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POPLAR PATHOLOGY SURVEYS AND RESEARCH IN THE PACIFIC REGION

Brenda Callan, Mycologist
Forest Insect and Disease Survey

A four-year FRDA-funded project entitled "Pathology Study: development of diagnostic tools for poplar disease in British Columbia" is in progress, under the supervision of B. Callan. This project aims to increase understanding of Populus diseases in B.C. An up-to-date host fungus checklist for native and hybrid Populus species and a diagnostic guide to the most common poplar pests will be two key products of this project.

Many collections have been made during special forays aimed at gathering information on incidence and distribution of aspen, hybrid and balsam poplar and cottonwood diseases. These collections augment historical records and add to data collected during the course of normal Forest Insect and Disease Survey collections. A summary of the more important Populus diseases encountered over the first two years (1991-1992) of this project, plus some historical information, is presented in the remainder of this report.

The host-fungus checklist is nearing completion. New host records, especially for saprophytic fungi, are being found continuously. This indicates that the checklist will be a preliminary documentation of poplar fungi in B.C., identifying distribution gaps and other previously undocumented host-fungus associations. By the end of the project, an accurate assessment of the major poplar diseases, their distribution, and relative importance will be available.

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PRELIMINARY DISEASE SURVEY RESULTS

Cankers and rots

Trembling aspen disease concerns in B.C. differ from those in other aspen-rich areas in North America. Hypoxylon canker, caused by the fungus Hypoxylon mammatum, can cause widespread severe damage to trembling aspen in many regions of North America. However, it appears to be relatively rare in B.C., with approximately twenty historical records, mostly from areas around Prince George and Kamloops. In the past two years only one confirmed collection has been made, from a single standing dead tree in Prince George.

In mature and overmature trembling aspen stands, large diffuse blackened cankers (sooty-bark cankers) caused by the cup-fungus Encoelia pruinosa (Cenangium singulare), are prevalent in the Prince George, Fort Nelson and Dawson Creek districts. Although they are different in appearance, sooty-bark cankers have sometimes been confused with Hypoxylon cankers in field surveys. Stands assumed to be damaged by H. mammatum should be rechecked and collections made to confirm identification of the pathogen.

The primary cause of cankers on all wounded, frost or sun-damaged Populus species throughout B.C. is the oportunistic Valsa sordida (also known as Cytospora canker), which causes a characteristic orange internal discoloration of bark around elongated sunken or cracked lesions. During damp weather, orange spore tendrils may be exuded from discolored bark. These symptoms differ from commonly-encountered damage caused by the poplar borer (Saperda calcarata), in which the orange discoloration is a shiny external sap exudate originating from insect entrance holes which are often marked by frass.

In crowded decadent aspen stands, root decay centres caused by Armillaria sinapina have been recently encountered in the Prince George Region. Historical FIDS records are scanty, but have been augmented by culturally confirmed identifications made by Duncan Morrison, root rot pathologist at the Pacific Forestry Centre. The majority of these older records also come from aspen stands around Prince George. Root disease centres usually have fallen or standing dead trees in the centre, and dying trees at the periphery. Armillaria root rot is a potential problem and may contribute to yield declines where it occurs in naturally regenerated stands. Black cottonwood, balsam poplar and hybrid poplars in natural stands and plantations are also potentially affected by Armillaria root rot, but severity and distribution has not yet been well documented.

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One of the most economically damaging aspen pathogens is Phellinus tremulae, a fungus which lowers wood value in the incipient stage by causing a red-brown stain, and later becomes structurally damaging as a white heart rot. Phellinus tremulae has been documented in mature aspen stands throughout the tree's range in B.C. Within stands, however, decay and stain are extremely difficult to detect in every tree unless the external sign of a conk is present.

All of the above pathogens cause more damage when combined with other factors debilitating the host. Hence, increased incidence of root rots and cankers may be expected in regions where aspen and other Populus spp have been severely and repeatedly defoliated by insects. Examples of such locations are Williston Lake (four consecutive years, large aspen tortrix), the Prince George region (nine consecutive years, forest tent caterpillar) and Prince Rupert (northern tent caterpillar).

Hybrid poplar plantations

Several paper companies have well-established hybrid poplar stool beds and variously-aged plantations, most of which are located on Vancouver Island and the lower mainland. Primary pathology concerns to date are directed towards diseases of young plantations.

In one plantation on Vancouver Island, newly-planted whips were partially damaged or completely killed by fungi causing "blackstem". The fungus primarily involved is Phomopsis oblonga, but Cytospora canker (Valsa sordida) was occasionally present. Sunscald, drought and other stress factors contribute to blackstem when inoculum, either from contaminated cuttings or nearby diseased trees, is present.

Two closely related species of fungi, Mycosphaerella populorum (Septoria musiva) and M. populicola (S. populicola) can cause severe cankering problems in plantations elsewhere in North America, but incidences of Septoria cankers in B.C. are so far rare. Both fungi are present in hybrid poplar plantations and natural cottonwood stands, but damage has been limited to light defoliation from leaf spots. Some clones in trials have been severely defoliated, but none of those used in the actual plantations have been heavily affected.

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Conversely, leaf blotching and leader dieback caused by Venturia populina has damaged young hybrid poplar plantations on Vancouver Island. The cool moist coastal climate increased inoculum and susceptibility to the extent that heavy foliar damage resulted. Dieback of leaves and petioles to the leader frequently resulted in cankers and leader breakage. The latter has not been encountered elsewhere.

Large irregular leaf blotches caused by the fungus Linospora tetraspora have caused low to moderate foliar damage to plantations in the Fraser River delta.

Leaf rusts

Two native leaf rusts frequently cause moderate to high defoliation throughout the range of native Populus species. As with most foliar diseases, young trees (regeneration) are most damaged from repeated defoliation. Alternate hosts are conifer species (pine, fir, Douglas-fir, spruce, hemlock). The rust must alternate through the conifer host in order to complete its life cycle and reinfect the Populus host the following season. Melampsora medusae attacks trembling aspen, and M. occidentalis attacks cottonwood and balsam poplar. The hybrid poplars used in plantations are generally resistant to native rust strains.

The potential introduction of two non-native leaf rusts pose a serious threat to the health of hybrid poplar plantations in British Columbia. In the fall of 1991, these fungi were introduced into hybrid poplar plantations along the lower Columbia River in the United States. The first rust detected in the fall was a strain of M. medusae which caused severe defoliation of hybrid poplars. The rust overwintered and appeared again this year. Later in the fall of 1991, a second rust was detected, and its identity as M. larici-populina was confirmed in the spring of 1992. It is Eurasian in origin and has not been previously detected on North America. To date M. larici-populina is present in two plantations at low levels, it has also overwintered and was detected again in 1992. Both rusts have alternate conifer hosts where they are established elsewhere in the world. However, they have not yet been detected on conifers in the U.S., which indicates that at least in the United States, they can overwinter on hybrid poplar. Potential damage to conifers is low.

If these two rusts were to become established in British Columbia, there is no reason to doubt that they will be damaging to hybrid poplar plantations. In fact, M. larici-populina is most damaging in countries with cooler climates. Repeated defoliations within a single growing season may occur. Hybrid poplar

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plantations on Vancouver Island and along the Fraser River are at risk from these pathogens as the wind-borne rust spores are easily spread long distances. Rust spores and mycelium can be easily overlooked on imported propagation material, so care should be taken to import material only from rust-free areas.

CONCLUSIONS

Both historical data and this pathology project clearly show that many Populus disease problems in British Columbia are unique to this province.

Additional pathology surveys and collections will be made in the next two years. Apart from the checklist and guidebook, other publications such as this periodic pest report will be generated. In addition, a large slide and herbarium collection of poplar diseases is being compiled.

Populus disease samples may be sent for diagnosis to the Forest Insect and Disease Survey, Pacific Forestry Centre, 506 West Burnside Road, Victoria, B.C.