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Is phosphine or its derivatives responsible for mortality of stored product insects?

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ABSTRACT

Phosphine remains the single-most economic and recognised fumigant in global grain production systems. However, using a single fumigant and continued misuse of phosphine have resulted in development of chemical resistance in economically-important stored grain insects, leading to poor control and economic losses. Unlike methyl bromide and cyanide, that are directly toxic, phosphine creates multi derivatives of phosphine, that are toxic on different targets. As a result, phosphine fumigant shows the increased amount of toxin progressively during the fumigation. Moreover, the published mode of action reported the indirect and complex toxicity. By means of molecular biology, people believe that phosphine disrupts the energy metabolism inside each single cell. However, the pathways through the phosphine itself or/and its derivative molecules into the cells of insects are not discussed and reported. The interaction between phosphine molecules and its metabolites is also ignored. Therefore, we conducted systematic *in-vitro* experiments to explore the capability of phosphine itself to penetrate into reported insect targets and the possible interaction with energy metabolites. The results provided better understanding of phosphine toxicity for further understanding “phosphine” objective mode of action.

Keywords: Fumigant, Phosphine, Phosphine resistance, Toxicity, Metabolites, Mode of action