European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Data sheets on pests recommended for regulation
Fiches informatives sur les organismes recommandés pour réglementation

Puccinia hemerocallidis

Identity

Name: *Puccinia hemerocallidis* von Thümen
Taxonomic position: Fungi: Basidiomycota: Pucciniomycetes: Pucciniales: Pucciniaceae
Notes on taxonomy and nomenclature: *Puccinia hemerocallidis* was described from telial material on *Hemerocallis flava* in Siberia (RU) (von Thümen, 1880), while its uredinial stage was described on *Hemerocallis longituba* in Japan (Dietel, 1899). At about the same time, another species *Puccinia funkiae* Dietel was described for an uredinial-telial rust on *Hosta albomarginata* in Japan (Dietel, 1898). Hiratsuka & Hasebe (1978) later concluded that the two fungi are taxonomically the same, and treated *P. funkiae* as a synonym of *P. hemerocallidis*. However, this treatment is questionable (see Hosts)
Common names: rust of daylily (English)
EPPO code: PUCCHM
Phytosanitary categorization: EPPO A2 List no. 346.

Hosts

P. hemerocallidis is a macrocyclic heteroecious rust. *Hemerocallis* spp. are its main, and probably its only (see below) uredinial-telial hosts. *H. flava*, *H. fulva*, *H. longituba*, *H. minor*, *H. thunbergii* (Hiratsuka & Sato, 1951), and their hybrids are the main forms of *Hemerocallis* spp. in cultivation. The spermogonial-aecidial hosts are *Patrinia* spp.: *P. scabiosaefolia* in Russia (Tranzschel, 1914) and in addition *P. gibbosa*, *P. rupestris*, *P. triloba* and *P. villosa* in Japan (Hiratsuka *et al*., 1992), although it is not clear that this has been conclusively demonstrated for each species. *Patrinia* spp. (*Valerianaceae*) are common wild plants in Japan and other Far Eastern countries, but do not occur naturally in other parts of the world. Some are grown as garden plants elsewhere to a limited extent.

According to Hiratsuka *et al*. (1992), who treat *P. funkiae* as a synonym, *P. hemerocallidis* also infects *Hosta* spp. However, this taxonomic treatment is based solely on the morphological similarity of the uredinial-telial stage, without any critical evaluation of the life cycle or host specificity. In the modern treatment of the *Liliaceae sensu lato*, *Hemerocallis* and *Hosta* are not closely related, belonging to different families (*Hemerocallidaceae* and *Hostaceae*). There are no published records of *P. hemerocallidis* on *Hosta* in areas where the species has been introduced.

Geographical distribution[1]

EPPO region: Russia (Primorski territory)
Asia: China, Japan, Republic of Korea, Russia (Primorski territory), Taiwan, Thailand
North America: Canada (2001), USA (first found in 2000)
Central American and Carribean: Panama (2006)
Oceania: Australia (reported in 2002, in south-east Queensland)
EU: absent.

Biology

P. hemerocallidis, a macrocyclic heteroecious rust, overwinters as dormant teliospores within tissues of the primary host *Hemerocallis*. The basidiospores produced in spring are dispersed by wind and infect the alternate host *Patrinia*, on which the fungus produces spermogonia and aecia. Aeciospores are disseminated by wind and infect *Hemerocallis* spp. again. On this host, the fungus produces urediniospores, which can reinfect the same host, and teliospores.

In the native range of *P. hemerocallidis*, winters are relatively severe, and *Hemerocallis* spp. die back to dormant buds in winter. *P. hemerocallidis* does not overwinter as vegetative mycelium within these dormant buds, nor can urediniospores persist on diseased leaves. Accordingly, overwintered teliospores are the sole source of primary infection in the disease cycle, and the presence of the alternate host *Patrinia* is essential for the life cycle to be completed.

In areas elsewhere in the world where *P. hemerocallidis* has been introduced, *Patrinia* spp. are not or hardly present, and this rust would accordingly not be expected to survive. However, it is now well established, for example in Midwestern and Southern USA. Williams-Woodward *et al*. (2001) suppose that the disease cycle in the USA is maintained entirely by vegetatively reproducing urediniospores. Recent genetic analyses have shown some genetic variability within the fungal populations found in North America (Hernández *et al*., 2002), which suggests that the fungus does pass through the spermogonial-aecidial stage on an alternate host (cultivated *Patrinia*, or possibly other *Valerianaceae*).

[1]An updated geographical distribution can be viewed on the EPPO website.

Detection and identification

Symptoms

The symptoms on *Hemerocallis* are typical of a *Puccinia* rust, and no confusion is possible as this is the only rust of this host. Leaf lesions first appear as chlorotic areas, visible on both surfaces of the leaf. Uredinia are produced on both leaf surfaces, but mainly the lower, and release masses of orange-yellow urediniospores, which may cover the entire leaf surface. Later in the season, telia appear among the uredinia on the lower leaf surface, appearing honey-brown at first turning reddish-brown and eventually blackish. Spermogonia and aecia on *Patrinia* are typical of *Puccinia*, but are not described here in detail because they are not likely to be encountered outside the native range of *P. hemerocallidis*.

Morphology

Uredinia are mostly hypophyllous, subepidermal in origin and soon become erumpent, yellow or orange-yellow and powdery. Produced singly on a short pedicel, urediniospores are subglobose or ellipsoid, (19-)21–31 × 16–23(-27) µm. The wall is evenly echinulate, colourless or pale-yellowish and evenly 2–3(-4) µm thick.

Telia are hypophyllous and subepidermal in origin, long, covered by host epidermis and blackish-brown. Teliospores are produced in locules surrounded by brown paraphyses, pedicellate, long ellipsoid or clavate (30-)34–73 × 12–25(-27) µm. The wall is 2–3 µm thick at the sides and 3–11 µm thick at the apex, smooth and brown. The pedicel is partially persistent, yellowish brown and up to 30 µm long.

Pathways for movement

P. hemerocallidis is locally dispersed by air-borne urediniospores (with basidiospores and aeciospores and basidiospores possibly significant if the alternate host is present). Urediniospores can be disseminated by wind or plant handling (e.g. hands, shoes, clothes of workers etc.). *Hemerocallis* is normally propagated vegetatively, by breaking up the clumps of rhizomes. If these carry living leaves, these can carry vegetative mycelium of the fungus for local dispersal. Long-distance spread can be ensured by trade in plants for planting.

Pest significance

Economic impact

P. hemerocallidis causes a serious disease of *Hemerocallis*, which can disfigure and destroy much of the foliage of a plant. There is little information available on the commercial importance of this rust in Japan, for nurseries or for gardeners, but it is causing serious problems in North America where it has been introduced.

Control

The main method of control is to remove and destroy infected foliage by cutting at soil level, and apply fungicides to the new growth. Overhead watering should be avoided as it favours urediniospore germination and infection. It is possible that rust-resistant cultivars of *Hemerocallis* will be developed.

Phytosanitary risk

Hemerocallis are common perennial garden plants throughout the EPPO region, and *P. hemerocallidis* would find suitable conditions to attack this host in most parts of the region. Though the alternate host *Patrinia* is hardly cultivated in Europe, its absence would not prevent spread of the disease, since the fungus can multiply and survive by urediniospore transmission only. Such spread would be more favoured in Southern Europe (where *Hemerocallis* plants retain foliage through the winter), than in the north (where the foliage normally dies down completely in winter).

The disease can spread readily under nursery conditions and lead to direct losses to growers through losses in quality. The introduction of *P. hemerocallidis* would lead to the application of fungicide treatments on a crop which so far hardly needed them. For the gardener, *Hemerocallis* are popular perennial plants, easy to grow and virtually pest and disease free. Introduction of this serious disease would much reduce their value as garden plants.

It can be noted that the Australian Quarantine and Inspection Service is now establishing phytosanitary measures (treatments of seeds and nursery stocks of *Hemerocallis*, *Patrinia* and *Hosta*) to prevent the entry of *P. hemerocallidis*.

Phytosanitary measures

P. hemerocallidis was added in 2007 to the EPPO A2 List, and endangered EPPO countries are therefore recommended to regulate it as a quarantine pest The pest is already native to part of the EPPO region (Primorskii territory, Russia), but the risk of further spread from that source is small. More significant is the fact that the fungus was detected in imported plants in UK in 2001, and destroyed, confirming that the pathway for entry exists (from the Far East or from North America). Given the epidemiology of the daylily rust fungus and its ability to survive as a latent infection, eradication may be difficult once the pathogen is introduced. The best strategy in the EPPO region is to exclude the pest from the greater part of the region where it does not occur, by requiring all imported plants for planting of *Hemerocallis* to originate from a pest-free area (and possibly also *Patrinia*, while recognizing that this constitutes an insignificant pathway in practice).

Acknowledgement

This datasheet was prepared by Dr I. M. Smith (former Director General of EPPO) on the basis of a datasheet of the Crop Protection Compendium.

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