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EURASIAN POPLAR LEAF RUST - MELAMPSORA LARICI-POPULINA AND MELAMPSORA MEDUSAE ON HYBRID POPLARS

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Recently, two rust fungi have been introduced into hybrid poplar plantations in the United States, with potentially damaging results. This pest report describes these fungal pathogens and the diseases they cause, and discusses the potential damage to native and hybrid poplars in Canada. Currently, neither pathogen has been detected in Canada. Importers of poplar propagation stock are cautioned about the risks of accepting cuttings from infected areas.

1) INTRODUCTION TO U.S. HYBRID POPLAR PLANTATIONS:

a) Melampsora medusae

In the fall of 1991, a leaf rust on commercial hybrid Populus trichocarpa X deltoides (TXD) plantations along the lower Columbia River was reported and identified as Melampsora medusae. This species of rust is endemic in North America, but until now was pathogenic to trembling aspen (Populus tremuloides), but not the hybrid poplars or cottonwoods (Populus trichocarpa). The original disease locus was a commercial plantation of 5 - 50 ha - sized monclonal blocks of a total of 11 clones. **This new strain of M. medusae caused defoliation by early fall of several different clones in large hybrid poplar plantations along the lower Columbia River. The rust overwintered, and is reappearing this year.**

b) Melampsora larici-populina

This rust was found in late fall 1991, again in the lower Columbia River hybrid poplar plantations, with the identification confirmed in the spring of 1992 by USDA and Forestry Canada scientists. It is Eurasian in origin and has not previously been detected in North America. **To date, M. larici-populina is present in only two plantations at low levels, and damage to the hybrid poplars is not severe, but it has overwintered and was detected again in 1992.**

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2) KNOWN HOST RANGES

Both rusts are heteroecious, and have alternate conifer hosts. The rusts produce inconspicuous aecia on conifer needles and cause little damage unless they occur in high infection levels in nurseries on exotic hosts (i.e. Pinus radiata). However, the recent damage from the uredinial state of M. medusae on hybrid poplars in Oregon is high, and expected to increase, as many cycles of urediniospore production may occur over a growing season.

In contrast, damage from M. larici-populina is low, but the USDA Pest Risk Assessment for this rust states that the probability of the successful colonization of the rust is rated as high. To date, it has been detected in the U.S.A. on poplars only; coniferous hosts around the infected plantations have been monitored closely, but only the native rusts have been detected on them. Populus alba and P. deltoides are resistant, and there have been no reports of M. larici-populina on P. tremuloides or P. grandidentata.

A general host range is listed below based on current literature. The two native species of Melampsora damaging to Populus are included for comparison purposes.

Native poplar rusts:

1) M. occidentalis

a) deciduous hosts: Populus trichocarpa, P. balsamifera, some hybrid poplars
Note: the TXD clones used in the plantations and trembling aspen are resistant to this rust.

b) coniferous hosts: Larix, Pseudotsuga, Pinus, Abies, Picea.

2) M. medusae

a) deciduous hosts: Populus deltoides, P. tremuloides, P. balsamifera.
Note: P. trichocarpa and TXD hybrids were previously resistant to endemic forms of this rust.

b) coniferous hosts: Larix, Pseudotsuga, Pinus, Abies, Picea, Tsuga.

Introduced poplar rusts:

1) M. medusae

a) deciduous hosts: As above for the native M. medusae, but TXD hybrids are also susceptible.

b) coniferous hosts: Not yet determined; telia have been observed to germinate too early in the spring for the basidiospores to infect Douglas-fir.

2) M. larici-populina

a) deciduous hosts: Populus spp, including deltoides, maximowiczii, nigra, nigra italica, balsamifera, and trichocarpa. Hybrids: P. x canadensis, P. deltoides x trichocarpa, P. deltoides x nigra. All show varying degrees of resistance.

b) coniferous hosts: Larix. New Zealand also reports Pseudotsuga menziesii as a host.

3) HOST RANGE TESTING FOR NORTH AMERICAN TREES

North American host range tests on Populus for M. larici-populina are being undertaken by scientists at Washington State University, and preliminary results show that native P. trichocarpa, as well as TXD clones and other hybrids, were susceptible. P. alba and P. deltoides were resistant. Tests on the host ranges for the alternate conifer hosts are not yet complete. Thus, cottonwoods and hybrid poplars grown in North America are susceptible.

THE RUST DISEASE CYCLE - SPREAD

Rust infestations in poplars can start one of two ways; by infection in the spring by aeciospores produced on needles of the alternate coniferous host, or by urediniospores produced from overwintering rust mycelium established in buds of the poplar host. In the latter form it would be extremely difficult to detect in imported propagation material. Most commonly in the native Melampsoras, both conifer and deciduous hosts are required for re-infection to occur in the spring. The rust typically overwinters in telia on fallen poplar leaves. The telia germinate in the spring to produce basidiospores which infect the coniferous host. Aeciospores produced on the conifers then infect the poplars.

Urediniospores can travel great distances by wind, and have also been collected and carried by bees.

WORLD DISTRIBUTION RANGES

Melampsora medusae is found throughout North America, and also in Argentina, Japan, France and Australia.

Melampsora larici-populina is widespread in Europe, Asia, Africa, and South America. It became established quickly after introduction to Australia and New Zealand, around the same time that M. medusae was also introduced to these two countries.

CURRENT AND POTENTIAL DAMAGE TO HYBRID POPLARS IN KNOWN EPIPHYTOTICS: POTENTIAL SPREAD TO CANADA

Melampsora medusae has already been observed to cause premature yellowing and leaf loss in the U.S. hybrid poplar plantations. It has already become established as a damaging pathogen. Decrease in growth, increased rotation times, and susceptibility to other opportunistic pathogens and adverse environmental conditions may be expected.

Although it has not yet caused great damage in North America, M. larici-populina is considered to be the most widespread and damaging poplar rust in Europe. There is no reason to believe that it will not also be damaging in Canada, especially as optimum growth occurs in countries with cooler climates. Repeated defoliations within a single growing season may occur, with successive new flushes of leaves attacked and killed.

Hybrid poplar plantations on Vancouver Island and along the Fraser River are at risk from these pathogens. The rusts are easily spread long distances by wind-borne urediniospores, and some scientists believe that they spread from Australia to New Zealand in this manner. Some of the ornamental poplars are susceptible and could act as disease repositories.

Many susceptible species, including Lombardy poplars and hybrid poplars, are commonly used as windbreaks and prairie shelter belts. These could potentially sustain severe damage. Larch would sustain negligible damage.

CURRENT STATUS OF DISEASE CONTROL

At this time, M. medusae is well established in the Oregon hybrid poplar plantations, and would be extremely difficult to eradicate.

Melampsora larici-populina has only been established in two, smaller areas, and is present at low enough levels that eradicate control measures could still be applied. Such measures have not been undertaken at this time, however. Alternatively, fungicides sprayed on M. larici-populina infested plantations to control rust sporulation might be considered until more radical control measures are decided upon.

The best control measures for these rusts lie in breeding resistant clones. Genetic resistance would be harder to maintain if the rusts are able to complete their life cycles on their alternate hosts. This would increase the likelihood of recombination, and consequent formation of new races. Large monocultures of a few clones also encourages a rapid breakdown of resistance.

Cultural practices may also contribute to disease severity. If nurseries are not adjacent (< 0.8 km) to stands of potential alternate coniferous hosts, there is less likelihood of establishing early season infections. Heavy fertilization encouraging rapid growth also contributes to heavy rust damage.

Discussions on quarantine actions have taken place, but regulations and their enforcement will take time to implement. The most immediate action should be voluntary, extreme caution on the part of propagators and others importing stock from known infected areas. Material with incipient infections in dormant buds would not be detected until after it was planted.

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