

**DELTAMETHRIN, SPINETORAM AND THEIR COMBINATIONS ALTER
HEAT TOLERANCE IN *Sitophilus oryzae* (COLEOPTERA:
CURCULIONIDAE) AND *Tribolium castaneum* (COLEOPTERA:
TENEBRIONIDAE) ADULTS**

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Insect damage in stored grains and grain-based products dates back to early civilization; *Sitophilus oryzae* (L.) and *Tribolium castaneum* (Herbst) are serious pests. Insecticides are effective management measures but accompany negative impacts on biotic/abiotic environment, decreased efficacy over time and are expensive. The combination of treatments, including insecticides, synergizes efficacy and may overcome the above limitations. The exposure to bacterial formulation spinetoram, pyrethroid deltamethrin and high temperature are effective treatments but their effects on certain species when used alone or in combination are poorly understood. This study evaluated the single and combined effects of spinetoram, deltamethrin and heat on the mortality of *S. oryzae* and *T. castaneum* adults following a completely randomized design. The insect adults were pre-exposed to different concentrations of deltamethrin or deltamethrin+spinetoram combinations. Subsequently, *S. oryzae* and *T. castaneum* were held at 42°C and 46°C, respectively. Insect mortality at different durations was determined. The lethal time to kill 50% of the population (LT₅₀) determined heat tolerance. Without exposure to heat, deltamethrin+spinetoram combination caused higher mortality than deltamethrin alone in *S. oryzae* but not in *T. castaneum*. Increased duration at high temperature increased the mortality in both species. The heat tolerance (LT₅₀) was reduced in *S. oryzae* when pre-exposed either to deltamethrin alone or deltamethrin+spinetoram combination, at all the concentrations tested. However, *T. castaneum* adults reduced heat tolerance (LT₅₀) at 15 ppm either with deltamethrin alone or deltamethrin+spinetoram combination. In general, pre-exposure to deltamethrin and spinetoram combination synergizes mortality and reduces the survival (LT₅₀) at high temperature (LT₅₀) compared to deltamethrin alone in *S. oryzae* but not in *T. castaneum*. Pre-exposure to deltamethrin and spinetoram reduces heat tolerance, enabling pest management at shorter exposure durations and lowering heat energy costs. Future experiments need to address the limitations identified in this study for improvements.

Keywords: Combined effect, Insecticides, Lethal Time, Stored-product pests, Synergy