COMPOSITION AND BIOACTIVITY OF ESSENTIAL OILS OF *Lantana camara* L., *Tephrosia vogelii* HOOK AND *Ocimum americanum* L. AGAINST MAJOR COLEOPTERAN PESTS OF STORED FOOD GRAINS

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ABSTRACT

Food security and post-harvest handling are greatly undermined by insect pests which cause about 20% post-harvest losses of food grains in subsistence agriculture. Despite the enormous potential for pest control, the indigenous plant-based products have remained largely unexploited. In an attempt to address the insect pest menace in grain storage, a scientific study was conducted to evaluate the contact toxicity (instant and residual), fumigant toxicity (space and grain), repellence (instant and residual) and reproduction inhibition of essential oils extracted from aerial parts of three indigenous plants, *Ocimum americanum* L., *Lantana camara* L. and *Tephrosia vogelii* Hook, and selected isolated constituents against adult *Sitophilus oryzae* L., *Rhyzopertha dominica* F., *Tribolium castaneum* (Herbst) and *Callosobruchus chinensis* L. insects. The study also evaluated the intra-species and inter-plant variations in composition of essential oils and possible phytotoxic effects of selected essential oils on treated seed grains. In the contact toxicity, repellence and reproduction inhibition studies, essential oils and a constituent, eugenol, were each evaluated at four rates (0.5, 1.0, 1.5 and 2.0 µL/g grain) with 4-6 replicates per concentration. In the same bioassays, soya oil (10 µL/g grain) and Actellic 5EC (1.0 µL/g grain) were included as positive controls with Acetone (0.5 µL/g grain) and untreated grains as negative controls. In the space and grain fumigation studies, four (0, 1, 5 and 10 µl/L air) and five (0, 30, 50, 70 and 100 µl/L air) rates, respectively, with 4-6 replicates per essential oil concentration or constituent were tested against adult stages of three or four test insects. All the laboratory bioassays, arranged in a completely randomized design (CRD), were conducted in a room maintained at 30±2°C, 68±2% RH and 12D: 12D (total darkness). Except for residual (contact and repellence) studies and chemical compositional analysis, bioactivity of test essential oils and their constituents against adult stages of four coleopteran pests were significantly influenced (P<0.0001- 0.0484) by intra-species and inter-plant variations in chemical composition, concentration applied, time after application, insect species and corresponding factor interactions. With a few exceptions, test essential oils demonstrated clear temporal dose-dependent contact toxicity, repellence and reproduction inhibition against adult stages of test insects and phytotoxicity on treated wheat seeds. Results of space fumigation showed that, irrespective of plant part assayed, *O. americanum, L. camara* and *T. vogelii* essential oils produced LC_{50} values of 0.38- 34.68, 0.77- 64.10 and 0.44- 43.50 µl/L air, respectively, against adult stages of the four test insects. In the grain fumigation studies with *O. americanum* leaf essential oil, 50 µl/L, 7 days exposure and 120 h post-fumigation time were enough to obtain 95.4-100% kill of adult *S. oryzae* and *R. dominica* and 65.5% mortality of *T. castaneum*, which was comparable to methyl bromide's recommended dose of 30-50 g/M^3 grain and that of highly active Labiate sp. Oil, ZP51® (50 µl/L). At the highest concentration (0.20% v/w) and 120 days of storage, *O. americanum* and *T. vogelii* fruit essential oils caused 25.0- 40.0 and 33.0- 51.0% inhibition of wheat seed germination with corresponding EC_{50} values of 6.22- 0.37 and 2.10- 0.19% v/w, respectively. Results of GC-MS analysis showed marked intra-species and inter-plant variations in which eugenol (49.2%) and germacrene D (19.22%) were dominant in leaves of *O. americanum* and *T. vogelii* whereas E-caryophyllene (15.5%) in the fruits of *L. camara* implying the test plants were eugenol, germacrene D and E-caryophyllene chemotypes, respectively. The potential of essential oils and their volatile constituetnts as alternative contact insecticides, fumigants and protectants of durable agricultural products and scientific implications are discussed.

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