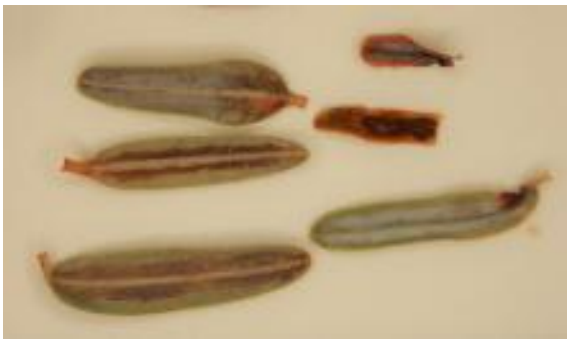
EPPO Datasheet: *Melampsora farlowii*

Last updated: 2023-03-20

IDENTITY

Preferred name: *Melampsora farlowii*
Authority: (Arthur) Davis
Taxonomic position: Fungi: Basidiomycota: Pucciniomycotina: Pucciniomycetes: Pucciniales: Melampsoraceae
Other scientific names: *Chrysomyxa farlowii* (Arthur) Saccardo & Traverso, *Necium farlowii* Arthur
Common names: hemlock twig rust, rust of hemlock, rust of tsuga
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: MELMFA



more photos...

Notes on taxonomy and nomenclature

Melampsora farlowii is an autoecious, microcyclic rust fungus with a telial stage and teliospores. Teliospores can germinate and produce basidia and basidiospores. The fungus species was first considered under the monotypic genus *Necium* J.C. Arthur, as *N. farlowii*, because of its host range and unique life cycle (Arthur 1907). Later on, Saccardo and Traverso (1910) considered the fungus under the genus *Chrysomyxa* as *C. farlowii*. Finally, Davis (1915) transferred this taxon from *Necium* to the genus *Melampsora* as *M. farlowii*.

Tsuga is a common host for the aecia of the macrocyclic (=long-cycled) rust *Melampsora abietis-canadensis* and for the telia of the microcyclic (=short-cycled) *M. farlowii*. *M. abietis-canadensis* and *M. farlowii* may be considered as 'correlated species' occurring on *Tsuga* (Arthur, 1934; Jackson, 1931).

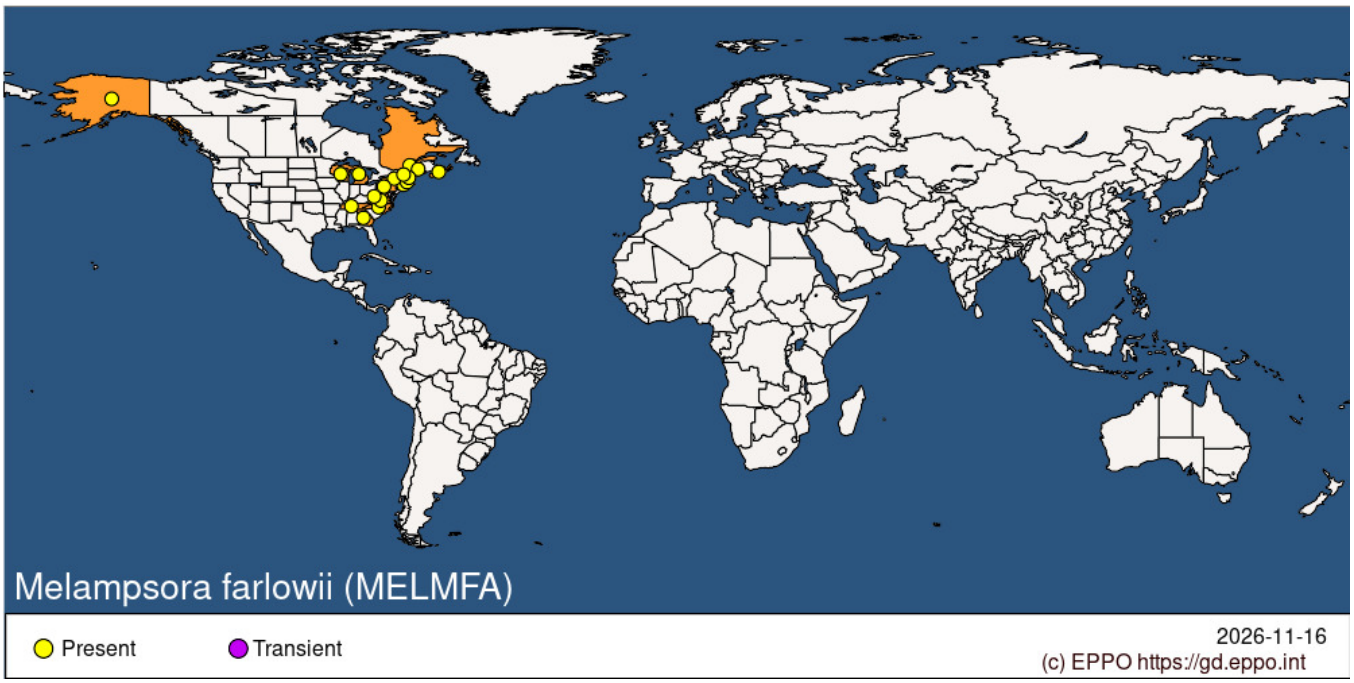
HOSTS

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

Host list: *Tsuga canadensis, Tsuga caroliniana, Tsuga sp.*

GEOGRAPHICAL DISTRIBUTION

Hemlock rust caused by *Melampsora farlowii* has only been reported from eastern North America and Alaska, so far. In Canada, the pathogen is reported in Nova Scotia and Quebec on *Tsuga canadensis*. In the USA, the disease is reported as present in Alaska, Connecticut, Georgia, Maine, Massachusetts, Michigan, New Hampshire, New York, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin on *T. canadensis* and from North Carolina on *T. caroliniana* (Hepting and Toole 1939; Kenaley and Hudler, 2010; MyCoPortal, 2023). The rust fungus is found mainly at higher altitudes in the southern part of its range (CABI, 2019).



North America: Canada (Nova Scotia, Québec), United States of America (Alaska, Connecticut, Georgia, Maine, Massachusetts, Michigan, New Hampshire, New York, North Carolina, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, Wisconsin)

BIOLOGY

Melampsora farlowii is a microcyclic, autoecious rust on *Tsuga*, affecting leaves, twigs and cones, and for which only the telial and basidial stages are known. Telia overwinter on twigs and cones killed the previous spring, and spore release coincides with hemlock bud burst. Given favourable meteorological conditions (i.e., cool, wet weather), teliospores germinate in place, producing abundant basidiospores from early May to June. These basidiospores infect the current season's leaves and cones; further telia appear within 2-4 weeks of infection. Telia mature throughout the growing season and represent the overwintering state of the fungus as sori on cones and twigs, giving rise to basidiospores the following spring (Hepting and Toole, 1939; Hepting, 1971; Kenaley and Hudler, 2010; Peace, 1962).

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. In spring (late April – early June), ten or more continuous hours of precipitation appear to be required for teliospore germination and the resultant production of basidiospores. Dew is insufficient for teliospore germination. Thus, cool (10 –18° C), wet weather lasting greater than one-day is sufficient for teliospore germination and the production of basidiospores. 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 (CABI, 2019; Hepting and Toole, 1939; Kenaley and Hudler, 2010).

DETECTION AND IDENTIFICATION

Symptoms

Melampsora farlowii causes shoot blight and shoot curl of the current season’s shoots of *T. canadensis* and *T. caroliniana*. Leaves, cones and twigs are generally attacked. In addition to causing death and malformation of branches, the disease also causes abortion of newly formed cones. 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. Uninfected needles drop from affected twigs resulting in few needles remaining on the twig at points distal to the point of infection. Infected twigs later curl as the fungus invades

the vascular tissue and remain on the tree for a year or more. 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. Aborted cones often persist on affected trees (Hepting, 1971; Hepting and Toole, 1939; Kenaley and Hudler, 2010).

Hemlock rust can be destructive on *Tsuga* spp., particularly *T. canadensis* in nurseries. Nursery-grown hemlocks, 0.6-5 m high, are especially liable to severe attack. However, in the forest, this rust apparently does little damage, killing only occasional twigs and aborting cones, although trees up to 26 m may also be infected. Since diseased cones produce no seed, the rust can also affect the seed crop (CABI, 2019; Hepting and Toole, 1939; Hepting, 1971; Kenaley and Hudler, 2010).

Morphology

Telia are hypophyllous, occasionally epiphyllous and on cones and twigs, waxy, reddish to rust-brown, linear, confluent, composed of single palisades of sessile teliospores that form just beneath the epidermis (subepidermal). Teliospores are oblong or cylindric (7-10 x 35-58 µm), teliospore wall is yellowish-brown, smooth, uniformly 0.5-1 µm thick or slightly thicker on the upper part. Basidiospores are spherical, reddish yellow, with an average diameter of 8 µm. Spermogonia, aecia and uredinia have not been found (Arthur 1934, Kenaley and Hudler 2010, Peace 1962).

Detection and inspection methods

The disease can be identified based on symptoms and morphological descriptions of telia, teliospores and basidiospores previously described on this datasheet (see Detection and identification part).

The disease is detected by inspecting the abaxial surface of the needles or twigs for waxy linear telial pustules that are subepidermal, reddish to rust-brown and remaining covered. The fungus can be positively identified on the basis of symptoms and morphological features. *Melampsora farlowii* is the only rust fungus with a telial state has been reported on *Tsuga* spp.. It can be distinguished by its 1-celled, sessile, laterally adherent oblong or cylindric teliospores (Arthur, 1934; EFSA PLH Panel, 2018; Kenaley and Hudler, 2010).

PATHWAYS FOR MOVEMENT

Under natural conditions the spread of the disease is ensured by basidiospore dispersal (CABI, 2019). In international trade, *M. farlowii* is liable to be carried on infected host plants for planting.

PEST SIGNIFICANCE

Economic impact

Hemlock rust is the most destructive rust attacking *Tsuga* spp., particularly *Tsuga canadensis*. Although not generally a problem in forests in natural stands along the Appalachian range, hemlock twig rust can cause damage in commercial tree nurseries, where cultural conditions favour the development of the disease (Hepting and Toole, 1939; Kenaley & Hudler, 2010). In commercial nurseries raising ornamental trees, *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 (Hepting and Toole, 1939; Hepting, 1971).

Control

Kenaley and Hudler (2010) recommend spraying with triadimefon, neem oil or mancozeb once when buds break and twice at 7 - 14-day intervals in commercial nurseries. As inoculum produced within infected nursery beds or cultures will persist, it is also recommended to not plant susceptible *Tsuga* species in areas where disease is severe (Kenaley and Hudler 2010).

Phytosanitary risk

In the EPPO region *M. farlowii* is potentially dangerous to all *Tsuga* spp. wherever these are grown in particular in commercial nurseries. The rust could probably cause damage to *T. heterophylla* which is a relatively important forest species in some EPPO countries, and may increase in importance in the future. 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.

PHYTOSANITARY MEASURES

EPPO (EPPO, 2018) recommend that plants for planting (except seeds) and cut branches of *Tsuga* spp., should come from pest-free areas. In the EU, the importation of *Tsuga* plants other than fruit and seeds in prohibited from any non-European country (EFSA PLH Panel, 2018).

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Datasheet history

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EPPO (1980) Data sheets on quarantine organisms No. 15, *Melampsora farlowii*. *EPPO Bulletin* **10**(1), 9-12. https://doi.org/10.1111/j.1365-2338.1980.tb02687.x

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