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Toxicity and repellency of essential oils from four medicinal plants against stored rice weevil *Sitophilus oryzae*

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Spices and essential oils are known to have various effects on stored product pests. Essential oils are believed to act as semiochemicals and have also been shown to be potent source of botanical pesticides. The present study was carried out to investigate the toxicity and repellant action of four common essential oil-bearing plants in Sri Lanka against stored rice pest *Sitophilus oryzae*. Contact and fumigant toxicities and repellant activities of the essential oils of citronella (*Cymbopogon nardus*), lemongrass (*Cymbopogon citratus*), cinnamon leaf (*Cynnamomum zelaynicum*), and *Alpinia calcarata* rhizomes to stored rice pest *S. oryzae* were investigated. For the contact toxicity study, an appropriate amount of essential oil was evenly applied on the inner surface of the container and 10 adult insects were introduced into the container with 3 g of rice. In the fumigant toxicity test, the required amount of essential oil was applied to a filter paper attached to the inner side of the lid of the container and a metal mesh was used to cover the mouth of the container to avoid contact of test insect with the essential oil. The repellent effect of test essential oil was studied using 'Y' shaped olfactometer. The repellant effects of four essential oils against *S. oryzae* revealed that some degree of repellency at doses ranging from 1 to10 microliter. The percentage responded to the baited arm of the olfactometer was varied from 30 to 20% in *C. nardua C. zeylanicum,* and *A. calcarata* at a dose of 7.5 microliter. The repellent action of *C. citratus* was less effective compared with the other three oils. The fumigant toxicity of test essential oils caused adults mortality ranging from 80 to 100 % at concentrations higher than 0.5 g L^{-1}. The contact toxicity showed 100% mortality at concentrations of 0.2, 0.5, 7.5, and 0.5 g L^{-1} in essential oils of citronella, cinnamon leaf, lemongrass and *A. calcarata,* respectively. In toxicity assays, the adults of *S. oryzae* were more susceptible to essential oil of cinnamon leaf than to the other three oils, resulting in the lowest LC_{50} values for fumigant toxicity and contact toxicities. In all cases, the susceptibility of the test insect to contact and fumigant toxicities increased with increasing concentrations of essential oils. The statistical analysis of the results revealed that these results are significantly different from those observed in the controls. Thus, *C. zeylanicum* and *C. nardus* could be considered highly toxic essential oils and *C. citratus* and *A. calcarata* can be regarded moderately toxic essential oils against *S. oryzae*. These essential oils could therefore be used to develop botanical pesticides to protect stored rice in the region.

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