Needle Blight of Port-Orford-Cedar Caused by *Stigmina thujina* in Hawaii

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ABSTRACT

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A needle blight caused by *Stigmina thujina* was observed on Port-Orford-cedar (*Chamaecyparis lawsoniana*) on several of the Hawaiian Islands. This is the first report of the disease on *C. lawsoniana* and in Hawaii.

In 1979, several trees of Port-Orford-cedar (*Chamaecyparis lawsoniana* (A. Murr.) Parl.) in Kokee State Park on the island of Kauai, HI, were found to be severely affected by a needle blight. A fungus referable to the genus *Stigmina* was sporulating profusely on dead needles. Plantings of Port-Orford-cedar on other Hawaiian Islands were examined and found to be similarly affected. This paper reports the distribution and symptomatology of the disease and describes the causal organism.

DISTRIBUTION AND SEVERITY

Several plantings of Port-Orford-cedar were examined on the islands of Hawaii, Kauai, Maui, and Molokai to determine the distribution and severity of the disease. These included Hilo Forest Reserve (1,646-m elevation) and Honuaula Forest Reserve (1,890-m elevation), Hawaii Island; Kokee State Park (1,146-m elevation), Kauai Island; Makawao Forest Reserve (1,280-m elevation) and Olinda Prison (1,098-m elevation), Maui Island; and Molokai Forest Reserve (853-m elevation) and Waikolu Lookout (1,067-m elevation), Molokai Island. The needle blight was present in all plantings.

Severity of the disease within each planting, based on visual, subjective estimates of crown loss, ranged from no symptoms to complete defoliation and death. A tree-by-tree survey was made in two of the plantings to determine the severity of infection. Defoliation on individual trees was subjectively estimated at 10% intervals of live crown. Of the 342 trees at Olinda Prison, 6.1% were healthy, 33.4% were 10–50% defoliated, 42.7% were 60–80% defoliated, 16.4% were 80–90% defoliated, and 1.4% were dead (apparently after complete defoliation). The degree of defoliation appeared to result from variation in susceptibility of individual trees; in several cases, healthy trees were adjacent to trees heavily defoliated (Fig. 1A). Although tree height was not measured, differences in height between infected and healthy trees were obvious (Fig. 1A).

In the Hilo Forest Reserve, the level of infection was lower than at Olinda Prison. Of the 1,613 trees surveyed, 45.3% were 10–50% defoliated, 7.1% were 60–80% defoliated, 3.5% were more than 80% defoliated, 36.3% were healthy, and 7.8% were dead. An agent other than needle blight was probably responsible for killing the trees because most of the dead trees occurred together in a small area of the plantation.

Although a tree-by-tree survey was not made on Molokai Island, the plantings there appeared to be most severely damaged. Healthy trees were seldom seen, and most trees were more than 50% defoliated. Only one infected tree was found in the Makawao Forest Reserve on Maui Island, which includes mixed conifers and *Eucalyptus* spp. and where the *C. lawsoniana* trees are widely scattered.

SYMPTOMATOLOGY

Although there was no opportunity to observe progressive symptom development, it appeared that infection began on the lower branches and proceeded upwards. Individual needles may have become infected and died, but small branchlets or twigs generally died after being girdled by the fungus (Fig. 1B). On some severely affected trees, the lower branches were killed and the trees had the appearance of being singed by fire. On other trees, branches remained alive to the ground with only the extreme tips of the branches having green needles (Fig. 1C).

THE PATHOGEN

Description. Fruiting bodies (sporodochia) of the pathogen were produced copiously on dead needles and branchlets. They generally occurred on the lower branchlet surface but were often found on the inside surfaces of the closely appressed, scalelike leaves and were difficult to see. The sporodochia (Fig. 1D) were at first innate but became erumpent by circumscissile rupture of the epidermis. They were black, 120–270 μm wide, and 60–170 μm high. Conidiophores arose from a stromatic layer 20–30 μm thick, forming a dense palisade, and were septate, dark, and 3–4.5 μm wide and 50–80 μm long. Sporogenous cells were holoblastic and annellitic with one to several annellations. Conidia were dark, cylindric, smooth walled, curved (often sharply so in the upper part), 4–10 (usually 7–9) septate, rounded at the apex, truncate with a marginal frill at the base, and 30–60 (44.1) × 6.2–8.8 (7.2) μm.

On malt extract agar at 24 C, the pathogen produced black, cottony or tufted colonies and no spores. After 3 wk, average colony diameter was 12 mm.

Taxonomy. No species of *Stigmina* have been previously reported from *Chamaecyparis*, and few have been reported on conifers in general. *S. deflectens, S. juniperina*, and *S. glomerulosa* are all associated with needle blight diseases of *Juniperus* spp. (5); *S. verrucosa* (5) is found on needles of *Picea glauca*, and *S. thujina* (Dearn.) Sutton on needles of *Thuja plicata* (3). The *Chamaecyparis* fungus was compared with descriptions of all of these and found to be most similar to *S. thujina*. Comparisons with the type of *S. thujina* obtained from the National Fungus Collections (BPI) verified the *Chamaecyparis* fungus to be that species.

The needle blight pathogen was first described as *Coryneum thujinum* Dearn. in 1924 (3) from dead leaves of *T. plicata* collected in Lane County, OR. Morgan-Jones (5) transferred the fungus to the genus *Sciniatosporium* Kalchbr. as *Sc. thujinum* (Dearn.) Morgan-Jones. Sutton (6), however, rejected the name *Sciniatosporium* and transferred the fungus to *Stigmina* as *S. thujina* (Dearn.) Sutton. This appears to be the proper disposition of the fungus.

DISCUSSION

On the basis of numerous herbarium specimens in BPI, the Plant Pathology Herbarium at Oregon State University, and the Pacific Forest Research Center Herbarium in Victoria, B.C., Canada, *S. thujina* is widely distributed throughout

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the range of *T. plicata* in Oregon, Washington, Idaho, and British Columbia. There is also a single specimen in BPI collected on *T. plicata* in Franklin, NC, in 1951.

Although widespread in distribution, *S. thujina* apparently does little damage to *T. plicata*. Except for specimen packet notations that the fungus is parasitic, only Hedgecock (4) has reported it to be associated with a foliar blight in North America. In Europe, Boudru (2) reported *S. thujina* on seedlings of *T. plicata* in France, and Benben (1) found it in plantations of *T. plicata* and *T. occidentalis* L. in Poland. Damage caused by the fungus was slight in both instances.

Although the native range of *T. plicata* overlaps almost the total range of *C. lawsoniana* in the western United States, *S. thujina* has never been reported from the latter species. In Hawaii, *S. thujina* was not observed in the few *T. plicata* plantings examined during this study. One planting containing both *C. lawsoniana* and *T. plicata* (Makawao

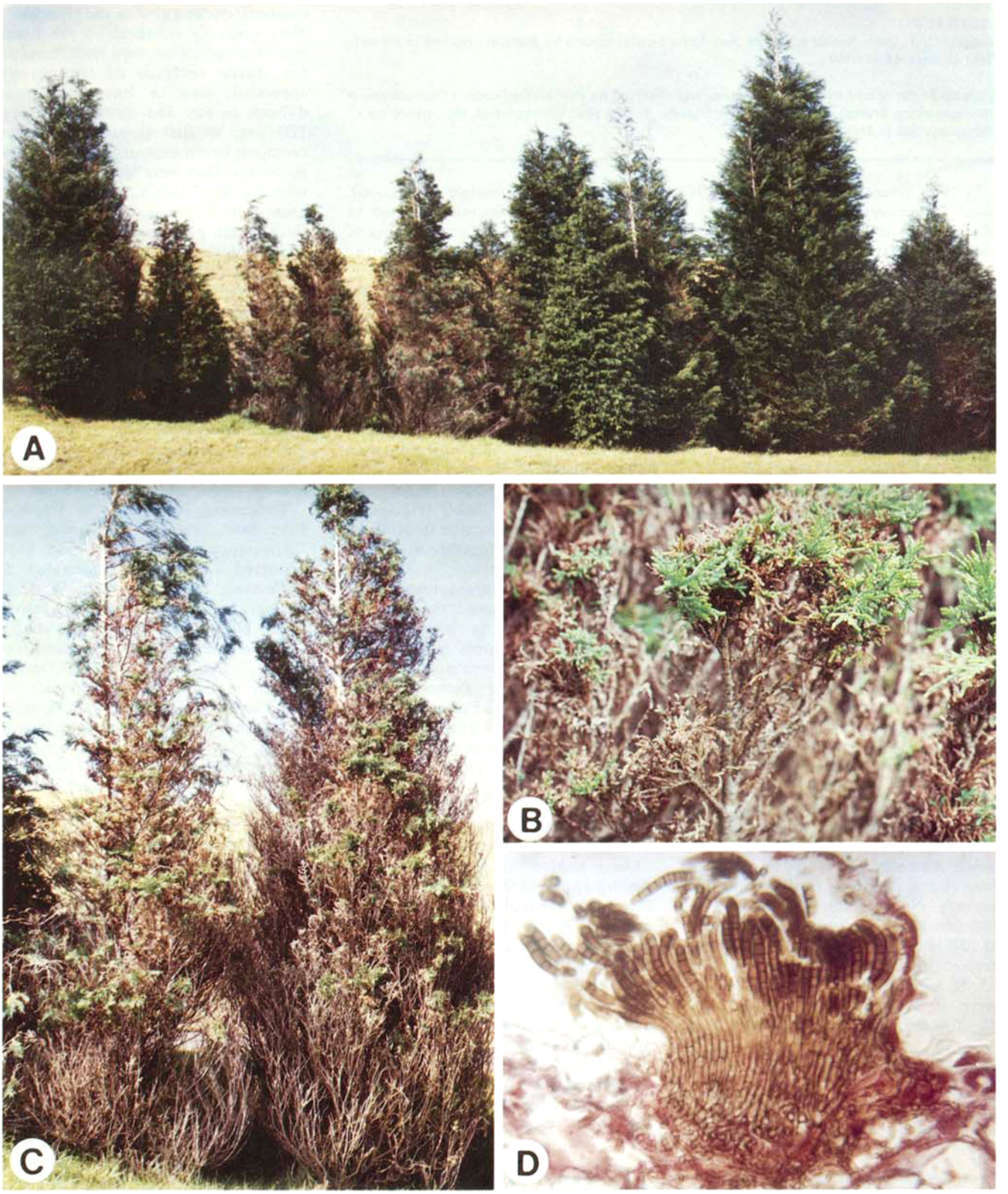

Fig. 1. *Stigmina* blight of *Chamaecyparis lawsoniana*: **(A)** Variation in degree of individual tree infection. **(B)** Branchlet and twig mortality. **(C)** Severe defoliation with branch tips still alive. **(D)** Sporodochium and conidia of *S. thujina* (×320).

Forest Reserve, Maui Island) was examined, but only one tree of *C. lawsoniana* was found to be slightly infected. The reason for the discrepancy in hosts between the western United States and Hawaii is not known.

The fungus has apparently been in Hawaii for a long time because it is found widely distributed on all the major islands except Oahu and Lanai, where no plantings of *C. lawsoniana* exist. Unpublished records at the University of Hawaii Plant Disease Clinic indicate that the fungus was collected at several locations on Molokai Island in 1970 and 1971.

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