

***AILANTHUS*, TREE-OF-HEAVEN UPDATE, A NORTHEAST REGIONAL BIOLOGICAL CONTROL PROJECT**

**Scott M. Salom¹, Loke T. Kok¹, Nathan Herrick¹, Tom McAvoy¹, Donald Davis²,
Mark Schall², Matt Kasson², Du Yu-Zhou³, Ji Hailong³, He Xiao³, Richard Reardon⁴**

¹Virginia Tech, Blacksburg, VA 24061

²Pennsylvania State University, University Park, PA 16802

³Yangzhou University, Yangzhou 225009 Jiangsu, P.R. China

⁴USDA Forest Service, Morgantown, WV 26505

ABSTRACT

The tree-of-heaven (TOH), *Ailanthus altissima* (Mill.) Swingle (Sapindales: Simaroubaceae), is an invasive weed tree distributed throughout most of the continental United States. It is a hardy pioneer species that colonizes disturbed sites, such as road medians, rights-of-way, and forest settings. It produces allelopathic chemicals, millions of seeds, and sprouts back when cut, making it an extraordinarily good competitor, resulting in the displacement of native plant species. Herbicide treatments can provide short-term relief, but are expensive and nonsustainable. In 2002, Ding Jianqing, Biological Control Institute of China, identified two weevil herbivores from China as potential biological control agents for TOH. They are the closely related *Euchryptorrhynchus brandti* (Harold) and *E. chinensis* (Olivier) (Coleoptera: Curculionidae). Both species develop under the bark of the main stem of the tree and are considered tree killers and major pests of TOH in China. Additionally, both species are not known to feed on other plants in their native habitat. Due to this recommendation, Virginia Tech began importing both weevil species to their Beneficial Insect Quarantine Laboratory in 2004 to initiate quarantine studies of both species. *E. brandti*, the smaller of the two species, has been easier to maintain and study and has been the subject of most of our testing. Since its arrival, we have studied the insect's biology, developed laboratory-based rearing procedures, and carried out the full suite of host-range studies. All studies are nearing completion and we hope to petition USDA APHIS for release of this insect in 2010.

In an effort to learn more about *E. brandti* in its native habitat, we initiated a new study in 2008 that examined the life cycle of the weevil at TOH sites in eastern China (Shandong Province). More specifically, we examined seasonal activity, feeding and oviposition behavior, and colonization of trees as a function of tree health. After 1 year of sampling, we found that *E. brandti* often co-occur with *E. chinensis* on the lower boles of trees. They were commonly found mating and active on trees throughout the spring, summer, and fall, and were rarely found in the canopy and/or on foliage. Oviposition could only be sampled by cutting bark sections off the tree. It was found that eggs were present in the phloem tissue from spring to fall, and in most cases, development on any single tree never went beyond the first instar. Emergence was observed only from trees that were dead. Our hypothesis is that their development cannot be completed in healthy trees, only weakened, dying trees. We were not able to observe trees in decline, therefore more work is planned in 2009 to try to better understand this relationship between the herbivore and its host.

In south-central Pennsylvania, TOH invaded an oak-dominated forest that had been logged and left with large openings. In 2000, the TOH within the stand started to show signs of wilting. Fungi isolated from these trees included *Verticillium albo-atrum* and *V. dahlia*. Pathogenicity tests showed that *V. albo-atrum* was capable of killing inoculated seedlings in the lab and inoculated trees in the field. The spread of the

pathogen was tracked annually, and by 2007, 7,000 trees were dead. Preliminary host-range testing shows that northern red oak, chestnut oak, red maple, sugar maple, yellow-poplar, and white ash are not susceptible to the pathogen. However, striped maple does show some signs of susceptibility.

Future work in biological control will consider testing whether *E. brandti* can serve as a vector for the pathogen and enhance its spread. The insect attacks and feeds on live trees in the lower boles. In a preliminary test in the lab, weevils emerging from TOH bolts infected with the fungus did carry the pathogen. Studies are underway to determine the extent to which *E. brandti* and *V. albo-atrum* can be used together as biological control agents for TOH.