PEST ALERT

Walnut Twig Beetle and Thousand Cankers Disease of Black Walnut

Within the past decade an unusual decline of black walnut (*Juglans nigra*) has been observed in several western states. Initial symptoms involve a yellowing and thinning of the upper crown, which progresses to include death of progressively larger branches (Figure 1). During the final stages large areas of foliage may rapidly wilt. Trees often are killed within three years after initial symptoms are noted. Tree mortality is the result of attack by the walnut twig beetle (*Pityophthorus juglandis*) and subsequent canker development around beetle galleries caused by a fungal associate (*Geosmithia* sp.) of the beetle (Figure 2). A second fungus (*Fusarium solani*) is also associated with canker formation on the trunk and scaffold branches. The proposed name for this insect-disease complex is *thousand cankers*.

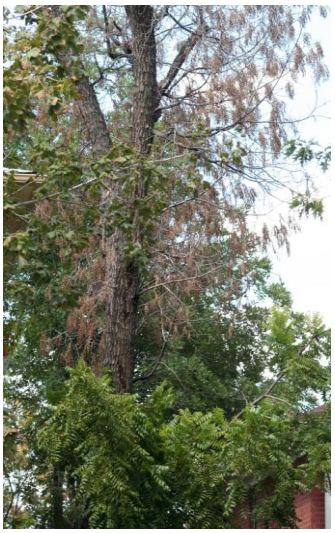

Figure 1. Rapidly wilting black walnut in the final stage of thousand cankers disease.

Figure 2. Coalescing branch cankers produced by *Geosmithia*. Note the whitish sporulation of *Geosmithia* in lower left gallery

Walnut Twig Beetle

Distribution. The walnut twig beetle is native to North America, being originally described in 1928 based on specimens collected in the area of "Lone Mountain", New Mexico (Lincoln County). In the 1992 catalog of Bark and Ambrosia Beetles by Wood and Bright the primary range of the insect was listed to include New Mexico, Arizona, and Chihuahua, Mexico (Figure 3). This range appears to coincide largely with the distribution of Arizona walnut (*J. major*), the likely original native host. In Arizona walnut the insect functions as a "typical" twig beetle, confining its development to overshaded or injured small diameter limbs and functioning as a natural pruning agent.

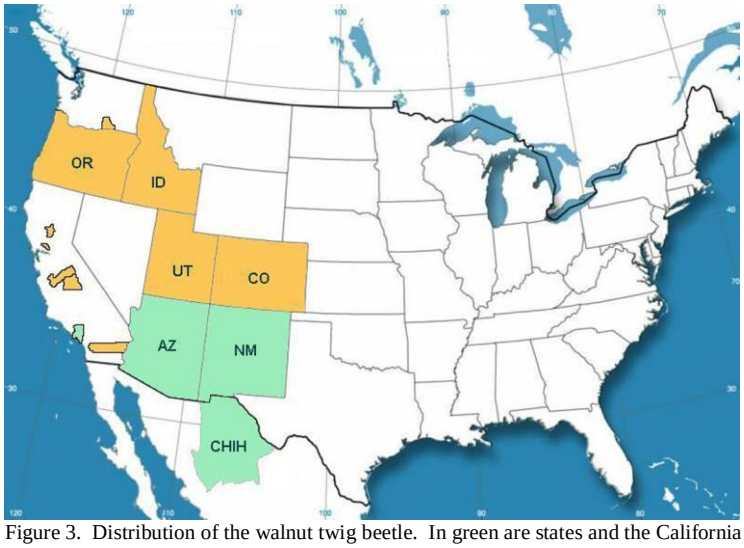

Figure 3. Distribution of the walnut twig beetle. In green are states and the California county of Los Angeles with records of the species prior to 1992. States in orange and additional counties in California and Washington have reported the insect since 1998.

Isolated captures of the walnut twig beetle in California were first recorded in 1959 in Los Angeles County in association with both black walnut and southern California walnut, *J. californica*. Since 2002, it has been recovered extensively in the state and is thought to be established throughout most of southern California and the Central Valley. Northern California walnut, *J. hindsii*, has also been noted to be a suitable host for the beetle.

The first published record of a cluster of black walnut mortality associated with the walnut twig beetle was in the Espanola Valley of northern New Mexico where large numbers of mature black walnut died in 2001. However, this may have been preceded in Utah where undetermined black walnut mortality occurred in the early 1990s along the Wasatch Front; a Utah record of the beetle dates to 1988. Similar widespread decline also occurred about this time in the Boise-Meridian area of Idaho where the twig beetle was first confirmed present in 2003. Black walnut declines have been noted in some Front Range communities in Colorado since 2001 and the twig beetle has been confirmed present in the state since 2004. In those communities where the insect has been detected, the majority of black walnut has since died. *P. juglandis* has been recorded from Oregon (Portland) since 1997, has been commonly captured in funnel traps in The Dalles since 2004, and is suspected of being associated with recent widespread death of *Juglans* spp. in the Willamette Valley of Oregon. Walnut decline associated with the presence of walnut twig beetle were reported from the Prosser area of Washington in 2008.

Prior to these recent reports, walnut twig beetle was not associated with any significant *Juglans* mortality. In most areas where the die-offs of black walnut have occurred, drought was originally suspected as the cause of the decline and death of trees, with the beetle as a secondary pest. The widespread area across which *Juglans* spp. die-off have been recently reported, the documented presence of an associated canker-producing fungal pathogen carried by the twig beetle, and the occurrence of black walnut death in irrigated sites not sustaining drought, all suggest an alternate underlying cause.

Description. The walnut twig beetle *Pityophthorus juglandis* is a minute (1.5-1.9 mm) yellowish-brown bark beetle, about 3X long as it is wide. It is the only *Pityophthorus* species associated with *Juglans* but can be readily distinguished from other members of the genus by several physical features (Figures 4, 5). Among these are 4 to 6 concentric rows of asperities on the prothorax, usually broken and overlapping at the median line. The declivity at the end of the wing covers is steep, very shallowly bisulcate, and at the apex it is generally flattened with small granules.

Figure 4. Walnut twig beetle, side view. *Photograph by Jim LaBonte, Oregon Department of Agriculture*.

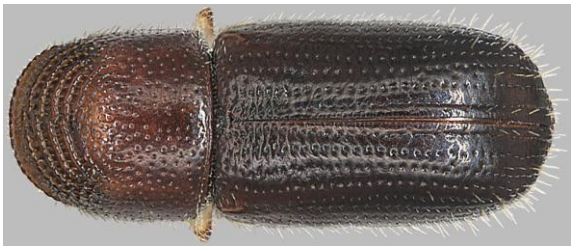

Figure 5. Walnut twig beetle, top view. *Photograph by Jim LaBonte, Oregon Department of Agriculture.*

Life History and Habits. Despite its small size - and pending common name - attacks by adult *P. juglandis* and larval development in black walnut rarely occur in twigs. Instead tunneling is almost always confined to branches greater than 2 cm diameter. Very large branches and even the trunk can be colonized.

Winter is spent primarily, and possibly exclusively, in the adult stage sheltered within cavities excavated in the bark of the trunk. Adults resume activity by late-April and most fly to branches to mate and initiate new tunnels for egg galleries; some may remain in the trunk and expand overwintering tunnels. During tunneling the *Geosmithia* fungus is introduced and subsequently grows in advance of the bark beetle (Figure 6). Larvae feed for 4-6 weeks under the bark in meandering tunnels that run perpendicular to the egg gallery (Figure 7) and pupate at the end of the tunnel.


Figure 6. Walnut twig beetle and associated staining around tunnel.

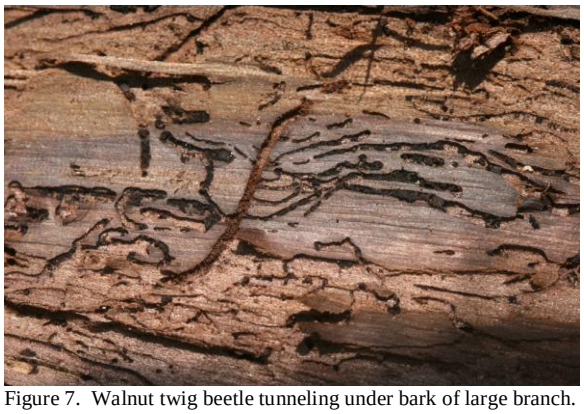
Figure 7. Walnut twig beetle tunneling under bark of large branch.

Adults emerge to produce a second generation. Peak flight activity of adults occurs from mid-July through late August and declines by early fall as the beetles enter hibernation sites. A small number of beetles produced from eggs laid late in the season may not complete development until November.

Cankers

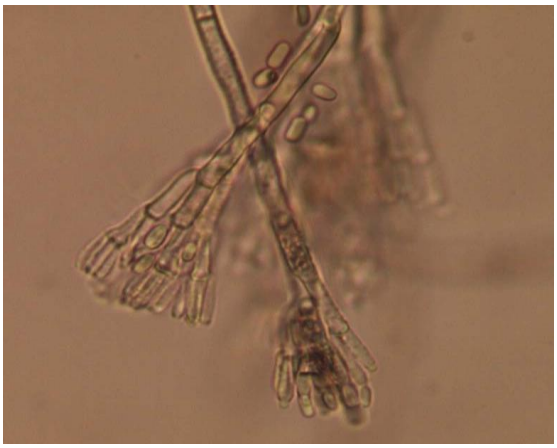
Figure 8. Conidiophores and conidia of *Geosmithia*

Two different types of cankers have been observed on declining walnut trees. Small, diffuse, dark brown to black cankers, caused by an unnamed fungus in the genus *Geosmithia*, initially develop around the tunnels of the walnut twig beetle (Figure 8). The fungus has also been cultured from beetles that emerge from black walnut.

Branch cankers may not visible until the outer bark is shaved to expose the tunnels, although a dark amber stain may form on the bark surface in association with the cankers. Cankers expand rapidly and develop more expansively lengthwise than circumferentially along the stem. On thick barked branches and the trunk, canker may at first be localized in outer bark tissue and extend into the cambium only after extensive bark

discoloration has occurred. Eventually multiple cankers coalesce to produce girdling that results in branch dieback. The number of cankers that are formed on branches and the trunk is enormous; hence the name **thousand cankers** to describe the disease.

There appears to be a range in susceptibility of *Juglans* species to the *Geosmithia* fungus. Black walnut is a very susceptible host, with large cankers developing in response to inoculation. Other species, including Arizona walnut and little walnut (*J. microcarpa*) develop more restricted cankers following artificial inoculation. Evaluation of *Juglans* and related potential nut tree hosts (e.g., *Carya*) for susceptibility to thousand cankers disease will be determined in future studies.

A second canker type may occur on black walnut trees in advanced stages of decline. These diffuse cankers are much larger than branch cankers caused by *Geosmithia* and often exceed two meters in length, extend from the ground into the scaffold branches, and may encompass more than half the circumference of the trunk (Figure 9). Trunk cankers are not readily visible without removal of the outer bark. However, a dark brown to black stain on the bark surface or in bark cracks often indicates the presence of a canker. The inner bark and cambium below the bark surface on the canker face is macerated, water-soaked and stained dark brown to black. Both the walnut twig beetle and *Geosmithia* are found in the macerated bark but a second fungus *Fusarium solani* also has been consistently isolated from canker margins. The importance of *Fusarium solani* in the development of these trunk cankers is still being determined.

Figure 9. Large trunk cankers of black walnut associated with *Fusarium solani*.

Management

Controls for thousand cankers disease have not yet been identified and their development will require better understanding of the biology of the walnut twig beetle and the canker-producing *Geosmithia* fungus. Because of the extended period when adult beetles are active and the extensive areas of the trees that are colonized, foliar insecticide spray applications likely have limited effectiveness. Furthermore, colonization of the bark and cambium by *Geosmithia* may continue even if adult beetles or larvae are killed by the insecticide. The involvement of the fungus also will likely limit the ability of systemic insecticides to effectively move in plants in a manner to kill beetles. Rapid detection and removal of infected trees currently remains the primary means of managing thousand cankers disease. Drenching insecticides applied to the trunk in late summer may also be useful in killing beetles as they seek winter hibernation quarters.

For further information concerning the walnut twig beetle and the thousand cankers disease of walnut, contact Whitney Cranshaw (Whitney.Cranshaw@ColoState.EDU) or Ned Tisserat (Ned.Tisserat@ColoState.EDU), Department of Bioagricultural Sciences and Pest Management, Colorado State University.

Colorado State University