

## .Data Sheets on Quarantine Pests

**Citrus blight disease****IDENTITY****Name:** Citrus blight disease**Taxonomic position:** Unknown**Common names:** Young tree decline, sandhill decline, roadside decline, rough lemon decline (English)  
Declinamiento, marchitamiento repentino (Spanish)  
Declinio (Portuguese)**Notes on taxonomy and nomenclature:** Typical citrus blight is the disease known in Florida (USA). More or less similar diseases have been described from other parts of the world. Since the cause of blight is not known, it is impossible to state categorically whether these diseases are the same as or different from blight. For the purposes of this data sheet, blight is treated as a single disease. Certain other diseases, for example amachamiento in Mexico, have been compared with blight and shown to be distinct (Orozco-Santos, 1991); blight-like symptoms in Texas (USA) proved not to be real blight.**EPPQ computer code:** CSBXXX**EPPQ A1 list:** No. 278**EU Annex designation:** II/A1 (as "blight and blight-like" on citrus)**HOSTS**

Blight affects mainly grapefruits (*Citrus paradisi*) and oranges (*C. sinensis*), and incidence is lower on lemons (*C. limon*) and mandarins (*C. reticulata*). Trees on rootstocks of *Citrus jambhiri*, *C. nobilis* and *Poncirus trifoliata* are highly susceptible. Trees on rootstocks of *Citrus macrophylla*, *C. volkameriana* and *Citroncirus x webberi* are also susceptible, but those on rootstocks of *Citrus aurantium* and *C. reshni* are tolerant, and those on *C. sinensis* are highly resistant (Young *et al.*, 1980a).

**GEOGRAPHICAL DISTRIBUTION****EPPQ region:** Turkey (unconfirmed; blight-like symptoms seen by Azeri (1980)).**Asia:** Turkey (unconfirmed; blight-like symptoms seen by Azeri (1980)).**Africa:** Mozambique, South Africa.**North America:** USA (Florida, Hawaii, absent from California).**Central America and Caribbean:** Cuba, Dominican Republic.**South America:** Argentina, Brazil (Bahía, Rio de Janeiro, São Paulo), Colombia, Suriname, Uruguay, Venezuela (Ochoa *et al.*, 1988).**Oceania:** Australia (Queensland).**EU:** Absent.

## BIOLOGY

The cause of blight is not known. The disease has not been transmitted by budding or grafting from the aerial parts, and trees reconstituted from roots and buds of blighted trees are healthy (Wutscher & Smith, 1988), so the pathogen does not appear to be a virus, MLO or virus-like agent. Nickel (1987), however, finding double-stranded RNA in diseased plants, has suggested a viral etiology. Blight has been reproduced by placing mature healthy trees adjacent to affected trees and grafting their roots together (bringing exposed cambial surfaces into contact) (Tucker *et al.*, 1984). This suggests transmission of a possibly soil-borne agent, affecting the plant systemically. However, attempts to demonstrate transmission by soil have failed (Timmer & Graham, 1992). No particular vector, aerial or soil-borne (e.g. nematode), has been found or suggested.

Various suggestions of causal agents have been made. *Xylella fastidiosa* (EPPO/CABI, 1996d) has been detected in blight-affected trees and suggested as the agent of blight (Hopkins, 1988; Hopkins *et al.*, 1990, 1991). Controlling the cicadellid vectors of *X. fastidiosa* is reported to reduce the spread of blight (Adlerz *et al.*, 1989). It seems clear that *X. fastidiosa* does occur in *Citrus* in Florida and causes a decline, but it is not clear that typical blight can predictably be obtained by reinoculation. Indeed, in Brazil (EPPO/CABI, 1996d), *X. fastidiosa* is now known to be the cause of a distinct citrus disease (variegated chlorosis). Besides, *X. fastidiosa* does not, at least reportedly, occur outside the American continent, whereas blight is known from other continents.

Blight symptoms are somewhat like those of vascular wilt diseases (see Symptoms), and vascular wilt fungi would fit the concept of a soil-borne systemic agent (see above). However, no specific vascular wilt pathogen has been identified, although there were early claims that hyphae could be found associated with vascular occlusions (Childs & Carlyse, 1974). It has been suggested that blight is associated with rotting of the fibrous roots (Nemec *et al.*, 1978) or necrosis of major roots, caused by *Fusarium solani*. Graham *et al.* (1983) found that *F. solani* would only infect major roots if the tree was already in decline, which suggests that the root necrosis is a consequence rather than a cause of blight. Nemec *et al.* (1980) isolated pathogenic strains of *F. solani* from lesions on fibrous roots and successfully reinoculated roots, inducing blight-like symptoms in the plants. Nemec *et al.* (1991) detected naphthazarin toxins, produced by *F. solani*, in roots and branches of trees with blight symptoms, which suggests a mechanism by which fusarium root rot could cause blight. However, *F. solani* root lesions are also found on trees not showing blight symptoms or affected by other pests (e.g. nematodes), and the toxins can also be found in these trees. So infection of citrus roots by *F. solani* could not be a sufficient cause of blight, and other factors have to be simultaneously invoked (shallow soils, nutrition, bad drainage; Burnett *et al.*, 1982).

It has been suggested that blight has purely abiotic causes. In Brazil (São Paulo state) and USA (Florida), increased blight incidence has been associated with higher soil pH. Experimental soil liming enhances blight with time. A linear disease progress rate has been reported, rather than a logistic pattern as would be expected from an infectious agent. However, the transmissibility of blight by root grafting is generally accepted, so it is suggested that these abiotic factors are associated with the expression of the blight pathogen.

A further hypothesis is that blight (with its characteristic diagnostic indications) could be a non-specific stress reaction of citrus to different abiotic or biotic factors, but in that case, it is surprising that it has been reported with a distinctly limited geographical distribution. Stress proteins have been described in affected trees (Derrick *et al.*, 1990; Bausher & Sweeney, 1991), but it is not known if they are specific to blight.

## DETECTION AND IDENTIFICATION

### Symptoms

The disease is more noticeable in groves receiving above-average care (high-standard cultural practices). The first symptoms appear only on adult trees entering their 4-6th year. The disease generally affects only bearing trees. Once a tree is affected, it does not recover. Blight causes a general decline of the tree canopy with wilt, leaf loss, twig dieback, and poor growth flushes. Symptoms may be confined to one sector of the canopy. Symptoms of blight can be confused with those of other diseases, e.g. greening (in South Africa; EPPO/CABI, 1996a), tristeza (EPPO/CABI, 1996b) or spreading decline caused by burrowing nematodes (*Radophilus citrophilus*) (in Florida; EPPO/CABI, 1996c). The situation is further complicated because blight often occurs at the same time as other factors causing decline (nematodes, root weevils or beetles, viruses, bacterial and fungal foot rots) (Albrigo & Young, 1979; Timmer, 1984).

Water transport in the xylem of blighted trees is impaired. The trees fail to take up or transport water, even if it is injected under pressure (this is diagnostic of the disease; Lee et al., 1984). The xylem vessels of the trunk, large branches and roots are blocked by light-yellow amorphous plugs, or by dark-brown filamentous plugs (Brlansky et al., 1985). The failure of water transport seems to be attributable to the amorphous plugs, and symptoms appear to be due to lack of water transport to the canopy.

While leaves often show zinc deficiency symptoms, zinc accumulates in the bark and outer xylem of the trunk, usually prior to the formation of plugs or to visible symptom development (Young et al., 1980b; Albrigo & Young, 1981). The significance of these high levels of zinc is not known. Zinc analysis is also useful for diagnosis.

The symptoms described above are those of typical blight in Florida. Elsewhere, blight can be diagnosed by the same principal criteria (Wutscher et al., 1980; Brlansky et al., 1984; Beretta et al., 1988), but there are minor differences in symptomatology and hosts affected.

### Morphology

The pathogen is unknown.

### Detection and inspection methods

No procedures are available for small trees. Blight can be diagnosed by water injection and zinc analysis in field trees (Cohen & Wutscher, 1979). Root grafting could theoretically be used for diagnosis, but the incubation period is long (18-24 months). Once trees begin to be affected, they decline rapidly. The long delay is a serious drawback for use of grafting as a test method. There is an imperative need to develop a more rapid method. Bausher & Sweeney (1991) report use of an antiserum to leaves from blighted citrus as a means of immunological detection of blight; it remains to be proved, however, that the proteins detected are specific to blight.

## MEANS OF MOVEMENT AND DISPERSAL

Since the identity of the pathogen is not known, it is difficult to generalize about its potential for spread. Under natural conditions in South Africa (Marais, 1992), the disease appears to be randomly distributed initially, but often becomes clumped in later stages, suggesting short-distance spread. Tree-to-tree spread appears to be increasing in South Africa. This could possibly be due to mechanical damage by hoeing, bringing damaged root surfaces into contact.

There is no indication that blight could be spread in international trade by budwood, since attempts to transmit the disease by budwood have failed. However, rootstocks, or

grafted trees, could presumably carry the pathogen on their root systems. It is also possible that the pathogen could persist in soil.

## **PEST SIGNIFICANCE**

### **Economic impact**

Citrus blight is one of the most serious economic problems for citrus growers in Florida (USA) and Brazil. Millions of citrus trees are lost every year, with yearly loss rates of 4-7% in affected orchards. In Florida, losses are estimated at 500 000 trees per year.

### **Control**

The only means of control is to replace affected trees with trees on tolerant rootstocks. In general this means avoiding rootstocks of rough lemon (*Citrus jambhiri*) and instead choosing from Swingle citrumelo (*Poncirus trifoliata* x *Citrus paradisi*), Cleopatra mandarin (*C. reshni*), Empress mandarin (*C. reticulata*) or X639. Tetracycline or fungicide treatment does not prevent or cure blight (Lee *et al.*, 1982; Timmer *et al.*, 1985).

### **Phytosanitary risk**

Citrus blight has recently been added to the EPPO A1 list and is also of quarantine significance for APPPC. Its economic importance is considerable, but it is difficult, so long as the pathogen and its means of transmission are not known, to estimate how likely it is to establish in new areas, such as the EPPO region. In addition, it is not clear by what pathways it might enter new areas.

Blight does, however, appear to be a transmissible disease, and one of limited distribution. This could mean either that blight is caused by a pathogen (like *Xylella fastidiosa*) of limited geographical distribution or else that the pathogen is widespread (like *Fusarium solani*), in which case it is the accompanying environmental conditions which would have to be unique to the areas where blight occurs. In the first case, blight is of considerable quarantine importance, and in the second of none at all. The current hypotheses of blight etiology do not quite fit these cases, however. No candidate pathogen has been found to have a limited distribution coinciding with that of blight. Nor do the necessary environmental conditions seem so unique. Provisionally at least, until the true etiology of citrus blight has been determined, it must be in the long-term interest of the EPPO region to take measures to exclude it, even if there is a certain possibility that there is no quarantine pest to exclude and pathway analysis suggests that its introduction is not very likely.

## **PHYTOSANITARY MEASURES**

Since the nature of the pathogen and its transmission are so little understood, it is difficult to decide how and whether phytosanitary measures would help to prevent international spread. It is simplest to recommend that importation of citrus plants with roots, and associated soil, from countries where blight occurs should be prohibited. In practice, this is already so for citrus more generally. If plants are moved in quarantine from areas with blight, Frison & Taher (1991) recommend that any propagations should be held under containment for at least 24 months, and the donor tree kept under surveillance for the same period.

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