

Sublethal Effects of Entomopathogenic Nematodes and Fungus against the Red Palm Weevil, *Rhynchophorus Ferrugineus* (Olivier) (Curculionidae: Coleoptera)

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Abstract : The invasive Red Palm Weevil (RPW) (*Rhynchophorus ferrugineus* [Olivier] (Coleoptera: Curculionidae) is one of the most destructive palm pests in the world. Synthetic pesticides are environmentally hazardous pest control strategies being used in the past with emerging need of eco-friendly biological approaches including microbial entomopathogens for RPW management. The sublethal effects of a single entomopathogenic fungus (EPF) *Beauveria bassiana* (WG-11) (Ascomycota: Hypocreales) and two entomopathogenic nematode (EPN) species *Heterorhabditis bacteriophora* (Poinar) and *Steinernema carpocapsae* (Weiser) (Nematoda: Rhabditida) were evaluated in various combinations against laboratory-reared 3rd, 5th and 8th instar larvae of RPW in laboratory assays. Individual and combined effects of both entomopathogens (EP) were observed after the pre-application of *B. bassiana* fungus at 1-2-week intervals. A number of parameters were measured after the application of sub-lethal doses of EPF such as diet consumption, development, frass production, mortality, and weight gain. Combined treatments were tested for additive and synergistic effects. Synergism was more frequently observed in *B. bassiana* and *S. carpocapsae* combined treatments than in *B. bassiana* and *H. bacteriophora* combinations. Early instar larvae of RPW were more susceptible than older instars. Synergistic effects were observed in the 3rd and 5th instars exposed to *B. bassiana* and *S. carpocapsae* at 0, 7 and 14-day intervals. Whereas, in 8th instar larvae, the synergistic effect was observed only in *B. bassiana* and *S. carpocapsae* treatments after 0 and 7 days intervals. EPN treatments decreased pupation, egg hatching and emergence of adults. Lethal effects of nematodes were also observed in all growth stages of *R. ferrugineus*. Reduced larval weight, increased larval, pre-pupal and pupal duration, reduced adult weight and life span were observed. Sub-lethal concentrations of both entomopathogens induced variations in the different developmental stages and reduced food consumption, frass production, growth, and weight gain. So, on the basis of results, it is concluded that synthetic pesticides should be replaced with environmentally friendly sustainable biopesticides.

Keywords : *H. bacteriophora*, *S. carpocapsae*, *B. bassiana*, mortality

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