EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

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This PRA document was modified in 2021 to clarify the phytosanitary measures recommended

Report of a Pest risk management for *P. kernoviae* and *P. ramorum*

This summary presents the main features of a pest risk analysis - management which has been conducted on the pest, according to EPPO Decision support scheme for quarantine pests. A full PRA record is also available (EPPO (2013) *Pest risk management for Phytophthora kernoviae* and *Phytophthora ramorum*. EPPO, Paris. Available at http://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm).

Pests: ***Phytophthora kernoviae* and *Phytophthora ramorum***

PRA area: EPPO region

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STAGE 3: MANAGEMENT

Note: The measures recommended for *P. kernoviae* and *P. ramorum* are the same. Although it may occur that the justification for measure is based on information available for one of the two pathogens only, the EWG considered that their biology is sufficiently similar for the same measures to be recommended

Pathways considered during pest risk management for both pests

- Plants for planting (except seeds) of host plants
- Soil as a contaminant (e.g. on footwear, machinery, etc.)
- (Isolated) bark or wood chips of susceptible host plants, not intended for burning
- Round wood and sawn wood of susceptible host plants
- Natural spread
- Plants for planting (except seeds) of non-host plants
- Soil/growing medium (with organic matter) as a commodity
- Foliage or cut branches (for ornamental purposes) of foliar hosts

Note that the PRA prepared by the FP6 project RAPRA does not follow the same terminology for '*susceptible hosts*', '*host plants*' and '*foliar hosts*'. For the PRM report, these terms are explained below in individual pathways.

General comment on the host plants

Assessors considered that hosts presenting higher risks could be identified and that risk managers may consider focussing regulation on such higher risk plants. The characteristics of high risk plants are:

- High sporulators (first criteria and sufficient on its own to classify a plant on the high risk level)
- Highly susceptible
- High volume of trade

For *P. ramorum*, examples of higher risk genera includes: *Camelia, Rhododendron, Viburnum, Pieris, Larix, Vaccinium*.

For *P. kernoviae*, examples of higher risk genera includes: *Rhododendron, Vaccinium, Drimys, Quercus ilex, Magnolia, Michelia.*

1. Plants for planting (except seeds) of host plants

In addition to commercial movement of host plants, it was considered important that this pathway should include introduction of plants by private individuals.

Freedom of plants for planting from the pests can be achieved by specified growing conditions, area freedom, place of production freedom and crop freedom.

New consideration included in these recommendations compared to measures currently in place for *P. ramorum* in EPPO Countries regulating the pest.

The occurrence of infections in tall sporulating hosts (Larch) for *P. ramorum* needs to be taken into account in terms of spread capacity of the pest. Consequently the EWG decided to include a 'buffer zone' concept for *P. ramorum* and *P. kernoviae*. In particular infections on sporulating hosts close to places of production, especially infections on tall sporulating hosts, such as larch, were considered to justify additional phytosanitary measures compared to those already in place in some EPPO member countries.

Key evidence used to set an appropriate distance was provided by Webber (2010). Very high sporulation from an infected stand of larch (*Larix kaempferi*) resulted infection of beech, chestnut, hemlock, Douglas fir, Nothofagus, rhododendron, silver birch and Lawson's cypress within a distance of 100m. Although spore monitoring conducted during this study showed that inoculum could be detected at low levels at a distance of up to 1 km from the infected area the data show that infections only occurred within a distance of 100 metres.

For sporulating 'shrub' hosts (e.g. rhododendron), the weight of evidence is that the majority of plants become infected when situated within 10 m of an infected host, usually within 5 m. For this reason, a distance of 10 m was recommended for sporulating shrub hosts.

In summary, the recommended distances of the buffer zone are at least:

- 10 metres around host shrubs e.g. rhododendron
- 100 metres around host trees e.g. larch.

These distances should be adapted to local circumstances.

The Panel on Phytosanitary Measures considered that measures proposed for pest freedom of the crop, place of production or area will address most risks (see maximum distance of spread in 7.20) provided that suitable surveillance, monitoring and testing regimes are in place (see below for details on those measures).

Plants grown in specified conditions

Specified conditions are:

- there is no source of infection on the place of production or nearby,
- plants should be produced from non-infected initial plant material,
- the plants are grown in growing media free from the pathogen,
- stringent hygienic measures are taken to prevent introduction of the pathogens from other sources,
- plants are irrigated with water free from the pests.

Area freedom (ISPM 4)

Countries wishing to export host plants into the EPPO region on the basis of area freedom should have confirmed freedom by official surveys of host plants at places of production and the natural environment.

Verification of area freedom is achieved by visual inspections of host plants at places of production and in the natural environment carried out

during the growing season preferably after suitable conditions (e.g. rainy periods for plants grown outside) and laboratory testing of any suspicious plants. Testing of water courses is recommended for detecting *P. ramorum* in wider areas (the method has been used successfully for *P. ramorum* but evidence is limited for *P. kernoviae*).

Inspections can focus on plants such as rhododendron that are considered to act as good 'indicator' plants of the presence of *P. ramorum /kernoviae*. In forests, inspection should also focus on Larch.

Place of production freedom

Situation 1 (no infection in the buffer zone)

- Plants for planting arriving at the place of production are free from the pathogens.

and

- No infection is found on the place of production and within the buffer zone (see above)

Or

Situation 2 (infection detected in the buffer zone)

- Plants for planting arriving at the place of production are free from the pathogens.

and

- No infection is found on the place of production.
- In the case of an infection of a host plant in the buffer zone (unless there is evidence that the plant does not sporulate)[1]:
    - Elimination of the infested host plant(s) and any other adjacent hosts plants unless there is evidence that they do not sporulate,
      and
    - Establishment of a demarcated area consisting of at least the area within 10 meters from the infected plant(s) (or 100 metres in case of a tall hosts)
      and
    - Host plants on the place of production in the demarcated area should be held for 3 months of active growth after the time of destruction of the infested host plant(s) and inspected twice before release. Laboratory testing of any suspicious plants should be carried out. Inspection of other host plants on the same place of production should be performed as well. Baiting on water, root ball/growing media on the premises is recommended.
      and
    - Hosts plants in the demarcated area should not have received any treatment with anti-Phytophthora fungicides during this period.

Additional measures recommended for implementation by growers as part of good production practices include:

- Retention of host plants coming from outside the nursery in an isolated area under conditions suitable for symptom expression for 6 weeks (e.g. high humidity, no fungicide treatments)
- Ensure irrigation water is pest free

[1] *Note:* known sporulating hosts include
For *P. ramorum*: *Camellia* sp., *Larix* sp., *Pieris* sp., *Rhododendron* sp., *Vaccinium* sp., *Viburnum* sp.
For *P. kernoviae: Drimys* sp., *Magnolia* sp., *Michelia* sp., *Quercus ilex, Rhododendron* sp., *Vaccinium* sp.

- Implementation of hygienic measures
- Implementation of safe disposal of waste
- Implementation of proper drainage

Verification of pest freedom of a place of production freedom is achieved by:

- Visual inspections of host plants in the place of production and the buffer zone carried out during the growing season preferably after suitable conditions (e.g. rainy periods for plants grown outside) and laboratory testing of any suspicious plants.
    - In the place of production, at least two inspections should be carried out for high risk hosts and at least one inspection on the other hosts.
    - In the buffer zone at least one inspection should be carried out on the high-risk hosts.

Some additional verification measures can be implemented such as:

- Testing of irrigation and drain water
- Testing of root balls and substrates

Pest freedom of the crop

Crop here should be interpreted as the plants produced on the place of production and intended to form the consignment to be certified.
This option also requires that a buffer zone is established around the place of production. The exact limit of the buffer zone should be evaluated by the NPPO based on factors such as the height of the sporulating host plants, the sporulation potential on these hosts and the vegetation in the vicinity of the place of production. Recommended distances are 10 metres for shrubs and up to 100 metres in case of presence of tall sporulating hosts such as mature Larch. These distances will depend on local circumstances.

Pest freedom of the plants for planting can be guaranteed when:

- The plants have been produced in a pest free place of production (see place of production freedom)

Or

- Plants for planting arriving on the place of production are free from the pathogens.

and

- In case of an infection on other plants within the place of production the following measures should be implemented:

Plants grown in container
Infected plants, other plants[2], associated growing media and plant debris within a 2-m radius (this should be increased for tall trees) should be destroyed. Disinfection measures should be taken on the container standing area. Containers should either be destroyed or sterilized.

Field grown plants
Infected plants, other plants, soil attached to roots and plant debris within a 2-m radius (this should be increased for tall trees) should be destroyed. No host plants should be grown in the soil for a period of at least four years. Alternatively soil can be removed to a depth of 0.5

[2] The EWG recommends that non-host plants should be destroyed in a 2 metre radius as well because the growing media could be infected by the pathogens. Alternatively the growing media can be removed and destroyed.

metre[3]. It should be disposed of safely or sterilized or covered with a water proof barrier to prevent re-infection. These measures are supported by studies conducted in UK (Turner *et al*., 2008) and Belgium (Vercauteren *et al.* 2012) which have shown that the pest is able to survive outside for at least 28 and 33 months on different types of substrate (UK and Belgium study respectively). In California *P. ramorum* could be detected at depths down to the hard pan ranging from 15 to 45 cm (Yakabe & MacDonald, 2010).

All host plants within a 10 m radius of the infected plants (to be increased in the case of tall plants) plus any remaining plants from the same lot as the diseased plants should be held for further assessment. Release of these plants is allowed following two negative visual inspections during 3 months of active growth and no treatment that could suppress symptoms should be applied during the quarantine period for all susceptible plants under quarantine. During that period, plants should preferably remain *in situ* but in exceptional situations where there is a high risk of spread the NPPO may authorise their transfer under official control to another area. If an infection is found in the new area, all plants moved may need to be destroyed unless traceability on initial order of the plants is ensured.

Note that when an infection is also detected in the buffer zone (as defined above) the measures as described in the section pest free place of production apply in addition to those implemented at the place of production.

Trace back and trace forward of associated plant material is critical.
Additional measures strongly recommended when the source of an infection has not been identified.
Investigation should be conducted in the nursery by drain water and root ball baiting tests.
Inspection of the entire place of production including all host plants.

Verification of pest freedom of the plants is achieved by:

- Visual inspections of host plants in the place of production and the buffer zone carried out during the growing season preferably after suitable conditions (e.g. rainy periods for plants grown outside) and laboratory testing of any suspicious plants.
    - In the place of production, at least two inspections should be carried out for high risk hosts and at least one inspection on the other hosts.
    - In the buffer zone at least one inspection should be carried out on the high risk hosts.

Some additional verification measures can be implemented such as:

- Testing of irrigation and drain water
- Testing of root balls and substrates

Comment

Phytosanitary measures are already in place in some EPPO Member countries for the movement of plants for planting that are hosts of *P. ramorum.* However, a new concept of “buffer zone” is introduced in the measures recommended in this document. Restrictions of movement of plants for planting are imposed for host plants located within a 10 m radius of the infected plants (including situation where the infected plant is situated outside of the place of production). This buffer zone is

[3] This depth is recommended in the Practical Guide for the Nursery Stock and Garden Centre Industry, DEFRA 2005

	increased to a 100 m radius for situations where a tall sporulating host is found infected. The new concept of a buffer zone and the increased distance for tall sporulating hosts is likely to have an impact on the nursery trade within the EPPO region.
Post-entry quarantine (in the framework of a bilateral agreement)	Based on visual detection of suspicious symptoms on host plants and laboratory testing. Post-entry quarantine would allow time for the development of symptoms in asymptomatic material as the incubation period is relatively short (symptoms can develop within 2 weeks if the conditions are conducive; for treated plants, six weeks is recommended). However, there is a possibility that not all latent infection will result in symptom development within such period. Root ball testing is then advised. An option could be to prolong the post-entry quarantine and require systematic testing of root ball. It should be noted that keeping the plants apart from other plants on the nursery is a good plant production practice that should be implemented by importers.

2. Soil as a contaminant (e.g. on footwear, machinery etc.)

Measures were considered justified on this pathway because of the weight of scientific evidence confirming that the pests are found in soil on shoes and machinery.

In areas where the pest is present, recommended measures include:

- Cleaning or disinfection of footwear, vehicles (incl. bikes) and machinery leaving an infected area and
- Public awareness campaigns on these requirements (including at airports and ports).

3. (Isolated) bark or wood chips of susceptible host plants, not intended for burning

Measures apply to susceptible hosts, i.e. those on which cankers develop (see Table 1 (*P. ramorum*) and Table 2 (*P. kernoviae*) in the PRM record).

Area freedom (ISPM 4)	Countries wishing to export (isolated) bark or wood chips of susceptible host plants not intended for burning into the EPPO region on the basis of area freedom should have confirmed freedom by official surveys of host plants at places of production and the natural environment. Verification of area freedom is achieved by visual inspections of host plants at places of production and in the natural environment carried out during the growing season preferably after suitable conditions (e.g. rainy periods for plants grown outside) and laboratory testing of any suspicious plants. Testing of water courses is recommended for detecting *P. ramorum* in wider areas (the method has been used successfully for *P. ramorum* but evidence is limited for *P. kernoviae*). Inspections can focus on plants such as rhododendron that are considered to act as good 'indicator' plants of the presence of *P. ramorum /kernoviae*. In forests, inspection should also focus on larch.
Treatment	Composting OR Heat treatment for 1-hour at 55°C

4. Round wood and sawn wood of susceptible host plants

The EWG considered that this pathway presents a lower risk than bark because of the intended use. Risk would mainly arise if the logs are stored outside and in humid conditions.
Measures apply to susceptible hosts, i.e. those on which cankers develop (see Table 1 (*P. ramorum*) and Table 2 (*P. kernoviae*) in the PRM record).

Area freedom (ISPM 4)

Countries wishing to export round wood or sawn wood of susceptible host plants on the basis of area freedom should have confirmed freedom by official surveys of host plants at places of production and the natural environment.

Verification of area freedom is achieved by visual inspections of host plants at places of production and in the natural environment carried out during the growing season preferably after suitable conditions (e.g. rainy periods for plants grown outside) and laboratory testing of any suspicious plants. Testing of water courses is recommended for detecting *P. ramorum* in wider areas (the method has been used successfully for *P. ramorum* but evidence is limited for *P. kernoviae*).

Inspections can focus on plants such as rhododendron that are considered to act as good 'indicator' plants of the presence of *P. ramorum /kernoviae*. In forests, inspection should also focus on Larch.

Treatment

Treatment of the consignment (55°C for one hour extrapolated from data on wood chips)
OR
Removal of 3 cm of outer sapwood

5. Natural spread

Natural spread by air, water or animal vectors is currently not a major pathway for introduction of the pathogen into the PRA area and movement between EPPO countries. Natural spread has occurred locally from larch, rhododendron and vaccinium.

Measures to mitigate against natural spread were developed and are presented in Appendix 3 of the PRA record.

6. Plants for planting (except seeds) of non-host plants

The risk presented by the entry of non-host plants was considered to be low. The risk is linked to the presence of infested growing media attached to non-host plants or the presence of plant debris on growing media.

Based on the measures identified for host plants, measures to be recommended for non-host plants for planting are the following:

Plants for planting of non-host plants should either:

- originate from an area free from *P. ramorum* or *P. kernoviae* (see pathway 1) or
- originate from a place of production or a crop free from the pests (see pathway 1) or
- be free from growing media or
- be grown in specified conditions (e.g. isolation from host plants, use of growing media and water free from the pests, adoption of growing practices and hygiene measures to reduce the risk of contamination).

7. Soil/growing medium (with organic matter) as a commodity

Phytosanitary measures were considered to be justified on this pathway because of scientific evidence confirming that the pests are found in soil.

It was recommended that soil/ growing medium as a commodity should originate either from an area free from the pests or from a place of production free from *P. ramorum* or *P. kernoviae* (see pathway 1) or be treated by heat or chemicals.

8. Foliage or cut branches (for ornamental purposes) of foliar hosts

Measures apply to foliar hosts, i.e. those on which leaf symptoms develop (see Appendix 1 in the PRM record).

The level of risk of establishment from *P. ramorum* and *P. kernoviae* arising from these commodities was considered to be low, and it was concluded that regulation of this pathway may not be justified and does not seem proportionate to the risk. It was also recognised that measures are difficult to implement in practice.
However, it was recognised that host foliage is moving within and between EPPO countries. Therefore, national measures prohibiting harvest of host foliage from infested places should be established as part of measures to prevent spread from an outbreak.
The PRM record does not recommend measures on this pathway at import.

Surveillance and eradication in the PRA area

Imports

To prevent the introduction of *P. ramorum* lineages not already present in the EPPO region (NA1, NA2 and unknowns) and the further introduction of isolates of the EU1 lineage or of *P kernoviae*, EPPO countries should inspect all plants for planting (particularly trees and shrubs) imported from countries where *P. ramorum/P. kernoviae* are known to occur, followed by destruction and safe disposal of any plants found to be infected.

Places of production

Continued surveillance and eradication/containment measures on nurseries within the EPPO region would also continue to reduce further establishment and spread of the pathogen throughout the region with trade in plants for planting and should be established.

Semi-natural or natural environments

Surveillance of semi-natural or natural environments to detect outbreaks and appropriate eradication/containment measures would also reduce further establishment and spread to new areas within the EPPO region, as well as minimizing impacts in those areas where the pathogen has established.

Recognition was given that this is resource intensive and eradication in such environments has proven extremely difficult if not impossible.

Measures that can be implemented to eradicate or contain the pests were developed and are presented in Appendix 3 of the PRM record.

OVERALL CONCLUSIONS

The pest is considered to present a risk and pest risk management should be implemented.

CONCLUSION:
Recommendation for possible measures for the endangered area:

Plants for planting (except seeds) of host plants	Plants grown in specified conditions (detailed above) or Pest-free area (ISPM 4) or Pest-free place of production (two situations described in the text above: infections or no infection in the buffer zone) or Pest freedom of the crop or Post-entry quarantine (in the framework of a bilateral agreement)
Soil as a contaminant (e.g. on footwear, machinery etc.)	In areas where the pest is present, recommended measures include: • Cleaning or disinfection of footwear, vehicles (incl. bikes) and machinery leaving an infected area and • Public awareness campaigns on these requirements (including at airports and ports).
(Isolated) bark or wood chips of susceptible host plants, not intended for burning	Pest-free area (ISPM 4) or Composting or Heat treatment for 1-hour at 55°C
Round wood and sawn wood of susceptible host plants	Pest-free area (ISPM 4) or Treatment of the consignment (55°C for one hour extrapolated from data on wood chips) or Removal of 3 cm of outer sapwood
Plants for planting (except seeds) of non-host plants	Pest-free area (ISPM 4) or Pest-free place of production or Pest freedom of the crop or Free from growing media or Grown in specified conditions (see details above)
Soil/growing medium (with organic matter) as a commodity	Pest-free area or Pest free place of production or Treatment (heat or chemicals)

* For foliage or cut branches (for ornamental purposes) of foliar hosts, no phytosanitary measures are recommended. However national measures prohibiting harvest of host foliage from infested places should be established as part of measures to prevent spread from an outbreak.