Forest Research

Threats to Tree Health in Britain

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Forest Research

10th Dec 2021

What is THDAS?

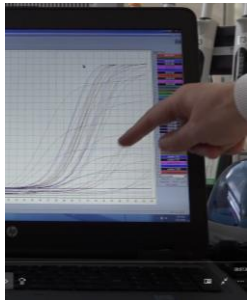
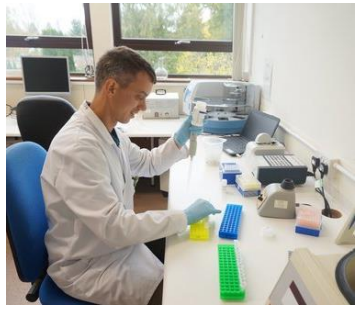
- Tree Health Diagnostic and Advisory service (THDAS) has been running since the 1960s
- Part of Tree Health Group within the Centre for Ecosystems, Society and Biosecurity (CESB) at Forest Research
- Team of pathologists and entomologists
- Providing impartial advice or identifying pests and pathogens on trees in England, Scotland and Wales
  - Private and public sectors in forestry
  - Local authorities
  - Arboricultural consultants and tree surgeons
  - General public
- Gather information about the health of trees in Britain
- THDAS acts as an early warning system for tree health

https://treealert.forestresearch.gov.uk

- Work alongside Tree/Plant Health Teams from the three countries (Forestry Commission England, Scottish Forestry, Natural Resources Wales, APHA)

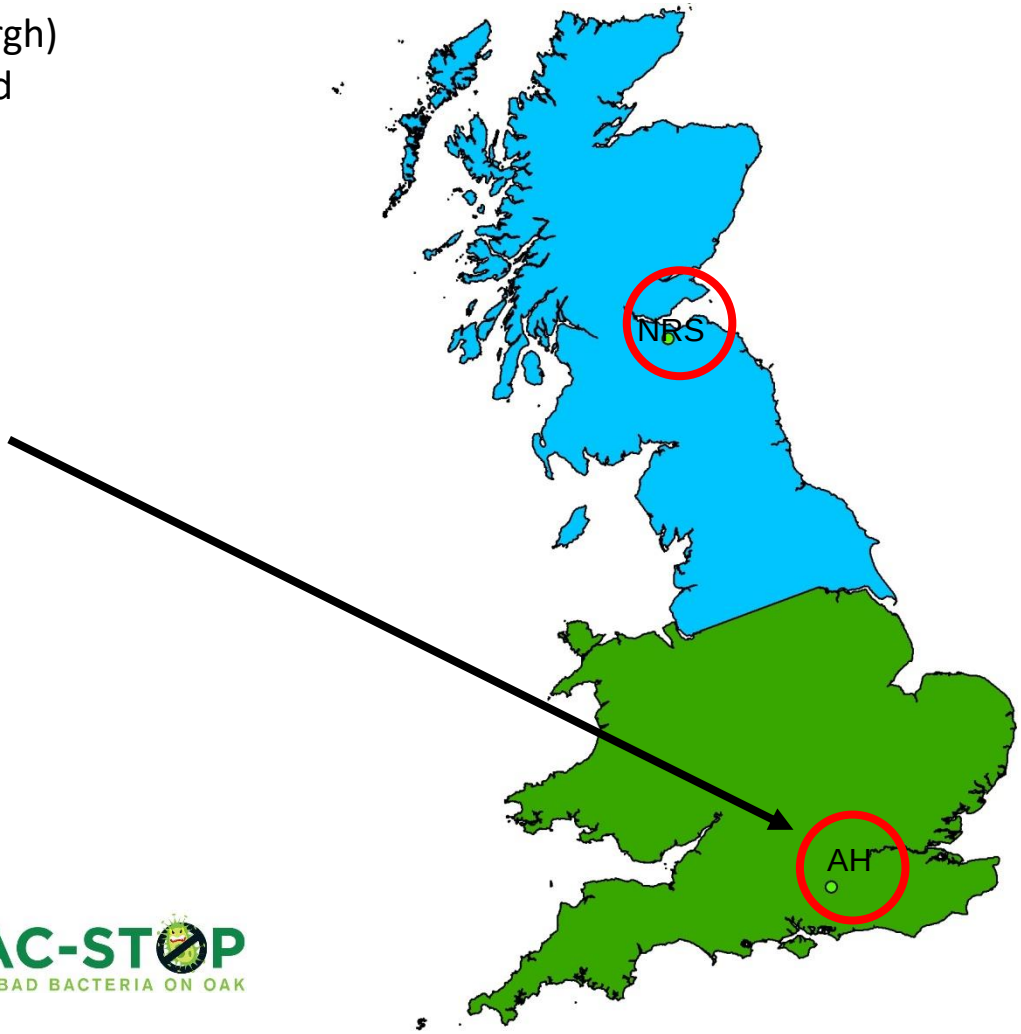





What is THDAS?

- Two stations cover the UK
  - Northern Research Station (Edinburgh)
    - Scotland and Northern England
  - Alice Holt (Farnham, Surrey)
    - Southern England and Wales



- Work with projects:

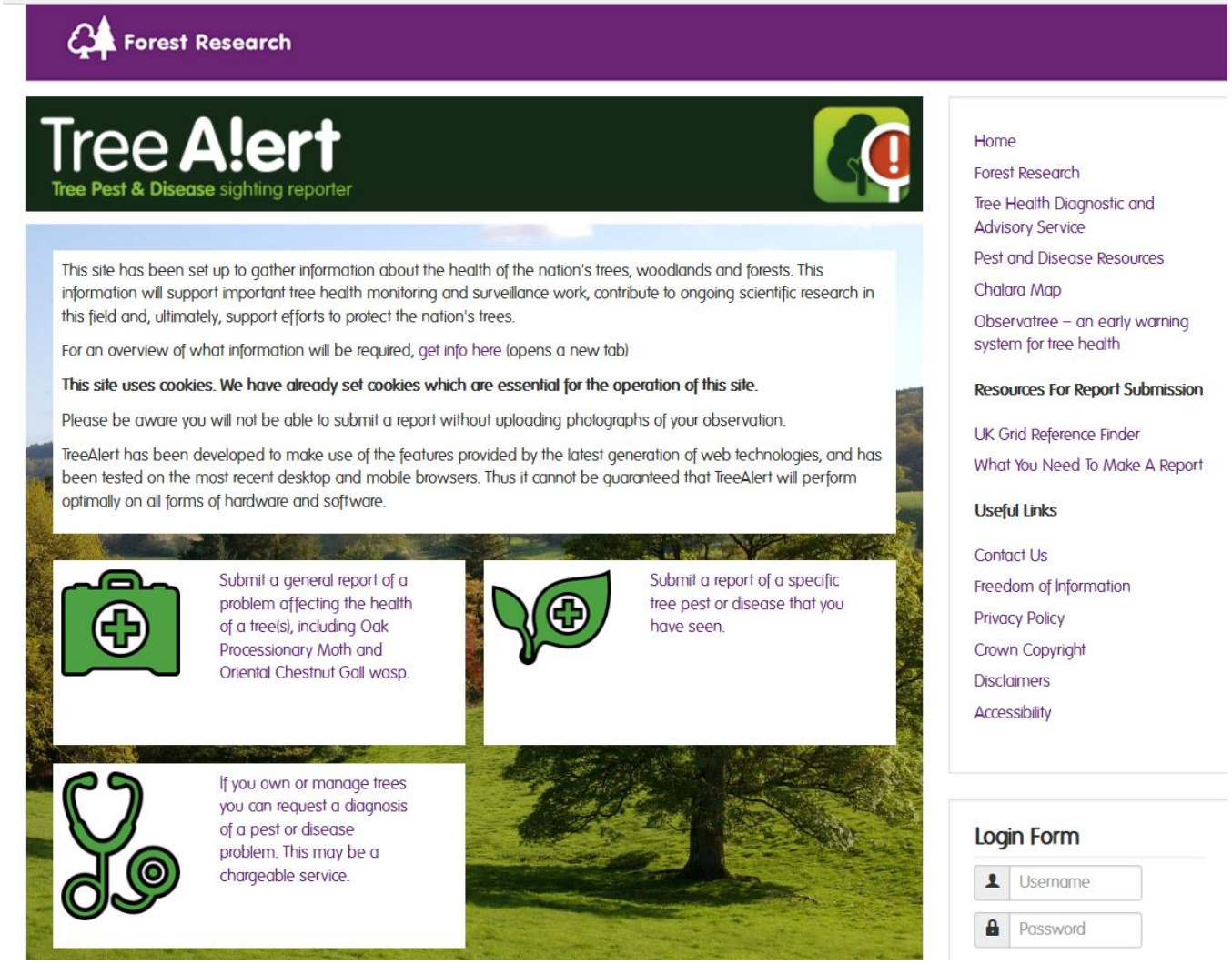
Observatree monitoring tree health

BRIGIT Vector Borne Disease of Plants

BAC-STOP STOP BAD BACTERIA ON OAK

TreeAlert

- TreeAlert is a system for reporting suspected tree pests and diseases of concern in Britain (https://treealert.forestresearch.gov.uk/)



What happen to submitted reports?

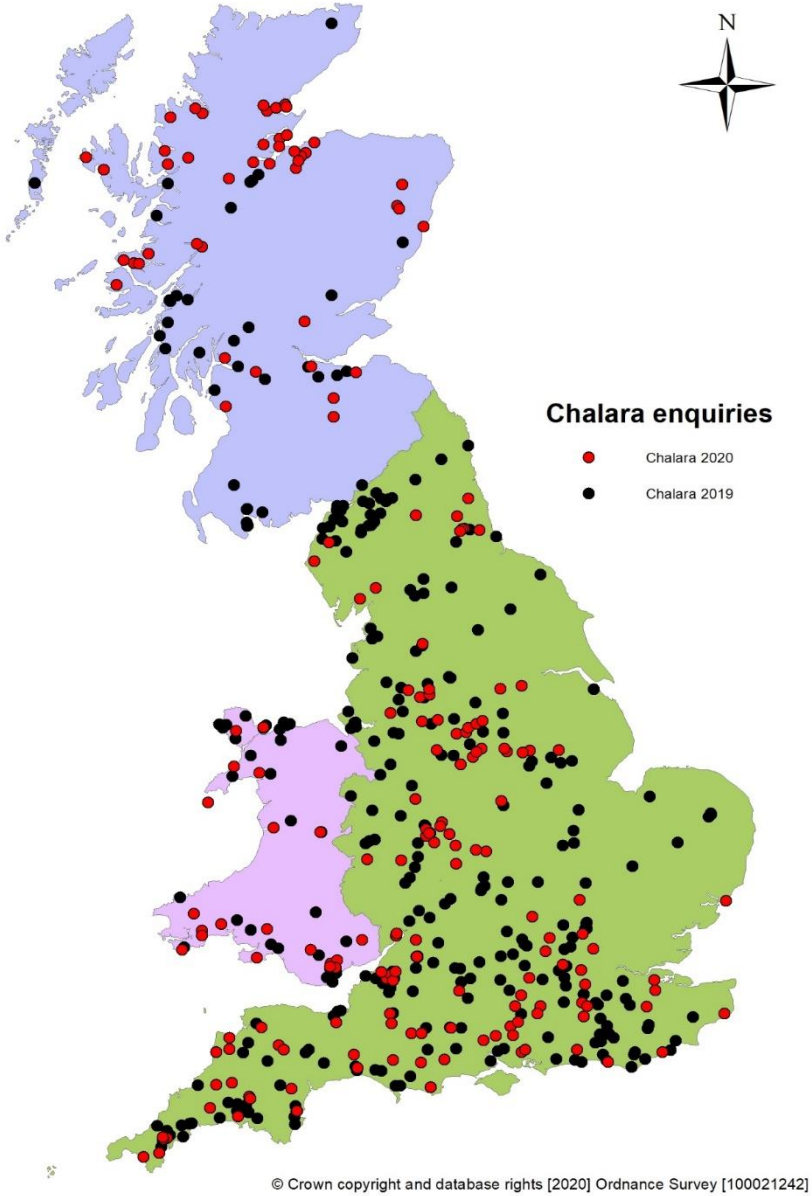
- TreeAlert reports are checked daily
  - Triage
  - Enquiries are allocated to entomologists or pathologists
  - Priority given to regulated or quarantine organism
    - These cases are followed up by the wider Plant Health Services, the authorities in England, Scotland and Wales
    - In some cases are followed directly by THDAS team members
  - Reply to all enquiries
  - In some cases THDAS might request samples
  - In some cases site visits need to be arranged

Overview of current tree diseases through THDAS

In the last five years

- The main five diseases reported on trees through THDAS in the last five years have been:
  - Chalara ash dieback (*Hymenocyphus fraxineus*)
    - Detected in England in 2012 but here earlier
  - Cedar shoot blight (*Sirococcus tsugae*)
    - Detected in England at the end of 2014 but here earlier
  - Honey fungus (*Armillaria* spp.)
  - Phytophthora diseases (*Phytophthora* spp.)
  - Neonectria canker of fir (*Neonectria neomacrospora*)
    - Re-emerging disease in Europe since 2008 but here since the 1960s

Chalara ash dieback



Hymenoscyphus fraxineus
Mainly on *Fraxinus excelsior*

Detection of *Hf* on other *Fraxinus* spp.

- *F. albicans*
- *F. americana*
- *F. angustifolia*
- *F. caroliniana*
- *F. chinensis*
- *F. latifolia*
- *F. mandshurica*
- *F. nigra*
- *F. ornus*
- *F. paxiana*
- *F. pennsylvanica*
- *F. profunda*
- *F. sieboldiana*
- *F. texensis*
- *F. velutina*

Detection of *Hf* on non-*Fraxinus* spp.

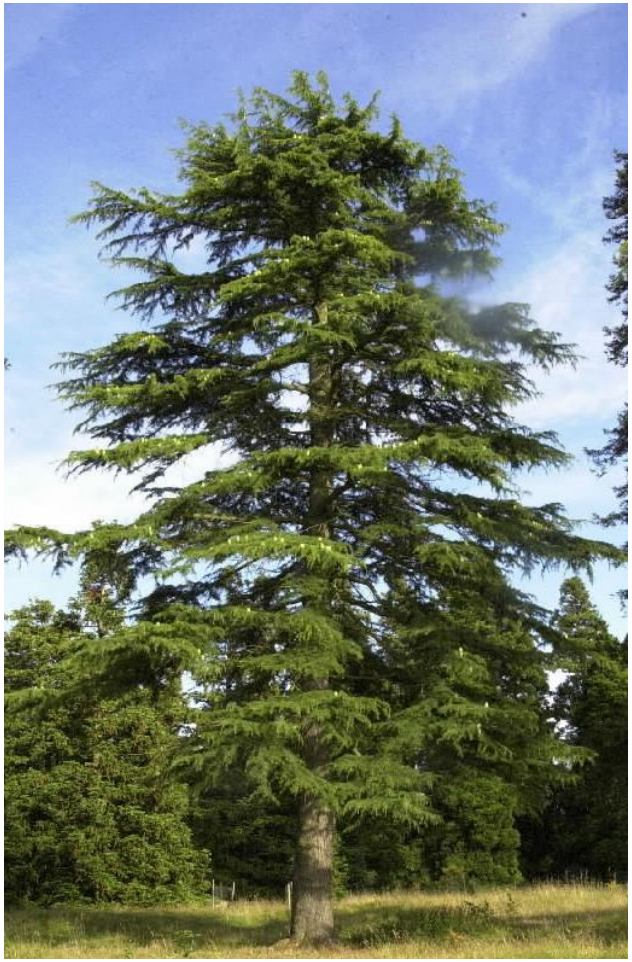


Phillyrea latifolia


Phillyrea angustifolia


Chionanthus virginicus

Sirococcus blight of cedars



Sirococcus blight of cedars

Sirococcus tsugae on cedars

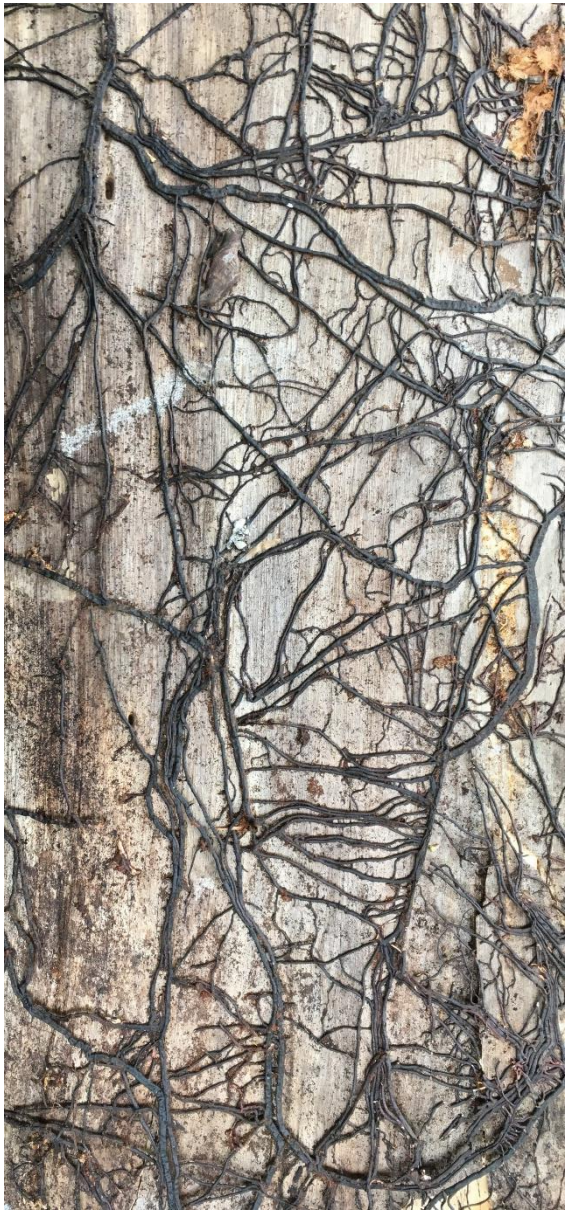
Sirococcus blight of cedars

Sirococcus tsugae on cedars

Sirococcus blight of cedars

Sirococcus blight of cedars

Honey fungus (*Armillaria*)



Honey fungus (*Armillaria*)

Root disease cause by *Phytophthora*

P. cinnamomi on *Castanea sativa*

P. lateralis on *Lawson cypress*

P. austrocedri on *Juniperus communis*

Bleeding cause by *Phytophthora*

P. pseudosyringae on beech

P. plurivora on *Tilia*

P. ramorum on oak

Phytophthora species	Cases	Number of cases on each affected species
P. plurivora	71	*Acer* (15), *Alnus* (1), *Castanea* (1), *Corylus* (1), *Fagus* (14), *Pinus* (1), *Rhododendron* (1), *Salix* (1), *Thuja* (1), *Tilia* (33), *Ulmus* (1), Unknown (1)
P. cinnamomi	43	*Abies* (1), *Castanea* (22), *Chamaecyparis* (3), *Cupressus* (1), *Nothofagus* (1), *Pinus* (1), *Pseudotsuga* (1), *Quercus* (3), *Taxus* (7), Unknown (3)
P. austrocedri	37	*Chamaecyparis* (1), *Cupressus* (2), *Juniperus* (32), Unknown (2)
P. cambivora	27	*Araucaria* (1), *Chamaecyparis* (2), *Fagus* (19), *Fraxinus* (1), *Quercus* (2), *Rhododendron* (1), *Tilia* (1)
P. pseudosyringae	26	*Acer* (1), *Alnus* (1), *Betula* (1), *Fagus* (11), *Larix* (1), *Nothofagus* (9), *Tilia* (1), *Vaccinium* (1)
P. ramorum	26	*Abies* (1), *Castanea* (6), *Fagus* (4), *Larix* (7), *Nothofagus* (1), *Pieris* (2), *Quercus* (3), *Rhododendron* (2)
P. lateralis	18	*Chamaecyparis* (17), *Cupressus* (1)
P. siskiyouensis	13	*Alnus* (13)
P. alni	8	*Alnus* (8)
P. cactorum	7	*Acer* (1), *Cedrus* (1), *Daphne* (1), *Fraxinus* (1), *Rhododendron* (1), *Sorbus* (1), *Tilia* (1)
P. cryptogea	6	*Abies* (1), *Magnolia* (1), *Picea* (1), *Pinus* (1), *Pseudotsuga* (1), *Taxus* (1)
P. gonapodyides	5	*Abies* (1), *Fagus* (3), *Taxus* (1)
P. ilicis	5	*Ilex* (5)
P. megasperma	5	*Abies* (2), *Larix* (1), *Picea* (1), *Taxus* (1)
P. syringae	4	*Fraxinus* (1), *Malus* (1), *Rhododendron* (2)
P. chlamydospora	2	*Ilex* (1), Soil (1)
P. chlamydospora x P. gonapodyides	1	*Fagus* (1)
P. citrophthora	1	*Taxus* (1)
P. foliorum	1	*Rhododendron* (1)
P. kernoviae	1	*Rhododendron* (1)
P. gallica	1	*Tilia* (1)

Neonectria canker on fir

Neonectria canker on fir

Diplodia shoot blight

Heterobasidion root rot

– *H. annosum* (on *Thuja plicata* – western red cedar, on *Pseudotsuga menziesii* – Douglas-fir and on *Tsuga heterophylla*- western hemlock)

– *H. abietinum* (on *Tsuga heterophylla*- western hemlock and on *Abies grandis* and *A. procera* – noble fir)

Swiss needle cast

- Foliar disease specific to Douglas-Fir (*Pseudotsuga menziesii*)
- Caused by the fungus *Nothophaeocryptopus gaeumannii*
- Symptoms include:
  - Chlorotic needles
  - Decreased needle retention
  - Sparse crowns
  - Growth reduction (20 –55%)
- Mortality is rare

- **Anthracnose** (*Apiognomonia veneta*) can cause shoot blight (young leaves and shoots may die back in spring) and bud blight (buds may fail to open), cankers on twigs and small branches




- **Powdery mildew** (*Erysiphe platani*), chlorosis and distortion of young leaves that are covered in thick white or grey coating


New pathogen threats to key tree species

Chestnut blight on sweet chestnut

Present in London

Chestnut blight

- It is caused by the fungus *Cryphonectria parasitica*
- Affects the **bark** of sweet chestnut and enters through fissures or wounds
- The dead bark becomes visible as a **sunken canker**
- Stems or branches are **girdled by lesions** and die
- Above the girdling canker, leaves collapse, wilt and turn brown, but remain attached
- Below the canker there will be **epicormic growth**

Chestnut blight

Cankers

Cankers

Cryphonectria parasitica

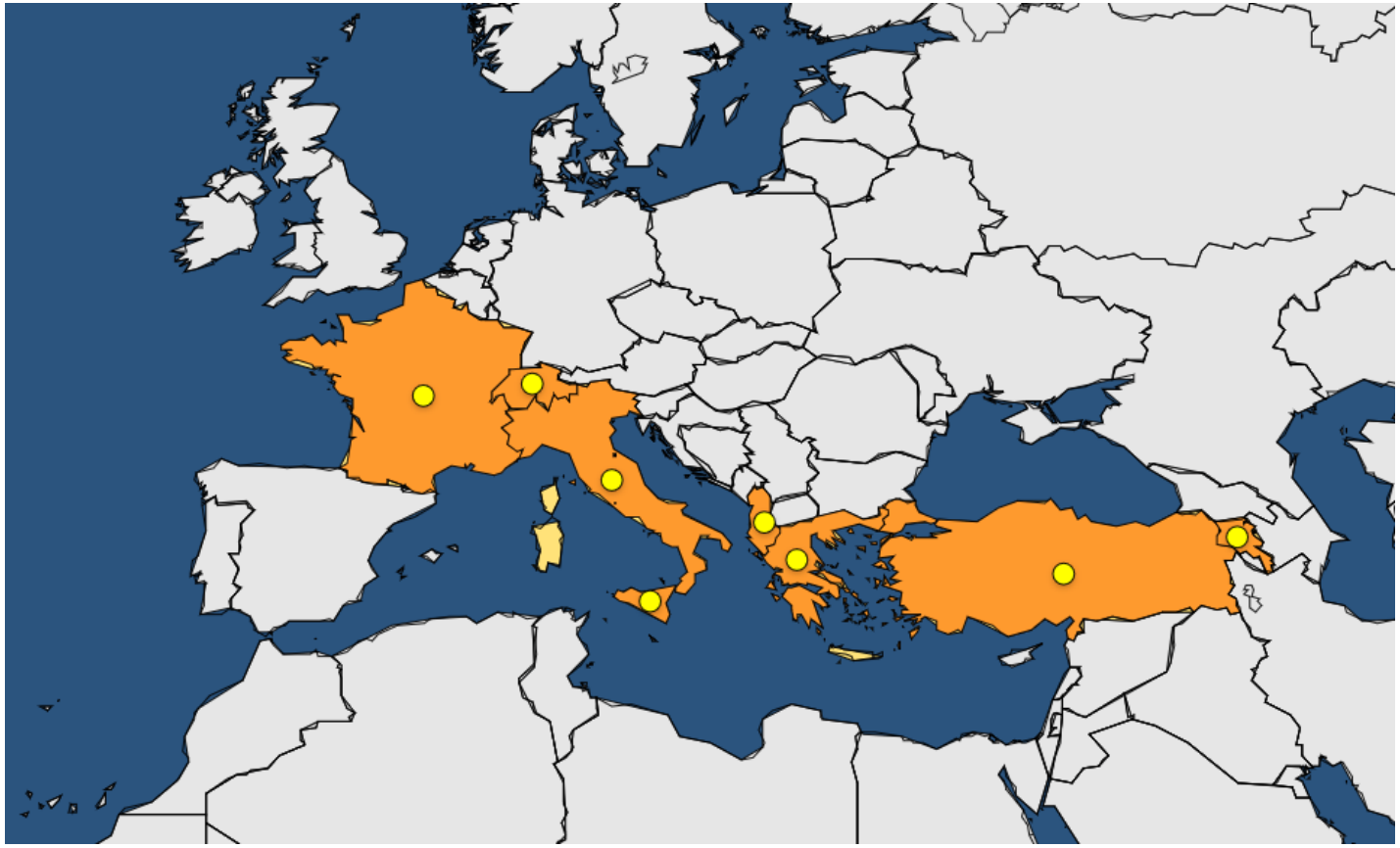
Eradication

Canker stain of plane/Plane wilt (*Ceratocystis platani*)

Not currently known in UK

Situation in Europe

- This species is regulated as a harmful organism in the EU
- An introduction from USA to Naples (Italy) during WW II on packaging material



Hosts

- *Platanus* spp.
  - **Oriental plane** (*Platanus orientalis*) (natural and planted in Europe and Asia. Planted in Oceania, North and South America)
  - **London plane** (*Platanus* x *acerifolia,* syn. *Platanus* x hispanica, syn. *Platanus* x *hibrida*) (planted worldwide)
  - **American sycamore** (*P. occidentalis*) (native to North America)

Most Susceptible

(natural stands, coppices, and public and private gardens in both rural and urban environments)

Infection process

- It is a wound pathogen (small wound is enough for infection)
- Invasion and colonisation of the sapwood causes reaction processes from the host-plant (formation of tyloses, gums)
- These reactions block the vessels parts of the vascular system resulting in sudden wilting of a portion of the crown
- Wilting usually occurs in the spring-summer period, when the water demand of the tree is higher
- When the infection occurs late in the season, the following summer the infected branch or the entire tree may fail to flush, or the buds can burst and the emerging leaves suddenly wither and die.
- Under the bark causes necrosis of the vascular cambium and the inner bark (elongated strips with elliptical to flame-shaped patterns of bluish-black to reddish-brown discolouration)
- The disease is always fatal

Symptoms

(P. Tsopelas & N. Soulioti, FRIA, Greece)

(Tsopelas *et al.* 2015)

(P. Tsopelas & N. Soulioti, FRIA, Greece)

(Photo provided by James Roberts, UK)

(P. Tsopelas & N. Soulioti, FRIA, Greece)

Symptoms

Nikoleta Soulioti, FRIA, Greece

Francis Marie, France

orange/purple streaking

Francis Marie, France

Thomas Cech, BFW, Austria

Mode of spread

- **Root contact** through root graft with a neighbouring diseased trees. This results in the "domino" occurrence of the disease in avenue trees
- **Water, soil** and **debris**
- **Sawdust** from diseased trees is highly infective and can easily be transferred by the wind
- **Human activity**: pruning tools, construction activities, road maintenance which move soil and cause damage to roots
- In new areas by the use of infected **planting material**, or even **infected wood** (is how the disease found its way from the USA to Europe during World War II)

Xylella fastidiosa

Bacterial Leaf Scorch

Not currently known in UK

Xylella fastidiosa

- *Xylella fastidiosa* has been described by the European Commission as “one of the most dangerous plant bacteria worldwide”

- This insect-transmitted bacterial plant pathogen infects >500 species including crops, ornamental plants, and trees

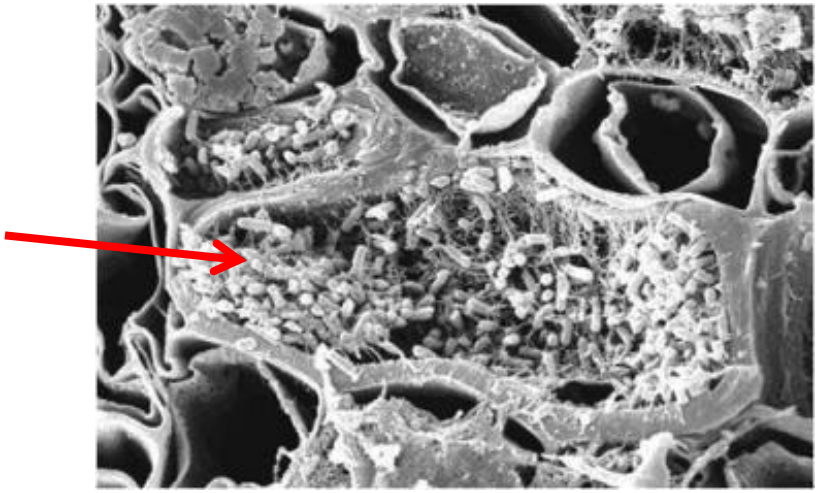
- In Italy alone, over one million olive trees are dying from *Xylella* in a disease called Olive Quick Decline Syndrome

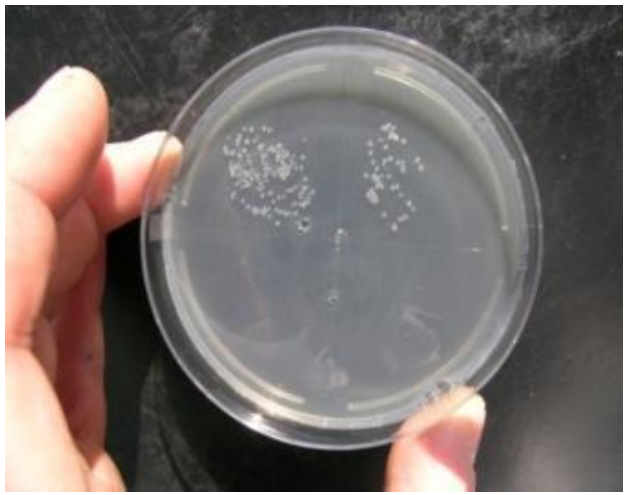
- So far, *Xylella* **has not been reported in the UK**

Introduction

- Xylem-inhabiting fastidious bacteria

- The bacteria multiplies in the vessels and these become blocked, and water can not reach all parts of the plant from the roots and infected plants essentially begin to suffer from drought





- Transmitted by xylem-feeding insects. The pathogen is maintained in the gut of the vector and adults need to feed on infected plants in order to acquire and transmit the pathogen.

Vectors

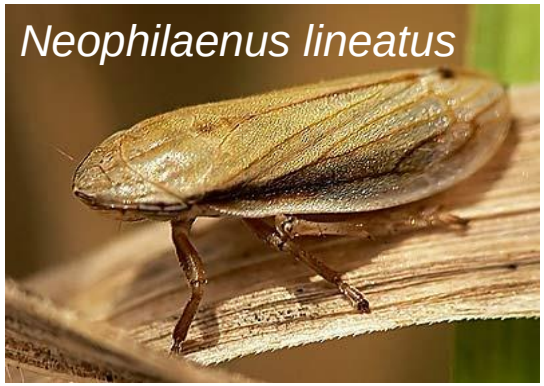
– The meadow spittlebug (*Philaenus spumarius*) is the main vector identified in Europe to date and is the primary vector in Italy

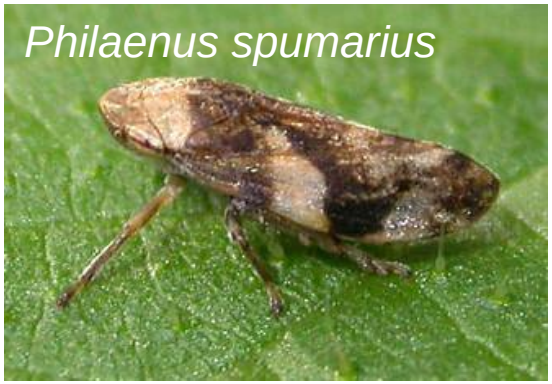


– This species is widespread in Europe (including the UK) and feeds on hundreds of hosts

Common potential *Xylella* vectors in Britain:

(froghoppers, spittlebugs, cuckoo-spit insects)





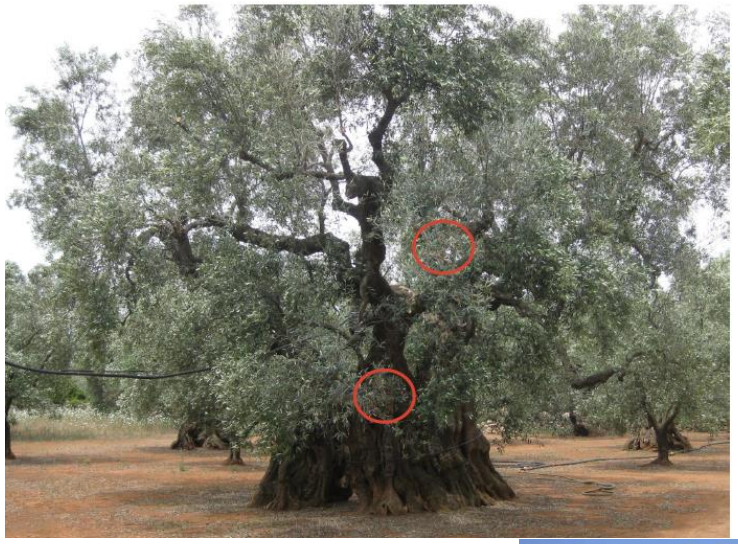
Grasses, rushes Herbaceous dicots Bushes / trees

(Slide provided by Alan Stewart, University of Sussex)

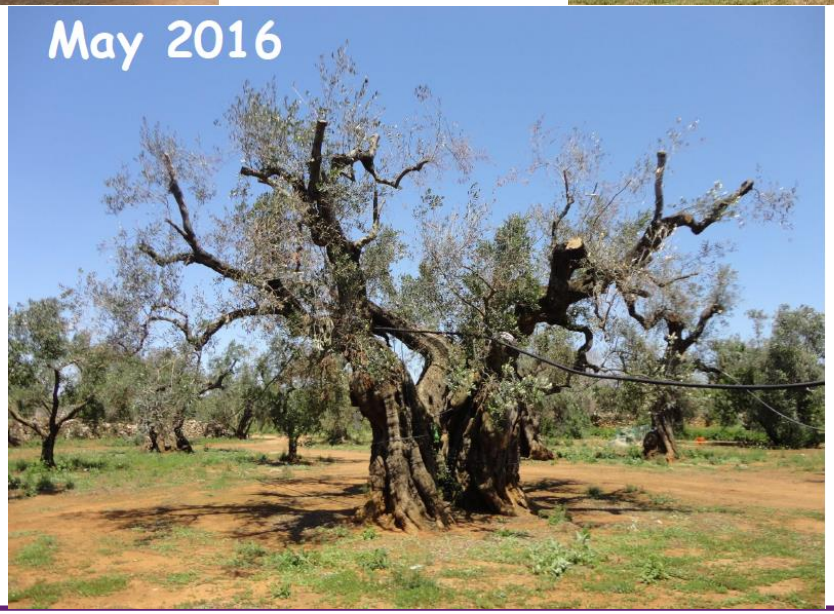
Diseases

- The causal agent of Pierce's disease of grapevine, phony peach disease, plum leaf scald, almond, elm, oak, American sycamore, mulberry and maple leaf scorch, and citrus variegated chlorosis disease, among other diseases

March 2015



Same tree in September 2015



Subspecies

- *Xylella fastidiosa* - four characterised subspecies
  - *Xylella fastidiosa* subsp. *fastidiosa*
    - Pierce Disease on grapevine and almond leaf scorch
  - *Xylella fastidiosa* subsp. *pauca*
    - South American strains causing citrus variegated chlorosis and coffee leaf scorch
  - *Xylella fastidiosa* subsp. *sandyi*
    - Oleander in California and Texas
  - *Xylella fastidiosa* subsp. *multiplex* 
    - Endemic to North America, numerous host but generally not grapevine and it is most frequently associated with trees (particularly urban trees)

Xylella on trees

- The disease **BLS (Bacterial Leaf Scorch)** is recognised as a major disease of street and landscape trees in the mid-Atlantic and south-eastern United States since 2010
- Symptoms on trees are not always distinct: e.g. on *Quercus palustris* the disease appears as early senescence with no distinct pattern of necrosis
- The first report of *Xylella* on trees was on American **elm** *(Ulmus americana*) in 1959 (Wester & Jylkka)
- Since the 1980s:
  - Reported on **oak species** *Quercus rubra*, *Q. coccinea, Q. falcata, Q. imbricaria, Q. laurifolia, Q. palustris, Q. shumardii, Q. virginiana*
  - Reported on American sycamore (*Platanus occidentalis*)
  - Reported on maple (*Acer rubrum*)

Symptoms

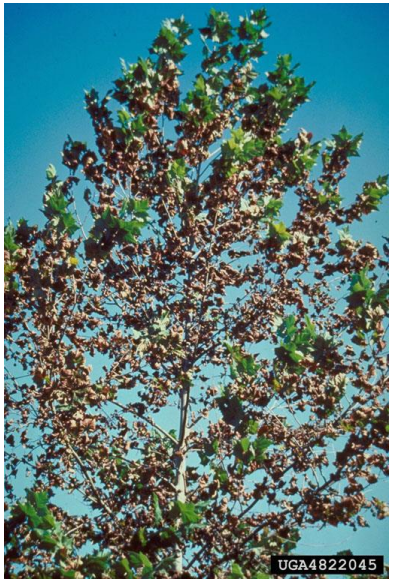
- Leaf scorching
- Wilting of the foliage
- Defoliation
- Chlorosis or bronzing along the leaf margin
- Dwarfing
- Death

Symptoms

(Brian Olsom, Oklahoma State University, Bugwood.org)

(John Hartman John Hartman, University of Kentucky, Bugwood.org)

(Theodor D. Leininger Theodor D. Leininger, USDA Forest Service, Bugwood.org)



(Edward L. Barnard, Florida Department of Agriculture and Consumer Services, Bugwood.org)

Biosecurity measures

- Pathogens can survive in water, soil or in sawdust. Therefore, before and after visiting new sites or carrying out any work on a site:
  - Ensure that your footwear is clean (visually free from loose soil and plant debris). If necessary, brush or wash in soapy water
  - Ensure that pruning tools/chainsaws/machinery are clean and disinfected before and after use
  - Ensure that PPE and climbing equipment are clean
  - Clean bikes/cars tyres, walking sticks, tents, climbing ropes, boats, (visually free from loose soil and plant debris)
  - Use clean irrigation water
  - Construction activities, road maintenance which move soil and can cause damage to roots can be entry points
- New plantings/introduction of infected planting material, or even infected wood can be a pathway
- Monitoring tree health regularly

Observatree

- **Tree Health Early Warning System** (THEW) using citizen science
- Early detection requires increased surveillance
- Checking trees in Britain - forests and woodlands
  More eyes on the ground
- Over 200 trained volunteers
- Resources: (http://www.observatree.org.uk/resources/)
  - Videos
  - Webinars
  - E-learning packages
  - Observatree field guides, posters and calendars
- Priority List (22 pests and diseases selected):
  - Nine are not known to be present in Britain
  - 13 are known to be present in Britain