Forestry Commission

Contingency plan for *Candidatus* Phytoplasma ulmi (Elm Yellows Phytoplasma)

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INTRODUCTION

1. Outbreaks of serious or significant pests require strategic-level plans developed at a national level, describing the overall aim and high-level objectives to be achieved, and setting out the response strategy to either eradicate or contain the outbreaks.

2. Following identification by the UK Plant Health Risk Register, the Plant Health Risk Group (PHRG) has commissioned pest-specific contingency plans for those pests that pose the greatest risk and require stakeholder consultation. The Forestry Commission is also prioritising plans which require updating, including the plan for *Candidatus* Phytoplasma ulmi.

3. The purpose of pest-specific contingency plans is to ensure a rapid and effective response to an outbreak of the pest or disease 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 surveillance and 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 either contain or eradicate, including work to determine success.

Recovery

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

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

INTRODUCTION

The purpose of pest-specific contingency plans is to ensure a rapid and effective response to an outbreak of the pest or disease described, in this case *Candidatus* Phytoplasma ulmi, or the common name elm yellows phytoplasma (EYP). It is designed to help government agencies anticipate, assess, prepare for, prevent, respond to and recover from pest outbreaks.

Scope

This contingency plan was prepared by the Forestry Commission's cross-border Plant Health team to be used at country and national levels. It should be used in England in conjunction with the Defra Plant Health Contingency Plan, which was developed by Defra/Fera/APHA, 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. 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 outbreak 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 pest.

This contingency plan covers outbreaks of *Candidatus* Phytoplasma ulmi in all situations where elm (*Ulmus* species) is planted or occurs naturally, i.e. forestry, natural and semi-natural habitats, agricultural landscapes, urban environments, and parks and gardens. It is designed to help government agencies anticipate, assess, prepare for, prevent, respond to and recover from outbreaks of the pest.

This plan will be updated following new information, lessons identified from outbreaks of other pests, or changes in policy or contact details. (It was last updated in October 2015).

Objectives of this plan

- To raise awareness of the potential threat posed by elm yellows phytoplasma (EYP), and therefore ensure that stakeholders are aware of the symptoms which this disease causes.
- To provide guidance on steps to be taken whenever symptoms of attack by EYP and its vector are observed.
- To ensure that infections by EYP and its vector are managed promptly, with the aim of eradicating pioneer populations of the species.
- To ensure that all relevant staff of the Forestry Commission, other government agencies and local authorities 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 the media) are kept fully informed of the scale of infestation, at both regional and national levels.

Anticipation and Assessment

1.1. Elm yellows phytoplasma is a serious and destructive pest of elm species (*Ulmus sp*).

1.2. It is native to Europe, and has been introduced into North America.

1.3. Transmission by the vector will occur only locally, and the disease has a restricted distribution within the USA and Europe. In international trade, infected planting material of elms could carry the disease, and possibly also infective vectors. The vector itself would most probably be carried as eggs in the bark of elm plants (although these would not be infective).

1.4 It can cause excessive damage in its own right, with several epidemics in the USA. It can also weaken trees and make them more susceptible to Dutch elm disease.

1.5.. It is officially absent from the UK, although there has been an outbreak, since eradicated, which originated on cultivars brought in from Italy in 2013.

Preparation

2.1. EYP is an EPPO A1 quarantine pest (OEPP/EPPO, 1979), and is also of quarantine significance for the Inter-African Phytosanitary Security Council (IAPSC). The US vector (*Scaphoideus luteolus*) is of no quarantine significance in its own right. It appears that Asian and European elms are moderately or highly resistant to the phloem necrosis agent. It has been suggested that the phytoplasma is an elm pathogen native to and unimportant in Europe or Asia, which was introduced into the USA during the 1800s in infected seedlings before they developed symptoms.

2.2 It is also currently ECIAI listed (although proposed for review, because when it was listed the pathogen in the USA was thought to be distinct from that in Europe, which is now known not to be the case). The UK is currently seeking Protected Zone status.

2.3. It has been placed on the UK Plant Health Risk Register with an unmitigated risk rating of 36/125.

2.4. A Pest Risk Analysis (PRA) was completed in 2014.

Response

Legislation

3.1. A list of the relevant legislation which can influence a response is listed in appendix 3.

OFFICIAL ACTION FOLLOWING A PRESUMPTIVE DIAGNOSIS

Trigger

3.2. The key indicators which would trigger a response are findings of or reports of:

- the presence of an infected tree in a nursery;
- the presence of an infected tree in the wider environment; or
- the presence of the disease in a consignment of imported plants.

This can be reported by nursery growers, woodland owners or managers, or members of the public.

Determining the response

3.3. In England, a duty officer (from FC England or 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 in Scotland and Wales. The response officer investigates and reports back to the Defra Contingency Core Group. For outbreaks in Scotland and Wales, respective country teams will fully manage the outbreak as per their own generic contingency plans, but will provide updates to the Defra Contingency Core Group for information purposes and for Defra to report to ministers and the European Commission (EC)

3.4. The response officer will gather information including the location, likely origin, host or commodity, level of damage, extent of outbreak and chance of spread. The contingency core group will comprise plant health officials and specialists from the risk group. Based on the information fed back to the contingency core group, in England they will decide upon the alert status given (black, amber or red), which will determine the level of response. (See Appendix 2 for alert status table). In Scotland and Wales, the core contingency 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 to resolve the incident.

Holding consignments and movement / planting restrictions

3.5. Until further investigation, no material shall leave the site and local operations will be halted until such time as the suspected case is confirmed as a false alarm, until the outbreak has been eradicated, or until such time as it is determined that such a restriction no longer serves a useful purpose.

Preliminary trace forward / trace backward

3.6. The most likely source of entry is the importation of live trees or planting stock from Europe, or possibly North America, although there is much greater movement of trees from Europe.

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 include any clonally related or potentially contaminated stocks, where appropriate.

Surveying to determine whether there is an outbreak

3.8. A new outbreak of EYP will be most likely detected either by general surveillance or a suspected sighting reported by a landowner, land manager or member. Confirmation that EYP is present will require examination of samples and follow-up inspections.

3.9. Follow-up inspections, either by APHA for non-woodland situations or a Forestry Commission England plant health officer in England for woodlands, should gather information about:

- the likely origin of the disease and, if a consignment of 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 that might influence the outbreak, e.g. public access, presence of watercourses, etc. Include maps if possible;
- the hosts infested at the site (species, variety, development stage, etc.);
- when and how the disease was detected and identified (including photographs of symptoms);
- the level of disease incidence
- the extent and impact of damage (including part of host affected);
- any recent importation or movements of host plants or host plant products into and out of the affected site;
- any movement of people, products, equipment and vehicles into or out of the affected site where appropriate;
- any relevant treatments applied to host plants that might affect development of symptoms or detection and diagnosis of the disease;
- the history of the disease on the site, at the place of production or in the area; and
- the likely biodiversity impacts of any control, including any duty of care obligations under the Natural Environment and Rural Communities (2006) Act.

3.10. 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 and Advisory Service at Forest Research for diagnosis. Suspect 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 PHSI staff should be sent to Fera Science for analysis.

Confirmation of a new outbreak

3.11. Positive identification of EYP can only be done using accepted molecular methods in the laboratory. Samples should not be removed from the site unless done so by an individual trained to do so and with the relevant safety equipment.

OFFICIAL ACTION FOLLOWING THE CONFIRMATION OF AN OUTBREAK

Strategic actions on confirmation

3.12. On positive confirmation the following should be initiated:

- notify ministers and senior officials;
- set up regular (determined by scale of outbreak) Lead Government Department (LGD) meetings to keep partners aware of the current status, actions and possible future requirements, and to agree a communications strategy;
- notify the EU and others; and
- discuss with stakeholders.

3.12. In most instances the Forestry Commission (England and Scotland) is likely to appoint an incident controller and an incident management team. In Wales the Welsh Government would take the lead. 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.

Communication

3.13. The incident controller will set up a management structure to implement incident management functions. 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. Depending on the location, these would include Forestry Commission England, Forestry Commission Scotland, the ICF, Confor, the Scottish Government, SNH, the Environment Agency, Natural England and other members of the Defra group, the Welsh Government, Natural Resources Wales, Woodland Trust,

the Country Land & Business Association, Scottish Land & Estates, National Farmers' Unions and relevant local authorities.

Surveillance

3.14. To determine the extent of the outbreak all elm trees within a 1km radius of infected elm trees are to be inspected for signs of EY. Sticky traps should be located within this 1km zone to look for vectors, which in the UK are leafhopper species, including *Macropsis mendax* and the common froghopper, *Philaenus spumarius* . An option for this is four traps at 500m from the outbreak located along cardinal points, preferably on stakes close to or hung from elm trees at foliage height to catch species likely to be flying to the trees to feed. Traps should be left out for the duration of the time that the vectors are in their adult life form, which in the case of *Philaneus spumarius* is from June to September. The results should be examined by experienced entomologists.

3.15. The public can be encouraged to look for any signs of outbreaks, which will be most effective during the late summer months when the leaves of affected trees will droop and suffer premature senescence.

Demarcated zones

3.16. A 1km demarcated zone is established around infected trees where all elm trees are assessed for the presence of EYP.

3.17. Nurseries within the 1km demarcated zone will be inspected by Plant Health & Seeds Inspectorate (PHSI) staff for the presence of EYP. Movement of elm plants will be suspended until the presence or absence of EY within the nursery and within the 1km zone can be determined.

Tracing forwards and backwards

3.18. 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 visited and inspected for the presence of EYP. In addition, any supplies of elm planting material from the nursery over the previous two years should be traced to the final planting sites and inspected for the presence of EYP.

Pest management procedures

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

are to be contained and eradicated. It should be made clear at the outset that the costs of any remedial actions required will be borne by the landowner. The Forestry Commission or APHA will need to consider whether direct intervention by government is needed to ensure a rapid response to reduce the risk of spread.

Disposal

3.20. The most effective method of dealing with a tree infected with EYP is to fell the tree and burn the infected material. It is important that any stump regeneration be effectively treated as well. All equipment used in the disposal of EYP-infected trees should undergo thorough cleaning between sites as per standard biosecurity protocols.

3.21. Trees, including the branch and round wood that are to be felled to eradicate EYP infection, should be destroyed, preferably on site or by burning in a nearby location within the demarcated area designated for this purpose. Burning must comply with appropriate waste management regulations, which are administered by the Environment Agency in England, the Scottish Environment Protection Agency and Natural Resources Wales. No more than 10 tonnes may be burned per 24-hour period: burning more than this will require specific approval from the relevant authority.

3.22. Deep burial on site is also an acceptable disposal method.

3.23. If material has to be moved from site, it should be transported, with a protective covering ensuring that all material is contained, to a licensed incinerator or deep burial site.

Public outreach

3.24. It is crucial to have public support for the management programme and to help with general surveillance. Engaging the public will require the provision of timely, balanced and accurate information about monitoring and control. It can also provide opportunities for the public to participate in monitoring and reporting suspect trees using the Tree Alert reporting tool. Information, subject to available budget, can be made available through newspapers, radio, TV, the internet, social media and trade and specialist media. It should be targeted locally, especially within the infested and regulated areas and, where appropriate, at a national level.

3.25. It is important to provide information about the location and size of the infested and regulated areas, statutory and voluntary responsibilities, rates of spread, management options, pathways and the how the pest might have arrived and could be transported. Information provision should also cover the prospects for British forestry and what people can do to help, especially in terms of monitoring. Managing this level of public engagement will require a central administration and communications 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.

Review measures in the case of prolonged official action

3.26. Efforts should shift to containment if eradication proves unachievable, and the focus should move to a plan for containing the outbreak as much as possible. A review of the management programme should be undertaken regularly (e.g. 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;
- consideration of alternative approaches or the cessation of statutory action; and
- consideration of the impacts of control methods on biodiversity.

3.27. 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 pest management information as appropriate.

Criteria for declaring a change of policy

3.28. Policy changes to be considered in light of:

- changes in the geographic distribution of EYP;
- new or updated research information about the pest species' range and lifecycle; and
- identification of new pathways.

Evaluation and review of the contingency plan

3.29 .Annual reviews of the plan should take account of:

- any new legislative measures or amendments to measures implemented to reduce the risk of introduction;

- changes in the geographical distribution of EYP;
- new or updated research information about the range and life cycle of EYP;
- any new pathways identified; and
- lessons identified from other outbreaks which will improve this plan and any Standard Operating Procedures (SOPs) or Operational Guidance.

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

Recovery

4.1. A site can be deemed as recovered from an outbreak if, after three years of monitoring, there are no indications of disease or vector presence.

Appendix 1: Pest background information

Species name: *Candidatus Phytoplasma ulmi*

Synonyms: none

Common names: Elm Phloem Necrosis Phytoplasma (UK), Elm Yellows Phytoplasma and Elm Yellows (usually in USA)

UK risk rating: Unmitigated 36/125 Mitigated 36/125

EU status: Present

EPPO status: EPPO A1 list no. 26;

UK status: Currently unreported in the UK

Hosts

European hosts:
Ulmus prarvifolia
Ulmus pumila
Ulmus chenmoui
Ulmus japonica
Ulmus villosa
Ulmus minor

American hosts;
Ulmus americana
Ulmus alata
Ulmus crassifolia
Ulmus rubra
Ulmus serotina
Ulmus rubra x pumila
Ulmus parvifolia

Life history
In North America, *S. luteolus* is the primary vector, although the spittlebug (*Lepyronia quadrangularis)* and a species of *Latalus* (leafhopper) can act as vectors. *S. luteolus* overwinters as eggs in the bark of small branches of elm, and there is an extended hatching period and five nymphal instars develop over 36-42 days. Adults are present from early June until the first frosts and are the only winged stage. Both adults and nymphs can transmit the phytoplasma, and the insects are infective for life.

Studies in North America also indicate the common froghopper (*Philaenus spumarius)*, which is widespread in the UK, can also vector EYP. In Europe, *Macropsis mendax* has been shown to be the vector of EYP, although this is a rare and notable species in the UK. Several other invertebrates have been identified as potential vectors in the UK, including *Cixius* species, *Iassus scutellaris* and *Alligidius commutatus*. Although EYP has been found in the gut of these insects, that is not conclusive of vectoring capability, so their status as vectors is uncertain.

Within the tree, the phytoplasma itself is found only in the phloem sieve tubes, where it induces callose deposition and cell collapse. It is thought to overwinter in the few uncollapsed sieve elements in the roots, and then move to the upper parts of the tree after new functional phloem has been produced in the spring (Braun & Sinclair, 1976).

A brief summary of the lifecycle and suitable points for surveillance, monitoring and possible control is given below, although exact timings are not clearly known from a UK perspective:

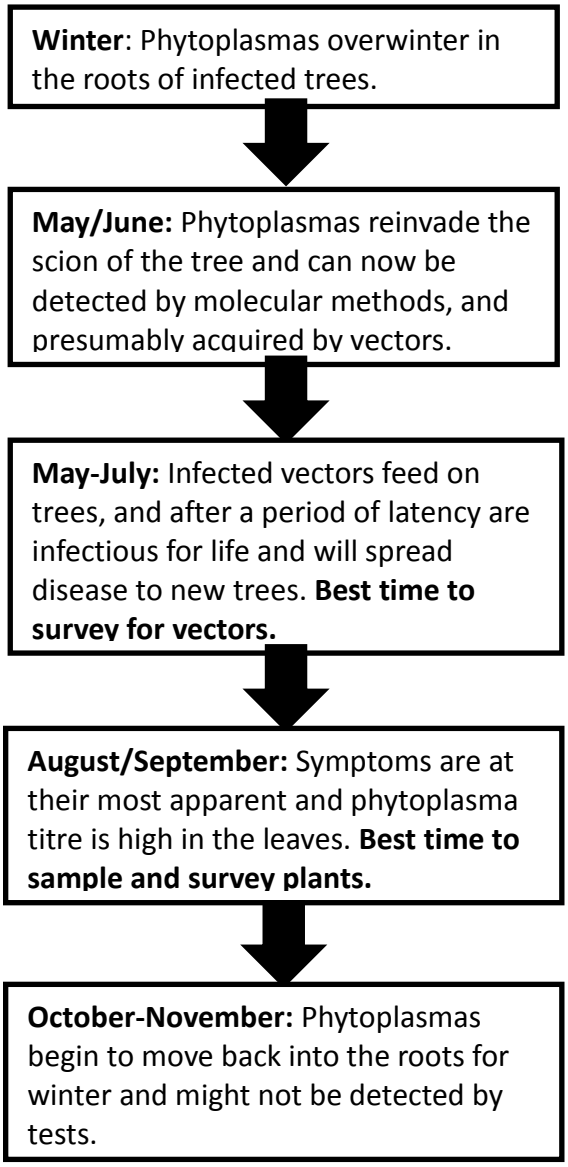

Figure 1: Flow diagram of the lifecycle of *Candidatus* Phytoplasma ulmi, with suggested times to survey for the pathogen and any potential vectors. The timings of when surveillance should be carried out are not known precisely in a UK context.

Identification

The EPPO datasheet provides extensive information on identification and symptoms, although it focuses on the American vector *Scaphoideus luteolus*. External symptoms are

variable, and in general symptoms are more severe in North American species than European species. The first foliar symptoms seen are between mid-July and mid-September, and include yellowing of the leaves, drooping or downward bending of turgid leaves (epinasty) and premature casting of leaves. Usually all the branches on the tree show symptoms at once, although occasionally symptoms can be confined to individual branches. Late in the growing season, the leaves on infected trees appear prematurely senescent. These trees might then fail to produce leaves the following spring, or begin growth and then die.

Figure 2: Example of premature senescence following infection by EYP. Source W. Sinclair, Cornell University

Figure 3: Development of characteristic ‘witches’ brooms’ following premature casting of leaves. Source E. Colin, IRSTEA

In North American elm species, the inner phloem of lower trunks and roots develops a butterscotch colour, sometimes even before the foliar symptoms appear. In larger stems, the discoloration tends to occur in vertical bands with diffuse margins, associated with the position of specific buttress roots. The cambial region and the surface of the wood might also show discoloration, but this colouring does not usually extend more than1mm into the wood.

Figure 4: Distinctive yellowing of the phloem after infection with EYP in North American *Ulmus* species. Such discolouration does not occur in affected European *Ulmus* species. W. Sinclair, Cornell University

If very dark colouration is seen in the outer wood, it's likely that the tree has been infected by Dutch elm disease (*Ceratocystis ulmi*) as well as EYP.

Further information on symptoms can also be found in the Forestry Commission Pest Alert

Identification of vector.

In the UK, the following are present and could act as vectors for EYP:

- *Cixius* species (e.g. *C. nervosa*); widespread and common on deciduous trees and shrubs

- *Philaenus spumarius* – Common Froghopper; a common species across a wide range of plants.

- *Iassus scutellaris*: considered common in certain localities, but confined to the south of England; particularly associated with elm, and recorded in hedgerows of English elm
- *Alligidius (Allygus) commutatus*
- *Macrospis mendax* (synonym *Macropsis glandacea)*; uncommon, present in eastern and south-eastern England.

Distribution of the organism

The EYP micro-organism is present in Europe in the Czech Republic, France, Germany, Italy and Serbia. It is also present in the eastern United States.

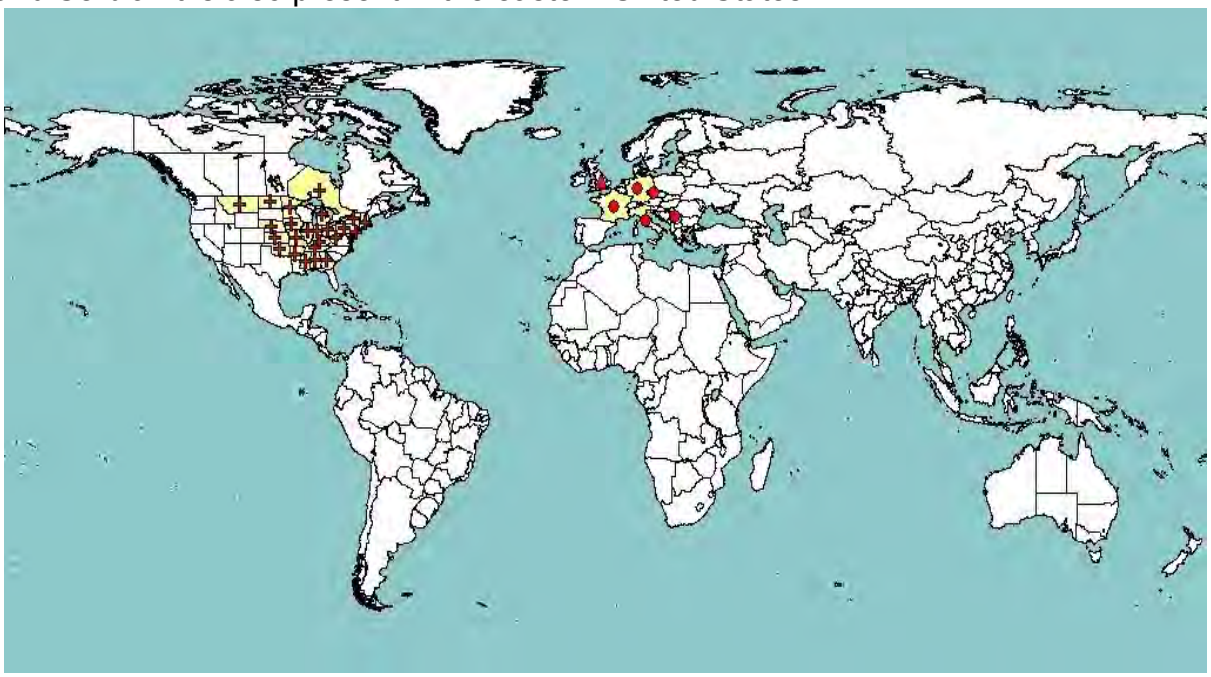

Figure 5: Current distribution of EYP as of October 2015 - circles represent national records and crosses represent sub-national records. (EPPO PQR database)

Damage impact and controls

EYP could pose a serious threat to elm if it were to become established in Britain.
EYP is classed as a quarantine organism, so there is a requirement to report suspected infected trees. At present there is no known practical method for prevention or cure. Control of the vector is also considered impractical. Once a tree is known to be infected, removal and disposal is required.

Main pathways

The most likely entry to the UK would be via imports of infected planting stock. Once in the UK, transmission will likely be by the identified vectors, but will only occur locally, unless infected plants are moved between nurseries before detection. The phytoplasma might also be transmitted via root grafts and bark patch grafts.

Import controls

There is a statutory pre-notification scheme for import of live plants of elm from the European Union. Plants of *Ulmus*, intended for planting, other than seeds that originate in North American countries, should be accompanied by an official statement that no symptoms of EYP have been observed at the place of production or in its immediate vicinity since the beginning of the previous complete cycle of vegetation.

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
Plant Health Act 1967
Forestry Act 1967

European:
EC Council Directive 2000/29/EC

References

Barnett, D.E., (1977), A revision of the nearctic species of the genus Scaphoideus (Homoptera: Cicadellidae). Transactions of the American Entomological Society 102, 485-593.

Braun, E.J.; Sinclair, W.A. (1976) Histopathology of phloem necrosis in *Ulmus americana*. Phytopathology 66, 598-607.

CABI/EPPO Invasive species compendium. Elm phloem necrosis phytoplasma and its vector *Scaphoideus luteolus.* Datasheet