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Data Sheets on Quarantine Pests

Deuterophoma tracheiphila

IDENTITY

Name: *Deuterophoma tracheiphila* Petri
Synonyms: *Phoma tracheiphila* (Petri) Kantschaveli & Gikashvili
Bakerophoma tracheiphila (Petri) Ciferri
Taxonomic position: Fungi: Ascomycetes (probable anamorph)
Common names: Mal secco (Italian)
Bayer computer code: DEUTTR
EU Annex designation: II/A2 - as *Phoma tracheiphila*

HOSTS

The principal host is lemons; *D. tracheiphila* has also been reported on citrons, bergamots, limes, sour oranges and rough lemons.

Almost all citrus plants are susceptible to artificial infections of *D. tracheiphila*. In the field, hybrids of citrus, related genera (*Eremocitrus*, *Fortunella*, *Poncirus* and *Severinia*) and other species have different degrees of resistance to the disease. Most cultivars of oranges, mandarins (*Citrus deliciosa* and *C. reticulata*), clementines and grapefruits are only occasionally affected. A number of rootstocks such as *C. reshni*, *Poncirus trifoliata* and, to a lesser extent, *C. sinensis* x *P. trifoliata* have been reported to be resistant.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Mediterranean and Black Sea areas including Albania, Algeria, Cyprus, France (unconfirmed), Greece (including Crete and Aegean Islands), Israel, Italy (including Sardinia and Sicily), Lebanon, Russia (Caucasus), Syria, Tunisia, Turkey.
Asia: Cyprus, Georgia, Iraq, Israel, Lebanon, Syria, Turkey, Yemen.
Africa: Algeria, Tunisia.
South America: Colombia (doubtful record).
EU: Present.
Distribution map: See CMI (1989, No. 155).

BIOLOGY

Inoculum enters through wounds; penetration through stomata is questioned (Perrotta & Graniti, 1988). Cultivation practices, wind, frost and hail that cause injuries to different organs favour infection by *D. tracheiphila*. Inoculum could be provided both by conidia produced from pycnidia present on withered twigs, and by conidia produced from phialides borne on free hyphae on exposed woody surfaces of the tree or on debris. Inoculum is believed to be water-borne (Solel, 1976). The range of temperature at which infection will occur is considered to be between 14 and 28°C. The optimum temperature for growth of the pathogen and for symptom expression is 20-25°C, whereas the maximum temperature for mycelial growth is 30°C. In the Mediteranean region, infection periods depend on local

climatic and seasonal conditions: in Sicily infections usually occur between September and April (Somma & Scarito, 1986).

The length of the incubation period may vary according to the seasons (Grasso & Tirrò, 1984). Prunings containing affected twigs or branches can be a source of inoculum for several weeks. The fungus can survive within infected twigs in the soil for more than 4 months (De Cicco *et al.*, 1987).

Acervuli of the *Colletotrichum* state of *Glomerella cingulata*, a secondary invader of withered twigs, are often associated with the pycnidia of *D. tracheiphila*. Severe outbreaks of mal secco often occur after hail storms and frosts.

For more information on the biology of the pathogen, see Petri (1929; 1930), Goidanich & Ruggieri (1947).

DETECTION AND IDENTIFICATION

Symptoms

The first symptoms appear in spring as leaf and shoot chlorosis followed by a dieback of twigs and branches. On the affected twigs, raised black points within lead-grey or ash-grey areas of withered twigs indicate the presence of pycnidia. The growth of sprouts from the base of the affected branches and suckers from the rootstock are a very common response of the host to the disease. Gradually the pathogen affects the entire tree which eventually dies. On cutting into the infected twigs, the characteristic salmon-pink or orange-reddish discoloration of the wood can be seen; this internal symptom is associated with gum production within the xylem vessels. In addition to the more common form of mal secco, two different forms of the disease can be distinguished: "mal fulminante" which is a rapid fatal form of the disease apparently due to root infection; and "mal nero" which is a consequence of chronic infection of the tree leading to a browning of the heartwood.

Morphology

Mature black ostiolate pycnidia (60-165 x 45-140 µm diameter) bear a neck; within the pycnidial cavity, minute unicellular, mononucleate and sometimes binucleate hyaline conidia (0.5-1.5 x 2-4 µm) are produced by conidiogenous cells (phialides). Sometimes conidia are extruded through ostioles in whitish cirri. Larger conidia are produced by phialides (12-30 x 3-6 µm) borne on free hyphae growing on exposed wood surfaces, wounded plant tissues, and within the xylem elements of the infected host; they are hyaline, unicellular, uninucleate and sometimes binucleate or trinucleate, straight or curved, with rounded apices (3-8 x 1.5-3 µm).

Ovoid, subpyriform blastoconidia (sensu Goidanich *et al.*, 1948) (15-17 x 7-9 µm) are produced inside the xylem vessel of the host and in agar culture. Chromogenous and non-chromogenous variants have been distinguished in culture (Graniti, 1969). Strains differing in virulence have been found to occur in nature (Magnano di San Lio *et al.*, 1992).

No teleomorph is known. For more information see Graniti (1955), and a full description is given by Ciccarone (1971) and by Punithalingam & Holliday (1973).

Detection and inspection methods

Lemon trees can be inspected for the presence of the typical pinkish discoloration of the xylem. The fungus can easily be isolated from infected xylem on agar media.

MEANS OF MOVEMENT/DISPERSAL

Under natural conditions, inoculum of *D. tracheiphila* is dispersed by wind and rain; birds and insects have been suspected to be vectors. Long-distance spread of mal secco occurs through infected propagative material and plants.

PEST SIGNIFICANCE

Economic impact

In the Mediterranean region, *D. tracheiphila* is the most destructive fungal disease of lemons. Up to 100% of trees in a lemon orchard of a susceptible cultivar can be affected. Destructive outbreaks of *D. tracheiphila* may occur after frost spells and hail storms in spring (Perrotta & Graniti, 1988). In general, injury to the tree through severe, cold weather may predispose it to fungal attack. The symptoms of the disease are most severe in spring and autumn; at high summer temperatures, spread in the host vascular system ceases and the symptoms do not develop further (Ruggieri, 1953). The disease reduces the quantity and quality of lemon production in the areas where the pathogen is present, and limits the use of susceptible species and cultivars.

Control

D. tracheiphila can be kept under control by pruning infected twigs as soon as the first symptom appears (Salerno & Cutuli, 1982). Common practices aimed either at saving the affected trees or at eradicating the inoculum include cutting of whole branches and grafting the pollarded tree with resistant cultivars or species. Burning of the pruned branches is recommended in order to eliminate possible sources of inoculum. Injury during cultural practices must be avoided. Chemical control is not widely used except in nurseries. Copper fungicides and ziram are the most common products used. Systemic products are effective only as preventives (Solel & Salerno, 1989).

The best method of controlling the disease would be to grow resistant clones but unfortunately this is not easily achieved. In some areas of Sicily the resistant lemon cultivar Monachello has replaced the susceptible cultivar Femminello but it is of inferior quality. Resistant clones of cultivar Femminello have been selected but they either do not adapt to different environmental conditions or have still to be tested in the field (Gentile *et al.*, 1992; Salerno & Cutuli, 1992).

Phytosanitary risk

D. tracheiphila has not been listed as a quarantine pest by EPPO, but is of quarantine concern to most other regional plant protection organizations (APPPC, CPPC, COSAVE, IAPSC, NAPPO). The fungus does not occur in several citrus-growing countriesof the EPPO region, especially in the Iberian peninsula and Morocco. The introduction of *D. tracheiphila* is principally a threat to lemon growing in Spain and Portugal. The fact that*D. tracheiphila* does not already occur throughout the Mediterranean citrus-growing areas is possibly linked with the severe restrictions on movement of citrus propagating material mainly in relation to virus diseases. There is no obvious climatic or cultural factor limiting potential establishment of mal secco in uninfested areas.

PHYTOSANITARY MEASURES

In countries or areas where the disease has not yet been reported, plants for new plantings or replantings should notcome from nurseries located in infected lemon areas.

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