

Susceptibility of *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae) Life Stages to Elevated Temperatures Used During Structural Heat Treatments

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Methyl bromide is still widely used in food processing and storage facilities for the suppression of stored-product insect pests, but its use is scheduled to be phased out as part of the Montreal Protocol. Little information is available on the response of the cigarette beetle, *Lasioderma serricorne* (F.), a pest associated with food-processing facilities, to elevated temperatures. Heat treatment of food-processing facilities involves using elevated temperatures (46 to 60°C for 24 h) for management of stored-product insect pests. In collaboration with scientists at Kansas State University, we evaluated stage-specific susceptibility of *L. serricorne* to elevated temperatures in order to identify the most heat tolerant stage. Exposure of eggs, larvae, pupae, and adults to 46, 50 and 54°C, in the laboratory indicated the egg stage to be the most heat-tolerant. The lethal time to kill 99% of eggs at 46°C was 605 min; it decreased to 190 min at 50°C, and 39 min at 54°C. Therefore, during structural heat treatments, eggs should be used in bioassays for gauging the effectiveness of heat treatments, because treatments aimed at controlling the egg stage should control all other life stages of *L. serricorne*.

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Ground, Pelleted Poultry Feed: An Optimal Diet for the Cigarette Beetle, *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae)

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The cigarette beetle, *Lasioderma serricorne*, is frequently a pest of stored-products. However, data were lacking on an easy to prepare diet so that the species could be easily reared for scientific studies. In collaboration with scientists at Kansas State University, we studied the life history parameters of *L. serricorne* on a diet of ground, pelleted feed plus 5% (by wt) ground brewer's yeast at 28°C and 65% relative humidity. The

mean duration for eggs was 8.1 days, and the mean egg viability was 92.0%. There were four discrete larval stages, and the mean developmental times of first, second, third, and fourth larval stages were 4.7, 4.5, 4.7, and 11.8 days, respectively. The survivorship of first through third stages was about 99%, whereas the fourth larval stage was 85%. The mean pupal duration was 4.6 days, and pupal survivorship was 98%. On average, females laid 105 eggs during their lifetime with an average of 12 eggs per day. A diet of ground, pelleted feed combined with 5% yeast, appears to be a suitable and easy to prepare diet for mass rearing the cigarette beetle.

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Protein and Quality Characterization of Pegaso Wheat Near-Isogenic Lines

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Submitted to: Journal of Cereal Science

Gluten proteins are major components of wheat flour and are responsible for the formation of cohesive dough necessary to make bread. Bread quality is determined by the molecular structure of wheat storage proteins which in turn governs the interactions of proteins during the bread making process. As the technology has progressed in wheat genetics, use of novel genetic lines such as near-isogenic lines (NILs), have been used to deduce the relationships between composition and functionality. The goal of this study was to deduce the effects of changes in protein subunit composition on functionality of wheat proteins and thus, to establish composition-functionality relationships using NILs. Two important conclusions arise from this study. First, null lines at Gli-1 loci, specifically at Gli-B1 loci resulted in higher amounts of unextractable polymeric proteins (UPP) which have been linked to dough strength. Second the lack of gliadins encoded at Gli-A2 and Gli-D2 loci also caused a marked increase in UPP. This might be attributed to removal of possible chain terminators at Gli-1 or Gli-2 loci, absence of which would shift the molecular weights to higher values and increase dough strength properties. This information can be used by the wheat breeding community to improve the genetic quality of U.S. wheats.

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Determining Single Kernel Weight and Moisture Content of Fusarium-Damaged Wheat by Near Infrared Spectroscopy

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Submitted to: Cereal Chemistry

Moisture content (MC) is an important trait in grain quality evaluation. The MC of grain is usually expressed as a percentage of moisture based on wet weight or dry weight of kernels. Other quality traits such as starch, protein, oil contents are then expressed relative to MC. Near infrared (NIR) spectrometric techniques are often used to measure traits, but NIR spectra are affected by the mass of a constituent, which may not be related to the percentage of the constituent being measured. This may particularly be a problem when measuring traits in single kernels which can vary significantly in size. Thus a small kernel and large kernel can have the same percentage of water, but the mass of water can be quite different. We are developing single kernel techniques to assess Fusarium damage and to estimate deoxynivalenol contents of wheat grain samples affected by Fusarium head blight (FHB). Such grain samples are quite heterogeneous in terms of kernel size, weight and other chemical and physical properties. The results of this study showed that single kernel MC as well as fresh or dry weight and water mass of kernels could be predicted by NIR spectroscopy. Therefore, in single kernel analysis it is important to express quality traits such as MC in terms of mass/kernel basis rather than percentage basis. When the fresh weight of the kernel can be provided, the water mass of kernels could be accurately estimated by using predicted MC. This concept of measuring the mass of a constituent may also help in measuring traits like starch quality and protein quality where the mass of starch or protein must first be measured.

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Identification of Damaged Wheat Kernels and Cracked-Shell Hazelnuts with Impact Acoustics Time-Frequency Patterns

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Submitted to: Transactions of the ASABE

A new method for identifying and separating damaged wheat kernels and cracked-shell hazelnuts was developed. The method uses the sound emanating as wheat or nuts drop onto a plate as the basis for discrimination. The new approach separated insect and fungal damaged wheat kernels from undamaged wheat kernels with 96% and 94% accuracy, respectively. It also separated cracked-shell hazelnuts from those with undamaged shells with 97.1% accuracy. The method is highly adaptable and should find uses for other food kernel inspections as well.

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Discrimination Between Closed and Open Shell (Turkish) Pistachio Nuts Using Undecimated Wavelet Packet Transform

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Current methods for separating closed- from open-shell pistachio nuts have low accuracy, high cost, and can damage the nuts. A new method for separating closed- and open-shell pistachio nuts uses the sound emanating from the nuts as they drop onto a plate as the basis for discrimination. This study expanded the capability of the original acoustic based sorter by improving accuracy and making the system more adaptable to other commodities. Accuracy is improved by over ten percent for a variety of nuts that is particularly difficult to separate. This can represent a saving of millions of dollars a year for pistachio processors. Additionally, some nuts that are difficult to separate need to be separated by hand, increasing the possibility of introducing food pathogens. This work will help reduce this risk.

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