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Enotomopathogenic Fungi: An Efficient Biological Control Agent for Insects Inhabitants Management

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Abstract

In agriculture, there is a rising need for less chemical fertiliser, as well as improved pesticide resistance, has fuelled the growth of alternative insect-pest control methods. Microbial biocontrol agents (MBCAs) are an appealing alternative to conventional pesticides. Entomopathogenic Fungi are natural enemies that decimate insect populations while presenting no threat to public health and the surroundings. They are among the most effective biocontrol agents. They have a broad host range and the ability to manage both saps sucking insects as well as pests with mouthparts of biting and chewing type due to their pathogenicity pathway. However, they only make up a small part of the total pesticide business. This study focuses on the latest achievements of Entomopathogenic Fungi, including their potential mechanisms, plan of action to increase our understanding of insect pest biological control.

Introduction

Pest inspections, detection, and treatment are all part of Integrated Pest Management (IPM). Following examination and identification; an environmentally friendly, insect-specific pesticide with low persistence is applied to treat the insects (if necessary). As a result, Biological pest control is recognised as an integral component of integrated pest management (IPM). The extensive use of synthetic chemical pesticides and insecticides has contaminated the environment and had a severe influence on human health and animal welfare, as well as the need for decreased chemical inputs in agriculture, all of which encouraged the development of alternative pest control methods. MBCAs include viruses, bacteria, nematodes, and fungus that have been utilized with remarkable effectiveness all around the world. But, of all the MBCAs, fungal biocontrol agents are the most significant due to their ease of administration, improved formulation, large number of known pathogenic strains, simple engineering approaches. Likewise, given of their vast host range, pathogenicity pathway, and capacity to manage sap sucking and gnawing mouthparts insects and pets, EPF are essential BCA. The most appealing and non-hazardous alternative technique for insect pest management is to use these microbes as biological control agents. Entomopathogenic fungi have the highest promise due to their diverse host range. Entomopathogenic fungi are a phylogenetically varied collection of heterotrophic, as well as eukaryotic, and unicellular or multicellular (filamentous) microbes which reproduce via spores, either sexually or asexually (Singh *et al.*, 2020). A fungus is the causative pathogen in around 80% of insect infestations. Almost all insects seem to be susceptible to certain of the fungi's infections, which can result in death.

Because of their wide host range, entomopathogenic fungi offer the most potential. Entomopathogenic fungi are a phylogenetically varied collection of heterotrophic, as well as unicellular or multicellular (filamentous) microorganisms that recreate through spores, either sexually or agamically.

Entomopathogenic Fungi (EPF)

EPF are prevalent, having both restricted and wide range of hostas well as a variety of biocontrol uses against arthropods, and also insects, and plant destructive microorganisms.

Certain entomopathogenic fungi, such as *Aschersonia aleyrodes,* have limited host ranges. It exclusively targets scale insects as well as whiteflies; some fungal species are even more selective to specific pests and poses a broader host range.

Entomopathogens like *M. anisopliae* as well as *B. bassiana* have been thoroughly studied in terms of pathogenicity to a variety of insects, and they have been utilized as natural enemies for agricultural pests all over the world (Khan *et al*., 2012).

The vast majority of EPF species are *Ascomycota fungi* as well as *Zygomycota fungi*. Nutritionally, these fungi could be saprotrophs that penetrate the rhizosphere and some of them have progressed to several Ecological nutritional patterns.

Entomopathogenic Fungi Life Cycle

The EPF life cycle consists of spores that become mycelium, which in turn produce spores in the spore-mycelial spore stage (Khan *et al*., 2012). Most entomopathogenic fungi have two distinct phases in their life cycle: a normal mycelia development phase originating primarily from outside the host body, anda yeast like growing stage.

EPF differ in their pathogenicity from other bacteria as well as viruses; they infect insects by penetrating the cuticle of the host, which is made up of chitin fibrils consisting of proteins, lipids, pigments as well as *N-acyl catecholamines* (Khan *et al*., 2012).

Extracellular enzymes like as proteases, as well as chitinases, and lipases are released to break down the cuticle's major components and allow hyphal penetration. Infection had a clear relationship with exoenzyme outflow. The entrance of fungus into the hemocoel of the insect is considered to include both mechanical force and enzymatic activity (Khan *et al*., 2012).

Beauveria bassiana

It's a filamentous fungus from the deuteromycete class among insect pathogens, commonly known as imperfect fungus. Certain insect hosts have Beauveria strains that are well-adapted (Sandhu *et al*., 2012).

B. bassiana spp. are being isolated from various of insects that are medicinal or agriculturally important all over the world. It may be found in a broad variety of soils and also functions as a pathogen against a number of insect species, producing the white muscadine sickness, as a result, it is classified as an entomopathogenic fungus.

In addition to decreasing infections caused by soil-borne plant pathogens*, Beauveria bassiana* has been displayed to restrict the advancement of plant pathogenic parasite in vitro and increase systemic resistance when pathogens attack the plant (Sandhu *et al*., 2012).

Nomuraea rileyi

It's a dimorphic hyphomycete which may kill insects in an epizootic situation. The host specificity of *N. rileyi,* its ecologically friendly qualities make it an appealing choice for insect pest management. Although it has been known to infect and develop in a variety of insect hosts, including *Trichoplusia ni,* as well as *Heliothis zea*, and *Plathypena scabra*, and others (Sandhu *et al*., 2012).

Mode of Action

Within microorganisms, entomopathogenic fungi are the most abundant types of insect pathogens. These insect-killing fungi proliferate quickly. Entomogenous fungi show promise as a myco-biocontrol agent for a variety of agricultural pests. Fungal infections affect a variety of species such as Lepidoptera, as well as Coleoptera, Homoptera, and Hymenoptera, and Diptera species. Myco-biocontrol agents made from entomopathogenic fungus have a ton of potential, due to the fact that they are a varied group of over 750 species that cause fungal diseases in insect populations when distributed in the environment (Sandhu *et al*., 2012).

Advantages and Disadvantages of Entomopathogenic Fungi

Advantages

- They offer a high degree of selectivity for pest control while not hurting helpful insect predators or parasites that aren't detrimental.
- They pose no threat to the environment as well as animal health, who are usually harmed by chemical pesticide treatments.
- Insect resistance cannot develop since they infect in a variety of ways, and they may be employed as long-term pest management.
- Biotechnological research has a great potential for future growth.
- Reduce the usage of chemical pesticides.

Disadvantages

- They have a very slow mortality rate: it generally takes 2-3 weeks to destroy the insects, whereas conventional pesticides may kill them in as little as 2-3 hours.
- To germinate and induce infection, they need certain environmental conditions like temperature, humidity, and duration of light.
- It may be extremely expensive to manufacture for commercial usage.
- Lack of tenacity and poor infection rate under adverse environmental circumstances.

Conclusion

Entomopathogenic fungi are better alternative to synthetic pesticides for use because they are not harmful to humans, they can be used in integrated pest management (IPM), and have little influence on non-target species. When complete eradication of a pest wasn't needed, most entomopathogenic fungi were best utilized. As a result, they seem to play an important part in IPM, and further innovation in available resources would be beneficial in achieving sustainable pest control.

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