THOUSAND CANKER DISEASE

Pityophthorus juglandis and fungus Geosmithia morbida

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- Since 2010, thousand cankers disease has been found in 6 eastern states in the native range of black walnut: Tennessee, Virginia, Pennsylvania, North Carolina, Ohio, and Maryland.
- The known distribution of thousand cankers disease changes from year to year. Please consult the maps at http://thousandcankers.com/ for the most current information.
- In summer 2014, the fungus that causes thousand cankers disease was discovered in a walnut plantation in Indiana. The pathogen was found associated with an apparently native weevil, *Stenomimus pallidus*, rather than the beetle that usually transports or vectors the pathogen. Scientists are uncertain whether the weevil can spread the fungus sufficiently well to cause disease in walnut trees.
- The Pennsylvania infestation now is found in 6 counties: Lancaster joins Bucks, Chester, Delaware, Lancaster, Montgomery and Philadelphia.
- See the map for information on the states affected and which states have adopted quarantines on the movement of walnut trees (nursery stock) and wood.
- Thousand cankers disease is caused by a previously undescribed fungus that is transported by a twig beetle native to Mexico, parts of Arizona and New Mexico, and possibly California. The disease was recognized by science in 2008, but it had been present in parts of the West since the 1990s.
- In the West, thousand cankers disease has caused widespread mortality in eastern black walnut trees planted in urban areas; and in northern and southern California black walnuts.

Black walnut (*Juglans nigra*) is native to much of the eastern deciduous forest. It produces wood prized for woodworking and furniture-making. Its nuts provide valuable hard mast for wildlife as well as nuts for human consumption and several industrial uses.

In recent years, a disease complex has killed many black walnuts planted outside the species' natural range, in urban areas of the Rocky Mountain and Pacific states. The disease is caused by a previously unknown fungus *Geosmithia morbida* that is carried from tree to tree by a walnut twig beetle (*Pityophthorus juglandis*) (Tisserat 2009). This beetle is native to the Southwestern United States and neighboring Mexico, where it feeds on twigs of Arizona walnut (*J. major*). The origin of the fungus is unknown. The fungus is associated with the beetle in Arizona and other places (Tisserat 2009; Cranshaw 2009). However, its association with a native weevil in Indiana (Indiana DNR 2014) raises the possibility that the fungus might be established more widely in the East than previously thought.

The disease kills black walnut trees slowly – perhaps 10 years after the initial attack. Small cankers form at the site of each beetle attack; the damage is caused by the cumulative effect of thousands of such cankers which develop around the individual sites of beetle attack. Insects reach such numbers that the numerous small cankers eventually coalesce and cut off the flow of nutrients (Tisserat 2009). While death is slow, symptoms appear only at late stages – when it is already too late to save either that tree or nearby trees (Cranshaw 2009).

J. nigra is much more susceptible than other species in the genus tested so far (Tisserat 2009). As to butternut (*J. cinera*), the *Geosmithia* fungus has caused canker formation following artificial inoculations, but not of the same magnitude as those on black walnut. It isn't known whether butternut is a host of the walnut twig beetle (Tisserat pers. comm. February 2010).

The beetle is widespread in California, where it has been present since at least the 1950s (Seybold 2009). Two walnuts native to California – Northern and Southern California black walnut (*J. hindsii* and *J. californica*) – are also being killed, especially the southern species (Seybold 2009). The beetle is present in most western states.

Black walnut has significant economic value.

Although most walnuts sold in the U.S. for human consumption are from orchards of English or Persian walnuts (*J. regia*), there is a thriving niche market for native black walnuts centered on Missouri. Hammons Products Company processes 25-30 million pounds of walnuts every year; these walnuts are collected in Missouri and 14 other states. Hammons produces 1.5 – 2 million pounds of nutmeat for food and 15-20 million pounds of shells for industrial uses such as polishing metal, cleaning oil drilling equipment, even as skin cleansers (Hammons 2009). In Missouri, the nuts alone have a net present value of $220 million (Van Sambeek 2009). Processing the nuts provides 80 – 120 jobs at the Hammons plant; thousands of others across the species' range earn extra income by collecting the nuts (Hammons 2009).

Black walnut's greatest economic value comes from the wood. Top grade walnut (an estimated 12% of supplies) is used for millwork and veneer; it is also exported. Medium grade wood is used in furniture, cabinetry, flooring, and other manufactured items; this makes up an estimated 50% of the wood harvested. Lower grade walnut is used as sleepers (railroad ties), mine timbers, pallet parts and flooring. This is an estimated 38% of the total walnut wood (USDA APHIS 2009).

Considering the tree's entire native range, net volume of black walnut growing stock on timber land in 2002 was estimated at more than 3.4 billion cubic feet with a value greater than $500 billion (USDA APHIS 2009).

If Missouri walnuts succumb to the disease over a 20 year period, the net present value of the lost wood would be $225 million (not accounting for the growth that would normally continue during a 20-year period). The value of the nuts adds another $220 million. The cost of removing and replacing 40,000 urban trees would be $56 million. Also calculated were the wages of 210 timber jobs and 600 nut-related jobs cycling through the economy. Thus, the total net present value is $500 million in Missouri alone. Included in this calculation are (Van Sambeek (2009). In Indiana, officials calculated the timber value of the state's walnut growing stock at $1.7 billion (Indiana DNR).

It is extremely difficult to detect the tiny beetle. Scientists have developed a trap and lure that can help with detection, but it is effective only across short distances.

The principle pathway by which the beetle could spread through the eastern forests would be movement of wood in various forms. Even small logs can harbor huge numbers of beetles; one study found 23,040 beetles in 2 logs 18 inches long by 5 ½ inches in diameter (Cranshaw 2009). The beetles apparently can survive for a significant period in such logs – studies are under way to determine how long (Cranshaw 2009; Tisserat 2009).

According to data collected by USDA APHIS (Pfister 2009), walnut could be moved as veneer logs, sawlogs, burls, stumps, even firewood. Sawmills usually obtain their wood from less than 300 miles away.

Burls and graft unions from older orchard trees (called "claro walnut") have interesting patterns – this wood has been shipped long distances to veneer mills and individual woodworkers. There is great concern about individuals either selling wood from trees that died or sending wood pieces to friends who are woodworkers (Alexander 2009; Cranshaw 2009). A search of eBay in November 2009 turned up approximately 500 listings of walnut lumber, logs, or blanks for woodturning and carving. While most were from states in the species' natural range, some were from Oregon, where the disease is present (Volkman pers. comm. February 2010). The author's search of the "Woodfinders" website in late November 2009 turned up 26 suppliers of "claro walnut", including six from California, four from Oregon, and one from Colorado – all states where the disease is present.

There is the potential that thousand cankers disease could be spread through movement of wood packaging (crates and pallets) – especially packing from Mexico but possibly also from western American states (Pfister 2009). While wood packaging from Mexico is required to be treated (Pfister 2009), a significant proportion of wood packaging from Mexico does not comply with the international standard (Haack *et al*. 2014). At present, no regulation requires any treatment of wood packaging moving inside the United States.

Scientists have been studying various treatments for logs so that they would be safe to move. Debarking the log does not eliminate the pathogen because it can survive temporarily on the sapwood surface of a freshly debarked log, and it is almost impossible to remove all the bark. However, both the beetle and fungus are almost certainly killed by heat treatment that heats the outer sapwood to at least 56°C for 40 minutes (Mayfield *et al*. 2014). Heating large logs intended for processing into veneer or boards to this temperature before they are moved out of the harvest area should help prevent spread of thousand cankers disease.

Black walnut makes good firewood, and smaller logs or pieces are often so used (Pfister 2009; Pscheidt 2009). In 2009, APHIS began working with the firewood industry and the states to develop a national strategy for managing the risks from multiple pests to many native trees associated with firewood movement. In the National Firewood Task Force report, issued in 2010, APHIS called for an industry certification program. As of August 2014, neither the agency nor the industry has put the promised actions into effect.

In the absence of a broad firewood management program, black walnut firewood from the eastern United States (but not the West) can be managed by utilizing the existing federal and state standards for firewood made from ash. Ash trees across a wide area from the Atlantic coast to the Great Plains are infested by the emerald ash borer [LINK to Gallery page], so a federal quarantine and state regulations are in place. In fact, many states apply the same restrictions to all hardwood firewood because officials have difficulty distinguishing tree species based on the wood alone. Furthermore, walnut often grows in association with white and green ash (*Fraxinus americana* and *F. pennsylvanica*), and it is likely that walnut could be comingled with ash in any loads of firewood obtained in the eastern United States. The scientists note that it is easier to regulate firewood under a single firewood heat treatment standard. Therefore, they recommend applying to firewood made from walnut coming from areas affected by thousand cankers disease the same heat treatment as is already required for ash from emerald ash borer infested areas: heating the wood to 60C at the wood center for 60 minutes (Mayfield *et al*. 2014).

USFS scientists and managers developed a conservation priority-setting framework for forest tree species at risk from pest & pathogens and other threats. The Project CAPTURE (Conservation Assessment and Prioritization of Forest Trees Under Risk of Extirpation) uses FIA data and expert opinion to group tree species under threat by non-native pests into vulnerability classes and specify appropriate management and conservation strategies. The scientists prioritized 419 tree species native to the North American continent. The analysis identified 15 taxonomic groups requiring the most immediate conservation intervention because of the tree species' exposure to an extrinsic threat, their sensitivity to the threat, and their ability to adapt to it. Each of these 15 most vulnerable species, and several additional species, should be the focus

of both a comprehensive gene conservation program and a genetic resistance screening and development effort. Thousand cankers disease is not known to be a threat to any of these 15 most vulnerable species.

For more information on this pest-fungal complex, please visit:

- Thousandcankers.com

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