riverside, California. It was brought into more widespread use by the entomologist Paul H. DeBach (1914-1993) who worked on citrus crop pests throughout his life who is considered as the Father of biological control.

International Organisation for Biological Control (IOBC) promotes environmentally safe methods of pest and disease control.

Regional Sections of IOBC

APRS	**Asia and the Pacific Regional Section (India, South-East Asia, Japan and Australia)**	NRS	**Nearctic Regional Section (North America)**
ATRS	African Tropical Regional Section (African countries south of the Sahara)	NTRS	Neotropical Regional Section (Latin-American countries)
EPRS	East Palearctic Regional Section (Eastern Europe)	WPRS	West Palearctic Regional Section (Europe, Mediterranean Region, Near- and Middle East)

The Union Minister of Agriculture and Farmers Welfare Government of India, Shri Narendra Singh Tomar inaugurated the Integrated Biological Control Laboratory at National Institue of Plant Health Management

What is biocontrol?

Biocontrol, also known as biological control, is the natural process of getting rid of insects, pests, and other disease-causing agents by using their biological enemies. The agents used for this are referred to as biocontrol agents. One of them are microorganisms.

Predation and parasitism are the foundation of biocontrol. Compared to utilizing pesticides and insecticides to destroy insects and other pests, it is much more dependable and healthy. As a result, this avoids soil pollution and health problems like insecticide poisoning.

Biocontrol agents!!

The use of biocontrol agents is essential in organic farming. Farmers who

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practice organic farming hold a mutualism. In other words, organic farmers maintain a balance between beneficial and detrimental elements in the environment. The use of chemicals to eradicate pests and parasites may not always be effective and may sometimes harm beneficial agents. Instead, producers employed biocontrol agents that are able to outlive the insects and pests that harm crops. This kind of pest management requires in-depth knowledge of the life cycles and feeding preferences of many living forms.

Bio-control agent types

Two categories of biological control exist:

Traditional biocontrol (Importation): This method employs the pest's natural adversary as a biocontrol agent. The invasive plant's natural predators are used in this strategy, however if introduced species aren't picked carefully, they sometimes turn into serious pests.

Inductive biocontrol (Augmentation): The target weed is killed by a huge number of released natural enemies. The inundative release method is most frequently utilized with nematodes.

Bio-Control Agents List

- Spiders, flies, ladybugs, wasps, beetles, and dragonflies are examples of insect predators.
- Pathogenic microorganisms, including bacteria, fungus, and viruses. The bacteria coccobacillus are more harmful to insects. They are used to combat insects and aphids and have an impact on insects' digestive systems. In order to combat green peach aphids, one uses the fungus Entomophaga.
- In order to kill the host body, parasitoids lay eggs there. It later serves as a source of nourishment for the larva's growth. It frequently functions as a biocontrol agent.

Microbial biocontrol agents

Microbes are another type of biological control agent in addition to insects. Bacteria, fungi, viruses, and protozoans are some of these microorganisms. In three different methods, microbes function as biocontrol agents: either they infect pests with diseases, compete with them, or even kill them.

Biotechnology has grown significantly and produced a large number of biocontrol agents. An example of a microbial biocontrol agent is *Bacillus thuringiensis*, also known as Bt. The butterfly caterpillars can be killed by spraying plants with a Bt solution consisting of spores. The larvae are killed by the toxins released by the swallowed spores in their stomachs.

By introducing the harmful genes of *B.thuringiensis* into plants, biotechnology has created plants that are resistant to both disease

and pests. such as Bt cotton. Other microbial biocontrol agents include baculoviruses of the genus Nucleopolyhedrovirus and the fungus-like Trichoderma. Due to their specialized nature and high price, these agents are seldom widely used.

How Microbes are Used as Biocontrol Agents?

Some of the microbes that are used as biocontrol agents are given below:

a. Bacterial Pesticide

i. The most commonly used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*.

ii. *Bacillus thuringiensis* (Bt) is a gram-positive bacterium that is used to get rid of butterfly caterpillars.

iii. In this, the dried spore of *Bacillus thuringiensis* is mixed with water and sprayed onto vulnerable plants such as Brassica and fruit trees.

iv. These spores are eaten by the insect larvae and in the gut of the larvae, the toxin is released, and the larvae get killed.

b. Viral Pesticides

i. There are more than 1600 different viruses that infect around 1100 species of mites and insects.

ii. A special group of viruses known as **baculovirus**, to which about 100 insect species are susceptible, accounts for more than 10% of all insect pathogenic viruses. **Baculoviruses** are rod-shaped particles that contain DNA. Baculoviruses are pathogenic agents that attack insects and other members of the phylum Arthropoda.

iii. The majority of baculoviruses that are used as biological control agents belong to the genus **Nucleopolyhedrovirus**.

iv. These viruses are good agents for species-specific, narrow spectrum, insecticidal applications.

c. Protozoan Pesticides

i. These protozoan pathogens naturally infect a wide range of insect hosts.

ii. Even though these pathogens can kill their insect hosts, many are important for their chronic and debilitating effects.

iii. One of the important and common consequences of protozoan infection is a reduction in the number of offspring produced by infected insects.

iv. Although protozoan pathogens play a significant role in the natural limitation of insect populations, few appear to be suited for development as insecticides.

d. Fungal Pesticides

i. *Beauveria bassiana* is an entomopathogenic fungus that is

responsible for causing white muscardine disease in a range of insects, including whiteflies, thrips, grasshoppers, aphids and certain types of beetles.

ii. *B. bassiana* spores need to come in contact with a host. Once the host insect is infected, the fungus grows inside of the insect rapidly, feeding on the nutrients present in the host's body and producing toxins in turn. When the host dies, the *B. bassiana* covers the carcass in a layer of white mould that produces more infective spores.

iii. *Trichoderma* is known to exhibit biocontrol over several plant pathogens.

Microbial Herbicide

1. Herbicides that are used to control unwanted plant growth are also called weedkillers.
2. The microbial origin of herbicides has developed drastically in the last few years, and it is now contributing as an alternative to chemical herbicides.
3. The microbial herbicides are effective enough to control weeds and it is applied in many countries.

Advantages of Microbes as Biocontrol Agents

These have no negative impacts on plants, mammals, fish, birds or even on non-target insects. This is specifically desirable when beneficial insects are being conserved to aid in the overall **Integrated Pest Management** (IPM) Programme or when an ecologically sensitive area is being treated.

Some of the advantages are as follows:

1. These are cost-effective.
2. These biocontrol agents reduce the use of chemicals and other pesticides.
3. As it is easily available, effective in all seasons and easy to use.
4. They are environment friendly and also do not cause any side effects.

Disadvantages of Microbes as Biological Agents

Some of the disadvantages are as follows:

1. The high specificity against the target disease and pathogen may require multiple microbial pesticides.
2. It may affect product quality.
3. Pest is not completely removed by these biocontrol agents.
4. These are not very effective for short scale applications.