

DOES UNDERDOSING SELECT FOR RESISTANCE TO PHOSPHINE?

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In eastern Australia farmers are increasingly reliant on phosphine to control insect pests. Many fumigations undertaken on farms and by produce merchants occur in unsealed storages of all types. These fumigations vary considerably in the doses achieved and hence in their efficacy. The aim of this work was to determine what effect current small scale fumigation practices have on selection for resistance to phosphine. Farm fumigations, undertaken in a variety of situations, were monitored to determine typical doses achieved in practice. Meanwhile, the responses to phosphine of adults, eggs and pupae of phosphine-resistant, heterozygous and susceptible *Rhyzopertha dominica*, *Sitophilus oryzae* and *Tribolium castaneum* were measured in the laboratory. Assays were at a range of concentrations of phosphine for exposure periods of 3 and 6 days. The responses to phosphine of each life stage and each species varied considerably as did the dominance of the resistant phenotype. There was a wide range of concentration x time profiles observed in the field fumigations, none of which, however, would have controlled all stages of all species. Analysis of the responses of resistant, susceptible and heterozygous individuals showed that any fumigation that does not achieve a dose sufficient to kill all life stages of resistant insects will select for resistance, ie. underdosing will select for resistance. The significance of this result to the management of phosphine resistance is discussed.