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Penn State DNA Sequencing Project Named Top Priority

UNIVERSITY PARK, Pa. – A Penn State project on Asian longhorned beetles was recently designated as a top priority for genome sequencing at the U.S. Department of Energy's Joint Genome Institute.

The project aims to sequence the genomes of microbes that live in the gut of the Asian longhorned beetle. The goal is to explore microbiological approaches to developing new sources of energy.

Asian longhorned beetles are a serious invasive species that kills hardwood trees such as maple, box elder, horsechestnut, elm, and poplar. Invasive species are organisms that adapt quickly to a new environment, reproduce and spread rapidly into new locations, often displacing the organisms that were originally there. According to Ed Rajotte, Pennsylvania IPM Program coordinator at Penn State, the United States is under constant threat of new invasive species entering the country. "These invasive species can be pests and may cause disruption and losses to agriculture, forestry and other parts of the economy, with losses totaling in the billions of dollars," he explains.

According to Kelli Hoover, associate professor of entomology at Penn State, the Asian longhorned beetle was introduced into the United States from wood pallets and other wood packing material accompanying cargo shipments from Asia. "They were first discovered in 1996 on several hardwood trees in Brooklyn, New York. The beetles quickly spread to Long Island, Queens, and Manhattan. Currently, quarantine and control strategies are in place in New York, Illinois, and New Jersey to help eradicate this serious pest."

Adults are easy to spot. "About one to 1 1/2 inches long, Asian longhorned beetles have long antennae and are shiny black with white markings," Hoover says. "After mating, adult females chew depressions into the bark of trees where they lay their eggs. Once the eggs hatch, small white larvae bore their way through the bark into the tree, feeding deeper into the tree's heartwood forming tunnels, or galleries, in the trunk and branches. This damage weakens the integrity of the tree and will eventually kill it if the infestation is severe enough."

Hoover says that over the course of a year, a larva will mature and then pupate near the surface, under the bark. From the pupa, an adult beetle emerges, chewing its way out of the tree and forming characteristic round holes approximately 3/8 of an inch in diameter. "Many holes will appear on a heavily infested tree, usually accompanied by sawdust and sap oozing from the holes. The beetles emerge from June through October with adults flying in search of mates and new egg-laying sites to complete their life cycle."

The Asian longhorned beetle project was submitted by The Schatz Center for Tree Molecular Genetics in the School of Forest Resources at Penn State. The team working on the project

consists of a diverse group of scientists including Hoover, John Carlson, director of the Schatz Center, Ming Tien, professor of biochemistry, Maria Jimenez-Gasco, assistant professor of plant pathology, and Scott Geib, graduate student in entomology. The project was chosen for potential sequencing because it addresses the department of energy's mission needs in biofuels production.

According to Hoover, Asian longhorned beetles contain a diverse set of enzymes, which in combination are able to degrade woody biomass to simple sugars that may be useful in biofuel production. "In contrast to other wood-boring beetles, Asian longhorned beetles feed on healthy trees in addition to decaying trees, and presumably contain lignin-degrading fungi internally, rather than ingesting the fungi present in decaying wood," she explains. "The sequence information will likely reveal a variety of enzymes in the beetles capable of degrading cellulose, hemicellulose and lignin. In addition to biofuels, the enzymes might also be used in bioremediation, textiles and food production."

The Schatz Center for Tree Molecular Genetics was founded in 1998. Through endowments for a Professorship in tree genetics, a post-doctoral fellowship, visiting scholar support, undergraduate awards, colloquia, and library collections, the Schatz Center provides funding for research and education in forest genetics and related technologies at the University Park and Mont Alto campuses of Penn State. For more information on the center and their current projects, visit their Web site at <http://schatz.cas.psu.edu/>.

Established in 1963, Penn State's Department of Entomology has grown into a well-balanced department providing undergraduate education, graduate student training and extension outreach education focusing on both domestic and international issues. Twenty faculty and more than thirty graduate students work on a variety of research topics providing insights into insect ecology, behavior and molecular biology as well as integrated pest management. The department is part of Penn State's College of Agricultural Sciences. For more information about solving insect problems, descriptions of research and education programs or admission to the graduate program, visit Web site at <http://www.ento.psu.edu/> or contact the department at (814) 865-1895.

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