

Formosan Sweetgum Susceptible to North American *Endothia gyrosa*

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ABSTRACT

Endothia gyrosa is causing a serious canker disease of Formosan sweetgum (*Liquidambar formosana*) in a Mississippi test planting. An Asiatic tree species attacked by a virulent species of *Endothia* native to North America suggests the possibility of an epidemic in Asia reciprocal to

chestnut blight in the USA. Care should be taken to assure that this pathogen is not introduced into the range of *L. formosana* in Asia.

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Additional key words: *Liquidambar styraciflua*, wound pathogen, canker disease.

A planting of Formosan sweetgum (*Liquidambar formosana* Hance.) was established on the Harrison Experimental Forest near Gulfport, Mississippi, in 1964 (7). The trees were grown from seed collected on the island of Taiwan, and 42 half-sib families are represented. This introduced species of *Liquidambar* is of interest because its brilliant spring and fall coloration is unusual in the Gulf region of the USA. It thus has considerable potential as an ornamental (Fig. 1-2).

A serious stem canker disease has occurred in the planting. By October 1972, 70 of the 400 trees had elongate, sunken stem cankers (Fig. 3). The cankers varied from 20 to 60 cm in length and frequently had girdled the trunks and killed the upper portion of the trees. The trees had received an initial pruning to a height of about 1 m in January 1972, and all cankers appeared to have originated at branch stubs. The pruning wounds ranged from 1-3 cm in diam.

Orange-colored stromata were present on all of the cankers (Fig. 3-5); they persisted through the winter and summer of 1973. Resin flow and a purple stain were common on the surface of the canker; below the surface, the bark and wood were dark brown (Fig. 6). The stromata are 1 to 2 mm in diam, orange-rufous (2), and irregularly spaced on the surface of the dead bark. When the stromata are wet, bacilliform pycnidiospores 0.75 - 1.0 × 3-4 μm in size exude from irregularly shaped pycnidia imbedded in the stromal tissue; spore tendrils, however, are not formed. The majority of the stromata produce only pycnidia; perithecia were not found until March 1973. The perithecia are deeply imbedded in the stroma, globose, 250-300 μm in diam, with slightly protruding necks 100-120 μm in diam and 400-500 μm long (Fig. 7-a). The ascospores are one-celled, allantoid with slightly tapering ends, and measure 2 - 2.5 × 6-10 μm (Fig. 7-b). These characteristics correspond closely to the description of *Endothia gyrosa* (Schw.) Fries, given by Shear et al. (3). The disease and associated pathogen are also similar to the orange hobnail canker disease reported by Van Arsdel (5) on oak in Texas. In culture, the fungus grows slower, but is otherwise very similar to that isolated by Van Arsdel (*personal communication*).

In November 1972, ten healthy *L. formosana* trees and five native sweetgum (*L. styraciflua* L.) trees in the same planting were inoculated with an agar culture of *E. gyrosa* and with a water suspension of pycnidiospores obtained from the cankers. Each tree was wounded in three places by removal of a 1 cm disk of bark to expose the stemwood. One wound per tree was filled with a plug of agar and mycelium, one was sprayed with the spore suspension, and the third was rinsed with distilled water. The wounds were then covered with wet cloth and sealed with polyethylene for 2 mo. By 15 May 1973, three inoculations with agar plugs had produced typical sunken cankers on *L. formosana*, and one of these had developed orange stromata (Fig. 8). Two cankers formed from wounds sprayed with the spore suspension, but these did not have stromata. One of the *L. styraciflua* trees developed a canker at the wound inoculated with the agar culture, and typical stromata were formed. All wounds rinsed with distilled water appeared healthy. *E. gyrosa* was reisolated from cankers with stromata.

E. gyrosa is a wound pathogen on native sweetgum, beech, and oak species in the southeastern United States (3). Except for trees that we inoculated, native sweetgums of the same age planted adjacent to the exotic species were not affected. The native trees, however, were not pruned and infection courts may not have been present.

Because individual trees in the plantation appear to be resistant to the disease, selection may still provide a useful ornamental. Application of wound dressings probably will also prevent infection.

The American chestnut was destroyed by *Endothia parasitica* (Murr.) P. J., & H. W. And., a fungus introduced from Asia (1). The present attacks by a native *Endothia* on an introduced Asiatic tree suggest the possibility of a reciprocal epidemic, should the pathogen be introduced to Asia. *Liquidambar formosana* is a wood-producing species of the Yangtze River watershed in central China and of secondary forests throughout the central portion of Taiwan at altitudes of about 900-2,000 m (6). The tree is also planted extensively as an ornamental in Japan (Dr. Takao Kobayashi, *personal communication*). Although *E. gyrosa* was reported on



Fig. 1-8. Canker of Formosan sweet gum (*Liquidambar formosana*) caused by *Endothia gyrosa*. **1)** Fall coloration. **2)** Spring leaf colors. **3)** Stem canker with characteristic depression above and below a branch stub (apparent entry point) showing discoloration, resin flow, and orange stromata. **4)** Stromata size variation. **5)** Perithecia (black spots) emerging from stromata. **6)** Internal stem structure showing death and discoloration of the phloem and xylem above and immediately below the branch stub on left. Pencil shows the upper limit of depression. Discoloration beneath healed pruning wound and extending into the lower stem is of uncertain origin. **7-(a, b)** Microscopic characteristics: **a,** perithecia with long dark necks; **b,** asci and ascospores. **8)** Early signs of infection after artificial inoculation.

oak in China in 1934 (4), the virulence of the North American strain suggests that it should never be transported to Asia.

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