

Inheritance and characterization of strong resistance to phosphine in Australian *Sitophilus oryzae* (L.)

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Abstract

Sitophilus oryzae is a major pest of stored grain across Southeast Asia and is of increasing concern in other regions due to the advent of strong resistance to phosphine, the fumigant used to protect stored grain from pest insects. We investigated the inheritance of genes controlling resistance to phosphine in a strongly resistant strain collected in Australia (NNSO7525) and find that the trait is autosomally inherited and incompletely recessive with a degree of dominance of -0.66. The strongly resistant strain has an LC50 55.4 times greater than a susceptible reference strain (LS2) and 9.23 times greater than a weakly resistant strain (QSO335). The data suggest that two or more genes are responsible for strong resistance, and that one of these genes, designated So_rph1, not only contributes to strong resistance, but is also responsible for the weak resistance phenotype of strain QSO335. These results demonstrate that the genetic mechanism of phosphine resistance in *S. oryzae* is similar to that of other stored product insect pests. Notably, a better tolerance of F1 backcross generation to phosphine compared to the strong resistance strain at high dose is a special case only in *S. oryzae* which may be caused by multiple alleles of one of the resistant genes.

Keywords: phosphine resistance, fumigation, inheritance, *Sitophilus oryzae*, rice weevil