



Department
for Environment
Food & Rural Affairs

Pest specific plant health response plan: Outbreaks of xylophagous cerambycid beetles



Figure 1. Adult *Saperda candida*. © Gilles Gonthier under licence (<https://creativecommons.org/licenses/by/2.0/>).



Figure 2. Adult *Oemona hirta*. © Epitree under licence (<https://creativecommons.org/licenses/by-nc/2.0/>).

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This document is also available on our website at:

<https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/>

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1. Introduction and scope

- 1.1. This pest specific response plan has been prepared by the Defra Risk and Policy team. It describes how the Plant Health Service for England will respond if an infestation of a non-native cerambycid of concern is discovered.
- 1.2. The plant health authorities in Northern Ireland, Scotland and Wales have been consulted on this plan and will use it as the basis for the action they will take in the event of a non-native cerambycid of concern being detected in their territories.
- 1.3. This document will be used in conjunction with the *Defra Contingency Plan for Plant and Bee Health in England* (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593508/generic-contingency-plan-plant-bee-health-england.pdf), which gives details of the teams and organisations involved in pest response in England, and their responsibilities and governance. It also describes how these teams and organisations work together in the event of an outbreak of a plant health pest.
- 1.4. The aims of this response plan are to facilitate the containment and eradication of cerambycids and to make stakeholders aware of the planned actions.

2. Summary of threat

- 2.1. Larvae of xylophagous cerambycids bore galleries into the sapwood and heartwood of their hosts, weakening, and sometimes leading to the death of, these plants (Eyre and Haack, 2017).
- 2.2. Feeding damage and the death of plants impacts the economy, with respect to reduced yield, the environment, with respect to the loss of ecosystem services, and society, with respect to declining recreational and amenity sites (e.g. Gao *et al.*, 1993; Jim and Chen, 2009).

3. Response

Official action to be taken following the suspicion or confirmation of a cerambycid on imported plants

- 3.1. If a cerambycid is suspected by the Plant Health and Seeds Inspectorate (PHSI) or Forestry Commission (FC) to be present in a consignment moving in trade, the PHSI or FC must hold the consignment until a diagnosis is made. Samples should be sent to Fera Science Ltd., National Agri-Food Innovation Campus, Sand Hutton, York, YO41 1LZ (01904 462000) or Forest Research, Alice Holt Lodge, Wrecclesham, Farnham, GU10 4LH (0300 067 5600), in a sealed bag or container, within at least two other layers of containment, which are not liable to be crushed during transit. Damaged eggs, larvae or pupae should be submitted in tubes of 70% ethanol to prevent further degradation.
- 3.2. In instances where either live beetles or signs of live beetles is strongly suspected or confirmed, the inspector shall determine the level of plant health risk in the circumstances taking into account the weather conditions, the time of year and the likelihood of the pest escaping and order the appropriate remedial action. This may involve, if possible, the

reloading of material back into the freight container and closing the doors or requiring the consignment be covered to prevent insect escape.

- 3.3. When an infestation of a cerambycid is confirmed, the PHSI or FC should advise the client of the action that needs to be taken by way of an official plant health notice. The consignment should be destroyed by either wood chipping, incineration or deep burial.
- 3.4. Where there is a high risk of escape before destruction, fumigation and/or foliar insecticides may be used under guidance from the Defra Risk and Policy team.
- 3.5. If intercepted inland, any host plants should be surveyed on the site or in the immediate vicinity initially, before extending out to within a radius of at least 1 km around the finding for a time period equal to the maximum recorded time for development + one additional year. In the first year, these surveys will be regular and intensive.
- 3.6. A Europhyt notification should be made upon confirmation of an interception of a live cerambycid.
- 3.7. In the event that all or part of the consignment has not been held and has been distributed to other premises prior to diagnosis, trace forward and trace back inspections should take place upon suspicion or confirmation of a cerambycid. Details of recent past and future consignments from the same grower/supplier should also be obtained.
- 3.8. If available, a pest alert to raise awareness of the cerambycid and its symptoms should be distributed to packers/processors and importers where the cerambycid has been found, and to those in the local area and those associated with the infested premises. Published pest alerts are available on the Plant Health Portal - <https://planthealthportal.defra.gov.uk/pests-and-diseases/pest-and-disease-alerts/notifiable-pests/>.

Official action to be taken following the suspicion of a cerambycid outbreak

- 3.9. A Contingency Core Group (CCG), chaired by the Chief Plant Health Officer (CPHO) or their deputy and including specialists from APHA, Defra and other organisations, should be set up to assess the risk and decide on a suitable response at strategic and operational levels. This may include gathering more information on the suspected outbreak, such as the completion of the outbreak assessment, notification of ministers and senior officials, and agreeing a communications strategy. The CCG will also decide who will be the control authority, and the control authority will then nominate an incident commander. An Incident Management Team (IMT) meeting, chaired by the Incident Commander, will subsequently convene to produce an Incident Action Plan (IAP) to outline the operational plan. See the Defra *Generic Contingency Plan for Plant and Bee Health in England* for full details.
- 3.10. The CCG will set an alert status, which will take into account of the specific nature of the outbreak.

Restrictions on movement of material

Wood packaging material

3.11. If a cerambycid is suspected to have emerged from wood packaging material (WPM) at an inland site, all the WPM from the same consignment should be placed on hold pending further investigation.

Nursery, orchard or garden centre

3.12. If a cerambycid is suspected at a nursery, orchard or garden centre, all suitable woody plants and other suspect material should be placed on hold pending further investigation.

Wider environment

3.13. If a cerambycid is suspected in a tree or is found free living in the wider environment, all suitable woody plants and wood material within a radius of 100 m should not be moved out of the 100 m zone pending further investigation.

Preliminary trace forward / trace backward

3.14. Information obtained regarding the origins of infested consignments or plants should be used to locate other related and therefore potentially infested consignments of products in WPM or plants. Information should also be obtained on the destination to which suspect consignments have been sent. For findings in the wider environment, where no trace forward or backward can be done, the most likely source should be identified and investigated.

Confirming a new outbreak

How to survey to determine whether there is an outbreak

3.15. Information to be gathered by the PHSI on the suspicion of an infestation of a cerambycid, in accordance with ISPM 6; guidelines and surveillance (http://www.acfs.go.th/sps/downloads/13717_ISPM_6_E.pdf):

- The origin of the plants.
- Any information on the original source of the pest.
- Details of other premises or destinations where the plants have been sent, where the beetle may be present.
- The layout of the premises and surrounding area (in relation to potential buffer zones), including a map of the fields/cropping/buildings, at risk growers, and details of neighbouring plants, especially any commercial or non-commercial hosts in orchards, parks or gardens.
- Contact details of the appropriate department in the local authority if appropriate.
- Details of the plant variety, growth stage, dimensions (diameter or girth at breast height, approximate height), age/maturity and general condition.
- Description of the surrounding habitat, including all hosts (species and approximate size).
- Area and level of infestation, including life stages and a description of symptoms (photos would be helpful). Symptoms may include larval tunnelling within the wood.

- The location of any known populations, including grid references.
- The date and time the sample was taken, how it was identified and by whom.
- Current treatments/controls in place e.g. chemical treatments.
- Details of the movement of wood and wood packaging, people, equipment, machinery etc. to and from the infested area.
- Cultural and working practices.
- The name, address, email and telephone number of the person who found the pest and/or its symptoms.

3.16. This information should be included on the plant pest investigation template (see Appendix III of the *Defra Generic Contingency Plan for Plant and Bee Health in England*).

3.17. Further to information gathering, samples of other cerambycid infested wood should be taken to confirm the extent of the infestation e.g. in surrounding gardens, parks etc. This initial survey will be used to determine if it is an isolated finding or an established outbreak. For example, where an adult beetle is found but no host plant is located following the survey, the outbreak will be treated as an isolated finding, as there is no evidence to suggest the pest has become established.

3.18. Finance for the surveys will depend on the individual circumstances of the outbreak, and will be subject to discussion, usually between Defra policy, the PHSI and FC.

Sampling

3.19. Any eggs, larvae, pupae or adults found during the course of inspection, survey or tree removal operations, should be submitted by the PHSI or FC to Fera Science Ltd. or Forest Research as in point 3.1.

3.20. If a tree is suspected of containing a cerambycid, destructive sampling is likely to be required for confirmation, including the removal of the bark to reveal young larvae and tunnelling, and cutting through the trunk to reveal deeper galleries within the sapwood and heartwood. This may require the use of contractors.

3.21. Traps may be available for monitoring adult beetles during their flight period.

Diagnostic procedures

3.22. Diagnostic procedures will depend on the species found, but would likely involve morphological identification supported with molecular analysis where possible.

Criteria for determining an outbreak

3.23. An outbreak will be declared if there is evidence showing that a cerambycid has established a population within host trees other than those that the pest has been moved to the UK with. For example:

- 1) An adult beetle found on WPM at an importer and a fresh exit hole is found in the wood packaging. In this case, an outbreak will not be declared.

- 2) An adult beetle and a fresh exit hole is found on a mature tree anywhere in England. In this situation, an outbreak of a cerambycid will be declared.

3.24. Where an outbreak is not declared, points 3.5-3.8 should be carried out.

Official Action to be taken following the confirmation of an outbreak

3.25. The diagnosis of the cerambycid will inform what action should be taken, with respect to demarcation, surveillance, and management.

3.26. The scale of the outbreak will determine the size and nature of the IMT and action.

Communication

3.27. The IMT will assess the risks and communicate details to the IPPC, EU and EPPO, in accordance with ISPM 17: pest reporting (<https://www.ippc.int/en/publications/606/>), as well as within Government to Ministers, senior officials and other government departments, devolved authorities, and agencies (e.g., the Environment Agency) on a regular basis as appropriate; and to stakeholders.

3.28. Information on the outbreak will be communicated to residents and businesses outside the infested zone using various media formats e.g. leaflets, official posters, articles in local newspapers, appropriate websites, local radio etc. Consideration should also be given to the use of social media such as a 'Facebook' or 'Twitter' pages where members of the public can post questions relating to the outbreak.

3.29. When an outbreak is considered likely to have a limited public impact, as appropriate APHA or FC's media and communication teams will coordinate external communications. Example scenarios could include an outbreak in a nursery surrounded by a low urban density or in an urban area where there are few host plants resulting in limited felling activity. If the outbreak occurs in an area that is likely to cause significant media and public interest, for example an inner city nature reserve/public park with a high density of trees that require felling, then external communications will be coordinated through the Defra Press Office. In all cases, the Defra Press office must be kept informed of the current status of the outbreak and any action taken.

3.30. Depending on the scale and circumstances of the outbreak, a public meeting may be required to inform the local residents and relevant stakeholders of the surveillance and eradication programme.

3.31. A communication plan could involve the following:

- Frequently Asked Questions: a Q&A will be developed for staff as a reference source for questions considered likely to be asked by the media and members of the public. A version of the document for public dissemination will be made available electronically via the appropriate website.
- Lines to take: outlining the main messages that should be put across to the public.

- Stakeholder/message matrix: the Stakeholder/message matrix sets out the list of stakeholders likely to be affected by any outbreak, the order in which they should be contacted, the timescale and method for contacting them, and who they should be contacted by.

Demarcated zones

- 3.32. Once an outbreak has been confirmed, a demarcated area should be established around known infested trees. This will include two zones:
- 1) The **infested zone**, where the presence of the cerambycid has been confirmed, and which includes all plants showing symptoms caused by the cerambycid and, where appropriate, all plants belonging to the same lot at the time of planting. As a minimum, the radius of this zone will extend to 100 m around all known infested plants.
 - 2) The **buffer zone**, which will initially include the area within 2 km of the infested zone, but may extend further depending on the situation. This can be reduced to an area within 1 km of the infested zone following surveys, if considered appropriate by the IMT.
- 3.33. Initial maps of outbreak sites should be produced by either the PHSI, FC or the Risk and Policy team.
- 3.34. All host plants within the infested and buffer zone should be surveyed for signs of the beetle.
- 3.35. If it is considered possible that the beetle has been spread to other destinations, such as those with a history of receiving potentially infested trees or wood from within the demarcated area e.g. firewood merchants or local authority green waste disposal sites, then these areas should be surveyed. These zones should be treated as if they are part of the buffer zone.
- 3.36. The demarcated area should be adjusted in response to further findings. If the cerambycid is found within an area outside the infested zone, this should subsequently be designated as infested.
- 3.37. The PHSI or FC will contact garden centres, nurseries and other traders of host plants, as well as owners/managers/tenants of woodland areas, conservation areas and amenity land such as parks, within the demarcated areas to inform them of the requirements that will apply to them (see Pest Management Procedures). Controls on the movement of specified plants or wood will be implemented either by statutory plant health notices, or by a statutory instrument, or a combination of the two, depending on the nature and scale of the incident. The location of any demarcated areas will be published on '.gov.uk' in order to inform all other stakeholders (including residents, businesses and landowners) within the demarcated areas of the requirements that will apply to them.

Decontamination procedures

- 3.38. Any waste (plant or other potentially infested material) should be removed and destroyed (via deep burial, incineration or chipping).

Surveillance

- 3.39. Ideally, all host plants should be surveyed in the buffer zone. Hosts nearest to the infested zone should be surveyed first, with decreasing priority as the distance increases from the infested zone. The area closest to the infested zone, and high risk premises, such as nurseries and firewood importers, may be surveyed by a systematic survey of all host plants and plant products, and the rest may be surveyed by surveying just high risk hosts. The areas to be surveyed systematically and by surveying only high risk hosts, and how this should be done, will be determined by the IMT.
- 3.40. A selection of sentinel plants will also be surveyed on a more regular basis, ideally at least three times per year (in spring, summer and winter). These will be single or groups of trees of the most favoured hosts of the cerambycid selected to have a representation across the demarcated area. These trees could be selected on a circular route around the outbreak site (based on public pathways or other convenient routes), thereby providing a balance between being representative and accessible.
- 3.41. Hosts will initially be surveyed by inspectors from the ground with the aid of binoculars. Tree climbers may also be used, as they can spot symptoms that would not be possible to detect from the ground. A decision on when and where to use tree climbers will be made by the IMT.
- 3.42. If suspicious symptoms are seen on host plants, as well as non-host plants, that cannot be dismissed as being likely to be due to another cause, destructive sampling is required to confirm infestation by the cerambycid, including the removal of the bark to reveal young larvae and tunnelling, and/or cutting through the trunk or branches to reveal deeper galleries within the sapwood and heartwood (e.g. Ostojá-Starzewski, 2016).
- 3.43. If available, traps may also be used for monitoring of adult beetles during their flight period.
- 3.44. Surveys will be carried out annually, and will continue until no beetle has been detected for at least two lifecycles of the beetle. These surveys will be carried out by ground surveyors and tree climbers, with a specific survey plan developed based on the outbreak situation.
- 3.45. The first surveys of the demarcated area will be carried out as soon as possible after the outbreak has been discovered. For deciduous trees, subsequent surveys will be carried out during the winter or early spring when the trees are not in leaf, as this is considered to be the best time of the year to detect exit/ejection holes.
- 3.46. To aid surveillance, trees to be inspected or which have been inspected can be mapped using GIS software or similar.

Pest Management procedures

- 3.47. The movement of host plants and plant products (e.g. wood and wood packaging) out of or within the demarcated area should be restricted as appropriate.
- 3.48. All host plants within a radius of at least 100 m of any plant or plant product found to be infested should be cut down and removed. The distance chosen will depend on the biology of the cerambycid. If there is little information on its biology, it should be considered to be similar to *A. glabripennis*. There is evidence showing that *A. glabripennis* is able to fly greater than 100 m and up to 203 m (Straw *et al.*, 2016), therefore felling of preferred hosts further

than 100 m should be considered. This would depend on the outbreak situation (including the extent, age and source of the outbreak) and host distribution in and around the infested zone. If infested plants are found outside the flying period for the beetle, the felling and removal should be carried out prior to the start of the next flying period, but ideally within a short space of time to allow the felled trees to be checked for further signs of infestation which could lead to the need to fell additional trees.

- The removal of host plants will remain the responsibility of the occupier or other person in charge of the premises. Contact information for the Arboricultural Association with their register of qualified tree surgeons and ConFor (Confederation of Forestry Industries) will be provided to enable landowners to identify qualified operatives to carry out removal work. In exceptional circumstances, the removal of trees and shrubs may be carried out by the PHSI or FC.
- In the case of private householders, officials may agree to organise the felling and removal of host trees and shrubs, with responsibility for payment of costs remaining with the occupier or other person in charge, or for it to be undertaken by the relevant local authority which will be responsible for determining whether to accept responsibility for the costs of the work or seek recovery. Exceptionally, officials may, in the interests of speed, have to arrange for the work to be carried out and bear the cost, where possible seeking recovery after the event.

3.49. The radius of the areas described may be adjusted to reflect the density of potential and favoured hosts and the number of beetles, larvae, exit holes and other symptoms that have been found.

3.50. In exceptional cases where the IMT concludes that felling is inappropriate, an alternative eradication measure may be applied offering the same level of protection against the spread of the cerambycid.

3.51. Plants and hedgerows should be cut as close as possible to ground level. The cut surface should be examined for signs of cerambycid activity. If signs are found then the stumps should be ground down to a level at which no symptoms are seen or, alternatively, the stumps should be dug up. Any roots above ground may also need to be removed.

3.52. If the removal of stumps could cause unacceptable damage, fine mesh may be used to cover the stumps to prevent the escape of any remaining beetles, and to prevent any re-infestation (van der Gaag *et al.*, 2010; Roselli *et al.*, 2013). The IMT will advise this on a case by case basis.

3.53. All felled trunks and branches should be cut into sections of a size that can be easily turned over and examined by inspectors before disposal. The outside of the logs and cut ends must be examined for any signs of cerambycid damage. This could include exit holes and frass. Damage that is considered to potentially be caused by the cerambycid should be checked by cutting thin slivers of wood away from the surface to reveal whether there is any tunneling below, and/or splitting the wood open with a hand axe. An alternative to cutting open suspect logs in the field is to transfer them to a laboratory or other facility set up to carry out this task. If this option is taken then the logs need to be transported within three layers of containment and the laboratory/other facility needs to be licensed to hold such materials.

- Although time consuming, this may yield valuable information, including the extent and age of an outbreak.

- 3.54. The possibility of using foliar insecticide treatments and/or biopesticides will be considered by the IMT for trees or shrubs within the infested zone if the outbreak is discovered during the potential adult flight period. They could help to prevent further spread of cerambycids in the year that the outbreak is first discovered. However, they are likely only to be beneficial for heavy infestations of the beetle, where there is a high likelihood of further spread, as treatments have the potential to act as repellents to adult beetles.
- 3.55. After the clearance of plants in the infested area, sentinel plants of an appropriate size may be planted and/or marked out from already established plants within this zone in order to attract and monitor for the cerambycid. The plants will be as close as possible to the locations where the infested plants were found, ideally on publicly owned or managed land, but always with the prior consent of the person in charge of the land. The plants will be inspected for signs of infestation a minimum of twice a year. If signs or symptoms of cerambycids are seen, these plants will be destructively sampled.

Disposal plan

- 3.56. During the cerambycid flight period, all felled plants and parts of plants from the infested area should be destroyed/processed as soon as possible after it has been inspected, within a maximum of one week. Options for destruction/processing are:
- 1) Wood chipping. This would be the most appropriate method of disinfecting shrubs, small trees and branches.
 - 2) Burning or incineration.
 - 3) Moved under containment to a location known and approved by the PHSI or FC. For example, material with no visible signs of infestation could be moved to a new location in cerambycid proof containers (e.g. steel shipping containers) and dealt with once conditions are too cool to permit adult activity.
- 3.57. During the winter, unprocessed logs may be moved out of the infested area under official notice if they are going to a site where they will be processed by one of the following methods before the following flight season:
- 1) Wood chipping. It may be possible to leave the chipped material in situ but away from footpaths etc. (e.g. where large areas are infested) under an Environment Agency exemption which permits a maximum of 250 cubic metres in any one deposit.
 - 2) Burning or incineration. Burning either in situ (under an Environment Agency exemption, which allows a total quantity not exceeding 10 tonnes to be burned in any period of 24 hours) or at a commercial incinerator. NB: it will often not be practical to burn whole trees or large sections, other than those with small diameters e.g. branch wood.
 - 3) Other methods of disposal, such as deep burial of non-hazardous waste at a local authority approved landfill site, or use as biomass, may be considered on a case by case basis.

- 3.58. In cases where a local authority has the necessary equipment and facilities to carry out the removal and destruction of host material in amenity areas, arrangements may be explored with the authority concerned for the disposal of material from other sources such as private dwellings and commercial premises.
- 3.59. Any disposal of waste material must be done in accordance with the relevant legislation. Growers need to obtain permission for exemptions from the Agricultural Waste Regulations from the Environment Agency. No charges are made for these exemptions. Further information on activities that require a permit and those which require the registration of an exemption can be found on the EA website at: <https://www.gov.uk/topic/environmental-management/environmental-permits>.
- 3.60. Landowners need to ensure that any clearance complies with Habitat Regulations. If needed, permissions can be sought to undertake emergency activities e.g. felling. Further information may be obtained from Natural England or the FC (the latter being the lead authority for all forestry activity).

Replanting

- 3.61. No host plants will be planted in the demarcated area during the outbreak, except sentinel/trap plants.

4. Criteria for declaring eradication / change of policy

- 4.1. The outbreak will be declared eradicated if the pest is not detected for a period covering at least two lifecycles of the cerambycid.

5. Evaluation and review of the contingency plan

- 5.1. The *Defra Generic Contingency Plan for Plant and Bee Health in England* requires that the pest specific plan is reviewed following an outbreak. This pest specific contingency plan should also be reviewed annually to take into account of changes in legislation, control procedures, pesticides, sampling and diagnosis methods, and any other relevant amendments.

6. Annex I

Saperda candida (round-headed apple tree borer)

1. Background

Distribution

Saperda candida is native to North America, and is currently present in southern Canada and central and eastern USA (EPPO Global Database, 2018a). The beetle was also recorded on the Island of Fehmarn, Germany, in 2008, following finds of circular bore holes (~ 9 mm diameter) and a beetle on stems of *Sorbus intermedia* (Swedish whitebeam) along an avenue in Johannisberg and Mattiasfelde (EPPO Reporting Service, 2008). Eighteen of the 250 trees lining the avenue were subsequently felled and incinerated, and monitoring carried out within 2 km of the infested trees. Further symptoms were discovered on two *Malus* trees on a private property and on *Crataegus* on a public green. The beetle is currently classed as under eradication in Germany.

(P) present, (W) widespread, (L) localized, (O) occasionally present, (D) reported in the past, no longer present, (E) eradicated, (I) absent, intercepted only		
COUNTRY/REGION	DISTRIBUTION (see codes above)	REFERENCES: please write (name, date) citation here and include full bibliographic details in reference list
ASIA	Absent	
AFRICA	Absent	
NORTH AMERICA	W	
CANADA		
Alberta	L	Linsley and Chemsak (1995)
Manitoba	P	EPPO Global Database (2018a)
New Brunswick	P	EPPO Global Database (2018a)
Nova Scotia	P	Bousquet (1991)
Ontario	P	Bousquet (1991)
Québec	P	EPPO Global Database (2018a)
Saskatchewan	P	EPPO Global Database (2018a)
USA	W	
Alabama	P	EPPO (2009)
Arkansas	P	Becker (1918)
Connecticut	P	EPPO (2009)
Delaware	P	EPPO (2009)
Florida	P	EPPO Global Database (2018a)
Georgia	P	Morris (2002)
Illinois	P	EPPO Global Database (2018a)
Indiana	P	EPPO (2009)
Iowa	P	EPPO (2009)
Kansas	P	EPPO (2009)
Kentucky	P	EPPO (2009)
Maine	P	EPPO (2009)
Maryland	P	EPPO (2009)

Massachusetts	P	EPPO (2009)
Michigan	P	EPPO (2009)
Minnesota	P	EPPO Global Database (2018a)
Mississippi	P	Schiefer (1998, 2001)
Missouri	P	EPPO Global Database (2018a)
Nebraska	P	EPPO (2009)
New Hampshire	P	EPPO Global Database (2018a)
New Jersey	P	EPPO (2009)
New York	P	EPPO (2009)
North Carolina	P	EPPO (2009)
North Dakota	P	EPPO Global Database (2018a)
Ohio	P	EPPO (2009)
Oklahoma	P	EPPO (2009)
Pennsylvania	P	EPPO (2009)
Rhode Island	P	EPPO (2009)
South Carolina	P	EPPO (2009)
South Dakota	P	EPPO (2009)
Tennessee	P	EPPO (2009)
Texas	P	EPPO (2009)
Vermont	P	EPPO (2009)
Virginia	P	EPPO (2009)
West Virginia	P	EPPO Global Database (2018a)
Wisconsin	P	EPPO (2009)
CENTRAL AMERICA & THE CARIBBEAN	Absent	
SOUTH AMERICA	Absent	
EUROPE	L	
Germany	L	Under eradication, EPPO Reporting Service (2008)
Netherlands	Absent	EPPO Global Database (2018a)
OCEANIA	Absent	

Hosts

Cydonia oblonga (quince), *Malus domestica* (apple) and *Pyrus communis* (pear) are considered to be important cultivated hosts, while *Amelanchier* (Juneberry), *Aronia* (chokeberry) *Crataegus* (hawthorn), *Malus coronaria* (wild crab-apple) and *Sorbus* (mountain ash) are considered important wild hosts (Hess, 1940; EPPO, 2009). Some other hosts mentioned, such as the flowering plant, *Solidago rugosa*, may only be incidental/visited by adults.

Host plant	Type	Reference
<i>Amelanchier</i> (Juneberry)	Major	EPPO Global Database (2018a)
<i>Amelanchier canadensis</i>		Hess (1940)
<i>Amelanchier intermedia</i>		Hess (1940)
<i>Amelanchier laevis</i>		Hess (1940)
<i>Amygdalus</i>	Minor	Linsley and Chemsak (1995)
<i>Araria</i>	Minor	Linsley and Chemsak (1995)
<i>Aronia</i> (chokeberry)	Minor	EPPO Global Database (2018a)
<i>Aronia arbutifolia</i> (red chokeberry)		Hess (1940)
<i>Cotoneaster</i>	Minor	EPPO Global Database (2018a)
<i>Crataegus</i> (hawthorn)	Minor	EPPO Global Database (2018a)

<i>Cydonia oblonga</i> (quince)	Major	EPPO Global Database (2018a)
<i>Malus coronaria</i> (wild crab-apple)	Major	Hess (1940)
<i>Malus domestica</i> (apple)	Major	EPPO Global Database (2018a)
<i>Prunus</i>	Minor	EPPO Global Database (2018a)
<i>Prunus avium</i> (cherry)	Major	EPPO Global Database (2018a)
<i>Prunus domestica</i> (plum)	Major	EPPO Global Database (2018a)
<i>Prunus persica</i> (peach)	Major	EPPO Global Database (2018a)
<i>Pyracantha</i> (firethorn)	Minor	EPPO Global Database (2018a)
<i>Pyrus</i>	Minor	EPPO Global Database (2018a)
<i>Pyrus communis</i> (pear)	Major	EPPO Global Database (2018a)
<i>Solidago rugosa</i> (wrinkleleaf goldenrod)	Minor	Lovell (1915)
<i>Sorbus</i> (mountain-ash)	Minor	EPPO Global Database (2018a)
<i>Sorbus americana</i> (American mountain ash)		Hess (1940)
<i>Sorbus intermedia</i> (Swedish whitebeam)	Minor	EPPO Global Database (2018a)

Lifecycle

Following a 5 to 17 day period after eclosion in the host plant, adults emerge over a month period between April and July in their native range following a latitudinal gradient moving from the south to the north (Wilson, 1924; Hess, 1940). After mating and following a period averaging 13 days (ranging from 4 to 26 days), females move to the base of the trunk to lay their eggs, preferably in warm, humid conditions (Hess, 1940). They first make a slit in the bark with their mandibles, before making a semi-circular opening to one side of the slit between the bark and the cambium into which their egg(s) are laid (Hess, 1940). Under experimental conditions, females laid an average of 21 to 41 eggs over a period of about 22 days (ranging from 8 to 41 days), and it is expected that females would lay closer to 41 eggs over a longer time period in nature (Becker, 1918; Hess, 1940).

Larvae hatch from the eggs in about 14 and a half days (ranging from 10 to 25 days) and initially bore into the inner bark or cambium layer, before tunnelling into the wood as they develop (Wilson, 1924; Hess, 1940; EPPO, 2010). Larvae form galleries upwards and downwards through the trunk near to where they hatched until late autumn, and leave a trail of frass in the process, which is pushed through openings in the trunk (Chandler, 1949). During the winter, larvae move to the bottom of their tunnels (at or below ground level) (Hess, 1940). The length of larval development depends on the temperature and can take between 1 and 5 years in the native range of the beetle (Hess, 1940). Once mature, the larvae excavate pupal chambers near to the bark (Wilson, 1924; Hess, 1940). Pupation generally lasts about 20 to 25 days (Becker, 1918; Brooks, 1920; Hess, 1940).

Hess (1940) recorded the average lifespan of male and female adults as 11 and 26.2 days, respectively, but this is likely to be an underestimate due to the confined experimental conditions the adults were subject to. Adults feed on foliage, fruit and bark, with hawthorn being preferred over apple, pear and chokeberry (Hess, 1940). Bark was also preferred over fruit and foliage when the beetle was studied on apple trees (Hess, 1940).

Action to prevent outbreaks

Saperda candida is an IAI EU listed pest. It is also an A1 listed pest for the EPPO region and is therefore recommended for regulation by EPPO member countries.

Prohibitions

In annex III of the EU Directive 2000/29/EC, the following hosts of *S. candida* are prohibited from entry into member states:

- Plants of *Cydonia* Mill., *Crataegus* L., *Malus* Mill., *Prunus* L., *Pyrus* L., intended for planting, other than dormant plants free from leaves, flowers and fruit, from non-European countries (Part A, article 9)
- Plants of *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, intended for planting, other than seeds, without prejudice to the prohibitions applicable to the plants listed in Annex III A (9), where appropriate, non-European countries, other than Mediterranean countries, Australia, New Zealand, Canada, and the continental states of the USA (Part A, article 18)

Plant requirements

In annex IV of the EU Directive 2009/29/EC, the wood of host plants of *S. candida* not originating in the community require the following:

- Whether or not listed among the CN codes in Part B of Annex V, wood of *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L., including that which has not kept its round surface, originating in Canada and the USA, other than in the form of:
 - Chips, sawdust and shavings, obtained in whole or part from these plants,
 - Wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignments and which meets the same Union phytosanitary requirements as the wood in the consignment

must have an official statement that the wood:

- Originates in an area free from *Saperda candida* Fabricius, established by the national plant protection organisation in the country of origin, in accordance with the relevant International Standards for Phytosanitary Measures, or

- Has undergone an appropriate heat treatment to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood, or
- Has undergone an appropriate ionising radiation to achieve a minimum absorbed dose of 1 kGy throughout the wood (Part A I, article 7.4)
- Whether or not listed among the CN codes in Part B of Annex V, wood in the form of chips obtained in whole or part from *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L., originating in Canada and the USA must have an official statement that the wood:
 - Originates in an area established by the national plant protection organisation in the country of origin as being free from *Saperda candida* Fabricius in accordance with the relevant International Standards for Phytosanitary Measures, or
 - Has been processed into pieces of not more than 2.5 cm thickness and width, or
 - Has undergone an appropriate heat treatment to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the chips (Part A I, article 7.5)
- Plants intended for planting, other than scions, cuttings, plants in tissue culture, pollen and seeds, of *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L. originating in Canada and the USA, without prejudice to the provisions applicable to the plants in Annex III, must have an official statement that the plants:
 - Have been grown throughout their life in an area free from *Saperda candida* Fabricius, established by the national plant protection organisation in the country of origin, in accordance with relevant International Standards for Phytosanitary Measures, or
 - Have been grown during a period of at least two years prior to export, or in the case of plants which are younger than two years have been grown throughout their life, in a place of production established as free from *Saperda candida* Fabricius in accordance with relevant International Standards for Phytosanitary Measures, which:
 - Is registered and supervised by the national plant protection organisation in the country of origin, and
 - Has been subjected annually to two official inspections for any signs of *Saperda candida* Fabricius carried out at appropriate times, and
 - Where the plants have been grown in a site with complete physical protection against *Saperda candida* Fabricius, or with the application of appropriate preventative treatments and surrounded by a buffer zone with a width of at least 500 m where the absence of *Saperda candida* Fabricius

- was confirmed by official surveys carried out annually at appropriate times, and
 - Immediately prior to export the plants have been subjected to a meticulous inspection for the presence of *Saperda candida* Fabricius, in particular in the stems of the plant, including, where appropriate, destructive sampling (Part A I, article 14.1)
- trees and shrubs, intended for planting, other than seeds and plants in tissue culture, originating in third countries other than European and Mediterranean countries, must have an official statement that the plants:
 - Are clean (i.e. free from plant debris) and free from flowers and fruits
 - Have been grown in nurseries
 - Have been inspected at appropriate times and prior to export and found free from symptoms of harmful bacteria, viruses and virus-like organisms, and either found free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to eliminate such organisms (Part A I, article 39)

Inspections

In annex V of the EU Directive 2000/29/EC, a plant health inspection is required in the country of origin or the consignor country before being permitted to enter the community for the following hosts of *S. candida*:

Plants, plant products and other objects originating in the Community of relevance to the entire Community and which must be accompanied by a plant passport

- Plants intended for planting, other than seeds, of the genera *Amelanchier* Med., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., other than *Prunus laurocerasus* L. and *Prunus lusitanica* L., *Pyracantha* Roem., *Pyrus* L., and *Sorbus* L. (Part A I, article 1.1)
- Plants intended for planting, other than seeds, of the genera *Prunus laurocerasus* L. and *Prunus lusitanica* L., if they are plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separated from that of other products (Part A I, article 2.1)

Plants, plant products and other objects originating in the Community, and of relevance for certain protected zones, and which must be accompanied by a plant passport valid for the appropriate zone when introduced into or moved within that zone

- Plants intended for planting, other than seeds, of *Prunus* L. (Part A II, article 1.2)
- Plants, other than fruit and seeds, of *Amelanchier* Med., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Pyracantha* Roem., *Pyrus* L., and *Sorbus* L. (Part A II, article 1.3)

Plants, plant products and other objects originating in territories, other than those territories referred to in Part A of relevance for the entire Community

- Plants, intended for planting, other than seeds, but including seeds of *Prunus* L. (Part B I, article 1)
- Parts of plants, other than fruits and seeds, of *Prunus* L., originating in non-European countries (Part B I, article 2)
- Certain wood types of *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L., and *Sorbus* L., including wood which has not kept its natural round surface, except sawdust or shavings, originating in Canada or the USA, but not including wood packaging material defined in Annex IV Part A I, article 2 (Part B I, article 6)

Plants, plant products and other objects originating in territories, other than those territories referred to in Part A of relevance for certain protected zones

- Parts of plants, other than fruit and seeds, of *Amelanchier* Med., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Pyracantha* Roem., *Pyrus* L., and *Sorbus* L. (Part B II, article 4)

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Wood packaging material must be made of debarked wood and wood must be treated using one of the following:

- 1) Heat treatment using a conventional steam or dry kiln heat chamber, which must achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core)
- 2) Heat treatment using dielectric heating for wood not exceeding 20 cm⁴ when measured across the smallest dimension of the piece or the stack must achieve a minimum temperature of 60°C for 1 continuous minute throughout the entire profile of the wood (including its surface) and must be achieved within 30 minutes from the start of the treatment
- 3) Methyl bromide treatment for wood not exceeding 20 cm in cross-section at its smallest dimension must achieve a minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in the standard and must be achieved throughout the profile of the wood, including its core

- 4) Sulfuryl fluoride treatment for wood not exceeding 20 cm in cross-section at its smallest dimension and wood packaging material not exceeding 75% moisture content must achieve a minimum CT over 24 or 48 hours at the target temperature and final residual concentration specified in the standard and must be achieved throughout the profile of the wood, including its core

A mark indicating that wood packaging material has been subjected to approved phytosanitary treatment in accordance with the standard comprises the following required components:

- The symbol
- A country code
- A producer/treatment provider code
- A treatment code using the appropriate abbreviation (HT for conventional steam or dry kiln heat chamber, DH for dielectric heating, MB for methyl bromide or SF for sulfuryl fluoride)

2. Detection and inspection methods

Morphology

Egg: Light cream colour when laid and turns light brown as it ages. The egg is about 3.5 mm long and 1.3 mm wide.

Larva: Legless and cream coloured. A newly hatched larva is about 3-4 mm long, while a mature larva is about 40-45 mm long. The pre-pupal stage is shorter, and is about 18-19 mm long in males, and 24-25 mm long in females.

Pupa: Initially light yellow, before the mandibles, eyes, wings and leg joints darken with age. The pupa is 18-19 mm long in males, and 23-24 mm long in females.

Adult: The dorsal side of the body is light brown, with the exception of two white stripes, which extend from the head to the tip of the elytra. The eyes are black, and the antennae, face, legs, and the under surface of the body are silvery white. Adults range from 12-22 mm long, though most are between 18 and 20 mm long. Males and females differ by their pygidium (hind segment), which is entire in males and formed of two longitudinally separated plates in females.



Fig. 3. Adult *S. candida*. © Ben Sale under licence
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Diagnostics

There are no morphological keys that will allow the positive identification of eggs, larvae or pupae of *S. candida*. Adults can be identified to the family Cerambycidae using Booth *et al.* (1990), and confirmed to the genus *Saperda* using Bense (1995). Identification to species requires regional keys and descriptions, which can be obtained using Nearn *et al.* (2017). There are no published reference sequences for *S. candida*, though there are sequences for 17 other species within the genus.

Symptoms

Whole plant

Feeding by young larvae within the trunk cambium can prevent the circulation of sap, weakening the tree, inhibiting fruit production, causing dieback, and eventually leading to the death of the tree (Hess, 1940; Chandler and Flint, 1942; EPPO, 2010). Galleries formed in the wood layer can also weaken the tree to a point that the trunk can be broken off in the wind (Hess, 1940; EPPO, 2010).

Trunk

Larvae bore galleries underneath the bark in the cambium layer and the sapwood of the tree, which can be seen when the bark is removed (Hess, 1940). As the larvae feed, they also produce a copious amount of frass, which can be seen at the base of the tree trunk (Wilson, 1924; Hess, 1940). Additionally, when adults emerge from the pupal chamber and leave the tree, they produce emergence holes of around 4.7 and 6.1 mm in diameter (males and females, respectively) (Hess, 1940). Generally, the emergence holes are concentrated near the base of the trunk, within the first 7 or 8 inches, though very occasionally they are found several feet above the ground (Hess, 1940).

Surveillance

Visual inspection is the primary method for detecting infested trees. Surveys should focus on all woody host plants (see host table), particularly *Cydonia oblonga* (quince), *Malus domestica* (apple), *Pyrus communis* (pear), *Amelanchier* (Juneberry), *Aronia* (chokeberry) *Crataegus*

(hawthorn), *Malus coronaria* (wild crab-apple) and *Sorbus* (mountain ash). Symptoms to look for include:

- Frass underneath the tree (Wilson, 1924; Hess, 1940).
- Exit holes in the trunk (averaging 4.7-6.1 mm in diameter), with a focus on the first 7-8 inches of trunk from the ground (Hess, 1940).
- Adult beetles, which are easily recognised from their colouration.

To confirm a tree is infested, destructive sampling is usually required, including the removal of the bark to reveal larvae and tunnelling, and cutting through the trunk to reveal deeper galleries within the sapwood.

3. Outbreak control methods

Hess (1940) describes a method of hitting infested trees with a large padded wooden mallet 10 times during the pupal/pre-emergence period. This was effective in preventing the emergence of any beetles from 10 young seedling apple trees.

Wood chipping – to dimensions of no more than 15 mm in thickness and width (based on the size of pupae).

7. Annex II

Oemona hirta (lemon tree borer)

1. Background

Distribution

Oemona hirta is native to New Zealand and is present on both main islands (EPPO Global Database, 2018b). It has also been recorded on other islands off the two main islands, including Somes, Mopokuna, Cuvier, Kapiti, Blumine and Pickersgill (Campbell *et al.*, 1984; Moeeds and Meads, 1987; Grehan, 1990). The beetle is fairly widespread in New Zealand, but is uncommon in drier areas (Hosking, 1978).

The beetle was intercepted in the UK on *Wisteria* plants in 1983 and 2010, but no further beetles have been found (EPPO, 2013).

Hosts

Oemona hirta is highly polyphagous, with most records of damage coming from woody dicotyledons (EPPO, 2014). The native New Zealand plant, mahoe (*Melicytus* spp.), is considered to be one of the primary original hosts of *O. hirta*, but the beetle has also been recorded on a number of other endemic species to New Zealand, as well as a number of species that have been introduced to the country (EPPO, 2014; DeNitto *et al.*, 2015). It is likely that a number of hosts remain unrecorded and that *O. hirta* will be able to use other species as hosts outside of its native range.

Frequent damage has been reported on *Citrus* spp. (where most damage has been recorded), *Diospyros kaki* (persimmon), *Vitis vinifera* (grapevine), *Malus* spp. (apple), *Populus* spp. (poplar) and *Ulex europaeus* (gorse) (EPPO, 2014). Occasional damage has also been reported on *Prunus dulcis* (almond), *P. avium* (cherry), *P. domestica* (plum), *P. persica* (peach), *Vaccinium* sp. (blueberry), *Castanea* sp. (chestnut), *Corylus* sp. (hazelnut), *Pyrus* spp. (pear), *Juglans* (walnut), *Cytisus scoparius* (broom), *Acacia melanoxylon* (blackwood), conifer hosts (*Abies*, *Pinus*, *Chamaecyparis*, *Cryptomeria*, *Cupressus* and *Sequoia sempervirens*), *Euonymus japonicus*, *Quercus* sp. (oak), *Paulownia*, *Salix* sp. (willow), *Alnus*, *Acacia*, *Eucalyptus*, *Fraxinus*, *Platanus*, *Podocarpus*, and *Ulmus* (EPPO, 2014).

A comprehensive list of host plants, containing 200 species from 81 families, can be found in Annex I of the EPPO PRA (EPPO, 2014).

Life cycle

Following a short period after eclosion that allows their integument to harden, adults emerge from their host between October and January (EPPO, 2013). After a further 3-4 days, adults begin to mate (Wang *et al.*, 1998; DeNitto *et al.*, 2015). Females then begin to lay eggs singly in the

junctions of leaves and stems, bark crevices and fresh pruning wounds (Taylor, 1957; Clearwater, 1981; Lu and Wang, 2005; Gourlay, 2007). Generally, these are laid on twigs and less often on branches and stems or on dead wood (Dumbleton, 1937; Hosking, 1978). Wang *et al.* (1998) reported females laying an average of 51.3 eggs, with an average oviposition period of 17.7 days under experimental conditions. Outdoors, Dye *et al.* (1950) observed an oviposition period of 30 days.

Following an incubation period of 9-13 days, larvae hatch from the eggs and bore directly into the wood of their host, first into the sapwood and then into the heartwood (Dye, 1950; Wang *et al.*, 2002; EPPO, 2013). If they are in a branch, larvae will generally tunnel through the branch towards the stem, and sometimes into the stem itself (EPPO, 2014). There are also some larvae that bore around the branches (Cottier, 1938). Side tunnels leading out of the tree are produced at regular intervals (every 6-8 cm or so), allowing larvae to eject any accumulated frass ("ejection holes", Dumbleton, 1937; Lu and Wang, 2005). Once mature, larvae form a cell in the wood in which to pupate (Clearwater, 1981). Pupation lasts for roughly 2-3 weeks (Cottier, 1938; Wang *et al.*, 2002; Lu and Wang, 2005), though low temperatures may extend this period; Dye (1950) observed a pupation period lasting 63 days outdoors at 11°C and 83% RH.

Adults live for 1-2 months, are generally active at night, and feed on pollen and nectar (Dye, 1950; Clearwater, 1981; Wang *et al.*, 1998; EPPO, 2013). In most parts of New Zealand, the lifecycle of *O. hirta* is 2 years, but given that the larval period can be completed within 150-300 days at 23°C in the lab, the lifecycle may be as little as one year in warmer climes (Wang *et al.*, 2002; EPPO, 2014). Equally, the lifecycle may be extended beyond 2 years in colder climes (EPPO, 2014).

Action to prevent outbreaks

Oemona hirta is an IAI EU listed pest. It is also an A1 listed pest for the EPPO region and is therefore recommended for regulation by EPPO member countries.

Prohibitions

These refer to hosts where frequent damage has been reported.

In annex III of the EU Directive 2000/29/EC, the following hosts of *O. hirta* are prohibited from entry into member states:

- Plants of *Abies* Mill., *Chamaecyparis* Spach., and *Pinus* L., other than fruit and seeds, from non-European countries (Part A, article 1)
- Plants of *Castanea* Mill., and *Quercus* L., with leaves, other than fruit and seeds, from non-European countries (Part A, article 2)
- Plants of *Populus* L., with leaves, other than fruit and seeds, from North American countries (Part A, article 3)
- Isolated bark of *Castanea* Mill., from third countries (Part A, article 5)

- Isolated bark of *Quercus* L., other than *Quercus suber* L., from North American countries (Part A, article 6)
- Isolated bark of *Acer saccharum* Marsh., from North American countries (Part A, article 7)
- Isolated bark of *Populus* L., from countries of the American continent (Part A, article 8)
- Plants of *Chaenomeles* Lindl., *Crataegus* L., *Malus* Mill., *Prunus* L., *Pyrus* L. and *Rosa* L., intended for planting, other than dormant plants free from leaves, flowers and fruit, from non-European countries (Part A, article 9)
- Plants of *Photinia* Lindl., intended for planting, other than dormant plants free from leaves, flowers and fruit, from USA, China, Japan, the Republic of Korea and Democratic People's Republic of Korea (Part A, article 9.1)
- Plants of stolon- or tuber-forming species of *Solanum* L. or their hybrids, intended for planting, other than those tubers of *Solanum tuberosum* L. as specified under Annex III A (10), from third countries (Part A, article 11)
- Plants of Solanaceae intended for planting, other than seeds and those items covered by Annex III A (10), (11) or (12), from third countries, other than European and Mediterranean countries (Part A, article 13).
- Plants of *Vitis* L., other than fruits, from third countries (Part A, article 15)
- Plants of *Citrus* L., and their hybrids, other than fruit and seeds, from third countries (Part A, article 16)
- Plants of *Phoenix* spp., other than fruit and seeds, from Algeria and Morocco (Part A, article 17)
- Plants of *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, intended for planting, other than seeds, without prejudice to the prohibitions applicable to the plants listed in Annex III A (9), where appropriate, non-European countries, other than Mediterranean countries, Australia, New Zealand, Canada, and the continental states of the USA (Part A, article 18)

Wood requirements

In annex IV of EU Directive 2009/29/EC, the wood of host plants of *O. hirta* not originating in the community require the following:

- Wood of *Acer saccharum* Marsh., including wood which has not kept its natural round surface, originating in Canada and the USA, other than:
 - Wood intended for the production of veneer

- Chips, particles, sawdust, shavings, wood waste and scrap,
- Wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignment and which meets the same Union phytosanitary requirements as the wood in the consignment

shall have evidence of a mark 'Kiln-dried', or 'KD' or another internationally recognised mark, put on the wood or on its packaging in accordance with current usage, that it has an official statement that the wood has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule (Part A, Section I, article 2.1)

- Wood of *Quercus* L., including wood which has not kept its natural round surface, originating in the USA, other than in the form of:
 - Chips, particles, sawdust, shavings, wood waste and scrap
 - Casks, barrels, vats, tubs and other coopers' products and parts thereof, of wood, including staves where there is documented evidence that the wood has been produced or manufactured using heat treatment to achieve a minimum temperature of 176°C for 20 minutes
 - Wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignment and which meets the same Union phytosanitary requirements as the wood in the consignment

Shall have an official statement that the wood:

- is squared so as to remove entirely the rounded surface, or
 - is bark-free and the water content is less than 20% expressed as a percentage of the dry matter, or
 - is bark-free and has been disinfected by an appropriate hot-air or hot water treatment, or
 - in the case of sawn wood with or without residual bark attached, there shall be evidence by a mark 'Kiln-dried', 'KD' or another internationally recognised mark, put on the wood or on its packaging in accordance with current usage, that it has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule (Part A, Section I, article 3)
- Wood of *Platanus* L., including wood which has not kept its natural round surface, originating in Armenia, Switzerland or the USA, other than in the form of:
 - Chips, particles, sawdust, shavings, wood waste and scrap

- Wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignment and which meets the same Union phytosanitary requirements as the wood in the consignment

shall have evidence of a mark 'Kiln-dried', 'KD' or another internationally recognised mark, put on the wood or on its packaging in accordance with current usage, and that it has an official statement that the wood has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule (Part A, Section I, article 5)

- Wood of *Populus* L., including wood which has not kept its natural round surface, originating in countries of the American continent, except in the form of:
 - Chips, particles, sawdust, shavings, wood waste and scrap
 - Wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignment and which meets the same Union phytosanitary requirements as the wood in the consignment

shall have an official statement that the wood is bark-free or has evidence of a mark 'Kiln-dried', 'KD' or another internationally recognised mark, put on the wood or on its packaging in accordance with current usage, and that it has an official statement that the wood has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule (Part A, Section I, article 6)

- Whether or not listed among the CN codes in Annex V, Part B, wood in the form of chips, particles, sawdust, shavings, wood waste and scrap and obtained in whole or in part from *Acer saccharum* Marsh., originating in the USA and Canada, and *Populus* L., originating in the American continent, must have an official statement that the wood:
 - Has been produced from debarked round wood, or
 - Has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule, or
 - Has undergone an appropriate fumigation treatment, or
 - Has undergone an appropriate heat treatment to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including at its core) (Part A, Section I, article 7.1.1)
- Whether or not listed among the CN codes in Annex V, Part B, wood in the form of chips, particles, sawdust, shavings, wood waste and scrap and obtained in whole or in part from

Platanus L., originating in Armenia, Switzerland or the USA, and *Quercus*, originating in the USA, must have an official statement that the wood:

- Has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter achieved through an appropriate time/temperature schedule, or
- Has undergone an appropriate fumigation treatment, or
- Has undergone an appropriate heat treatment to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including at its core) (Part A, Section I, article 7.1.2, 7.2)

Plant requirements

In annex IV of EU Directive 2009/29/EC, trees and shrubs, intended for planting, other than seeds and plants in tissue culture, originating in third countries other than European and Mediterranean countries, must have an official statement that the plants:

- Are clean (i.e. free from plant debris) and free from flowers and fruits
- Have been grown in nurseries
- Have been inspected at appropriate times and prior to export and found free from symptoms of harmful bacteria, viruses and virus-like organisms, and either found free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to eliminate such organisms (Part A, article 39)

Inspections

In annex V of the EU Directive 2000/29/EC, a plant health inspection is required in the country of origin or the consignor country before being permitted to enter the community for the following hosts of *O. hirta*:

Plants, plant products and other objects originating in the community of relevance to the entire Community and which must be accompanied by a plant passport

- Plants, intended for planting other than seeds, of the genera *Chaenomeles* Lindl., *Crataegus* L., *Eriobotrya* Lindl., *Malus* Mill., *Photinia davidiana* (Dcne.) Cardot, *Prunus* L., other than *Prunus laurocerasus* L. and *Prunus lusitanica* L., *Pyrus* L., and *Sorbus* L. (Part A I, article 1.1)
- Plants of stolon- or tuber-forming species of *Solanum* L. or their hybrids, intended for planting (Part A I, article 1.3)
- Plants of *Choisya* Kunth, *Casimiroa* La Llave, and *Vitis* L. (Part A I, article 1.4)
- Without prejudice to point 1.6 (in EU Directive), plants of *Citrus* L. and their hybrids, other than fruit and seeds (Part A I, article 1.5)

- Certain wood types of *Platanus* L., including wood which has not kept its natural round surface (Part A I, article 1.7)
- Plants intended for planting, other than seeds, of the genera *Abies* Mill., *Castanea* Mill., *Lupinus* L., *Pinus* L., *Platanus* L., *Populus* L., *Quercus* L., *Rubus* L., and *Ulmus* L., if they are plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separated from that of other products (Part A I, article 2.1)
- Plants of *Solanaceae*, other than those referred to in point 1.3, intended for planting, other than seeds (Part A I, article 2.2)
- Plants of *Persea* spp., rooted or with growing medium attached or associated (Part A I, article 2.3)
- Plants of *Palmae*, intended for planting, having a diameter of the stem at the base of over 5 cm and belonging to *Phoenix* L. (Part A I, article 2.4)

Plants, plant products and other objects originating in the Community, and of relevance for certain protected zones, and which must be accompanied by a plant passport valid for the appropriate zone when introduced into or moved within that zone

- Plants of *Abies* Mill. and *Pinus* L. (Part A II, article 1.1)
- Plants intended for planting, other than seeds, of *Platanus* L., *Populus* L., *Prunus* L. and *Quercus* spp., other than *Quercus suber*, and *Ulmus* L. (Part A II, article 1.2)
- Plants, other than fruit and seeds, of *Castanea* Mill., *Chaenomeles* Lindl., *Crataegus* L., *Eriobotrya* Lindl., *Eucalyptus* L'Hérit., *Malus* Mill., *Photinia Davidiana* (Dcne.) Cardot, *Pyrus* L., *Sorbus* L. and *Vitis* L. (Part A II, article 1.3)
- Plants of *Palmae*, intended for planting, having a diameter of the stem at the base of over 5 cm and belonging to *Phoenix* L. (Part A II, article 1.3.1)
- Certain wood types of conifers (Coniferales) and *Castanea* Mill., excluding wood which is bark-free, and *Platanus* L., including wood which has not kept its natural round surface (Part A II, article 1.10)
- Isolated bark of *Castanea* Mill. and conifers (Coniferales) (Part A II, article 1.11)
- Plants of *Ficus* L., *Hibiscus* L. and *Nerium oleander* L., intended for planting, other than seeds, if they are plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production,

other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separated from that of other products (Part A II, article 2.1)

Plants, plant products and other objects originating in territories, other than those territories referred to in Part A of relevance for the entire Community

- Plants, intended for planting (Part B I, article 1)
- Parts of plants, other than fruits and seeds, of:
 - *Castanea* Mill., *Phoenix* spp., *Populus* L., *Quercus* L.
 - Conifers (Coniferales)
 - *Acer saccharum* Marsh., originating in North American countries,
 - *Prunus* L., originating in non-European countries
 - Cut branches of *Betula* L., with or without foliage
 - Cut branches of *Fraxinus* L., *Juglans ailantifolia* Carr., *Ulmus davidiana* Planch., with or without foliage, originating in Canada, China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea, Russia, Taiwan and the USA
 - *Amyris* P. Browne and *Casimiroa* La Llave (Part B I, article 2)
- Parts of plants, other than fruits but including seeds, of *Choisya* Kunth (Part B I, article 2.1)
- Isolated bark of:
 - Conifers (Coniferales), originating in non-European countries
 - *Acer saccharum* Marsh., *Populus* L., and *Quercus* L. other than *Quercus suber* L.
 - *Fraxinus* L., *Juglans ailantifolia* Carr., *Ulmus davidiana* Planch., originating in Canada, China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea, Russia, Taiwan and the USA
 - *Betula* L., originating in Canada and the USA (Part B I, article 5)
- Certain wood types of:
 - *Quercus* L., including wood which has not kept its natural round surface, originating in the USA, except wood which meets the description referred to for CN code 4416 00 00 and where there is documented evidence that the wood has been processed or manufactured using a heat treatment to achieve a minimum temperature of 176°C for 20 minutes
 - *Platanus* L., including wood which has not kept its natural round surface, originating in countries of the American continent
 - Conifers (Coniferales), including wood which has not kept its natural round surface, originating in non-European countries, Kazakhstan, Russia and Turkey
 - *Populus* L., including wood which has not kept its natural round surface, originating in countries of the American continent
 - *Acer saccharum* Marsh., including wood which has not kept its natural surface, originating in Canada and the USA

- *Fraxinus* L., *Juglans ailantifolia* Carr. and *Ulmus davidiana* Planch., including wood which has not kept its natural round surface, originating in Canada, China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea, Russia, Taiwan and the USA
- *Betula* L., including wood which has not kept its natural round surface, originating in Canada and the USA
- *Crataegus* L., *Malus* Mill., *Prunus* L., *Pyrus* L. and *Sorbus* L., including wood which has not kept its natural round surface, except sawdust or shavings, originating in Canada or the USA (Part B I, article 6)

Plants, plant products and other objects originating in territories, other than those territories referred to in Part A of relevance for certain protected zones

- Parts of plants, other than fruit and seeds, of *Chaenomeles* Lindl., *Crataegus* L., *Eriobotrya* Lindl., *Malus* Mill., *Photinia davidiana* (Dcne.) Cardot, *Pyrus* L., and *Sorbus* L. (Part B II, article 4)
- Certain wood types of conifers (Coniferales), excluding wood which is bark-free originating in European third countries, and *Castanea* Mill., excluding wood which is bark-free (Part B II, article 7)
- Parts of plants of *Eucalyptus* l'Hérit (Part B II, article 8)
- Isolated bark of conifers (Coniferales) originating in European third countries (Part B II, article 9)

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Wood packaging material must be made of debarked wood and wood must be treated using one of the following:

- 1) Heat treatment using a conventional steam or dry kiln heat chamber, which must achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core)
- 2) Heat treatment using dielectric heating for wood not exceeding 20 cm⁴ when measured across the smallest dimension of the piece or the stack must achieve a minimum temperature of 60°C for 1 continuous minute throughout the entire profile of the wood (including its surface) and must be achieved within 30 minutes from the start of the treatment
- 3) Methyl bromide treatment for wood not exceeding 20 cm in cross-section at its smallest dimension must achieve a minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in the standard and must be achieved throughout the profile of the wood, including its core
- 4) Sulfuryl fluoride treatment for wood not exceeding 20 cm in cross-section at its smallest dimension and wood packaging material not exceeding 75% moisture content must achieve a minimum CT over 24 or 48 hours at the target temperature and final residual

concentration specified in the standard and must be achieved throughout the profile of the wood, including its core

A mark indicating that wood packaging material has been subjected to approved phytosanitary treatment in accordance with the standard comprises the following required components:

- The symbol
- A country code
- A producer/treatment provider code
- A treatment code using the appropriate abbreviation (HT for conventional steam or dry kiln heat chamber, DH for dielectric heating, MB for methyl bromide or SF for sulfuryl fluoride)

Notification schemes

Castanea, *Fraxinus*, *Pinus*, *Platanus*, *Prunus*, *Quercus* and *Ulmus* trees arriving from the EU must be notified to the PHSI prior to the intended date of introduction into England of the trees or within 5 days of their arrival. Apart from *Fraxinus*, which is prohibited, there is a requirement for 75% of notified consignments to be inspected. *Castanea* trees are inspected for *Cryphonectria parasitica* (chestnut blight) and *Dryocosmus kuriphilus* (oriental chestnut gall wasp), *Pinus* trees are inspected for *Dothistroma septosporum* (red band needle blight), *Thaumetopoea pityocampa* (pine processionary moth) and *Thaumetopoea pinivora* (Scandinavian northern pine processionary moth), *Platanus* trees are inspected for *Ceratocystis platani* (plane wilt), *Prunus* trees are inspected for *Xanthomonas arboricola pruni*, *Xylella fastidiosa*, *Anoplophora chinensis* (from EU MS with outbreaks), apricot chlorotic leafroll phytoplasma, plum pox virus, *Xylosandrus crassiusculus*, *Aromia bungii*, and *Platynota stultana*. *Quercus* trees are inspected for *Thaumetopoea processionea* (oak processionary moth) and *C. parasitica* (chestnut blight), and *Ulmus* trees are inspected for *Candidatus Phytoplasma ulmi* (elm yellows phytoplasma). While the trees are not inspected for *O. hirta* specifically, inspections for these other pests may pick up symptoms of *O. hirta*.

2. Detection and inspection methods

Morphology

Egg: Large (2-2.2 mm) (EPPO, 2013).

Larva: Reaches 25-40 mm in length and about 8 mm wide at maturity, is creamy white, and has dark brown/black mandibles (Hudson, 1934; Dumbleton, 1957; Clearwater, 1981; Ostojá-Starzewski *et al.*, 2010).

Pupa: Around 20-25 mm in size (EPPO, 2014).

Adult: Females are roughly 14-31 mm in length and are larger than males, with proportionately smaller antennae (Ostojá-Starzewski *et al.*, 2010). The body colour is red-brown to almost black, and the elytra are covered in fine yellow hairs (Ostojá-Starzewski *et al.*, 2010). A distinctive feature

is the transverse, parallel raised ridges on the dorsal surface of the thorax (Ostojá-Starzewski *et al.*, 2010).

Diagnosics

Larvae arriving from New Zealand can be examined with reference to Dumbleton (1957), but this only covers 20 species native to New Zealand, including *O. hirta*, but not other *Oemona* species, so *O. hirta* cannot be excluded from its sister taxa. Duffer (1963) provides a standalone description of *O. hirta* larva, but likewise does not refer to the other *Oemona* species. Therefore, any larvae must either be reared to adult stage or tested using DNA sequencing. The adult may be morphologically diagnosed using Lu and Wang (2005) and Ostojá-Starzewski *et al.* (2010). Three reliable sequences are available for *O. hirta*, but there are no sequences available for other *Oemona* species. However, the barcode region used will usually differentiate between species unless they hybridise or form species complexes.

Symptoms

Larvae bore galleries underneath the bark in the sapwood and heartwood of the tree, predominantly in twigs and branches, but sometimes in the trunk (EPPO, 2014). This feeding can lead to the wilting and death of twigs, and the collapse of branches in the wind. Larvae which bore around branches can also girdle them, leading to their death (Cottier, 1938).

As larvae feed, they produce frass, which may be seen around the ejection holes (EPPO, 2014). These ejection holes, measuring 1-3 mm, may also be able to be seen (EPPO, 2014) and are often produced at regular intervals giving an infested twig a flute-like appearance.

Surveillance

Visual inspection is the primary method for detecting infested trees. Because *O. hirta* has such a wide host range, and there are likely to be many hosts that are unrecorded, all woody plants should be surveyed, with particular focus on *Citrus* spp., *Diospyros kaki* (persimmon), *Vitis vinifera* (grapevine), *Malus* spp. (apple), *Populus* spp. (poplar) and *Ulex europaeus* (gorse). Symptoms to look out for include:

- Ejection holes (1-3 mm) and frass
- Dead or wilting twigs and/or branches
- Adults beetles

To confirm a tree is infested, destructive sampling is usually required, including the removal of the bark to reveal larvae and tunnelling, and cutting through the twigs and branches to reveal deeper galleries within the sapwood and heartwood.

4. Outbreak control measures

The nematode, *Steinernema feltiae*, has shown promising results against *O. hirta* as a biological control agent in studies by Clearwater and Wouts (1980) and Wouts and Clearwater (1980).

Wood chipping – to dimensions of no more than 15 mm in thickness and width (based on the size of pupae).

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