

**Title** Impact of short-term heat pre-treatment at 50 °C on the toxicity of contact insecticides to adults of three *Sitophilus granarius* (L.) populations

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### Abstract

The effect of short-term heat pre-treatment on the toxicity of contact insecticides was tested on *Sitophilus granarius* adults from three populations in order to examine possible interactions. In the laboratory: (a) weevil paralysis time (PT) after start of direct exposure to 50 °C; (b) the impact of three short-term heat pre-treatments at 50 °C (PT<sub>20</sub>, PT<sub>50</sub> and PT<sub>80</sub>) on the 24 and 72 h recovery rates of laboratory (Lab) strain adults exposed to one of five insecticides on filter papers; and (c) deltamethrin and dichlorvos toxicity to weevils of two populations with altered insecticide susceptibility after exposure to 50 °C over the PT<sub>80</sub> interval, were determined.

The PT<sub>99</sub> values for weevils after exposure to 50 °C showed that the population selected with pirimiphos-methyl had the longest paralysis time. Previous heat treatments of the Lab strain for the PT<sub>20</sub> and PT<sub>50</sub> intervals had little impact on the toxicity of the insecticides, chlorpyrifos-methyl being the most toxic with the first interval, deltamethrin with the second, while malathion was the least toxic. However, after heat treatment of the Lab strain over the PT<sub>80</sub> and after a 72-h recovery period, deltamethrin and dichlorvos showed reduced toxicity, while chlorpyrifos-methyl was the most toxic insecticide and malathion again the least toxic.

For field and selected weevils, heat pre-treatment at 50 °C over the PT<sub>80</sub> increased deltamethrin and dichlorvos toxicity to selected populations, but not to field populations when compared to their toxicity without pre-heating. Deltamethrin and dichlorvos toxicity after a 72-h recovery period from heat treatment over the PT<sub>80</sub> was higher to the selected population than to the resistant field population. Compared to the Lab strain, deltamethrin demonstrated lower toxicity to selected weevils and especially to a field population, while dichlorvos was considerably more toxic to both populations.