A REVIEW:

Mechanisms involved in the entomopathogenesis of *Beauveria bassiana*

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The entomopathogenic fungus, *Beauveria bassiana,* is attracting increased attention as potential biological control agent against insect pests. Understanding mechanisms of fungal pathogenesis in insects will provide a rational basis for strain selection and improvement. The action of cytotoxins is suggested by cellular disruption prior to hyphae penetration. Behavioural symptoms such as partial or general paralysis, sluggishness and decreased irritability in mycosed insects are consistent with the action of neuromuscular toxins. There is strong evidence supporting the role of cuticle-degrading proteases (PR1 and PR2) as well as phospholipase B (PLB) in fungal pathogens and their correlations to virulence. Two PLB-encoding genes *(plb1* and *plb2,* 57% identity) and PR2-encoding genes *(try1* and *try2,* 22.4% identity) were detected in *Beauveria bassiana.* The structure similarity of TRY2 protease to insect enzymes might allow the fungal cells to evade host "non-self" recognition and thus might represent one important virulence determinant. PR1 is a serine protease that degrades rapidly cuticular proteins. Production of PR1 is transcriptionally modulated by carbon catabolite and nitrogen metabolite repression. The formation of PLB2 was not influenced by carbon or nitrogen sources. In poor media containing insect cuticles, the synthesis of PLB2 was prevalent. The detailed analysis of the role of putative pathogenic factors depends on the transformation-mediated site-specific disruption of the specific genes. Because of the presence of toxins, lipases and proteases released by the *Beauveria bassiana*, it can be exploited as an entomopathogen in the control of agricultural pests.

Insecticide resistance and the demand for reduced chemical inputs in agriculture have provided an impetus to the development of alternative forms of pest control. Biological control offers an attractive alternative or supplement to the use of chemical pesticides. Microbial biological control agents are naturally occurring organisms and perceived as being less damaging to the environment. Furthermore, their generally complex mode of action makes it unlikely that resistance could be developed to a bio-pesticide. Biological pest control agents include viruses, bacteria, fungi, and nematodes. The use of microorganisms as selective pesticides had some notable successes.

Entomopathogenic fungi:

Human appreciation of the fungi attacking insects is by no means limited to the modern concern in using them for the biological control of insect pests. Two millennia ago, the Chinese were aware of the mummification of silk worms and cicadas by species of *Cordyceps* and *Isaria*, and placed semiprecious and precious stone effigies of these insects in the mouth of their dead in an attempt to confer a similar degree of immortality (Kobayasi, 1977). The benevolence of fungi as microbial control agent was first brought to prominence in the legends of insect pathology in 325 B.C by Aristotle's *Historia animalium* describing diseases of honeybee. Naturalists and philosophers of succeeding generation alluded to the infections of honeybee, silkworm and other insects.

Entomopathogenic fungi were among the first organisms to be used for the biological control of pests. More than 700 species of fungi from around 90 genera are pathogenic to insects. Most are found within the deuteromycetes and entomophorales. Agostino Bassi established the germ theory of diseases in animals in the mid 1830s with his studies on *Beauveria bassiana* infections of silkworm larvae (Steinhaus, 1956). The fungus most frequently isolated from dead insects collected in the field is *B. bassiana*. The host range of the species is extensive and includes almost all the orders of insects (Narasimhan, 1970).

All the insects have their natural enemies, and parasites such as virus, bacteria nematode, protozoa and fungi. These natural enemies will