



Limette

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Phytophthora Disease

Background

Phytophthora was once to most serious disease in all citrus growing areas of the world. Citrus was grown by seed and most sweet orange cultivars are very susceptible to Phytophthora.

In bad drained soils tree loss due bark infection and girdling of the trunk were often severe. The later used grafting method, mainly onto the tolerant Sour Orange (*Citrus aurantium*) rootstock protected the trees from Phytophthora stem end rot, but the appearance of virus diseases made the further widespread use of Sour Orange as rootstock nearly impossible.

So propagation onto less Phytophthora tolerant rootstock, i.e. Rough Lemon (*Citrus jambhiri*) increased, till the Citranges and other Poncirus Hybrides became common.

But still today, loss due Phytophthora infections were significant in arid growing areas as also in bad drained soils where the soil texture does not permit the use of tolerant rootstocks. Also there are losses by root rot after root infection with Phytophthora fungus, significant onto some new mandarin type rootstocks, i.e. Cleopatra mandarine.

The causal agent

Phytophthora nicotianae and *Phytophthora citrophthora* are the two most common found and important species of this fungus. *P. nicotianae* is more common in subtropical areas of the world, causing bark scaling, root rot and gummosis, but will not cause lesion wide above the ground. *P. citrophthora* is found in more mediterranean climates, causing root damage and gummosis during the cool month with often found high rainfall. The later one often infects the bark above the trunk, causing

bark lesions and is also a cause of brown root rot.

Under favorable conditions *Phytophthora* develops papillate sporangia that will release high numbers of spores. The sporangias range in size from 25-40 x 40-60 µm.

After spore germination the mycelium grows best if temperatures range between 24°C and 32°C. Only the *P. syringae* grows best if temperature is less than 20°C, so is a serious problem in cold, wet growing areas.

Infection and Symptoms

The spores enter in humid conditions the healthy plant by small cracks in the bark or little lesions of the roots. Wetting of the bark by irrigation may soften the bark tissue, giving the spores by the humid condition favorable conditions to infect the cambial layers. The spores enter through the bark and germinate onto the cambial tissue. The mycelium growth will destroy the cambial layer.

Exposed cambial tissue is susceptible to infection for approximately 14 days.

After infection the bark dries, cracks and sap oozing occurs. On tolerant rootstocks the infected bark cracks and is quickly dropped. Cambial regrowth will grow over the lesion area, but leaving often large visible scars or dark sunken trunk or branch lesions.

In root infection the spores enter the zone of elongation. First the cortex is damaged, later sloughed off. In this rotting material the fungus develops its spores which will persist in the soil for long time. First visible symptoms are dark, brown or black sunken areas in the root, which quickly will enlarge. After the cortex is sloughed off often only the inner root strain is left. Above visible symptoms include leaf yellowing, wilting and leaf dropping. This is a result of the complete or partial girdled trunk or by decreased root function due root damage.

The disease develops best during cool and wet conditions, so is seldom found in dry, hot

climatic with light, good drained soils and modern drip irrigation, or micro sprinklers which do not wet the trunk.

Disease control

Control after infection is seldom possible. Commonly preventive steps are taken to avoid outbreak of infection. Disease tolerant rootstocks are used and a careful irrigation schedule without a wetting of trunk and branches is the best prevention, bad drained soils need more careful maintenance to avoid root damage. Most mandarin rootstocks are less tolerant to rot damage. More tolerant are Carrizo and Troyer Citrange. Tolerance means that root regeneration by root regrowth is faster than root damage by *Phytophthora*. Citrus macrophylla, Swingle Citrumelo and Poncirus trifoliata are considered to be resistant to *Phytophthora*.

Fosetyl-AI is a recommended fungicide after *Phytophthora* infections and works proper in field usage. Irrigation of container grown citrus trees with this fungicide may prevent a root infection or control the fungus after infection of the roots. Stem and trunk lesions should be cut out till reaching healthy tissue. A copper fungicide or Fosetyl-AI is painted to the cut surface for control and the wound is sealed with a wound wax.

Regular Copper fungicide applications in the field will help to prevent infection in critical growing areas, as careful seed and seedbed fumigation will help to prevent outbreak of this disease. The seed is washed, rinsed and dipped into hot water, additional dipping of the seed into a fungicide. Container nurseries should use only soil free potting medias, which should not get in contact with bare soil. Potting medias can be sterilised with steam and hot temperatures for approximately 15 Minutes.

In orchards use of ground fungicide applications should depend on the rootstocks used.

Adequate drainage and careful irrigation is the best control of this fungus, as well as the avoidance of any trunk, branch or stem injury. So this natural preventive method will give no possibilities for the fungus to enter the plant. In bad drained soils the use of tolerant rootstocks is recommended.

Tolerant to bark infection are Citrus aurantium, Poncirus trifoliata, Citrus macrophylla, and most Poncirus Hybrid Rootstocks. Less tolerant are

Volkamer Lemon, Rangpur Mandarin-Lime, susceptible to bark infection are Cleopatra and Shekwasha Mandarin. Tolerant to root rot is Poncirus trifoliata, Citrus macrophylla and Swingle Citrumelo. Moderate tolerance exhibit Volkamer Lemon and most Citranges. Very susceptible to root rot is Citrus aurantium and the mandarin type rootstocks.

For further informations read following publications: Compendium of Citrus Diseases by the American Phytopathological Society, Rootstocks for Florida Citrus by the University of Florida and the publication Citrus Nurseries and Planting Techniques by the french CIRAD institute.

Club News

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