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Antimicrobial Active Substances from Entomopathogenic Fungi (Various Applications of Entomopathogenic Fungi)

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Insects constitute the largest and most diverse group of animals in the world. They also serve as the hosts or nutrient sources for an immense assemblage of pathogens, parasites, and predators. More than 700 fungal species from 100 genera have adopted an entomopathogenic lifestyle. Although entomopathogenic fungi were studied as only biocontrol agents against a variety of pests in various countries, it has been recently focused their additional roles in nature. They are antagonists to/against plant pathogens, endophytes, and possibly even plant growth promoting agents. The potential antimicrobial effect against fungal plant pathogens by an isolate of entomopathogenic fungi including *Beauveria bassiana*, *Lecanicillium* spp., and *Isaria fumosorosea* have been reported since late 1990s, but wasn't reported pathogenicity of the isolate against pests. Later, a Canadian *Lecanicillium* sp. isolate and *L. longisporium* isolated from Vertalec® showed simultaneous control effect against both aphid and cucumber powder mildew. Therefore, the antimicrobial activities of 342 fungi isolates collected from various regions and conditions in Korea were evaluated against plant pathogenic fungus *Botrytis cinerea* using dual culture technique on agar plate. As a result, 186 isolates (54.4%) shown the antifungal activity against *B. cinerea*. The culture filtrates of selected fungi completely suppressed the growth of the microorganisms, indicating that suppression was due to the presence of antimicrobial substances in the culture filtrate.

Mode of action of these fungi against insect involves the attachment of conidia to the insect cuticle, followed by germination, cuticle penetration, and internal dissemination throughout the insect. During infection process, secreted enzymes, proteinous toxins, and/or secondary metabolites secreted by entomopathogenic fungi can be used to overcome the host immune system, modify host behavior, and defend host resources. Recently, secondary metabolites isolated from entomopathogenic fungi have been reported as potential bioactive substances. Generally, most of bioactive substances produced by entomopathogenic fungi have reported low molecular weight (lower than 1,000 g/mol) as peptide and, in contrast the high molecular weight fungal bioactive substances are rare. Most substances based on entomopathogenic fungi were shown antimicrobial activity with narrow control ranges. In our study we analyzed the antimicrobial substances having antagonistic effects to *B. cinerea*. Antimicrobial substances in our fungal culture filtrates showed high thermostability, high stability to proteolytic enzymes, and hydrophilicity and their molecular weights were differed from substance. In conclusion, entomopathogenic fungi showed pathogenicity against insect pests and culture filtrate of the fungi also shown to antimicrobial activity. In the future, we can use the entomopathogenic fungi and its secondary metabolites to control both insect pest control and plant pathogenic fungi simultaneously.