



The Food & Environment Research Agency

Rapid Pest Risk Analysis for

Melampsoridium hiratsukanum

This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist Risk Managers decide on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.

STAGE 1: INITIATION

1. What is the name of the pest?

Melampsoridium hiratsukanum S.Ito ex Hirata.

Common name: alder rust

Taxonomic note

Three fungi cause foliar rust on alders worldwide: *Melampsoridium alni*, *M. betulinum* and *M. hiratsukanum*. These three species are morphologically similar making accurate identification to species difficult and this has led to much confusion and therefore doubt about the authenticity of many older records. The taxonomy has been investigated using DNA analysis (ITS sequencing) confirming the presence of three species and aiding accurate identification to species since the late 1990s (Kurkela *et al.*, 1999).

2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC¹) and in the lists of EPPO²?

The pest is not listed in the EC Plant Health Directive and is not recommended for regulation as a quarantine pest by EPPO, nor is it on the EPPO Alert List.

3. What is the reason for the rapid assessment?

In the mid-1990s, an epidemic of foliar rust on alders (*Alnus glutinosa* and *A. incana*) was reported in Estonia and Finland (Kurkela *et al.*, 1999). The cause was identified as *Melampsoridium hiratsukanum* and not *M. betulinum* that had caused the previous epidemic on European alder in the 1970s. Following these initial outbreaks of *M. hiratsukanum* it has been reported in many other European countries. It was confirmed for the first time in the UK (Wales) in October 2009 (Hantula *et al.*, 2012). A rapid pest risk analysis was requested as part of a review of Forestry pests to assess the risk posed to the UK.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?

There are numerous records of *M. hiratsukanum* worldwide, but many of these are in doubt due to the difficulties in reliably identifying to species without using molecular techniques. Many of these records may actually be of the closely related species *M. betulinum*. The rust

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF>

² [http://archives.eppo.int/EPPOStandards/PM1_GENERAL/pm1-02\(21\)_A1A2_2012.pdf](http://archives.eppo.int/EPPOStandards/PM1_GENERAL/pm1-02(21)_A1A2_2012.pdf)

most probably originated in Asia spreading into continental Europe in the past 20 to 30 years (Lilja *et al.*, 2011).

Records earlier than 2005 may possibly be inaccurate due to taxonomic confusion (N. Stringer (Mycologist, published author), pers comm.).

Reliable records are available for the countries detailed below. Unless stated otherwise the records are taken from the EPPO global database; <http://gd3.eppo.int/organism.php/MELDHI/distribution> accessed 26 02 2013.

Asia: - China, Japan, Nepal (Adhikari & Manandha, 1989)

Europe: - Austria, Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Norway, Poland, Romania, Russia, Slovakia, Switzerland, Turkey, Ukraine, UK.

North America: – Canada

5. Is the pest established or transient, or suspected to be established/transient in the UK? (Include summary information on interceptions and outbreaks here).

This pathogen is present in the UK and was confirmed for the first time in Wales on samples collected in 2000 (N. Stringer, pers comm.) from the native alder *Alnus glutinosa* and *A. cordata* and *A. incana*, which are introduced species. It was reliably identified to species as both morphological and molecular techniques were used (Hantula *et al.*, 2012).

There were previous records in the UK (Wilson and Henderson, 1966) but these were later corrected to *M. betulinum* (Henderson and Bennell, 1979).

Hantula *et al.* (2009), examined samples of rust from *A. glutinosa* and *A. incana* in Scotland (sampled 2002 and 2005 respectively) and found that they were indistinguishable from *M. betulinum* indicating the presence of both species on alder in the UK.

There are numerous records of *M. hiratsukanum* in the UK on alder, with nearly 200 records in Wales, 2 records on *Betula pubescens* (N. Stringer (Mycologist, published author), pers. comm.) and further records throughout England; but no records on *Larix* spp. (British Mycological Society FRDBI record details-accessed 15 02 2013).

In Wales, the rust is particularly damaging on *A. incana* (less damage on *A. glutinosa*) with symptoms seen from July onwards causing significant premature defoliation. Mixed infections of *M. hiratsukanum* and *M. betulinum* have been observed (N. Stringer (Mycologist, published author) pers. comm.).

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?

The pest is described as a heteroecious rust that produces two different fruiting bodies (uredinia and telia) on the leaves of the main host (alder) and a further two different types of fruiting bodies (spermagonai and aecia) on the alternate host (larch).

Natural hosts: *Alnus* spp, especially *A. hirsuta*, *A. incana* and *A. glutinosa* but also *A. cordata* and *A. rubra*, *Betula pubescens* (N. Stringer (Mycologist, published author) pers. comm.) and *Larix* spp., especially *L. dahurica*, *L. sibirica* (Lilja *et al.*, 2011; Hantula *et al.*, 2012),

Experimental hosts – *L. decidua*, *L. laricina* (Hantula *et al.*, 2012)

Alnus glutinosa is native and widespread in the UK (BSBI, 2012), and are common trees of riversides, fens and wet woodland (Clapham *et al.*, 1962). Other species of *Alnus* are introduced, sometimes planted and sometimes naturalised, for example *A. incana* is naturalised, but also planted as an ornamental and roadside tree (Mabey, 1996). Other

introduced species present in the UK are *A. cordata*, *A. cordata x incana*, *A. rubra*, *A. viridis* and *A. x hybrid* (BSBI, 2012).

Betula pubescens is a native birch, tolerant of wet and cold conditions and widely distributed in the UK. There are two records of *M. hiratsukanum* on *B. pubescens*, confirmed by molecular testing; although, to date these have only been found on birch in the presence of heavily infected alders (N. Stringer (Mycologist, published author) pers. comm.). The other native species of birch are *Betula pendula*, also widely distributed and *Betula nana*, largely found in Scotland (BSBI, 2012).

Larch is an important forest tree, with both *Larix decidua* and *Larix kaempferi* having been introduced and commonly grown in the UK (BSBI, 2012; Clapham *et al.*, 1962), but as the damage to needles is minor it is unlikely to have a significant impact on larch (Hantula & Scholler, 2006).

7. If the pest needs a vector, is it present in the UK?

No vector required.

8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK? (By pathway):

Airborne spores

Hantula (2009) hypothesised that a natural migration of the pest from the Far East to Europe could have occurred given the continuity of both main and alternative hosts for the pathogen within the intervening area. This route of arrival in Europe would be consistent with the broad front over which new records of the pest have been made since the mid-1990s. The absence of reports from the western area of the Russian Federation casts some doubt on the idea that natural dispersal has been the main pathway for spread, although it is not known whether these areas have been surveyed. Proving that inoculum was airborne rather than carried by people or infected plant material is difficult, and there are few documented cases over long distances, however Brown and Hovmøller (2002) do report on good evidence that this has occurred with a couple of rust fungi, and suggest that long distance dispersal may be more likely with rusts due to the spores robust nature. The finding of this pathogen on such a broad front in Europe suggests that, although spread could be by movement of infected plant material, it would be less likely than natural dispersal.

Plants for planting

Infected plants for planting of *Alnus*, *Betula* and *Larix* spp could be a significant pathway for additional entry of the pathogen into the UK. There is no existing legislation regulating the movement of *Alnus* or *Betula* into the UK and the movement of *Larix* is restricted only with respect to freedom from another pest. If the pathogen behaves in a similar way to other related pathogens, it is likely to survive in bud scales in dormant buds. This would mean that the pathogen could be spread with dormant plants not just those with visually infected leaves. This would also mean that visual inspection of dormant host plants moving into the UK would be an ineffective means of detecting the pathogen. There is no available data documenting the level of imports of these tree genera.

Seeds

The potential for seed borne infection is unknown. Although there is no specific evidence to suggest that this pathogen is seed borne, this cannot be ruled out as other species of rust from similar genera may be seed borne.

Wood

The pest is a foliar pathogen so there is less risk from wood although the pathogen might survive in dormant buds which, if these were to be able to develop on cut wood, could introduce the pathogen into pest free area.

Air currents:	Very unlikely	<input type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input checked="" type="checkbox"/>
Plants:	Very unlikely	<input type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input checked="" type="checkbox"/>	Very likely	<input type="checkbox"/>
Seed:	Very unlikely	<input type="checkbox"/>	Unlikely	<input checked="" type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>
Wood:	Very unlikely	<input checked="" type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>

9. How likely is the pest to establish outdoors or under protection in the UK?

The pest has been confirmed as present outdoors in the UK on samples collected in 2000 from *Alnus cordata*, *A. incana*, *A. glutinosa* and *Betula pubescens*, although it may have been here for longer (see section 5).

The host genera are widespread and common in the UK. In addition, a related rust species on birch (*M. betulinum*) is prevalent and widespread in the UK (NBN Gateway, 2013), suggesting the possibility of wider establishment potential.

Outdoors:	Very unlikely	<input type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input checked="" type="checkbox"/>
Under protection:	Very unlikely	<input checked="" type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>

Neither host plant is commonly grown under protection hence it is very unlikely it would establish under protection.

10. How quickly could the pest spread in the UK?

The pest produces dry airborne spores, therefore introduction and spread around Europe has most probably occurred due to airborne spores. The pest has been described as spreading very rapidly in Europe over the past 10 years, although there are no specific reports of distances that spores can travel (Lilja *et al.*, 2011).

The host genera are widespread and common in the UK. However, by analogy with the closely related species, *M. betulinum*, the fungus may complete its life cycle on alder alone without the need for the alternate host (larch) resulting in rapid build up of inoculum (Sinclair & Lyon, 2005).

In terms of trade, the host genera are popular plants. RHS Plant Finder (<http://apps.rhs.org.uk/rhsplantfinder/>) lists 46 nurseries selling *Alnus*, 193 selling *Betula* and 73 selling *Larix*. Should the disease go undetected it could be disseminated rapidly through the nursery trade.

Natural spread:	Very slowly	<input type="checkbox"/>	Slowly	<input type="checkbox"/>	Moderate pace	<input type="checkbox"/>	Quickly	<input checked="" type="checkbox"/>	Very quickly	<input type="checkbox"/>
In trade:	Very slowly	<input type="checkbox"/>	Slowly	<input type="checkbox"/>	Moderate pace	<input type="checkbox"/>	Quickly	<input checked="" type="checkbox"/>	Very quickly	<input type="checkbox"/>

11. What is the area endangered by the pest?

The endangered area would be all areas where hosts occur, this include woodlands and amenity trees, urban landscaping and private gardens. The pest has a preference for more humid environments and cool conditions.

12. What is the pest's economic, environmental or social impact within its existing distribution?

The disease causes considerable damage to alder foliage in late summer, when diseased trees can easily be seen from a distance. Foliage turns brown and the leaf margins curl inwards. The rust can cause defoliation and crown thinning, successive infections can lead to tree death (Lilja *et al.*, 2011). In Hungary the first record of this disease was when a "leaf rust epidemic was observed on *Alnus glutinosa* at some nurseries" (Szabó, 2002).

There are only two confirmed records of *M. hiratsukanum* on birch, which would suggest a low impact. However, the rust could be mistaken for *M. betulinum* and so may be more widely found on *Betula* than has been documented.

On larch, the disease infects needles but is described as causing a negligible effect (Hantula J. & Scholler M, 2006).

The pathogen can cause significant damage to alder but its timber is now rarely used. It is of significant environmental importance in riparian environments and *Alnus* species are widely planted for amenity purposes.

Very small ☐ Small ☐ Medium ☒ Large ☐ Very large ☐

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?

In the UK, the known hosts are all widespread, common trees (see section 6), both natural and planted as ornamental and roadside trees. The rust is unlikely to cause significant economic or social impact but the effect on alders in particular could have serious environmental impacts, this rust adding further damage following the spread of *Phytophthora alni*. *A. glutinosa* (along with *Betula pubescens*) acts, as a keystone species in carr woodlands. *A. cordata* (Italian Alder) and *A. incana* (Grey Alder) are widely planted in parks and gardens. They are also used for windbreaks and reclaiming derelict land (see e.g. www.britishhardwood.co.uk/alnus-cordata-italian-alder/124/). The pest has been documented in the UK as causing "major defoliation of alder at the end of September / early October" with a suggestion that trees can become infected as early as July (N. Stringer (Mycologist, published author) pers. comm.).

Larch is an economically important forest tree but the pathogen causes only negligible damage.

Very small ☐ Small ☐ Medium ☒ Large ☐ Very large ☐

14. What is the pest's potential as a vector of plant pathogens?

Highly unlikely.

STAGE 3: PEST RISK MANAGEMENT

15. What are the risk management options for the UK? (*Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors*).

There is no existing legislation which applies to this pathogen and the movement of *Alnus* spp. in to the UK is currently not regulated. The movement of *Larix* spp. into the UK from non-European third countries is prohibited and movement from European third countries or other EU Member States requires a phytosanitary certificate or a plant passport but these are issued in relation to requirement which have no impact on the movement of *M. hiratsukanum*.

Exclusion

Attempts to exclude this pathogen via regulation for plants for planting, possibly including seed, of *Alnus*, *Betula* and *Larix* spp. would not seem to be appropriate as the pathogen is already present in the UK. In particular as it is likely that the main means of spread is via wind blown spores the regulation of plants for planting would be of little benefit. It would be inappropriate to regulate the more minor pathway of plants for planting because we can control it when there is a higher risk pathway involving wind blown spores which we are unable to control.

Eradication

Eradication may be possible in small areas of infection where it may be possible to eradicate by the removal of infected trees. However due to the possibility of spread via wind blown spores it would be impossible to tell how far the pest had spread and it would be difficult to define the area of host trees which would need to be removed in order to achieve a successful eradication.

Containment

As the pest has the ability to produce and spread via airborne spores, making it possible for long distance spread to occur rapidly, it is impractical to consider containment.

Given that *M. hiratsukanum* is considered to be present at 200 sites across Wales and other in England statutory action would not seem to be appropriate. To our knowledge this pest has been present outdoors in the UK since 2000 (although it may have been here for longer).

16. Summary and conclusion of rapid assessment.

(Highlight key uncertainties and topics that will require particular emphasis in a detailed PRA) General / overall summary and conclusion and then specific text on each part of assessment...

The taxonomic confusion concerning the identification of this particular species results in a major uncertainty concerning knowledge about its distribution and impact. A survey would need to be performed using both morphological and molecular diagnostic techniques to determine the current distribution of this organism in the UK. In particular the situation on birch is unclear, and there is a possibility that the pest may be more widespread on this host than recorded.

This rapid assessment shows:

Risk of entry: Entry is highly likely via natural migration due to airborne spores blown in from the continent, where the disease is prevalent and spreading. Entry via plants for planting is likely, particularly as visual inspection of dormant host plants moving into the UK would be an ineffective means of detecting the pathogen. Introduction could occur on infected plants of either host genera. Seeds and wood are considered lower risk pathways.

Risk of establishment: Very likely - already present in the UK and very likely to establish outdoors; the closely related species *M. betulinum* is widely distributed throughout the UK (NBN Gateway, 2013).

Economic impact: Moderate – Causes significant damage to alder, which has already been impacted by *Phytophthora alni*. Not a major forest tree, but of environmental significance in riparian environments. Although larch is a major forest species the pathogen is not particularly damaging to this host.

Endangered area: all areas where hosts, particularly alders, occur, this includes woodlands and amenity trees, urban landscaping and private gardens.

Risk management: As *M. hiratsukanum* is already present in the UK and is likely to be spread by wind borne spores risk management measures to exclude, eradicate or contain *M. hiratsukanum* would seem to be unlikely to be effective.



17. Is there a need for a detailed PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used. (for PH Risk Management Work stream to decide) ✓ (put tick in box)

Based on the current information available regarding the distribution of this pathogen within the UK a more detailed PRA is not considered to be necessary, although a wider survey for the presence of this pest, especially on birch (for which there are currently two records) may reveal more information to reduce uncertainty.

No	✓
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Yes		PRA area: UK or EU		PRA scheme: UK or EPPO	
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18. IMAGES OF PEST

	
<p>Fig. 1 <i>Melampsoridium hiratsukanum</i> on <i>Alnus incana</i>, photo by Metla/Erkki Oksanen.</p>	<p>Fig. 2 Spermogonia and aecia of <i>Melampsoridium hiratsukanum</i> on <i>Larix dahurica</i> after artificial infection with basidiospores, photo by Metla/Timo Kurkela.</p>

19. Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

M. hiratsukanum has been present in the UK since at least 2000. As the pest has the ability to produce and spread via airborne spores, making it possible for long distance spread to occur rapidly, it is impractical to consider containment. Statutory action against potential pathways of entry therefore seem to be unwarranted. One suggested action to reduce uncertainty would be to survey more widely in the UK for the presence of this pest, particularly on birch, for which there are currently two records, but this would be of low priority given the conclusions of the risk assessment.

Yes
Statutory action ☐

No
Statutory action ☒

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