Detecting and identifying

Canker stain of plane



LUCIO MONTECCHIO

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Treework Environmental Practice

LONDON TREE OFFICERS ASSOCIATION
CARING FOR THE CAPITAL'S TREES

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Platanus acerifolia: an artificial tree

The Family Platanaceae is represented by a single genus, *Platanus*, which includes eleven species from many regions of the northern hemisphere, excluding Africa.

The three most common species are *Platanus orientalis* L., *Platanus occidentalis* L. and their fertile hybrid *Platanus x acerifolia* (Aiton) Willd (syn. *P. occidentalis x P. orientalis; P. x hispanica; P. x hybrida; P. intermedia*).

Despite the origins of *P. occidentalis* and *P. orientalis* being geographically far apart (North America and Eurasia respectively) their similarity suggests the existence of a common ancestor with an extensive range, broken into two distinct regions separated by the Atlantic Ocean.

Such long isolation did not significantly modify the genomes of the two species and, due to their inter-fertility, a vigorous and hardy hybrid was artificially produced around 1670 at the Oxford Botanical Garden, at first catalogued as "*Platanus inter orientalem et occidentalem media*", then named *P. acerifolia* (Ait.) by William Aiton in 1789 and commonly known as "London plane" or "plane".

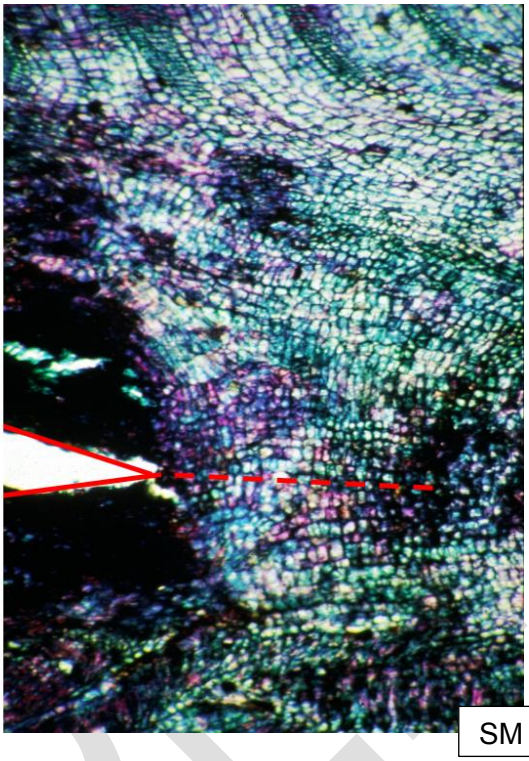
Due to its hybrid nature, *P. acerifolia* is theoretically characterized by a considerable genetic variability with intermediate features from the two relatives. Nevertheless, since the very beginning few "plus trees" – selected for their architecture, growth rate, vigour, tolerance to intense pruning and adaptability to dry and compacted soils – were easily replicated through the vegetative propagation of cuttings.

This resulted in the selection of a small number of quite similar genotypes and the rapid substitution of *P. occidentalis* by *P. acerifolia* across the UK, accelerated during the Industrial Revolution due to the latter's tolerance to air pollution.

> "*In the numerous London squares and gardens it is certainly surprising to see how healthy, clean and fresh looking this plane appears […]. Although surrounded by myriads of chimneys, its leaves for size and freshness can vie almost with the foliage in the country far removed from smoke and town atmosphere*" (G. Berry, 1881. *The Garden*, vol. 20, p. 372).

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While infections from an infected plant to a neighbouring plant can happen through the movement of mycelium between grafted roots, the first tree in an outbreak must be colonized by fungal propagules (mycelium, spores or conidia) transported onto a wound from outside.

This can happen through aerial dispersal (although conidia are relatively heavy) or by means of flying vectors like insects or other animals. There is however no clear evidence of these having an important role.

Usually infection is caused by infected wood, wood products or contaminated equipment being moved and spreading the pathogen into new trees via wounds.

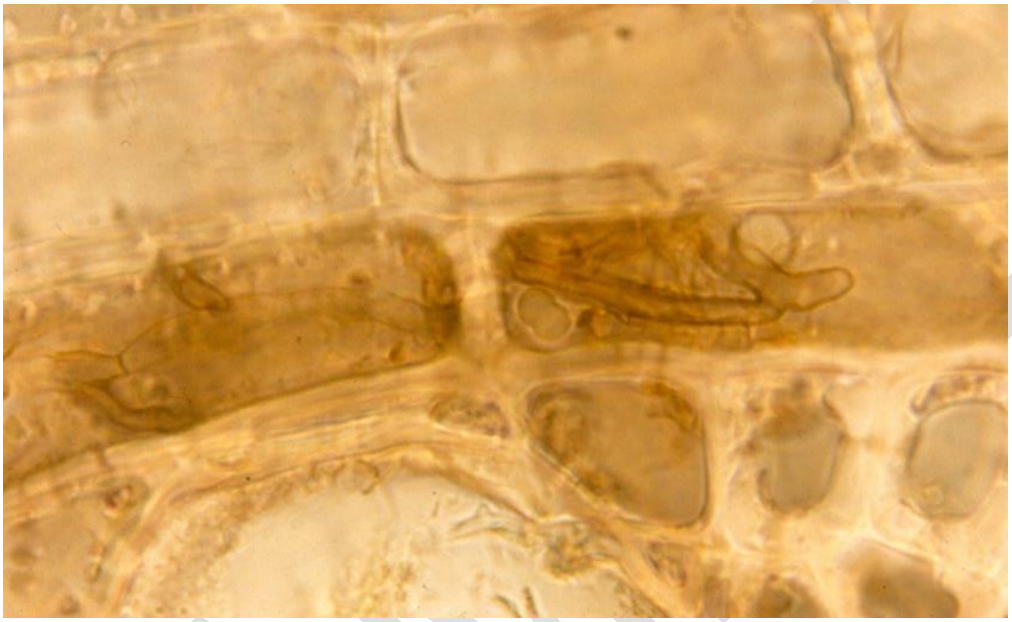
Once they reach the subcortical tissue, propagules germinate new mycelium producing toxic metabolytes (mainly belonging to the Cerato-platanin family of proteins) able to devitalize the cell contents (cytoplasmatic membrane and organelles), allowing the fungus to move to the neighboring cells through pits.

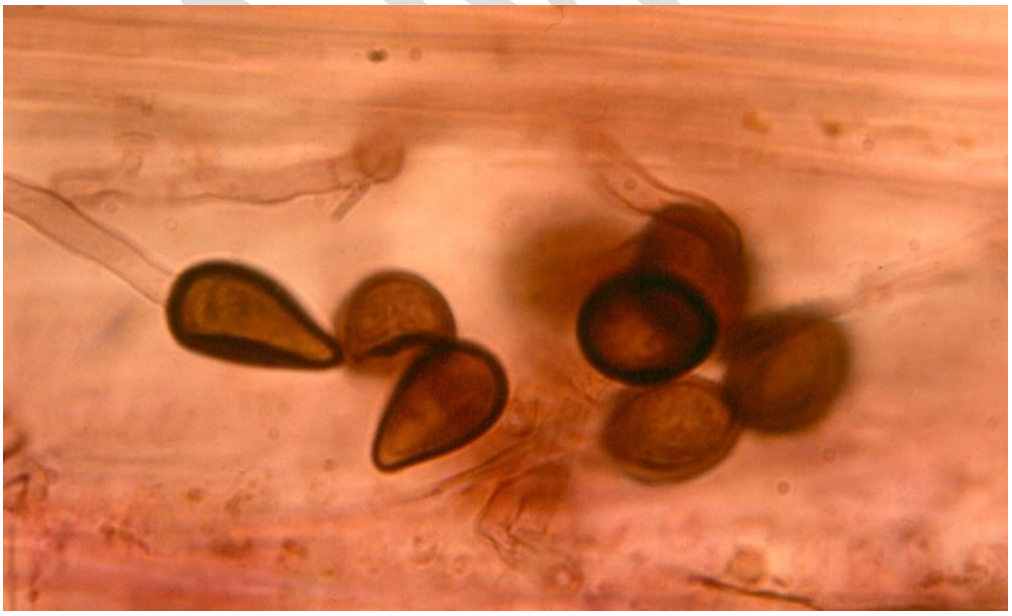
Digestion of the cell walls and colonization of cambium, phloem, xylem and – preferentially because of their starch (glucose) content – parenchymatic rays is due to the release of pectolytic, cellulosolytic and amylolytic enzymes.

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The fungus also moves very quickly through vessels, inside which it grows and releases conidia, mainly of the pyriform type (see pictures below).

These can lie dormant but usually spread the inoculum downwards through sap, causing further infections in the same tree including roots, then moving to neighboring trees when root grafts are present.





Tree-to-tree via root grafted monospecific plantations

Root grafts between neighboring trees are very frequently found along monocultured, linear plane plantations on roads and rivers, where trees are usually less than 15m from each other and where physical obstacles like asphalt or water encourage roots to develop towards neighboring trees.

In such cases, an outbreak originating from an above-ground wound will easily spread from one tree to another, showing a centrifugal symptom intensity from the first tree infected to the others.

Main symptoms

Outer visible symptoms related to the presence of *C. platani* are:

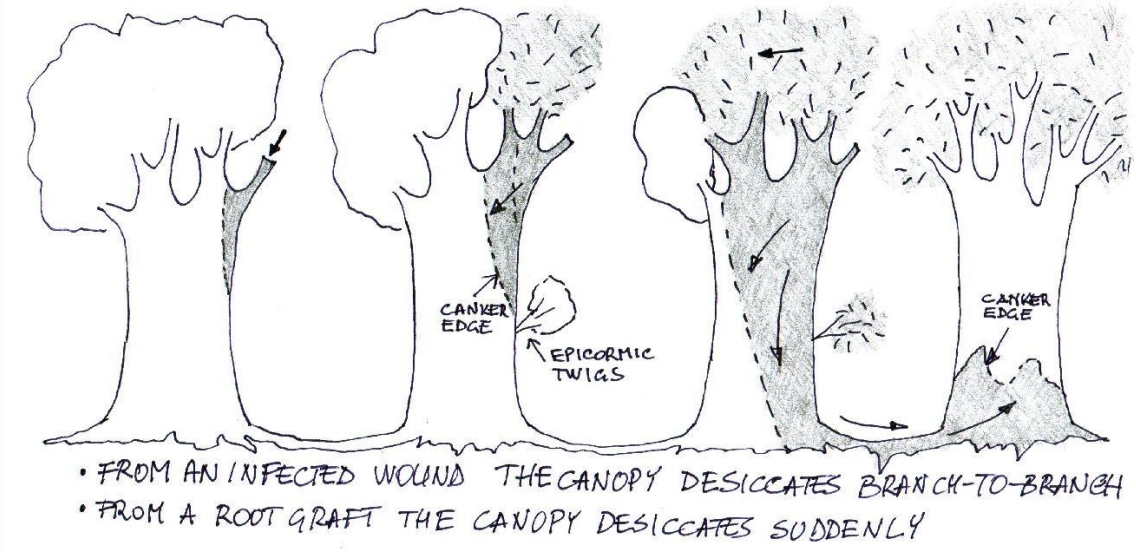
1. **Desiccation of leaves above the fungal infection**. Mycelium grows inside the vessels, releasing conidia and stimulating the tree into the overproduction of tyloses. As a consequence, symptoms associated with insufficient sap translocation are particularly visible from late spring to the beginning of summer when the water required by leaves is not supported by the transport system. As a result the leaves above the infected vessels are usually smaller, yellowing, wilted, and remain on the tree in this desiccated state.
2. **Desiccation of canopy branch-to-branch.** Canopy will not desiccate evenly, but in vertical sections from branch to branch, following the fungal pathway and the vascular involvement.
3. **Non-closing, sub-elliptical canker** oriented according to the vessels, due to devitalization of cambial tissue by both toxic and enzymatic compounds. Accordingly, wound closure does not occur. By removing the outer tissues (using a knife, increment borer etc.) **radial necrosis of internal tissues** corresponding to parenchymatic rays (rich in starch and preferred nutritional source) will be visible. Depending on fungal virulence and plant susceptibility/dimensions, in a few months or years the necrosis grows both longitudinally and tangentially (along the circumference), interrupting sap transport and leading to desiccation of the entire part above.
4. Production of **epicormic twigs below the canker**. In an attempt to restore photosynthetic efficiency the tree often tries to produce

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new leaves below the infection, but as *C. platani* is a parasite it will spread downwards into living tissues, killing new growth.

Tree death will occur in a number of years (approximately 4-10) depending on age, size and condition.

When the parasite moves to a neighboring tree by means of root grafts, a substantial part of the root system dies very quickly, with a basal canker growing from the roots to collar and upwards until the trunk is completely girdled, closely followed by a **sudden, complete desiccation of the canopy**.



necessarily "canker stain of plane" due to *C. platani*: this is the reason we need to sample it.

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Sample collection and fungal identification

Sample collection.

Toolbox: camera, notebook, gouge or robust knife, disposable gloves, waterproof marker, ID tree plates, increment borer (>20cm long), plastic food bags (not rubbish bags; they could release fungitoxic gases), cotton, sterile water, disinfectants (alcohol 60%, bleach 20%, etc.) to wash and then methodically rinse in water all tools before moving to the following tree.

1) Identify (by means of pictures and an ID plate) both the tree as a whole and its main symptoms.
2) Gently remove the bark to identify the necrosis edge by means of a sterile knife or gouge.
3) Screw a sterile increment borer tangentially (not radially as usually) to cross at least one necrosis.



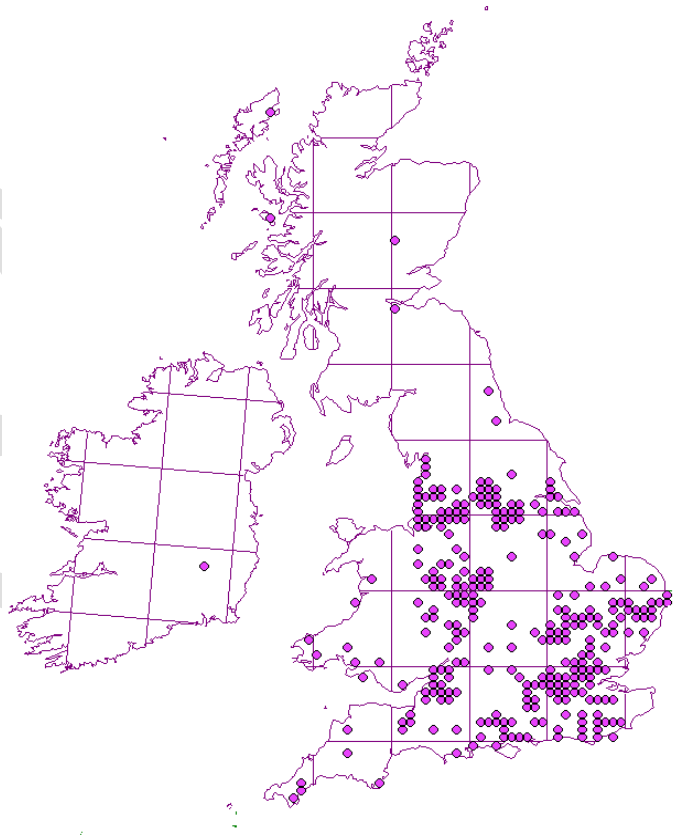
Control

Prevention and control in the UK

There is no cure for *C. platani*. Prevention and containment are the only efficient ways to slow down the spread of this quarantine parasite, regulated by EU Directive 2000/29/EC, Annex II/A2. Movement of trees for planting and non-squared wood from countries where the disease is occurs is prohibited.

Since October 2014 the UK has held EU Protected Zone Status (PZS) for *C. platani*, requiring robust controls relating to importations of plane trees and ensuring that planes can only be imported from other areas which have been designated free of the disease.

In order to maintain PZS it is necessary to demonstrate that the pathogen is being actively looked for and that it has not been confirmed as being present. Since 2014 the LTOA have been leading on this work for the Forestry Commission (FC) in the UK.



Distribution of London plane in the UK (FERA, 2013). *Shaded areas indicate presence of London plane in 10km squares across the UK.*

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