The Efficacy of the Essential Oils of Sri Lankan *Cinnamomum zeylanicum* Fruit and *Micromelum minutum* Leaf against *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)

P. A. Paranagama* and J.J. Gunasekera
Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka

Abstract

The bruchid, *Callosobruchus maculatus* (F.) causes major losses during the storage of cowpea seeds [*Vigna unguiculata* (L.) Walp.] in Sri Lanka. Essential oils isolated from *Cinnamomum zeylanicum* fruit and *Micromelum minutum* leaves were tested for potential insecticidal activity against *C. maculatus*. The adults of *C. maculatus* were susceptible to both fumigant and contact toxicity of *C. zeylanicum* fruit oil and *M. minutum* leaf oil. In the fumigant toxicity assay LC_{50} value (0.801 g/L) of *M. minutum* leaf oil was lower than that of *C. zeylanicum* fruit oil. LC_{50} values of 0.071 g/L and 0.795 g/L were obtained for the contact toxicity of *M. minutum* leaf oil and *C. zeylanicum* fruit oil, respectively. Oviposition and F_1 adult emergence were significantly inhibited by *C. zeylanicum* fruit oil and *M. minutum* leaf oil at concentrations higher than 1.25 g/L and 0.25 g/L, respectively in the contact toxicity and 1.00 g/L and 3.00 g/L respectively in the fumigant toxicity. Repellent activity of *M. minutum* leaf oil was more potent to *C. maculatus* than *C. zeylanicum* fruit oil at doses ranging 10–80 mg. Analysis of the two oils revealed that bicyclogermacene (16.0%) was the major constituent of *M. minutum* leaf oil and β-ylangene and linalool (13.9 % and 13.2 %, respectively) were in the *C. zeylanicum* fruit oil.

Key Word Index

Cinnamomum zeylanicum, Lauraceae, *Micromelum minutum,*Rutaceae, *Callosobruchus maculatus,* cowpea, essential oil composition.

Introduction

Cowpea [*Vigna unguiculatua* (L.) Walp.] is one of the major grain legumes of great antiquity and cultivated throughout Asia for more than 2,000 years. Now it is widely grown in the tropics as well as West and Central African countries (1). Cowpea provides considerable amounts of carbohydrate (62–64 %) and protein (20–24 %) for the natural diet (2). The insect infestation of seeds causes weight and quality losses that lead to the reduction of commercial values and seed germination. *Callosobruchus maculatus* is the most important storage pest encountered in stored cowpea (3).

The protection of stored cowpea from insect damage currently relies on fumigants, such as phosphine, pirimiphos methyl and phoxhim (4-6). Phosphine (PH_3) is the most widely used fumigant for disinfesting stored grain in warehouses. Widespread use of synthetic, chemical pesticides has significant drawbacks including development of insecticide resistance strains, increased costs, handling hazards, insecticide residues on grains and threat to human health and the environment (6).

The use of plant materials in controlling pests is an ancient measure in many parts of the world. The mixing of the plant materials such as leaf, bark, seed and vegetable oils is a traditional practice in most Asian and African countries (7-8). The low toxicity, low price, and human and environmental safety are the advantages of botanical pesticides. Hence they are ideal control measures that could be adapted for protection of agricultural products.

Essential oils are natural plant volatile substances found in a variety of odoriferous plants, categories under plants secondary metabolites. The volatile constituents of essential oils are monoterpenes, sesquiterpenes and phenolic compounds. (9) In the past few years, essential oils have gained reputation as potentially bioactive compounds against many insects. Citronella [*Cymbopogon nardus* (L.)] Rendle is used as a mosquito repellant and cinnamon (*C. zeylanicum Blume*), lemongrass [*C. citrates* (DC.) Stapf] and thyme (*Thymus vulgaris* L.) oils are effective in deferring a wide variety of insects (10-11). Therefore, in recent years the essential oil bearing plants have become popular among agriculturists due to bioactive

*Address for correspondence

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