

Title Calorimetric evaluation of responses of *Sitophilus oryzae* and *Tribolium confusum* to elevated temperatures and controlled atmospheres

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Abstract

Metabolic heat rates, determined by microcalorimetry, were used to measure the effect of controlled atmospheres (CAs) and elevated temperatures on the stored-product insects *Sitophilus oryzae* (rice weevil) and *Tribolium confusum* (confused flour beetle). Results for larval and adult stages in air, and in a range of low O₂ and/or high CO₂ CAs, at temperatures from 15 to 45 °C, showed the general effectiveness of such atmospheres in lowering the lethal temperatures relative to those in air. Effects on adult *S. oryzae* at 25 °C were explored in more detail in experiments using the following conditions: exposure to anoxic CAs for extended times; exposure to hypoxic CAs; and simulated hermetic storage. A simple scanning calorimetric method was developed for determining lethal temperatures and a combined thermo-gravimetric and differential thermal-analysis method was used to interpret the thermal events, due to loss of water, occurring at and above these temperatures.