



Research Kernels

Our Latest Research Results – May/June 2015

Two small secreted proteins of *Puccinia triticina* are candidate avirulence effectors in wheat

Authors: V. Segovia, M. Bruce, J. Rupp, L. Huang, G.

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Submitted to: Molecular Plant Microbe Interactions

Wheat farmers around the world constantly face the threat of yield losses due to fungal pathogens. One of the major diseases is leaf rust caused by the fungus *Puccinia triticina*. Each year, there are over seventy different races of leaf rust collected from wheat fields around the world. The fungus infects the plant and injects molecules that help overcome the plant's defenses. However, if the plant has a gene for fungal resistance, the resistance protein may recognize one of the molecules injected by the fungus and trigger a resistant reaction and in turn, kill the cell limiting the spread of the fungus. This system also puts significant selection pressure on the fungus to select for mutations in the recognized molecule so the plant can no longer recognize a fungal infection. This research describes two proteins from *P. triticina* that meet the criteria for fungal molecules that trigger plant resistance responses. This information may lead to better ways of developing durable resistance.

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Adaptation of a rapid method to determine starch damage in sorghum

Authors: J.D. Wilson, R.C. Kaufman, B.W. Seabourn,

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Submitted to: Journal of Food Properties

Sorghum is gaining in popularity in the United States for food uses especially as an alternative for individuals sensitive to gluten. Sorghum is lower in glycemic index compared to other cereal products, thus contributes toward the fight against obesity and diabetes. The milling process transforms grain into flour and may result in the inadvertent disruption of starch granules that are responsible for water absorption and end product quality. Thus monitoring the amount of starch damage is paramount to food processors. This study developed a method for quantifying sorghum starch damage by adapting an iodine absorption method. The method is rapid and can be adapted to other cereal grains.

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Host and Vector Susceptibility to an Emerging Orbivirus in the United States, Epizootic Hemorrhagic Disease Virus Serotype 6

Authors: M.G. Ruder, D.E. Stallknecht, A.B. Allison, D.G.

Mead, D.L. Carter, E.W. Howerth

Submitted to: Veterinary Pathology

Epizootic hemorrhagic disease (EHD) is an important viral disease of white-tailed deer and occasionally cattle, and is transmitted to animals by the bite of infected insects known as *Culicoides* biting midges. Two different serotypes of EHDV, EHDV-1 and EHDV-2, have been circulating between ruminants (like deer and cattle) and *Culicoides* biting midges in the United States for over 60 years; however, in 2006 a new serotype (EHDV-6) was documented and since that time this emerging virus has caused death of infected white-tailed deer from the eastern United States. In this study, our goal was to determine the outcome of infection in white-tailed deer, cattle, and an insect vector, *Culicoides sonorensis*, with EHDV-6 since these are important hosts for the EHD viruses that have circulated in the U.S. for a long time. Findings of the study indicate both white-tailed deer and cattle can become infected with EHDV-6. Deer became severely ill, whereas cattle showed no symptoms. Additionally, *Culicoides sonorensis* supported virus replication although additional research is needed to confirm this species is capable of transmitting the virus to cattle and deer. The introduction and subsequent establishment of this exotic virus in the U.S. is significant and additional field and laboratory studies are needed to better understand the epidemiology of this emerging virus.

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Modified dough preparation for alveograph analysis with limited flour sample size

Authors: Y.R. Chen, B.W. Seabourn, T.J. Herald

Submitted to: Cereal Chemistry

Dough rheological characteristics, such as resistance-to-extension and extensibility, obtained by alveograph testing are important traits for determination of wheat and flour quality. A challenging issue that faces wheat breeding programs and some wheat-research projects is the relatively large flour sample size of 250 g required for the AACC (54-

30A) standard alveograph method. A modified dough preparation procedure for a small flour sample size was developed for the alveograph test method. A dough was prepared by mixing 80 g flour with 60% water absorption (2.5% salt solution) for 4 min in a 100-g pin mixer, then sheeted and cut into three patties of defined thickness under specified conditions. Data generated by the modified dough preparation method was significantly correlated with the results from the standard alveograph method. The correlation coefficients (r) for each of six alveograph dough characteristics of 40 different advanced breeding lines and wheat varieties were 0.92 for P (mm H₂O), 0.73 for L (mm), 0.83 for W (10⁻⁴ J), 0.90 for P/L, 0.90 for le (%), and 0.76 for G. Alveograph results from dough prepared using the modified method correlated better to dough mixing properties and baking characteristics than dough made using the standard method. The modified dough preparation was easier and more convenient than the standard method, and test time for the modified dough preparation was shorter. This modified dough preparation procedure for the alveograph may be useful for wheat breeding programs as well as an alternative to the standard alveograph method for milling and baking industries and wheat quality research.

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Efficacy of Deltamethrin at Short Exposure Intervals or on a Partially-Treated Grain Mass

Authors: Nickolas G. Kavallieratos, Christos G. Athanassiou, Frank H. Authur

Submitted to: Journal of Economic Entomology

Normal procedures for treating grain as it is loaded into storage involve treatment of the entire grain mass. Alternative methods include treating only the top portion of the grain mass because it is assumed that most insects are in this top portion. However, this provides a means whereby insect pests can escape the treatment by moving to the untreated grain. We conducted study by exposing stored product beetles for short time periods on brown rice treated with the insecticide deltamethrin or by exposing the insects on mixtures of treated and untreated rice. Insects were able to recover from exposure when moved from treated rice to untreated rice and insect mortality was limited. Entire treatment of the rice provided the most effective control for most of the species evaluated in our study. Results show optimal insect control is achieved when the entire grain mass is treated with an insecticide, instead of treating only the top portion. Incorporation of these results into management practices will enable managers of stored grain to reduce economic losses caused by stored product insects.

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Genetic variation for heat tolerance in primitive cultivated subspecies of *Triticum turgidum* L.

Authors: J. Fu, R. Bowden, V. Prasad, A. Ibrahim

Submitted to: Journal of Crop Improvement

Compared to many other crops, wheat is very susceptible to high temperature stress during the grain filling period. Heat stress is currently one of the biggest constraints on wheat yields in the Great Plains Region of the US. The problem is expected to get worse as atmospheric carbon dioxide levels increase. The goal of this study was to investigate the variation for heat tolerance in primitive cultivated subspecies of tetraploid (emmer or durum) wheat. Thirty-eight wheat lines belonging to five subspecies collected from nineteen countries were studied for heat tolerance in controlled environments. Several lines with tolerance to high temperature stress were identified. These will be useful to breeding programs for the improvement of heat tolerance in wheat.

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