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Data Sheets on Quarantine Pests

Phymatotrichopsis omnivora

IDENTITY

Name: *Phymatotrichopsis omnivora* (Duggar) Hennebert
Synonyms: *Phymatotrichum omnivorum* Duggar
Ozonium omnivorum Shear
Ozonium auricomum Link
Teleomorph: Possibly *Trechispora brinkmannii* (Bresad.) D.P. Rogers & H.S. Jackson
Taxonomic position: Fungi: Basidiomycetes: Aphyllophorales
Despite some doubt on the association with a specific teleomorph, basidiomycete affinities seem clear.)
Common names: Phymatotrichum root rot, Texas root rot (English)
Maladie du Texas du cotonnier (French)
Wurzelfäule der Baumwolle (German)
Pudrición texana (Spanish)
Notes on taxonomy and nomenclature: *Trechispora brinkmannii* has been reported to be the teleomorph of *P. omnivora* (Baniecki & Bloss, 1969) but this has been considered doubtful by Hennebert (1973). According to Farr *et al.* (1989), who prefer the name *Sistotrema brinkmannii* (Bresad.) J. Eriksson, the species is widespread on wood and plant debris, and represents several morphologically similar biological entities. Since the taxon *T. brinkmannii* has a wider biological spectrum and geographical distribution than *P. omnivora*, it is preferable for phytosanitary purposes to follow the most current usage and refer to the fungus causing Texas root rot as *P. omnivora*.
Bayer computer code: PHMPOM
EPPO A1 list: No. 21
EU Annex designation: I/A1 - as *Trechispora brinkmannii*

HOSTS

The major host is cotton, including *Gossypium herbaceum*, *G. hirsutum* and *G. barbadense*. The fungus can also develop on more than 200 species of dicotyledons including 31 economic field crops, 58 vegetable crops, 18 fruits and berries including citrus, 35 forest trees and shrubs, 7 herbaceous ornamentals and 20 weeds (Streets, 1937; Streets & Bloss, 1973). Monocotyledons are thought to be immune, but fungal strands have been reported on such hosts in nature. The potential host range in the EPPO region is presumably just as wide.

GEOGRAPHICAL DISTRIBUTION

EPPO region : Absent.
Asia: Uzbekistan (very doubtful record).
Africa: Somalia (very doubtful record).

North America: Indigenous in Mexico (northern) and USA (south-western states including Arizona, Arkansas, California, Louisiana, Nevada, New Mexico, Oklahoma, Texas, Utah). Unconfirmed report from Hawaii.
Central America and Caribbean: Dominican Republic (unconfirmed).
South America: Brazil, Venezuela.
EU: Absent.
Distribution map: See CMI (1990, No. 15).
For doubtful reports, see Streets & Bloss (1973).

BIOLOGY

P. omnivora is not seedborne. The primary inoculum is sclerotia, or strands surviving on roots of host plants. The fungus spreads as fine mycelial strands which traverse the soil and infect other roots. Experiments have shown that strands did not survive for 1 year on roots of killed cotton plants remaining in the soil, and strands buried 25 cm deep in the rhizosphere of cotton plants in the field did not survive for more than 3 months. Thus, strands require live cotton roots for overwintering. Sclerotia, on the other hand, have been shown to survive for at least 5 years. Strands and sclerotia have been found at depths of 2 m and 2.6 m, respectively (although most occur at 0.5-0.9 m), thus demonstrating that they can tolerate high levels of CO_2. The fungus was not eliminated in soil flooded for 120 days. After heavy summer rain, the fungus may come to the soil surface and form large tawny mycelial mats, 10-20 cm in diameter and 0.6 cm thick, on which conidia are borne. These spores germinate with difficulty or not at all and probably play no part in dissemination. Nothing is known about the possible role of the teleomorph.

Temperature is an important factor in survival, relatively high winter temperatures being favourable (Wheeler & Hine, 1972). Rush *et al.* (1984), analysing the factors which affect symptom appearance, concluded that root rot is favoured by temperatures over 22°C and relatively high soil moisture. Jeger & Lyda (1986) looked for environmental correlates to forecast disease incidence, and identified cumulative precipitation up to the end of the growing season and (inversely) temperatures above 34°C. A threshold criterion based on cumulative precipitation and mean maximum temperature during the preceding 10 days could be used to forecast annual incidence. Percy (1983) assessed soil base exchange capacity, pH, sodium content, calcium content and clay fraction, and also mean annual air temperature, as factors limiting the occurrence of *P. omnivora*. A map of the potential distribution of the fungus in North America, based on this analysis, was coterminous with the known distribution. In addition, the fungus cannot tolerate soil temperatures below freezing for any appreciable time. Thus, temperature and soil requirements appear to be the factors restricting the natural distribution. This restriction also implies that the fungus is not adaptable, and there is no suggestion of the appearance of new forms.

For more information on the biology of the pathogen see Streets (1937) and Streets & Bloss (1973).

DETECTION AND IDENTIFICATION

Symptoms

The disease on cotton appears in spots in the field and these areas do not necessarily produce a diseased crop the next year. The infection of the root system early in the season does not cause above-ground symptoms (Rush *et al.*, 1984). Symptoms only become conspicuous during the summer, as a sudden wilting of the plant, with or without a prior chlorosis of the leaves. The foliage droops, turns brown and may remain hanging on the branches for a few days before dropping off to leave a bare, dead stalk. At this stage, the roots are dead and their surface is covered with a network of tawny yellow fungal strands. If there is abundant water, brown to black wart-like sclerotia on the surface roots are also seen. The cortex of the killed roots is soft and readily peels.

The conidial stage develops on the ground, near the margin of the zone of dying plants in the form of cushion-like, creamy yellowish masses. These spore mats are not, however, often found in cotton fields.

Morphology

Conidia unicellular, hyaline, globose or ovate, 4.8-5.5 µm in diameter or 6-8 x 5-6 µm. Mycelial strands about 200 µm in diameter, bearing acicular hyphae, with distinctive cruciform branches emanating from the peripheral mycelium. Sclerotia irregular in shape, brown to black, 1-5 mm in diameter.

More detailed information is given by Streets (1937) and Streets & Bloss (1973).

Detection and inspection methods

In general, the coarse brown parallel strands of mycelium visible with a hand-lens on rotted roots of host plants are characteristic.

MEANS OF MOVEMENT AND DISPERSAL

Under natural conditions, as a soilborne pathogen, *P. omnivora* has low dispersal potential. It persists at certain locations where soil conditions are favourable, and does not very readily spread. It is most likely to be transported by human agency, with soil or on roots of infected host plants. In North America, internal quarantine measures have been applied to prevent spread into uninfested areas, but it is likely that the fungus has reached its natural limits in any case. The risk of intercontinental introduction is mainly with hosts other than cotton since, in this crop, the fungus is not seedborne and cotton plants are not usually moved in trade. EPPO has no records of the fungus being intercepted in internationally traded consignments.

PEST SIGNIFICANCE

Economic impact

The fungus is most serious on cotton; on this host it kills plants before maturity, reduces yield and quality by killing partly developed bolls and reduces lint quality in plants which survive until harvest. Mulrean *et al.* (1984) have analysed the elements of yield loss in cotton. Each year, it is estimated that 2% of the cotton yield in Texas (USA) is lost to root rot (Watkins, 1981). Cotton cultivation has been abandoned in some cases on soils which most favour the fungus.

On sunflowers, *P. omnivora* alone delays seed germination, and this combined with late planting may result in significant losses (Orellana, 1973). The references to *P. omnivora* in the APS Compendia of Plant Diseases (e.g. Stuteville & Erwin, 1990) give a partial view of the situation on other crops. Winter-grown annual crops (such as sugarbeet) escape disease. Apples, peaches, pecans, grapes, and in Mexico mangoes and avocados, suffer significant losses, and *P. omnivora* is a major constraint to apple cultivation in Texas. *Ulmus* spp. have been severely attacked, but the disease is only minor on citrus, roses and *Rhododendron*. It is damaging on lucerne but not on sweet potatoes or groundnuts. In general, there is relatively little information on hosts other than cotton in the research literature, which suggests that, though many are attacked by the fungus, relatively few suffer significant economic loss.

Control

The disease occurs particularly on heavy calcareous soils.

Heavy nitrogenous manuring and deep cultivation reduce losses. The disease on cotton is mainly controlled by rotation (e.g. with sorghum) and cultural practices such as early planting, to allow the crop to establish and start boll formation before root rot becomes significant. Foliar or granular applications of sterol-inhibiting fungicides have been shown in experimental trials to control the disease in cotton (Whitson & Hine, 1986).

Chemicals can be used to control the fungus in the soil. The standard soil treatments have been reported to be effective (dichloropropene, metham-sodium, methyl bromide) and also drenches with fungicides such as the benzimidazoles. Such treatments would be too costly for field crops, but might be suitable for land on which a high-value horticultural crop was to be grown. Only the soil directly treated is affected, and experience shows that after a certain time this soil is recontaminated by *P. omnivora* coming from deeper soil layers. Thus, it is doubtful whether such treatments would be effective enough to be used for eradication.

Little useful varietal resistance has been found in the major hosts, but see for example Bird *et al*. (1984). There is considerable research interest in antagonistic fungi which colonize and destroy *P. omnivora* sclerotia (e.g. Kenerley & Stack, 1987).

Phytosanitary risk

P. omnivora is listed as an A1 quarantine pest by EPPO (OEPP/EPPO, 1979) and is also of quarantine significance for APPPC, IAPSC and CPPC. In view of the temperature and soil factors which appear to limit the distribution of the pest rather precisely in North America (see Biology), potential distribution in other continents would mainly be in the warmer wetter areas (South America, Africa, India). In the EPPO region, the cotton-growing countries of the Mediterranean basin would be more likely to be affected than the more continental areas of Russia. With respect to other host plants, the risk is evidently much greater for southern Europe than for northern or eastern Europe.

PHYTOSANITARY MEASURES

It is recommended to prohibit the importation of soil from countries where *P. omnivora* occurs (OEPP/EPPO, 1990). This normally implies also that no soil should accompany plants imported from those countries. However, inorganic or sterilized growing media could, if necessary, be accepted, or other safeguards to ensure that there is no possibility that *P. omnivora* could be present in the growing medium.

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