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Data Sheets on Quarantine Pests

Melampsora farlowii

IDENTITY

Name: *Melampsora farlowii* (J.C. Arthur) J.J. Davis
Synonyms: *Chrysomyxa farlowii* Saccardo & Traverso
Necium farlowii J.C. Arthur
Taxonomic position: Fungi: Basidiomycetes: Uredinales
Common names: Hemlock rust (English)
Hemlocks-Tannen-Rost (German)
Bayer computer code: MELMFA
EPPO A1 list: No. 15
EU Annex designation: I/A1

HOSTS

The principal hosts are *Tsuga canadensis* and *T. caroliniana*. Some *Tsuga* spp. have been introduced as ornamental trees and *T. heterophylla* is a relatively important forest species in some EPPO countries (though not recorded as a host of *M. farlowii*).

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (Nova Scotia), eastern USA (Michigan, New Hampshire, New York, North Carolina, Pennsylvania, Vermont, Virginia, Wisconsin), mainly at higher altitudes in the southern part of its range.
EU: Absent.
Distribution map: See CMI (1982, No. 546).

BIOLOGY

M. farlowii is an autoecious leaf and twig rust of which only the teliospore stage is known. Telia overwinter on twigs and cones killed the previous spring, and spore release coincides with hemlock bud burst. Teliospores germinate in place, producing abundant basidiospores from early May to June. These spores infect the current season's leaves; further telia appear within 2-3 weeks of infection, although the spores within them will not germinate until the following spring.

Incidence of the disease is affected by rainfall, the duration of which is more important than the amount; short showers often do not last long enough for basidiospores to be produced. At least 10 h of rain appear necessary for basidiospore production, dew being insufficient for teliospore germination. Disease severity seems to vary with altitude; it was reported as being severe in nurseries at 1200 and 1300 m and practically absent from a nursery nearby at 830 m; it may be that the lower temperatures at higher altitudes favour development of the fungus.

For additional information, see Hepting & Toole (1939), Peace (1962), Hepting (1971).

DETECTION AND IDENTIFICATION

Symptoms

The first symptom in the spring is a yellowing of the new leaves, one month or so after bud burst. Seven to 10 days later, the shoots at the leaf bases turn orange and then become flaccid, causing the shoots to droop. Most needles absciss from the region of infection to the tips of the shoots. The latter curl up as the season progresses but remain on the tree a year or more, so giving the latter a singed appearance.

Infected cones remain closed, do not produce seed and are frequently discoloured, shrivelled and mummified. Small swollen places on the cone scales indicate the presence of telia.

Nursery-grown hemlocks, 0.6-5 m high, are especially liable to severe attack although trees up to 26 m may also be infected.

Morphology

Telia hypophyllous and on cones, waxy, reddish, linear, confluent, composed of single palisades of sessile teliospores that form just beneath and within the epidermis. Teliospores oblong or cylindric, wall pale-brown, smooth, uniformly 0.5-1 µm thick or slightly thicker above; 7-10 x 35-58 µm. Basidiospores spherical, reddish yellow, with an average diameter on germination of 8 µm. Pycnia, aecia and uredia have not been found.

For additional information, see Arthur (1962).

MEANS OF MOVEMENT AND DISPERSAL

Under natural conditions the spread of the disease is ensured by teliospore dispersal. In international trade, *M. farlowii* is liable to be carried on infected host planting material.

PEST SIGNIFICANCE

Economic impact

This is the most destructive rust attacking *Tsuga* spp., particularly *Tsuga canadensis*. In commercial nurseries raising ornamental trees in the southern Appalachians, *Tsuga* plants a few years old are often rendered unsaleable following attack. In addition to causing death and malformation of branches, the disease also causes abortion of newly formed cones.

The rust could cause damage to *T. heterophylla* which is a relatively important species in some EPPO countries, and could increase in importance. Since *M. farlowii* occurs commonly in north-eastern North America, it is reasonable to expect that its optimum development at lower latitudes would be at higher elevations.

Control

Weekly spraying with lime-sulfur during May gives some control.

Phytosanitary risk

M. farlowii is listed as an A1 quarantine organism by EPPO (OEPP/EPPO, 1980) and IAPSC. In the EPPO region it is potentially dangerous to all *Tsuga* spp. wherever grown.

PHYTOSANITARY MEASURES

EPPO recommends (OEPP/EPPO, 1990) that all countries should prohibit importation of plants for planting and cut branches of *Tsuga* spp. from North America.

BIBLIOGRAPHY

Arthur, J.C. (1962) *Manual of the rusts in United States and Canada*. Purdue Research Foundation, Purdue, Indiana, USA.

CMI (1982) *Distribution Maps of Plant Diseases* No. 546 (edition 1). CAB International, Wallingford, UK.

Hepting, G.H. (1971) Diseases of forest and shade trees of the United States. *Agricultural Handbook, Forest Service, US Department of Agriculture* No. 386, 489-492.

Hepting, G.H.; Toole, E.R. (1939) The hemlock rust caused by *Melampsora farlowii*. *Phytopathology* **29**, 463-473.

OEPP/EPPO (1980) Data sheets on quarantine organisms No. 15, *Melampsora farlowii*. *Bulletin OEPP/EPPO Bulletin* **10** (1).

OEPP/EPPO (1990) Specific quarantine requirements. *EPPO Technical Documents*, No. 1008.

Peace, T.R. (1962) *Pathology of trees and shrubs*. Oxford University Press, Oxford, UK.