

## Questions and Answers about Thousand Cankers Disease of Walnut

**What is Thousand Cankers disease of walnut?** This is a newly recognized disease (2008) of certain walnut species (*Juglans*) caused by a fungus (*Geosmithia* sp.) that is vectored by a bark beetle (walnut twig beetle). Thousand Cankers disease has produced widespread death of walnuts in many western states during the past decade.

**What are symptoms of the disease?** A recently identified *Geosmithia* fungus kills an area of bark in the twigs and branches where it is introduced when the walnut twig beetle tunnels into the limb. These dead areas are called cankers and numerous cankers are formed when the walnut twig beetles are abundant. These cankers coalesce to girdle twigs and branches, restricting movement of water and nutrients.

Early symptoms are yellowing of leaves and foliage thinning of the upper crown of the tree. As the disease progresses larger limbs are killed which may have dead, flagging leaves associated with them. In end stages the fungus may be introduced into the trunk and large cankered areas develop in the trunk. Usually a tree dies within three years after initial symptoms are observed in the crown of the tree.

**What is the insect vector?** The walnut twig beetle, *Pityophthorus juglandis* (Blackman), is the only insect presently known to transmit the fungus from tree to tree. Investigations are currently underway to see if other species that tunnel into walnut (e.g., various borers, ambrosia beetles) may also be incidental vectors.

The walnut twig beetle is a native species to North America. It was first described in 1928 from southern New Mexico, where the presumed host was Arizona walnut (*Juglans major*). Prior to 1992 it was reported from Arizona, New Mexico, and northern Mexico (Chihuahua) where Arizona walnut grows. Also, there were two 1959 California reports of the beetle from walnut collected in Los Angeles County. The latter may indicate that the insect also was native to southern California, or may have been early introductions.

**What is the fungus?** The *Geosmithia* species of fungus identified in 2008 is a previously undescribed species. It is invariably associated with cankers in walnut and is recovered from cankers in Arizona walnut. It is also regularly recovered from the walnut twig beetle.

Research into the genetics and biology of this fungus are underway or proposed. However, the limited data collected so far indicate the fungus has the genetic diversity that would be expected from a long established species, rather than a recent introduction.

**Are other fungi involved?** A strain of *Fusarium solani* has been found in the large trunk cankers that develop during the end stage of Thousand Cankers disease. The importance of this fungus in the epidemiology of the disease is still in study.

**What species of trees are susceptible to this disease?** This disease was first recognized on black walnut (*Juglans nigra*) and this species is highly susceptible. Arizona walnut (*Juglans major*) apparently is quite resistant.

Evaluating other species is a major focus of 2009 research. Tentatively it appears that northern California walnut (*Juglans hindsii*) and southern California walnut (*Juglans californica*) are moderately susceptible as die-offs of these trees from Thousand Cankers disease have recently been observed. The commercial nut-producing English walnut (*Juglans regia*) appears to have fairly high resistance. Pecan (*Carya*) also appears to be resistant.

**Can trees survive this disease?** Thousand Cankers kills trees from the cumulative effects of numerous coalescing cankers that develop around individual entry wounds made by walnut twig beetles. Although the fungus does grow within the tree, the area infected is limited; it *does not* move systemically in the plant as do some other insect vectored fungi such as the species involved in Dutch elm disease (*Ophiostoma novo-ulmi*).

Presumably methods that can prevent tunneling by walnut twig beetles can prevent further spread of this disease. To date, effective techniques to control the walnut twig beetle have not been identified.

**Where does Thousand Cankers presently occur?** Die-offs of walnuts suspected or confirmed to have been produced by this insect/fungal complex have been recorded from northern New Mexico, Colorado, Utah, Idaho, Oregon, California and Washington. All of these sites also now report the presence of the walnut twig beetle, indicating a broad range extension of this insect within the past decade or so.

It is hoped that the eastern edge of this disease is along the Front Range of Colorado, where it has caused widespread death of black walnut in the last five years in communities that include Boulder, Colorado Springs and several towns in the western Metro Denver area. Mapping the range of thousand cankers disease, particularly along its eastern “frontier”, is a major focus of 2009 research.

If you wish to report the location of any *Juglans* in eastern Colorado you may contact the survey team by email: [CAS\\_WalnutSurvey@Colostate.EDU](mailto:CAS_WalnutSurvey@Colostate.EDU).

**Does this disease concern walnut grown outside the western states?** *Absolutely.* Thousand cankers is presently having devastating effects on black walnut and some other *Juglans* in most western states. However, in most areas these involve the widely dispersed plantings made by humans. Most areas where damage by thousand cankers disease has occurred are sites where *Juglans* is not native. Parts of California are an exception, where native *Juglans* species (*J. hindsii*, *J. californica*) appear to be involved in the present outbreak.

This serious situation could become catastrophic if infective walnut twig beetles were allowed to colonize areas where black walnut grows as a native tree. Based on the patterns seen in the West, such a colonization could very possibly develop into an uncontrollable outbreak. This may ultimately have the potential to destroy black walnut in its native range in a manner previously demonstrated by introduced species such the emerald ash borer (affecting NA *Fraxinus* spp.) and pathogens that produce Dutch elm disease (affecting American elm) and chestnut blight (affecting American chestnut).

**Where did this disease come from?** The origin of the disease is currently in debate and further research will be needed to better develop hypotheses on this subject.

One theory suggests that the disease resulted from a transfer of the walnut twig beetle and its associated *Geosmithia* fungus from Arizona walnut into new species of *Juglans* that were planted across the western states. It is known that both the beetle and the fungus occur in Arizona walnut and in this species they do negligible damage. Somehow infective beetles dispersed throughout much of the western US during the past 20-25 years or so and found susceptible black walnut and other *Juglans* that have been planted by humans within the past century.

How such dispersal occurred may have been through a natural dispersal event or by human transfer. Regardless, once established there would have been a lag time for the beetle populations to build so that the disease became evident. The earliest known suspected cluster of black walnut die-off from this disease is thought to have occurred in Utah and western Colorado in the early to mid-1990s. Often, early black walnut die-offs associated with this disease appear to have been diagnosed as being drought related or of unknown cause.

Alternately this disease could have originated from a wholly new pathogen or one that was recently introduced into North America. Studies of the genetics of the *Geosmithia* sp. and its present distribution in native and introduced host *Juglans* should provide information that will resolve this question. Present information on the genetics of fungal strains collected across the western US indicates that it shows the genetic diversity of an organism that has been present for a long period; there is no evidence of a “genetic bottleneck” that might be expected to occur following an introduction.

**Are there any traps for this insect?** Walnut twig beetle can be trapped in Lindgren funnels and yellow sticky panels. However, there is no evidence that either of these designs is particularly attractive and it is likely that captures in these traps are just incidental. Attempts to increase capture by use of pinyon and walnut wood did not to increase captures in these traps.

Sex pheromones produced by the walnut twig beetle appear to be present, based on observations of beetle behavior by California researchers. These chemicals may be effective attractants. Work is in progress to identify these pheromone and test them in future field studies.

**Does drought have an effect on this disease?** The effects of drought on Thousand Cankers disease is probably minimal and indirect. Well watered and well maintained black walnut appear to be quite susceptible to development of the disease. Drought stress perhaps could have some effect on progression of canker development and twig beetle survival. These have not been documented and are probably of minor importance in the overall epidemiology of this disease. Future studies are needed to better answer this question.

**What is the life cycle of the walnut twig beetle?** Recent observations can provide the broad outlines for the life history of this insect, which previously has received no study because of its negligible importance in native hosts.

The great majority of adult beetles excavate chambers in outer bark of walnut trunks during autumn and overwinter there. (Overwintering tunnels may be concentrated in the south and west sides of the tree.) In late April and early May the beetles emerge and fly to limbs where they initiate tunneling under the bark, creating an egg gallery along which eggs are laid.

Larvae develop in the living cambium tissues, excavating shallow tunnels that branch from the egg gallery. Pupation occurs at the end of the tunnels and adults cut their way out through the bark, producing a minute exit hole.

A generation can be completed in about 6-7 weeks. Two, possibly three, generations will be produced during a growing season. Distinct peaks of adult activity are not very clear and adults can be initiating new attacks over a continuous period throughout most of the season. Adults produced late in the season, in late summer and early fall, move to trunks for overwintering.

**What treatments are available for Thousand Cankers disease?** There are no known means of reliably controlling this disease that have been identified. Some techniques directed at the vector ultimately may prove to be useful and further research will hopefully find something. But it may not. Research studies planned for 2009 may provide some answers within the year.

Control of walnut twig beetle by use of drenching sprays of insecticides (permethrin, bifenthrin) is a technique used successfully against some other bark beetles (e.g., mountain pine beetle, Ips beetles). However, infested black walnut trees that have received repeated insecticide spray treatments by arborists in Colorado are observed to continue to decline and die. This method appears to have only limited effectiveness.

The use of soil applied systemic neonicotinoid insecticides is a possibility for bark beetle control and there has been some use of imidacloprid for this purpose. Anecdotally these treatments seem to have had negligible effectiveness. Trials to look at the value of these treatments in a preventive vs. curative manner and trials that involve evaluation of other neonicotinoid insecticides (e.g., dinotefuran, clothianidin) are planned.

The overwintering habit of this beetle to move into the trunk bark may provide a means to manage populations. This could involve trunk sprays of effective insecticides prior to when beetles enter the trunk. Such targeted treatments of the trunk have been used to help manage some other bark beetles with similar habit (e.g., native elm bark beetle, ash bark beetles). Trials to evaluate this technique are planned for 2009.

Trunk injected fungicides have not been evaluated for managing this disease. Opportunities for such evaluations may become available in the future.

**What should be done to help prevent further damage by Thousand Cankers disease?** It is extremely important that from this point on that no infective walnut twig beetles are ever allowed to move east of the current known range of Thousand Cankers disease. Salvaged trees with bark intact will very likely contain these beetles.

Due to the high value of black walnut for woodworking purposes, the movement of such wood is most likely to occur by wood workers and wood turners; black walnut is rarely used as firewood. Therefore it is very important that woodworkers, mills and companies involved in lumber movement, foresters and arborists understand the serious nature of this threat and never allow movement of infective walnut wood into areas where this disease does not occur.

Walnut logs with bark intact and walnut bark both may be sources of infective beetles. Milled wood without bark and logs without bark that have been dried for three years or more likely will not be a source of risk. However, it is strongly recommended that no untreated walnut logs originating from any state west of Colorado ever moves east of Colorado.

**Where can I get more information on this situation?** A fact sheet on this disease has been developed by Colorado State University and will be regularly updated as new information is learned. It is located on the Colorado State Extension publications web site and can be accessed at: [http://www.ext.colostate.edu/pubs/insect/0812\\_alert.pdf](http://www.ext.colostate.edu/pubs/insect/0812_alert.pdf)

June 6, 2009 draft

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