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Data Sheets on Quarantine Pests

Gymnosporangium clavipes

IDENTITY

Name: *Gymnosporangium clavipes* (Cooke & Peck) Cooke & Peck
Synonyms: *Gymnosporangium germinale* Kern
Podisoma gymnosporangium-clavipes Cooke & Peck
Anamorph: *Caeoma germinale* Schweinitz
Roestelia aurantiaca Peck
Taxonomic position: Fungi: Basidiomycetes: Uredinales
Common names: Quince rust (English)
Notes on taxonomy and nomenclature: For information on the taxonomy of *Gymnosporangium* spp. see Kern (1973).
Bayer computer code: GYMNCL
EPPO A1 list: No. 253
EU Annex designation: I/A1 - as *Gymnosporangium* spp. (non-European)

HOSTS

The main aecial host is *Cydonia oblonga* (quince), but apples (*Malus pumila*) are also infected. These would be the most important crops at risk in the EPPO region. Species of *Amelanchier*, *Aronia*, *Chaenomeles*, *Crataegus*, *Mespilus* and *Photinia* have also been recorded as hosts. So has European pear (*Pyrus communis*), but the disease is of no importance on this host. Ziller (1974) notes that the host range of this species is wider than that of any other North American tree rust: in its aecial state it is known to parasitize 480 species in 10 genera. The main telial hosts are *Juniperus virginiana*, occasionally grown in central Europe as a timber tree or elsewhere as an ornamental tree or dwarf shrub, and *J. communis* (including subsp. *alpina*, syn. *J. sibirica*), a native species in eastern North America and through most of Europe, also much grown as various ornamental cultivars. It may be noted that these two *Juniperus* spp. belong respectively to subgenera *Sabina* and *Oxycedrus*, and that *G. clavipes* is the only *Gymnosporangium* sp. to have hosts in both subgenera. According to Peterson (1982), f.sp. *cupressi* occurs on *Cupressus*, rather than *Juniperus*, in Mexico and Guatemala.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (Alberta, British Columbia, Manitoba, Northwest Territory, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan), Mexico, USA (widespread).
Central America and Caribbean: Guatemala.
EU: Absent.
Distribution map: See CMI (1975, No. 121).

BIOLOGY

G. clavipes, like other *Gymnosporangium* spp., is heteroecious in that it requires *Juniperus* and rosaceous hosts of subfamily Pomoideae to complete its life cycle. Telia are produced on twigs and branches of *J. communis* or *J. virginiana* in the spring. In moist conditions, the telia germinate *in situ* and produce basidiospores which are dispersed and are able to infect nearby *Malus* or *Cydonia*.

Infection from basidiospores gives rise to pycnia borne on the surface of apple or quince fruits; they are visible from late spring to early summer. The most favourable conditions for infection are an extended wetting period (over 48 h) with a mean temperature over 10°C between the tight cluster and late pink bud stages (Aldwinckle, 1990). Later, aeciospores are produced inside tubular protective sheaths (peridia). The aeciospores are released when the peridium ruptures and are capable of being wind-borne over long distances to a *Juniperus* host. After germinating on the *Juniperus* host, an overwintering latent mycelium is produced. Infection of apple or quince does not persist after infected fruits have fallen. The telial state appears on *Juniperus* in the spring to begin the life cycle again. For more information see Peterson (1967).

DETECTION AND IDENTIFICATION

Symptoms

On *Juniperus*, *G. clavipes* causes slight fusiform swellings on twigs and larger branches (see Morphology). The fungus causes severe symptoms on fruits of its aecial hosts apple and quince. Dark-green lesions appear at the calyx end, extending to the core, and causing distortion of the fruit, without necessarily any obvious sign of rust. The fact that the lesions extend to the core distinguishes this species from *G. juniperi-virginianae* (EPPO/CABI, 1996), whose fruit lesions are only superficial (Aldwinckle, 1990).

Morphology

On *Juniperus*

Telia are small cushions of orange-brown spores, 1-3 mm in diameter, on or among the foliage. Teliospores are two-celled, ellipsoid, 20-28 x 35-60 µm, wall 0.5 µm thick, constricted at the septum, often having the upper cell broader than the lower, and often having distinctively long carrot-shaped swollen pedicels, 10-25 µm wide.

On apple and quince fruits

Aecia are roestelioid, fructicolous with the peridia white and tubular, 2 mm high x 0.4-05 mm diameter. Dehiscent at the apex and lacerate at the sides. The aeciospore mass is orange fading to white. Aeciospores are larger than in most other species, with a diameter of 28-36 µm. Details can be found in Laundon (1977).

Detection and inspection methods

The inspection of imported *Juniperus* which may have latent infection is particularly important. A secure quarantine procedure would involve retention under closed conditions for 2 years and frequent inspection during January-May.

MEANS OF MOVEMENT AND DISPERSAL

Under natural conditions, spread of *G. clavipes* is by basidiospore dispersal to apple and quince, and by wind-borne aeciospores to *J. communis* or *J. virginiana*. In international trade, plants of these two *Juniperus* spp. from North America are liable to be infected by *G. clavipes*. Like other *Gymnosporangium* spp., *G. clavipes* can be latent during winter (the probable importing period) and may not be detectable at pre-export phytosanitary

certification. Infection may also have remained latent on the plants in the previous growing season.

Introduction of *G. clavipes* on commercial importations of plants of apple or quince is very unlikely as leaves are not usually infected, and are in any case not persistent in the dormant stage. While fruits are the plant part normally infected, it is very unlikely that infected fruits would be harvested or meet quality standards for export.

PEST SIGNIFICANCE

Economic impact

G. clavipes can be severe on apple fruits in eastern North America, but is a less important pest than *G. juniperi-virginianae* (EPPO/CABI, 1996). Ziller (1974) knew of no reports of serious damage in western Canada.

Control

G. clavipes can be adequately controlled on apples by routine fungicide applications (e.g. sterol-inhibiting fungicides). Varietal differences in susceptibility of apple are known for *G. clavipes* (Warner, 1990). Suppression of the alternate hosts (*Juniperus communis* and *J. virginiana*) within a certain radius of orchards is recommended, but may be difficult as they are often present in private gardens.

Phytosanitary risk

G. clavipes is one of the non-European *Gymnosporangium* spp. listed as A1 quarantine organisms by EPPO (OEPP/EPPO, 1983). It is also listed as a quarantine pest by by COSAVE and IAPSC. Other *Gymnosporangium* spp. already occur on apples in Europe, e.g. *G. tremelloides* with *J. communis* as alternate host (Smith *et al.*, 1988). The severity of infection on apples (the important host) is determined by the proximity of infected alternate hosts. In practice, *G. tremelloides* is of very minor importance. In favour of the quarantine pest status of *G. clavipes* is the fact that it infects apple fruits, which is not the case for any European species, that it has a very wide host range on the Rosaceae, and that *J. communis*, widespread in Europe as a wild and cultivated species, is one of its alternate hosts. Against it is the fact that European apple rust, with the same alternate host, is in any case very easily controlled.

PHYTOSANITARY MEASURES

Measures such as those proposed for *G. juniperi-virginianae* would also be suitable for *G. clavipes* (EPPO/CABI, 1996).

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