

A Modeling Study of Aeolian Erosion Enhanced by Surface Wind Confluences over Mexico City

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Submitted to: Aeolian Research

Using erosion and air quality models, a study of the effect of wind eroded soil on fine dust production and movement in Mexico City was conducted. The importance of wind erosion from the dry Lake of Texcoco and agricultural lands to the east and southeast of Mexico City on urban air quality, its genesis, morphology, and regional implications was established. The erosion and air quality models described provide a useful computational tool to study the wind erosion phenomenon, its sources, and impact on urban regions. Contact John Tatarko, telephone 785-537-5542, email john.tatarko@ars.usda.gov

Evaluation of Catmint Oil and Hydrogenated Catmint Oil as Repellents for *Tribolium castaneum* and *Tribolium confusum*

Authors: F.H. Arthur, E.A. Jenson, J.F. Campbell

Submitted to: Journal of Insect Science

Repellents are used in insect pest management programs to keep insects from infesting commodities, but there are few repellents that can be used for stored-product insects. We evaluated two types of oils made from catmint plants as repellents for the red flour beetle and the confused flour beetle, two important pests of stored products. We used visual assessments and video recordings to evaluate the reactions of the beetles to the repellents. Simple visual assessments were inconclusive, but the video recordings showed that both oil products were more repellent to the red flour beetle than to the confused flour beetle. Red flour beetles avoided the area that was treated with the oils. The results show that the catmint oil products are effective repellents for the red flour beetle.

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Two Uridine-Diphosphate N-Acetylglucosamine Pyrophosphorylases are Critical for *Tribolium castaneum* Molting, Survival, and Fecundity

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Submitted to: Biochemical Journal

Chitinous structures in insects, such as the exoskeleton and digestive sac, are vital for insect survival and could be exploited by appropriately-targeted biopesticides. We identified two new "UAP" genes in the red flour beetle that are required to generate the basic building blocks not only of chitin, but also other vital insect sugar polymers and sugar-proteins. All other invertebrates examined have only one UAP gene. One of the two beetle genes is similar to the corresponding one in other invertebrates, while the other seems to have unique functions in nutrition and growth. If the second gene is eliminated, the insects die, apparently of starvation. Our ongoing gene discovery efforts in this pest insect continue to reveal new weaknesses that may lead to new methods of insect control.

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Atmospheric Pressure-Thermal Desorption (AP-TD)/Electrospray Ionization-Mass Spectrometry for the Rapid Analysis of *Bacillus* Spores

Authors: F. Basile, S. Zhang, Y.-S. Shin, B.S. Drolet

Submitted to: Analyst

Use of mass spectrometry (MS) in a variety of scenarios ranging from industrial and clinical to national security/forensic applications increasingly requires rapid detection of analytes from a variety of sample conditions, and the implementation of field-portable instrumentation. An MS technique is described where spores of the bacterium *Bacillus* were rapidly detected and analyzed from complex samples. Bacterial spores were detected even in the presence of growth media in crude lyophilized (freeze-dried) samples. Repetitive analyses could be performed in less than 5 min total analysis time (including sample loading, heating, and data acquisition). This approach was more successful than other direct ambient MS approaches to detect the biomarker from

Bacillus spores. A detection limit for the biomarker was estimated at 1 part per million, which corresponded to a calculated detection limit of 100,000 spores or 0.1% by weight spore composition in solid samples (assuming a 1 mg sample size). The technique allowed the differentiation of bacterial spores from other 'suspicious white powders' using a single stage for mass analysis and with minimum sample preparation, making this approach suitable for simple field-portable MS instrumentation and pattern recognition data analysis. Contact Barbara Drolet, telephone 307-766-3651, email barbara.drolet@ars.usda.gov

Efficacy of Layer Treatment with Methoprene for Control of *Rhyzopertha dominica* (Coleoptera: Bostrychidae) on Wheat, Rice, and Maize

Authors: C.G. Athanassiou, F.H. Arthur, J.E. Throne

Submitted to: Pest Management Science

Lesser grain borers are serious pests of stored grains throughout the world, but they have developed resistance to many of the insecticides used for their control. Thus, alternative control technologies are required. Insect growth regulators are a type of insecticide that interfere with insect development, but they have low mammalian toxicity. We evaluated the effectiveness of the insect growth regulator methoprene for control of lesser grain borers in wheat, rice, and corn to determine whether treating just a layer on the top of the grain mass, rather than the whole grain mass, would provide effective control. In wheat and rice, the layer treatments were not as effective as whole-grain treatment, but there were fewer progeny produced as the application rate of methoprene increased. However, on corn the partial treatments were as effective as the whole-grain treatment. Our results suggest that partial layer treatments with methoprene can be used to control lesser grain borers on corn, but may not be effective for control of this species on wheat and rice.

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Automated Sorting of Glabrous Versus Pubescent Annual Canarygrass Seeds

Authors: T. C. Pearson, D. Knievel, P. Hucl

Submitted to: Applied Engineering in Agriculture

Some seeds, such as barley and canary seed have small silica "hairs" attached to their hull which is an irritant while handling the seed and is a known carcinogen on some seeds. Mutants of some seeds do not have these hairs so it is desirable for breeding programs to have a way to select "hairless" seeds so they can be propagated again. The hairless trait is hereditary. We describe a low-cost automated system to detect canary seed for the hairless trait and remove them from the bulk sample. This will help breeders develop seeds that have fewer of the irritating and sometimes unhealthy silica hairs.

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