

Data Sheets on Quarantine Pests

*Gymnosporangium yamadae***IDENTITY**

Name: *Gymnosporangium yamadae* Miyabe ex Yamada

Taxonomic position: Fungi: Basidiomycetes: Uredinales

Common names: Japanese apple rust (English)

Notes on taxonomy and nomenclature: For information on the taxonomy of *Gymnosporangium* spp. see Kern (1973).

Bayer computer code: GYMNYA

EPPO A1 list: No. 256

EU Annex designation: I/A1 - as *Gymnosporangium* spp. (non-European)

HOSTS

The main aecial hosts are apples (*Malus pumila*), and other *Malus* spp. Apples are an important crop throughout the EPPO region. The telial host is *Juniperus chinensis*, widely grown as an ornamental tree or dwarf ornamental, or bonsai plant.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.

Asia: China (Gansu, Guangxi, Hebei, Henan, Hunan, Jilin, Jiangsu, Liaoning, Shandong, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang), Japan (Hokkaido, Honshu), Korea Democratic People's Republic, Korea Republic.

EU: Absent.

Distribution map: See IMI (1994, No. 528).

BIOLOGY

G. yamadae, 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 stems of *J. chinensis* in spring. In moist conditions, the telia germinate *in situ* and produce basidiospores which are dispersed and are able to infect nearby apple trees. Infection of *J. chinensis* by *G. yamadae* is only annual, teliospores being produced for one year only.

Infection from basidiospores gives rise to pycnia borne on the upper surface of apple leaves; they are visible from late spring to early summer. Later, aeciospores are produced inside tubular protective sheaths (peridia) on the underside of the leaf. Fruit infection is rare for *G. yamadae*. The aeciospores are released when the peridium ruptures and are capable of being wind-borne over long distances to *J. chinensis*. After germinating on *J. chinensis*, an overwintering latent mycelium is produced. Infection of apple does not persist after infected leaves or fruits have fallen. The telial state appears on *J. chinensis* in the spring to begin the life cycle again. For more information see Tanaka (1922), Peterson (1967).

DETECTION AND IDENTIFICATION

Symptoms

On *Juniperus chinensis*, *G. yamadae* causes fusiform swellings on stems which can produce telial horns under wet conditions (see Morphology). On apple, the most conspicuous symptoms are the appearance of the aecia and pycnia on the leaves (see Morphology). On susceptible cultivars, *G. yamadae* can cause very severe defoliation. Infections on fruits are rare.

Morphology

On *Juniperus*

G. yamadae causes swelling of the stems, and the teliospores are produced on tongue-shaped yellowish-red telial masses, 3-5 mm long. The teliospores are two-celled, ellipsoid, 15-24 x 32-45 µm, wall 1-1.5 µm thick.

On apple

Aecia are roestelioid, hypophyllous with the peridia long-tubular or horn-shaped, 3-8 mm high, lacerate at the sides. The aeciospore mass is chestnut-brown. Aeciospores are 17-28 µm in diameter. 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. yamadae* is by basidiospore dispersal to apple, and by wind-borne aeciospores to *Juniperus chinensis*. In international trade, all plants of *J. chinensis* from the Far East are liable to be infected by *G. yamadae*. Like other *Gymnosporangium* spp., *G. yamadae* 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. yamadae* on commercial importations of plants of apple is very unlikely as infection is not persistent in the dormant stage. Fruits are rarely infected.

PEST SIGNIFICANCE

Economic impact

G. yamadae is an important pest of apple in northern Japan, causing defoliation.

Control

Other *Gymnosporangium* spp. can be adequately controlled on apples by routine fungicide applications (e.g. sterol-inhibiting fungicides), and this probably applies to *G. yamadae*. In Japan, *G. yamadae* was mentioned among the most important target pests for a new triazole fungicide (Ohyama *et al.*, 1988). Some apple cultivars may be resistant, and Ha & Shim (1995) have selected for rust resistance in ornamental *Malus* in the Korea Republic (the rust is referred to as *G. juniperi-virginianae*, but this is presumably an error). Suppression of the alternate host (*Juniperus chinensis*) within a certain radius of orchards is recommended, but may be difficult as it is often present in private gardens.

Phytosanitary risk

G. yamadae 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 IAPSC.

Other *Gymnosporangium* spp. already occur on apples in Europe, e.g. *G. tremelloides* with *Juniperus communis* as alternate host (Smith *et al.*, 1988). The severity of infection on apples is determined by the proximity of infected alternate hosts and, in practice, *G. tremelloides* is of very minor importance. In favour of the quarantine pest status of *G. yamadae* is the fact that it could very probably establish in Europe and that it does appear to be a more damaging species than its European counterpart. Against it is the fact that apple rust is in any case easily controlled, that *J. chinensis* is not indigenous to Europe, being grown only as an ornamental. The need for this specific alternate host could in practice severely limit the area of establishment. It may be noted that the earlier edition of the EPPO data sheet covering this species (OEPP/EPPO, 1983) suggested that species of *Juniperus* subgenus *Sabina* might in general be hosts; this statement appears to be without foundation. An important point concerning *G. yamadae* is that bonsai junipers present a likely pathway for entry, and that bonsai plants are in any case under close surveillance for many exotic pests.

PHYTOSANITARY MEASURES

As infection of *Juniperus* is systemic in stems and evergreen leaves, no chemical treatment is likely to be completely effective to treat imported plants found to be infected. It is most unlikely that infection from the telial stage could be carried on packing materials and the risk is virtually confined to infected plants.

EPPO proposes (OEPP/EPPO, 1990) that all countries may prohibit importation of plants for planting and cut branches of *Juniperus* from the Far East. If plants for planting of *J. chinensis* (or other *Juniperus* spp.) are imported from the Far East, the consignment should be kept in quarantine over the growing season and found free from *Gymnosporangium* spp. All countries should require that plants for planting and cut branches of *Juniperus* from the Far East should come from a field found free, with its immediate vicinity, from these diseases during the last two growing seasons. All countries should also require that plants for planting and cut branches of *Malus* from the Far East should be dormant and free from leaves.

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