

Beetle, fungus deliver one-two punch to black walnut trees

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The tiny walnut twig beetle has become a vector of the *Geosmithia* fungus, which now threatens black walnut trees throughout the West.

(PhysOrg.com) -- A newly discovered disease, caused by a previously undescribed fungus hitchhiking on a tiny native bark beetle, is infecting and killing hundreds of black walnut trees in California and seven other Western states.

The havoc wreaked by the combined pests, coined "thousand cankers disease," represents a serious threat to black walnut trees, says chemical ecologist and forest entomologist Steve Seybold of the Davis-based Pacific Southwest Research Station, USDA Forest Service, and an affiliate of the Department of Entomology, University of California, Davis.

"The black walnut trees could go the way of the American chestnut or American elm," warns entomologist Lynn Kimsey, director of the Bohart Museum of Entomology, which houses one of the largest insect collections in North America.

"By itself, the very tiny walnut twig beetle does relatively little damage," Seybold said. But combined with the aggressive fungus, it can kill a walnut tree in one to three years. Despite the "twig" in its common name, the walnut twig beetle also

bores holes in large branches and even in the trunk of walnut trees.

The beetle, *Pityophthorus juglandis*, native to Arizona, California, New Mexico and Mexico, is widely distributed in California, from San Diego to Shasta counties. Known since 1959 as just another specimen in the drawers of California insect museums, it has emerged on the radar screens of entomologists and plant scientists because it has been found in abundance on dying walnut trees statewide. The disease also has been found in Colorado, Arizona, New Mexico, Idaho, Utah, Washington and Oregon.

"It's a hard time for hardwoods," said Seybold, who organized and chaired a symposium at the Entomological Society of America's 65th annual meeting, held last fall in Reno. "This is behaving like an invasive pathogen that has run amuck."

Scientists are concerned that the disease may also impact English walnut and California walnut production. "There are hints that the fungus may have infected English walnuts in Utah," Seybold said, "and there are several symptomatic English walnut trees at the USDA National Germplasm collection located in nearby Winters; but beyond that we do not know the extent of the threat to the industry."

The fungus, with its barrel-shaped spores, appears to be an undescribed and perhaps exotic species within the genus *Geosmithia*, said postdoctoral researcher Andrew Graves of the UC Davis Department of Plant Pathology. Graves, part of a Davis-based team working on the project since June 2008, has noted that there are seven named species of *Geosmithia*.

Colorado State University plant pathologist Ned Tisserat, who placed the fungus in the genus *Geosmithia* and gave the disease its name, told the ESA symposium: "It is really, really a scary disease;

it's as bad as butternut (walnut) canker." Butternut (*Juglans cinerea*) also is known as white walnut.

Graves, who also holds a doctorate in entomology from the University of Minnesota, described the beetle as a reddish-brown bark beetle, about 1.5 to 1.9 millimeters long. "It's much smaller in size than a grain of rice," he said. The entrance holes into the black walnut tree look like pin pricks.

"But if you peel back the bark, you'll see the well-developed beetle galleries and blotches of fungal-stained wood and bark that look like a thousand cankers," said Graves, who is researching the host colonization behavior of the beetle. He described some of the coalescing cankers as "enormous." The cankers widen and girdle twigs and branches, resulting in die back of the tree crown.

Disease symptoms include dark stains on the outer bark tissue that extend into the cambium; yellowing and thinning of the upper crown; wilting of leaves; flagging branches; die back and eventual death, all within three years. Seybold said that the disease is so recently discovered that specialists have not had time to develop and test integrated pest management tools to address the issue. The natural system of attraction of the beetles to the trees and to each other might form the basis of a future monitoring and tree protection toolkit.

"The impact of these beetles and their fungus," Kimsey said, "may be devastating to yet another of our native trees. When I think of the possibility of losing all of the magnificent black walnuts in Davis, it makes me very sad."

The disease complex first gained notice in the Española Valley of New Mexico in 2001 when walnut trees declined and died. Scientists initially attributed the mortality to drought stress. However, when the drought subsided, the massive dieoffs did not.

The beetle-disease complex is associated with widespread deaths of black walnuts planted as street or highway trees in Boulder, Colo., Portland, Ore., Prosser, Wash., and several counties in California, including Los Angeles, Sutter, Ventura and Yolo. It was first noted by scientists in

California in 2008.

UC Davis walnut specialist Charles Leslie, a member of the Davis-based thousand cankers disease research team, says two species of black walnut are native to California: *Juglans californica* (a southern California shrublike black walnut) and *Juglans hindsii* (the northern California black walnut).

Northern California black walnut is widely planted in Yolo County as an ornamental tree, lining roads and ranches, Leslie said. "These black walnuts are different from the commercial walnuts grown in the Central Valley, which are Persian, commonly called "English" walnut trees grown on black walnut root stock."

California black walnut "is prized more as a shade tree than for its nuts," Leslie said. "To crack the nut, you need to run over it with the family Hummer or hit it with a sledgehammer," he quipped.

However, eastern black walnut is a favorite in the ice cream industry, and the wood is especially prized for furniture and guitars.

To confirm the extent of the disease in the state, the Davis researchers are participating in a federally funded project to collect diseased branches throughout California, particularly in the native ranges of *Juglans californica* (Los Angeles and Ventura counties) and *Juglans hindsii* (Mount Diablo and elsewhere in Contra Costa and Yolo counties). They are also rearing the beetles and studying host colonization behavior. "The beetle appears to pump out at least two generations a year in California," Graves said.

Colorado State University plant sciences professor Whitney Cranshaw, who is on the front lines of the research in Boulder and Denver, said people continually ask him "How can a little twig beetle be killing healthy trees?"

"With *Geosmithia*," he said. "The fungus is carried into the tree when the beetle tunnels into and wounds the tree. The fungus produces large cankers."

The aggressive fungus girdles the tree and "it's death by 1,000 cankers," Cranshaw said.

The attacks generally occur from mid-April through mid-September. At the end of summer, the beetles and the fungus that they carry move into the lower part of the trunk to hibernate.

In their continuing research, scientists hope to establish a baseline of the beetle and fungal populations to understand the full extent of the problem. Native black walnut trees in the western U.S. are important components of the vegetation along streams and riparian zones, Seybold said, so their "loss may have significant ecological implications."

The scientists also advocate research on vector transmission, overwintering biology, an estimation of the risk and threat to the walnut-growing industry in California and to commercially valuable native black walnut trees in the eastern U.S., development of attractive baits, and an insecticide treatment.

Insecticides may prove useful, but only if used prior to the beetle arriving at the tree, Graves said. "Insecticide sprays are of limited effectiveness due to the extended period when the beetles are active, and because the beetles are feeding beneath the bark, insecticides will not be useful in killing beetles that have already entered the tree. Even if the insecticide kills the adult beetles and larvae, the *Geosmithia* may continue to colonize the bark and phloem."

The scientists also discussed their research this past spring at meetings in Savannah, Georgia (National Forest Health Monitoring Workshop); Spokane, Wash. (Western [Forest](#) Insect Work Conference); and San Diego (Pacific Branch ESA Meeting).

Provided by University of California, Davis

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