

Fumigant toxicity of silica encapsulated essential oils against pulse beetle, *Callosobruchus maculatus* (F.) (Coleoptera: Chrysomelidae)

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ABSTRACT

India is the largest producer and consumer of pulses and shares 959.68 lakh ha area and 973.92 lakh tonnes of the global production. Among the insect pests infesting stored pulses, bruchid *Callosobruchus maculatus* (F.) (Coleoptera: Chrysomelidae) is the most serious one and it attacks invariably all the pulses under storage conditions with mild infestation in the field as well. It is therefore, imperative to save the stored pulses from this serious pest. In many storage systems, fumigants are the most economical and convenient tool for managing stored grain insect pests. The increasing problem with today's fumigants makes it necessary for research to devise other control procedures and to identify new fumigants, which are eco-friendly and less expensive. Nano formulations of essential oils have been tested as alternatives to synthetic pesticides. Essential oil-based nano formulations have shown significant efficacy in the management of different storage pests over the past decade. The efficacy of silica encapsulated essential oils *viz.*, clove, citronella, cinnamon, sweet basil and geranium were investigated against pulse beetle *C. maculatus* through fumigant toxicity bioassay and LC₅₀ values were 16.767, 13.483, 9.930, and 60.486 µg/ cm³ respectively. The study showed that all the essential oils tested, except citronella, were toxic to *C. maculatus* adults, with varying degrees of toxicity. The LT₅₀ values for silica encapsulated essential oils were as follows: sweet basil (80.479 hours), cinnamon (72.845 hours), clove (68.326 hours), and geranium (73.938 hours). In comparison, the LT₅₀ values for the non encapsulated essential oils were: sweet basil (56.867 hours), cinnamon (61.263 hours), clove (44.424 hours), and geranium (59.808 hours). These results indicate that mesoporous silica nano particles (MSNs) encapsulated with essential oils are more effective than the non encapsulated essential oils.

Key Words: *C. maculatus*, *Essential oils*, *Mesoporous silica nanoparticles* and *Nano formulations*.