Effect of Spinosad on the heat tolerance and cold tolerance of *Sitophilus oryzae* (Coleoptera: Curculionidae)

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Abstract

Rice Weevil *Sitophilus oryzae* (Coleoptera: Curculionidae) is a serious insect pest of stored products in Sri Lanka. Currently Pirimiphos Methyl is recommended to control this species but grain handlers seek for alternatives. Exposure to high or low temperature is popular in stored-product insect pest management but are expensive. Therefore it is important to look for treatments that synergize extreme temperature sensitivity. Spinosad is effective against certain stored-product insects but has not yet been tested for its synergy with heat or cold. This experiment was conducted to evaluate effect of Spinosad on the heat tolerance and cold tolerance of *Sitophilus oryzae* adults. Experiment was laid out in a complete randomized design with four replicates. The concentration of Spinosad and the duration of exposure were changed making them a factorial set of treatments. Four week old *Sitophilus oryzae* adults were first exposed to a series of concentration of Spinosad. Later they were held at 40°C or at 11°C for different durations. Mortality was counted 24 hours after the termination of heat or cold exposure. Increase in the exposure period to heat or cold increased mortality of *Sitophilus oryzae* adults. Preexposure to Spinosad at 12.5 ppm or above synergized the adult mortality at high or low temperature showing a dose response. This study shows that heat tolerance and cold tolerance of *Sitophilus oryzae* adults is reduced by pre exposure to Spinosad. Therefore, Spinosad can be used as a grain protectant in combination with high or low temperatures against *Sitophilus oryzae* in particular and need to test for its efficacy on other stored-product insect species as well.

Keywords: *Sitophilus oryzae*, Spinosad, cold tolerance, heat tolerance, synergy

1. Introduction

Rice Weevil *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) is a serious insect pest of stored products in Sri Lanka (Gunarathna and Karunaratne, 2009). Currently Pirimiphos Methyl is recommended to control this species (Rubasinghe et al., 2006) but grain handlers seek for alternatives. Exposure to high (Beckett et al., 2007) or low temperature (Fields, 1992) is popular in stored-product insect pest management but are expensive. Therefore it is important to look for treatments that synergize extreme temperature sensitivity of these insects. Spinosad is a fermented bacterial formulation derived from *Saccharopolyspora spinosa* Mertz and Yao (Mertz and Yao, 1990). Spinosad is effective against certain stored-product insects (Huang and Subramanyam, 2007) but has not yet been tested for its synergy with heat or cold. The objectives of this study were to evaluate effect of Spinosad on the heat tolerance and cold tolerance of *S. oryzae* adults.

2. Materials and Methods

A commercial preparation of Spinosad available at the local market in Sri Lanka was used as the test compound. A concentration series was prepared by diluting the test compound in distilled water. Red rice (variety Basmati) was used in the experiment to spray Spinosad. One of the selected Spinosad concentrations (0.5 mL) was sprayed onto rice placed in each Petri dish, covered with the lid, and was shaken well to ensure uniform distribution of sprayed concentration. Spraying was conducted from the lowest to the highest concentration of Spinosad. The distilled water was sprayed as the control. There were six exposure periods for heat tolerance experiment and seven exposure periods for the cold tolerance experiment. For each treatment, with a particular concentration and exposure period, there were four replicates. Twenty *S. oryzae* adults were introduced to each Petri dish containing the sprayed rice medium, and were held at room temperature (32±1°C) for 36-48 h. Later, they were kept in an oven maintained at 40°C or in a refrigerator at11±0.5°C for different durations, and mortality counted. Temperature was recorded by a portable digital thermometer (TECPEL 506B CE, Taiwan).

3. Results ad Discussion

Increased duration at high or low temperature increased the mortality of *S. oryzae* adults. Pre exposure to Spinosad synergized the adult mortality at high or low temperature.

This study shows that heat tolerance and cold tolerance of *S. oryzae* adults are reduced by prior exposure to Spinosad. Therefore, Spinosad can be used as a grain protectant in particular against *S. oryzae* in combination with high or low temperatures and need to be tested for its efficacy on other stored-product insect species as well.

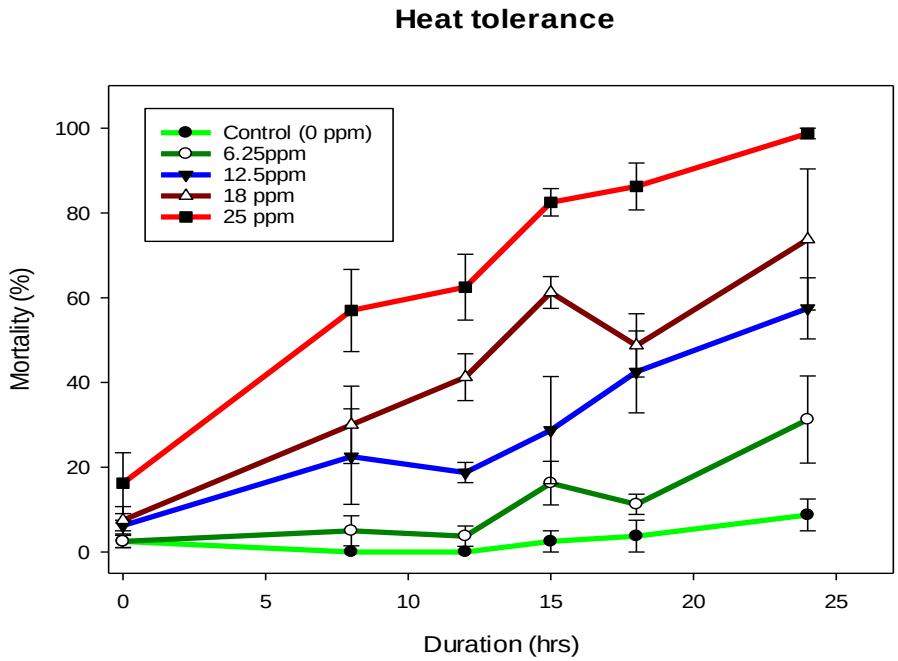

Figure 1 Heat tolerance of *S. oryzae* adults.

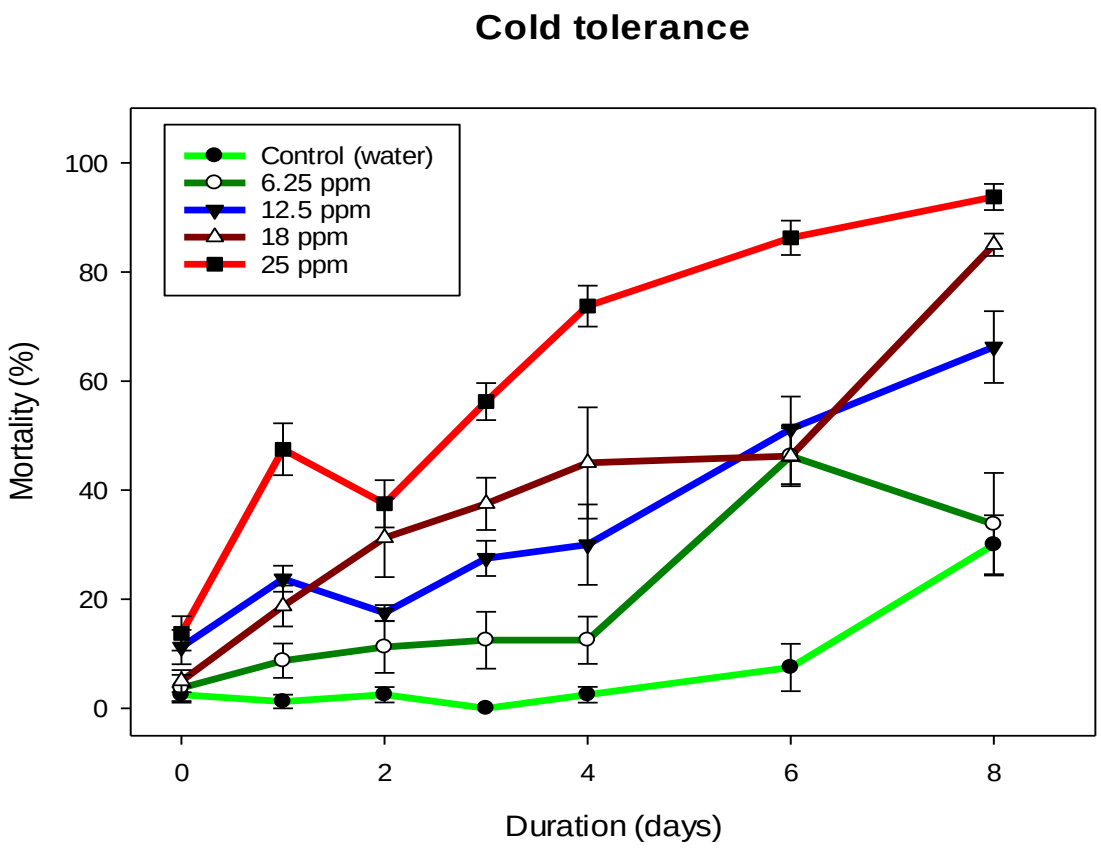

Figure 2 Effect of cold tolerance on *Sitophilus oryzae*.

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