



Research Kernels

Our Latest Research Results – June 2014

Oviposition of *Dermestes maculatus* DeGeer, the hide beetle, as affected by biological and environmental conditions

Authors: E.A. Fontenot, F.H. Arthur, K.L. Hartzler

Submitted to: Journal of Stored Products Research

The hide beetle can infest a wide variety of stored food products, particularly protein-based food and feed. We have developed a method to mass rear this insect but it is difficult to collect eggs from that diet. We evaluated different methods to collect eggs and small larvae and found that synthetic fur was suitable for collecting large numbers of individual eggs or young larvae. In addition, we found that females laid fewer eggs on diet that had already been used for rearing compared with fresh diet. Results show how the biology of an individual insect species can be used to help rear the insect on artificial diet and to maximize collection methods for different life stages.

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Mineral content in grains of seven food-grade sorghum hybrids grown in a Mediterranean environment

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Submitted to: Journal of Agricultural and Food Chemistry

Sorghum is a major crop used for food, feed and industrial purposes worldwide. The objective of this study was to determine the mineral content in grains of seven white food-grade sorghum hybrids bred and adapted for growth in the central USA and grown in a Mediterranean area of Southern Italy. The seven hybrids were analyzed for grain, ash and for both grain macro- and micro-nutrient minerals content. Either nutritionally essential macro-elements content, i.e. K, Na, Mg, Ca and P, or essential micro-elements content such as Al, Fe, Mn, Ni and Zn, or trace elements content such as Ag, Ba, Cd, Cr, Co, I, Mo, Se, Pb, Sn and V, were investigated. The overall results demonstrate that, with respect to other crops, food-grade sorghum was characterized by high Mg, Fe and Zn content, high K:Na ratio and low Ca:P ratio. Interestingly, significant variations in the content of the essential elements were found among the seven white sorghum hybrids examined, and the seven sorghum hybrids were shown to cluster into three distinct groups on the basis of the mineral profile. These results are discussed in the

context of the importance of minerals in human nutrition and of the opportunity to select the best white sorghum varieties from the point of view of mineral content.

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Phytosanitary irradiation of *Diaphorina citri* (Hemiptera: Psyllidae)

Authors: G.J. Hallman, D.L. Chapa

Submitted to: Florida Entomologist

The Asian citrus psyllid (ACP) is a major pest of citrus mainly as a vector of the devastating citrus greening disease (HLB). Irradiation is one phytosanitary treatment to prevent quarantine pests from becoming established in new geographical areas, but doses to control ACP have not been determined. This research found that a dose to kill ACP outright to prevent its vectoring the causative agent of HLB would be >2 kGy, which would not be tolerated by essentially any fresh hosts of the pest. A dose to prevent its reproduction (which is the objective of most irradiation treatments against adult pests) could be 150 Gy, which is tolerated by the vast majority of fresh commodities. Therefore, although irradiation might not be able to prevent transmission of HLB by ACP, it can be used to prevent the insect from becoming established, and this information aids in developing generic irradiation treatments that can be used for groups of pests.

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Insect thermotolerance comparing host infestation methods: *Anastrepha ludens* (Diptera: Tephritidae) reared in grapefruit or diet

Authors: G.J. Hallman

Submitted to: Journal of Economic Entomology

When insect control research deviates from the natural situation the possible effects of these deviations on efficacy should be evaluated. Some pest control techniques are based upon research using untested assumptions about variables that might affect efficacy. For example, some phytosanitary treatments designed to disinfest agricultural commodities of invasive pests are based on research that used insects reared on diet and then inserted into fruit without testing if this technique alters efficacy. This research compared infestation via insertion of diet-reared Mexican fruit fly larvae into grapefruits vs. grapefruits infested via female

flies laying eggs in the peel. Although the results did not show statistically significant differences between the two techniques, tendencies observed caution against accepting untested assumptions about efficacy when experimental techniques stray from more natural situations.

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Development of a 96-well Plate Iodine Binding Assay for Amylose Content Determination

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Submitted to:

Cereal starch amylose/amylopectin (AM/AP) ratios are critical in functional properties for food and industrial applications. Conventional methods for the determination of AM/AP of cereal starches are very time consuming and labor intensive making it very difficult to screen large sample sets. Studying large data sets is necessary for evaluating breeding samples and investigating the impact the environment has on cereal starch development. The objective of this study was to adapt and optimize the iodine binding assay (colorimetric) in a 96 well plate format for both single and dual wavelength ($\lambda 620\text{nm}$ and $\lambda 510\text{nm}$ respectively) assays. The standard curve for amylose content was scaled down to work in a 96-well plate format as demonstrated by regression equations with R^2 values of 0.999 and 0.993 for single and dual wavelength, respectively. The plate methods were applicable over large ranges of amylose contents: high amylose maize starch at $61.7 \pm 2.3\%$, normal wheat starch at $29.0 \pm 0.74\%$, and a waxy maize starch at $1.2 \pm 0.9\%$. The method exhibited slightly greater amylose content values than the Concanavalin A method for normal type starches; but is consistent with cuvette scale iodine binding assays. This method was tested on maize, wheat and sorghum starch providing excellent repeatability.

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Complete Sequence Analysis of a Novel Serotype of Bluetongue Virus from Western North America

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Submitted to: PeerJ

Bluetongue is a disease of domestic and wild ruminants that can be fatal and is caused by an insect-transmitted virus. There are four types of the virus throughout the United States (US), while one type was previously only detected in the southeastern US. Genetic analysis performed in this study suggest co-circulation of viruses in the southeastern US, and supports the previous finding that the western isolate is related to recent southeastern strains. This study further supports the need for an ongoing entomologic and livestock

surveillance program for this economically important livestock disease.

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Hydrology Submodel

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Submitted to: Agricultural Handbook

The susceptibility of an agricultural field to the removal of soil by wind is directly related to the amount of biomass produced and retained on the soil surface, the size and toughness of clods and crust on the soil surface, and the water content of the soil surface. The Wind Erosion Prediction System (WEPS) requires a hydrology submodel that tracks the movement of water through the near-surface soil to predict the amount of soil water available to produce a crop, the moisture available to decompose crop residue, the changes in soil water content that influence soil crust and clod creation and strength, and the daily variation of the water content at the soil surface. In the WEPS hydrology submodel, two modeling methods are implemented. The first method is based on the concept that the rate of water movement is a function of soil texture and density, and can be modeled by dividing the soil into a series of layers and integrating the rate equations over time. This resulted in a fairly realistic simulation, but for some applications of WEPS, requires too much computer time. The second, faster, method incorporates the water balance methods implemented by the Water Erosion Prediction Project (WEPP), where the infiltration and runoff of water is modeled on a time scale of seconds to minutes, while the movement of water at other times is modeled using a daily water balance. As implemented, both methods show good results in estimating the water content of a bare soil surface and its influence on the susceptibility of the soil to wind erosion. For the field data available, the first method overestimated the cumulative evaporation from the soil profiles while the second method underestimated it making the submodel less suitable for estimating crop biomass production based on soil water content. Additional validation is recommended.

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