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Plant Biosecurity Resources – increasing the accessibility of notifiable plant pest information for Professional Operators

Project Final Report

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Royal Botanic Garden Edinburgh

Plant Healthy

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Details of Copyright Images:
The pictures within the report are provided by the authors. Subsequent pictures used to produce the pest factsheets have been downloaded from EPPO which are available for free for training purposes.

Content

1 Glossary of Abbreviations and Definitions

Defra	Department for Environment, Food and Rural Affairs
EPPO	The European and Mediterranean Plant Protection Organization
EU	European Union
GB	Great Britain
HTA	The Horticultural Trade Association
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
NPPO	National Plant Protection Organisation
OPM	Oak Processionary Moth
PHA	Plant Health Alliance
PHCS	Plant Healthy Certification Scheme
PHMS	Plant Health Management Standard
PRA	Pest Risk Analysis
RSPB	Royal Society for Protection of Birds
SOPRA	Site and Operational Pest Risk Analysis
UK	United Kingdom
UKPHRR	UK Plant Health Risk Register

Professional Operators	For the purposes of this report means any plant supply business based in the UK who is required to issue a plant passport – for further detail please refer to the information on the Plant Health Portal – Am I a Professional Operator?[1]
Article 89	Relates directly to EU Regulation 2016/2031, Article 89 "Authorisation of professional operators to issue plant passports", which is part of the legislation that the UK Government has retained post-Brexit
Article 91	Relates directly to EU Regulation 2016/2031, Article 91 "Pest risk management plans" which is part of the legislation that the UK Government has retained post-Brexit

[1] https://planthealthportal.defra.gov.uk/plant-passports/am-i-a-professional-operator/

2 Executive summary

Introduced plant pests and pathogens (henceforth "pests") have a significant impact on businesses, organisations, landowners and the wider natural environment. A recent global assessment report on biodiversity and ecosystem services carried out by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) states that introduced species are one of the five main drivers of biodiversity loss.

The current UK plant health regime relies heavily on the plant passporting system for Professional Operators to manage plant movements within Great Britain, and phytosanitary certificates for imported plants. One aspect of this system is to ensure traceability of plants in the event of a pest outbreak, enabling the relevant plant health authority to trace-back and trace-forward potentially infected stock and manage it in a timely fashion.

In order for this system to work, businesses moving plants (known as Professional Operators) issue plant passports and are required to demonstrate that they have the necessary knowledge of the notifiable pests that could affect the plants and plant products that they grow, manage or handle. This is specified in the EU Regulation 2016/2031, Article 89 "Authorisation of professional operators to issue plant passports", which is part of the legislation that the UK Government has retained post-Brexit. In addition, Article 91 of EU Regulation 2016/2031 "Pest risk management plans" indicates that Professional Operators could have in place pest risk management plans which are approved by a competent authority.

A previous study (PHC2021/01: Biosecurity practices to support plant health: a review of knowledge and practice) identified that stakeholders felt more definitive information/guidance would help them with risk assessments and adoption of tighter biosecurity measures. Pulling together more accessible, up-to-date, pest-relevant information for the plant species which they grow and/or move would support Professional Operators when assessing pest risks to their site and/or operations and also when presenting information for the purposes of being authorised to issue plant passports.

This research project therefore aimed to help address this knowledge gap by developing fact sheets and a prototype webtool. Both present Professional Operators with host specific pest information to use when issuing plant passports and carrying out pest risk plans for their sites.

Case studies were also developed to illustrate practical examples of plant biosecurity best practice.

2.1 Outputs

- Thirty-nine pest specific datasheets for the 22 GB Priority Pests plus the 17 pests that have a UK mitigated risk rating of 60 or above on the UK Plant Health Risk Register (UKPHRR), supporting Professional Operators to understand the pest risks specific to the hosts they are moving (fulfilling Article 89, EU Regulation 2016/2031).

- A unique, site-specific, summary sheet is produced for each user, supporting the Professional Operator using the system to risk assess their site for their pest risk management plan (Article 91 of EU Regulation 2016/2031).

- A prototyping exercise for an automated webtool which produces specific pest information and a summary sheet automatically for each user.

- The production of 3 case studies to demonstrate plant biosecurity best practice currently in place at businesses and organisations that have adopted the Plant Health Management Standard (PHMS).

2.2 Conclusions

- Professional Operators would benefit from support when assessing pest risks to their site and/or operations. There is information available (e.g. UKPHRR), but it is currently difficult and time consuming to access and understand for a non-specialist.

- The pest sheets produced during this project provide Professional Operators with information to carry out a pest risk analysis for each of the 39 pests covered. In addition, the pest sheets can be a training tool for their staff which is relevant to their business or organisation and the host plants grown and traded.

- The prototype webtool developed brings relevant pest management information into one place for a Professional Operator, to support a more accurate pest risk analysis process for their site and related operations. However, using pre-existing data such as the UKPHRR can be problematic because it relies on the data being regularly updated. This would have to be addressed if this prototype was to be developed further and launched for use.

- Such a system could improve the quality of information that Professional Operators compile and present as part of their official authorisation process to issue Plant Passports. It could also help demonstrate their competence during a Plant Healthy Certification audit. The information on plant pests could also support a pest risk management plan as per Article 91 of EU Regulation 2016/2031.

- This work can feed into current UK Plant Health Service workstreams looking at how to improve the accessibility of information on the UK Plant Health Portal.

- The case studies provide real-world examples of how various organisations/businesses improved their biosecurity processes, using the PHMS as a framework. It is hoped that this will provide ideas and inspiration for other organisations/businesses as they strive to improve their biosecurity processes.

- Initial benchmarking of PHMS against Article 91 shows a good alignment with the regulatory requirements for Professional Operators. This benchmarking is a key step as good voluntary standards should align with the regulatory framework to ensure, in the case of plant biosecurity, that an integrated systems approach is established. The next step is to conduct an in-depth benchmarking exercise with relevant personnel from across the UK Plant Health Service.

3 Background

The introduction of damaging plant pests and diseases has accelerated globally over the last 30 years (Brasier, 2008; Eyre, et al., 2013; Potter & Urquhart, 2017). This has caused the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to declare that introduced species (e.g. plant pathogens, weeds, mammals, invertebrate pests, etc.) are one of the five main drivers of biodiversity loss in their global assessment report on biodiversity and ecosystem services (IPBES, 2019). It has become widely accepted that these damaging species move around the globe on traded plants, timber, wooden products, and by hitchhiking on non-plant products (Potter & Urquhart, 2017).

Unfortunately, Great Britain (GB) has not escaped this phenomenon (Brasier, 2008, Woodland Trust, 2021). The continual introduction of plant pests and diseases, many of which were unknown to science 30 years ago, has caused significant damage to natural ecosystems (Boyd, et al, 2013). These include *Phytophthora ramorum*, the cause of sudden larch death, *Hymenoscyphus fraxineus*, the cause of the ash dieback epidemic (Figure 1), and *Thaumetopoea processionea* (oak processionary moth), a significant management issue on oak trees.

Figure 1: Ash dieback lesion on a branch of F. excelsior. Author.

In order to mitigate the risk of the introduction of new species, phytosanitary certificates and plant passports are used to provide traceability of material. If, for example, an imported oak tree is found to be infested with oak processionary moth (OPM), the other trees in that consignment can be found and managed through the electronic system (i.e. they should have a phytosanitary certificate if imported or plant passport if they have originated within GB).

GB businesses that move plants are required to be registered with SASA in Scotland or APHA in England and Wales. The system relies on a nursery inspecting the plants, declaring them free from notifiable plant pests, and issuing a plant passport before they are moved within the country. If plants are to be exported, then a phytosanitary certificate is issued by the competent authority. Any GB-based plant supply business is required to issue a plant passport with a plant or consignment of plants, and are known as Professional Operators (Defra, 2021). This relates directly to EU Regulation 2016/2031, Article 89 “Authorisation of professional operators to issue plant passports”, which is part of the legislation that the UK Government has retained post-Brexit (UK Government, 2020).

In order to carry out their legal responsibilities under Article 89, Professional Operators are required to demonstrate that they have the necessary knowledge of the notifiable pests that could affect the plants and plant products that they grow, manage or handle. In addition, Article 91 of EU Regulation 2016/2031 “Pest risk management plans” indicates that Professional Operators may have in place pest risk management plans which are approved by

a competent authority. In order to do this effectively, they need up-to-date, pest-relevant information for the plant species which they grow and/or move.

Systematically compiling and updating pest-risk information is a considerable task, given the thousands of plant species used in the horticultural sector coupled with the increasing number of plant pests of concern. Each site overseen by a Professional Operator is unique, with heterogeneity not necessarily being linked to the size of a business or organisation. This can mean that smaller outfits, with few staff, find themselves having to present in-depth specialist knowledge to effectively meet the requirements of Article 89 and Plant Healthy Certification, which is based on the Plant Health Management Standard (PHMS) and involves conducting a Site and Operational Pest Risk Analysis (SOPRA). However, irrespective of the size or complexity of a business or organisation, specialist knowledge and know-how are required to effectively compile the pest and disease information required to implement effective plant biosecurity systems.

A previous PHC Scotland project (Elliot, et al., 2023) detected uncertainty in this area. Stakeholders were asked what would help them with their risk assessment and adoption of tighter biosecurity measures: one of the top answers was "more definitive information/guidance".

This indicated that stakeholders, many of which will be registered as Professional Operators and issuing plant passports, are lacking confidence in their notifiable pest risk knowledge. There is a considerable amount of information available, much of which is dispersed and patchy, that can make the task feel insurmountable. For example, there are currently over 1,400 pests on the UK Plant Health Risk Register (UKPHRR) (Defra, 2023), several hundred of which are considered harmful to our cultivated and naturally occurring flora. It therefore follows, that Professional Operators may find it challenging to use the UKPHRR in relation to the plant species that they grow, move and manage.

Given the impact of introduced pests to Scotland, it is of paramount importance that Professional Operators can access the information on notifiable pests in order to meet their legal responsibilities under Articles 89 and 91 with accuracy and confidence. This will reduce the risk of pest introductions and spread, and support plant health authorities trace plants and respond to outbreaks in a timely fashion if a notifiable pest is detected.

The freely available PHMS has been developed by the Plant Health Alliance (PHA) to provide an auditable standard (PHA, 2022). Currently the standard has been used to support assurance systems such as the Plant Healthy Certification Scheme (PHCS), the Woodland Trust's UK & Ireland Sourced and Grown (UKISG), the Horticultural Trades Association's Ornamental Horticulture Assurance Scheme (OHAS) and Fera's Ready to Plant system. The PHMS has informally been cross-referenced with Article 91, thus the pest risk management measures that are covered in Article 91 are broadly reflected in the requirements of the PHMS. However clear detail on how the PHMS relates to Article 91 would be useful for policy makers.

The gathering of specialist knowledge to facilitate the effective application of sustainable management practices is an issue that spans many areas of environmental stewardship. An example where technology has been used to present complex information in a bespoke, site-specific manner is the Woodland Wildlife Toolkit (Sylva, 2019). The toolkit was developed by the following partners: Bat Conservation Trust, Butterfly Conservation, Forestry Commission, Natural England, Plantlife, Royal Society for Protection of Birds (RSPB), Sylva Foundation and Woodland Trust.

The toolkit provides advice on managing woodlands for wildlife, in particular rare and declining species that are dependent on woodland habitats. The information is geo-referenced meaning that a woodland manager can submit an enquiry for a given area of woodland and

immediately be presented with information on which important wildlife is likely to be in or near the woodland based on available survey or distribution data and the habitats and features that these species need. This information can then inform a woodland management plan with a view to provide these habitats where appropriate through practical woodland management actions.

Inspired by the approach of the Woodland Wildlife Toolkit, an aim of this project was to develop a prototype system that could serve up relevant pest and disease information based on the plants that a Professional Operator grows, manages or handles as part of their business or organisation's operations.

3.1 Project aim

It has been recognised that the UKPHRR works well for identifying information for a specific pest, however it is not so easy to query the UKPHRR for a host plant or a list of host species, such as a stock list for a nursery, a buying list for a retail business or an inventory of plants in a garden.

The overall project aim was to address the issues of information availability outlined above by generating and presenting easily accessible information to help support Professional Operators provide the information in relation to Articles 89 and 91 of EU Regulation 2016/2031. This will improve biosecurity outcomes for individual horticultural sites, supply chains and the wider environment. In order to meet this overall aim, this project:

- produced a suite of 39 pest management information sheets providing crucial and need-to-know information for Professional Operators to help fulfil their obligations (the 22 GB Priority Pests plus the 17 pests that currently have a UK mitigated risk rating of 60 or above on the UKPHRR). The information presented includes key points on host species, pest identification, life cycles, movement pathways and management measures. These pest management sheets are in a uniform format and subsequent sheets can be added to the suite of 39 pests as and when further high-impact notifiable pests are identified.

- developed a pest risk analysis summary document detailing the main pathways by which pests spread and how the various PHMS requirements minimise pest risk. This provides Professional Operators with a quick overview of the management options for all 39 pests and how, by adopting a systems approach, they can mitigate risk on their site, something which is not currently available anywhere else (e.g. the UKPHRR).

- cross-referenced the PHMS with Article 91 with the aim of ensuring that the PHMS is well-aligned with regulations and therefore provides the confidence for Government or other bodies to include the PHMS in their procurement policies or other policy requirements.

- undertook an initial prototyping exercise (engaging with the web-development team at the Sylva Foundation) to test an automatic webtool which provides Professional Operators with information to conduct a SOPRA, and the assessment procedures carried out by the competent authorities, to authorise businesses to issue plant passports. The aim is to support Professional Operators access the need-to-know information easily so that they can focus on conducting the critical thinking required to integrate effective plant biosecurity measures within their operations and on their sites.

- produced four case studies which demonstrate biosecurity best practice currently in place at a variety of businesses and organisations that have adopted the PHMS.

4 Methods

In order to meet this evidence gap, we identified 39 pests which could be used to populate a prototype webtool for Professional Operators to use to assess pest risks to their operations. The 39 pests used are the 22 GB priority pests, as per The Plant Health (Amendment etc.) (EU Exit) Regulations 2020 (Legislation.gov.uk), and the 17 additional pests with mitigated risk rating of 60 or above on the UKPHRR as of November 2023 (Defra, 2023). The mitigated risk rating scores were used, as where applicable, these scores represent an adjustment to the unmitigated risk rating for the specified pest. This process takes into account the phytosanitary controls which are in place to reduce the risk of a pests entry into, or establishment, spread and impact within GB. For a full description of how unmitigated and mitigated risk rating scores are calculated see: *Guidance document for the UK plant health pest risk register* (2021).

4.1 Pest factsheets

Based on experience and engagement with stakeholders during previous Plant Health Centre projects (particularly PHC2021/01: Biosecurity practices to support plant health: a review of knowledge and practice), the factsheets were designed to present key information to Professional Operators in the most accessible way. The factsheets are available in appendix A.

Initially, a template factsheet was developed with the relevant data:

- Pest name (scientific and common names (where available on the UKPHRR))
- Which plant hosts are affected?
- What do I need to look for?
- What statutory actions are in place?
- Pathways of highest risk.
- Key measures to protect my site.
- Three photographs (where available) showing the relevant diagnostic features of the pest.
- Where to report suspected pests to.

Data for the factsheets were sourced from:

- The UK Plant Health Risk Register
- Pest Risk Analyses (PRAs) compiled by the UK and international Plant Health Authorities
- The European and Mediterranean Plant Protection Organization (EPPO)
- Forest Research pest resources
- Other international online resources including academic literature on pests.

4.2 Prototype webtool – converting UKPHRR data into pest risk management information

The following are a series of steps that were taken to convert the information for the 39 pests into a format that could inform a webtool's outputs based on a search for an individual plant or a list of different plant species. Steps 1-6 were taken to produce the SOPRA template spreadsheet, followed by steps 7 – 14 to organise the data in a searchable format for a web-developer to develop the prototype webtool. The data can be found in appendix B.

4.2.1 Creating the SOPRA template:

1 – download CSV file from the UKPHRR and save in an Excel format (essential to ensure all future changes to the spreadsheet are saved).

2 – highlight all 22 GB priority pests on Schedule 1 of the New Annex to Commission Implementing EU Regulation 2019/1702.

3 – search the spreadsheet for all other pests with a mitigated risk rating of 60 and above, this resulted in an additional 17 pests.

4 – remove all of the pests on the risk register that did not fall into the above two categories.

5 – organise the pest information in columns starting with the 22 GB priority pests and arranging these pests in descending order based on their mitigated risk rating, followed by arranging the 17 additional pests with mitigated risk rating of 60 or above in descending order, again based on their mitigated risk rating.

6 – list under each pest the mitigated risk ratings and the hosts plants (a list that is set out within an individual spreadsheet cell).

4.2.2 Development of the spreadsheet into an information sheet that could be presented to a web-developer

7 – take the lists of host species from each of the cells pertaining to a specific pest and list in a column in order to cross-reference all host genera with all pest species. It was decided that the plant list would use only the genus information for the purposes of a prototype (as explained below).

8 – the list of all host genera (198) that related to one or more of the 39 pests was then cross referenced against the pest species this resulted in database that was based on binary information where a '1' indicated that a host plant genus could be infested with a named pest and a '0' indicated that a plant was not a host of a named pest. Some genera had multiple pests, e.g. based on the UKPHRR information the genus *Solanum* can potentially be infested by 15 pests out of the 39-pest species whereas several genera, e.g. *Nepeta, Thuja* and *Vinca* are susceptible to infestation from a single pest species.

9 – as the pest pathways are also listed in a single cell on the UKPHRR, conduct a similar exercise that was carried out at step 7 and 8 for the pathway information. This resulted in a binary table that cross-referenced pests with the pathways that they can be moved or travel along.

10 – design a summary sheet which involved rotating the spreadsheet so that the list of the 39 pests appeared in rows as this seemed to be the clearest way to present the pest information.

11 – select the salient information from the UKPHRR that relates to the pathways of introduction and spread of each pest and set out in columns (see appendix B).

12 – review the PHMS requirements and select the key measures that prevent the movement of each pest based on the pathways presented in the UKPHRR (i.e. data in step 11).

13 – number the pests from 1 – 39 and based on the information in the cross-referenced spreadsheet, create a list of the plant genera numerically linking the pest or pests that can infest each host genus.

14 – design, using several PowerPoint slides, how the website should function as a means to communicate with the web-designer the desired functionality of the prototype webtool. This included the two search options: (1) to upload a list of genera presented as a CSV file and (2) to select radial buttons of each genus as a means of conducting a search. Additionally, the information required in a basic search output was specified.

The above steps are a highly summarised set of steps that represent a considerable data organisation and design process. During this process notes were taken regarding some of the limitations of the data which must be made clear to potential users of the data arranged and presented in the prototype webtool.

4.2.3 Taxonomic level used

Information on host plants is provided on a number of levels in the UKPHRR. These range from: plants (general), coniferous trees, families, genera and species. To ensure a consistent approach the decision was taken to use only genus information. Using the genus information does present the risk of a genus or genera not being included for a specified pest e.g. in the case of an entire family being presented as hosts for a pest.

Example A - The bacterial pest *Clavibacter sepedonicus* has the following host plants listed under the host entry on the UKPHRR: *Solanum; Solanum tuberosum; Plants (general)*. For the purposes of the prototype the genus *Solanum* was used as this will indicate all species in the genus *Solanum*, although it will not pick up all plants.

Example B – The insect pest *Ips typographus* has the following host plants listed under the host entry on the UKPHRR: *Abies; Coniferous trees; Larix; Picea; Picea abies; Pinus; Pseudotsuga*. For the purposes of the prototype the genera *Abies; Larix; Picea; Pinus; Pseudotsuga* were used as this will flag up all species in these genera, however it will not pick up all coniferous trees.

Example C - The insect pest *Epitrix papa* has the following host plants listed under the host entry on the UKPHRR: *Capsicum annuum; Solanum lycopersicum; Nicotiana tabacum; Solanum melongena; Solanum tuberosum.* The insect pest *Epitrix subcrinita* has the following host plants listed under the host entry on the UKPHRR: *Capsicum annuum; Lycium; Solanum lycopersicum; Nicotiana alata; Physalis alkekengi var. franchetii; Solanum melongena; Solanum tuberosum*. Taking the genus *Nicotiana* as an example, there are two species of *Nicotiana* listed, each under the two different pests highlighted above. For the purposes of the prototype, the genus was used meaning that irrespective of the species of *Nicotiana* a Professional Operator grows or handles, both of these pests will be presented for the genus *Nicotiana*.

4.3 Case Studies

Previous engagement with stakeholders (Elliot, et al., 2023) showed that many horticultural professionals struggled with plant health improvements because they found the subject area intimidating and that they struggled to know where to start. Therefore, it was decided to incorporate case studies into this project to demonstrate how organisations/businesses meet the requirements of the PHMS in the hope that those accessing the case studies gain a better understanding of where to begin improving their biosecurity standards.

The four case studies which were developed here therefore illustrate how plant health risks are managed across a range of operators and how the PHMS can be used to drive improvements. The aim was to share the experiences of a range of Professional Operators as they assess the plant health risks associated with their organisations/businesses and mitigate them using the PHMS. The sites and their scopes of certification were:

- Royal Botanic Garden Edinburgh (RGBE) – nursery, garden and retail area (3 individual case studies in one)
- Provender Nurseries Limited, Swanley, Kent - nursery
- Nicholsons, Bicester, Oxfordshire – arboriculture, nursery, retail area and landscaping
- Royal Horticultural Society Garden Harlow Carr, Harrogate, Yorkshire – nursery, garden

and retail area

Site managers were contacted to explain the project and to ask permission to use their site as a case study. The sites were then visited to speak to the site managers to understand their processes. Photographs and detailed notes were taken. A final draft of each case study was sent to the respective site manager for their approval.

5 Results

5.1 Pest factsheets

Thirty-nine pest factsheets were produced (appendix A) which give Professional Operators (or any user) the information they require to assess the risks associated with the particular pest. The information presented includes the pest name, hosts, symptoms and signs, pathways, statutory actions to be taken, and the key measures that should be taken to protect a site (based on the requirements of the PHMS) (Figure 2).

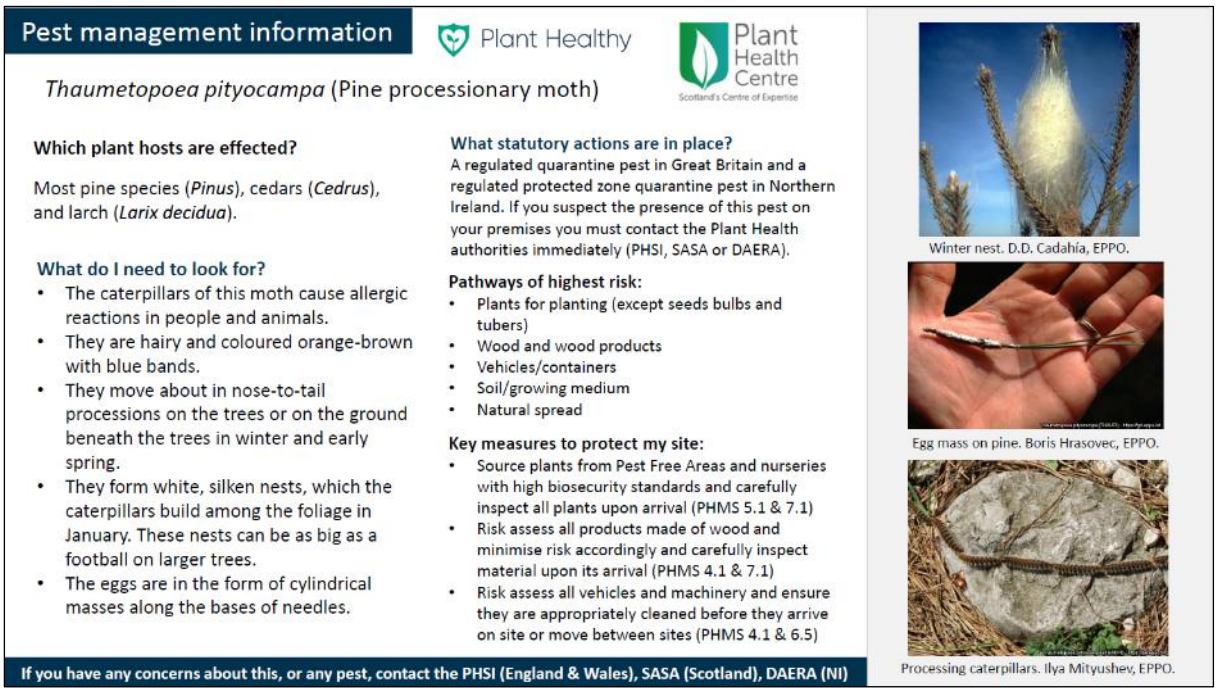


Figure 2: An example of one of the 39 pest sheets produced.

The factsheets (appendix A) are ready to be used as a resource for Professional Operators, however consideration needs to be given to how they will be kept up to date. For example, a new pathway may be identified for a particular pest, this will need to be communicated to Professional Operators in an updated factsheet. It is therefore important that updates of the factsheets are made when required and that Professional Operators regularly download factsheets to ensure that they have the most up to date versions (e.g. annually as part of the Plant Healthy Certification audit process).

5.2 The prototype webtool

One approach to keeping the factsheets updated would be to develop them into a webtool. Therefore, a prototype of a webtool was developed which if taken forward would be able to give Professional Operators accurate, useable information to develop their pest risk analysis relevant to their business or organisation (Figure 3).

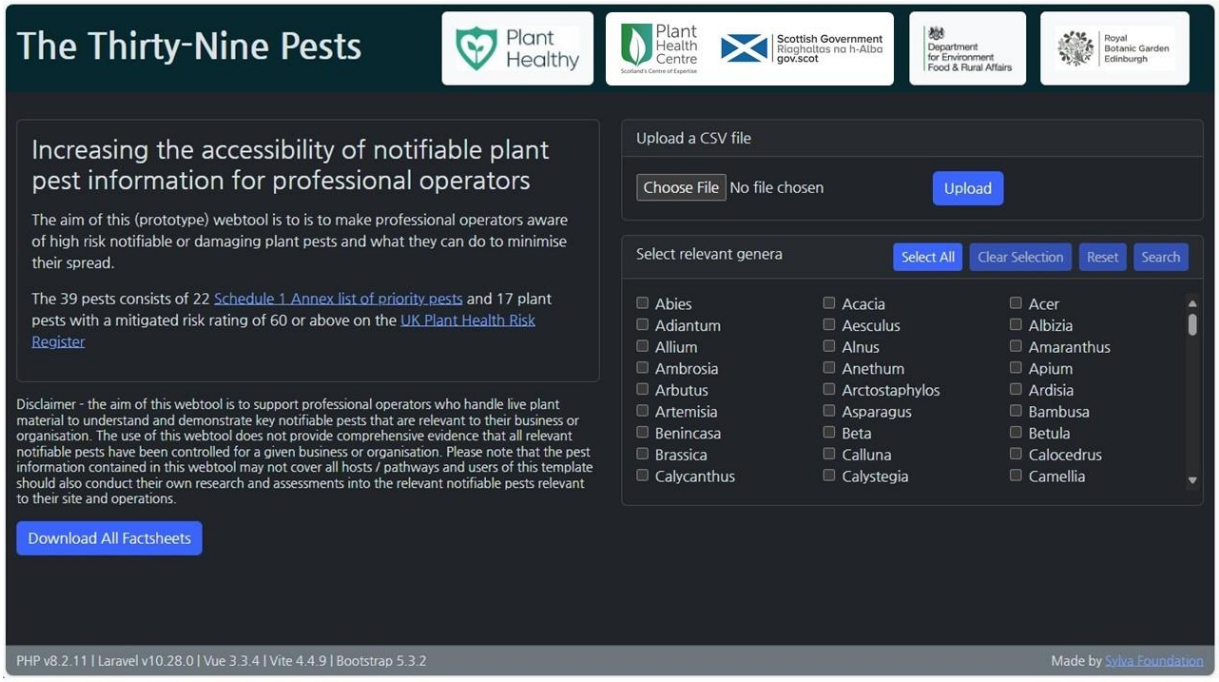


Figure 3: A screenshot of the 39 pests webtool.

In the prototype, a stock list of plants can be uploaded to the tool (as a csv file) or individual genera selected from a list. Once this has been entered and the search button selected, the prototype presents the user with a pest management information summary sheet that couples the pathways for each of the 39 pests with specific PHMS measures to minimise the risk of pest movement and establishment (see appendix C for screenshots of the prototype webtool's function). The methods below and a detailed user guide for the webtool would be made available to a future developer and host. In developing the prototype, the following information was included:

- A pest factsheet (see section 4.2)
- Pest name (scientific)
- Common name
- Type of Pest
- Host Genus or Genera
- UK Presence
- Pathways (e.g. Plants for planting (except seeds bulbs and tubers), Firewood, Soil/growing medium, Hitchhiking, etc.)
- Key measures to prevent movement and spread (related to the specific requirement in the PHMS).

This information supports Professional Operators gather the information in relation to Article 89. Importantly, this information immediately makes the link between a particular pest, its host, and the main pathways that may bring it onto a site. This gives the site owner/manager immediate clarification of the pest risk to their particular site and activities.

5.3 Case studies

Four case studies were conducted, RBGE (appendix D), Provender (appendix E), Nicholsons (appendix F) and Royal Horticultural Society (RHS) Harlow Carr Garden (appendix G).

It became apparent during previous biosecurity research (e.g. PHC2021/01: Biosecurity practices to support plant health: a review of knowledge and practice) that many horticultural professionals were intimidated by the perceived complications involved in improving biosecurity during their operations. These case studies therefore present information in a way that aims to remove such barriers to improvement, by giving readers an idea of where to start with their plant health improvements.

For example, the Provender case study explains the need for good biosecurity from the perspective of a successful plant production and sales business. They state that the first Plant Healthy Certification Scheme audit is difficult but that once a business such as theirs gets into the habit of annual audits, the process becomes much more straightforward and embedded in everyday processes. They also talk about specific areas of importance such as thorough checking of incoming and outgoing plants, good record keeping and good plant husbandry.

The Royal Botanic Garden Edinburgh case study combines a number of different elements of their organisation which need to be accounted for during biosecurity improvements. This is not just the retail area (i.e. garden centre) which stocks plants from outside the garden, but also the nursery which produces plants for the garden, and the biosecurity related to the important plant collections in the wider garden. Processes discussed in this case study include checking goods-in thoroughly (including the pallets that they may be delivered on) in the retail area as well as in the nursery (e.g. growing media deliveries), and a description of the isolation and quarantine facilities and procedures that are in place to reduce the risk of the inadvertent introduction of a pest onto the site.

The Nicholsons case study shows that as a plant production nursery, Plant Healthy Certification enables them to show other businesses they deal with, and also their customers, that they have a high level of professionalism, which includes understanding and minimising the plant health risks to the business. Being certified has challenged areas of their business and made managers tackle areas that had not previously been considered, e.g. record keeping. Being proactive with plant biosecurity gives staff and customers peace of mind.

At the RHS, Plant Healthy certification is now a key part of the RHS's Sustainability Strategy Biosecurity Neutral target, it also provides them with a valuable framework for much of their biosecurity work. One particularly valuable element of Plant Healthy is the expectation from the scheme for continual improvement within operations. This therefore requires members of the scheme to keep up to date with the latest developments in the field of plant biosecurity and proactively consider how their pest risk management plans and systems might need to change and adapt. The annual audit is appreciated by the RHS as a valuable reminder that plant health and biosecurity is an ever-changing landscape.

5.4 Benchmarking exercise

A comparison exercise took place to explore the potential for the PHMS to align with retained EU Regulation 2016/2031 - Article 91 – *Pest Risk Management Plans* (see Appendix H, for full details).

Plant health regulations on biosecurity standards for the agri-food chain include the regulation of pests of trees and wood. The regulation takes a risk-based approach to plant protection, and the pest and disease control measures are stringent. Several plant health regulations are EU regulations, amended and retained after the UK exited the EU. A key

regulation is EU Regulation 2016/2031 of the European Parliament and of the Council on protective measures against pests of plants.

EU Regulation 2016/2031 establishes rules to determine the phytosanitary risks posed by any species, strain or biotype of pathogenic agents, animals or parasitic plants injurious to plants or plant products ('pests') and measures to reduce those risks to an acceptable level (EU, 2019).

The PHMS comprises of mainly voluntary requirements and was co-designed with regulatory authorities, trade bodies, researchers and third sector organisations with the first version (1.0) being released in January 2019. When a new version of the PHMS is deemed necessary, feedback from such sources are sought as set out under the PHMS's requirement or standard setting procedure. The current version of the PHMS is 1.2.

For the PHMS to be effective the requirements aim to align with the regulatory framework. Section 1 of the PHMS sets out checks to help ensure that a Professional Operator is meeting regulatory requirements. The overall aim is to ensure that the PHMS relates sensibly with existing and new regulations and thereby supports the work of the NPPO and any agencies that deliver duties on behalf of the NPPO.

A key aim of the PHMS is to support Professional Operators to understand, identify and document the information and evidence stipulated by retained EU Regulation 2016/2031 - Article 89 - *Authorisation of professional operators to issue plant passports*. A related article in Regulation (EU) 2016/2031 is Article 91 – *Pest Risk Management Plans*. This article sets out the elements of a management plan that an Authorised Operator may establish to demonstrate that they have effective policies, procedures and practices in place to minimise the risk from notifiable plant pests.

To further the aim of aligning the voluntary aspects of the PHMS with the regulatory framework, an initial comparison exercise was conducted as part of this project to identify the extent that the current version of the PHMS (v1.2) aligns with Article 91 and its sub-articles. This exercise was conducted with a view to support future discussions and co-design exercises with the NPPO, relevant agencies and other bodies that rely upon or relate to the PHMS. This exercise should help further the development of a systems approach to plant biosecurity that spans the regulatory framework and the voluntary requirements of the PHMS.

A table showing a current assessment of the comparison between Article 91 and its sub-articles with the requirements and sub-requirements of the PHMS has been produced (appendix H). As a summary, the exercise demonstrates that the PHMS relates thematically to most areas of the sub-articles set out in Article 91. However, there are specific aspects of other articles and sub articles set out in EU Regulation 2016/2031 that the PHMS does not appear to cover. A next step would be to carry out an in-depth benchmarking exercise with the relevant personnel from the UK Plant Health Service.

6 Discussion

There is a clear need to present consistent and focused notifiable pest management information to Professional Operators. There is good information available, however it is in a variety of formats and the quality and type of information is variable. The purpose of this project was to explore if pest information could be set out in a consistent format to support Professional Operators by presenting bespoke plant biosecurity information for their site and associated operations. This information aims to enable Professional Operators to focus their attention on the critical analysis processes required to establish effective plant biosecurity systems.

During the course of this study, Defra initiated a project entitled Plant Health Information with the stated vision of *'providing the correct information, in the right place, at the right time in the correct format.'* Clearly the of aim of this study chimes closely with the aim of this Defra project and it is likely that the Defra team are better placed to address some of the potential information pitfalls encountered during this study. Discussions have been held with the Defra team and a comparison exercise should be conducted between the two systems to ensure that the information presented to Professional Operators is consistent. This raises the question of which organisation is best placed to host a webtool of this nature if it is to progress beyond a prototype.

The summary sheet and the individual pest sheets produced as part of this project were well received by a review group (namely the Plant Healthy Certification Scheme Technical Advisory Group). The concept of the protype webtool was generally well received, although well-considered notes of caution were raised as to how easily accessible pest and disease information would be perceived by specific stakeholder groups such as specifiers of plants – i.e. would the information inadvertently change their attitudes to specific genera or indeed to the risks associated with plants in general. This is a communication issue and should be addressed with clear supporting information if the webtool progresses beyond a prototype stage. How pest information would be updated was also raised as a concern, although this is a resource and communications issue that could be managed if there was the will and means to do so.

Using a pre-existing data source such as the UKPHRR to carry out this kind of development exercise is not without its issues. For example, the prototype webtool uses the taxonomic level of genus for clarity, but the UKPHRR uses different taxonomic levels, for example, plants (general), coniferous trees, families, genera and species. Therefore, using the genus information does present the risk of a genus or genera not being included for a specified pest in the prototype webtool e.g. in the case of an entire family being presented as hosts for a pest.

In addition, a name change of a host can mean that it is missed entirely by a webtool such as the one prototyped here. For example, the important *Xylella fastidiosa* host rosemary has recently changed name from *Rosmarinus officinalis* to *Salvia rosmarinus* which may mean that it could be missed during this kind of exercise, i.e. if the trader searches for *Salvia rosmarinus* on either the UKPHRR or the webtool it will not come back as a *Xylella* host, but it would if they searched for *Rosmarinus officinalis*.

Therefore, an important consideration of using UKPHRR data for any risk assessment exercise is understanding how often the host lists on the register are updated. For example, *Xylella fastidiosa* and its sub-species are polyphagous pests. The plant host list for *Xylella fastidiosa* has expanded from three hundred to over six hundred in recent years. The host species that are listed on the UK Plant Health Portal and the plant species listed as hosts on the UKPHRR are not the same. *Xylella fastidiosa* is a complex organism and research into this pest and the extent of its potential hosts is ongoing. *Xylella fastidiosa* is just one pest on a risk register of over 1,400 plant pests. A general consideration for the UKPHRR is the potential of the data being inconsistent or incomplete which clearly presents a limitation when using the data on the UKPHRR database for developing a webtool such as the one prototyped here. It should be acknowledged that there is a considerable amount of pest and disease data to curate and keeping all information up to date is a significant task but one recommendation from this study would be that the data on the UKPHRR is updated monthly to capture a constantly changing pest landscape.

Another consideration relates directly to the concept of presenting the highest risk notifiable pests to Professional Operators (Article 89 of EU Regulation 2016/2031). The prototype did not include pests which require no statutory action. For example, *Arion vulgaris*, Spanish slug (mitigated risk rating of 60), was not included in the group of pests with a mitigated risk rating

of 60 above as it did not require statutory action. Conversely, there may be other pests that do require statutory action, but which have a lower risk rating (below 60) that were not considered for inclusion in this prototype, but could be included as part of future developments.

This project has highlighted the importance of maintaining quality and consistent information as well as a need for keeping the information up to date. Currently pest information can be accessed from several sources and in some cases the information is inconsistent (e.g. host lists for specific pests). Curating and managing the range and complexity of the relevant information is a considerable task. Advances have been made in recent times by establishing the UKPHRR and it would be useful to understand how the host lists for critical pests are managed as this in turn will support the accuracy of the prototype webtool outputs.

The benchmarking exercise between the PHMS and Article 91 of EU Regulation 2016/2031 demonstrated that the PHMS relates thematically to most areas of the sub-articles set out in Article 91. However, there are specific aspects of other articles and sub-articles set out in EU Regulation 2016/2031 that the PHMS does not appear to cover. A next step would be to carry out an in-depth benchmarking exercise with the relevant personnel from the UK Plant Health Service.

7 Conclusions

The pest factsheets developed during this project have been well received by a select group of stakeholders. They could be further developed to cover many more pests of concern, leading to a better understanding of regulated pests by Professional Operators. The pest sheets developed here provide a business or organisation with a tangible product which can not only inform their site and operational pest risk analysis but can also be used as a staff awareness and training tool. For example, they can be printed out and placed on a staff notice board.

Keeping factsheet information updated is critical and the 39 Pests prototype webtool concept is the first attempt to use UKPHRR data to develop a webtool for Professional Operators to assess pest risk specifically for their site and associated operations. The information gathered and analysed for the development of this prototype webtool gives Professional Operators (or potentially any user) key information to help fulfil their legal obligations when issuing plant passports or carrying out a risk assessment of their activities.

The information presented immediately makes the link between a particular pest, its host, and the main pathways which pose a risk of bringing the pest onto a site. This gives the site manager focussed information regarding the pest risks to their particular site and activities, which was not previously easily available.

As with any knowledge system, the webtool relies on the quality of the information that the system utilises and the information on the pests in the webtool would need to be updated by future developers / host and checked on a regular basis with the managers of the UKPHRR and other relevant agencies. This should help address some of the considerations covered in this report.

The prototype webtool produced as part of this project could potentially be further developed as part of the improvements planned for the UKPHRR and portal. This would ensure that future changes to the risk register (e.g. the addition of more pests) could be automatically linked to the pest risk webtool.

The information that the fact sheets and the prototype webtool presents is of importance to plant biosecurity in the UK and should therefore be used with caution. The information is available from other sources, however the webtool would enhance the accessibility and

consistency of the information if it is developed and launched. By presenting pest specific measures in a pest management framework, it can inform biosecurity management systems for both regulatory and voluntary purposes. It is therefore critical to ensure that all the information is compiled correctly. For the prototype webtool to be made available to Professional Operators, there should be an assessment by and an agreement with the relevant Defra team and the UK Plant Health Service to ensure that the information is accurate and kept up to date.

The case studies presented during this project show that improving biosecurity across different types of organisation/business is challenging but that it is worthwhile and important for the future of UK horticulture and related sectors. The case studies are therefore an ideal tool for sharing important biosecurity information in a more relevant format to Professional Operators who are looking to improve their plant biosecurity systems.

8 Appendix A: Thirty-nine pest factsheets

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Bactericera cockerelli (potato psyllid)

Which plant hosts are effected?

Has been found several times on plants imported from Mexico. Hosts include potato plants (*Solanum tuberosum*), tomato (*S. lycopersicum*), pepper (*Capsicum annum*), aubergine (*S. melongena*) and other solanaceous hosts.

What do I need to look for?

- A small psyllid (about 2.75mm long) which varies in colour from pale green to dark brown.
- An important vector of the bacterium *Candidatus* Liberibacter solanacearum (LSO), which causes 'Zebra Chip' disease. Symptoms in potato and tomato include:
- Delayed growth.
- Erectness of new foliage.
- Chlorosis and purpling of new foliage with leaf basal cupping and upward rolling throughout the plant.
- Shortened and thickened terminal internodes resulting in resetting.
- Enlarged nodes.
- Axillary branches or aerial potato tubers.
- Disruption of fruit set, and production of numerous small fruits of poor quality.
- See *Candidatus* Liberibacter solanacearum factsheet.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Plants for planting (except seeds bulbs and tubers)

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

B. Cockerelli nymph. Defra

B. Cockerelli adult. Defra

Infected potatoes. Joseph E. Munyaneza, USDA

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Agrilus planipennis (Emerald Ash Borer)

Which plant hosts are effected?

Most *Fraxinus* species (ash) are susceptible as well as *Juglans ailantifolia* var. *ailantifolia*, *Juglans mandshurica*, *Pterocarya rhoifolia* and *Ulmus davidiana*.

What do I need to look for?

- A small (7.5mm - 13.5mm long), slender, metallic green beetle.
- Ash branches dieback from the top of the tree and the foliage yellows.
- Bark fissures between 5 and 10cms long form where the bark is responding to larval feeding beneath.
- Newly emerged adults bore 'D'-shaped exit holes (3-4 mm diameter) on trunks and branches.
- Basal sprouting and the presence of woodpeckers may indicate wood-boring beetle activity.
- After 1 to 2 years of infestation, the bark often falls off in pieces from damaged trees, exposing the insect galleries.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Firewood
- Wood and wood products
- Squared wood
- Non-squared wood
- Wood packaging material
- Bark

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

A. Planipennis adult. Eduard Jendek, EPPO.

Flat and broad larva. Eduard Jendek, EPPO.

'D' shaped exit hole. Eduard Jendek, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Thaumetopoea pityocampa (Pine processionary moth)

Which plant hosts are effected?

Most pine species (*Pinus*), cedars (*Cedrus*), and larch (*Larix decidua*).

What do I need to look for?

- The caterpillars of this moth cause allergic reactions in people and animals.
- They are hairy and coloured orange-brown with blue bands.
- They move about in nose-to-tail processions on the trees or on the ground beneath the trees in winter and early spring.
- They form white, silken nests, which the caterpillars build among the foliage in January. These nests can be as big as a football on larger trees.
- The eggs are in the form of cylindrical masses along the bases of needles.

What statutory actions are in place?

A regulated quarantine pest in Great Britain and a regulated protected zone quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

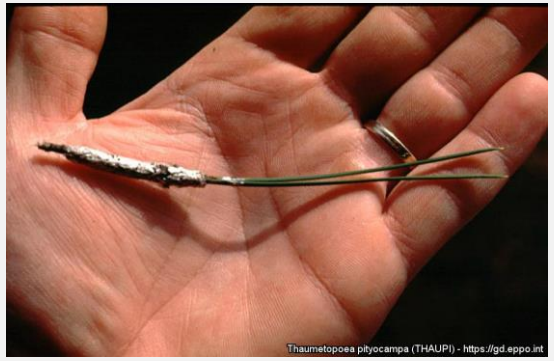
- Plants for planting (except seeds bulbs and tubers)
- Wood and wood products
- Vehicles/containers
- Soil/growing medium
- Natural spread

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Winter nest. D.D. Cadahía, EPPO.



Egg mass on pine. Boris Hrasovec, EPPO.

Processing caterpillars. Ilya Mityushev, EPPO.

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Agrilus anxius (Bronze birch borer)

Which plant hosts are effected?

All birch species (*Betula*). Particularly, but not exclusively, from North America (Canada and the U.S.).

What do I need to look for?

- A small, narrow, metallic copper-coloured beetle between 7 and 12mm long.
- Leaf yellowing in summer and branch dieback appear in the upper crown of the tree.
- Rust-coloured sap oozing, and staining, can also appear on the outer bark, along with swellings and bumps where the tree has healed inside.
- Emerging adults bore 3 to 5mm-wide 'D'-shaped exit holes in the bark. Sinuous larval galleries can also be found under the bark.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Firewood, wood and wood products, non-squared wood
- Plant parts and plant products

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all relevant plant products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Callus tissue over a gallery. Steven Katovich, EPPO.

Adult and 'D' shaped exit hole.
Eduard Jendek, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Thaumetopoea processionea (Oak Processionary Moth, OPM)

Which plant hosts are effected?
Arrived in the UK initially in 2007 but has been intercepted several times since. Exclusive to oak trees (saplings) of any age but larger older specimen trees require particular close examination for eggs on the outer branches.

What do I need to look for?

- The caterpillars of this moth cause allergic reactions in people and animals.
- They live almost exclusively in oak trees.
- They often cluster together.
- They move about in nose-to-tail processions on the trees or on the ground beneath the trees in winter and early spring.
- They form white, silken nests, which the caterpillars build on oak trunks. They soon discolour to brown.
- The eggs are laid in rectangular blocks known as ‘plaques’ on outer branches of oak trees. They can be difficult to spot.

What statutory actions are in place?

A regulated quarantine pest in Great Britain (known to occur in the country) and a regulated protected zone quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Roundwood of oak with bark present

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

An OPM nest. Wietse den Hartog, EPPO.


An OPM caterpillar. The Tree Council


An OPM egg plaque. Gyorgy Csoka

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Anoplophora glabripennis (Asian longhorn beetle)

Which plant hosts are effected?
Many broadleaf tree species including *Acer, Aesculus, Alnus, Betula, Carpinus, Cercidiphyllum, Corylus, Fagus, Fraxinus, Koelreuteria, Malus, Morus, Platanus, Populus, Prunus, Pyrus, Salix, Tilia* and *Ulmus*.

What do I need to look for?

- A very large beetle, about 20 to 40mm long, with black and white markings.
- The antennae, or 'horns', are up to twice the body length and coloured black with white or light blue bands.
- Large, circular 'exit' holes, around 10 mm in diameter, on the main trunk or branches.
- Shredded wood or sawdust associated with the exit holes (this may be piled on branches below or on the ground at the base of the tree).
- Very similar to *Anoplophora chinensis* (the citrus longhorn beetle) – see *A. chinensis* factsheet.

What statutory actions are in place?
A regulated quarantine pest; also regulated by emergency measures. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Wood and wood products
- Wood packaging material

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

A. glabripennis Adult. M. Maspero, EPPO.

A. glabripennis larvae. M. Maspero, EPPO.

A. glabripennis exit holes. F. Hérard, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Ceratocystis platani (Plane Wilt)

Which plant hosts are effected?
Plane trees (*Platanus*), specifically *Platanus occidentalis, Platanus orientalis* and *Platanus* x *acerifolia*.

What do I need to look for?

- Severe wilting and yellowing (chlorosis) of the leaves, and tree death.
- Sunken lesions on thin-barked trees, with orange/purple streaking around the margin.
- In thicker-barked trees the only external signs of cankering may be vertical cracks.
- When the bark is removed, leopard-like dots (brown to dark violet) appear in the outer wood.
- In cross-section through infected branches bluish-black discoloration in the wood can be visible extending radially into affected branches or stems.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this disease on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Wood packaging material
- Soil/growing medium
- Water
- Hitchhiking
- Agricultural machinery

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
- Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)

Infected trees often dieback on one side. M. Guerin, EPPO.

Dark streaks due to *C. platani*. A. Vigouroux, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Clavibacter sepedonicus (Bacterial ring rot of potato)

Which plant hosts are effected?
The Solanaceae family are effected, including potato, tomato and aubergine (*Solanum*), peppers (*Capsicum*) and tobacco (*Nicotiana*).

What do I need to look for?

- Infections of ring rot can often be symptomless.
- The disease can cause plants to wilt but symptoms are much more likely to be observed in infected tubers.
- In the early stages the tissues around the vascular ring appear glassy and water soaked when tubers are cut across the heel end.
- As infection progresses the vascular ring becomes discoloured and a soft cheese like rot develops around the vascular ring (hence the name "ring" rot).
- The skin of the potato may appear slightly sunken, dry and cracked, the tubers may also start to mummify.
- Infected tubers can also be invaded by secondary pathogens leading to complete breakdown of the tuber.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Bulbs or tubers
- Packing cases

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all packaging cases and minimise risk accordingly and carefully inspect packaging upon its arrival (PHMS 4.1 & 7.1)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Symptoms on a potato plant. J.D. Janse, EPPO

Positive eggplant test. CSL, EPPO

Potato tuber infected by ring rot. CSL, EPPO

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Ips typographus (Larger eight-toothed European spruce bark beetle)

Which plant hosts are effected?
A serious pest of coniferous trees, first discovered in Southern England in 2018. Specific species effected include *Abies, Larix, Picea, Pinus* and *Pseudotsuga*.

What do I need to look for?

- Black or brownish-black beetles which are usually 4.0 – 5.5 mm long, cylindrical and robust.
- They are often associated with windblown, damaged and recently-felled spruce trees, where they build up numbers before moving on to attack adjacent live trees.
- Also known as 'engraver' beetles because of the 'engraved' appearance of the galleries.
- Larval galleries radiate outward from linear galleries becoming wider as the larvae grow and burrow along. This gallery pattern is unique to this species.

What statutory actions are in place?
Regulated quarantine pest (Great Britain). Regulated protected zone quarantine pest (Northern Ireland). If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

I. Typographus adult. Gilles San Martin, EPPO.

Adults overwintering under spruce bark. Iris Bernardinelli, EPPO.


Galleries and larvae. EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Aromia bungii (Red-necked longhorn beetle)

Which plant hosts are effected?

Prunus are particularly high-risk hosts but there are many others including *Bambusa*, *Diospyros, Juglans, Olea, Populus, Prunus, Pterocarya, Punica, Pyrus, Quercus, Schima* and *Zanthoxylum*.

What do I need to look for?

- These beetles are 22-38 mm in length and elongate, about 4 times longer than wide.
- They are shiny and blue-black except for the pronotum (section just behind the head), which is usually distinctively bright red.
- The pronotum bears a pair of stout, spine-like lateral tubercles.
- The antennae are as long, or slightly longer than the body and uniformly black.
- As with many other longhorn species the male tends to be smaller, with proportionally longer antennae, than the female.
- An entirely black form of this pest has been reported in Italy.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Wood and wood products
- Wood packaging material

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

Adult beetle. R. Griffo, EPPO.

Larva of A. bungii. R. Griffo, EPPO.

Larva inside wood. M. Maspero, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Anoplophora chinensis (Citrus Longhorn Beetle)

Which plant hosts are effected?
A very wide host range of frequently traded species including *Acer, Aesculus, Alnus, Betula, Carpinus, Citrus, Cornus, Corylus, Cotoneaster, Crataegus, Cryptomeria, Fagus, Ficus, Hibiscus, Juglans, Lagerstroemia, Malus, Platanus, Populus, Prunus, Pyrus, Rosa, Salix, Ulmus* and *Vaccinium*.

What do I need to look for?

- Adult beetles are large (21mm in length for males to 37mm for females) with black and white markings.
- The antennae, or 'horns', are longer than their bodies (between 1.2 and two times the body length) and are black with white or light blue bands.
- They are very similar in appearance to the related Asian longhorn beetle (*Anoplophora glabripennis*) – see *A. glabripennis* factsheet

What statutory actions are in place?

A regulated quarantine pest and regulated by emergency measures. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Cut flowers or branches

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Adult beetle. EPPO.


Vertical section through a gallery. Dominic Eyre, EPPO.

Exit holes. M. Maspero, EPPO.

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Epitrix cucumeris (Potato flea beetle)

Which plant hosts are effected?

The Solanaceae family are effected, including potato, tomato and aubergine (*Solanum*), peppers (*Capsicum*), tobacco (*Nicotiana*), Petunia hybrids (*Petunia* x *hybrida*), and *Physalis*.

What do I need to look for?

- Potato flea beetles are dark, tiny (1.5-2.0 mm long), oval, convex and hairy.
- It is most likely therefore that they will be discovered by the damage they cause to potato foliage and tubers.
- The adult beetles feed on the foliage producing small, scattered shot-holes, which can occasionally be so severe as to depress yield.
- The larvae feed on the root system and some species also feed on the tubers, which causes the most serious damage.

What statutory actions are in place?

Regulated quarantine pest (Great Britain). Regulated by emergency measures (Northern Ireland). If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Soil/growing medium
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Adult beetle. Jean-François Germain, EPPO.

E. cucumeris damage on potato. Jean-François Germain, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Epitrix papa (Potato flea beetle)

Which plant hosts are effected?
The Solanaceae family are effected, including potato, tomato and aubergine (Solanum), peppers (Capsicum) and tobacco (Nicotiana).

What do I need to look for?

- Potato flea beetles are dark, tiny (1.5-2.0 mm long), oval, convex and hairy.
- It is most likely therefore that they will be discovered by the damage they cause to potato foliage and tubers.
- The adult beetles feed on the foliage producing small, scattered shot-holes, which can occasionally be so severe as to depress yield.
- The larvae feed on the root system and some species also feed on the tubers, which causes the most serious damage.

What statutory actions are in place?

Regulated quarantine pest (Great Britain). Regulated by emergency measures (Northern Ireland). If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Plants for planting (except seeds bulbs and tubers)
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Adult beetle. Jean-François Germain, EPPO.

Epitrix spp. damage on potato. Jean-François Germain, EPPO.

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Epitrix subcrinita (Western potato flea beetle)

Which plant hosts are effected?
The Solanaceae family are effected, including potato, tomato and aubergine (*Solanum*), peppers (*Capsicum*) and tobacco (*Nicotiana*). *Physalis alkekengi* var. franchetii is also named as a host.

What do I need to look for?

- Potato flea beetles are dark, tiny (1.5-2.0 mm long), oval, convex and hairy.
- It is most likely therefore that they will be discovered by the damage they cause to potato foliage and tubers.
- The adult beetles feed on the foliage producing small, scattered shot-holes, which can occasionally be so severe as to depress yield.
- The larvae feed on the root system and some species also feed on the tubers, which causes the most serious damage.

What statutory actions are in place?
Regulated quarantine pest (Great Britain). Regulated by emergency measures (Northern Ireland). If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Plants for planting (except seeds bulbs and tubers)
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Adult beetle. Jean-François Germain, EPPO.

Epitrix spp. damage on potato.
Jean-François Germain, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Epitrix tuberis (Tuber potato beetle)

Which plant hosts are effected?
The Solanaceae family are effected, including potato, tomato and aubergine (*Solanum*), peppers (*Capsicum*) and tobacco (*Nicotiana*). *Physalis*, *Petunia* and *Lycium* are also named as hosts.

What do I need to look for

- Potato flea beetles are dark, tiny (1.5-2.0 mm long), oval, convex and hairy.
- It is most likely therefore that they will be discovered by the damage they cause to potato foliage and tubers.
- The adult beetles feed on the foliage producing small, scattered shot-holes, which can occasionally be so severe as to depress yield.
- The larvae feed on the root system and some species also feed on the tubers, which causes the most serious damage.

What statutory actions are in place?
Regulated quarantine pest (Great Britain). Regulated by emergency measures (Northern Ireland). If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Soil/growing medium
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Adult beetle. Jean-François Germain, EPPO.

Epitrix spp. damage on potato.
Jean-François Germain, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Fusarium circinatum (Pitch canker of pine)

Which plant hosts are effected?
A serious disease of pine (*Pinus*).

What do I need to look for?

- Causes damping-off in seedlings (although these can also be caused by other agents).
- Needles turn red, brown or chlorotic (pale, yellow, or yellow-white), and die from the base upwards, or the entire seedling dies.

In trees:

- Yellowing of the needles, which turn red in time and finally drop.
- Dieback of the shoots from the tip, occasionally producing 'shepherd's crook' symptoms.
- Repeated infections may result in significant crown dieback.
- Cankers might appear on the shoots, on the main branches and trunk, associated with conspicuous resin exudate (pitch).
- The cankers can cause varying levels of trunk deformation and can eventually girdle branches and trunks.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Cut flowers or branches
- Seeds
- Bark; Non-squared wood; Squared wood; Woodchip

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all sources of bark and branch wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

F. circinatum infection. Miloň Dvořák, EPPO.

F. circinatum infection on foliage. Forest Research.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Xylella fastidiosa (Xylella)

Which plant hosts are effected?
More than 600 hosts are known for Xylella. The more high-risk hosts are coffee, *Polygala myrtifolia, Lavandula* (lavender), *Nerium oleander, Rosmarinus officinalis* (rosemary), *Prunus dulcis* (cherry) and *Olea europaea* (olive).

What do I need to look for?

- Symptoms vary depending on the host plant species and its degree of susceptibility, but include:
- Marginal leaf scorch
- Wilting of foliage
- Withering of branches
- Severe infections can result in dieback, stunting and eventual death, especially in a particularly susceptible host species, for example, olive trees or grape vines.
- On plane (Platanus spp.), maple (Acer spp.), oak (Quercus spp.) and elm (Ulmus spp.) trees the symptoms include leaf scorch, sometimes also with dieback of twigs and branches. Characteristic leaf symptoms in summer on trees includes browning at the leaf margins (but not along the main veins), and there is often a yellow edge to the browned areas.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Insect vectors

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)

Symptoms on *Polygala myrtifolia*. D. Boscia, EPPO.

Symptoms on *Nerium oleander*. D. Boscia, EPPO.

Symptoms on cherry. D. Boscia, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Rose Rosette virus and *Phyllocoptes fructiphilus*

Which plant hosts are effected?
Roses (*Rosa* species and cultivars). This includes *Rosa canina*, *Rosa rubiginosa* and *Rosa rugosa*. *Phyllocoptes fructiphilus* is a tiny mite which spreads the virus (not yet known to be present in the UK).

What do I need to look for?

- Symptoms are highly variable depending on the rose cultivar in question, its age, and growth stage. Climatic conditions can also influence symptom development.
- Symptoms first appear on leaves, before emerging on stems and branches.
- Leaves redden and become distorted, whilst shoots elongate and redden.
- Witches' brooms and excessive thorniness are characteristic of RRV infection
- During the later stages of infection, reduced flowering and flower malformations are common.
- Diseased plants exhibit a gradual decline and die within 1-5 years, usually as a result of enhanced susceptibility to frosts.
- Rose rosette virus symptom progression is quicker in smaller, younger plants with infected seedlings rarely surviving after one year.

What statutory actions are in place?
A regulated quarantine pest in Great Britain and regulated by emergency measures in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Cut flowers or branches

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Leaf mosaic and mottling caused by RRV.
Patrick Di Bello, EPPO

Reddened shoots on an infected rose.
Patrick Di Bello, EPPO

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Thrips palmi (melon thrips; oriental thrips)

Which plant hosts are effected?
Many plants from a wide range of families. Specific examples include *Capsicum, Cucumis, Cyclamen, Chrysanthemum, Ficus, Helianthus, Nicotiana, Phaseolus, Pisum*, Orchidaceae (family), Solanaceae (family).

What do I need to look for?

- Almost entirely yellow in colouration, although a dark longitudinal line is formed by the joining of the wings when they are held at rest.
- Adults and nymphs both feed by sucking the cell contents from leaves, flowers and fruits, thereby causing surface silvery scars, and leaf deformation or chlorosis.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruits or vegetables
- Plants for planting (except seeds bulbs and tubers)
- Cut flowers or branches

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Damage on aubergine. J. Guyot, EPPO

An Adult *T. palmi*. J. Guyot, EPPO

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Leptinotarsa decemlineata (Colorado Beetle)

Which plant hosts are effected?
The Solanaceae family, including *Hyoscyamus niger* (henbane), *Solanum rostratum* (buffalo bur), *Solanum elaeagnifolium* (silverleaf nightshade) tomato, aubergine and potato.

What do I need to look for?

- Wing cases (main body)- Yellow/cream with ten straight black longitudinal stripes (5 on each side, the 5th stripe is narrow and runs along the margin).
- Head and area just behind it- Orange marked with irregularly shaped black spots.
- Antennae (feelers)- Not clubbed (they have no increase in width at the tips).
- Overall appearance - Oval shaped and very shiny. Wing cases cover the whole abdomen.

What statutory actions are in place?
A regulated quarantine pest in Great Britain and a regulated protected zone quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Hitchhiking

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Adult *L. decemlineata.* Ilya Mityushev, EPPO.

L. Decemlineata larva. Ilya Mityushev, EPPO.

Potato leaf damage. A J William Parr, EPPO.

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Ips amitinus (small spruce bark beetle)

Which plant hosts are effected?
Coniferous trees commonly used in forestry, including *Abies, Larix, Picea* and *Pinus*.

What do I need to look for?

- Beetles are dark-brown and 3.5 - 5.0 mm long.
- Prefers to breed in smaller-sized material, often in the upper part of weakened trees.
- Can occasionally mass-attack healthy trees, when population densities are high.
- Larval galleries are found beneath the bark in stem sections 2-27 cm in diameter although sections 8-15 cm in diameter are most frequently colonized.
- Sections with 2-3 mm thick bark are preferred.

What statutory actions are in place?
A regulated quarantine pest in Great Britain and a regulated protected zone quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Adult *I. amitinus*. Ivan Andreevich, EPPO

side viewElytral declivity of Ips amitinus (). Ivan Andreevich, EPPO

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Ips duplicatus (double-spined bark beetle)

Which plant hosts are effected?
Coniferous trees commonly used in forestry, including Abies, Larix, Picea and Pinus.

What do I need to look for?

- Adults are small (2.8-4 mm long), cylindrical, dark-brown, shiny and hairy.
- The larvae are 4.5-5.5 mm long, white, cylindrical and legless, with small, brown, chitinous heads and brown mandibles.
- Trees have discoloured crowns.
- The needles are lighter in colour, form mats and often fall to the ground green.
- The frass (light-brown sawdust) can be found on the bark, on the basal part of the stems of standing trees.
- Woodpeckers often break off the bark of attacked stems whilst hunting for larvae.

What statutory actions are in place?
A regulated quarantine pest in Great Britain and a regulated protected zone quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Adult beetle. Bugwood.org

Larval galleries. J. Liska, Bugwood.org

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Agrilus bilineatus (Two-lined chestnut borer)

Which plant hosts are effected?
Oak species (*Quercus*), including native oaks, and American chestnut (*Castanea dentata*).

What do I need to look for?

- The adults are most likely to be seen in late spring and early summer.
- They are between 6 to 12mm (0.2-0.5 inches) long, slender and black with a light, yellowish stripe on each wing cover.
- The larvae are white, slender, flattened, and about 25mm (1 inch) long, with two spines at the rear end.
- D-shaped 'exit' holes in the bark where the adult beetles emerge after pupation are also a sign of infestation although these can also be made by other Agrilus species.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood
- Wood packaging material

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

Adult beetle. D. L. Miller, EPPO.

Larval galleries in *Quercus ellipsoidalis*. S. Katovich, EPPO.

4th instar larva. S. Katovich, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Phytophthora ramorum

Which plant hosts are effected?
There are more than 150 known hosts for *P. ramorum* including many commonly traded species such as *Viburnum, Rhododendron, Magnolia* and *Pieris*.

What do I need to look for?

- Black regions on leaf petioles which extend into the leaf along the midrib on species such as Rhododendron and Pieris.
- The regions spread until the entire branch is dead, often forming a 'shepherd's crook'.
- Black, weeping cankers on branches and stems of infected plants.
- The inner bark under the bleeding areas is usually discoloured and dying.
- On mature trees, black bleeding patches on the trunk and dieback of the crown.

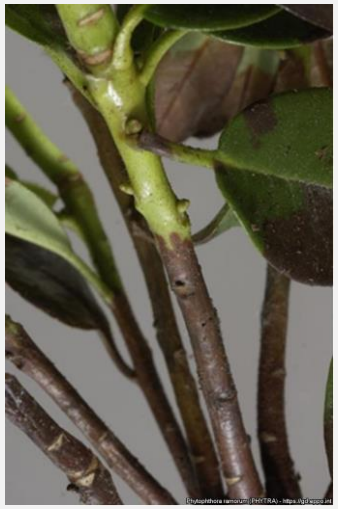
What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood
- Bark
- Soil/growing medium

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2)



Rhododendron shoot canker. FERA

Rhododendron leaf necrosis of midrib from petiole. FERA

Viburnum leaf tip necrosis. FERA

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Prodiplosis longifila

Which plant hosts are effected?
Many frequently traded species including *Allium, Asparagus, Capsicum, Citrus, Cucumis, Solanum, Tagetes, Vitis* and *Gossypium*.

What do I need to look for?

- The adult is small, black-yellowish and about 1.5 mm in length.
- The larva is almost transparent when newly formed and yellowish during the last instar. A full-grown larva is about 1.9 mm in length.
- Flowers have necrosed ovary, stamens, and petals. Where infestations are heavy there may be excessive flower drop.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruits or vegetables
- Plants for planting (except seeds bulbs and tubers)

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Adult of *P. longifila*. Maria Manzano, EPPO

Larvae on tomato. Maria Manzano, EPPO

Tomato fruit damage. Maria Manzano, EPPO

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Acute oak decline

Which plant hosts are effected?
Quercus species (*Quercus cerris, Quercus ilex, Quercus petraea, Quercus pyrenaica* and *Quercus robur*)

What do I need to look for?
- Thinning tree canopy.
- Dark-coloured, vertical, weeping fissures, which seep black fluid through vertical cracks between bark plates and down the trunk.

What statutory actions are in place?
Not regulated. However, if you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:
- Squared wood
- Non-squared wood

Key measures to protect my site:
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)

Bleeding on oak trunk.
Forest Research

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Agrilus biguttatus (oak jewel beetle)

Which plant hosts are effected?
Oak (*Quercus*). A native beetle which is protected under the Wildlife & Countryside Act 1981. Therefore, it should not be controlled. May play some role in acute oak decline but yet to be clarified.

What do I need to look for?

- Adults are iridescent green/blue or bronzy/green and 10-13mm (0.4-0.5 inches) long.
- They have two distinctive white spots on the wing-cases.
- Usually found in mature trees which are already declining.
- D-shaped 'exit' holes on the trunks of trees.

What statutory actions are in place?
Not regulated due to its natural presence.

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood
- Firewood
- Natural spread

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7)

Adult beetle. Forest Research

Adult beetle. Forest Research

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Candidatus Liberibacter solanacearum (zebra chip)

Which plant hosts are effected?
Apium graveolens, Capsicum annuum, Capsicum frutescens, Daucus carota, Foeniculum vulgare, Solanum lycopersicum, Pastinaca sativa, Petroselinum crispum, Solanum dulcamara and *Solanum tuberosum.*

What do I need to look for?
Symptoms in potato and tomato include:

- Delayed growth.
- Erectness of new foliage.
- Chlorosis and purpling of new foliage with leaf basal cupping and upward rolling throughout the plant.
- Shortened and thickened terminal internodes resulting in resetting.
- Enlarged nodes.
- Axillary branches or aerial potato tubers.
- Disruption of fruit set, and production of numerous small fruits of poor quality.
- Spread via a small psyllid called *Bactericera cockerelli*.
- See *Bactericera cockerelli* factsheet.

What statutory actions are in place?
A regulated non quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Fruits or vegetables
- Seeds
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

An infected potato. J.E. Munyaneza, EPPO

B. cockerelli adults with eggs. J.E. Munyaneza, EPPO

Infected potato plants. J.E. Munyaneza, EPPO

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Phytophthora infestans (potato late blight)

Which plant hosts are effected?
Solanum lycopersicum and *Solanum tuberosum* (tomato and potato).

What do I need to look for?

- Very young lesions on potato or tomato foliage appear as irregularly shaped, small (2-10 mm) lesions with or without a small surrounding area of collapsed but still green tissue.
- Lesions later turn brown.
- Older lesions are larger and circular, unless delimited by the leaflet margin, and are surrounded by a zone of collapsed tissue that is not yet necrotic. The non-necrotic tissue may also appear somewhat chlorotic.
- If there are many lesions on a single leaflet, the entire leaf can turn chlorotic.
- Patches of infected plants have a characteristic odour.
- Infected potato tubers exhibit wet and dry rots.
- On tomato fruits, lesions are firm, large, irregular, brownish-green blotches; the lesion surface has a greasy, rough appearance.

What statutory actions are in place?
There are currently no statutory actions in place for *P. infestans.*

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Soil/growing medium
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Symptoms on tomato fruit. A. Minuto, EPPO.

Symptoms on potato leaf. T. P. Banaras, EPPO.

Leaf symptoms. Dorina Pitorac, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Candidatus Phytoplasma solani

Which plant hosts are effected?

A wide range of crop and ornamental plants are effected including potato, tomato, strawberry, lavender, peony, *Vaccinium* and *Vitis* (grapevine). Vectored by an insect (see *Hyalesthes obsoletus* factsheet).

What do I need to look for?

On potato (known as potato stolbur):

- Upward rolling and purplish or red discoloration of the top leaves.
- Shortened internodes.
- Aerial tubers.
- Early senescence.
- Plant wilting and death.

On tomato (known as tomato stolbur):

- Short internodes near to the plant apex and smaller curled leaves with thicker tissues.
- Yellowing or purpling leaves.
- Adventitious roots sometimes appear on the stem.
- Plants infected early are bushy because of the development of numerous axillary buds.
- The flowers of infected plants are abnormally straight, they are sterile and have altered morphological development.
- Fewer fruits are produced, and they are smaller, lacking colour, and dense.

What statutory actions are in place?

A regulated quarantine pest in Great Britain and a regulated non quarantine pest in Northern Ireland. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Natural spread

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7)

Excessive branching on tomato. EPPO.

Symptoms on a potato. M.A. Kuznetsova, EPPO.

Shrivelled grapes on an infected vine. EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Corythucha arcuata (oak lace bug)

Which plant hosts are effected?
Species of chestnut (*Castanea*) and oak (*Quercus*).

What do I need to look for?

- Adults are distinctive with their delicate, milk-white, lacy wings with variable brown markings. They can grow to 4mm long and have rectangular wings.
- Small, yellow spots form on the upper surfaces of leaves, often concentrated around the leaf veins.
- The yellow spots coalesce into large yellow and bronze areas on the affected leaves as the population increases.
- Leaves fall prematurely.
- Damage to the leaves is visible during summer and tends to progress from July to September.
- Droplets of liquid frass (droppings) can be seen on the undersides of leaves. These dry out into hard, black spots.

What statutory actions are in place?
There are currently no statutory actions for this pest. However, if you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)

Adult oak lace bug. Gilles San Martin, EPPO.

Empty egg cases. Varga András, EPPO.

Symptoms on oak. Varga András, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Dendroctonus valens (red turpentine beetle)

Which plant hosts are effected?
Many coniferous species which are of importance to forestry including larch (*Larix*), spruce (*Picea*) and pine (*Pinus*).

What do I need to look for?

- Adult beetles are 6 to 10 mm long and about twice as long as wide.
- When adults first emerge from the pupa they are tan, but they soon turn dark reddish-brown.
- On living trees, the beetles are usually only found excavating holes on the lower part of the tree, within a metre or two of the ground.
- Galleries are formed under the bark in the lower part of the trunk and the upper part of the root system.
- The beetles hibernate in the roots in winter.
- In spring, the beetles bore their way out of the trunk and disperse leaving small exit holes in the bark.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Squared wood
- Non-squared wood
- Wood packaging material
- Woodchip and Bark
- Cut flowers or branches

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

Adult beetle. CABI

Larva. Donald Owen, California Department of Forestry and Fire Protection.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Globodera pallida European Strains (cyst nematode)

Which plant hosts are effected?
A wide range of species including *Allium, Asparagus, Beta, Brassica, Capsicum, Dahlia, Fragaria, Gladiolus, Hyacinthus, Iris, Lilium, Solanum, Narcissus* and *Tulipa*.

What do I need to look for?

- *Globodera* species have round cysts, whilst all other groups have lemon-shaped cysts.
- Diagnosis of the exact species in question can only be achieved in a specialised laboratory.
- Damage may appear similar as signs of mineral deficiency or as patches of stunted yellowing plants, or as wilting due to an inefficient root system.
- However, such symptoms usually only appear when infestation levels are already high.
- From July onwards cysts may be seen on roots.
- Fungal diseases such as Rhizoctonia and Verticillium wilt may also be present and contributing to poor growth.

What statutory actions are in place?
A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruits or vegetables
- Soil/growing medium
- Bulbs or tubers

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2)
- Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Cysts of *G. pallida*.
CSL, EPPO.

Broken cyst with eggs of *G. pallida*. EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Heterobasidion irregulare

Which plant hosts are effected?
Many coniferous species which are of importance to forestry including larch (*Larix*), spruce (*Picea*) and pine (*Pinus*). Additional hosts include juniper (*Juniperus*) and western red cedar (*Thuja*).

What do I need to look for?

Above-ground symptoms:

- The formation of white mycelia between bark scales followed by fruit bodies that usually form at the base of the tree or stump.
- Reduced height growth.
- Patches of dead and declining trees.
- Wind-thrown trees.
- Reduced shoot and diameter growth.
- Resin-soaking at the root collar.
- The crown may become thin and foliage becomes chlorotic.
- Patches of old dead trees surrounded by progressively newer dead, chlorotic, then healthy trees, usually in a circular area. This is a result of the pathogen moving outward from an initial infection.

Below-ground symptoms include:

- Excessive pitch production
- Stringy, white root decay
- Root lesions.

What statutory actions are in place?
A provisional quarantine pest in Great Britain. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Squared wood
- Non-squared wood
- Wood packaging material

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)

Fruiting bodies of *H. irregulare*. Angelo Mazzaglia, EPPO

Pine trees killed by *H. irregulare* in Italy. Angelo Mazzaglia, EPPO

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Hyalesthes obsoletus

Which plant hosts are effected?
Planthopper which can vector the pathogen causing potato stolbur disease (See Candidatus Liberibacter solanacearum factsheet). Hosts include *Convolvulus arvensis, Galium verum, Lavandula angustifolia, Solanum lycopersicum, Olea europaea, Plantago sempervirens, Ranunculus bulbosus, Salvia sclarea, Satureja, Solanum tuberosum, Tanacetum vulgare, Urtica dioica, Vitex agnus-castus* and *Vitis vinifera* ssp. vinifera.

What do I need to look for?

- Adults 4-5 mm in length, body mostly black, wings transparent with dark patches.
- See Candidatus Liberibacter solanacearum factsheet for disease details.

What statutory actions are in place?
A provisional quarantine pest in Great Britain. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Natural spread
- Hitchhiking

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7)
- Ensure proportionate measures are in place to minimise the risk of pests spreading on, around or off the site by visitors (PHMS 6.8)

Adult *H. obsoletus*.
Gernot Kunz, FLOW.

Adult *H. obsoletus*.
Konrad Zobel, iNaturalist.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Lonsdalea populi

Which plant hosts are effected?
Populus species and hybrids such as *Populus* x *canadensis*. *Salix matsudana* is also recorded as a host.

What do I need to look for?
- The bark of symptomatic poplar trees becomes vertically cracked.
- Copious white frothy fluid and creamy slime comes out of the cracks.
- Yellowing foliage.
- Severely affected trees can die after few years.

What statutory actions are in place?
A provisional quarantine pest in Great Britain. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:
- Plants for planting (except seeds bulbs and tubers)
- Non-squared wood

Key measures to protect my site:
- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Platynota stultana (the omnivorous leafroller)

Which plant hosts are effected?
A wide range of species including *Apium, Capsicum, Chrysanthemum, Cyclamen, Dianthus, Gossypium, Gramineae, Juglans, Solanum, Malus, Ocimum, Pelargonium, Phaseolus, Pinus, Prunus, Punica, Rosa, Rubus, Taxus, Vitis, Zea* and *Citrus.*

What do I need to look for?

- Adult moths are between 7 and 13 mm in length (12–25 mm wingspan).
- They rest with their wings folded over its back in a tented bell shape, with the hindwings completely hidden.
- The wing markings consist of shades of fawn and dark brown but are variable in both colour and strength.
- Newly hatched larvae are cream with a brown head and are less than 2 mm long.
- Larvae reach a maximum of 15–19 mm in length and the colour becomes very variable, but is usually grey-green, greenish or cream, with a brown or black head.
- There are very small whitish spots along the body, and a dark stripe down the centre through which the body contents can be seen moving.

What statutory actions are in place?
A provisional quarantine pest in Great Britain. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Fruit or vegetables
- Plants for planting (except seeds bulbs and tubers)
- Cut flowers or branches

Key measures to protect my site:

- Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1)
- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all relevant plant products (e.g. cut flowers) and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Adult *P. stultana* captured in a trap. Miguel Ángel, EPPO

P. stultana larva. UK Plant Health Portal, Defra.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Sirococcus tsugae

Which plant hosts are effected?
Cedars (*Cedrus, Cedrus atlantica, Cedrus deodara*) and hemlocks (*Tsuga, Tsuga canadensis, Tsuga heterophylla, Tsuga mertensiana*).

What do I need to look for?

- Affected trees have dead needles on the shoots, dead shoots, cankers and resin exudation.
- The dead needles are very distinctive as they have a characteristic 'pink' colour, later becoming brown.
- The fruiting bodies may be observed on the dead needles.
- Branches die as they become girdled.
- Brown lesions are evident in the phloem tissue of the bark, these can spread from branches into the main stem, where they can spread longitudinally.

What statutory actions are in place?
An EPPO Alert is in place for this disease. If you suspect the presence of this pest on your premises you should contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Seeds
- Cut flowers or branches

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess seed sources and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all relevant plant products (e.g. branch wood) and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Infected *Cedrus atlantica*. Thomas Brand, EPPO.

Infected *Cedrus atlantica*. Thomas Brand, EPPO.

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Xylosandrus germanus (Black timber bark beetle)

Which plant hosts are effected?
A wide range of tree species including *Abies, Acer, Alnus, Betula, Camellia, Carpinus, Carya, Castanea, Cornus, Corylus, Fraxinus, Juglans, Magnolia, Picea, Pinus, Populus, Prunus, Pseudotsuga, Quercus, Salix, Styrax, Ulmus, Vitis* and *Fagus*.

What do I need to look for?

- Small, black beetles, 2.0-2.3 mm long, 2.3 times as long as wide.
- The beetle's galleries are relatively shallow in the wood.
- The inoculated ambrosia fungus associated with the beetle stains the timber around the infestation.
- Symptoms in healthy infested trees include top dieback, profuse basal epicormic sprouting and a reduction in tree growth.

What statutory actions are in place?
No statutory actions currently in place. However, if you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Squared wood
- Non-squared wood
- Wood packaging material
- Bark
- Natural spread
- Cut flowers or branches

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

X. germanus adult. CABI

X. germanus adult. CABI

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

9 Appendix B: Thirty-nine pest final data organisation for webtool

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
1	*Bactericera cockerelli*	Potato psyllid Tomato psyllid	Insect	auto populated cell with selected genera…….	Absent	1	1																					• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
2	*Agrilus planipennis*	Emerald Ash Borer	Beetle	auto populated cell with selected genera…….	Absent		1	1	1	1	1	1	1															• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
3	*Thaumetopoea pityocampa*	Pine processionary moth	Moth	auto populated cell with selected genera…….	Absent		1		1					1	1	1												• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)
4	*Agrilus anxius*	Bronze birch borer	Beetle	auto populated cell with selected genera…….	Absent		1	1	1		1						1											• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Risk assess all relevant plant products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
5	*Thaumetopoea processionea*	Oak processionary moth	Moth	auto populated cell with selected genera…….	Present (limited)		1																				1	• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
6	*Anoplophora glabripennis*	Asian longhorn beetle	Beetle	auto populated cell with selected genera…….	Absent		1		1			1																• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
7	*Ceratocystis platani*	plane wilt	Fungus	auto populated cell with selected genera…….	Absent		1					1			1			1	1			1						• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6) • Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
8	*Clavibacter sepedonicus*	Bacterial ring rot of potato	Bacterium	auto populated cell with selected genera……	Absent															1	1							• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all packaging cases and minimise risk accordingly and carefully inspect packaging upon its arrival (PHMS 4.1 & 7.1)
9	Ips typographus	Larger eight-toothed European spruce bark beetle	Beetle	auto populated cell with selected genera……	Under Eradication		1				1																	• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
10	*Aromia bungii*	Red-necked longhorn beetle	Beetle	auto populated cell with selected genera……	Absent		1		1			1																• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
11	*Anoplophora chinensis*	Citrus longhorn beetle	Beetle	auto populated cell with selected genera……	Absent		1																			1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
12	*Epitrix cucumeris*	Potato flea beetle	Insect	auto populated cell with selected genera……	Absent	1									1					1								• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
13	*Epitrix papa*	Epitrix papa	Insect	auto populated cell with selected genera……	Absent	1	1													1								• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
14	*Epitrix subcrinita*	Western potato flea beetle	Insect	auto populated cell with selected genera……	Absent	1	1													1								• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
15	*Epitrix tuberis*	Tuber flea beetle	Insect	auto populated cell with selected genera…….	Absent	1									1					1									• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
16	*Fusarium circinatum*	Pitch canker of pine	Fungus	auto populated cell with selected genera…….	Absent		1			1	1		1										1	1		1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Risk assess all sources of bark and branch wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
17	*Xylella fastidiosa*	Xylella	Bacteria	auto populated cell with selected genera…….	Absent		1																		1			• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)
18	*Rose Rosette virus and* Phyllocoptes fructiphilus	Rose Rosette virus	Virus	auto populated cell with selected genera…….	Absent		1																			1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
19	*Thrips palmi*	melon thrips; oriental thrips; southern yellow thrips	Insect	auto populated cell with selected genera…….	Absent	1	1																			1		• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
20	*Leptinotarsa decemlineata*	Colorado beetle	Beetle	auto populated cell with selected genera…….	Absent	1													1									• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Risk assess all vehicles and machinery and ensure they are appropriately cleaned before they arrive on site or move between sites (PHMS 4.1 & 6.5)
21	*Ips amitinus*	Eight-toothed spruce bark beetle; Small spruce bark beetle	Insect	auto populated cell with selected genera…….	Absent		1				1																	• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
22	*Ips duplicatus*	Double-spined bark beetle; Northern bark beetle	Insect	auto populated cell with selected genera……	Absent		1				1																	• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
23	*Agrilus bilineatus*	Two-lined chestnut borer	Insect	auto populated cell with selected genera……	Absent		1				1	1																• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
24	*Phytophthora ramorum*	Ramorum disease	Oomycete	auto populated cell with selected genera……	Present		1				1		1		1													• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2)
25	*Prodiplosis longifila*	Prodiplosis longifila	Insect	auto populated cell with selected genera……	Absent	1	1																					• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
26	*Acute oak decline*	Acute Oak Decline	Other	auto populated cell with selected genera……	Present (Limited)					1	1																	• Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)
27	*Agrilus biguttatus*	Oak jewel beetle; Oak splendour beetle; Two - spot woodborer	Insect	auto populated cell with selected genera……	Present (Limited)		1	1			1					1												• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7)
28	*Candidatus Liberibacter solanacearum*	zebra chip	Bacterium	auto populated cell with selected genera……	Absent	1	1													1				1				• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
29	*Phytophthora infestans*	Downy mildew: potato; Late blight: potato; Late blight: tomato	Oomycete	auto populated cell with selected genera……	Present		1								1					1								• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
30	Candidatus Phytoplasma solani'	Black wood of grapevine	Phytoplasma	auto populated cell with selected genera……	Absent		1									1												• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7)
31	Corythucha arcuata	Oak lace bug	Insect	auto populated cell with selected genera……	Absent		1																					• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Regularly monitor susceptible host species for symptoms of the presence of plant pests (PHMS 8.1)
32	*Dendroctonus valens*	Red turpentine beetle	Insect	auto populated cell with selected genera……	Absent		1			1	1	1	1											1		1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
33	Globodera pallida European Strains	Cyst nematode	Nematode	auto populated cell with selected genera……	Present	1									1					1								• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Assess soil and growing media for the potential to harbour pests and minimise the risk accordingly (PHMS 6.2) • Source live plant material, bulbs and tubers from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
34	*Heterobasidion irregulare*	Heterobasidion irregulare	Fungus	auto populated cell with selected genera……	Absent		1			1	1	1																• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
35	*Hyalesthes obsoletus*	Hyalesthes obsoletus	Insect	auto populated cell with selected genera……	Absent		1									1			1									• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Based on the pest's lifecycle, periodically assess host plant species surrounding the site (PHMS 6.7) • Ensure proportionate measures are in place to minimise the risk of pests spreading on, around or off the site by visitors (PHMS 6.8)

Pest number	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera from the submitted list	Present or absent in the UK	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread This list is not exhaustive - i.e. the measures that are presented are up to three examples of some key measures from the Plant Health Management Standard (PHMS)
36	*Lonsdalea populi*	Lonsdalea populi	Bacterium	auto populated cell with selected genera…….	Absent		1				1																	• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
37	*Platynota stultana*	Omnivorus leafroller	Moth	auto populated cell with selected genera…….	Absent	1	1																			1		• Ensure suitable plant hygiene and housekeeping measures are in place (PHMS 6.1) • Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all relevant plant products (e.g. cut flowers) and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
38	*Sirococcus tsugae*	Shoot Blight on Cedar; Tip blight on Eastern Hemlocks	Fungus	auto populated cell with selected genera…….	Present (Unknown Distribution)		1																1			1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess seed sources and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Risk assess all relevant plant products (e.g. branch wood) and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
39	*Xylosandrus germanus*	Black timber bark beetle; Smaller alnus bark beetle; tea root borer	Insect	auto populated cell with selected genera…….	Present (Limited)		1			1	1	1	1			1										1		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

10 Appendix C: Screenshots of the prototype webtool's function

Option A – choose a CSV file of genera (excel spreadsheets saved as a csv. file) and press upload to display results

	A	B
1	Abies	
2	Cornus	
3	Fagus	
4	Petunia	
5	Lavandula	
6	Larix	
7	Prunus	
8		

The Thirty-Nine Pests

Increasing the accessibility of notifiable plant pest information for professional operators

The aim of this (prototype) webtool is to is to make professional operators aware of high risk notifiable or damaging plant pests and what they can do to minimise their spread.

The 39 pests consists of 22 Schedule 1 Annex list of priority pests and 17 plant pests with a mitigated risk rating of 60 or above on the UK Plant Health Risk Register

Disclaimer - the aim of this webtool is to support professional operators who handle live plant material to understand and demonstrate key notifiable pests that are relevant to their business or organisation. The use of this webtool does not provide comprehensive evidence that all relevant notifiable pests have been controlled for a given business or organisation. Please note that the pest information contained in this webtool may not cover all hosts / pathways and users of this template should also conduct their own research and assessments into the relevant notifiable pests relevant to their site and operations.

Download All Factsheets

Upload a CSV file

Choose File No file chosen Upload

Select relevant genera

Select All Clear Selection Reset Search

- Abies
- Adiantum
- Allium
- Ambrosia
- Arbutus
- Artemisia
- Benincasa
- Brassica
- Calycanthus
- Acacia
- Aesculus
- Alnus
- Anethum
- Arctostaphylos
- Asparagus
- Beta
- Calluna
- Calystegia
- Acer
- Albizia
- Amaranthus
- Apium
- Ardisia
- Bambusa
- Betula
- Calocedrus
- Camellia

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The 39 pests consists of 22 Schedule 1 Annex list of priority pests and 17 plant pests with a mitigated risk rating of 60 or above on the UK Plant Health Risk Register

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Download All Factsheets

Upload a CSV file

Choose File | No file chosen | Upload

Select relevant genera | Select All | Clear Selection | Reset | Search

- [ ] Abies
- [ ] Adiantum
- [ ] Allium
- [ ] Ambrosia
- [ ] Arbutus
- [ ] Artemisia
- [ ] Benincasa
- [ ] Brassica
- [ ] Calycanthus
- [ ] Acacia
- [ ] Aesculus
- [x] Alnus
- [ ] Anethum
- [ ] Arctostaphylos
- [ ] Asparagus
- [ ] Beta
- [ ] Calluna
- [ ] Calystegia
- [x] Acer
- [ ] Albizia
- [ ] Amaranthus
- [ ] Apium
- [ ] Ardisia
- [ ] Bambusa
- [x] Betula
- [ ] Calocedrus
- [ ] Camellia

Option B – (i) select all genera individually and then (ii) press search to display results

The Thirty-Nine Pests

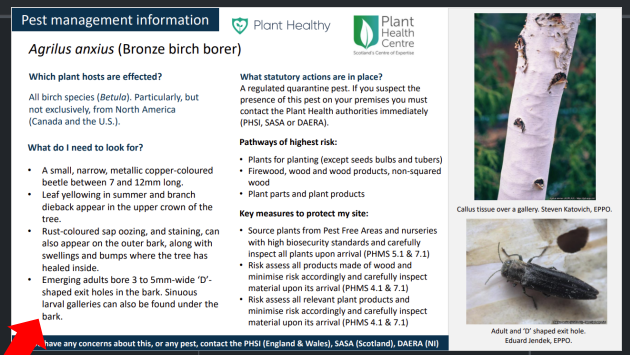
Download All Factsheets

Select to download all of the 39 pest management sheets (no search required)

- Brassica
- Calluna
- Calocedrus
- Calycanthus
- Calystegia
- Camellia

Results

Summary table of search results are displayed at base of page


Pest management information

Plant Healthy

Plant Health Centre

Agrilus anxius (Bronze birch borer)

Which plant hosts are effected?

All birch species (*Betula*). Particularly, but not exclusively, from North America (Canada and the U.S.).

What do I need to look for?

- A small, narrow, metallic copper-coloured beetle between 7 and 12mm long.
- Leaf yellowing in summer and branch dieback appear in the upper crown of the tree.
- Rust-coloured sap oozing, and staining, can also appear on the outer bark, along with swellings and bumps where the tree has healed inside.
- Emerging adults bore 3 to 5mm-wide 'D'-shaped exit holes in the bark. Sinuous larval galleries can also be found under the bark.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Firewood, wood and wood products, non-squared wood
- Plant parts and plant products

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all relevant plant products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Callus tissue over a gallery. Steven Katovich, EPPO.

Adult and 'D' shaped exit hole. Eduard Jendek, EPPO.

Pathway information

Key measures (i.e. not exhaustive) to prevent movement and spread of specific pest

Factsheet	Pest name (scientific)	Common name	Type of Pest	Host Genus or Genera	UK Presence	Fruit or vegetables	Plants for planting (except seeds bulbs and tubers)	Firewood	Wood and wood products	Squared wood	Non-squared wood	Wood packaging material	Bark	Vehicles/containers	Soil/growing medium	Natural spread	Plant parts and plant products	Water	Hitchhiking	Bulbs or tubers	Packing cases	Agricultural machinery	Seeds	Woodchip	Insect vectors	Cut flowers or branches	Roundwood of oak with bark present	Key measures to prevent movement and spread
	Agrilus anxius	Bronze birch borer	Beetle	Betula	Absent		✓	✓	✓		✓						✓											• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Risk assess all relevant plant products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
	Anoplophora glabripennis	Asian longhorn beetle	Beetle	Acer, Alnus, Betula	Absent		✓		✓			✓																• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1) • Ensure that all relevant Wood Packaging Material meets the ISPM 15 (PHMS 1.6)
	noplophora inensis	Citrus longhorn beetle	Beetle	Acer, Alnus, Betula	Absent		✓																			✓		• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Risk assess all branch wood and relevant wood products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
	Xy lla fastidiosa	Xylella	Bacteria	Acer	Absent		✓																		✓			• Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1) • Regularly monitor susceptible host species for symptoms of the presence of

Download individual pest management sheets

Pest management information

Plant Healthy

Plant Health Centre
Scotland's Centre of Expertise

Agrilus anxius (Bronze birch borer)

Which plant hosts are effected?

All birch species (*Betula*). Particularly, but not exclusively, from North America (Canada and the U.S.).

What do I need to look for?

- A small, narrow, metallic copper-coloured beetle between 7 and 12mm long.
- Leaf yellowing in summer and branch dieback appear in the upper crown of the tree.
- Rust-coloured sap oozing, and staining, can also appear on the outer bark, along with swellings and bumps where the tree has healed inside.
- Emerging adults bore 3 to 5mm-wide 'D'-shaped exit holes in the bark. Sinuous larval galleries can also be found under the bark.

What statutory actions are in place?

A regulated quarantine pest. If you suspect the presence of this pest on your premises you must contact the Plant Health authorities immediately (PHSI, SASA or DAERA).

Pathways of highest risk:

- Plants for planting (except seeds bulbs and tubers)
- Firewood, wood and wood products, non-squared wood
- Plant parts and plant products

Key measures to protect my site:

- Source plants from Pest Free Areas and nurseries with high biosecurity standards and carefully inspect all plants upon arrival (PHMS 5.1 & 7.1)
- Risk assess all products made of wood and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)
- Risk assess all relevant plant products and minimise risk accordingly and carefully inspect material upon its arrival (PHMS 4.1 & 7.1)

If you have any concerns about this, or any pest, contact the PHSI (England & Wales), SASA (Scotland), DAERA (NI)

Callus tissue over a gallery. Steven Katovich, EPPO.

Adult and 'D' shaped exit hole.
Eduard Jendek, EPPO.

11 Appendix D: Royal Botanic Garden Edinburgh case study

Plant Healthy Certification Scheme Case Study - Royal Botanic Garden Edinburgh

The Royal Botanic Garden (RBG) Edinburgh is a 70-acre garden containing a wide collection of plant species. It attracted 996,597 visitors in 2022. The main entrance contains a retail area which sells plants, plant products and garden/lifestyle sundries. RBGE has a nursery for the production of plants for the garden at a separate site, approximately 1 mile from the main garden.

Addressing plant health risks is a focus for RBG Edinburgh due to the significant pest and pathogen threats to the plant collection and the organisation's conservation activities. Additionally, as a charity, RBG Edinburgh is dedicated to demonstrating the responsible cultivation and management of plants to professionals and amateurs alike. In 2022 RBG Edinburgh became one of the first members of the Plant Healthy Certification Scheme to help address collectively the threat from new and emerging plant pests and diseases and to support RBG Edinburgh's promotion of the importance of robust plant biosecurity in horticulture and gardening to all people who visit RBG Edinburgh.

The Plant Healthy scheme requires the application of the Plant Health Management Standard's biosecurity requirements to all aspects of RBG Edinburgh's site and associated work. The process of becoming and maintaining Plant Healthy certification has highlighted several benefits. Three examples which are key to helping protect the organisation as a whole are:

(1) The centralisation of plant health policies and files ensures that up-to-date information can be quickly accessed when required by any member of staff.

(2) Plant health roles and responsibilities across all departments in the organisation are clear which in vital for good communications between all RBG Edinburgh staff.

(3) RBG Edinburgh feeds into the development of the Plant Health Management Standard through a Technical Advisory Group, thereby ensuring that the organisation can demonstrate that an evidence-based approach has been taken to establishing robust plant biosecurity measures across the organisation.

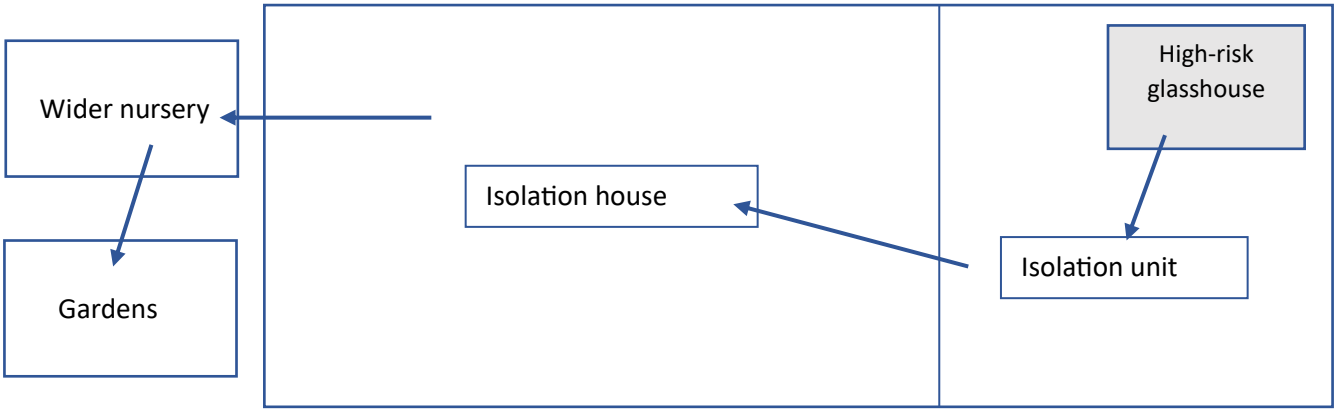
Biosecurity processes have been examined in three main areas at RBGE and these align with the three scopes of certification that RBGE is Plant Healthy Certified to – Nursery, Retail and Garden.

Nursery

A major risk to RBG Edinburgh's plant collections is the inadvertent introduction of a new plant pest or disease on live plants for planting. To help control and minimise the threat from this high-risk pathway for pest and disease movement RBG Edinburgh produces 99% of the plants used in the garden on its own nursery.

Where plants are occasionally brought into the garden for specific reasons, e.g. to acquire and protect rare or endangered species, these plants, upon arrival, will go into a high-risk glasshouse within a purpose-built isolation unit situated on the nursery. The plants are monitored daily and once they are assessed to be free from the presence or symptoms of pests and diseases, they are moved from the glasshouse to the isolation unit for a specified duration.

Plants are then move from this isolation unit into a wider isolation house. Here the plants start to grow and continue to be monitored. The plants remain in the wider isolation house for a period which is dependent on the risk they pose of carrying specific pests and diseases. This requires a knowledge of the pest and disease threats for the individual plant species that are grown on the nursery. It is only after plants are assessed as healthy that they are moved onto the wider nursery area and eventually planted in the garden to form part of the living collections.



The risk of introducing pests and diseases can come from several sources, another key pathway to assess is the use of brought in growing media. To manage this threat, RBGE's nursery sources all growing media from suppliers that have plant biosecurity policies that set out how they have minimised the risk of plant pests and diseases contaminating the substrate they produce. This forms part of the pathways risk analysis which is a requirement of the Standard. To help with this process the Scheme provides guidance on how to manage all of the main pathways of concern.

The Standard's Site and Operations Pest Risk Analysis supports all of RBG Edinburgh's nursery production processes, as its comprehensive framework requires the proactive identification of threats and the establishment of a suite of effective measures to minimise the risk from new and emerging plant pests and diseases.

Above left – all growing media used on the RBGE nursery has been risked assessed for harbouring pests & diseases. Above right – good hygiene procedures help ensure pests & diseases are not spread within the nursery.

Retail – the Botanics shop

The retail area presents a plant health risk to the garden as plants and wood products are sourced from external sources for sale in the shop which is situated within the garden's boundary. Unlike the nursery, these plants do not go through a rigorous isolation process, therefore it is essential that the plants and associated materials stocked that present pest and disease risks are carefully and continually sourced from responsible suppliers. These suppliers must have clear plant biosecurity policies and systems in place for them to be able to supply the Botancis shop.

Above left and right – supply chain management – critical to protecting the RBGE site and wider environment are due diligence checks on the suppliers of plants and products that can harbour and transmit plant pests and diseases.

The Plant Health Management Standard is a quality management system for plant biosecurity. For the system to be applied as an effective tool at RBG Edinburgh, a centralised and uniform basis for record keeping has been established. Clear and useable information systems that record the presence and movement of plant material and that link effectively with day-to-day business operations are vitally important for plant biosecurity. This information is the backbone of RBGE's traceability system. In the event that contaminated plants or plant material is inadvertently supplied, the system enables pests and diseases to be quickly tracked and traced through the plant supply chain. Traceability for live plants relies on the UK Plant Passporting information and this is now checked and recorded for every plant that arrives at the Botanics shop. The traceability procedure is checked as part of the audit and provides independent assurance that RBGE can at any time work quickly and effectively with government plant health inspectors to contain and eradicate any notifiable pests and diseases that may emerge in the horticultural sector.

The risk goes beyond the plants and associated products, as plant pests and diseases can also be transferred on packaging material. For this reason, all pallets that arrive on site are checked to ensure that they have been heat treated and meet ISPM 15 which is an internationally recognised standard for heat treating wood packaging material to kill plant pest and diseases that can live on or within wood. All other packaging materials are risked assessed and checked accordingly.

Perhaps not immediately obvious is the unifying benefit that applying the Standard confers when applied across a diverse organisation. Ensuring that RGB Edinburgh has a consistent approach to plant biosecurity enables all staff to play a part in protecting the gardens from pests and diseases.

Working together to the Standard is now seen as a significant step forward in lowering the risk to the garden, all related operations and the surrounding environment.

Heat treated pallets prevent the movement of pests and diseases on wood packaging material

Garden – RBGE's living collections

RBG Edinburgh's living collection is internationally recognised an important scientific collection of plant life. It is therefore important that the organisation acknowledges the biosecurity risks to the collection and manages the risk proactively. The Plant Health Management Standard has helped bolster the living collections plant biosecurity systems by applying a multiple-measure framework developed by scientists, practitioners and regulators.

Above left and right – Education and visitors – information boards and foot mats at the garden entrances both educate visitors to the garden and help unsure no plant pathogens are introduced on their footwear

Plant pathogens have been shown to move around on footwear and wheels (prams, bicycles, etc.) and so it is important that RBGE manages this risk. This is achieved using foot mats at all of the garden entrances which contain disinfectant. This not only helps prevents pathogens coming into the garden on footwear and wheels, but it also gives the garden an opportunity to engage with the public on biosecurity. The mats are maintained by members of the horticulture and visitor engagement teams.

The plants that grow in the gardens represent one of the most diverse living collections of plant taxa in Scotland. This actively managed and enlarging scientific collection enables RBGE to conserve some of the world's most critically endangered plants. Monitoring is a central tenet of the Plant Health Management Standard. The inherent diversity of the living collections presents the opportunity for the gardens to act as a 'sentinel site' through the carefully monitoring of the presence of unusual pests and diseases. This helps protect the gardens and Scotland's environment.

Central to the monitoring of the collections is the training of the RBGE staff. All ground staff undergo plant health and biosecurity training and are empowered and encouraged to report symptoms of concern to the person responsible for biosecurity within the organisation. The reporting within RBG Edinburgh and if required to SASA is an integral part of the Standard and one that will help protect the living collections and Scotland's cultivated and natural environment.

Through RBGE's biosecurity procedures and general practice, plant waste material is assessed for pests and diseases. Above - covered trailer to help minimise the potential to spread pests & diseases within the garden on plant waste.

12 Appendix E: Provender case study

Plant Healthy Certification Scheme - Provender Nurseries

Provender Nurseries was established in 2003, based in Kent, Provender Nurseries is a progressive, independent wholesale supplier of high-quality plants and trees alongside related landscape supplies and accessories to the horticultural trade industry throughout Kent, London, the South East, and further afield.

Provender Nurseries started selling plants from a small area on-site around 50m^2 in size. Over the years, Provender Nurseries has expanded to an 18-acre cash and carry which has enablled a wider range of stock to be displayed to customers. There has been a horticultural business the cash and carry site since 1982 supplying specialist soils and growing media to the horticultural trade, something that Provender Nurseries continues to do to this day.

Provender Nurseries became Plant Healthy certified in February 2021. As an early adopter, their intention was to become involved in a scheme that aims to demonstrate that by putting a suite of effective plant biosecurity measures in place, dedicated plants people can continue to grow and trade the variety of plants that are the foundation of the horticultural and landscaping profession.

The person responsible for plant biosecurity at Provender Nurseries is Stuart Tickner (ST), here Stuart offers an insight into how one of the largest wholesale cash and carry companies within the industry has integrated the requirements in the Plant Health Management Standard into their day-to-day operations.

Stuart Tickner is Head of Nursery, Bio-Security & Production at Provender Nurseries

What does it mean to be Plant Healthy certified?

ST - *To us as a wholesale plant supplier, it means we have a way of recording and monitoring our processes and making ourselves accountable for what and how we manage our purchasing, plant husbandry and other relevant processes. It is also a great way for us as suppliers to gain, share and be involved in industry-wide knowledge which should help us all improve.*

Provender Nurseries can promote that it is Plant Healthy certificated and this adds to our business' credentials. The name of the scheme works well as it is now recognised across the industry and delivers what exactly what it says.

Why is it so important to be Plant Healthy certified?

ST - *Plant Healthy certification is important in our day-to-day practices from purchasing, unloading deliveries and plant husbandry and we have found that being Plant Healthy certificated gives our customers peace of mind that as a business we are practicing and continue to practice good principles within our part of the plant supply chain. Plant Healthy is of utmost importance to the industry, which is why more suppliers and landscapers should get involved. Working together will enable us to make real changes that are relevant to the entire industry and also the wider landscape. By all growers and traders of plant material being Plant Healthy certificated, whether they import or source from within our country, it will help reduce the risk of spreading pest and diseases that could threaten the UK's and the planet's natural environment.*

What did you have to do to become a Plant Healthy certified member?

ST - *The process is thorough; however, it needs to be. For the first time, getting the certification is a hard process, as you must really look at what you do and how you record it, whilst trying to meet the Plant Health Management*

Standard's requirements. But once you have done that the yearly re-audit is fine and we find it an effective system to help us continually improve our policies, procedures and practices.

We examined our paperwork and practices in detail to scrutinise every aspect of what we do to ensure that it met the Standard's requirements. Some of the areas covered by the Standard include: looking at our supply chain, everyday practices on site, plant passporting and our biosecurity policy. But the most important thing in the whole process is to get our whole team and company to believe, support and implement the entire process.

How do you involve other members of staff?

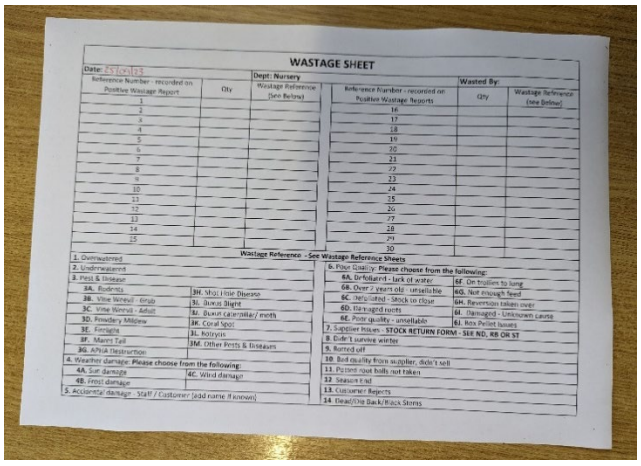
ST - *As part of our Plant Healthy work, we ensure all our staff are regularly trained. We hope that we can spread the message that good biosecurity involves all who work at Provender Nurseries and all within the wider sector. As such, we hold regularly events in partnership with trade bodies and invite other horticultural businesses to see and discuss what we are doing. The hope is that across the board, the Standard's requirements can then be upheld thereby enabling all plants people to be empowered to understand and adhere to robust approaches to plant biosecurity.*

Above – Richard McKenna (Managing Director) leads a tour of the site as part of a BALI knowledge sharing event hosted by Provender Nurseries

What would your advice be to others who are keen to adopt the Plant Health Management Standard?

ST - *Read the Plant Healthy Certification Manual and understand the Standard's requirements and the certification process. Really sit back and look at your business or organisation and be honest with yourselves. The Standard should be seen as a tool to help a business improve, so be ready to make changes if required.*

No gardener of horticulturalist wants to see our planet damaged, but to truly have a say, those within the industry need to be more involved in the decision and policy making. Plant Healthy is just one of the ways in which the industry can collaborate for change. For Provender Nurseries we strongly believe that being Plant Healthy certificated is a commitment, but one well worth taking.


WASTAGE SHEET

Date: 25/04/23 | Dept: Nursery | Wasted By:

Reference Number - recorded on Positive Wastage Report	Qty	Wastage Reference (See Below)	Reference Number - recorded on Positive Wastage Reports	Qty	Wastage Reference (see Below)
1			16		
2			17		
3			18		
4			19		
5			20		
6			21		
7			22		
8			23		
9			24		
10			25		
11			26		
12			27		
13			28		
14			29		
15			30		

Wastage Reference - See Wastage Reference Sheets

1. Overwintered		6. Poor Quality - Please choose from the following:	
2. Underwintered		6A. Dehydrated - lack of water	6F. On trollies to long
3. Pest & Disease		6B. Over 2 years old - unsellable	6G. Not enough feed
3A. Rodents	3H. Stolt / Rot Disease	6C. Defoliated - Stock to close	6H. Reversion takes over
3B. Vine Weevil - Grub	3I. Buxus Blight	6D. Rampant roots	6I. Damaged - Unknown cause
3C. Vine Weevil - Adult	3J. Buxus Caterpillar/ moth	6E. Poor quality - unsellable	6J. Rot Pellet Issues
3D. Powdery Mildew	3K. Coral Spot	7. Supplier Issues - STOCK RETURN FORM - SEE ND, RB OR ST	
3E. Fireblight	3L. Botrytis	8. Didn't survive winter	
3F. Marmi Tail	3M. Other Pests & Diseases	9. Burned off	
3G. Africa Destruction		10. Bad quality from supplier, didn't sell	
4. Weather damage: Please choose from the following:		11. Potted spot bolls not taken	
4A. Sun damage	4C. Wind damage	12. Season End	
4B. Frost damage		13. Customer Rejects	
5. Accidental damage - Staff / Customer (add name if known)		14. Dead/Die Back/Black Stems	

Above left – the Plant Health Management Standard is a set out as a Quality Management System that supports Provender Nurseries minimise wastage across the business.

Above right – Stringent checks take place of all goods received at Provender Nurseries. Plant Healthy certification ensures that all relevant staff are trained to identify symptoms and report potential pest findings immediately.

This case study is based on the following article: *Provender Nurseries on being Plant Healthy by Ashleigh Brown | 06 Nov 23 | Nature & Biodiversity, News, Opinion*

13 Appendix F: Nicholsons case study

Plant Healthy Certification Scheme – Nicholsons case study

Nicholsons is a family business that is committed to delivering quality environmental services with an emphasis on sustainability.

The business offers comprehensive environmental and ecological consultancy services and fully integrated garden and woodland design, management and contracting services. Nicholsons ensure that the stewardship of natural capital and environmental sustainability are at the heart of all that they do.

Nicholsons' headquarters is situated on a c. 10 hectare site in North Aston, Oxfordshire. The site is diverse with several divisions being based at North Aston, these include: arboriculture, forestry, landscaping and gardening. On the site is an extensive wholesale nursery and a retail outlet where plants are sourced, grown and supplied to professionals and the gardening public.

Merlin Brooke-Little, Director of Nicholsons' Plants Division, receiving Nicholsons' first Plant Healthy certificate on becoming certified in June 2021.

Handling, planting and managing a wide variety of plants for multiple uses is core to the products and services that Nicholsons' offer. The person responsible for plant biosecurity at Nicholsons is Merlin Brooke-Little (MB-L), here Merlin offers his views on how Nicholsons have integrated the requirements in the Plant Health Management Standard throughout their business and associated operations.

What does it mean to be Plant Healthy certified?

MB-L – *First and foremost it demonstrates that Nicholsons, as professional plants-people, understand well the potential threats associated with the movement of live plant material and related materials. Certification supports us in implementing robust plant biosecurity systems that help us minimise the risk of notifiable plant pests* (and diseases) *being introduced and spread through our work. Several worrying pests have emerged in the UK in recent decades that have affected our gardens and woodlands and we want to ensure that we do everything that we can to minimise the threat of more damage being caused by further plant pest introductions and spread.*

At Nicholsons we put environmental stewardship at the heart of everything that we do. The land management sector has had to deal with the damage that new plant and tree pests has wrought and we consider plant biosecurity as a key conservation and stewardship responsibility. All relevant staff are trained in plant biosecurity and we see the measures in the Plant Health Management Standard as a supportive tool that underpins all of our work.

Why is it important to establish robust plant biosecurity systems at Nicholsons?

MB-L – *Protecting our site and our customers from the disruption caused by plant pests and diseases in an important operational consideration, although it goes much further than that. Plant biosecurity starts with individual businesses implementing and maintaining a suite of measures that together form an effective risk management system. Beyond this first step it quickly becomes apparent that for the risk of plant pests to be managed effectively all stakeholders in the relevant land management sectors need to be aware of why plant biosecurity is critically important.*

What did you have to do to become a Plant Healthy certified member?

MB-L – *The Plant Healthy assessment was a really valuable process for us. We already considered ourselves to be stringent with our biosecurity measures but the Plant Healthy audit challenged areas such as record keeping and*

made us tackle some areas that we had not considered. Becoming Plant Healthy certified was a challenging but fulfilling process and well worthwhile for companies serious about our shared responsibilities.

What are the main benefits of being Plant Healthy certified?

MB-L – *As plants-people we have all chosen careers that enable us to enjoy plants and share the many benefits that they bring. At Nicholsons we want to work with plants responsibly and positively. The proactive and applied approach that is inherent in being Plant Healthy certified gives us a peace of mind that is reassuring to staff and customers alike.*

Plant health and in particular plant biosecurity are niche knowledge areas. There are many terms that are technical and specific to the fields of plant pathology or entomology. The Plant Health Management Standard helps de-mystify the concept of plant biosecurity and has helped us develop our own practical framework that we can add to as we develop our business or new threats emerge.

Above – Stock control - all products are traceable which will assist APHA to track any plant species in the event of a pest outbreak.

Plant Healthy feeds into our Quality management systems. Be it working with our suppliers to minimise the presence of pests, or by our monitoring regimes that extend across product lines as well as production processes, our focus is on ensuring that the plants we grow and supply are thriving. The continual improvement element of the Standard aligns well with the culture at Nicholsons as we actively encourage all of our staff to be looking for and communicating how we can work more effectively in terms of sustainably and land stewardship.

What would your advice be to others who are keen to adopt the Plant Health Management Standard?

MB-L – *For those who are new to the process, it could be easy to see the Plant Health Management Standard as a new and potentially separate set of actions for a business to adopt. What most should quickly find is that the measures have been deigned to be integrated or align with horticultural practices. In this sense the Standard should be seen as a support tool to help all in the sector directly address the threat of pests by implementing an effective biosecurity system. Nicholsons started by taking the self-assessment on the Plant Healthy website, this helped us see what we were already doing and what other measures we could implement to manage and minimise pest risk.*

Above left – water treatment and storage at Nicholsons. Water is drawn from the main reservoir, treated and then stored in covered water tanks to minimise the risk of contamination with *Phytophthora* species. Above right – waste management at Nicholsons. All waste materials are carefully sorted and stored so that each waste material type can be treated and disposed of appropriately or safely used, e.g. for sustainable energy generation.

14 Appendix G: Royal Horticultural Society Harlow Carr case study

Plant Healthy Certification Scheme – Royal Horticultural Society Garden Harlow Carr

The RHS is the UK's leading gardening charity. The charity promotes the value of plants and their role in supporting our economy, environment and wellbeing. The RHS is a leading organisation in the field of plant health and actively fosters a nationwide culture of biosecurity best practice.

RHS Harlow Carr, based in Harrogate, North Yorkshire, is the most northerly of all the RHS gardens. A team of horticulturalists, supported by students and volunteers, develop and manage the planting diversity of the 58 acres of garden and surrounding land.

Harlow Carr's location presents challenges and opportunities representative of the region. The landscape is diverse, with managed woodlands, streamside plantings, ornamental herbaceous borders, wildflower meadows and small-scale model gardens. Collectively these features illustrate different garden styles, types of planting, methods of supporting wildlife, ideas for greening grey spaces, and strategies for mitigating the effects of extreme weather.

In addition to the public gardens at RHS Harlow Carr, there is a nursery that sources and grows plants for the gardens, and a retail shop with a plant sales area. The person responsible for plant biosecurity at RHS Harlow Carr is Kirsty Wright (KW), and here Kirsty offers an insight into how they integrated the requirements of the Plant Health Management Standard into their day-to-day operations.

Kirsty Wright is the Plant Reception Coordinator within the RHS Biosecurity Team. Above: Kirsty running a training session covering the RHS's approach to plant biosecurity.

What does it mean to be Plant Healthy certified?

KW –*Plant Healthy certification forms a key part of the RHS's Sustainability Strategy Biosecurity Neutral target, but also provides us with a valuable framework for much of our biosecurity work. The RHS have fed into the development of the Plant Health Management Standard and being certified Plant Healthy demonstrates best practice, and enables the RHS to share our learnings and experiences with a wider community of professional horticulturalists and organisations, and with the UK's 30 million gardeners.*

The expectation from the scheme for continual improvement within our operations is critically important. Being Plant Healthy certified requires us to keep up-to-date with the latest developments in the field of plant biosecurity and proactively consider how our pest risk management plans and systems might need to change and adapt. The annual audit is a valuable reminder that plant health and biosecurity is an ever-changing landscape!

Why is it important to establish robust plant biosecurity systems at RHS Harlow Carr?

KW – *In recent years we have seen an increase in new and damaging pests in the UK, some of these have huge impacts on our landscapes, others affecting some of our favourite garden plants. For example, Phytophthora ramorum was introduced into the UK in 2002 on an ornamental Viburnum shrub, but the disease then spread onto larch trees and has caused sever impacts in our forestry sector. Box tree moth was accidentally introduced to the UK and has since made the sustainable growth of box impossible in some areas of the country. Other pests and diseases are polyphagous meaning that they could cause damage to a wide range of plant species across several sectors and we really don't want to be dealing with those!*

Keeping our garden open is fundamental to fulfilling our charitable aims- if we had to close the garden, or an area of it, because of an outbreak, then the reduction in visitors would impact on our ability to carry out education and outreach. We also have a real responsibility to the garden, forestry and farming landscapes around us- imagine if the RHS were at the source of a major outbreak! Imported plants have been the source of a number of damaging pests and disease over recent years. We want to showcase plants and gardening, but we need to balance those horticultural activities against potential risk and so robust biosecurity systems are fundamental to us at RHS Garden Harlow Carr.

What did you have to do to become a Plant Healthy certified member?

KW – *As Harlow Carr was our first RHS garden to go through the process, we had a pre-audit visit which helped the garden team to understand the expectations of the standard, and to identify where gaps existed in our processes. As the RHS is a complex organisation, this was a valuable way for us to start the process, but the free self-assessment on the Plant Healthy website has been really useful too. We then worked to improve the required areas before having our first audit.*

Central to the Standard is the requirement to carry out an assessment of the hosts, pests and pathways relevant to our site (Site and Operations Pest Risk Analysis) and to identify appropriate mitigations to reduce their risk of occurring. This process involved understanding the notifiable pests and diseases that pose a threat to the specific plants and plant material that we grow and use in the garden, nursery and retail centre. Once the species and areas of concern have been identified, controls are then implemented with a view to minimising the pest risk to an Appropriate Level of Protection.

Plant Healthy certification involves an annual audit which assess the business against the requirements of the Plant Health Management Standard, so an assessor from a Certification Body visited the site. They spent a day going through our procedures, and speaking to various staff members to check that the biosecurity systems we have implemented effectively meet the Standard's requirements in our day-to-day practice.

RECEPTION RISK MATRIX	Time in Reception depending on source		
Type of plant material (work from first row downwards to assess material type)	**UK [Entirely UK grown or in UK for > 12 months]**	**EU countries**	**Third countries**
Semi-mature tree with root ball. Taller than 5 m or girth greater than 20 cm e.g. specimen trees	12 weeks	1 year	1 year
Host of *Xylella fastidiosa* Highest risk *Xylella* hosts are *Coffea Hebe, Lavendula, Nerium, Olea, Polygala, Prunus, Salvia & Spartium*	4 weeks	1 year Highest risk hosts 12 weeks All other *Xylella* hosts	Refer to section 6 of HRH document (some prohibited)
Host of other high-impact pests Reception time is based on associated risks – refer to section 6	Refer to section 6 of HRH document	Refer to section 6 of HRH document	Refer to section 6 of HRH document (some prohibited)
Woody material in commercial potting mix e.g. small potted woody shrubs or plants	4 weeks	12 weeks	6-12 months Risk assessed
Woody material in soil Lifted and containerised, or root balled woody plants e.g. small trees, larger shrubs	12 weeks if lifted from private collection, botanic garden 6 weeks if nursery grown	12 weeks	6-12 months Risk assessed
Bare rooted young woody plants e.g. Whips, Bare-rooted roses	None	12 weeks	12 weeks
Herbaceous in sterile media i.e. commercial compost mix or sterile loam	None	4 weeks	12 weeks
Bedding, seeds, bulbs, plugs raised from seed or tissue culture	None	None	4 weeks

RISK RATING	TIME IN RECEPTION
None	No reception time needed
Low	4-6 weeks
Medium	12 weeks
High	6 months - 1 year (risk assessed)

What are the main benefits of being Plant Healthy certified?

KW – *As the UK's leading gardening charity, certification helps the RHS demonstrate that by working together across teams, and to a recognised system, we can all be part of a movement that is working to minimise the threat from destructive pests such as Xylella fastidiosa. Our RHS Vision is to enrich everyone's life through plants, and make the UK a greener and more beautiful place . We can help to do this by facilitating healthy plants and healthy garden ecosystems.*

Being proactive about plant biosecurity, whether it be seeking new information or improving control measures, is inherent within the Plant Health Management Standard. This attitude helps all at the RHS to address the threat positively and empowers all relevant staff to take responsibility for the areas of RHS Harlow Carr that they look after.

What would your advice be to others who are keen to adopt the Plant Health Management Standard?

KW – *Start by taking the free to use self-assessment on the Plant Healthy website. This is a good starting point as it enables you to gauge and assess what you are doing already and how the measures in the Plant Health Management Standard can be integrated into your organisation's or business's plans. You're probably doing lots of it already, and the downloadable report is a useful tool to support you filling in any gaps.*

Above left – all plants that RHS Harlow Carr handles are traceable in terms of where they have been sourced. Traceability is a key biosecurity system enabling horticulturalists to work effectively with government agencies to control a notifiable pest in the event of an incursion. Above right – communicating the importance of plant biosecurity to visitors and what we can all do to prevent pest spread is an important public engagement activity.

15 Appendix H: Benchmarking exercise

Article 91 - Pest risk management plans and relevant articles referred to in (in red)	Considerations as to how the Plant Health Management Standard (PHMS) – version 1.2 relates to Article 91 and associated Articles in
1. Authorised operators may have in place pest risk management plans. The competent authority shall approve those plans, if they fulfil all of the following conditions:	
(a) they set out measures which are appropriate for those operators to fulfil the obligations set out in Article 90(1); *Article 90* ***Obligations of authorised operators*** *– (1) Where an authorised operator intends to issue a UK plant passport, it shall identify and monitor the points of its production process, and the points concerning the movement of plants, plant products and other objects, which are critical as regards compliance with [Articles 33(2), 37(4A), 41(1B), 54(1), 85, 86, 86a and 87 (as the case may be) and any requirements specified in regulations made under Article 28(1) or 30(1)]. It shall keep for at least three years records concerning the identification and monitoring of those points.*	PHMS 4.1 (Site and Operations Pest Risk Analysis) requires the following: • *Pest Pathways - An assessment of relevant pathways for pests to potentially arrive, move around or leave the site(s)* • *Establishment of risk levels - A systematic risk assessment method for the plants and other relevant materials handled that commences with the highest risk notifiable pests* • *Controls - Measures are implemented that aim to mitigate the specific pest risks identified* The other PHMS requirements that require record keeping (or procedures) to be in place for operational areas (i.e. production processes) are: *1.1 Plant Passports, 1.2 Phytosanitary certificates, 6.7* [survey of] *Wider environment (including landscape plantings within the site), 7.1 Goods in* (procedures), 7.*1 Tradability* (chain of custody), *7.3 Plant Protection Treatments, 7.4 Dispatch* (procedures), *7.5 Complaints, issues and returns, 8.1 Monitoring, 8.2 Self-assessment, 8.3 Continual Improvement, and 9.1 Training.*
(b) they fulfil the requirements set out in paragraph 2 of this Article [90]. *Article 90* ***Obligations of authorised operators*** *– (2) The authorised operator referred to in paragraph 1 shall ensure that appropriate training* *is provided, when necessary, to its personnel involved in the examinations referred to in Article 87, in order to ensure that that personnel possesses the necessary knowledge to carry out those examinations.*	PHMS section 9. Training and Recognition does cover training to ensure suitably informed personnel are in place. However, the PHMS training requirements **<u>are not</u>** aligned with the specific examination measures that are covered in Article 87. Article 87 has five parts, which can be summarised as: (1) obligations for Plant Passporting examinations, (2) situations where the examination should be carried out by the competent authority (i.e. not the Authorised Operator), (3) the process of examination (without prejudice), i.e. a minimum of a visual examination and when a visual inspection alone by the Authorised Operator is not sufficient, (4) The understanding that the Competent Authority may supplement any inspections with specified measures, (5) how certification schemes under relevant legislation relate to the inspection process.
Authorised operators implementing an approved pest risk management plan may be subject to inspections with a reduced frequency, as referred to in point (b) of Article 22(3) of Regulation (EU) 2017/625.	
2. The pest risk management plans shall cover, where appropriate in the form of standard operating procedure manuals, at least the following:	The term *standard operating procedure manuals* is not used in the PHMS. Evidence required in parts of the PHMS does stipulate that procedures are in place, which are assessed during a Plant Healthy Certification Scheme audit.
(a) the information required under Article 66(2) concerning the registration of the authorised operator; *Article 66 - Procedure of registration - 2. The application for registration shall include the following elements:*	The PHMS does not stipulate the following sub-articles of Article 66: Article 66 items – (a), (b), (ci), (cii), (ciii), (d)

(a) name, address in Great Britain and contact details of the professional operator; *(b) a statement concerning the intention of the professional operator to exercise one or more of the activities referred to in Article 65(1) concerning plants, plant products and other objects;* *(c) a statement concerning the intention of the professional operator to carry out, as applicable, one or more of the following activities:* *(i) issuing of UK plant passports for plants, plant products and other objects* *pursuant to Article 84(1);* *(ii) placing of the mark on wood packaging material referred to in Article 96(1);* *(iii) issuing of any other attestation referred to in Article 99(1);* *(d) address of the premises and, where applicable, the location of land plots used by the professional operator... to carry out the activities referred to in Article 65(1) for the purpose of the registration; and* *(e) the commodity types, families, genera or species of the plants and plant products and, where appropriate, the nature of other objects concerned by the activities of the professional operator, as referred to in Article 65(1).*	The PHMS does partly cover as sub-requirements of 4.1 (Site and Operations Pest Risk Analysis), the information covered in Article 66 – item (e). The relevant PHMS 4.1 sub-requirements are: • *Susceptible host plants - A list of host plants that are grown or managed and susceptible materials* • *Notifiable pests – A framework that details the relevant notifiable pests* Article 66 items: (a) and (d) are covered as part of the auditing process of the Plant Healthy Certification Scheme.
(b) the information required under Articles 69(4) and 70(1) concerning the traceability of plants, plant products and other objects; Article 69 Traceability (4) - Professional operators shall keep the records referred to in paragraphs 1, 2 and 3 for at least three years after the date on which the plant, plant product or other object concerned was supplied to or by them. Article 71 Traceability (1) - Phytosanitary certificate for introduction into Great Britain.	This directly relates to PHMS requirements 1.1 Plant Passports – legislative requirements must be followed and 1.2 Phytosanitary Certificates – legislation with respect to Phytosanitary Certificates must be followed. Both PHMS 1.1 and 1.2 require records to be kept for three years. Additionally, PHMS requirement 7.2 requires that *Traceability must be provided for all plant material sourced, grown and handled*. This is assessed by the presence of records available to identify where plant material has originated and records available to identify the commercial party the plant material has been supplied to.
(c) a description of the production processes of the authorised operator and its activities as regards movement and sales of plants, plant products and other objects;	PHMS 4.1 requires the following: • *Site and operations - the site(s) boundaries and relevant operations are defined.* • *Pest Pathways - An assessment of relevant pathways for pests to potentially arrive, move around or leave the site(s)*
(d) an analysis of the critical points referred to in Article 90(1) and the measures taken by the authorised operator to mitigate the pest risks associated with those critical points;	PHMS 4.1 requires the following: • *Pest Pathways - An assessment of relevant pathways for pests to potentially arrive, move around or leave the site(s)* • *Establishment of risk levels - A systematic risk assessment method for the plants and other relevant materials handled that commences with the highest risk notifiable pests*

	• *Controls - Measures are implemented that aim to mitigate the specific pest risks identified* • *Managed risk – How the controls minimise the levels of risk* • *Appropriate Level of Protection (ALOP) - Justification of how ALOP is comprehensively achieved and maintained for all aspects of the site(s) and operations*
(e) the procedures in place and actions foreseen where quarantine pests are suspected or found to be present, the recording of those suspicions or findings and the recording of the actions taken;	PHMS 1.4 (Notifiable Pest Interceptions or Outbreaks) requires the following: *There must be a procedure in place to identify and manage any suspected notifiable pest interceptions or outbreaks*. PHMS 8.1 (Monitoring) requires the following: *Plant material must be regularly monitored for plant health issues and that • monitoring records are kept.*
(f) the roles and responsibilities of the personnel involved in the notifications referred to in Article 14, the examinations referred to in Article 87(1), the issuance of UK plant passports pursuant to Article 84(1), Article 93(1) and (2) and Article 94, and the attaching of ***UK plant passports*** *pursuant to Article 88; and*	PHMS 3.1 (Plant Health Responsibility) requires the following: *Plant health responsibility within the business/organisation must be clearly defined and designated to named personnel.* • *The roles of personnel with plant health management responsibilities are clearly defined, including delivering the requirements of this Standard throughout the business/organisation*
(g) the training provided to the personnel referred to in point (f) of this paragraph.	PHMS section 9. Training and Recognition does cover training to ensure suitably informed personnel are in place. However, the PHMS training requirements **<u>are not</u>** aligned with the specific examination measures that are referred to in Article 87(1), the issuance of UK plant passports pursuant to Article 84(1), Article 93(1) and (2) and Article 94, and the attaching of UK plant passports pursuant to Article 88.
3. Where the competent authority becomes aware that the professional operator concerned does not apply the measures referred to in point (a) of the first subparagraph of paragraph 1, or that a pest risk management plan is no longer up to date with any of the requirements referred to in point (b) of the first subparagraph of paragraph 1, that authority shall without delay take the measures necessary to ensure that non-compliance with those conditions does not continue. Those measures may include the withdrawal of the approval of that plan.	
Where the competent authority has taken measures in accordance with the first subparagraph other than the withdrawal of the approval of the plan, and the non-compliance continues, that authority shall without delay withdraw that approval.[1]	

[1] https://www.legislation.gov.uk/eur/2016/2031/article/91

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