Forestry Commission

Contingency Plan for Canker Stain of Plane (*Ceratocystis platani*)

INTRODUCTION

1. Serious or significant pests and diseases require strategic-level plans, developed at a national level, describing the overall aim and high-level objectives to be achieved, and the response strategy for either eradicating or containing an outbreak.
2. Following identification by the National Plant Health Risk Register, the Plant Health Risk Group (PHRG) has commissioned pest and disease-specific contingency plans for those pests and diseases which pose the greatest risk and which should be subject to stakeholder consultation, including this plan for *Ceratocystis platani.*
3. The purpose of pest and disease-specific contingency plans is to ensure a rapid and effective response to an outbreak of the pest described.
4. Contingency planning starts with the anticipation and assessment of potential threats, includes preparation and response, and finishes with recovery.

Anticipation

5. Researching sources of information and intelligence about the pest, including horizon scanning.

Assessment

6. Identifying concerns and the preparation of plans.
7. Setting outbreak objectives.

Preparation

8. Ensuring staff and stakeholders are familiar with the pest.

Response

9. Implementing the requirements to contain or eradicate, including work to determine success.

Recovery

10. Identifying when the response strategy has been effective, or when the continuing response is not considered feasible, cost effective or beneficial.

11. The Defra Contingency Plan for Plant Health in England (in draft 2016) gives details of the teams and organisations involved in pest and disease response in England, and of their responsibilities and governance. It also describes how these teams and organisations will work together in the event of an outbreak of a plant pest or disease.

Scope

This contingency plan was prepared by the Forestry Commission's cross-border Plant Health Service to be used at country and national levels. It should be used in England in conjunction with the Defra Plant Health Contingency Plan (in draft), being developed by Defra, and which provides details as to the level of response required and by whom, depending on the scenario. Forestry Commission England's Forest Services will use OGB17b 'Managing Incidents in the Forestry Commission' for relevant incidents. The Scottish Government has a generic plan in place for dealing with plant health outbreaks, and Forestry Commission Scotland and the Welsh Government will develop similar documents detailing their management of outbreaks. When an outbreak becomes of UK- or Great Britain-wide concern, the UK Chief Plant Health Officer will form an incident management team to co-ordinate the activities in the different countries.

This contingency plan falls into three main parts:

- official action following a presumptive diagnosis;
- official action following the confirmation of an outbreak; and
- background information about the disease.

This plan will be updated following new information or changes in policy or contact details (Last updated September 2016).

Objectives of this plan

- To raise awareness of the threat posed by *C. platani,* and thereby ensure that stakeholders are aware of the symptoms it causes.
- To provide guidance on steps to be taken whenever symptoms of *C. platani* infection are observed.
- To ensure that disease outbreaks caused by *C. platani* are managed promptly with the aim of eradicating new pathogen populations.
- To ensure that all relevant staff of the Forestry Commission, other Government agencies, Local Authorities and the London Tree Officers' Association (LTOA) are conversant with the contents of this Contingency Plan so that effective and immediate action is implemented.
- To ensure that good communications are put in place so that all stakeholders (including appropriate media) are kept fully informed of the scale of infestation both at regional and national levels.

Anticipation and Assessment

1.1. *Ceratocystis platani* (J.M. Walter) Engelbrecht & Harrington. (Ascomycota: Microascales) is a fungal pathogen which causes a disease commonly known as canker stain of plane, or plane wilt. It colonises the sapwood of *Platanus* species, inciting pronounced xylem staining, severe wilting and tree mortality.

1.2. It is considered native in the USA, but an introduced pathogen in Greece, Italy, Switzerland and France. There are unconfirmed reports from Armenia, and it is considered to have been present, but eradicated, from Spain. The rate of northerly spread of the disease in France has increased in recent years.

1.3. It is on the EPPO A2 list of quarantine species.

1.4. It is officially absent from the UK, although one case was reported on a London Plane in Guernsey in 2008.

Preparation

2.1. *Ceratocystis platani* is listed on the UK Plant Health Risk Register with an unmitigated risk high of 80/125. Plants for planting have been identified as the main pathway risk, along with root contact between mature trees. Infected pruning tools and insects can also aid its spread.

2.2. A UK Rapid Pest Risk Assessment for *Ceratocystis platani* was produced in 2013, and a European Food Safety Authority (EFSA) scientific opinion in 2014.

2.3. The UK now has protected zone status for *Ceratocystis platani.* Imports of *Platanus* plants from the EU must be plant passported, and there are import restrictions of *Platanus* wood from Armenia, Switzerland and the USA, following amendments to the Plant Health (Forestry) Order in 2013.

Legislation

2.4. A list of the legislation which might be relevant in a *Ceratocystis platani* outbreak is given in Appendix 3.

Response

Trigger

3.1. Protected-zone surveys for *C. platani* are carried out annually in the UK. The LTOA, under contract to the Forestry Commission, has been carrying out surveys in Greater London since 2013, and other survey work is planned or

has taken place in Southampton, Bristol and Kent. The key indicators which would trigger a response are findings or reports of:

- the presence of an infected tree in a nursery;
- the presence of an infected tree in the wider environment;
- the presence of the disease in a consignment of imported plants at the point of entry; or
- the presence of the disease in a consignment of imported wood, wood products or wood packaging material at the point of entry.

Detection can be made by the plant health authorities or reported by nursery growers, woodland owners or managers, or members of the public.

OFFICIAL ACTION FOLLOWING A PRESUMPTIVE DIAGNOSIS

Determining the response

3.2. In England, a duty officer from Forestry Commission England or the Animal & Plant Health Agency (APHA) will act as a point of contact for incidents, and it is their job to assign a response officer to incidents when they occur. Similar arrangements are expected to be in place for Scotland and Wales. The response officer investigates and reports back to the Defra Contingency Core Group, which is an 'ad hoc' group put together in response to a notification, and which is usually chaired by the Chief Plant Health Officer. Country teams in Scotland and Wales will fully manage the outbreak in accordance with their own generic contingency plans, but will provide updates to the Defra Contingency Core Group for information purposes, and for Defra to report to the European Commission (EC).

3.3. The response officer will gather information including the location, likely origin, host or commodity, level of damage, extent of outbreak, and risk of spread. The composition of the Contingency Core Group will comprise plant health officials and specialists from the Plant Health Risk Group.

3.4. Based on the information fed back to it, the Contingency Core Group in England will decide upon the alert status (black, amber or red) to be given to the outbreak, and this will determine the level of response. (See Appendix 2 for Alert Status Table.) In Scotland and Wales, the Contingency Core Group can advise on alert status and the appropriate response. If required, the Contingency Core Group will request the relevant organisation/s to set up an Incident Management Team (IMT) to resolve the incident.

Holding consignments and movement / planting restrictions

3.5. Until further investigation, a containment notice should be served, and no material should leave the outbreak site. Local operations associated with tree management will be halted until such time as the suspected case is confirmed as a false alarm. The extent of the site will be determined by the incident management team controller.

Preliminary trace forwards / trace backwards

3.6. The most likely source of entry is the importation of live trees or planting stock and infected wood from continental Europe (Pest Risk Assessment). There has been a requirement since 2013 for importers to notify all *Platanus* imports into England and Wales to APHA, and imports into Scotland to the Horticulture & Marketing Unit of the Scottish Government Rural Payments & Inspections Directorate. (For more information see Appendix 1 - Import Control.)

3.7. Depending upon the pathway of entry, tracing forwards and backwards to identify suspect material will be conducted to identify other potentially contaminated stock or sites. This will include suppliers, propagators and wholesalers, and any clonally related or potentially contaminated stocks, where appropriate. Also, the location of the nearest waterways or watercourses should be identified, because spores of the fungus can easily be transported in water. The disease might also be spread on tools, machinery and vehicles, so this should also be investigated. The disease

can also be spread through soil or infected plant material, including sawdust.

How to survey to determine whether there is an outbreak

3.8. A new outbreak of *C. platani* is most likely to be detected through specific surveys carried out as part of the annual protected zone surveys, general surveillance by local authorities, or following a Tree Alert report of a suspected sighting from a landowner/manager, a member of the public, or an Observatree volunteer.

3.9. For reliable detection and identification of *C. platani* in host material, laboratory testing using EPPO Standard PM 7/14 (EPPO, 2014), or the real-time PCR assay developed by Pilotti et al. (2012), is required.

3.10. Follow-up inspections will be undertaken, either by APHA for non-woodland situations or a Forestry Commission England Tree Health Officer for woodlands, to gather information. (The support of the LTOA should be sought if the outbreak is in London or South East England). The information gathered should include:

- the likely origin of the disease and, if a consignment of a plant and plant product is suspected to be at the origin of the outbreak, details such as other points of destination;
- the geographical location and ownership of the affected site, including any abiotic factors which might influence the outbreak, e.g. public access, presence of watercourses where *Platanus* trees might have interlocking roots and/or there is boat traffic, and distance from other planting sites with a *Platanus* component etc. Include maps if possible;
- hosts infected at the site (species, variety, age, proportion of hosts in the wooded area etc.);
- when and how the pest was detected and identified, and by whom (including photographs of symptoms);

- the level of disease incidence and, where appropriate, any fruiting bodies present;
- the possibility that insects and mammals could have transferred infectious propagules of the pathogen between host plants (although no vector is essentially associated with *C. platani* spread*)*. See the Rapid PRA 2013 for further information;
- the extent and impact of damage (including part/s of host/s affected);
- recent importation/s or movement/s of host plants or host plant products into and out of the affected site;
- movements of people, products, equipment and vehicles, where appropriate;
- ease of access for machinery on to the site;
- relevant treatments applied to host plants which could affect development of symptoms or detection and diagnosis of the disease;
- the history of the disease on the site, place of production, or in the area;
- any urban arboricultural works which might have taken place recently; and
- the likely biodiversity impacts of any control, including any duty of care obligations under the Natural Environment and Rural Communities (NERC) (2006) Act.

3.11. Suspect material from infected trees in the wider environment should be either:

(a) triple-wrapped in robust plastic bags; or

(b) double-wrapped in robust plastic bags and the bags placed inside a secure box or vial and sent immediately to the Tree Health Diagnostic & Advisory Service at Forest Research for diagnosis, following advance notice. Suspected vectors should be preserved in alcohol and sent in a similar manner. The samples should be accompanied by information about the date when the samples were collected, the location (address,

postcode, GPS) and contact details of the person collecting the samples. The address is: Tree Health Diagnostic & Advisory Service, Forest Research, Alice Holt Lodge, Gravel Hill Road, Wrecclesham, Farnham, Surrey, GU10 4LH.

Samples collected from nurseries by APHA's Plant Health & Seeds Inspectorate (PHSI) staff should be sent to Fera Science Limited for analysis.

Confirmation of a new outbreak

3.12. Positive identification of *C. platani* can only be conducted in the laboratory using defined diagnostic protocols. Where on-site diagnostic systems have been developed, these may be used by a pathologist or a suitably trained and competent plant health officer. Samples should only be removed from the site by trained individuals using safe and appropriate equipment, and operating according to biosecurity guidelines.

OFFICIAL ACTION FOLLOWING THE CONFIRMATION OF AN OUTBREAK

Strategic actions on confirmation

3.13. Upon positive confirmation the following actions must be initiated:

- notify Westminster Ministers and senior Defra and Forestry Commission officials;
- set up regular meetings with the Lead Government Department (LGD) to keep partners aware of the current status, actions and possible future requirements, and to agree a communications strategy. (The frequency of the meetings can be determined by the scale of the outbreak.);
- notify the Devolved Administrations and the EC; and
- inform and discuss with stakeholders.
- If the outbreak is in London or South-East England, consider including the LTOA in LGD meetings to help with public and stakeholder outreach.

3.14. In most instances where the outbreak is in woodland or parkland, Forestry Commission England is likely to appoint an incident controller and an incident management team. APHA would take the lead for outbreaks in commercial trade and nurseries. In Wales the Welsh Government, with Natural Resource Wales's support, would take the lead in woodland situations. Forestry Commission England's Forest Services will work to the generic Defra contingency plan (in draft), which will be enacted in response to a confirmed outbreak. Forestry Commission Scotland and the Welsh Government will have similar documents detailing their management of outbreaks.

3.15. Initial efforts will be directed towards eradicating new outbreaks following the procedures set out below. Failing eradication, efforts will concentrate on containment.

Communication

3.16. The Incident Controller sets up a management structure to deliver functions of incident management. The outbreak will determine the size and nature of the management structure. Identification of and liaison with key stakeholders is a crucial part of this process. See para 3.28 'Public outreach'.

Surveillance

3.17. All *Platanus* trees within a 1km radius of infected *Platanus* trees will be inspected for signs of *C. platani* to determine the extent of the outbreak. (Many city authorities hold databases of tree species and locations, and assistance should be sought from local tree officers.) The 1km radius has been set on a precautionary basis that insect or mammal transfer of spores is feasible, although it is understood to be a low risk and unlikely.

3.18. Other surveillance includes a follow-up survey to identify any infected trees which might have been missed, and to determine the outer extent of the

outbreak. The public will also be encouraged to look for any symptomatic trees, with resources available on the Observatree website.

Demarcated zones

3.19. A 1km demarcated zone will be established around infected trees, where all *Platanus* trees will be assessed for the presence of *C. platani*. There must be restrictions on movements of infected material both within and outside this zone. The size of the demarcated zone might need to be extended along the watercourses if there are watercourses within the zone with *Platanus* roots extending into the water, particularly if there is boat traffic, which can damage trunks and root systems.

3.20. Nurseries within the 1km demarcated zone will be inspected for the presence of *C. platani* and have their plant passporting for *Platanus* plants suspended until the presence or absence of *C. platani,* both within the nursery and within the 1km zone, can be determined.

Tracing forwards / backwards

3.21. If the infected trees have been recently planted, i.e. within the previous two years, the source of the plants must be traced back to the supplying nursery, and the nursery must be inspected by APHA for the presence of *C. platani*. In addition, any supplies of *Platanus* planting material from the nursery over the previous two to three years should be traced to their final planting sites, and inspected for the presence of *C. platani*.

Pest management procedures

3.22. Depending on the location of the new outbreak, Statutory Plant Health Notices (SPHNs) will be issued by either the Forestry Commission (in woodland and parkland situations) or APHA. Timely issue of and response to these and subsequent actions is essential if new outbreaks are to be

contained and eradicated. It should be made clear at the outset that the costs of any direct or remedial actions required for the removal or management of the infected trees will be borne by the landowner. The Forestry Commission or APHA will also need to consider whether direct intervention by government in terms of action to remove and treat infected material is required to ensure a rapid response to reduce the risk of spread.

Disposal

3.23. The most effective method of dealing with a tree infected with *C. platani* is to fell the tree and burn the infected material. The roots can interlock, so those trees in immediate proximity should also be felled and burned. (The definition of proximity will need to be considered on a case-by-case basis, particularly with reference to the potential for there to be interlocking roots and movement of spores via watercourses and soil water). As a precaution those visually healthy trees within 50m should also be considered for felling and destruction.

3.24. Trees, including the branch and round wood, which are felled to eradicate *C. platani* infections must be destroyed, preferably on site by burning, or by burning as close as possible within the demarcated area designated for this purpose. (Burning must comply with appropriate waste management regulations administered by the Environment Agency in England, the Scottish Environment Protection Agency (SEPA), and Natural Resources Wales). Forestry Commission England has a framework contract in place for a mobile incinerator which could be used if necessary.

3.25. Good practice would be to remove the entire tree, including the stump, because it can still be, or become, infected. However, this might be difficult in an urban environment, in which case treatment of the stump with an application herbicide should be carried out instead to prevent re-growth from the roots and stump. However, if the mycelium of the pathogen is not in the roots, felling the tree at the base can separate a healthy stump from a diseased crown. Panconesi (1999) recommends that if infection is present in the roots of the tree, the whole infected tree and all surrounding Platanus trees need to be removed, because the pathogen can survive for

long periods in the roots, and is readily spread through root anastomoses between neighbouring trees.

3.26. Although the EFSA considers deep burial of infected or suspected infected material to be an option, it is on the proviso that it is entombed and will not be disturbed or moved for many years, even decades. The spores are able to persist in soil and woody material for a considerable time, so no soil from infected sites should be moved or disturbed if possible. The pathogen can also survive for several months or years as chlamydospores in the wood of diseased trees. (Grosclaude et al., 1996; Engelbrecht et al., 2004)

3.27. If material has to be moved from site it should be transported, with a protective covering ensuring all material is contained, to a licensed incinerator. Because the fungus is a wound pathogen, care should be taken to avoid damaging any susceptible trees in close proximity to the operation. It is critical that all material is removed safely from the site, because even sawdust from *C. platani*-colonised sapwood can be a source of inoculum and can be dispersed by wind and water, leading to infection via wounds on otherwise healthy trees. (See appendix 1.) Large sheets should be placed on the ground to capture all leaf litter, and any remnants collected using an industrial vacuum cleaner once larger pieces have been disposed of. Similar procedures have been used in the recent outbreaks of *C. platani* along the Canal du Midi in France (http://archives.eppo.int/EPPOReporting/2005/Rse-0511.pdf), where the trees were also treated with a systemic herbicide to kill the tree and help contain the disease. Because the spores can survive in the soil for several months (Mutto Accordi 1989), there should be a restriction on movements of potentially contaminated soil. All equipment used in the felling and disposal process should be thoroughly cleaned and disinfected, along with any personal protection equipment used.

Public outreach

3.28. It is crucial to have the support of key sectors of the public, e.g. ramblers, and key stakeholders, such as tree officers, woodland owners and

managers etc, for the management programme and to help with general surveillance. Engaging these groups, and especially key stakeholders, will require the provision of timely, balanced and accurate information about monitoring and control. It will also make people aware of opportunities for them to participate in monitoring and reporting suspected cases using the on-line reporting tool Tree Alert. Information, subject to available budget, can be made available through newspapers, radio, TV, the internet and social and specialist media, and should be targeted locally, especially within the infested and regulated area/s. Consideration should be given to targeting audiences at a national level as well if it is thought possible that the disease might be present elsewhere.

3.29. It is important to provide information on the location and size of the infested and regulated areas, statutory and voluntary responsibilities, and estimated rates of spread, management options, pathways along which the pest might have arrived and could be dispersed, and what people can do to help, especially in terms of monitoring. Managing this level of public and stakeholder engagement will require a central administration office capable of handling a large numbers of enquiries and able to provide general and specific information. Liaison with communications and press teams from other countries might be required for cross-border outbreaks. If the outbreak is in London the LTOA has agreed to help with communicating the outbreak and the implications to the public.

Review measures in the case of prolonged official action

3.30. Where eradication proves not to be possible, the focus should move from working to eradicate the outbreak to containing it as much as possible. A review of the management programme should be undertaken regularly (at least annually) to determine the success and cost-effectiveness of the measures in the longer term. This review will involve consultation with stakeholders and should include:

- evaluation of the effectiveness of current measures;
- evaluation of the economic impact and cost-effectiveness of continuing existing measures;

- consideration of further measures to strengthen containment and eradication actions;
- consideration of statutory obligations and impact on import and export procedures; and
- consideration of alternative approaches or the cessation of statutory action.

Criteria for declaring a change of policy and reviewing the contingency plan

3.31. This and other contingency plans will be reviewed annually to accommodate any significant changes in pest/pathogen distribution, dispersal, refinement of surveillance techniques, and changes in legislation or policy. When and if policy makers in the country or countries affected deem that eradication is no longer achievable, there will be a move towards containment. The criteria for determining such a break point could be based on a percentage of host species lost, a set number of hectares lost, the number of individual outbreaks, the resources needed, or a combination of these, but this will be determined by the policy makers in the country or countries affected. Further details can be found in the Defra generic plan.

In circumstances where official action is no longer considered appropriate, stakeholders should be consulted, and a timetable and mechanism agreed, for the removal of official measures and for the dissemination of information about managing the pest as appropriate.

The plan should only be re-consulted upon if significant new information is presented which affects the approach to outbreak management.

Recovery

4.1. A site can be deemed to be in recovery when annual monitoring indicates no presence of the disease for three years.

4.2. Other considerations - Research has taken place to test the potential resistance or tolerance of a clone between *Platanus occidentalis* and *Platanus orientalis*. Tolerant *Platanus* species have been planted in France. (https://www.researchgate.net/publication/229525430_First_hybrid_plane_trees_to_show_resistance_against_canker_stain_Ceratocystis_fimbriata_f_sp_platani)

Appendix 1: Pest background information for *Ceratocystis platani*

The pathogen was originally described as *Endoconidiophora fimbriata* f. sp. *Platani,* and later transferred to the genus *Ceratocystis,* with inclusion in the *Ceratocystis fimbriata* species complex as *C. fimbriata* f. sp. *platani*. However, revision of this species complex based on new data resulted in the organism being raised from *forma specialis* level (*C. fimbriata* f. sp. *platani*) to species level (*Ceratocystis platani*).

Species name: *Ceratocystis platani* (Walter) Engelbrecht & Harrington

Synonyms: *Endoconidiophora fimbriata* (Ellis & Halsted) Davidson f.sp. *platani* Walter

Common names: Canker stain of plane, plane wilt (English)

UK risk rating: Unmitigated 80/125 Mitigated 40/125

EU status: Present

EPPO status: A2 list no. 136; EC Annex designation II/A2

UK status: Currently unreported in the UK

Hosts

The only confirmed hosts of *C. platani* are three species of the genus *Platanus*:

- *Platanus occidentalis* L. (American sycamore) eastern North America;
- *Platanus orientalis* L. (Oriental plane); and
- *Platanus* x *acerifolia* Ait. (Willd.) (London plane), a natural hybrid of the above two species.

Platanus orientalis and *P.* x *acerifolia* are extremely susceptible to the disease, whilst *P. occidentalis* is less so.

Life cycle and symptoms

Ceratocystis platani infects plane trees (*Platanus* spp.) at any time of the year, subject to temperature, by entering through wounds and extending into the sapwood, where it causes xylem staining and blockage of water. This results in sudden wilting of part or all of the crown, often followed by tree mortality. The staining caused by the pest can extend longitudinally in the sapwood at a rate of 50–100 cm per year, and reach the heartwood along the medullary rays. Infected trees exhibit sparse, chlorotic foliage and sunken, elongated or lens-shaped cankers on branches or the main stem, which then become roughened and black with age.

The fungus does not grow below 10^0C, and its most favourable period for infection and disease development is May to September. The spores of *C. platani* germinate when they come into contact with a freshly made wound, and then colonise the exposed tissues and invade the underlying sapwood, where it develops both longitudinally and tangentially. Asexual spores (conidia) of the pathogen start to appear 2-8 days following infection, visible as a light grey powdery layer on the wound (mainly pruning cuts), with sexual spores (ascospores) forming slightly later. Chlamydospores might also be produced inside the xylem vessels. Once in the host, the fungus moves through the xylem as a wilt pathogen, as well as causing bark cankers (See Figure 1.) It can survive for several months or years as chlamydospores in the wood of diseased trees, and for up to 3-4 months in soil during the winter.

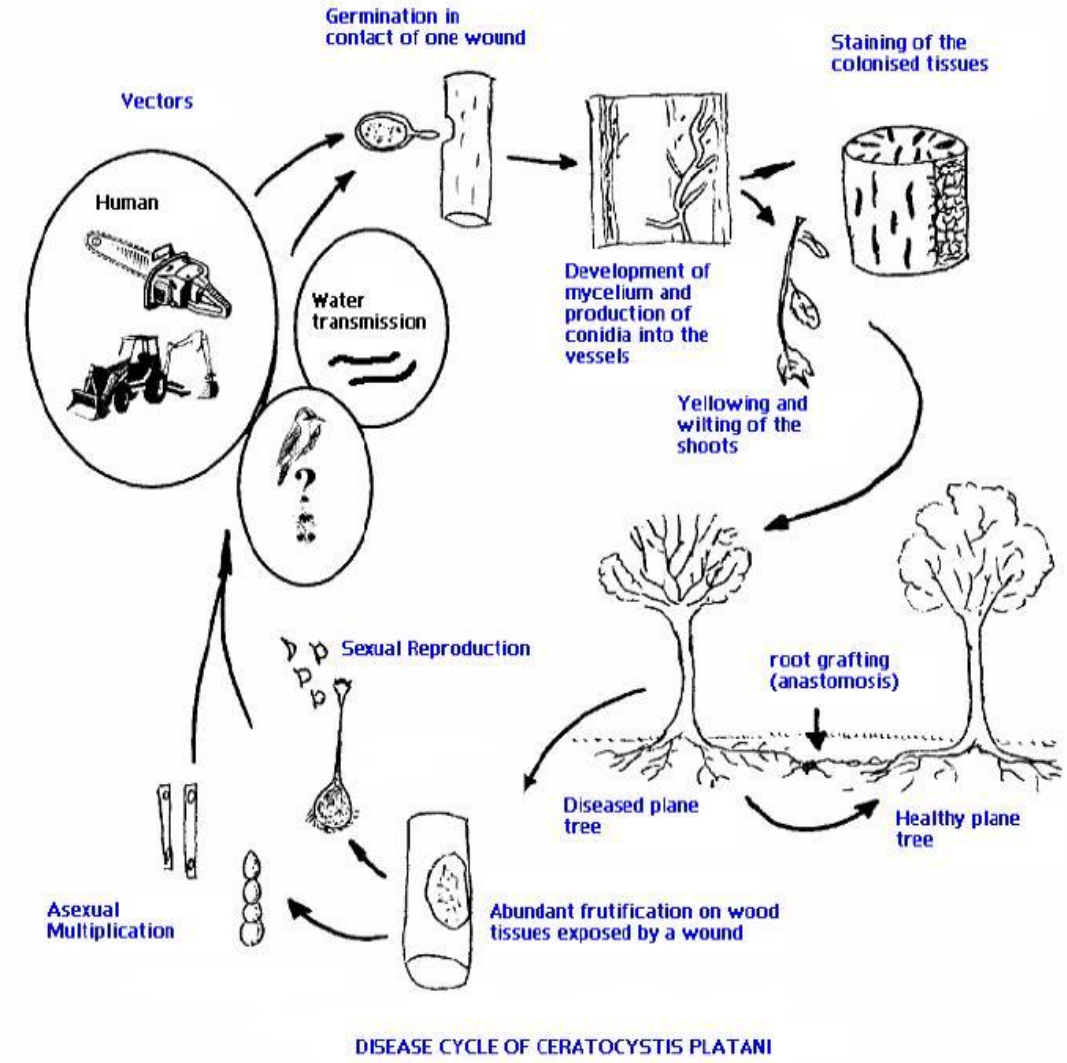

Figure 1 – *Ceratocystis platani* life cycle. Source N. Soulioti, Institute of Mediterranean Forest Ecosystems, Athens, Greece

C. platani inoculum (ascospores, conidia) can be spread by weather-related factors (rain, wind, wind-driven rain), and air-borne inoculum of *C. platani* has been detected 200m from the closest infected *Platanus*. Spores can also be washed down from canker surfaces by rain water into the soil at the base of the trees. The main sources of inoculum comprise spores, as well as the frass produced by some insects as they tunnel into infected trees.Inoculum can also be dispersed by insects, small rodents and birds, although spread via birds or rodents is considered insignificant. (See Figure 1.)

Spores, and frass or sawdust which contain the fungus, can also be dispersed in waterways, such as streams, rivers, drains and canals. Water is an important means of dispersal: woody material, including logs and pieces of branches from infected dead *Platanus* trees, as well as spores of *C. platani*, can be carried downstream, creating new infection foci in trees planted along rivers and water channels. In the outbreak along Canal du Midi, it is believed that the disease has been spread in the canal water, and infection has entered the trees through wounds on their roots caused by boats bumping into the canal banks.

Another means of *C. platani* natural spread is through root anastomosis (grafting) and root wounding. *Platanus* trees can grow close together along streams and rivers, and in this environment roots can graft together; likewise, in urban areas the roots of planted lines of trees can also anastomose. In such cases, once the pathogen is established in one tree, it can spread to neighbouring trees through the grafted root systems.

Symptoms

Single trees or groups of trees in a row of *Platanus* can be affected. A single branch with sparse, somewhat chlorotic foliage or wilting foliage is usually seen first, and later more extensive dieback of the crown. (Figure 2) Wilting occurs most often in the spring and summer, and typically the wilted leaves dry out, but do not fall immediately.

Infected trees or branches develop extensive lens-shaped lesions which affect the phloem, cambium and extensive areas of the sapwood. In the centre of the lesion, the necrotic bark becomes pale-brown and cracked, and the margins show no wound callus formation. (Figure 3) On thin-barked trees it can appear as sunken, dark, elongated spots, with orange/purple streaking around the margins. In thicker-barked trees the bark cankers can become roughened and black with age, and the only external signs of cankering might be vertical cracks.

When the bark is pared away, leopard-like dots (brown to dark violet) appear in the outer wood. Cross-sections of affected branches show bluish-black, or brown, spindle-shaped patches, extending radially and more or less side by side. The staining in the sapwood can extend longitudinally at a rate of 50–100cm per year, and can reach the heartwood along the medullary rays. An expanding

canker can kill a tree of 30-40cm diameter in 3-4 years, and a large, vigorous tree in 4-7 years.

The FC Pest Alert factsheet provides further details of symptoms of the disease.

Figure 2 – Advanced symptoms such as canopy thinning caused by *C. platani*. Source A. Vigouroux, ENSA

Figure 3 – Invasion of bark on tree stems *C. platani*. Source A. Vigouroux, ENSA

Figure 4 – Early stages of *C. platani*. Source A. Vigouroux, ENSA

Figure 5 – Extensive staining of stump infected with *C. platani*. Source: F. Maire

Figure 5- Gradual progression of infection caused by *C platani*
Source: John Parker (LTOA)

Distribution of the organism

Ceratocystis platani is thought to be indigenous to North America, and to have been introduced into Europe during World War 2, into the Naples area of Italy. It is believed it came in on infected wooden packaging material containing military supplies. Since then the disease has spread to Greece, southern France, Spain (where it has been declared eradicated) and Switzerland, with unconfirmed reports of it in Armenia.

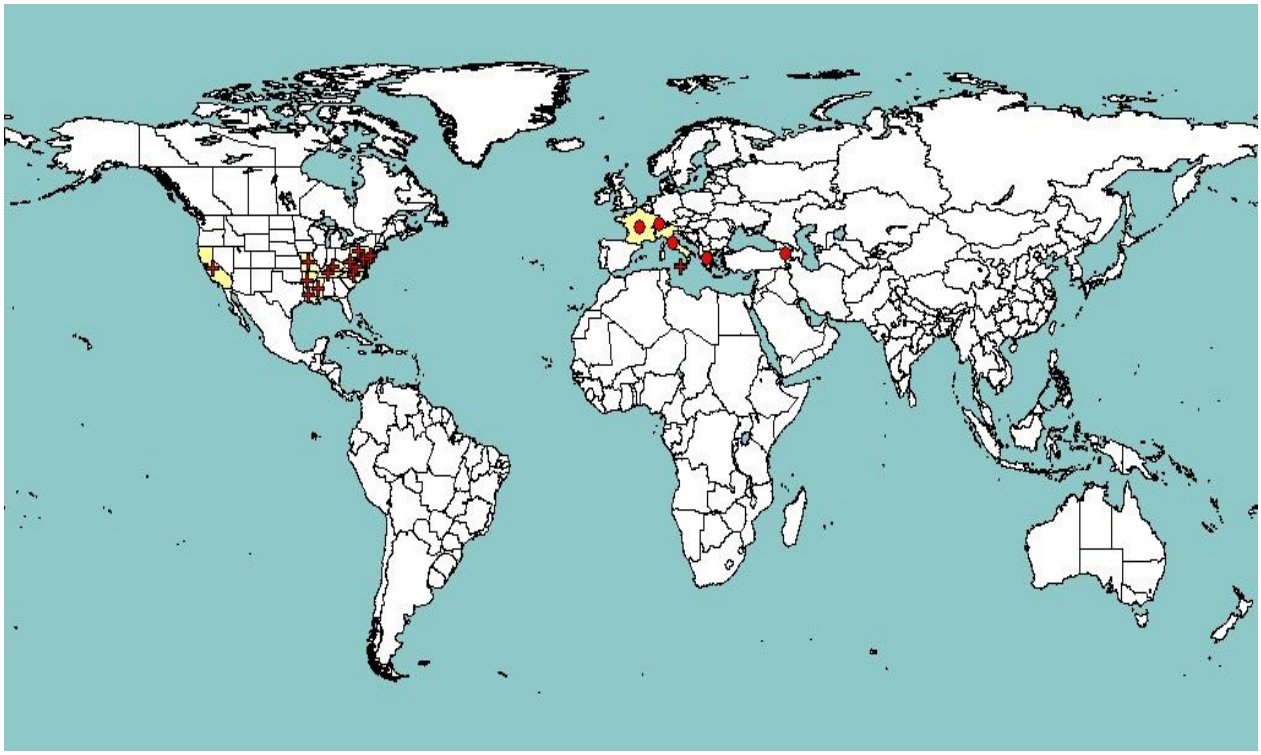

Figure 6. Distribution as of December 2015 of *Ceratocystis platani.* Circles represent national records, crosses represent subnational records. (EPPO PQR database)

Damage impact and controls

If *C. platani* were to become established in Britain, it could pose a serious threat to the various *Platanus* species present, although uncertainty remains about its rate of spread. For example, in France (http://archives.eppo.int/EPPOReporting/2005/Rse-0511.pdf) where Plane trees are abundant throughout, there has been ample opportunity for the disease to have spread much further than its current extent. In the eastern USA, before

1950, canker stain attacked 3.8% of the trees, and up to 80% in some towns. However, the disease appears to have lost importance in the US. In south-east France, *C. platani* has caused serious losses to shade trees. In Marseille, after a first phase of infection starting in 1945, 1850 *Platanus* trees averaging 110 years old were killed between 1960 and 1972 (about 13% of the initial population). The disease spread out of the city and into the next département (Vaucluse), where infected trees died in 3-7 years. The fungus invaded northern Italy in a few years and killed many trees, especially in young row plantings.

Because *C. platani* is classed as a quarantine organism, there is a requirement to report trees that are suspected of being infected. It can persist in infected wood, so the removal and burning of all infected material is considered the safest form of control, although the EFSA does also consider deep burial an option provided that the soil is not disturbed for a number of years.

There are no approved chemical treatments available, although authorities in France have been experimenting with fungicides to try and control the Canal Du Midi outbreak in Carcasonne. Some hybrid clones have been identified which show disease resistance or tolerance, and are being used to replant in areas where infected trees have been removed.

The most effective controls other than removal and burning are the stringent use of biosecurity practices, including disinfecting of pruning equipment and careful selection of planting stock from areas which are known to be disease free. Alternative broadleaf trees, such as Mulberry, are being considered as alternatives to Platanus, and are being used extensively in cities such as Paris and Tehran.

Main pathways

Apart from natural spread via air-borne or water-borne propagules, insect vectors or root anastomoses, there are a number of pathways that could allow *C. platani* to enter the UK and spread. It is accepted that this pest can spread over long distances via the movement of infected host plants for planting (rootstocks, grafted plants and scions). Infected wood or wood packaging material is another pathway, because *C. platani* can survive and sporulate heavily on cut wood surfaces, and wood can also contain long-lived chlamydospores. Pruning or tree-felling equipment which has been used on infected trees and not cleaned and

disinfected thoroughly is another possible means of spread and introduction. Spores are known to persist for a considerable period in both wood and soil, and the initial introduction of the pathogen to Europe is widely accepted to have been on wooden packaging material. Soil containing the pathogen could also be introduced on vehicles or equipment, and possibly also on contaminated footwear.

Import controls

In October 2014, UK was granted Protected Zone Status against *C. platani*. The new legislation bans the movement of plane plants to the UK unless they have been grown in a pest-free area and accompanied by a plant passport certifying this.

Imports into UK of plane wood from EU countries

Requirements:

Imported plane wood material must be accompanied by an official statement (plant passport) confirming that:

(a) it originates from an area that is known to be free from *Ceratocystis platani*; or

(b) (in the case of wood that it has been kiln dried to below 20% moisture content) a mark of 'Kiln Dried' or 'KD' on the wood or its packaging.

Imports into the UK of plane wood originating from Armenia, Switzerland and USA

Requirements

Wood, including wood which has not kept its round surface, must be accompanied by an official statement that it:

a. is bark-free; or

b. has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, and achieved through an appropriate time/temperature schedule. There shall be evidence of that kiln-drying by a mark 'Kiln-Dried' or 'KD' or another internationally recognised mark, on the wood or on any wrapping, in accordance with current usage.

Wood chips, wood waste, scraps and similar shall be accompanied by an official statement that it:

a. has been produced from debarked round wood; or

b. has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter achieved through an appropriate time/temperature schedule; or

c. has undergone an appropriate heat treatment to achieve a minimum core temperature of 56ºC for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core), the latter to be indicated on the phytosanitary certificate or phytosanitary certificate for re-export.

Appendix 2 – Alert status categories – (based on alert status levels for draft Defra generic contingency plan).

ALERT	STATUS	COMMAND LEVEL
White	Plant pest or disease with potential for limited geographical spread	Instigation of incident management plan involving operational command at appropriate level, and implementation of Standard Operating Procedures or scientific advice where applicable
Black	Significant plant pest or disease with potential for limited geographical spread	Instigation of incident management plan usually involving joint tactical and operational command at appropriate level. Implementation of plant pest/disease-specific response plans where applicable
Amber	Serious plant pest or disease with potential for relatively slow, but extensive, spread leading to host death and/or major economic, food security or environmental impacts	Instigation of incident management plan usually involving joint strategic and tactical command, and plant pest/disease-specific response plans where applicable
Red	Serious or catastrophic plant pest or disease with potential for rapid and extensive geographical spread leading to host death and/or major economic, food security or environmental impacts	Instigation of incident management plan involving strategic, tactical and operational command, and implementation of plant pest/disease-specific response plans where applicable

Appendix 3: Relevant legislation

Domestic:
The Waste Management Licensing (Scotland) Regulations 2011
The Environmental Permitting (England and Wales) Regulations 2010
Natural Environment and Rural Communities Act 2006
Plant Health (Forestry) Order 2005 (Unofficial Consolidated version)
Plant Health Act 1967
Forestry Act 1967

European:
EC Council Directive 2000/29/EC

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This contingency plans draws on recent extensive reviews of the literature have been undertaken and the relevant reviews are listed below.

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