Management of Stored Grain Pests (Coleoptera: Insecta) through Biological Pesticides

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ABSTRACT

Introduction: Majority of the population of the world depends on stored grains for its survival. This is particularly true in developing countries, where rice, wheat, and maize are the main foods. Stored grains are the main nutritional components as it provides major food sources to majority of world population. Cereal grains including rice, wheat and maize are widely cultivating in various areas of the world and used as an essential food (Murugesan *et al*., 2024; Shah *et al*., 2022). However, these principal grains are damaged by different factors which develop pre and post- harvest losses (Chidege *et al*., 2024; Zhang *et al*., 2023). It is estimated that under stored condition approximately 50-60% cereal grain losses have been occurred due to insect pest infestation and 10-30% loss occur due to technical incompetence (Ibrahim & Salem, 2019; Chidege *et al*., 2024).

Objectives: The principal objectives of this study were:

1. To extract and identify different phytochemicals from *Eucalyptus camaldulensis* Dehnh and *Azadirachta indica* A. Juss. leaves.
2. To test the biological activities of these extracts against *T. castaneum* and *S. oryzae* in a laboratory setting.
3. To investigate the potential of neem and eucalyptus leaf extracts to develop a cost-effective and green alternative of chemical pesticides to manage stored grain pests.

Methodology: The study utilized through Soxhlet extraction with pure methanol to process the leaves of fresh *A. indica* and *E. camaldulensis*, which were collected from Karachi. These extracts were then used as biomass and were oven-dried to allow further testing. The presence of terpenoids, tannins, and flavonoids in the extracts were identified through Thin Layer Chromatography (TLC) technique. Rice, wheat, and maize were used to grow colonies of *S. oryzae* and *T. castaneum*, under controlled temperature and humidity level (50-80% ± 2° and 32-35 ± 2°C, respectively). There were two bioassay methods were used, i.e., seed treatment method and filter paper treatment method to evaluate the effect of extracts. Chlorpyrifos was used as a positive control ranging from 200 to 1000 ppm. Larval and adult LC_{50} mortality rate was estimated after 24 and 48 hours of exposure to all treatments.

Key Findings: The results indicated the highest adult mortality rate of *T. castaneum* was 100%, obtained between 600 ppm to 800ppm against neem phytochemical, whereas eucalyptus phytochemical showed highest toxicity at 600 ppm that was 80%. The highest adult mortality of *S. oryzae* was observed at the concentration of 800 ppm that was 60% against neem phytochemicals, whereas eucalyptus photochemical showed highest mortality at the concentration of 600 ppm that was 90%.

The highest larval mortality rate of *T. castaneum* was 100% at 400 ppm concentration against neem phytochemicals while the same larval mortality was observed between 400 ppm to 600 ppm against eucalyptus phytochemical. The highest larval mortality of *S. oryzae*, was 100% appeared at 400 ppm against both phytochemicals.

Conclusion: This research showed that *A. indica* and *E. camaldulensis* leaf extracts effective as a natural biopesticide against main stores grain pests. The research supports the use of botanical extracts as biodegradable, safe for consumption, and effective options to manage stored grain pest. Future research should concentrate on formulation, stability, application techniques, and field investigations in order to facilitate commercialization.

Keywords: *Eucalyptus camaldulensis* Dehnh., Azadirachta indica A. Juss, Tribolium castaneum (Herbst), *Sitophilus oryzae* (L.), Biopesticides.

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