

Title Thermal imaging to detect infestation by *Cryptolestes ferrugineus* inside wheat kernels
Author A. Manickavasagan, D.S. Jayas and N.D.G. White
Citation Journal of Stored Products Research, Volume 44, Issue 2, 2008, Pages 186-192
Keywords Thermal imaging; Insect detection; *Cryptolestes ferrugineus*; Heat production by respiration

Abstract

Canada's zero tolerance for live insects in grain received from farmers, and shipped to domestic and export buyers, has necessitated the development of an accurate insect detection method. An infrared thermal imaging system was developed to detect infestation by six developmental stages (four larval instars, pupae and adults) of *Cryptolestes ferrugineus* under the seed coat on the germ of the wheat kernels. The artificially infested wheat kernels were removed from the incubation room (30 °C), refrigerated (5 °C) for 60 s, maintained at ambient conditions for 20 s, and imaged using a thermal camera to identify each developmental stage ($n=283$). The means of the highest 5% and 10% of all temperature values on the surface of the grain were significantly higher ($\alpha=0.05$) for grains having young larvae inside and lower for grains having pupae inside. Temperature distribution on the surface of the infested kernels with different stages of *C. ferrugineus* was highly correlated with the respiration rate of each developmental stage ($r=0.83-0.91$). The overall classification accuracy for a quadratic function was 83.5% and 77.7% for infested and sound kernels, respectively, and for a linear function, it was 77.6% and 83.0% for infested and sound kernels, respectively, in pairwise discriminations. Thermal imaging has the potential to identify whether the grain is infested or not, but is less effective in identifying which developmental stage is present.