Potential Biological Control of Invasive Tree-of-Heaven
(*Ailanthus altissima*)

D. D. Davis and M. T. Kasson

Department of Plant Pathology, Penn State University, University Park, PA 16802, USA
(ddd2@psu.edu)

Abstract

The highly invasive tree-of-heaven, *Ailanthus altissima* (Mill.) Swingle, was introduced into Pennsylvania (PA), USA, in 1784 and has since spread across PA and most of the USA. Wherever it is found, *Ailanthus* often dominates a site at the expense of native plant species. However, in 2002-2003, we discovered several stands of dead and dying *Ailanthus* trees within oak-dominated, mixed-hardwood forests in south-central PA. Isolations from symptomatic *Ailanthus* seedlings, root sprouts, saplings, and canopy trees in the field consistently yielded the naturally occurring, soil-borne, wilt fungus *Verticillium albo-atrum* Reinke & Berthold. Identification was based on morphological characteristics, and confirmed using molecular techniques. Potted *Ailanthus* seedlings in the greenhouse and canopy *Ailanthus* trees in the field were inoculated with a randomly selected isolate of *V. albo-atrum*. Classic wilt symptoms quickly developed on inoculated plants, from which *V. albo-atrum* was recovered, fulfilling Koch’s Postulates and illustrating that *V. albo-atrum* was highly virulent on *Ailanthus*. As of 2011, *V. albo-atrum* has killed thousands of canopy *Ailanthus* trees in south-central PA. Intermingled non-*Ailanthus* trees and understory shrubs have been generally unharmed. We hypothesize that a naturally occurring strain of *V. albo-atrum* has become host-adapted to *Ailanthus*. As part of risk assessment, we inoculated more than 80 non-*Ailanthus* species (potted seedlings in the greenhouse, as well as trees in the field) with a randomly selected strain of *V. albo-atrum*. Inoculated non-*Ailanthus* species were generally unharmed, again indicating that a pathogenic strain of *V. albo-atrum* may have become host-adapted to *Ailanthus*. In addition, past forest management practices in the area (e.g., clear-cutting large blocks of oaks killed by insect infestations) favored development of dense, nearly monoculture stands of clonal *Ailanthus*, which in turn. Short-range dissemination of *V. albo-atrum* within infected stands of *Ailanthus* likely occurs *via* intraspecific root grafts between diseased and healthy trees within these dense stands. Long-range dissemination of *V. albo-atrum* may be facilitated by *Euwallacea validus* (Eichhoff), an introduced ambrosia beetle that is epidemic on *Ailanthus* trees under stress from *V. albo-atrum* infections.