# Potentiation of entomopathogenic fungi with low doses of insecticides for managing Himalayan white grubs

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**The potential of entomopathogenic fungi, *Beauveria bassiana* and *Metarhizium anisopliae* was studied in combination with the commonly used insecticides, viz. clothianidin 50 WDG, imidacloprid 17.8 SL and chlorpyriphos 20 EC, against grubs of *Brahmina coriacea* (Hope) and *Holotrichia longipennis* (Blanchard). Clothianidin, imidacloprid and chlorpyriphos were applied at 50, 75 and 100 ppm respectively, and both the fungi were applied at $10^7$ conidia/ml. Synergistic interactions were consistent across all the combinations and calculated values of $\chi^2$ ranged from 4.2 to 5.73 in both the species of white grubs. The grubs of *H. longipennis* exhibited a higher degree of synergism than *B. coriacea* as observed from the mortality data. Among entomopathogenic fungi, *M. anisopliae* showed more synergism than *B. bassiana* against both species. This study will also help reduce insecticidal pollution and the cost of interventions for the management of white grubs in a sense that application rates of chemical insecticides and synergists will be reduced. This practice may be incorporated in integrated pest management, and further study of the synergistic interactions will guide how entomopathogenic fungi and insecticides can be combined to combat environmental pollution effectively.**

**Keywords:** *Beauveria bassiana*, *Brahmina coriacea*, chemicals, *Holotrichia longipennis*, interaction, *Metarhizium anisopliae*.

Since this insect spends most of its life in the soil, except for a brief mating period, they are difficult to manage with insecticides, as it is difficult for insecticides to move through soil into the root zone, where the grubs are generally found[5]. Hence, pest management tactics with curative and biointensive methods would benefit their management. Entomopathogenic fungi constitute a potential group of biocontrol agents against white grubs because the pest activity period coincides with the ideal humid conditions for their proliferation[6]. *Beauveria bassiana* (Bals.-Criv.) Vuill (Clavicipitaceae: Hypocreales) and *Metarhizium anisopliae* (Metchnikoff) Sorokin (Clavicipitaceae: Hypocreales) are widely used because of their virulence against white grubs. *Beauveria* and *Metarhizium* fungi grow naturally in soil and act as parasites causing white/green muscardine disease in various arthropod species[7,8]. There are reports from different parts of the world highlighting the population regulation of other ground-dwelling coleopteran pest species by entomopathogenic fungi such as *Beauveria brongniartii* (Saccardo)[9], *B. bassiana*[10] and *M. anisopliae*[11]). Biological control, which includes using entomopathogenic fungi as part of an integrated pest management (IPM) approach, aims to reduce farmers' reliance on synthetic insecticides[12]. Reliance on chemical insecticides persists partly because of the lesser availability of commercial formulations of biopesticides[13].

Biological–chemical synergism is one approach that has the potential to reduce risk management of white grubs