



Thousand Cankers Disease is Widespread in Black Walnut in the Western United States

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Black walnut (*Juglans nigra* L.) is native to eastern North America, and is distributed from New England and the Appalachian Mountains west to the Great Plains, and from the Canadian border south into Texas and the Florida panhandle (3). It has been widely planted west of its native range as an ornamental and nut tree. In the early 1990s black walnut mortality was observed along the front range of the Wasatch Mountains in Utah (Diane Alston, Utah State University, *personal communication*) as well as at sites in the Willamette Valley in Oregon (5). Mortality was not linked to a specific biotic cause at the time. Death of black walnut was associated with feeding by the walnut twig beetle (WTB), *Pityophthorus juglandis* Blackman, in Utah Co., UT, in 1997 (2) and in the Espanola Valley in New Mexico in 2001 (7). These observations were significant because black walnut is not a native host of the WTB; the beetle was originally collected in 1896 from a "black" walnut in Grant Co., NM (1). The host of this collection for the type specimen was most likely Arizona walnut, *J. major* (Torr.) A. Heller, based on geographic ranges of native walnut species. The WTB subsequently has been collected from naturally senescing or damaged twigs, branches, and stems of otherwise healthy Arizona walnut at many sites in Arizona and New Mexico.

The WTB was associated with black walnut mortality in Boulder and El Paso counties in Colorado in 2003 and in Oregon in 2007 (Fig. 1), although upon further inspection of museum collections, the WTB had been present in the latter state at least since 1997 (2). In 2008 black walnut death in Colorado was determined to be the result of aggressive feeding by the WTB on large branches and even the trunk, and subsequent canker development around beetle galleries caused by a newly described fungal symbiont of the beetle, *Geosmithia morbida*, (4,6). The disease was given the common name of thousand cankers disease (TCD) because of the enormous number of coalescing cankers that are formed in the bark of severely affected trees (6).

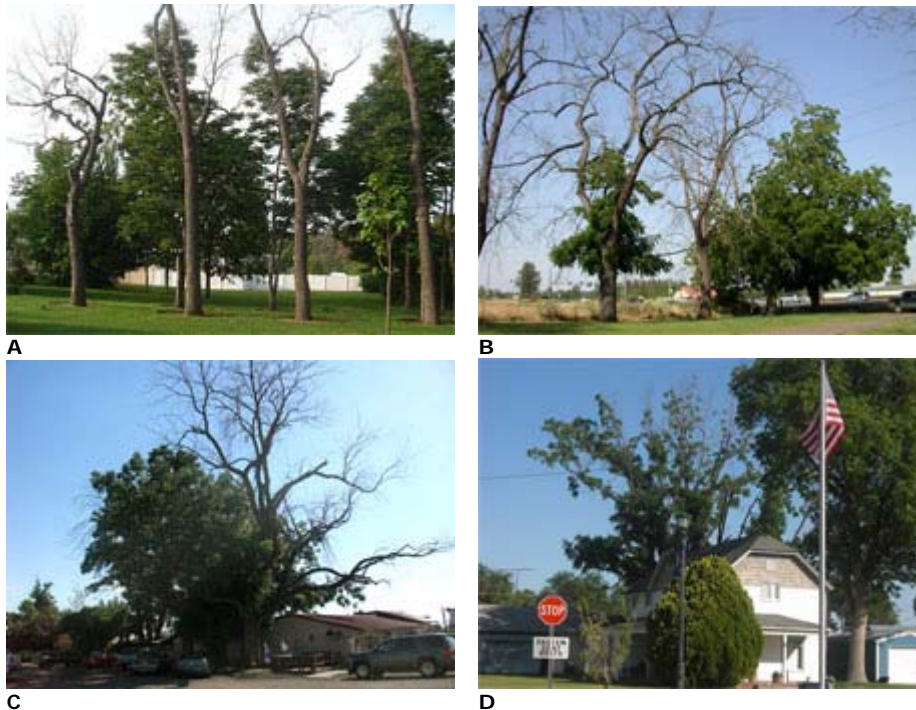


Fig. 1. Thousand cankers disease was identified in black walnut (*Juglans nigra*) or hybrids (Oregon only) of black walnut with northern California black walnut (*J. hindsii*), in (A) Colorado in 2008 and (B) Oregon in 2009, although walnut decline had been noted in Oregon since the early 1990s. Thousand cankers distribution in the western United States has expanded with confirmations in (C) Washington in 2009 and (D) and Idaho in 2010.

Symptoms of TCD in black walnut, including progressive crown thinning, bark cankers, branch dieback, and eventually mortality, have now been observed in a number of western states. To confirm the presence of *G. morbida*, branch and trunk samples with WTB galleries and cankers were collected from many of these locations and fungal isolations were attempted in a manner previously described (6). *G. morbida* was initially identified by morphological characteristics of the conidiophores and conidia, and colony shape and color on half-strength potato dextrose agar (4). DNA was extracted from single spore isolates and the ITS1, 5.8s, and ITS2 regions of the rDNA were amplified by using the ITS1 and ITS4 universal primers. All putative *G. morbida* isolates identified by morphological characteristics had ITS sequences with > 98% similarities to the type isolate (CBS124663). Koch's postulates were successfully completed with two Utah isolates (1222 and 1223) by using inoculation methods previously described (6). We have now isolated *G. morbida* from black walnut or hybrids of black walnut with northern California black walnut [*J. hindsii* (Jeps.) Jeps. ex R.E. Sm.] with TCD in California, Colorado, Idaho, New Mexico, Oregon, Utah, and Washington (Fig. 2).

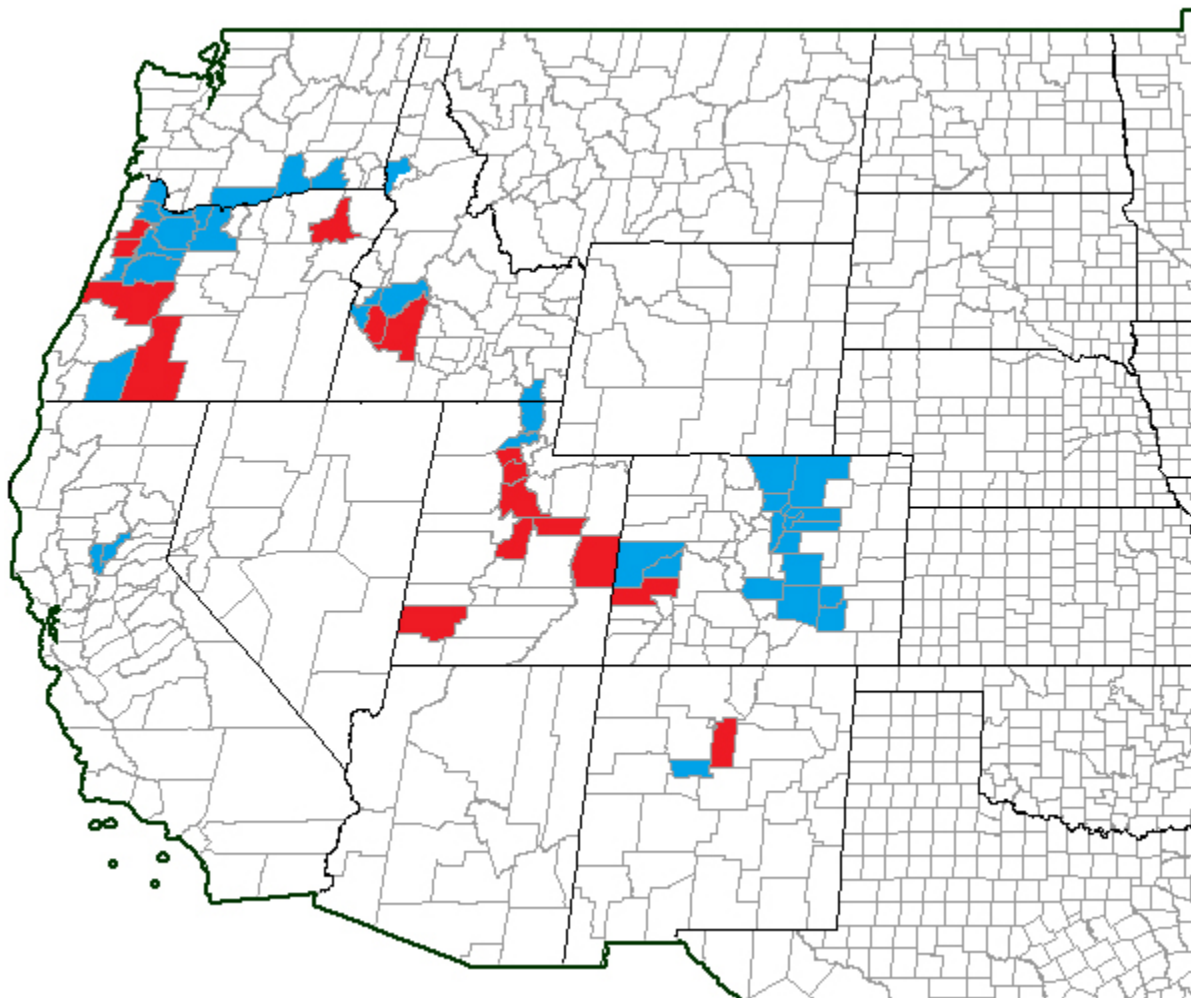


Fig. 2. Distribution of thousand cankers disease on black walnut (*Juglans nigra*) in the western United States. Counties highlighted in blue represent those in which *Geosmithia morbida* has been isolated from symptomatic trees. Counties highlighted in red represent those where symptoms of thousand cankers disease were observed, but where isolation of *G. morbida* was not attempted because trees were removed before samples could be collected. Some of the trees sampled for confirmation of *G. morbida* in Oregon are hybrids of *J. nigra* with *J. hindsii*.

The distribution of TCD in the West continues to expand. Most counties along the Front Range in Colorado now have TCD, with new reports in Fremont, Pueblo, and Weld counties in 2010. The disease also was found in Walla Walla and Benton counties in Washington in 2009 and in Canyon and Nez Perce counties in Idaho in 2010, thus extending the northernmost distribution of TCD in North America (Fig. 1). The southernmost extent of the distribution in black walnut is Albuquerque, NM (Bernalillo Co.), which was also confirmed in 2010. The actual range of TCD in the West is likely greater than reported here because systematic surveys have not been conducted in most western states, particularly in stands of native walnut species. Furthermore, black walnuts in some locations (e.g., several counties in Utah that lost trees in the 1990s or Santa Fe Co., NM, that lost trees in 2001) were killed and removed before TCD was confirmed as the cause.

Thousand cankers disease has intensified in severity in communities where it has been found. In some locations (e.g., Colorado Springs, Colorado), mature black walnuts have been eliminated, or nearly so, by TCD. Over 1,300 black walnuts or approximately 60% of the entire population in Boulder, Colorado have been removed since 2004 and fewer than 300 asymptomatic trees with a diameter at breast height exceeding 25 cm remain (Fig. 3). A similar mortality trend is now occurring in Denver, located approximately 39 km southeast of Boulder. In summary, TCD continues to cause extensive mortality to black walnut over a wide geographic region in the western United States.

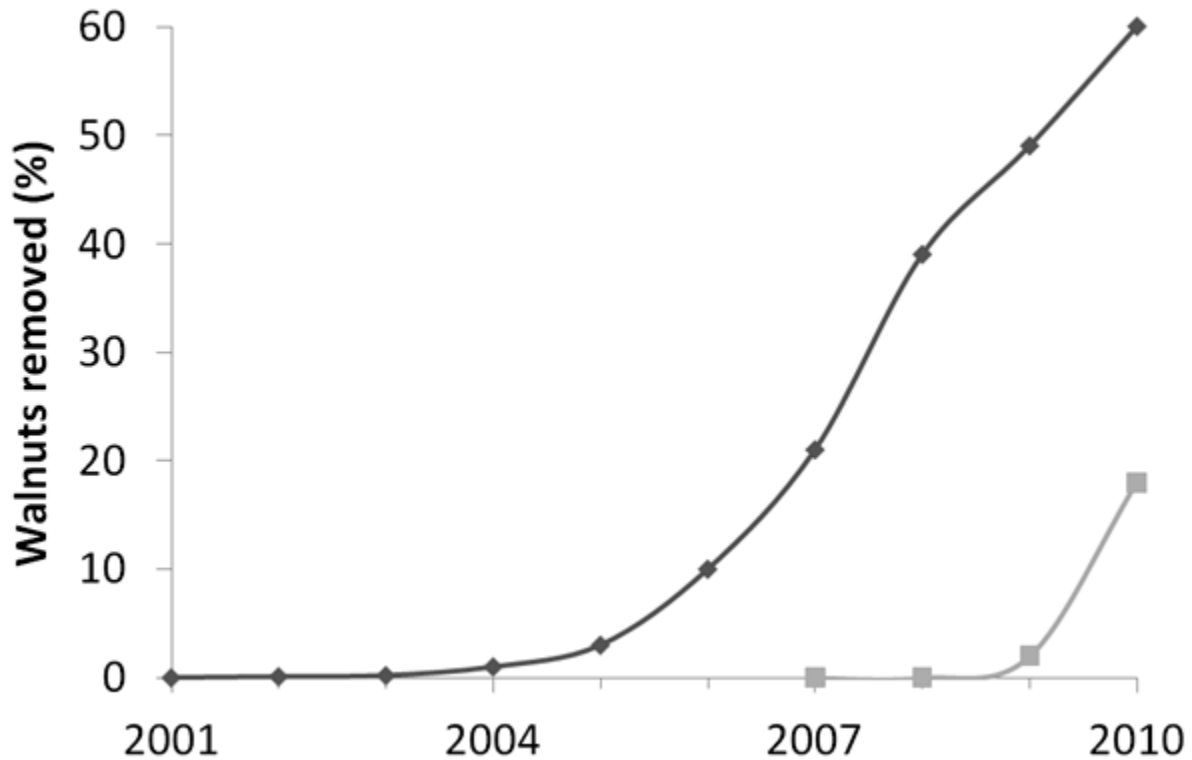


Fig. 3. Percentage of the total number of black walnuts that were removed in Boulder (black line) and Denver (gray line), Colorado, 2001-2010. Percentages are based on total black walnut inventories determined by detailed visual surveys in both cities.

Acknowledgments

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