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Compatibility between natural enemies and essential oils for the control of stored legume pests.

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Abstract

The objectives of the present study were to determine the fumigant, repellent and contact effects of basil, *Ocimum basilicum*, fenugreek, *Trigonella foenum-graecum* and garlic, *Allium sativum* as essential oils (EOs) against *Callosobruchus maculatus* and *Tyrophagus putrescentiae*. In view of the importance of using the natural enemies as a biological control in IPM programs, the impact of EOs on the Hymenoptera parasitoid, *Anisopteromalus calandrae* and the predator mite, *Cheyletus malaccensis* were evaluated. Also, the effect of EOs on the biology of tested arthropods in terms of reproductive potential and adult emergence. Finally, the biochemical response of *C. maculatus* to sublethal concentrations of EOs was determined. Data obtained demonstrated that *A. sativum, O. basilicum* and *T. foenum-graecum* EOs had fumigant toxicity on the stored grain pests *C. maculatus* and *T. putrescentiae*, and susceptibility of *T. putrescentiae* was the highest. Fumigant toxicity effect of EOs was also higher to the predator mite *C. malaccensis.* All EOs possesses repellency activity against *C. maculatus, T. putrecentiae* and the predator mite, *C. malaccensis.* The repellency of all Eos increased with increasing concentration. Results from lethal contact toxicity showed that *O. basilicum* was lest effect after three days post exposure against *C. maculatus, T. putrescentiae* and *C. malaccensis* with LC_{50} values of 19792.8, 9520.8 and 32334.5ppm, respectively. *A. sativum* oil induced the highest effect on *T. putrescentiae* and *C. malaccensis* with LC_{50} values of 4676.0 and 12453.1ppm after three days, respectively. Mortality of *C. maculatus* on cowpea seeds treated with sub lethal concentrations equivalent to 1/5 LC_{50} of *A. sativum* was higher than *O. basilicum* and *T. foenum-graecum* EO five days post exposure. A similar trend was observed for *T. putrescentiae*. All EOs at sublethal concentrations were highly detrimental to both *A. calandrae* and C. *malaccansis.* The effect of sublethal concentrations of EOs on *A. calandrae* was also similar in case of the predator mite, *C. malaccansis*. The protein and lipid level of *A. sativum* EO exposed adults was not significantly different from those of their controls. Based on lethal and sublethal direct exposure study, it could be concluded that all EOs evaluated were generally highly detrimental and non selective to both *A. calandrae*

and *C. malaccansis* and would be incompatible with biological control of *C. maculatus* and *T. putrescentiae*.

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