



Research Kernels

Our Latest Research Results – August 2014

Grain Sorghum Proteomics: An integrated approach towards characterization of seed storage proteins in kafirin allelic variants

Authors: J.E. Cremer, S.R. Bean, M. Tilley, B.P. Ioerger, J.B. Ohm, R.C. Kaufman, J.D. Wilson, D. Innes, E.K. Gilding I.D. Godwin

Submitted to:

Seed protein composition is an important quality trait and adds value to grains for food, feedstock and biomaterials uses. Because of this, an integrated proteomic approach was employed to characterize 28 sorghum lines with allelic variation at the kafirin loci in order to determine the effects of kafirin genetic diversity on the expression of seed proteins. This proteomic analysis compiled sequence and biochemical information for a wide range of proteins affecting sorghum endosperm structure and composition. The derived dataset will further augment annotation of the sorghum proteome and facilitate identification of potential targets for improved grain quality. Furthermore our data provides a basis for comparative studies with other major grain crops. Possible avenues for utilizing protein sequence data include the development of high-lysine varieties with increased albumin and globulin content for enhanced nutritional quality, and the modification of enzyme-regulated protein aggregation in the endosperm for increased starch availability.

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Development of a Rift Valley fever virus viremia challenge model in sheep and goats

Authors: H.M. Weingartl, C.K. Nfon, M.M. Miller, W.C. Wilson

Submitted to:

Vaccine
The study describes the development of a new easier to conduct infection model for evaluation of vaccines for the mosquito-borne virus Rift Valley fever, which causes severe to lethal disease in domestic ruminants and man. The disease is endemic in Sub-Saharan Africa and could be accidentally introduced into non-endemic countries. Current challenge models are useful but are complicated to perform in the required high biological secure facilities because they require synchronized pregnant animals.

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Effects of methoprene and synergized pyrethrin aerosol applications on *Tribolium castaneum* (Herbst) populations

Authors: A. Tucker, J. Campbell, F.H. Arthur, K.Y. Zhu

Submitted to:

Journal of Stored Products Research
Aerosol insecticides are often used as part of management programs for the red flour beetle inside mills and warehouses, and these aerosols generally target the adult stage. However, there is little information on if the presence of treated adults affects the overall population. We treated adult beetles with single and multiple applications of pyrethrin insecticide, pyrethrin with the insect growth regulator methoprene, or just the oil carrier that was in the pyrethrin formulation. After treatment the adults were put into various arenas with established populations to see if the presence of these treated adults affected the population. When a refugial food source was present, single applications of the insecticides did not affect the overall number of adults or the population growth rate. Multiple applications did result in some reduction of total numbers and the growth rate, especially when pyrethrin was combined with methoprene. However, this effect was mitigated by the population numbers. Results show that effects of a single insecticide application may be limited and multiple applications of an insecticide may be necessary to affect resident populations.

Contact Frank Arthur, telephone 785-776-2783, email Frank.Arthur@ars.usda.gov

Exogenous Salicylic Acid Enhance the Resistance of Wheat Seedlings to Hessian Fly (Diptera: Cecidomyiidae) Infestation under Heat Stress

Authors: J. Underwood, J. Moch, M. Chen, L. Zhu

Submitted to:

PLoS One
Hessian fly is one of the most destructive pests of wheat. The insect pest is mainly controlled by deploying resistant wheat. One of the challenges for the plant resistance strategy is that most, if not all, known resistance genes lose resistance under heat stress conditions. This challenge may become more serious under the scenario of climate change. To safeguard continuous success of the host plant resistance strategy in the future, we need to understand the mechanism for resistance genes to become ineffective under heat condition. This research reports that exogenous application of salicylic acid on wheat seedlings right before heat stress can partially prevent the loss of wheat resistance to Hessian fly under heat conditions. The

finding provides information that may eventually leads to mitigating the adverse impacts of heat stress on plant resistance.

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Association Analysis of Stem Rust Resistance in U.S. Winter Wheat

Authors: D. Zhang, R.L. Bowden, J. Yu, B.F. Carver, G. Bai

Submitted to: PloS One

Wheat stem rust has become a renewed threat to U.S. wheat production after the emergence and spread of a new rust pathogen race called Ug99 from Africa. To elucidate U.S. winter wheat resistance genes to stem rust, a panel of 137 U.S. winter wheat accessions were evaluated for rust infection types using six U.S. stem rust races (QFCSC, QTHJC, RCRSC, RKQQC, TPMKC and TTTTF) and Ug99, and screened with DNA markers. Association mapping successfully detected six known stem rust seedling resistance genes in U.S. winter wheat lines with frequencies: *Sr6* (12%), *Sr24* (9%), *Sr31* (15%), *Sr36* (9%), *Sr38* (19%), and *Sr1RS^{Amigo}* (8%). Adult plant resistance gene *Sr2* was present in 4% of lines. *Sr38* was the most prevalent *Sr* gene in both hard and soft winter wheat and was the most effective *Sr* gene in the adult plant field test. Resistance gene to Ug99 on chromosome 2B was from the alien chromosome segment carrying *Sr36*. Several significant markers were associated with potential novel rust resistance alleles on 3BL, 4AL, 4BL, 4DL and 6AS. Marker *Xgwm495-182* was associated with seedling resistance to Ug99. These markers that can effectively detect stem rust resistance genes to Ug99 and U.S. races are useful for pyramiding different sources of resistance genes in breeding.

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Dispersion, efficacy, and persistence of dichlorvos aerosol against two flour beetle life stages in a mill

Authors: B. Subramanyam, D.R. Boina, F.H. Arthur

Submitted to: Journal of Stored Products Research
Recently there has been increasing use of the insecticide dichlorvos as an aerosol to control stored-product insects inside mills, warehouses, and processing plants, but there is little new research regarding distribution and efficacy of dichlorvos in field sites. We conducted a study by placing test dishes of adult confused flour beetle and the pupal stage of the red flour beetle in open, obstructed, and concealed sites inside a flour mill. Dichlorvos dispersed throughout the individual floors of the mill and killed almost all insects in the open and obstructed sites, and killed most of the insects in the concealed sites. However, dichlorvos dissipated rapidly and gave little residual control. Results show that this insecticide will give immediate kill, but other insecticides may be needed for residual control.

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Phytosanitary irradiation of the invasive herbivorous terrestrial snail *Cornu aspersum* (Stylommatophora: Helicidae)

Authors: G.J. Hallman

Submitted to: Florida Entomologist

Snails and slugs are invasive species that may restrict trade in a wide variety of items from vegetables to floor tile. New measures are needed to prevent their transport with these items because the main form of control, methyl bromide fumigation, is increasingly restricted. Ionizing radiation, a treatment that is increasing in use, was studied for its ability to prevent reproduction of brown garden snail, an important invasive gastropod. Based on this research it is suggested that a relatively low dose of radiation, ~75 Gy, would be sufficient to prevent hatch of eggs laid by irradiated adults. This dose is readily tolerated by the great majority of fresh commodities. Those who may benefit from this research include industry involved in trade in commodities regulated because of snails and regulatory agencies, such as USDA-APHIS.

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