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Entomopathogenic Fungi: Insect Pest Control

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Abstract

As an alternative to synthetic inorganic chemical pesticides, entomopathogenic fungi (EPFs) are classified as biological (i.e., microbial) control agents of agricultural pests that are important and major. After a given amount of shelf life, they are very biodegradable, sustainable, and environmentally beneficial. They do not affect non-target pests or beneficial insects like parasitoids, pollinators, predators, etc., in contrast to chemical pesticides. In order to provide progressive farmers, state and central universities, and research institutions, EPFs are now commercially grown in biocontrol laboratories in greater amounts. This article has covered the method of action of EPFs as well as their sustained effects on a number of agricultural pests.

Introduction

According to Dhaliwal et al. (2015), insect pests are considered to be significant deterrents and have been responsible for 10.80% of crop losses worldwide in the post-Green Revolution era. Because of their great utility, ease of use, and low application effort, insecticides have become a vital tool for reducing these losses. However, up to 500 different pest species have developed resistance to insecticides as a result of concentrated chemical application. One further challenge facing farmers is their over reliance on artificial fertilizers. The reason for this is that these substances have a number of adverse impacts on humans, non-target species, and the environment. They are believed to have little to no mammalian toxicity and to be typically ecologically benign. Because of this, they have been created as microbial insecticides in a number of nations, including the US, to manage several significant arthropod

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pests in forestry, urban areas, and agriculture. In horticulture, forestry, and agriculture, phytopathogenic fungi play a significant role as biological control agents against insect pests and other arthropods. Therefore, it is believed that entomopathogens regulate pest infestations by acting as representatives of various bacterial, viral, fungal, and protozoan species. These EPFs are favored for killing insects at different phases of their life cycles because of their eco-friendliness and bio-persistence. In addition to being efficient against insect pests, the usage of EPFs is safe for the environment, including non-target creatures and people.

Entomopathogenic Fungi most imperative due to:

- Easy distribution,
- Easy manufacturing techniques,
- Availability of a large number of already identified strains
- Over-expression of exogenous toxins and endogenous proteins.

In order to combat Bothynoderes punctiventris (Germar) (Coleoptera: Curculionidae) (sugar beet weevil), Krassilstschik (1888) used the antagonistic nature of Metarhizium anisopliae (Metchnikoff) (Hypocreales: Clavipitaceae) conidiospores in Russia to carry out the first effective mass-produced microbial control application on a large scale.

Epidemiology and Mode of Action:

- Fungi may be utilized to control any insects, especially sucking insects, because they penetrate the cuticle directly, unlike other possible biocontrol agents.
- Insects can contract deadly diseases from entomopathogenic fungi, which also utilize epizootics to control insect populations in the wild.
- When the right circumstances (high humidity) are present, endophthalean fungus actively release spores that can quickly infect a vulnerable insect, even if these circumstances are only present momentarily.
- Because EPF species are primarily insulated from the soil, harmful sun radiation cannot harm them.

Application of EPFs in Agricultural Pest Control:

- A total of 1800 correlations between various fungus and insects were identified. More than 700 species of fungus belonging to over 90 distinct genera have been identified as being harmful to insects.

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- The most well-known strains from the genera Beauveria, Metarhizium, Isaria, Hirsutella, and Lecanicillium are among them. The most researched fungal species include Lecanicillium lecanii (Zimmerman) Viegas, Isaria fumosorosea Wize, Metarhizium anisopliae (Metschnikoff) Sorokin, and Beauveria bassiana (Balsamo-Crivelli) Vuillemin.
- Infected insects have been isolated from Beauveria bassiana and M. anisopliae, which are frequently found on them in both temperate and tropical parts of the world.
- Some EPF species, like I. fumosorosea and I. farinosa, may infect several hosts without displaying any of the many detrimental symptoms.It has been shown that some species of Beauveria and Metarhizium may infect and kill soil-dwelling insects, and EPF interacts with plant roots to support plant development and survival, as plants primarily rely on insects rather than soil for carbon.
- These fungal species are frequently employed to combat a variety of arthropod pests, together with other well-known hypocrealean fungi including I. fumosorosea, M. brunneum, M. robertsii, and Hirsutella thompsonii Fisher.
- They are mostly applied via inundative methods and have been shown to be successful against a variety of insects belonging to various feeding guilds, such as tephritid fruit flies, aphids, locusts, thrips, grubs, and moths, as well as mites, mosquitoes, and whiteflies.

Entomopathogens as Myco-Pesticides:

Products made from B. bassiana, M. anisopliae, B. brongniartii, and I. fumosorosea are the most widely used mycopesticides. The potential of fungal pathogens, specifically B. bassiana, Vuillemin, Isaria fumosorosea Wize, and M. anisopliae, to control insect pests in agriculture and urban areas is now being investigated. Numerous species from the orders Hemiptera, Coleoptera, Lepidoptera, and Isoptera are prone to different fungal diseases. This has resulted in several, varyingly successful attempts to employ EPF for pest control.

- For example, it has been documented that B. bassiana may oppose plant disease-causing pathogens in a variety of economically important crops, including grapevine, tomato, squash, cotton, and many others.

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- Beauveria sp. inhibits Rhizoctonia solani, Fusarium oxysporum, Botrytis cinerea, Septoria sp., Gaeumannomyces graminis, Pythium sp., and Zucchini yellow mosaic virus in squash, among other plant diseases.
- • The ascomycete fungus Ophiostoma ulmi Buisman is the cause of Dutch elm disease (DED), a vascular wilt disease that is less likely to spread when M. anisopliae is present. • Their capacity to boost the production of pathogenesis-related proteins and other defense enzymes in rice and peanuts after both plants have been dual treated with B. bassiana and Pseudomonas fluorescens. Entomopathogenic fungal endophytes stimulate the production of plant defense proteins in their colonized host.

Conclusion

Since chemical pesticides have a detrimental effect on beneficial organisms, including humans, as well as insect pests, entomopathogenic fungi are an excellent alternative to reduce environmental harm. Additionally, because they are highly biodegradable, they fall under the category of environmentally friendly management practices. It is imperative that farmers be educated and made aware of the advantages of these EPFs.

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