Data Sheets on Quarantine Pests

Puccinia horiana

IDENTITY

Name: *Puccinia horiana* P. Hennings
Taxonomic position: Fungi: Basidiomycetes: Uredinales
Common names: White rust (English)
Rouille blanche (French)
Weisser Chrysanthemenrost (German)
Roya blanca (Spanish)
Bayer computer code: PUCCHN
EPPO A2 list: No. 80
EU Annex designation: II/A2

HOSTS

Chrysanthemums are the only host, especially the florists' cultivars, widely cultivated in glasshouses in the EPPO region.

GEOGRAPHICAL DISTRIBUTION

P. horiana originates in Japan and has spread to other Far Eastern countries, to South Africa, and from there to Europe.
EPPO region: Widespread in France (Grouet & Allaire, 1973); since about 1964, locally established in Austria, Belgium, Denmark (Jorgensen, 1964), Germany, Hungary, Italy (Matta & Gullino, 1974), Netherlands (Boerema & Vermeulen, 1964), Norway (Gjaerum, 1965; but declared eradicated in 1988), Poland (Zamorski, 1982; unconfirmed), Russia (Far East), Sweden (Akesson, 1983), Switzerland, Tunisia, UK (accepted as established in Great Britain since 1988 and in Northern Ireland since 1990), Ukraine and Yugoslavia (Dordevic, 1983). Reported but not established in Cyprus (1987, eradicated), Finland, Hungary (1989), Ireland (1977) and Luxembourg. Found in the past but eradicated in the Czech Republic.
Asia: Brunei Darussalam, China, Cyprus (reported but not established), Hong Kong, Japan, Korea Democratic People's Republic, Korea Republic, Malaysia, Taiwan, Thailand, Russia (Far East).
Africa: South Africa, Tunisia.
North America: Mexico, USA (outbreak in New Jersey and Pennsylvania in late 1970s; outbreaks in Oregon and Washington in 1990, declared eradicated; outbreak in California in 1991; under eradication since 1994).
South America: Argentina, Brazil, Chile, Colombia, Uruguay, Venezuela.
Oceania: Australia (declared absent despite interception reports, Walker, 1983; outbreak in Victoria in 1986, Catley, 1987), New Zealand (1965).
EU: Present.
Distribution map: See CMI (1989, No. 403). Walker (1983) has critically reviewed the distribution data.

BIOLOGY

P. horiana is an autoecious rust. The bicellular teliospores germinate *in situ* to produce unicellular basidiospores which are dispersed in air currents. No other spores are known. High humidity, and a film of moisture, appear to be necessary for the germination of both teliospores and basidiospores. Teliospores are capable of germination as soon as they are mature; germination and discharge of basidiospores occur between 4 and 23°C and, at the optimum temperature of 17°C, discharge of basidiospores starts within 3 h. Basidiospores can germinate over a wide temperature range and, at 17-24°C, either surface of the leaf may be penetrated within 2 h. Thus, only 5 h of wetness is sufficient for a new infection to become established. Within the leaf, abundant, hyaline, intercellular hyphae are produced with intracellular haustoria. The incubation period is normally 7-10 days, but short periods of high temperatures (over 30°C) can apparently prolong the period to 8 weeks.

There are reports that dispersal by wind can occur over distances of 700 m and more but, as the basidiospores are very sensitive to desiccation at less than 90% RH, long-distance spread would only be likely during very wet periods. The ability of the fungus to overwinter outdoors is unknown. In experiments, teliospores in sori on detached leaves survived for 8 weeks at 50% RH but, at higher humidities or when buried in dry or moist compost, they only survived for 3 weeks or less. It would, therefore, appear that infected debris is not likely to be important in the carry-over of the disease. Some chrysanthemum cultivars appear to be more susceptible than others and there is evidence that there is more than one pathotype of the fungus. For more information, see Water (1981).

DETECTION AND IDENTIFICATION

Symptoms

On leaves

Following infection, pale-green to yellow spots, up to 5 mm in diameter, develop on the upper surface. The centres of these spots become brown and necrotic with aging. On the corresponding lower surface, raised, buff or pinkish, waxy pustules (telia) are found. As the spots on the upper surface become sunken, so these pustules become quite prominent and turn whitish when basidiospores are produced. Telia are occasionally found on the upper leaf surface. Severely attacked leaves wilt, hang down the stem and gradually dry up completely.

On bracts and stems

Sori sometimes develop when crops are excessively affected.

On flowers

Infection has been recorded as necrotic flecking with occasional pustules (Dickens, 1970).

Morphology

Telia hypophyllous, rarely epiphyllous, compact, pinkish-buff to white, 2-4 mm in diameter. Teliospores on pedicels up to 45 µm long; pale-yellow, oblong to oblong-clavate, slightly constricted, 30-45 x 13-17 µm, with thin walls, 1-2 µm thick at sides, thicker commonly 4-9 µm at apex. Germination of teliospores can be observed *in situ*. Basidiospores hyaline, slightly curved, broadly ellipsoid to fusiform, 7-14 x 5-9 µm.

For more details, see Hennings (1901), Baker (1967), Punithalingam (1968).

Detection and inspection methods

The fungus can be positively identified on the basis of symptoms and morphological features. Numerous other rust fungi have been reported on chrysanthemums, but they can be distinguished by their teliospore shape, size, surface ornamentation and colour

(Punithalingam, 1968). For more information, see Stahl (1964), Baker (1967), Firman & Martin (1968).

MEANS OF MOVEMENT AND DISPERSAL

Natural spread is unlikely over long distances, and is limited even between glasshouses (or else it would never have been possible to contain the disease at all). The disease is normally carried on infected cuttings and plants, including cut flowers, of glasshouse chrysanthemums.

PEST SIGNIFICANCE

Economic impact

Until 1963, *P. horiana* was confined to China and Japan, where it is presumably important although little seems to be published concerning it (Yamada, 1956). However, it has since spread rapidly on infected imported cuttings and is now a feared and serious disease in nurseries in Europe, frequently causing complete loss of glasshouse chrysanthemum crops. Severe outbreaks occurred in England and Denmark, and these were at first successfully eradicated. The disease was similarly contained in France following an initial outbreak in 1967, but appeared again in 1971, and has since spread rapidly throughout the country causing extensive losses. At the present time, white rust is established in most western European countries, and statutory measures have been abandoned in these.

Control

Preventive spraying with fungicides is effective but costly (Water, 1981). Active ingredients found useful include oxycarboxin, triforine, benodanil, triadimefon, diclobutrazol, dibitertanol and propiconazole. Rattink *et al.* (1985) experimented with systemic fungicides in the nutrient recirculating system of chrysanthemums grown on rockwool. Dickens (1990), using a similar set of fungicides, found that only propiconazole had sufficient eradicative activity to be useful in a statutory campaign. For more details on fungicidal control, see also Zamorski (1982), Dickens & Potter (1983), Krebs (1985).

Srivastava *et al.* (1985) suggest that *Verticillium lecanii*, used for biological control of aphids on glasshouse chrysanthemums, will also control *P. horiana*.

Some chrysanthemum cultivars are resistant and breeding for resistance continues (Rademaker & de Jong, 1985; 1987). Grouet (1984) reviews white rust control in general.

Phytosanitary risk

P. horiana is an EPPO A2 quarantine pest (OEPP/EPPO, 1982) and is also of quarantine significance for IAPSC, JUNAC and NAPPO. Once established, chrysanthemum white rust is extremely difficult and costly to eradicate. The intensification of chrysanthemum production, with high plant densities in humid glasshouses, provides an ideal environment for the fungus. For many years, the UK and Ireland in particular have maintained phytosanitary measures against the disease, subjecting it to statutory control wherever found. The justification for this policy was argued in terms of cost-effectiveness by Lelliott (1984) and Pemberton (1988). Now that the UK has abandoned this policy, it is not clear whether other countries will find it necessary or opportune to maintain measures, especially if they import potted plants or cut flowers of chrysanthemums from infested countries in significant numbers. If importation is limited to planting material, exclusion might be a more realistic policy.

PHYTOSANITARY MEASURES

EPPO recommends (OEPP/EPPO, 1990) that planting material of chrysanthemums should come from a place of production regularly inspected and found free for 3 months beforehand. The fungus should also be absent from the immediate vicinity of the place of production. For cut flowers, visual inspection is sufficient. Veenenbos (1984) outlined the pre-export inspection and control system used to provide this guarantee in the Netherlands. Such systems are now viewed in that country as less and less acceptable from an environmental standpoint, since they depend heavily on intensive use of plant protection products and also interfere with biological control systems in glasshouses. For the few countries where the disease is still absent, these arguments tend to support continued exclusion.

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