

PlantHealth

Thousand Cankers Disease: An Unusual Paradigm

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Within the past five years there has been dawning awareness of a serious threat to the future of black walnut (*Juglans nigra*)—thousand cankers disease (TCD). Although not recognized and described until 2008, this disease has been devastating walnuts in many Western states for a decade or more and continues to spread. In July 2010, thousand cankers was also found to be established and killing trees in a pocket around Knoxville, Tenn. This latest finding is the first found within the native range of black walnut.

Thousand cankers disease is caused by the combined action of two organisms—the walnut twig beetle (*Pityophthorus juglandis*) and a fungus (*Geosmithia morbida*). The walnut twig beetle is a minute bark beetle (1.5 to 1.9 mm) that develops under the bark. It appears to be invariably associated with the fungus that is introduced into trees, with the wounding made by the beetle vector.

Although damage is produced by

the tunneling of the developing walnut twig beetle larvae, the disease is largely related to the effects of the colonizing fungus. In susceptible hosts (for example, *J. nigra*) it grows readily around the galleries of the walnut twig beetle, producing an extensive dead area (canker) in the cambium about the size of a quarter. New cankers result when new beetles tunnel to produce egg galleries, and eventually limbs become massively compromised. In TCD end stages, cankers may coalesce to kill extensive areas of the cambium, at which point external symptoms begin to appear.



The walnut twig beetle acts in concert with a fungus, *Geosmithia morbida*, to threaten walnut species with thousand cankers disease.

PHOTO BY WHITNEY CRANSHAW

Thousand cankers disease is caused by the combined action of two organisms—the walnut twig beetle (*Pityophthorus juglandis*) and a fungus (*Geosmithia morbida*).

Crown thinning, foliage flagging and dieback of individual limbs are often the first symptoms of TCD infection. Once such symptoms are present, trees are typically in advanced stages of the disease and likely will die within two to three years.

An unusual paradigm

There are several aspects of thousand cankers that differ from other tree disorders. For one, TCD is produced by the combined activity of two organisms; alone, neither the walnut twig beetle nor *Geosmithia morbida* can cause tree death. However, both appear to be invariably associated, and the detection of either species is used to confirm the presence of thousand cankers.

Thousand cankers is also a relatively slow disease to develop. It results from the cumulative effects of multiple cankers (and multiple points of beetle tunneling), each confined to a limited area of the cambium. The fungus does not grow systemically in the plant, as do some other diseases produced by beetle-vectored fungi (such as Dutch elm disease).

Furthermore, the emergence of this disease within black walnut is due to a spread in distribution of the beetle and fungus within the continental U.S. The walnut twig beetle, and apparently *G. morbida*, are native species originally associated with Arizona walnut (*J. major*) and, perhaps, southern California walnut (*J. californica*). These plants grow in the southwestern U.S. and northern Mexico and appear to largely resist TCD. The walnut twig beetle and *G. morbida* are present, but their effects are very limited and typically appear associated only with damaged or overshadowed limbs. However, human plantings of *J. nigra* in the western U.S. placed a susceptible host in the path of the walnut twig beetle. The ultimate spread of walnut twig beetle throughout the western U.S., and into Tennessee, was undoubtedly assisted by human movement of infested walnut wood.

Thousand cankers and *Juglans* resistance

There are many factors that can affect TCD severity and progression of the



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disease. Perhaps most important are differences in relative susceptibility of different host species. This is a subject that is still incompletely understood, but it is clear that a wide range in susceptibility exists among *Juglans* species.

Most susceptible is black walnut, a key species that sustains the North American hardwood industry. There has also been considerable recent mortality among Northern California walnut (*J. hindsii*).

English (or Persian) walnut (*J. regia*) appears to have fairly good TCD-resistance, although it is not immune. There is also high resistance in Arizona walnut and, probably, southern California walnut. Data are lacking for butternut (*J. cinerea*) and, interestingly, walnut twig beetle has yet to be found in native stands of little walnut (*J. microcarpa*), which intergrade in distribution with Arizona walnut in New Mexico and Texas.

Host plant vigor may affect the rate of disease progression. Although there is no evidence that vigorously growing black walnut is resistant to attack by walnut twig beetle, TCD appears to be a disease of energy depletion, which results from the disruptive effects of cankers. Therefore, highly vigorous trees with good energy stores can be expected to survive longer after being colonized by infective walnut twig beetles.



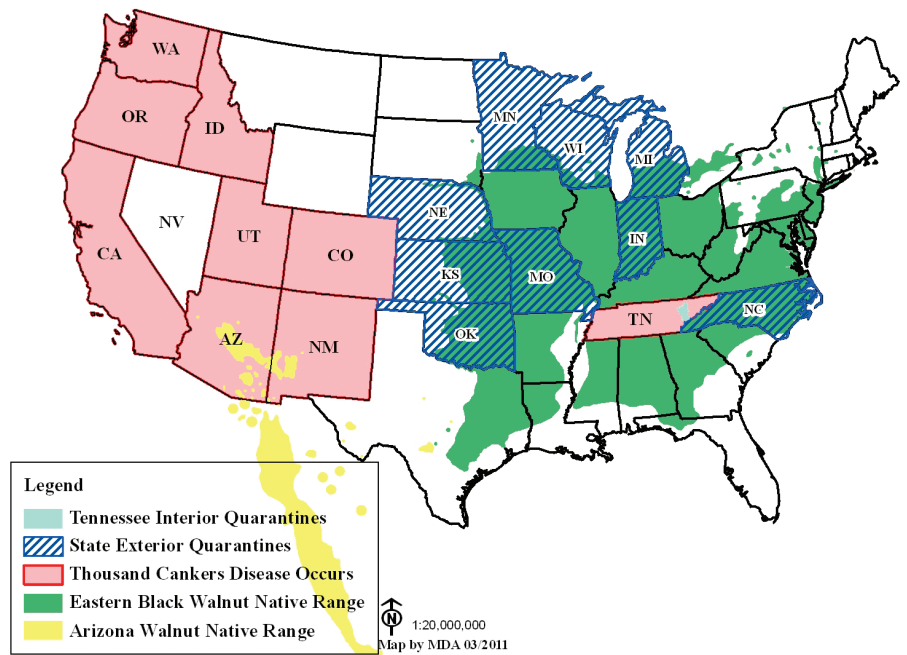
Damage is produced by the tunneling of the developing walnut twig beetle larvae, although TCD is largely related to the effects of the colonizing fungus.

PHOTO BY WHITNEY CRANSHAW

Finally, TCD will progress in large part due to the rate of new infection points initiated by infective beetles. In TCD-affected communities, enormous numbers of beetles emerge from dying trees and cut logs, posing serious threat to remaining trees and accelerating tree loss. Sanitation practices that limit sources of TCD inoculum (*Geosmithia*-infective walnut twig beetles) is a central practice in slowing the spread of this disease.

Effects on the nursery industry

It is hard to overstate the threat that thousand cankers has on the future of susceptible *Juglans*, particularly *J. nigra*.



Thousand cankers disease has been reported in western and southwestern United States and in Tennessee. As the disease spreads eastward, it threatens eastern black walnut (*Juglans nigra*) in its native range, which covers all or parts of over 30 states.

At present, there are no controls identified that have high promise for managing the disease once it has become established in a new area. Although the development of the disease is considerably slower than for some other disorders (many years; perhaps a couple of decades), the presence of thousand cankers at a new site is very likely a sentence of premature death for all susceptible hosts in the area.

Therefore, it is extremely important that every effort be made to slow the spread of thousand cankers and, particularly, to prevent its human-assisted movement to new areas. To this end, there must be restricted traffic of all walnut wood material that can potentially harbor live *Geosmithia*-infective walnut twig beetles. Milled wood with bark intact, logs and firewood are all very high-risk material for TCD spread.

In recent years several states (Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska and North Carolina) have established quarantines that prevent the movement of potentially infested walnut material from any region where TCD is known to occur. Although USDA-APHIS (Animal and Plant Health Inspection Service) has declined to coordinate a national response to this threat, individual state efforts are expanding. These quarantines, and increasing public awareness of the need to contain thousand cankers, are currently the main means to fight TCD.

The American nursery industry will also feel some effects of this new problem. At present, quarantines apply to all live material as well as wood products, so *Juglans*-material sales originating from infested states are restricted. Also, susceptible *Juglans* as a plant material is now “off-the-table” as a suitable choice in areas where TCD is present. Perhaps, in the future, resistant cultivars will be identified and developed, but TCD resistance is not currently known to occur in *J. nigra*.

For more information ...

The Thousand Cankers Web site, based at Colorado State University, provides many materials that can be used to learn more about this problem, including an illustrated pest alert, diagnostic guidelines, and a “questions and answers” sheet. It is located within the Department of Bioagricultural Sciences and Pest Management at: www.colostate.edu/Depts/bspm/extension%20and%20outreach/thousand%20cankers.html.

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