Title Garlic essential oil and its major component as fumigants for controlling *Tribolium castaneum* (Herbst) in chambers filled with stored grain

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Abstract

In this study, the fumigant activity of garlic essential oil and its major components, diallyl disulfide, diallyl trisulfide, and diallyl sulfide, against the stored-product insect, *Tribolium castaneum*, were investigated. Results from the space fumigation revealed that garlic essential oil and diallyl trisulfide had strong fumigant activities against the adult insect. In glass chambers (10 cm in diameter × 125 cm in height) filled with 10, 20, 30, 40, and 50% volume of rough rice, the fumigant activity of diallyl trisulfide was more potent than that of garlic essential oil. At the concentration of 8 μl/l and 50% filling ratio, to obtain 100% mortality, exposure time of only 4 days was needed for diallyl trisulfide, but a longer exposure time (6–7 days) was required for garlic essential oil. Meanwhile, the fumigant effects on the germination rate of kernels exposure were ascertained. Results proved that there were no side effects for these substances on germination rate of kernels exposed 6 months after fumigation. In addition, the fumigant effect on F_1 progeny production in rough rice was also evaluated for garlic essential oil and diallyl trisulfide. The results showed that progeny production was totally suppressed at 4 μl/l of these two substances, either at 10 or 50% filling ratio. The results may provide valuable advances for future fumigant development and possible utility as a fumigant especially as a seed protectant in warehouses filled with grain.