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ROLE OF BIOCONTROL AGENTS IN INTEGRATED PEST MANAGEMENT

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Abstract:

It is anticipated that there will be 8.5 billion people on the planet by 2030, 9.7 billion by 2050, and more than 11 billion by 2100. Pest control in agriculture is still necessary due to the strain on the industry to produce more food on the same amount of land or even less. The negative effects of pesticides have highlighted the need for safer and more practical alternatives, like bioagents and biopesticides. A pest is successfully controlled with the use of other living species (parasitoids, predators, and infections) that are spread by humans. In comparison to the frequent application of chemical pesticides, biocontrol agents are not only more sustainable but also safer and more specific to manage.

Biological Control

An integral part of an integrated pest management plan is biological control. It is characterized as the control of pest populations by natural enemies and usually entails a proactive human role. Predators, parasitoids, and diseases are examples of natural enemies of insect pests, commonly referred to as biological control agents. The use of diseases and insects to suppress weeds is known as biological control.

Techniques In Biological Control

Introduction

Natural enemies are being introduced and established in a new area where they were not previously present. The Vedalia beetle, *Rodolia cardinalis*, was transported from Australia to California in the 19th century and proved effective in eradicating cottony cushion scale.

Augmentation- To increase the number of naturally occurring natural enemies, natural enemies are reproduced and released.

- **Inoculative release-** *Encarsia formosa*, a natural enemy that is expected to reproduce, and a large number of individuals are released just once during the season to combat greenhouse whiteflies. The two-spotted spider mite is managed using the

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predatory mite *Phytoseiulus persimilis.*

- **Inundative release** Involves mass reproduction and releasing natural enemies regularly when pest populations reach harmful levels. To eradicate dangerous moths, the egg parasitoid *Trichogramma* is usually discharged through flooding.

Conservation: - Actions taken to conserve and unleash natural adversaries by manipulation of the environment. To maintain the populations of natural enemies, it may be necessary to provide a suitable environment, such as a shelter belt. Gardeners can promote earwigs, which are natural predators, by hanging flowerpots upside-down and filling them with straw.

Biological Control Agents

Parasitoids: - Insects that parasitize other insects are known as parasitoids. The parasitoids' immature stages grow on or inside their host, ultimately killing it. The host can be attacked by parasitoids at any stage (eggs, larvae, nymphs, pupae, adults).

- Commercially available parasitoids include *Trichogramma, Encarsia formosa*, and *Aphidius* species include *Aphidius ervi*, *A. colemani*, and *A. matricariae*.
- *Trichogramma* is an egg parasitoid that successfully attacks a variety of caterpillars.
- Whiteflies are managed in greenhouses using *Encarsia formosa.*
- *Aphididius* parasitoids work well to control aphids.

Predators: - A predator is a creature that hunts down and eats prey, which are smaller or more defenceless species. Some examples of predators include beetles, ground beetles, lacewings, syrphid (hover) flies, mantids, and yellowjacket wasps.

Entomo Pathogens: - An organism that causes disease in insects, typically a (bacterium, virus, protozoan, or fungus). Entomopathogenic fungus, entomopathogenic bacteria, entomopathogenic viruses, entomopathogenic nematodes, and entomopathogenic protozoa are some of these.

Need For Biocontrol

According to the UN's World Population Prospects (2011), the world's population will reach 8.5 billion by 2030, 9.7 billion by 2050, and more than 11 billion by 2100. Pest control in agriculture is still necessary due to the strain on the industry to produce more food on the same amount of land or even less. (2019) Shukla *et al*. Chemical pesticides used carelessly in agriculture have negative consequences on human health and the environment, as well as a decrease in natural enemies and an increase in small pests. The negative effects of chemicals have highlighted the need for safer

and more efficient alternatives like bioagents and biopesticides.

Benefits of Biocontrol Agents

Compared to other treatments, biological control is more affordable and environmentally beneficial. In contrast to blanket applications, bio-control agents protect the crop during the most vulnerable phases of pest incidence. They don't lead to problems with phytotoxicity. In comparison to the frequent application of chemical pesticides, the biocontrol agents are not only more sustainable but also safer and more targeted to use. The capacity of many biocontrol treatments to both prevent and treat illness as well as promote healthy root and plant growth promoting the soil's beneficial microflora- increases crop production. Biocontrol agents are quite safe to use on the target and to handle. The majority of biocontrol agents have demonstrated compatibility with other pest management techniques in general and with other biocontrol agents in particular, permitting the integration of various pest control techniques with greater practicability.

Although it has been in use for many years, biological control is still changing, and many advances have been made in the sector to meet today's demands for efficient pest management.

Biological *Isaria fumosorosea* (NBAIR- Pfu 5) is an entomopathogenic fungal that has been successful in controlling coconut rugose spiralling whiteflies.

To suppress the Fall army worm, *Trichogramma pretiosum* is also created commercially and dispersed.

Parasitic encyrtids When brought to Guam, the Palau Islands, and more recently Sri Lanka, *Acerophagus papayae*, which is known to suppress the papaya mealybug in its native habitat, successfully suppressed the papaya mealybug. The same was imported to India and was successfully used there to control papaya mealybug.

Limitations of Biocontrol Agents

Comparing biocontrol agents to conventional chemical pesticides, it may take them longer to reach their peak effectiveness. Some biocontrol agents might only be effective in specific geographical areas or have a restricted spectrum of activity. The cost of biocontrol agents may increase since they may be more expensive and may need numerous applications to be successful.

Biological Control Current Issues and Solutions

A) **Communication with stakeholders and the public-** Typically, stakeholders and the general public lack sufficient knowledge about biological control, and occasionally they even discount it as a viable pest management strategy. The general

public frequently expresses opposition to biocontrol. By highlighting the advantages of their work not only in the scientific literature but also verbally and in the media, biocontrol practitioners could help dispel some of the myths regarding biological control.

B) **Cost-effectiveness of biocontrol-** Practitioners of biological control frequently struggle to show how their programmes are profitable and beneficial in other ways. Early on in a biocontrol or IPM programme, biocontrol practitioners should consult economists, social scientists, and stakeholders to establish the targeted social, economic, and environmental advantages.

Present Status of Biological Control Agents in India

Biocontrol laboratories/ Units in India	361
Private sector laboratories	141
State biocontrol laboratories	98
ICAR/SAUs/ DBT laboratories	49
Private sector	38
Central Integrated Pest Management Centres (CIMPCs)	35

Fungal compounds make up the biggest percentage of biopesticides in India overall. In addition, Trichoderma strains are the most commonly utilised fungal biopesticides, followed by *Beauveria bassiana* and *Verticilium sps*. Pseudomonas and Bacillus take up the majority of the bacterial biopesticide market in India. *Bacillus sphaericus* and *Bacillus subtilis* are recognised as biopesticides in the case of Bacillus strains of *B. thuringiensis*.

Only viral biopesticides based on nucleopolyhedrosis viruses (NPVs) are utilised in India to biocontrol *Helicoverpa armigera*, and their share of the market is relatively small. Granulosis virus (GVs) naturally infecting sugarcane insect larvae in southern and northern Indian states was first noted quite early on, but their widespread replication and commercial production as biopesticides have not yet begun.

Nematode applications for pest control have begun. The two most efficient entomopathogenic nematodes utilised against various soil-borne pests in field settings are *Heterorhabditis* and *Steinernema*. However, there is currently no registered product on the market.

Conclusion

Chemical control methods must be gradually phased out in the current environment of organic farming and natural farming for the adoption of eco-friendly plant protection measures. The biological control approaches pave a clear pathway in light of the operating significance, and a flawless plan is urgently needed. The fine-tuning of biological

control technologies will continuously aid in greater acceptance by stakeholders, given that biological control methods currently occupy a higher proportion in IPM of significant pests of major crops.

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