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Pest categorisation of *Chrysomyxa arctostaphyli*

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Abstract

Following a request from the European Commission, the EFSA Panel on Plant Health performed a pest categorisation of *Chrysomyxa arctostaphyli,* a well-defined and distinguishable fungal species of the family Coleosporiaceae. The pathogen is regulated in Council Directive 2000/29/EC (Annex IAI) as a harmful organism whose introduction into the EU is banned. *C. arctostaphyli* is native to North America and is the causal agent of spruce broom rust. *C. arctostaphyli* is a heteroecious rust with a 2-year life cycle alternating between the aecial host *Picea* spp. and the telial host *Arctostaphylos* spp. The main reported aecial host is *P. engelmannii*, but also *P. abies*, *P. pungens*, *P. sitchensis, P. glauca, P. mariana* and *P. rubens* (as well as *Picea* as a genus) are reported as hosts. The fungus is not known to occur in the EU but could enter via host plants for planting and cut branches. It could establish in the EU, as hosts are present and climatic conditions are favourable. The extent of overlap between the ranges of the telial and aecial hosts is greater in the EU than in North America. The pathogen would be able to spread following establishment by dissemination of spores and human movement of infected host plants. Should the pathogen be introduced in the EU, impacts can be expected in spruce woodland, plantations and on ornamental spruce trees, leading to reduced tree growth and associated ecosystem service provision. The main uncertainty concerns the level of susceptibility of *P. abies* and *P. sitchensis* under European conditions. The criteria assessed by the Panel for consideration as a potential quarantine pest are met. As the pest is not present in the EU, not all criteria for consideration as a regulated non-quarantine pest are met.

Keywords: European Union, forest pathology, kinnikinnick, pest risk, plant pest, quarantine, tree health

Requestor: European Commission

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Table of contents

1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

Council Directive 2000/29/EC[1] on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community establishes the present European Union plant health regime. The Directive lays down the phytosanitary provisions and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union is prohibited, is detailed together with specific requirements for import or internal movement.

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031[2] on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorizations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/pest categorisation is not available.

1.1.2. Terms of reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002,[3] to provide scientific opinion in the field of plant health.

EFSA is requested to prepare and deliver a pest categorisation (step 1 analysis) for each of the regulated pests included in the appendices of the annex to this mandate. The methodology and template of pest categorisation have already been developed in past mandates for the organisms listed in Annex II Part A Section II of Directive 2000/29/EC. The same methodology and outcome is expected for this work as well.

The list of the harmful organisms included in the annex to this mandate comprises 133 harmful organisms or groups. A pest categorisation is expected for these 133 pests or groups and the delivery of the work would be stepwise at regular intervals through the year as detailed below. First priority covers the harmful organisms included in Appendix 1, comprising pests from Annex II Part A Section I and Annex II Part B of Directive 2000/29/EC. The delivery of all pest categorisations for the pests included in Appendix 1 is June 2018. The second priority is the pests included in Appendix 2, comprising the group of *Cicadellidae* (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), the group of *Tephritidae* (non-EU), the group of potato viruses and virus-like organisms, the group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. and the group of *Margarodes* (non-EU species). The delivery of all pest categorisations for the pests included in Appendix 2 is end 2019. The pests included in Appendix 3 cover pests of Annex I part A section I and all pests categorisations should be delivered by end 2020.

For the above mentioned groups, each covering a large number of pests, the pest categorisation will be performed for the group and not the individual harmful organisms listed under "such as" notation in the Annexes of the Directive 2000/29/EC. The criteria to be taken particularly under consideration for these cases are the analysis of host pest combination, investigation of pathways, the damages occurring and the relevant impact.

Finally, as indicated in the text above, all references to 'non-European' should be avoided and replaced by 'non-EU' and refer to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

[1] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. OJ L 169/1, 10.7.2000, p. 1–112.

[2] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants. OJ L 317, 23.11.2016, p. 4–104.

[3] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31/1, 1.2.2002, p. 1–24.

1.1.2.1. Terms of Reference: Appendix 1

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

Aleurocanthus spp.
Anthonomus bisignifer (Schenkling)
Anthonomus signatus (Say)
Aschistonyx eppoi Inouye
Carposina niponensis Walsingham
Enarmonia packardi (Zeller)
Enarmonia prunivora Walsh
Grapholita inopinata Heinrich
Hishomonus phycitis
Leucaspis japonica Ckll.
Listronotus bonariensis (Kuschel)
Numonia pyrivorella (Matsumura)
Oligonychus perditus Pritchard and Baker
Pissodes spp. (non-EU)
Scirtothrips aurantii Faure
Scirtothrips citri (Moultex)
Scolytidae spp. (non-EU)
Scrobipalpopsis solanivora Povolny
Tachypterellus quadrigibbus Say
Toxoptera citricida Kirk.
Unaspis citri Comstock

(b) Bacteria

Citrus variegated chlorosis
Erwinia stewartii (Smith) Dye
Xanthomonas campestris pv. *oryzae* (Ishiyama) Dye and pv. *oryzicola* (Fang. et al.) Dye

(c) Fungi

Alternaria alternata (Fr.) Keissler (non-EU pathogenic isolates)
Anisogramma anomala (Peck) E. Müller
Apiosporina morbosa (Schwein.) v. Arx
Ceratocystis virescens (Davidson) Moreau
Cercoseptoria pini-densiflorae (Hori and Nambu) Deighton
Cercospora angolensis Carv. and Mendes
Elsinoe spp. Bitanc. and Jenk. Mendes
Fusarium oxysporum f. sp. *albedinis* (Kilian and Maire) Gordon
Guignardia piricola (Nosa) Yamamoto
Puccinia pittieriana Hennings
Stegophora ulmea (Schweinitz: Fries) Sydow & Sydow
Venturia nashicola Tanaka and Yamamoto

(d) Virus and virus-like organisms

Beet curly top virus (non-EU isolates)
Black raspberry latent virus
Blight and blight-like
Cadang-Cadang viroid
Citrus tristeza virus (non-EU isolates)
Leprosis
Little cherry pathogen (non- EU isolates)
Naturally spreading psorosis
Palm lethal yellowing mycoplasm
Satsuma dwarf virus
Tatter leaf virus
Witches' broom (MLO)

Annex IIB

(a) Insect mites and nematodes, at all stages of their development

Anthonomus grandis (Boh.)
Cephalcia lariciphila (Klug)
Dendroctonus micans Kugelan
Gilphinia hercyniae (Hartig)
Gonipterus scutellatus Gyll.
Ips amitinus Eichhof
Ips cembrae Heer
Ips duplicatus Sahlberg
Ips sexdentatus Börner
Ips typographus Heer
Sternochetus mangiferae Fabricius

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton
Gremmeniella abietina (Lag.) Morelet
Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

List of harmful organisms for which pest categorisation is requested per group. The list below follows the categorisation included in the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

Group of Cicadellidae (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), such as:

1) *Carneocephala fulgida* Nottingham
2) *Draeculacephala minerva* Ball
3) *Graphocephala atropunctata* (Signoret)

Group of Tephritidae (non-EU) such as:

1) *Anastrepha fraterculus* (Wiedemann)
2) *Anastrepha ludens* (Loew)
3) *Anastrepha obliqua* Macquart
4) *Anastrepha suspensa* (Loew)
5) *Dacus ciliatus* Loew
6) *Dacus curcurbitae* Coquillet
7) *Dacus dorsalis* Hendel
8) *Dacus tryoni* (Froggatt)
9) *Dacus tsuneonis* Miyake
10) *Dacus zonatus* Saund.
11) *Epochra canadensis* (Loew)
12) *Pardalaspis cyanescens* Bezzi
13) *Pardalaspis quinaria* Bezzi
14) *Pterandrus rosa* (Karsch)
15) *Rhacochlaena japonica* Ito
16) *Rhagoletis completa* Cresson
17) *Rhagoletis fausta* (Osten-Sacken)
18) *Rhagoletis indifferens* Curran
19) *Rhagoletis mendax* Curran
20) *Rhagoletis pomonella* Walsh
21) *Rhagoletis suavis* (Loew)

(c) Viruses and virus-like organisms

Group of potato viruses and virus-like organisms such as:

1) Andean potato latent virus
2) Andean potato mottle virus
3) Arracacha virus B, oca strain
4) Potato black ringspot virus
5) Potato virus T
6) non-EU isolates of potato viruses A, M, S, V, X and Y (including Yo, Yn and Yc) and Potato leafroll virus

Group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., such as:

1) Blueberry leaf mottle virus
2) Cherry rasp leaf virus (American)
3) Peach mosaic virus (American)
4) Peach phony rickettsia
5) Peach rosette mosaic virus
6) Peach rosette mycoplasm
7) Peach X-disease mycoplasm
8) Peach yellows mycoplasm
9) Plum line pattern virus (American)
10) Raspberry leaf curl virus (American)
11) Strawberry witches' broom mycoplasma
12) Non-EU viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

Group of *Margarodes* (non-EU species) such as:

1) *Margarodes vitis* (Phillipi)
2) *Margarodes vredendalensis* de Klerk
3) *Margarodes prieskaensis* Jakubski

1.1.2.3. Terms of Reference: Appendix 3

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

Acleris spp. (non-EU)
Amauromyza maculosa (Malloch)
Anomala orientalis Waterhouse
Arrhenodes minutus Drury
Choristoneura spp. (non-EU)
Conotrachelus nenuphar (Herbst)
Dendrolimus sibiricus Tschetverikov
Diabrotica barberi Smith and Lawrence
Diabrotica undecimpunctata howardi Barber
Diabrotica undecimpunctata undecimpunctata Mannerheim
Diabrotica virgifera zeae Krysan & Smith
Diaphorina citri Kuway
Heliothis zea (Boddie)
Hirschmanniella spp., other than *Hirschmanniella gracilis* (de Man) Luc and Goodey
Liriomyza sativae Blanchard
Longidorus diadecturus Eveleigh and Allen
Monochamus spp. (non-EU)
Myndus crudus Van Duzee
Nacobbus aberrans (Thorne) Thorne and Allen
Naupactus leucoloma Boheman
Premnotrypes spp. (non-EU)
Pseudopityophthorus minutissimus (Zimmermann)
Pseudopityophthorus pruinosus (Eichhoff)
Scaphoideus luteolus (Van Duzee)
Spodoptera eridania (Cramer)
Spodoptera frugiperda (Smith)
Spodoptera litura (Fabricus)
Thrips palmi Karny
Xiphinema americanum Cobb sensu lato (non-EU populations)
Xiphinema californicum Lamberti and Bleve-Zacheo

(b) Fungi

Ceratocystis fagacearum (Bretz) Hunt
Chrysomyxa arctostaphyli Dietel
Cronartium spp. (non-EU)
Endocronartium spp. (non-EU)
Guignardia laricina (Saw.) Yamamoto and Ito
Gymnosporangium spp. (non-EU)
Inonotus weirii (Murril) Kotlaba and Pouzar
Melampsora farlowii (Arthur) Davis
Mycosphaerella larici-leptolepis Ito et al.
Mycosphaerella populorum G. E. Thompson
Phoma andina Turkensteen
Phyllosticta solitaria Ell. and Ev.
Septoria lycopersici Speg. var. *malagutii* Ciccarone and Boerema
Thecaphora solani Barrus
Trechispora brinkmannii (Bresad.) Rogers

(c) Viruses and virus-like organisms

Tobacco ringspot virus
Tomato ringspot virus
Bean golden mosaic virus
Cowpea mild mottle virus
Lettuce infectious yellows virus
Pepper mild tigré virus
Squash leaf curl virus
Euphorbia mosaic virus
Florida tomato virus

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

(a) Insects, mites and nematodes, at all stages of their development

Meloidogyne fallax Karssen
Popillia japonica Newman
Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

Clavibacter michiganensis (Smith) Davis et al. ssp. *sepedonicus* (Spieckermann and Kotthoff) Davis et al.
Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen
Synchytrium endobioticum (Schilbersky) Percival

Annex I B

(a) Insects, mites and nematodes, at all stages of their development

Leptinotarsa decemlineata Say
Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Chrysomyxa arctostaphyli is one of a number of pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a quarantine pest or those of a regulated non-quarantine pest (RNQP) for the area of the EU.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *C. arctostaphyli* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name (and its synonyms) of the pest as search terms. Relevant papers were reviewed and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plan Protection Organization (EPPO) Global Database (EPPO, 2018) and relevant publications.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTE) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MS) and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *C. arctostaphyli*, following guiding principles and steps presented in the EFSA guidance on the harmonised framework for pest risk assessment (EFSA PLH Panel, 2010) and as defined in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

In accordance with the guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work was started following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union RNQP in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. All relevant criteria have to be met for the pest to potentially qualify either as a quarantine pest or as a regulated non-quarantine pest. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as a RNQP that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel, in agreement with the EFSA guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism	Is the pest present in the EU territory? If not, it cannot be a regulated non-quarantine pest. (A regulated non-quarantine pest must be present in the risk assessment area)
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone)	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process, but following the agreed two-step approach, will continue only if requested by the risk managers. However, during the categorisation process, experts may identify key elements and knowledge gaps that could contribute significant uncertainty to a future assessment of risk. It would be useful to identify and highlight such gaps so that potential future requests can specifically target the major elements of uncertainty, perhaps suggesting specific scenarios to examine.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?

Yes

Chrysomyxa arctostaphyli Dietel is a fungus of the family Coleosporiaceae.

The species is also referred to using the synonym *Melampsoropsis arctostaphyli* and the anamorph *Peridermium coloradense* (Peterson, 1961a; EPPO, 1997).

3.1.2. Biology of the pest

C. arctostaphyli is the causal agent of spruce broom rust (EPPO, 1997). *C. arctostaphyli* is a heteroecious rust with a 2-year life cycle alternating between the aecial host *Picea* spp. and the telial host *Arctostaphylos* spp. (Figure 1).

The fungus persists in the twig and bud tissues of the brooms in spruce and colonise the current year's needles in the spring (Hennon and Trummer, 2001). Spermagonia develop on the underside of needles in spring and have a strong characteristic odour (Hennon and Trummer, 2001; Sinclair and Lyon, 2005). The odour attracts insects aiding cross-fertilisation of the fungus (Anon, 2011). Tiny colourless spermatia are produced and exuded in a small drop from the spermagonia (McBeath, 1981). The spermagonia are active during 5–7 days (McBeath, 1981). Aecia are bright orange pustules which burst open in summer releasing windborne aeciospores (orange-yellow, 16–25 × 23–35 μm; EPPO, 1997). Aecia usually remain active for a total of five weeks (McBeath, 1981). The aeciospores infect the leaves of the telial host (*Arctostaphylos* spp.) where the rust will overwinter. The infected leaves develop purple-brown spots. In spring, telia are formed on the underside of the 1-year old leaves (Ziller, 1974; Sinclair and Lyon, 2005). Teliospores (colourless, uniformly 1–1.5 μm thick; 13–18 × 23–64 μm; EPPO, 1997) germinate and produce basidiospores (7.5–8 × 8.5–9.5 μm; EPPO, 1997) that will infect the young needles of spruce. No urediniospores are produced by *C. arctostaphyli* (EPPO, 1997).

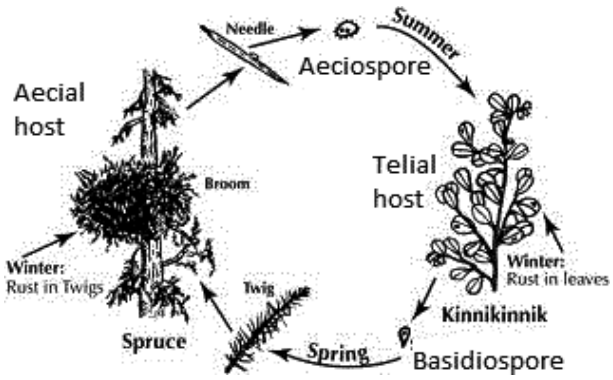

Figure 1: Life cycle of spruce broom rust (*Chrysomyxa arctostaphyli*) alternating between the aecial host (*Picea* spp.) and the telial host (*Arctostaphylos* spp. = 'kinnikinnik') (modified from Hennon and Trummer, 2001)

The fungus probably alters the growth hormones resulting in the production of numerous short lateral shoots causing the broom (Hennon and Trummer, 2001). The internodes and needles on the brooms are also shorter than normal (McBeath, 1981). The brooms grow over time and may become up to 2 m tall (Sinclair and Lyon, 2005). In the autumn, the needles in the broom die and fall which makes the broom look dead during winter (Hennon and Trummer, 2001). The branch and stem at the base of the broom are swollen due to the infection and may form a canker or gall (Schwandt, 2006).

The disease is mainly found in spruce stands where the *Arctostaphylos* host is also found (Hennon and Trummer, 2001). The microclimate also affects the disease and wet and cool conditions are reported as conducive (Anon, 2011, without date). The abundance of brooms showed no trend with stand age (Paragi, 2010).

3.1.3. Intraspecific diversity

No information was found on the intraspecific diversity of *C. arctostaphyli*.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes

The disease is easily identified based on the symptoms, i.e. as dense witches' brooms on spruce.

A key is available to distinguish *C. arctostaphyli* from other tree rusts in western Canada based on the morphology and symptom descriptions (Ziller, 1974).

The ITS region and the large subunit (28S) were also successfully used to discriminate *C. arctostaphyli* from other species of the genus in phylogenetic studies (Feau et al., 2011).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

C. arctostaphyli is only reported from North America (EPPO, 2018) (Figure 2). The pathogen is reported as widespread in Canada. In the USA it is reported from the northern and western states (Alaska, Arizona, Colorado, Idaho, Maine, Michigan, Montana, New Mexico, New York, Oregon, South Dakota, Utah, Washington, Wisconsin and Wyoming; EPPO, 2018).

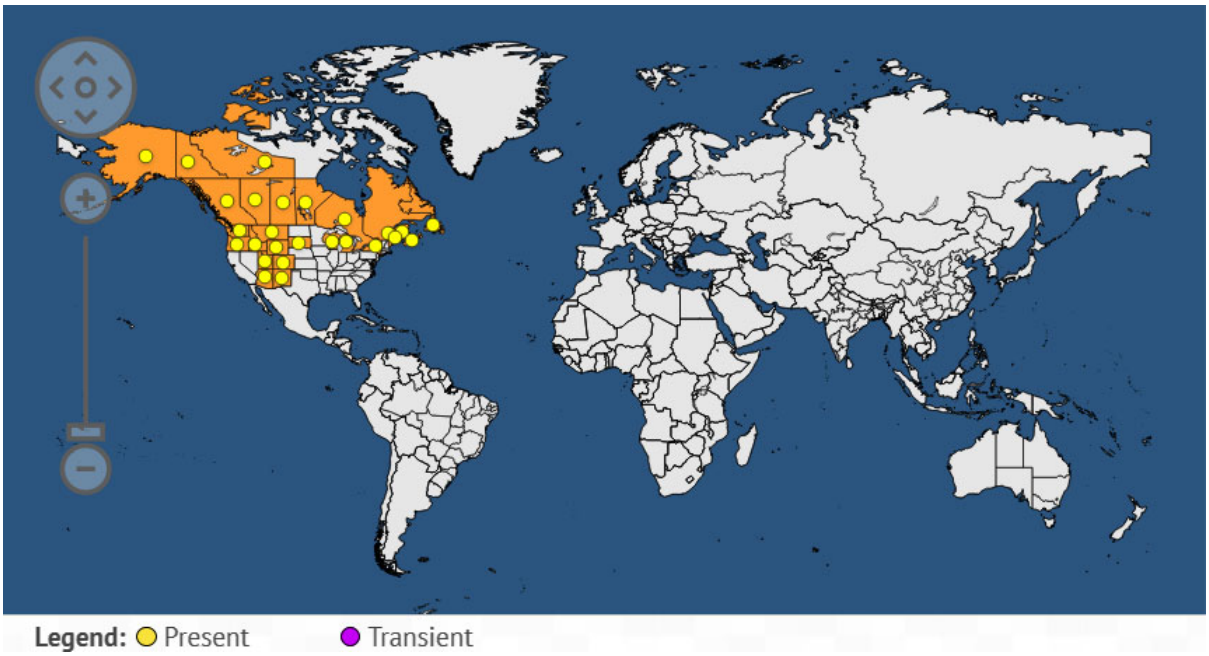

Figure 2: Global distribution map for *Chrysomyxa arctostaphyli* (extracted from EPPO, 2018; accessed March 2018). There are no reports of transient populations for this species

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

No, the pest is not reported to be present in the EU.

C. arctostaphyli has not been reported from the EU. The pathogen is reported as absent in the Netherlands (confirmed by survey, 2017), Slovenia (no pest record, 2017) and the UK (Plant Health Portal, accessed March 2018, https://planthealthportal.defra.gov.uk/data/pests/11462/data). With this exception, there are no reports of absence available to the Panel that have been confirmed by survey.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

C. arctostaphyli is listed in Council Directive 2000/29/EC. Details are presented in Tables 2 and 3.

Table 2: *Chrysomyxa arctostaphyli* in Council Directive 2000/29/EC

Annex I, Part A	**Harmful organisms whose introduction into, and spread within, all member states shall be banned**
Section I	**Harmful organisms not known to occur in any part of the community and relevant for the entire community**
(c)	Fungi
	Species
2.	*Chrysomyxa arctostaphyli* Dietel

3.3.2. Legislation addressing the hosts of *C. arctostaphyli*

Table 3: Regulated hosts and commodities that may involve *C. arctostaphyli* in Annexes III, IV and V of Council Directive 2000/29/EC

Annex III, Part A	**Plants, plant products and other objects the introduction of which shall be prohibited in all Member States**	
	Description	Country of origin
1.	Plants of [...] *Picea* A. Dietr.[...], other than fruit and seeds	Non-European countries

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The main reported aecial host is *Picea engelmannii*, but also *Picea abies*, *Picea pungens*, *Picea sitchensis* as well as *Picea* as a genus are reported as minor hosts (EPPO, 2018). However, the disease is reported as important on both *P. engelmannii* and *P. pungens* in Colorado and Arizona (EPPO, 1997). In addition, *Picea glauca, Picea mariana* and *Picea rubens* are also reported as hosts (Ziller, 1974; Sinclair and Lyon, 2005).

Arctostaphylos uva-ursi (common name: bearberry/kinnikinnik) is reported as the most important alternate host of the rust but also *Arctostaphylos nevadensis* and *Arctostaphylos patula* have been reported as telial hosts (Peterson, 1961b; Sinclair and Lyon, 2005). While *A. uva-ursi* is present both in North America and in Europe, *A. nevadensis* and *A. patula* are only present in Western North America (Calflora, 2018).

In Council Directive 2000/29/EC, the pest is not regulated on a particular host or commodity; its introduction into the EU is banned (Annex IAI).

3.4.2. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways!

Yes, via host plants for planting and cut branches.

The main host commodities on which the pathogen could enter into the EU are (EPPO, 2018):

- Plants for planting of *Picea* spp.
- Cut branches of *Picea* spp.

Both pathways are closed due to the ban on importing plants of *Picea*, other than fruit and seeds, from non-European countries.

The pathogen could also be introduced on plants of *Arctostaphylos* spp., a pathway which is not currently regulated.

As of March 2018, there were no records of interception of *C. arctostaphyli* in the Europhyt database.

3.4.3. Establishment

Is the pest able to become established in the EU territory?

Yes, the pest could establish in the EU, as hosts are present and favourable climatic conditions are common.

3.4.3.1. EU distribution of main host plants

The native *P. abies* and the introduced *P. sitchensis* are the most important potential hosts in the EU.

P. abies is an economically and ecologically very important tree species in Europe (Caudullo et al., 2016). It is planted widely also outside of its native range, i.e. in the north-western and central parts of Europe (Figure 3).

P. sitchensis, which is native to North America, is an important plantation tree in north-western Europe, particularity in Ireland and the UK (Houston Durrant et al., 2016) (Figure 4).

The alternate host, *A. uva-ursi,* is found across European mountain ranges (mainly Scandinavia, Scotland, the Pyrenees, Massif Central, Alps, Carpathians and Balkans) (Figure 5).

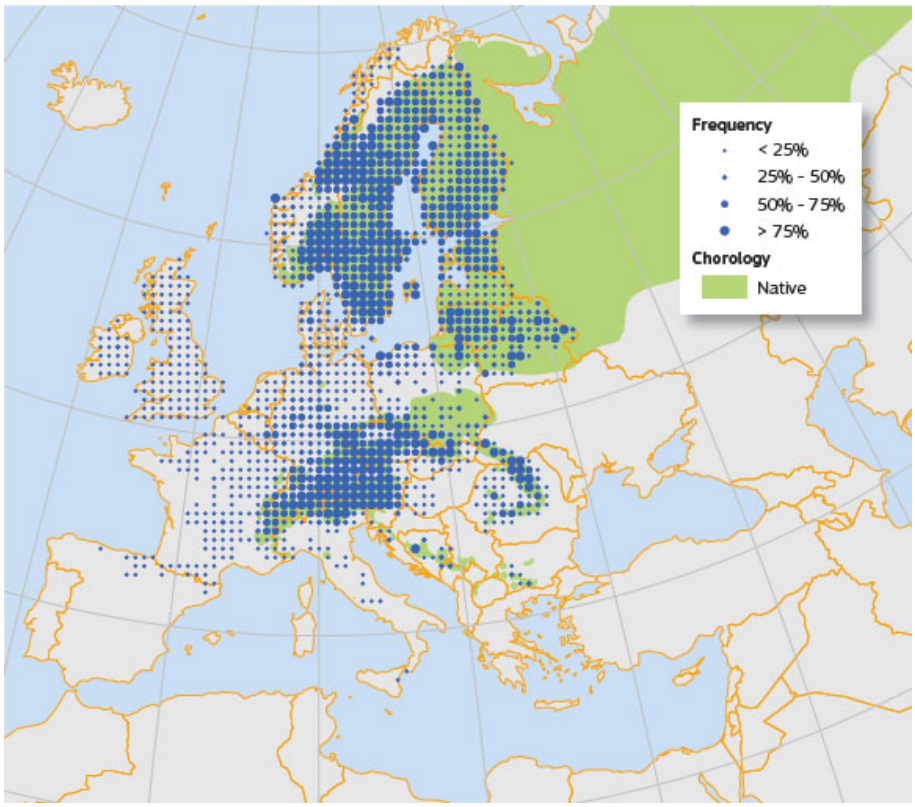

Figure 3: Plot distribution and simplified chorology map for *Picea abies*. Frequency of *P. abies* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *P. abies* is derived after EUFORGEN (from Caudullo et al., 2016)

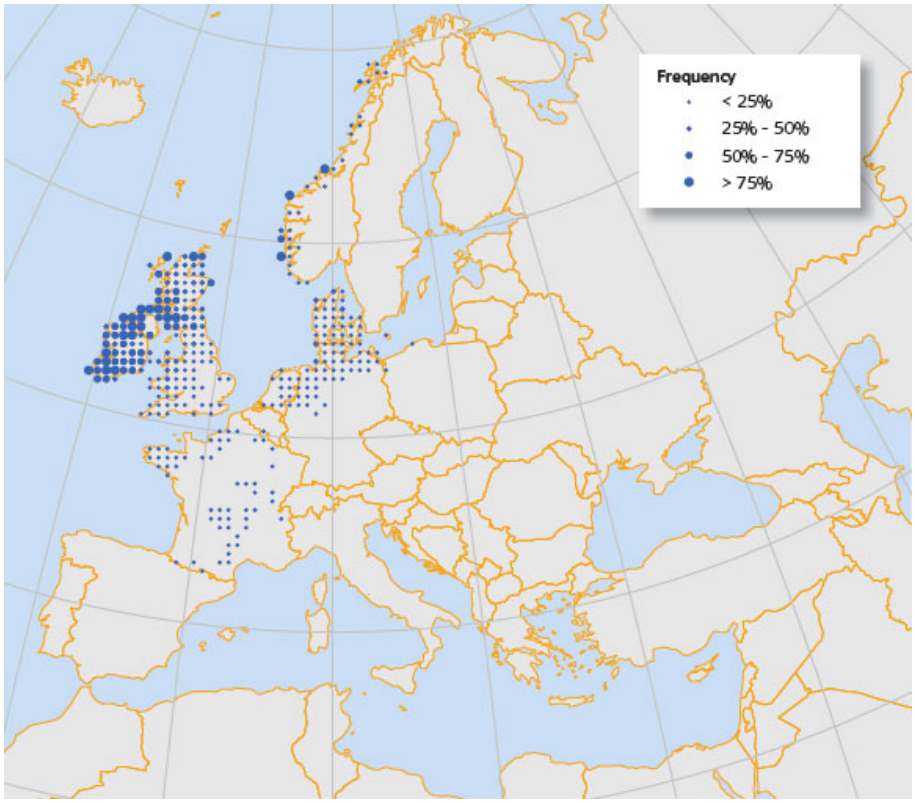

Figure 4: Plot distribution map for *Picea sitchensis*. Frequency of *P. sitchensis* occurrences within the field observations as reported by the National Forest Inventories (From Houston Durrant et al., 2016)

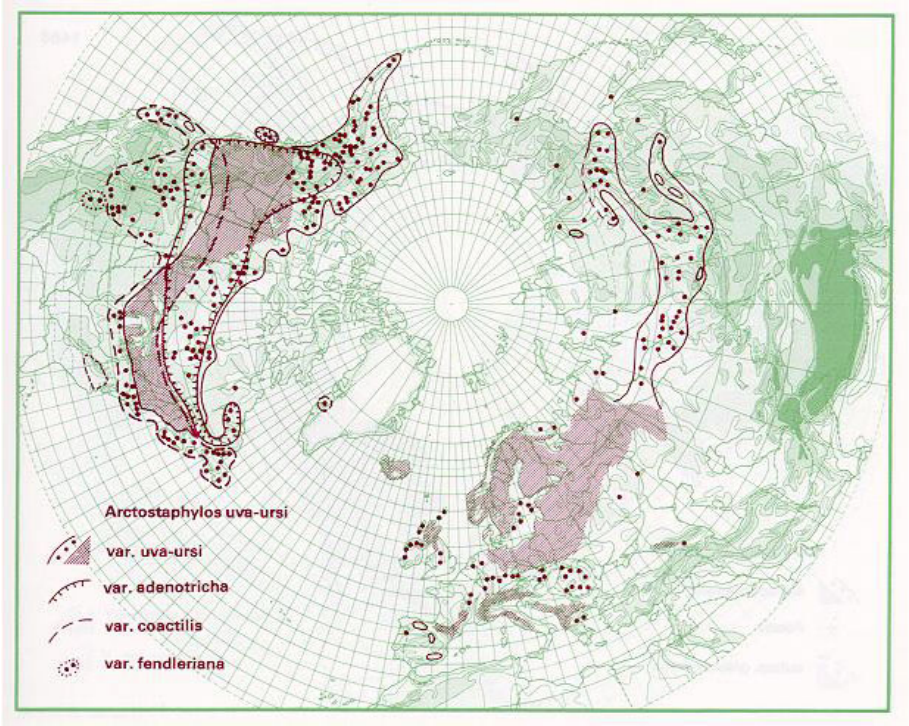

Figure 5: Distribution map for *Arctostaphylos uva-ursi*. With kind permission of the Swedish Museum of Natural History. Available online: http://linnaeus.nrm.se/flora/di/erica/arcto/arctuvav.jpg

3.4.3.2. Climatic conditions affecting establishment

The distribution of *C. arctostaphyli* in North America appears to represent areas with cold and temperate Köppen–Geiger climate types (Peel et al., 2007). For example, in eastern North America, it extends south along the Atlantic Coast to New Jersey and in the Appalachian Mountains to Virginia (Crane, 1991). These climate types overlap to large extent with the distribution of both hosts in Europe.

3.4.4. Spread

Is the pest able to spread within the EU territory following establishment? How?

Yes, the pathogen could spread within the EU by windblown spores and movement of host plants.

RNQPs: Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects?

No, plants for planting are not the main pathway of spread.

The fungus spreads by windblown spores. Aeciospores have potentially a very long range and may enable intercontinental spread (EPPO, 1997). Long distance spread may however be more likely on infected host plants (EPPO, 1997).

Spread of basidiospores from the *Arctostaphylos* host to the *Picea* host appears to have a shorter range. Indeed, removal of *Arctostaphylos* spp. from within 300 m has been suggested to reduce the damage on nearby spruce (Hennon and Trummer, 2001).

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, the pest introduction could have an impact in coniferous woodlands, plantations and on ornamental spruce trees.

RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?[4]

Yes, the introduction of the pest could have an impact on the intended use of plants for planting.

C. arctostaphyli causes brooms (Figure 6), and may also cause deformation of the trunk, cankers, growth loss, dead or broken tops and tree mortality (EPPO, 1997; Anon, 2011). Trees with numerous and large brooms often grow slowly and die prematurely (Hennon and Trummer, 2001; Sinclair and Lyon, 2005). However, generally the disease is not fatal and damage is mainly due to growth loss (Hennon and Trummer, 2001; Schwandt, 2006). Ecologically, the brooms appear to serve as an important, perhaps critical, winter habitat for birds and mammals (Hennon and Trummer, 2001).

Weakened trees may also be more susceptible to secondary attack by other pest and pathogens and the brooms may serve as infection sites for decay fungi, e.g. *Phellinus pini* (EPPO, 1997; Anon, 2011).

C. arctostaphyli is reported as important only in southern Colorado and northern Arizona (USA) on *P. engelmannii* and *P. pungens* (EPPO, 1997). Average incidence in Colorado is reported as about 4%, but locally high levels of infection can be found with 23–29% of spruce being infected (Anon, 2011). In the same state, an average cull factor of 24% due to the rust was reported for *P. engelmannii* (EPPO, 1997).

In Yukon Territory, Canada, a forest health survey found a minor incidence of about 10% of the matured spruce being infected (Anon, without date). In Alaska, a broom density of 3–46 brooms per hectare was reported (Paragi, 2010).

The rust is reported to be of minor importance to *P. sitchensis* (Viereck and Little, 1972; Harris, 1990).

Should the pathogen enter the EU, impacts on spruce growth and related ecosystem services can be expected. Since *A. uva-ursi* is more commonly associated with *Picea* in Eurasia than in North America, the rust is assumed to be of greater potential danger to spruce stands in Europe and Asia than in the native range of the pathogen (Ziller, 1974).

[4] See Section 2.1 on what falls outside EFSA's remit.

Figure 6: Witches broom caused by *Chrysomyxa arctostaphyli* on blue spruce (*Picea pungens*). Photo by William M. Ciesla, Forest Health Management International, Bugwood.org. Available online: https://www.forestryimages.org/browse/detail.cfm?imgnum=5382386

3.6. Availability and limits of mitigation measures

Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?

Yes, please see Section 3.6.2.

RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?

No, there are no known measures to prevent pest presence on plants for planting.

3.6.1. Phytosanitary measures

Phytosanitary measures are currently applied to plants for planting of *P. abies*, but the alternate host *Arctostaphylos* spp. is not covered (see Section 3.3.2). Import prohibition of *Arctostaphylos* spp. plants for planting is an available measure to reduce the risk of introduction.

3.6.1.1. Biological or technical factors limiting the feasibility and effectiveness of measures to prevent the entry, establishment and spread of the pest

- Aeciospores have a very high dispersal capacity and can survive storage for several months (EPPO, 1997).

3.6.1.2. Biological or technical factors limiting the ability to prevent the presence of the pest on plants for planting

- Chemical control has not been shown to be effective to manage the disease on spruce (Hennon and Trummer, 2001).

3.6.2. Pest control methods

- Removal of infected trees through selective thinning (Hennon and Trummer, 2001; Anon, 2011).
- Pruning of brooms may reduce the risk of breakage and maintain tree vigour in high value trees (Anon, 2011).

- Removal of *Arctostaphylos* spp. within 300 m may reduce the damage on nearby spruce (Hennon and Trummer, 2001).
- Given that *C. arctostaphyli* does not normally kill spruce trees, one management option is to take no action, considering that witches'-brooms offer refuge for many birds and small mammals, perhaps a desirable feature for some tree or woodland owners (Hennon and Trummer, 2001).

3.7. Uncertainty

- It is unclear how susceptible *P. abies* is to the disease and what level of damage the species could sustain. *P. sitchensis* is considered a minor host in North America but its susceptibility under European conditions is uncertain.
- It has been suggested, but not confirmed, that *Picea*-to-*Picea* transmission by aeciospores can occur (EPPO, 1997).

4. Conclusions

C. arctostaphyli meets the criteria assessed by EFSA for consideration as a potential quarantine pest (Table 4).

Table 4: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the pest as a species is clear	The identity of the pest as a species is clear	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest is not reported to be present in the EU	The pest is not reported to be present in the EU	None
Regulatory status (Section 3.3)	The pest is regulated by Council Directive 2000/29/EC (Annex IAI) as a harmful organism whose introduction into, and spread within, all Member States shall be banned	The pest is regulated by Council Directive 2000/29/EC (Annex IAI) as a harmful organism whose introduction into, and spread within, all Member States shall be banned	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Entry: the pest could enter the EU via plants for planting and cut branches of *Picea* spp. and *Arctostaphylos* spp. Establishment: hosts and favourable climatic conditions are widespread in the risk assessment area. Spread: the pest would be able to spread following establishment by dissemination of wind-blown spores and movement of host plants for planting and cut branches	Plants for planting are not the main pathway of spread, given that movement of cut branches and natural dissemination of spores can also disperse the pathogen	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Potential for consequences in the EU territory (Section 3.5)	The pest introduction would have economic and environmental impacts in coniferous woodlands, plantations and on ornamental trees	The pest introduction could have an impact on the intended use of plants for planting	There is uncertainty on the level of susceptibility of *P. abies* and *P. sitchensis* under European conditions
Available measures (Section 3.6)	Removal of infected trees, pruning of brooms and removal of *Arctostaphylos* spp. within 300 m of nearby spruces are available measures to reduce impacts	Import prohibition of *Picea* spp. and *Arctostaphylos* spp. plants for planting is an available measure to reduce the risk of introduction	None
Conclusion on pest categorisation (Section 4)	The criteria assessed by the Panel for consideration as a potential quarantine pest are met	The criterion on the pest presence in the EU is not met	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gap concerns the level of susceptibility of *P. abies* and *P. sitchensis* under European conditions (although there is no uncertainty that these tree species are hosts of the pathogen)		

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Abbreviations

DG SANTE	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
MS	Member State
PLH	EFSA Panel on Plant Health
RNQP	Regulated non-quarantine pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference