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Data Sheets on Quarantine Pests

Peach X-disease phytoplasma

IDENTITY

Name: Peach X-disease phytoplasma
Synonyms: Peach X-disease virus (formerly)
Peach western X MLO
Peach yellow leafroll MLO
Taxonomic position: Bacteria: Tenericutes: Mollicutes: Phytoplasmas
Common names: Peach X-disease, cherry buckskin, peach yellow leafroll, leaf casting yellows (English)
Enfermedad X del melocotonero (Spanish)
Notes on taxonomy and nomenclature: Two forms of peach X-disease used to be distinguished: eastern X-disease and western X-disease, with slightly different symptoms. These are now considered to be due to strains of the same pest. Monoclonal antibodies to an eastern X strain cross-react with western X strains (Jiang *et al*., 1989). In California (USA), one form of peach yellow leafroll is caused by X-disease phytoplasma, but similar diseases are caused by unrelated phytoplasmas (Kirkpatrick *et al.*, 1995). Canadian peach X-disease phytoplasma belongs to 16S ribosomal RNA (16Sr) group III of Lee *et al.* (1993), subgroup A (of which it is the type member). Phytoplasmas are also found in *Prunus* in Europe, but tests with DNA probes against X-disease and other phytoplasmas showed that the northern European prunus phytoplasmas are very homogeneous and have affinities with apple proliferation phytoplasma (EPPO/CABI, 1996a), that the southern European prunus phytoplasmas are related, and that peach X-disease phytoplasma is quite distinct (Ahrens *et al.*, 1993). The name European stone fruit yellows phytoplasma is proposed for the European pathogens (Lorenz *et al.*, 1994; Seemüller & Foster, 1995); this incorporates apricot chlorotic leaf roll phytoplasma (EPPO/CABI, 1996b).
EPPO computer code: PCXXXX
EPPO A1 list: No. 140
EU Annex designation: I/A1 - as Peach X-disease mycoplasm

HOSTS

Peaches (*Prunus persica*) are the principal host of peach X-disease phytoplasma, but the disease is also significant on cherries (*Prunus avium* and *P. cerasus*) and *P. salicina*. Other *Prunus* spp. can be infected, for example almonds (*P. dulcis*), apricots (*P. armeniaca*) and plums (*P. domestica*), but this is of no importance in practice. Uyemoto *et al.* (1991) tested a range of cherry cultivars and accessions, and other *Prunus* spp. by grafting on infected rootstocks: all cherry material was susceptible but *P. mahaleb*, *P. maackii*, *P. serotina*, *P. serrulata* and *P. subhirtella* were resistant. The wild species *P. virginiana* is an important natural reservoir of peach X-disease phytoplasma in eastern USA. The phytoplasma can also be artificially transmitted to herbaceous hosts, e.g. celery (*Apium graveolens*). It has been shown to occur in herbaceous weeds in orchards (e.g. *Medicago hispida*).

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (British Columbia, New Brunswick, Ontario), USA (first noted in California in 1931, Connecticut, Massachusetts, Michigan, New York, Utah, and many other states but not South Carolina, Georgia, Arkansas or Texas; Gilmer & Blodgett, 1976).
EU: Absent.

BIOLOGY

The disease is readily transmitted by budding or grafting, but the phytoplasma itself can be very irregularly distributed in the plant (according to strain). The infection potential of buds is highest in summer (Rosenberger & Jones, 1977). Transmission is also possible to various herbaceous plants by use of dodder (*Cuscuta* spp.). The most important practical form of transmission is by the leafhopper vectors - especially *Paraphlepsius irroratus* in eastern USA, and *Scaphytopius acutus*, *Colladonus montanus* and to a lesser extent *Colladonus geminatus*, *Fieberiella florii* and *Graphocephala confluens*. The phytoplasma has been detected, with DNA probes, in *P. irroratus* in Michigan (Rahardja *et al.*, 1992) and in *C. montanus* and *F. florii* in California (Kirkpatrick *et al.*, 1990). Transmission is mainly from wild trees of *Prunus virginiana* in eastern USA but also from infected peach to healthy peach in western USA. The dispersal behaviour of *P. irroratus* in peach and cherry orchards has recently been studied (Larsen & Whalon, 1988) and the consequences for X-disease movement considered. Recently, herbaceous weeds have also been shown to act as reservoirs in orchards; the vectors overwinter on these weeds and move onto the trees in summer.

The incubation period in peach or *P. virginiana* depends very much on the stage of development of the tree at the moment of infection. Symptoms are seen 6 weeks after the beginning of growth if buds were inoculated in the previous year. The latency period in the insect vector is long: 22-35 days for *C. geminatus* and 45 days for *S. acutus*.

DETECTION AND IDENTIFICATION

Symptoms

The first symptoms of infection of peach are yellow spotting and rolling of the leaves. Shortly after, the whole tree becomes chlorotic and its leaves fall, leaving a few rosettes at the tips of the shoots. Young trees die 1-3 years after first symptom appearance. Chronically infected older trees may survive several years but yield little or no fruit. Infected cherry trees on *Prunus mahaleb* rootstocks die rapidly because the rootstock is resistant, and a hypersentivive reaction occurs at the graft union. On other rootstocks, decline is slower (Uyemoto, 1989; Kirkpatrick *et al.*, 1995). Leaves are smaller and red-tinged, sometimes with enlarged stipules; fruits mature late, have short pedicels and bland-flavoured watery flesh.

Morphology

Electron microscope studies (Nasu *et al.*, 1970; Granett & Gilmer, 1971; MacBeath *et al.*, 1972) have shown the presence of typical phytoplasma cells in infected plants.

Detection and inspection methods

Peach X-disease phytoplasma can be tested on peach seedlings (cv. Elberta or GF305) in the field, but 4 years are needed for results to be certain. It can also be tested on the same indicators in the glasshouse, symptoms appearing up to 3 months after inoculation.

Serological methods (ELISA, immunosorbent electron microscopy) have been successfully tested for the detection of the pathogen in partially purified preparations from celery, an artificial herbaceous host (Sinha & Chiykowski, 1984) and in the leafhopper vectors (Sinha & Chiykowski, 1986; Sinha, 1988). Monoclonal antibodies specific to peach X-disease phytoplasma have been obtained (Jiang *et al.*, 1989). Peach X-disease phytoplasma has now become one of the type organisms for molecular studies on phytoplasma taxonomy (see Notes on taxonomy and nomenclature). Thus, a variety of serological or nucleic acid-based techniques exist which can distinguish the pest from related organisms. Some of these, particularly DNA probes, can very probably be applied to the practical detection and identification of X-disease in *Prunus*, but no specific details on practical use appear to have been published. Simple fluorescence microscopy with DAPI reagent can be used to detect the pathogen in mid-veins and petioles of peach and *P. virginiana* (Douglas, 1986). An EPPO phytosanitary procedure for fruit tree phytoplasmas gives details (OEPP/EPPO, 1994).

MEANS OF MOVEMENT AND DISPERSAL

The capacity of the vectors to disperse the phytoplasma is only local. The pathogen is most likely to be spread internationally in infected planting material or possibly in vectors carried on plants.

PEST SIGNIFICANCE

Economic impact

Unlike peach rosette and peach yellows (EPPO/CABI, 1996d), X-disease is of current economic importance in North America (Kirkpatrick *et al.*, 1995), particularly in California (where it causes serious problems on cherries and is part of the peach yellow leaf roll complex) and in Michigan. It is also very widely distributed.

Control

The proportion of infected plants in orchards, and consequently the degree of economic loss, can be kept to a relatively low level by respecting a few rules: destruction of diseased trees (especially cherries, which contain much higher concentrations of the pathogen than peaches), elimination of *P. virginiana* round orchards, removal of spring hosts of the vectors, management of ground cover, oxytetracycline treatment of affected trees, insecticide treatments against the vectors during the season and after harvest (Douglas & McClure, 1988). However, since these measures are complex, they are not always rigorously followed. Thus Lacy (1981) showed in a survey in 1979 that 14.7% out of 9835 peach trees observed had symptoms of X-disease. In Ontario (Canada), losses due to the disease are increasing. Microinjection capsules of oxytetracycline have been used successfully to treat peach trees (Cooley *et al.*, 1992).

Phytosanitary risk

Peach X-disease phytoplasma is an EPPO A1 quarantine pest (OEPP/EPPO, 1986), but has not been specified as a quarantine pest by any other regional plant protection organization. In the EPPO region, peach, the main host, has the greatest economic importance of all

Prunus spp. There are probably susceptible European cultivars and, in any case, American cultivars are frequently introduced. Of the North American vectors, at least *Fieberiella florii* occurs in Europe and there may also be local insects which might act as vectors. The production of healthy planting material of *Prunus* requires the exclusion of peach X-disease phytoplasma, reported to be seriously damaging if control measures are not properly applied. The fact that new American peach cultivars are regularly imported into Europe points strongly to the real risk which exists. The experience with peach latent mosaic viroid (EPPO/CABI, 1996c), introduced into Europe in just such circumstances, should not be forgotten.

PHYTOSANITARY MEASURES

EPPO suggests that countries may prohibit import of *Prunus* planting material from infested countries. Alternatively, EPPO recommends (OEPP/EPPO, 1990) that *Prunus* planting material should come from a field inspected during the growing season and, particularly for material from infested countries, the material should be subject to an official certification scheme, with particular emphasis on preventing reinfection of healthy material by airborne vectors. The EPPO certification scheme for fruit trees (OEPP/EPPO, 1991/1992), though intended to be used primarily within the EPPO region, provides a suitable model.

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