

Phosphine resistance-the North American perspective

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Abstract

Genetically based resistance to the fumigant gas hydrogen phosphide, or phosphine, has been known to occur in stored-product insects for over 60 years. In 2012 it was reported that some *Tribolium castaneum* (Tenebrionidae) and *Rhyzopertha dominica* (Bostrichidae) from Oklahoma in the central USA were up to 200-fold and 1500-fold resistant, respectively, to phosphine relative to susceptible laboratory strains of the same species. The discovery of strong resistance to phosphine in these species, and subsequent reports of resistance occurring to some degree in other populations, led to this geographic survey of phosphine resistance in North America. This paper reports occurrence and geographic variation among North American populations of major grain beetle pests *T. castaneum*, *R. dominica*, *Sitophilus oryzae* (Curculionidae) and *Cryptolestes ferrugineus* (Silvanidae). A discriminating dose bioassay with species-specific gas concentrations was utilized. Samples of live adult beetles were obtained from commercial and on-farm grain storages in both Canada and the USA. Trials of rapid tests for resistance were also conducted. Results suggest that phosphine resistance is common across North America in all four species, can vary from form weak to strong forms and is typically associated with commercial storage and/or distribution facilities that use phosphine frequently.

Keywords: phosphine, insecticide resistance, discriminating dose, Coleoptera