



Summary of the EPPO (European and Mediterranean Plant Protection Organisation) PRA on *Heterobasidion irregulare* (Fungi: Bondarzewiaceae) and its implications for Great Britain in preparation for new GB legislation



Fig 1. Fruiting bodies of *Heterobasidion irregulare* © Angelo Mazzaglia (University of Studies of Tuscia, Viterbo)



Fig 2. Symptoms of *Heterobasidion irregulare*, © Valerio Lucchesi (EPPO)

Background

Heterobasidion irregulare is a pathogenic fungus that causes root and butt rot on its host plants, mainly attacking important hosts from the Pinaceae (pine) and Cupressaceae (cypress) families, resulting in extensive tree mortality and a significant change in forest structure. *Heterobasidion irregulare* was initially found in the Americas (best documented in the USA, Canada, and Mexico, as well as reported in Cuba and the Dominican Republic) but has since spread to Italy on infected wood material during World War II.

This fungal pathogen was described as a new species belonging to the *Heterobasidion annosum* complex; the complex consists of five species that share similar morphology, biology and lifecycle. The *H. annosum* complex causes one of the most damaging diseases of conifers in the world, with annual losses valued at around €800 million in Europe. In addition, *H. irregulare* has advantageous traits, such as high infectivity and high production of spores. *Heterobasidion irregulare* was added to the EPPO Alert List in 2013 and moved to the EPPO A2 list in 2015.

Heterobasidion irregulare causes initial infection in recently cut stumps, stem wounds or roots via airborne spores. The fungus can then spread tree-to-tree in the form of mycelium through root contact or grafts. Mycelium may survive for many years in the infested tree. The impact of this disease can cause high tree mortality, resulting in a significant change in forest structure, release of CO₂ and the recreational value of sites, or reduced productivity and loss of fruit. Given that pine trees are widely planted across the EPPO region, the PRA concluded that *H. irregulare* has the potential to establish throughout the EPPO region.

The EPPO PRA for this fungus (September 2015) concluded that this pest poses a **high** risk (with **moderate** uncertainty) to the EPPO region.

A link to the EPPO PRA can be found at the following webpages:

[Heterobasidion irregulare \(HETEIR\)\[Documents\]\] EPPO Global Database](#)

A summary of the main findings of the EPPO PRA and their significance to Great Britain are given below.

Crop/sector considered most at risk in Great Britain

This fungus has a wide range of coniferous hosts. The main hosts of *H. irregulare* are in the pine and cypress families, including the *Pinus* (pine) and *Juniperus* (juniper) genera. *Heterobasidion irregulare* is more commonly associated with certain hosts, depending on its current distribution (North America or Italy). It is key to note that the confirmed coniferous hosts include *Picea sitchensis* (Sitka spruce), *P. abies* (Norway spruce), the native *Pinus sylvestris* (Scots pine), and *Pseudotsuga menziesii* (Douglas fir) which are all major forestry species in Great Britain. The EPPO PRA notes that while there is some uncertainty on what European species would be affected by this pathogen, it is reasonable to assume that all *Pinus* and *Juniperus* species in the EPPO region may be attacked.

Heterobasidion irregulare also has several deciduous non-conifer hosts, including *Quercus* (oak) and *Prunus* (genus that includes plums, cherries, peaches etc.). The full list of confirmed hosts is provided in Annex 1 of the EPPO PRA.

Summary and conclusions of the EPPO PRA

Risk of entry

Overall, the EPPO PRA concludes that there is a **moderate** likelihood of this fungus entering the EPPO region from countries where it occurs (with **moderate** uncertainty).

The likelihood of entry on each pathway was given a probability and uncertainty score:

Pathway from countries where <i>Heterobasidion irregulare</i> occurs	Probability	Uncertainty
Natural spread	Moderate/high, although slow	Moderate
Untreated wood packaging material	Moderate	Moderate
Wood of conifer hosts (except particle wood, waste wood and wood packaging material)		
From Italy	Moderate/low	High
More commonly associated with pest and from North America	Moderate/low	Moderate
Less commonly associated with pest and from North America	Low/very low	Moderate
Particle wood and waste wood (not agglomerated) of conifer hosts	Moderate/low	Moderate
Plants for planting (except seeds) of hosts	Low	High

Bark of conifer hosts	Low	High
Host Christmas trees	Low/very low	Moderate
Wood of <i>Quercus</i> , <i>Prunus serotina</i> , <i>Arbutus menziesii</i> , <i>Arctostaphylos</i> spp.	Low/very low	High
Particle wood and waste wood (not agglomerated) of deciduous non-conifer hosts	Very low	Moderate
Bark of deciduous non-conifer host species	Very low	Low
Wood packaging material treated by ISPM 15	Very low	Low
Agglomerate particle wood and waste wood of hosts	Very low	Low

Significance to GB: Significant volumes of coniferous wood are imported to the UK from North America (Canada and the USA) where the pest originated and where relevant phytosanitary measures already apply to all coniferous wood and bark. Imports of conifer wood from Italy are regulated only where bark is present on or with the wood. The average imports are provided below¹.

¹ Overseas trade data table spanning 2019 – 2023. His Majesty's Revenue and Customs. Available at: <https://www.uktradeinfo.com/trade-data/ots-custom-table/> (accessed 10 May 2024).

Region of origin	Imported Commodity (average tonnes per year)			
	Solid conifer fuelwood	Conifer wood in the rough	Sawn pine	Sawn fir and spruce
Italy	26	8.8	176	483
North America	453	25.5	6760	1291

The EPPO PRA estimates the trade of host plants for planting to be small. Many host plants, including Christmas trees and cut branches, of *H. irregulare* are currently prohibited from being imported into Great Britain from certain countries, including the North and Central American countries where this fungus is known to be present².

Within the current phytosanitary regulations³, all plants for planting, and a specific range of wood commodities require a phytosanitary certificate and must meet specific phytosanitary requirements to be imported into Great Britain, and as such may be subject to inspection. Defra would like to further reduce the risk of *H. irregulare* entering Great Britain on infested host commodities. Specific measures are proposed that address this risk.

Risk of establishment and spread

According to the EPPO PRA, the climate throughout the EPPO region is expected to be appropriate to *H. irregulare*. Multiple climate types present in the current distribution of *H. irregulare* are also found in the EPPO region. In addition, host plants occur throughout the EPPO region. The EPPO PRA therefore concludes that this fungus has the potential to establish throughout the EPPO region where pine trees occur. It rates the likelihood of establishment outdoors as **high** (with a **low** rating of uncertainty). A rating was not

² Plants of *Abies*, *Juniperus*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga*, and *Quercus* are all currently prohibited from being introduced into Great Britain from any third country outside the Euro-Mediterranean region. Plants for planting of *Prunus* are prohibited from being introduced into Great Britain from any third country.

³ [Commission Implementing Regulation \(EU\) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation \(EU\) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation \(EC\) No 690/2008 and amending Commission Implementing Regulation \(EU\) 2018/2019 \(legislation.gov.uk\)](#)

provided for the likelihood of establishment in protected areas, as host species are typically grown in open nurseries rather than protected conditions.

Heterobasidion irregulare spreads naturally by airborne spores or tree-to-tree in the form of mycelium. The rate of spread by mycelium in Italy is estimated to be 40 cm per year. Spores are more successful at long distance dispersal although the majority (99%) deposit within 100 m. In Italy, the overall rate of spread is estimated to be 1.3 km per year, though this is in an area of low host density. This rate of spread is expected to increase 10-20 km per year when the pest reaches areas with a high host population. Even so, natural spread to another EPPO country is estimated to take at least a decade.

The EPPO PRA concludes that it is likely that human-assisted spread of this pest (via the trade or movement of infested goods) will occur first before natural spread. After all, *H. irregulare* was introduced into Italy via the movement of infested wood packaging material. The magnitude of pest spread for this fungus was rated **moderate** (with **low** uncertainty).

Significance to GB: The EPPO PRA reports that the climate would be appropriate to *H. irregulare* throughout the EPPO region, including the UK. *Heterobasidion annosum*, a member of the same species complex as *H. irregulare* and that shares similar biology, is present in Great Britain so it is likely that the temperature and humidity are also suitable for *H. irregulare*. In addition, host species are present in the wild of Great Britain, in urban areas (such as gardens, parks and streets) and in cultivated areas such as nurseries, orchards and forest plantations, that would aid establishment and spread. To conclude, the rating given for the whole EPPO region on the establishment and spread of this pest should also apply to Great Britain.

Economic, environmental and social impact

The *H. annosum* complex causes one of the most damaging diseases of conifers in the world, with annual losses valued at around €800 million in Europe. *Heterobasidion irregulare* specifically can cause high tree mortality and reduced tree growth in affected areas. This fungus has also been reported to cause a significant change in forest structure and release of CO₂ from decaying wood, and the loss in vegetation then impacts the recreational value of sites. Infested trees can be a significant hazard, resulting in building damage, closure of recreational sites and even deaths, caused by falling trees. The EPPO PRA concludes that the overall impact of *H. irregulare* to its current area of distribution is **high** (with a **low** uncertainty).

The potential magnitude of impact in the EPPO region is expected to be largely similar. All pine trees of the EPPO region may be at risk of this pest and, as such, damage could be

substantial, adding to the existing damage caused by *H. annosum*. Pine nut production may also be impacted. Eradication is only considered possible in very limited circumstances.

Significance to GB: The forestry industry in GB would also be at risk from this pest, including 208 thousand hectares of Scots pine, 668 thousand hectares of Sitka spruce, 57 thousand hectares of Norway spruce and 46 thousand hectares of Douglas fir, as quantified in 2021, and 219 thousand hectares of oak, as quantified in 2012 (Forestry Statistics 2023⁴). Therefore, there could be a substantial economic impact on growers if this pest established in Great Britain.

Many of the host species are present in the wild of Great Britain, such as native species of oak or pine. Some species, such as Douglas fir, have been introduced and growing in the UK for hundreds of years and, over time, have acquired ecological roles. Certain host plants are also grown in UK gardens, parks and streets. The introduction of *H. irregulare* could cause significant social or environmental damage.

Risk management recommendations

The following is a summarised version of the EPPO Panel on Phytosanitary Measures recommendations for the higher risk pathways. See Section 16.1 of the EPPO PRA for the recommended measures in more detail, and Section 8 for the assessed pathways of pest entry. The EPPO Panel recommended that:

(1) Wood packaging material should:

meet ISPM 15 requirements.

(2) Round wood and sawn wood of conifer hosts should:

come from a Pest Free Area.

Or

be subject to a heat treatment.

⁴ [Ch1_Woodland.pdf \(forestresearch.gov.uk\)](#)

(3) Particle wood and waste wood (not agglomerated) of conifer hosts should:

come from a Pest Free Area.

Or

be subject to a heat treatment.

(4) Bark of conifer hosts (if measures are needed) should:

come from a Pest Free Area.

Or

be subject to a heat treatment.

(5) Host plants for planting (except seeds) should:

come from a Pest Free Area,

Or

Grown under complete physical protection and transported in conditions preventing infestation.

Or

be subject to a systems approach (recommending that the imported plants are younger than 5 years, grown in pots in sterilised substrate and a certain distance from the closest infestation, intensive monitoring etc.)

(6) Christmas trees of hosts (if measures are needed) should:

come from a Pest Free Area,

Or

Grown under complete physical protection and transported in conditions preventing infestation.

Or

be subject to a systems approach (recommending that the imported plants are younger than 5 years, grown in pots in sterilised substrate and a certain distance from the closest infestation, intensive monitoring etc.)

(7) Wood of deciduous non-conifer hosts (*Quercus*, *Prunus serotina*, *Arbutus menziesii*, *Arctostaphylos* spp.) (if measures are needed) should:

come from a Pest Free Area.

Or

be subject to a heat treatment.

Significance to GB: Within the current phytosanitary regulations², all plants for planting, and a specific range of wood commodities require a phytosanitary certificate and must meet specific phytosanitary requirements to be imported into Great Britain, and as such may be subject to inspection. Wood packaging material must meet ISPM 15 requirements to enter Great Britain. Defra would like to further reduce the risk of host commodities infested by *Heterobasidion irregulare* entering Great Britain. Using the EPPO PRA recommendations, new GB regulations will be drafted with the aim of further mitigating the risk of introducing this pest.

This summary of the EPPO PRA has been undertaken taking into account the environmental principles laid out in the Environment Act 2021. Of particular relevance are:

The prevention principle, which means that any policy on action taken, or not taken should aim to prevent environmental harm.

The precautionary principle, which assists the decision-making process where there is a lack of scientific certainty.