CGAHR
Center for Grain & Animal Health Research

Research Kernels

Our Latest Research Results - February 2013

Distribution, Abundance, and Seasonal Patterns of *Plodia interpunctella* (Hübner) in a Commercial Food Storage Facility

Authors: F.H. Arthur, J.F. Campbell, M.D. Toews
Submitted to: Journal of Stored Products Research
The Indianmeal moth is a major pest of stored food products, but there are few studies where resident populations have been monitored for more than one year in commercial facilities. We monitored Indianmeal moth populations inside a food warehouse for three years using an attractant for male moths. The focal points of infestation shifted during the storage period, but moths were consistently trapped in certain locations. Also, we caught moths in traps that were in places where no food was stored. In general, more moths were caught during the summer months compared to the remainder of the year. Cost estimates for the monitoring program were calculated using values provided by private industry. We used these values to show how reducing the number of traps could provide information on infestation trends while lowering the costs associated with insect monitoring. Results show the importance of monitoring for Indianmeal moths, but also emphasize the dynamic nature of insect infestations inside an active warehouse.
Contact Frank Arthur, telephone 785-776-2783, email Frank.Arthur@ars.usda.gov

Simultaneous Transfer, Introgression and Genomic Localization of Genes for Resistance to Stem Rust Race Ug99 from the Wheat D-Genome Progenitor Species, *Aegilops tauschii*

Authors: E. Olson, M.N. Rouse, M.O. Pumphrey, R.L. Bowden, B. Gill, J.A. Poland
Submitted to: Theoretical and Applied Genetics
Wheat production worldwide is threatened by stem rust. On susceptible varieties, this disease can cause severe crop loss. New races of wheat stem rust have been found over the past decade that can infect most of the wheat cultivars in the US and around the world. To address the need for resistance to this pathogen, previous studies were conducted to survey wild relatives of wheat for resistance and several promising sources of resistance were found. In this current study, two accessions of the wild wheat relative, *Aegilops tauschii*, were directly crossed with wheat and resistant plants recovered. The resistant plants were then crossed again to wheat to recover more desirable plant types and resistant plants were identified and selected. In the process of introgressing the new resistance genes into desirable wheat lines, populations were developed that enabled the genetic mapping of the resistance genes to identify where they are located in the genome. DNA markers were identified that are linked to the resistance genes and can be used for “marker-assisted selection” in wheat breeding.
Contact Jesse Poland, telephone 785-532-2709, email Jesse.Poland@ars.usda.gov

Functional Genomic Approaches in Cereal Rusts

Authors: G. Bakeren, X. Song, V. Panwar, R. Linning, X. Wang, C. Rampitsch, B. McCallum, B. Saville, J.P. Fellers
Submitted to: Canadian Journal of Plant Pathology
Cereal rusts cause significant economic losses each year. Plant breeders typically select for disease resistance genes to combat infection. Unfortunately, disease resistance genes frequently succumb to new races of the cereal rust fungi. Although study of rust fungi is difficult because they cannot be cultured on laboratory media, great advances are now occurring in understanding the genomes of rust pathogens and their arsenal of effector proteins that they use to attack plants. Understanding the mechanisms of pathogen attack may help us design better, more durable defenses in the plant.
Contact John Fellers, telephone 785-532-2367, email John.Fellers@ars.usda.gov

Evaluation of Sorghum [*Sorghum bicolor* (L.) Moench] Lines and Hybrids for Cold Tolerance Under Field and Controlled Environments

Authors: M. Kapanigowda, R. Perumal, R. Aiken, T.J. Herald, S. Bean, C.R. Little
Submitted to: Crop Science
Early season cold tolerance in sorghum contributes to emergence, seedling establishment, early vegetative growth, and reduces damping-off diseases under chilling conditions. The objectives of this study were to identify cold tolerant sources and to evaluate and optimize rapid screening techniques under a controlled environment. Forty-eight genotypes were selected and grown during 2011 in two locations. The results of the study showed that late emergence produces greater biomass compared to early emergence. A potting mixture study concluded that soil+vermiculate mix is more effective for

controlled environment cold tolerance screening than soil+sand or soil+peat potting mixes.
Contact Tom Herald, telephone 785-532-2703, email Tom.Herald@ars.usda.gov

Estimating the Relative Effects of the Endosperm Traits of Waxy and High Protein Digestibility on Yield in Grain Sorghum

Authors: B. Jampala, W.L. Rooney, G.C. Peterson, S. Bean, D.B. Hays
Submitted to: Field Crops Research
In sorghum grain, both the waxy endosperm and the high protein digestibility traits have the potential to significantly alter conversion efficiencies of sorghum in several applications including production of grain ethanol and brewing. However, there are concerns that these traits may confer a reduction in the agronomic and yield performance of lines and hybrids that possess them. The objective of this study was to assess the potential impact of both the waxy and high digestibility traits on the yield of grain sorghum lines across a range of growing locations. Across all environments, there was no significant difference between yields. In addition, analysis by genotype revealed that several waxy, high-digestible, and waxy high-digestible mutant lines were among the best yielding lines. These results imply that selection of high yielding WX and HD genotypes is possible, but a significant breeding emphasis on their development and selection is required to effectively identify those genotypes.
Contact Scott Bean, telephone 785-776-2725, email Scott.Bean@ars.usda.gov

Non-Destructive Species Identification of *Drosophila obscura* and *D. subobscura* (Diptera) Using Near-Infrared Spectroscopy

Authors: S. Fischnaller, F.E. Dowell, A. Lusser, B. Schlick-Steiner, F.M. Steiner
Submitted to: Fly
The vinegar flies *Drosophila subobscura* and *D. obscura* frequently serve as study organisms for evolutionary biology. However, accurate species identification of living specimens of both sexes is difficult, as the two species are morphologically very similar. In order to introduce wild-caught individuals to the laboratory with the aim to retain genetic variation, a rapid and non-destructive method for species identification with the potential for high throughput is needed as an alternative to morphology-based methods. Here we test the usefulness of the non-invasive method near-infrared (NIR) spectroscopy for discriminating live individuals of the two species. We found a classification success for wild-caught specimens of 85%, and the species specificity of the chemical profiles persists in laboratory offspring (87-92% success). This rapid NIR technique helped us to conclude that the cuticular chemistry is genetically determined, despite changes in the cuticular fingerprints which we interpret as due to laboratory adaptation, genetic drift and/or diet changes. Also, we demonstrated that by applying an appropriate cut-off value for interpreting the prediction values, the classification success can be immensely improved (to up to 99%), albeit at the cost of excluding a portion of specimens.
Contact Floyd Dowell, telephone 785-776-2753, email Floyd.Dowell@ars.usda.gov

Using Near-Infrared Spectroscopy to Resolve the Species, Gender, Age, and the Presence of Wolbachia Infection in Laboratory-Reared Drosophila

Authors: W.C. Aw, F.E. Dowell, W.O. Ballard
Submitted to: Genes, Genomes, Genetics
We determined the accuracy of near-infrared spectroscopy (NIRS) for determining species, gender, and age of the small flies, Drosophila, and also the presence of the organism Wolbachia that lives within the flies. Wolbachia may cause sperm and eggs to be unable to form viable offspring. This phenomenon increases the fitness of Wolbachia infected females and may drive the infection to spread rapidly within and between the populations. Wolbachia has also been proposed as a novel-biocontrol agent and the rapid determination of its frequency in populations will impact the success of these endeavors. NIRS was able to correctly classify fly species with about 90% accuracy, while flies were successfully classified by gender with accuracy greater than 90%. In age-grading test, it was possible to predict the age of flies as less than or greater than 9 days of age with about 80% accuracy. NIRS was able to detect Wolbachia-infected flies with about 90% accuracy. These results suggest that NIRS has the potential to quantify the species, gender, age, and presence of Wolbachia in fly populations.
Contact Floyd Dowell, telephone 785-776-2753, email Floyd.Dowell@ars.usda.gov

USDA-ARS Center for Grain and Animal Health Research

1515 College Avenue
Manhattan, KS 66502

800-627-0388
ars.usda.gov/npa/cgahr