

Entomopathogenic Fungi: Key Players of Biological Control

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SUMMARY

Crop plants are vulnerable to several pest and pathogens which limits their production. Despite affecting the quantity, they also deteriorate the quality of our produce. There are millions of insects belonging to different orders which act as crop pests. Management of these notorious creatures through synthetic chemicals posed a serious threat to our environment. Owing to such complexities, alternative management strategy such as biological control came to light. Several fungi feed on these insect pests and in term safeguard our crop viz., *Beauveria*, *Metarhizium*, *Verticillium* etc. The article mainly focusses on these fungi and their mode of action.

INTRODUCTION

Entomopathogenic fungi are regarded as a group of phylogenetically diverse, eukaryotic, heterotrophic, unicellular or multicellular microorganisms that reproduce via sexual or asexual spores or both and which parasitizes on insects. They are generally non-mobile in nature with the chitinous cell wall (Badii and Abreu, 2006). The word “Entomopathogenic” has been derived from two Greek words “Entomon” and “Genes” meaning insect and arise in respectively. So the term “entomopathogenic” usually refers to those microorganisms that arise in insects. These fungi are capable of attacking insects using them as hosts to develop part of their life cycle with that of the host machinery and reduce the insect populations to economic injury levels (Tanzini *et. al.*, 2001). By controlling the insect pests, they also minimize a large number of viral diseases transmitted by insects (Scholte *et. al.*, 2004). They may be obligate or facultative parasites of insects, with a high sporulation and survival rate (Delgado and Murcia, 2011). It has been estimated that nearly 75% of the diseases that occur in insects are caused by fungal pathogens. The entomopathogenic fungi infect living insects, called entomophagous or may survive on dead insects, called saprophagous, (Butt *et. al.*, 2006). In about 1.5 - 5.0 million species of fungi in the world 750 - 1,000 are estimated to be fungal entomopathogens placed in over 100 genera (St. Leger and Wang, 2010). These entomopathogenic fungi belong to different genera such as Chytridiomycota, Blastocladiomycota, Kickxellomycotina, Basidiomycota, Ascomycota, Entomophthoromycota etc.

Mode of Action

The first step is the release of massive spore numbers and/or sticky spore surfaces on the insect (Vega *et. al.*, 2012). These spores land on the insect surface and start germinating. The conidia form an appressorium that penetrates the insect cuticle.

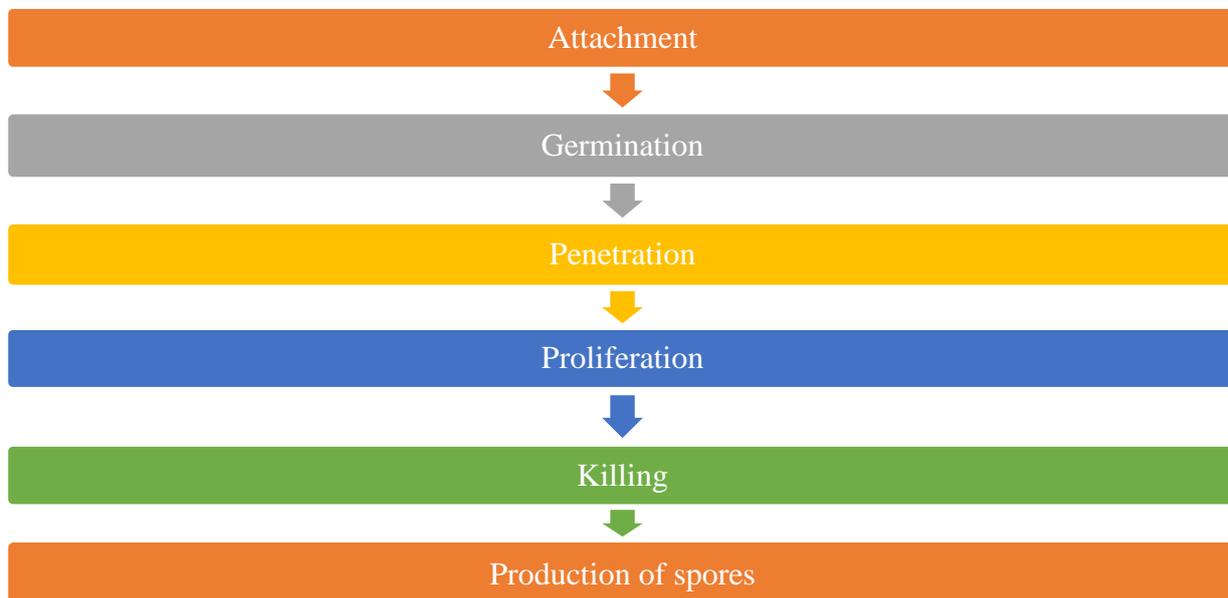


Figure 1. Various steps involved in the action of Entomopathogenic fungi

The appressorium then reaches haemocoel and proliferate within the muscles or other tissues of the host's body to collapse the host's immune system. Several toxins are also released in this process which eventually leads to the death of the host. The fungal pathogen manages to optimize spore production and dispersal under prevailing environmental conditions from the dead body of the host (Roy *et. al.*, 2006).

Table 1. Entomopathogenic Fungi Along with their Target Pests

Sl. No	Entomopathogenic fungi	Target insects
1.	<i>Beauveria bassiana</i>	Aphids, whiteflies, grasshoppers, white grubs, plant bugs, beetles, thrips, crickets,
2.	<i>Metarhizium. anisopilae</i>	Aphids, thrips, bugs, beetles
3.	<i>Verticillium leccani</i>	Aphids, whiteflies and thrips
4.	<i>Paecilomyces fumosoroseus</i>	Aphids, jassids, thrips, whitefly
5.	<i>Hirsutella thompsonii</i>	Eriophid mites
6.	<i>Nomuraea rileyi</i>	Caterpillars, <i>Spodoptera</i> , <i>Helicoverpa</i>
7.	<i>Pandora neoaphidis</i>	Green peach aphid

Toxin Production

Entomopathogens produces various types of toxins that affect the metabolism of the targeted insects rendering them weak and inactive. Beauvericin, bassinilode, Beauverolides, destructxin A, B, C are a few examples of the toxins produced.

Merits

- They are target specific and thus do not harm the untargeted ones
- Ecofriendly and no harmful effect on the environment
- No residual toxicity on ecosystem
- Economical and safe to use
- Can also be applicable at the harvest stage of crop

Demerits

- They are effective only against a selected group of insect pests
- Slow in action
- Each application may control part of insect pests
- The microbial products have a limited shelf life.
- The products are affected by heat, desiccation or ultraviolet radiations.

CONCLUSION

This article describes different entomopathogenic fungi which act as parasites of insects. These fungi are very effective and used for biocontrol of a wide number of targeted pests. They are efficient producers of several toxins which attack host metabolism. The use of entomopathogenic fungi has opened new avenues in insect pest management.

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