Weeping willow blight in coastal British Columbia[1]

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Surveys and laboratory studies were undertaken during the summers of 1973 and 1974 to determine the etiology of a blight disease of weeping willow (*Salix babylonica*) in south coastal British Columbia. Of 102 trees surveyed, 70 were infected with *Marssonina salicicola*, 53 were infected with *Pleurophomopsis salicicola*, and 21 with *Cytospora* sp. The validity of earlier host and pathogen reports for the area is questioned.

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Des contrôles sur le terrain et en laboratoire ont ete réalisés au cours des etes 1973 et 1974 pour etablir l'étiologie de la brûlure du saule pleureur dans la zone côtière du sud de la Colombie-Britannique. Sur les 102 arbres examines, 70 etaient infectes par *Marssonina salicicola*, 53 par *Pleurophomopsis salicicola* et 21 par *Cytospora* sp. Ces observations remettent en question la validité des rapports anterieurs sur l'identité des organismes pathogenes en cause et celle de leurs hôtes dans cette region particulière.

Willow blight is a major disease of ornamental willows in British Columbia, particularly the weeping willow *Salix babylonica* L. As a result, nurserymen are reluctant to grow weeping willows although a substantial and steady market does exist, particularly for parks and other areas where large, spreading trees are suitable.

Willow blight is a worldwide disease occurring wherever willows are grown. There is no consensus on the primary causal agents, however. Probably the most import components of the disease on a global scale are the scab fungus *Pollacia saliciperda* (All. & Tub.) Arx, and the black canker fungus *Physalospora miyabeana* Fukushi. The relative importance of the two fungi as primary parasites remains unresolved after 50 years of intermittent study (2, 4, 15, 18, 23, 25, 26).

In Canada the diseases caused by these two fungi were first observed in Nova Scotia and Prince Edward Island in the mid 1920's (17). Since then both fungi have been reported numerous times on *Salix* spp. including *.S. babylonica* (9, 10, 12, 27). Both fungi were associated with the disease in coastal British Columbia in 1940 arid 1941 on a few willows that were not identified to species (5, 6, 7). All of the diseased trees were destroyed, presumably in an attempt to eradicate the disease from the area. Since then the only published reports of the two fungi in coastal British Columbia were from southern Vancouver Island in 1960 and 1961 (11, 12).

Another fungus, *Marssonina kriegeriana* (Bres.) Magn. has frequently been reported as causing anthracnose and twig blight of *S. babylonica* L. in British Columbia (5, 8, 13, 14, 28). *M. kriegeriana* has also been reported on *Salix* spp. elsewhere in the world, although M. *salicicola* (Bres.) Magn. is more commonly associated with disease of S. *babylonica* L. (6, 20, 22, 24, 25).

Numerous other fungi, including *Cytospora* spp., have also been reported on *Salix* spp. but they appear to be of minor importance compared to the above named fungi (6, 24).

A bacterial blight caused by *Pseudomonas saliciperda* is reported to be important in Oregon although documentation of this pathogen is obscure (21).

Materials and methods

In order to clarify the current local situation, surveys were undertaken in the summers of 1973 and 1974. In 1973, specimens were collected only from weeping willows in nurseries in the Fraser Valley. In 1974, the survey was extended to include private homes and public areas. A sample consisted of 2-4 leafed-out branches taken from the perimeter of a tree. All told, samples were collected from 102 trees scattered fairly evenly from Rosedale in the east to West Vancouver in the west end of the Lower Fraser Valley, a distance of about 100 miles.

Diagnosis of potential pathogens was based on disease symptomology and fungus morphology. Rating of pathogenicity was based on the documented reputation of the the fungus and its relationship to healthy and diseased host tissues.

Results

Of the 102 trees sampled only 3 did not exhibit blight symptoms. All of the others exhibited blight with one or more associated fungi. In no case did bacterial infection

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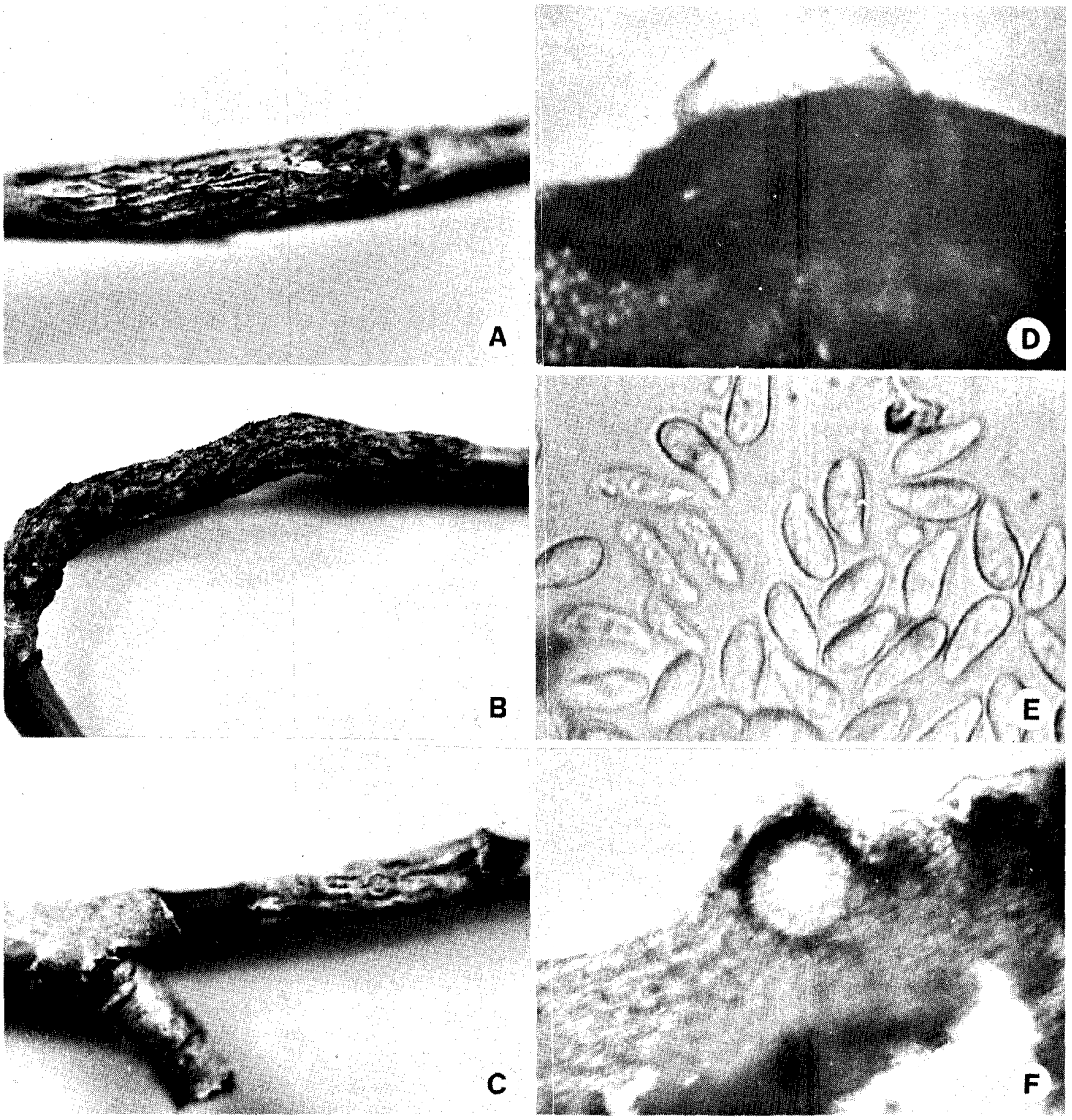

Figure 1. Blight of *Salix babylonica* L. A) A 1-year-old lesion in which pycnidia of *Pleurophomopsis salicicola* are barely visible. B) A 2-year-old canker containing both *Marssonina salicicola* and *P. salicicola.* C) A girdling canker. D) Acervulus of *M. salicicola,* X 80. E) Conidia of *M. salicicola,* X 700. F) Pycnidium of *P. salicicola,* X 100.

appear to be involved. Three distinct fungi were found associated with blight. These occurred either alone or in combination with one another as indicated in Table 1.

***Marssonina* sp.**

The most abundant fungus found was a ***Marssonina*** sp. The pathogenicity of ***Marssonina*** spp. to ***Salix*** has been well documented and thoroughly discussed (19, 24, 25). Symptoms could be found on young leaves and shoots. Observations made during the survey suggested that only tender immature tissue was susceptible to infection. No new infections were found on mature leaves and shoots.

Symptoms of ***Marssonina*** infection on young leaves were round to irregular, brown, 0.2-5 mm diameter spots, mostly on larger veins on the lower leaf surfaces and petioles. The lesions tended to coalesce when infection was heavy. A white encrustation appeared at or near the center of the lesion as the conidia in acervuli

Table 1. Occurence of potentially pathogenic fungi from 102 *Salix babylonica* trees in the willow blight survey of south coastal British Columbia, 1973-74

Fungus	Number of trees infected
Marssonina salicicola (M.s.)	**35**
Pleurophomopsis salicicola (P.s.)	15
Cytospora sp. (C. sp.*)*	**0**
M.s. + P.s.	28
M.s. + C. sp.	**11**
P.s. + C. sp.	**5**
M.s. + P.s. + C. sp.	*5*
Nil	**3**

approached maturity. If infection was heavy, particularly on petioles, there was considerable defoliation. On shoots the early symptoms were similar to those found on leaves, but the infection followed one of two courses. Where the fungus grew rapidly, girdling of the young shoot took place, resulting in death of the twig beyond the lesion. Where the fungus grew slowly, the bark split longitudinally in the necrotic area forming a canker. In the necrotic area bordering the canker, acervuli appeared as dark brown to black, shiny, raised areas. They split when mature and released conidia. When growth of the fungus was retarded, and particularly where the lesions were coalescent, there was considerable swelling of the twig and it took on a roughened, somewhat, spindle-shaped appearance. On these more mature twigs, cankers appeared to be self-limiting, considerable healing took place, and little wood remained exposed.

The diagnostic criteria of the *Marssonina* agree well with those given by Rimpau (25) for *Marssonina salicicola* (Bres.) Magn. He also described *M. salicicola* as the only *Marssonina* species on *Salix babylonica.* The *Marssonina* species found in this survey has been confirmed as *Drepanopeziza sphaeroides* (Fr.) Nannf., st. conicl. *Marssonina salicicola* (Bres.) Magn., by Dr. J. Bisset, Biosystematics Research Institute, Agriculture Canada, Ottawa; herbarium accession DAOM **16091**4.

Pleurophomopsis sp.

The second most abundant fungus found during the survey was a *Pleurophomopsis* species. Though lesions on leaves and shoots could be found early in the season, direct evidence of the fungus could not be found at this time. Unlike *M. salicicola,* the first fruiting bodies (pycnidia) were not found until late July.

Symptoms of *Pleurophomopsis* infection on twigs were much the same as those given for *M. salicicola.* At first the lesions on young shoots were minute black spots. As the infection progressed, the lesions increased in length up to about 20.0 mm. and were oval shaped or completely girdled the twig. As a lesion matured, the bark split and the edges became slightly raised. At this time pycnidia were readily seen in the necrotic tissue bordering the split and under the edges of the raised bark. On lesions resulting from the previous year's infection, almost completely exposed pycnidia were evident. During wet weather in spring and early summer, these pycnidia discharged masses of conidia, and as the season progressed a great many empty pycnidia were found.

The *Pleurophomopsis* has been identified by Dr. J. Bisset as *Pleurophomopsis salicicola* Petr., **DAOM 16091**5.

Cytospora sp.

The third and least abundant fungus found associated with blighted trees was a *Cytospora* sp. Although the *Cytospora* sp. was found on blighted trees, its pathogenicity has been questioned. Peace (25) considers no species of *Cytospora* to be a parasite of *Salix in* Britain. He notes that when it is found on dead twigs, they have been killed or severely weakened by some other agent.

There is also much confusion regarding the taxonomy of the genus. Dennis **(16)** considers the genus to be in urgent need of revision, and suggests that separation of the species is extremely difficult. He is also of the opinion that many of the named species are in fact the same and have been named because of their appearance on a particular host. Hepting (19) is of much the same opinion, stating that there are in fact probably fewer species than are found in the literature.

Considering these opinions, it was decided that to spend time on the diagnostic details of the *Cytospora* sp. would not serve any useful purpose. It is sufficient to note that a *Cytospora* sp. was found on dead twigs of ***S. babylonica,*** but that it was not likely a major blight pathogen.

Discussion

The results of the survey indicate that *Marssonina salicicola* (Bres.) Magn. is the major pathogen in the weeping willow blight disease in coastal British Columbia. Previous reports of *M. kriegeriana* could very well be in error as there are no published records of the criteria used in the original identifications for this area. The identification of a *Marssonina* sp. as a major pathogen has implications for control, as methods developed on other hosts may also be effective on weeping willow (3).

The widespread occurrence of *Pleurophomopsis salicicola* Petr. associated with the disease is an interesting discovery warranting further investigation.

The fact that neither of the classical blight pathogens *Pollacia saliciperda* (All. & Tub.) Arx. and *Physalospora miyabeana* Fukushi were found in this survey suggests that ***S. babylonica*** **L.** is highly resistant to these pathogens. This agrees with Hepting (19) but not with Peace (24), Barr (1), or Conners **(6)**. Unfortunately, the few published records rarely combine careful identifica-

tion of both pathogen and host so that the whole question of susceptibility remains in doubt. In south coastal British Columbia, S. *babylonica* is the only willow commonly grown in cultivation; a number of native Salix spp. do occur in the area, but they are of no economic importance and their disease status has not been studied.

It is apparent that the causal organisms of willow blight differ geographically and with host species. Identifications based solely on symptomatology and old host records should be treated with reservation.

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