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 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.

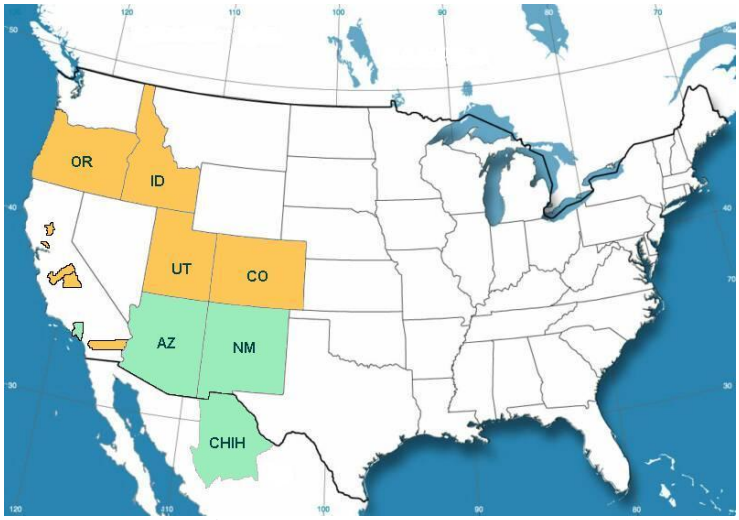

Figure 3. Distribution of the walnut twig beetle. In green are states and the California county of Los Angeles that had reported records of the species prior to 1992. States in orange and five additional California counties have reported the insect since 1998.

The first published record of a cluster of black walnut mortality associated with the walnut twig beetle was in the Espanola Valley of New Mexico

where large numbers of mature black walnut died in 2001. However, this may have been preceded in Utah with black walnut mortality in the early 1990s along the Wasatch Front, and Utah records of the beetle date to 1988. Similar widespread decline also occurred about this time in the Boise, Idaho area where the insect was first confirmed present in 2003. Black walnut mortality and the twig beetle have been noted in several Front Range communities in Colorado since 2004 and in most infested cities the majority of black walnut has since died. *P. juglandis* has been recorded from Oregon (Portland) since 1997, has been widely captured in funnel traps in The Dalles since 2004, and is suspected of being associated with recent widespread death of black walnut in the Willamette Valley of Oregon.

Isolated captures of the walnut twig beetle in California were first recorded in 1959 in Los Angeles County in association with both *J. nigra* and California walnut, *J. californica*. Since 2002, it has again been recovered from Los Angeles County as well as Riverside County and the Central Valley counties of Butte, Yolo, Fresno and Tulare.

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*.

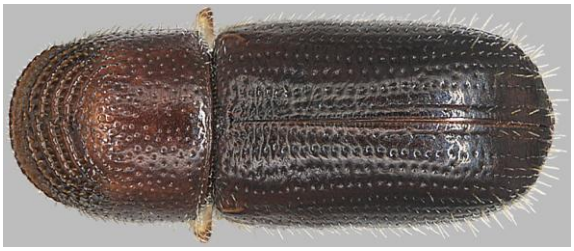

Figure 5. Walnut twig beetle, top view. *Photograph by Jim LaBonte, Oregon Department of Agriculture.*

Life History and Habits. Despite its small size - and the pending common name - attacks by adult *P. juglandis* in black walnut are not confined to twigs. Tunneling is most commonly seen in branches greater than 2 cm diameter and sometimes even occurs in trunks.

Winter is spent primarily and possibly exclusively, in the adult stage. Adults initiate tunnels by early May, entering through bark crevices. During tunneling the *Geosmithia* fungus is introduced and subsequently grows in advance of the bark beetle (Figure 6). Ultimately a nuptial chamber is produced from which one or more radiating eggs galleries are excavated (Figure 7). Larvae develop just under the bark and then enter the bark to pupate.

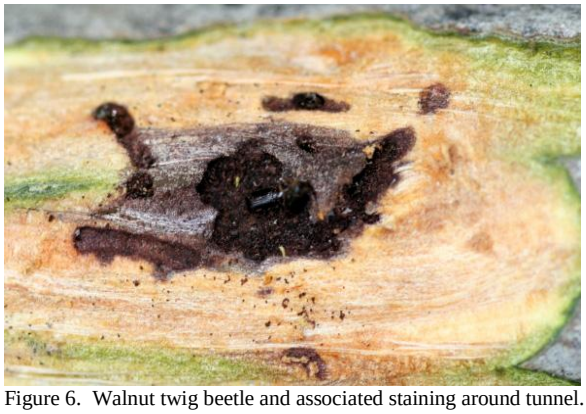

Figure 6. Walnut twig beetle and associated staining around tunnel.

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

A single generation has been observed to be completed in less than two months. Yellow sticky trap sampling in Boulder, Colorado found adult beetles to be present from mid-April through early October, when sampling was discontinued. Peak adult captures occurred from mid-July through late August. These data suggest that two or more generations may be produced annually, which may increasingly overlap later in the growing season.

Cankers

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 nuptial chambers of the walnut twig beetle in small twigs, branches and even the trunk (Figure 8). *Geosmithia* spp. are associates of bark beetles of hardwood and conifer trees but have not previously been reported as pathogens of *Juglans* or fungal associates of *P. juglandis*. Branch cankers may not visible until the outer bark is shaved from the entrance to the nuptial chamber; 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, cankers 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 and girdle twigs and branches, resulting 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.

Figure 8. Conidiophores and conidia of *Geosmithia*

A second canker type caused by the fungus *Fusarium solani* may occur on black walnut trees in advanced stages of decline. These diffuse cankers are much larger than those 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. *Fusarium solani* has not been isolated from cankers surrounding walnut twig beetle galleries or directly from beetles.

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* sp. Because of the extended period when adult beetles are active, insecticide spray applications will 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. This will likely limit the ability of systemic insecticides to control transmission of the fungus to new hosts before substantial infection occurs. Rapid detection and removal of infected trees currently remains the primary means of managing thousand cankers disease.

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.

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