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Pest categorisation of *Gilpinia hercyniae*

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Abstract

The Panel on Plant Health performed a pest categorisation of the Diprionid sawfly, *Gilpinia hercyniae* Hartig (Hymenoptera: Diprionidae), for the EU. *G. hercyniae* is a well-defined and distinguishable species, native to Europe but also present in North America, Japan, Mongolia, Korea and Pakistan, and recognised as a pest of spruce (*Picea* spp.). The pest is distributed in 19 Member States (MSs) of the EU. It is a quarantine pest listed in Annex IIB of Council Directive 2000/29/EC. Protected zones are in place in Greece, Ireland and the United Kingdom (Northern Ireland, Isle of Man and Jersey). Plants for planting of *Picea* spp. and soil and litter associated with *Picea* spp. are considered as pathways for this pest, which is also able to disperse by flight. The prepupae overwinter inside cocoons in the litter or in the foliage. In spring, the adults, mostly females emerge and lay 35–60 eggs per female in mature needles. The larvae feed on the mature needles through five instars. There are 1–3 generations per year; some of the prepupae undergo prolonged diapause for more than 1 year. The impact on *Picea abies* (= *excelsa*) is minimal, because only the needles of the previous years are attacked; however, outbreaks have occurred on non-native spruce, *Picea glauca* and *Picea sitchensis.* The pest is controlled everywhere by natural enemies, including nuclear polyedrosis viruses. The insects spread on plants for planting of *Picea* spp., with soil and litter associated with *Picea* spp., and by flight. The EU protected zones have a similar climate and similar host plants as the MS where *G. hercyniae* is established. All criteria assessed by EFSA for consideration as potential protected zone quarantine pest and as a potential regulated non-quarantine pest were met.

Keywords: Diprionidae, European spruce sawfly, European Union, pest risk, plant health, plant pest, quarantine

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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, is 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

Aleurocantus 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

Gilpinia hercyniae 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 excluding Ceuta, Melilla and the outermost regions of Member States (MSs) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Since *G. hercyniae* is regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone (Greece, Ireland and parts of the United Kingdom: Northern Ireland, the Isle of Man and Jersey); thus, the criteria refer to the protected zone instead of the EU territory.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *G. hercyniae* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Relevant papers were reviewed, and further references and information were obtained from experts, 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 Plant Protection Organization (EPPO) Global Database (EPPO, 2017).

Data about the import of commodity types that could potentially provide a pathway for the pest to enter 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 launched by the Directorate General for Health and Consumers (DG SANCO), 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 MSs and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *G. hercyniae*, 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 initiated following an evaluation of the EU's 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 as per the specific ToR 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 RNQP. 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 which 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, while addressing social impacts is outside the remit of the Panel, in agreement with 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).

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
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?
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, the identity of the pest is established. It can be identified at species level using conventional entomological keys.

Gilpinia hercyniae is an insect of the order Hymenoptera, family Diprionidae. Its taxonomy has been controversial until Reeks (1941) clearly separated it from *Gilpinia polytoma*, a close species feeding on the same host plants (*Picea* sp.). The ambiguity was associated with the fact that the species was introduced to North America in the early 20th century and caused considerable damage. It took some time before its identity was recognised and accepted in the North American literature (Smith, 1938 and Morris, 1958). Both species co-occur on spruce in Europe. Morphological differences in the genitalia are used to distinguish *G. hercyniae* from *G. polytoma* (Goulet, 1981). There are two additional species of the genus *Gilpinia* feeding on spruce in Europe, one with local occurrence (*Gilpinia fennica* in Scandinavia) and another rarely found (*Gilpinia abieticola*). They can be distinguished by subtle morphological differences shown by Viitasaari and Vikberg (1985). A checklist of some European countries where the four spruce *Gilpinia* are found is presented by Holuša and Roller (2004).

3.1.2. Biology of the pest

The life history of *G. hercyniae* has been reviewed by Morris (1958) and Pschorn-Walcher (1982), in comparison with other species of the same genus. It overwinters as a prepupa inside a cocoon spun in the litter or in the foliage. In spring (early May in Germany), the adults, mostly females because of thelytokous parthenogenesis is the major type of reproduction, emerge and lay eggs (35–60 per female) in the mature spruce needles. The larvae hatch shortly after and feed on the mature needles through five instars, then they spin the cocoon and turn into prepupae. There are 1–3 generations per year, depending on temperature and local conditions, and some of the prepupae can stay in prolonged diapause inside the cocoon for more than 1 year. Adult females are 7–8 mm long, while larvae are maximum 2 cm long. The larvae can feed only on mature needles, i.e. those produced in the previous years, as spruce may keep needles for several years. The current year needles, responsible for most of the photosynthesis and tree growth, are not suitable for larval feeding (Jensen, 1988).

3.1.3. Detection and identification of the pest

Are detection and identification methods available for the pest?
Yes, at the adult stage only.

Surveys to detect the occurrence of *G. hercyniae* in forests were carried out (Wong, 1972; Billany and Brown, 1977; Mohyuddin et al., 1984). Available methods include yellow sticky traps, Malaise traps, emergence traps and sweeping (Holuša and Roller, 2004). Identification of adult females is based on morphological traits provided by Goulet (1981) and Viitasaari and Vikberg (1985) for the four species of *Gilpinia* attaching spruce. Separation of the species at larval stage is difficult (Pschorn-Walcher, 1982) and larvae should be reared to adult stage for a confident identification.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

In non-EU Europe, *G. hercyniae* is present in Norway and Switzerland. Outside Europe, the pest has been reported in North America and Asia as presented in Figure 1 and Table 2.

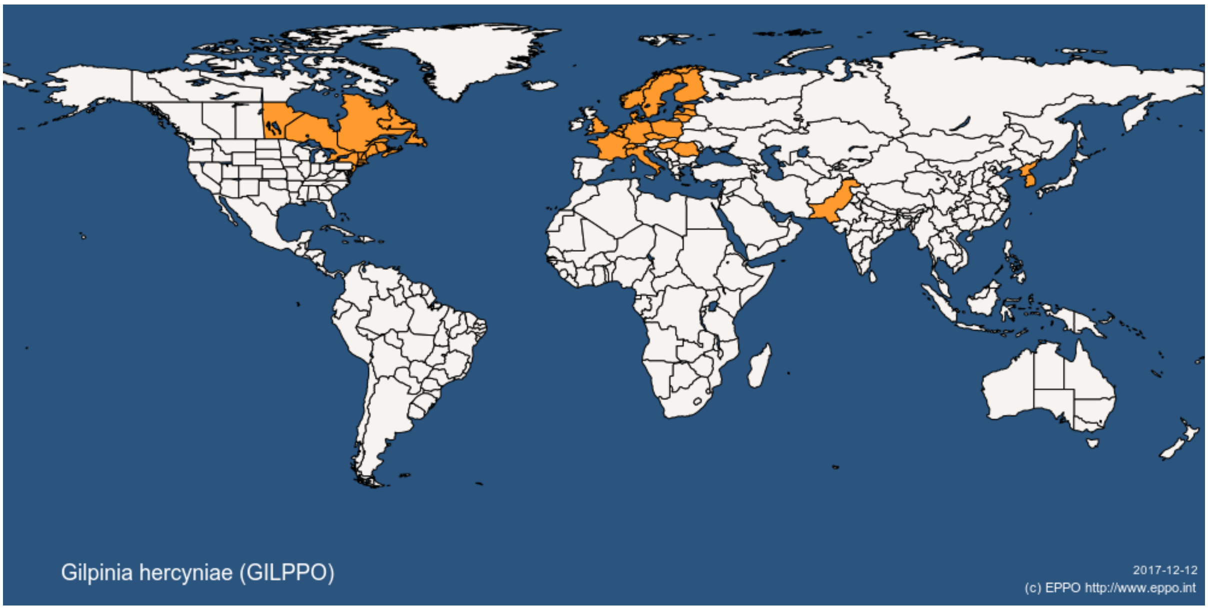

Figure 1: Global distribution map for *Gilpinia hercyniae* (extracted from the EPPO Global Database accessed on 19 September 2017)

Table 2: Global distribution of *Gilpinia hercyniae* extracted from the EPPO Global Database, CABI Crop Protection Compendium and other sources (accessed on 19 September 2017)

Country	Subnational distribution (provinces/states)	Status- EPPO GD Last update: 13 September 2017 Date accessed: 19 September 2017	CABI CPC Last update: 22 June 2017 Date accessed: 19 September 2017	Other sources
Canada	Manitoba	Present, no details		
	New Brunswick	Present, no details		
	Newfoundland	Present, no details		
	Nova Scotia	Present, no details		
	Ontario	Present, no details		
	Prince Edward Island		Restricted distribution	
	Quebec	Present, no details		
United States of America	Connecticut	Present, no details		
	Maine	Present, no details		
	Massachusetts	Present, no details		
	New Hampshire	Present, no details		
	New Jersey	Present, no details		
	New York	Present, no details		
	Pennsylvania		Present	
	Vermont	Present, no details		
	Wisconsin		Restricted distribution	

Country	Subnational distribution (provinces/states)	Status- EPPO GD Last update: 13 September 2017 Date accessed: 19 September 2017	CABI CPC Last update: 22 June 2017 Date accessed: 19 September 2017	Other sources
Asia	Japan	Present, no details		Pschorn-Walcher (1982)
	Democratic People's Republic of Korea	Present, no details		
	Republic of Korea	Present, no details		Pschorn-Walcher (1982)
	Mongolia		Present	
	Pakistan	Present, no details		Pschorn-Walcher (1982) Mohyuddin et al. (1984)
Non-EU Europe	Norway	Present, no details		
	Russia		Present	
	Switzerland	Present, few occurrences		
	Ukraine	Absent, unreliable record		

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?

Yes, the pest is present in the EU and has been reported from 19 MS (Table 3). The pest is absent in the protected zones confirmed by survey (Greece, Ireland and the UK: Northern Ireland, Isle of Man and Jersey).

Table 3: Current distribution of *Gilpinia hercyniae* in the 28 EU MS based on information from the EPPO Global Database and the CABI Crop Protection Compendium

Country	EPPO Global Database Last update: 13/9/2017 Date accessed: 19/9/2017	CABI Crop Protection Compendium Last update: 22/6/2017 Date accessed: 19/9/2017
Austria	No information	Widespread
Belgium	Present, no details	
Bulgaria	No information	
Croatia	No information	
Cyprus	No information	
Czech Republic	Present, restricted distribution	
Denmark	Present, no details	
Estonia	Present, no details	
Finland	Present, widespread	
France	Present, few occurrences	
Germany	Present, widespread	
Greece	Absent, confirmed by survey	
Hungary	Present, restricted distribution	
Ireland	Absent, confirmed by survey	
Italy	Present, restricted distribution	
Latvia	Present, no details	
Lithuania	Present, restricted distribution	
Luxembourg	Present, no details	
Malta	No information	

Country	EPPO Global Database Last update: 13/9/2017 Date accessed: 19/9/2017	CABI Crop Protection Compendium Last update: 22/6/2017 Date accessed: 19/9/2017
Netherlands	Present, no details	
Poland	Present, no details	
Portugal	No information	
Romania	Present, no details	
Slovak Republic	No information	Present
Slovenia	No information	
Spain	No information	
Sweden	Present, widespread	
United Kingdom	Present, restricted distribution Channel Islands (Absent, confirmed by survey), England (Present, widespread), Northern Ireland (Absent, confirmed by survey)	Wales (widespread)

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Gilpinia hercyniae is listed in Council Directive 2000/29/EC. Details are presented in Tables 4 and 5.

Table 4: *Gilpinia hercyniae* in Council Directive 2000/29/EC

Annex II, Part B	**Harmful organisms whose introduction into, and whose spread within, certain protected zones shall be banned if they are present on certain plants or plant products**		
(a)	Insects, mites and nematodes, at all stages of their development		
	Species	Subject of contamination	Protected zones
4.	*Gilpinia hercyniae* (Hartig)	Plants of *Picea* A. Dietr., intended for planting, other than seeds	EL, IRL, UK (Northern Ireland, Isle of Man and Jersey)

3.3.2. Legislation addressing the hosts of *Gilpinia hercyniae*

Table 5: Regulated hosts and commodities that may involve *Gilpinia hercyniae* 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
Annex IV, Part B	**Special requirements which shall be laid down by all member states for the introduction and movement of plants, plant products and other objects into and within certain protected zones**		
	Plants, plant products and other objects	Special requirements	Protected zone(s)
18.	Plants of Picea A. Dietr., intended for planting, other than seeds	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(1), Annex IV(A)(I)(8.1), (8.2), (10), Annex IV(A)(II)(5) and Annex IV(B)(7), (8), (9), (10), (11), (12), (13), (16), official statement that the plants have been produced in nurseries and that the place of production is free from *Gilpinia hercyniae* (Hartig).	EL, IRL, UK (Northern Ireland, Isle of Man and Jersey)

Annex V	**Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community**
Part A	Plants, plant products and other objects originating in the Community
Section II	Plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separate from that of other products
2.1	Plants intended for planting other than seeds of the genera [...] *Picea* A. Dietr. [...]

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The larvae feed on all species of spruce (*Picea* sp.) (Billany and Brown, 1977 and Pschorn-Walcher, 1982). In the native range (Eurasia), the pest is associated with Norway spruce (*Picea abies*). It has a preference for mature needles on Norway spruce (Jensen, 1988), although it may feed on the young ones in the case of white spruce (*Picea glauca*) in Canada. On this host, it may cause considerable damage and can kill the trees (Morris, 1958). The only outbreaks recorded so far were outside of the native range of the pest and on non-native host species, *P. glauca* in North America and Sitka spruce (*Picea sitchensis*) in Wales (Pschorn-Walcher, 1982).

3.4.2. Entry

> *Is the pest able to enter into the protected zones? If yes, identify and list the pathways!*
>
> **Yes**, the pest can enter the protected zones by human assisted spread or by natural spread from EU areas where the pest is present.

The main pathways of entry are:

- Plants for planting of *Picea* spp.
- Soil and litter associated with *Picea* spp.

There are measures in place for EU internal trade of plants of *Picea* spp. from countries where the pest occurs to protected zones. This pathway is closed for trade with non-European countries (Annex III A.1 of 2000/29/EC).

G. hercyniae entered the UK around 1906 (Billany and Brown, 1977), and this shows that human-assisted movement can occur across a geographic barrier.

There were no records of interception or outbreak of *G. hercyniae* in the Europhyt database.

3.4.3. Establishment

> *Is the pest able to become established in the protected zones?*
>
> **Yes**, the pest is already established in 19 MS. The climate of the EU protected zones is similar to that of the MS where *Gilpinia hercyniae* is established, and the pest's main host plants are present (Figure 2).

3.4.3.1. EU distribution of main host plants

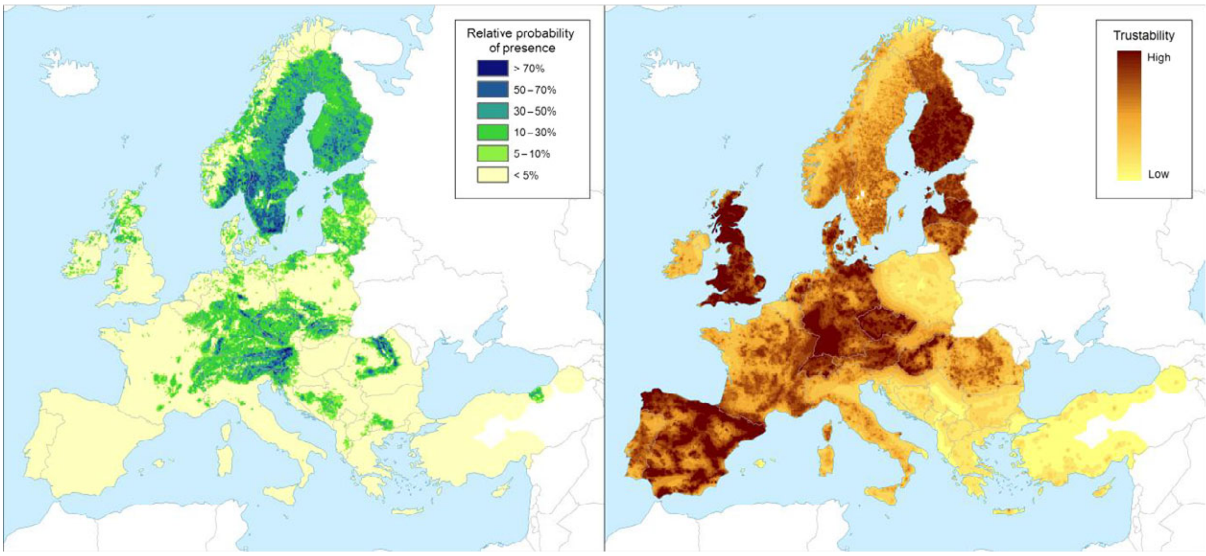

Figure 2: Left panel: Relative probability of presence (RPP) of the genus *Picea* (based on data from the species: *P. abies, P. sitchensis, P. glauca, P. engelmannii, P. pungens, P. omorika, P. orientalis*) in Europe, mapped at 100 km^2 resolution. The underlying data are from European-wide forest monitoring data sets and from national forestry inventories based on standard observation plots measuring in the order of hundreds m^2. RPP represents the probability of finding at least one individual of the taxon in a standard plot placed randomly within the grid cell. For details, see Appendix A (courtesy of JRC, 2017). Right panel: Trustability of RPP. This metric expresses the strength of the underlying information in each grid cell and varies according to the spatial variability in forestry inventories. The colour scale of the trustability map is obtained by plotting the cumulative probabilities (0–1) of the underlying index (for details see Appendix A)

3.4.3.2. Climatic conditions affecting establishment

Given the current distribution of *G. hercyniae*, the whole EU area (including the protected zones) is suitable for establishment. Figure 3 shows the Köppen–Geiger climate classification and the distribution of *G. hercyniae*.

The pest may affect native and planted spruce forest and ornamental trees.

In the UK, the species has spread in the 1950s and 1960s, reaching outbreak density in Wales between 1968 and 1974, although it has never colonised northern UK and Scotland. Billany and Brown (1977) assume that there could be a climatic limit to the spread as there are plantations of potentially susceptible host in those areas and the absence of geographic barriers to dispersal. However, in Canada, the spread was much faster even under generally colder conditions and the species has successfully invaded the eastern provinces and part of NE USA in a few decades (Morris, 1958). This was explained with the enemy-free space hypothesis (Morris, 1958).

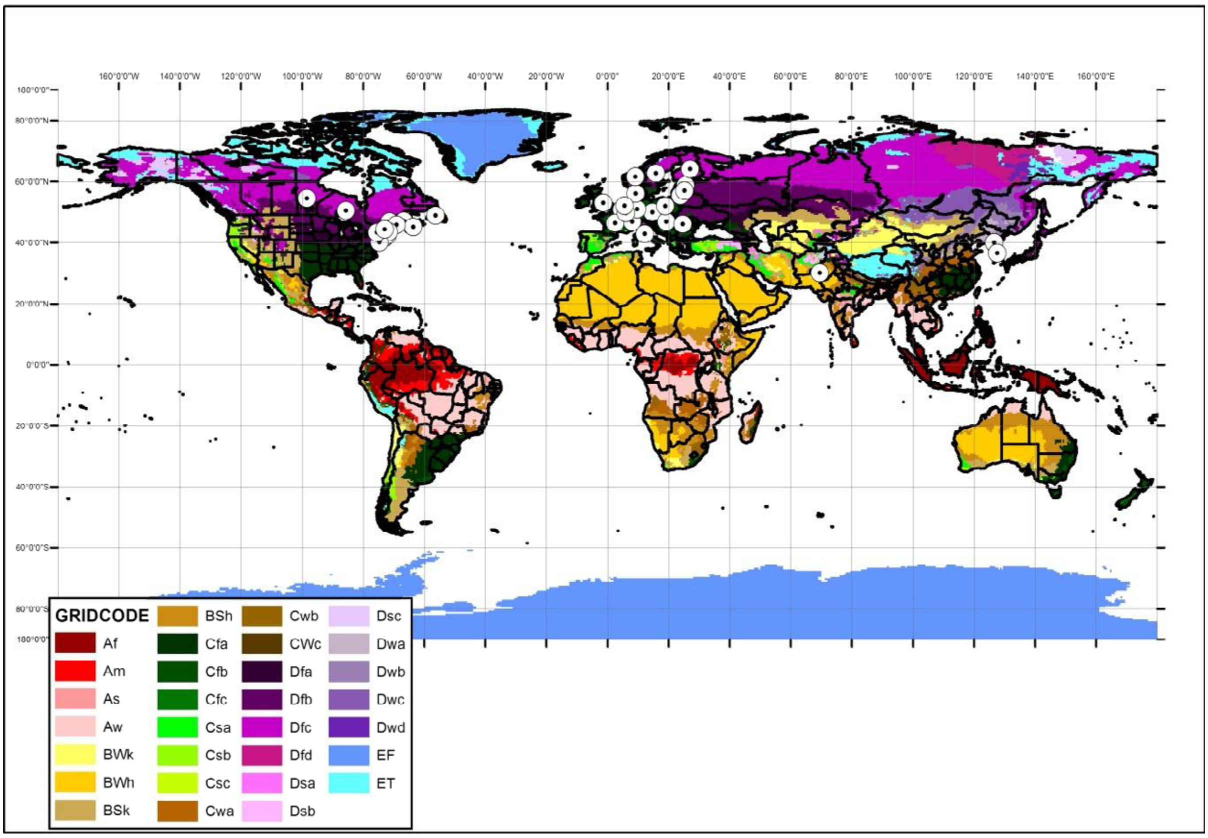

Figure 3: The current distribution of *Gilpinia hercyniae* presented by white dots on the Köppen–Geiger climate classification map (Kottek et al., 2006) of Eurasia

3.4.4. Spread

Is the pest able to spread within the protected zones following establishment? How?

Yes, the pest is spreading by active flight of females. Transportation with plants for planting is also possible.

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

Yes, plants for planting are the most important pathway for the pest.

3.5. Impacts

Would the pests' introduction have an economic or environmental impact in the protected zones?

Yes, outbreaks have occurred on non-native spruce, *P. glauca* and *P. sitchensis* (Section 3.4.1), and *P. sitchensis* is an important forest species in part of the protected zone. However, when the native Norway spruce (*P. abies*) is attacked, only the needles from the previous years are consumed by the larvae and there is very limited damage. Moreover, the pest is controlled everywhere by natural enemies, especially by nuclear polyedrosis viruses.

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, only in protected zones where plants are mainly used in forest plantations, especially in the case of Sitka spruce (*P. sitkensis*). For EU-internal trade (excluding protected zones), the presence of the pest on plants for planting does not have a significant impact because the pest is already widespread in forest areas within the EU.

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

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 protected zones such that the risk becomes mitigated? **Yes**, the material to be used in the protected zones has to be produced in pest-free areas or in nursery conditions that allow pest exclusion. *RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?* **Yes**, for trees produced in screened glasshouses in areas where the pest is present.

3.6.1. Phytosanitary measures

- Pest-free area
- Production in protected cultivation
- Restriction in trade for plants for planting younger than 1 year
- Restriction of trade of plants for planting to winter time and plants without soil.

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

- If plants for planting are taken with soil/litter, the probability to carry the sawfly is higher because of the potential occurrence of dormant prepupae inside the cocoons.
- detection of eggs in spruce needles can be troublesome because they are embedded in the tissues and difficult to find.

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

- The presence of *C. hercyniae* on mature spruce around the nurseries is difficult to monitor and to prevent.
- Protected cultivation is not a common practice in forest nurseries.

3.6.4. Pest control methods

The pest is not a problem in both native and introduced ranges because of the regulation by natural enemies. Nuclear polyedrosis viruses are often controlling the pest and were the reason for the collapse of the outbreaks in North America in the 1930s and in Wales 1968–1974 (Adams and Entwistle, 1981).

3.7. Uncertainty

From the history of *G. hercyniae* outbreaks, it is known that natural enemies contain population surges in newly colonised areas and maintain populations at low levels afterwards (Morris, 1958; Billany and Brown, 1977; Pschorn-Walcher, 1982). From the same events, it is also known that dispersal by natural flight is not important, whilst plants for planting play a central role. There is thus little uncertainty regarding the movements, impact and control of the pest.

4. Conclusions

All criteria assessed by EFSA above for consideration as potential protected zone quarantine pest and as a potential RNQP were met (Table 6).

Table 6: 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 protected zone quarantine pest (articles 32–35)	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 is established. Adults can be identified at species level using conventional entomological keys	The identity of the pest is established. Adults can be identified at species level using conventional entomological keys	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest has been reported from 19 EU-MS	The pest has been reported from 19 EU-MS	None
Regulatory status (Section 3.3)	Greece, Ireland and the United Kingdom (Northern Ireland, Isle of Man and Jersey) are protected zones with respect to *G. hercyniae.* The pest is regulated on plants for planting other than seeds of the genus *Picea.*	Greece, Ireland and the United Kingdom (Northern Ireland, Isle of Man and Jersey) are protected zones with respect to *G. hercyniae.* The pest is regulated on plants for planting other than seeds of the genus *Picea.*	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The pest can enter the protected zones by human-assisted spread or by natural spread from EU areas where the pest is present.	The main pathways of spread are plants for planting of *Picea* spp. and soil and litter associated with *Picea* spp.	None
Potential for consequences in the EU territory (Section 3.5)	Impact would be minimal if the native *Picea abies* is attacked, because only the needles from the previous years are consumed by the larvae. Moreover, the pest is regularly controlled by natural enemies, including nuclear polyedrosis viruses. However, outbreaks have occurred on non-native spruce, *P. glauca* and *P. sitchensis*	The presence of the pest on plants for planting could have an economic impact, most likely transient (until natural enemies would regulate pest populations), in protected zones where plants are mainly used in forest plantations, especially in the case of Sitka spruce (*Picea sitkensis*)	In relation to the RNQP status, the acceptable level of impact for forest nurseries cannot be judged by EFSA.
Available measures (Section 3.6)	The material to be used in the protected zones has to be produced in pest-free areas or in nursery conditions that allow pest exclusion. Eradication does not appear justified, because of the low impact on *P. abies*, and the control by local natural enemies observed everywhere	Trees could be produced in screened glasshouses in areas where the pest is present.	Screened glasshouses do not seem very realistic for forest nurseries
Conclusion on pest categorisation (Section 4)	All criteria assessed above by EFSA for consideration as potential protected zone quarantine pest were met.	All criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met.	In relation to the RNQP status, the acceptable level of impact for forest nurseries cannot be judged by EFSA.

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Aspects of assessment to focus on/ scenarios to address in future if appropriate	No further assessment or scenario to address.		

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Abbreviations

CLC	Corine Land Cover
C-SMFA	constrained spatial multi-scale frequency analysis
DG SANCO	Directorate General for Health and Consumers
EPPO	European and Mediterranean Plant Protection Organization
EUFGIS	European Information System on Forest Genetic Resources
FAO	Food and Agriculture Organization
GD^2	Georeferenced Data on Genetic Diversity
IPPC	International Plant Protection Convention
MS	Member State
PLH	EFSA Panel on Plant Health
RPP	Relative Probability of Presence
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Methodological notes on Figure 2

The relative probability of presence (RPP) reported here for *Picea* and *Pinus* spp. in Figure 2 and in the European Atlas of Forest Tree Species (de Rigo et al., 2016; San-Miguel-Ayanz et al., 2016) is the probability of that genus to occur in a given spatial unit (de Rigo et al., 2017). In forestry, such a probability for a single taxon is called 'relative'. The maps of RPP are produced by means of the constrained spatial multi-scale frequency analysis (C-SMFA) (de Rigo et al., 2014, 2017) of species presence data reported in geolocated plots by different forest inventories.

A.1. Geolocated plot databases

The RPP models rely on five geodatabases that provide presence/absence data for tree species and genera: four European-wide forest monitoring data sets and a harmonised collection of records from national forest inventories (de Rigo et al., 2014, 2016, 2017). The databases report observations made inside geolocalised sample plots positioned in a forested area, but do not provide information about the plot size or consistent quantitative information about the recorded species beyond presence/absence.

The harmonisation of these data sets was performed within the research project at the origin of the European Atlas of Forest Tree Species (de Rigo et al., 2016; San-Miguel-Ayanz, 2016; San-Miguel-Ayanz et al., 2016). Given the heterogeneity of strategies of field sampling design and establishment of sampling plots in the various national forest inventories (Chirici et al., 2011a,b), and also given legal constraints, the information from the original data sources was harmonised to refer to an INSPIRE compliant geospatial grid, with a spatial resolution of 1 km^2 pixel size, using the ETRS89 Lambert Azimuthal Equal-Area as geospatial projection (EPSG: 3035, http://spatialreference.org/ref/epsg/etrs89-etrs-laea/).

A.1.1. European National Forestry Inventories database

This data set was derived from National Forest Inventory data and provides information on the presence/absence of forest tree species in approximately 375,000 sample points with a spatial resolution of 1 km^2/pixel, covering 21 European countries (de Rigo et al., 2014, 2016).

A.1.2. Forest Focus/Monitoring data set

This project is a Community scheme for harmonised long-term monitoring of air pollution effects in European forest ecosystems, normed by EC Regulation No. 2152/2003[5]. Under this scheme, the monitoring is carried out by participating countries on the basis of a systematic network of observation points (Level I) and a network of observation plots for intensive and continuous monitoring (Level II). For managing the data, the JRC implemented a Forest Focus Monitoring Database System, from which the data used in this project were taken (Hiederer et al., 2007; Houston Durrant and Hiederer, 2009). The complete Forest Focus data set covers 30 European Countries with more than 8,600 sample points.

A.1.3. BioSoil data set

This data set was produced by one of a number of demonstration studies performed in response to the 'Forest Focus' Regulation (EC) No. 2152/2003 mentioned above. The aim of the BioSoil project was to provide harmonised soil and forest biodiversity data. It comprised two modules: a soil module (Hiederer et al., 2011) and a biodiversity module (Houston Durrant et al., 2011). The data set used in the C-SMFA RPP model came from the biodiversity module, in which plant species from both the tree layer and the ground vegetation layer were recorded for more than 3,300 sample points in 19 European Countries.

[5] Council of the European Union, 2003. Regulation (EC) No 2152/2003 of the European Parliament and of the Council of 17 November 2003 concerning monitoring of forests and environmental interactions in the Community (Forest Focus). Official Journal of the European Union 46 (L 324), 1–8.

A.1.4. European Information System on Forest Genetic Resources (EUFGIS)

EUFGIS (http://portal.eufgis.org) is a smaller geodatabase providing information on tree species composition in over 3,200 forest plots in 34 European countries. The plots are part of a network of forest stands managed for the genetic conservation of one or more target tree species. Hence, the plots represent the natural environment to which the target tree species are adapted.

A.1.5. Georeferenced Data on Genetic Diversity (GD^2)

GD^2 (http://gd2.pierroton.inra.fr) provides information about 63 species of interest for genetic conservation. The database covers 6,254 forest plots located in stands of natural populations that are traditionally analysed in genetic surveys. While this database covers fewer species than the others, it covers 66 countries in Europe, North Africa and the Middle East, making it the dataset with the largest geographic extent.

A.2. Modelling methodology

For modelling, the data were harmonised in order to have the same spatial resolution (1 km^2) and filtered to a study area comprising 36 countries in the European continent. The density of field observations varies greatly throughout the study area and large areas are poorly covered by the plot databases. A low density of field plots is particularly problematic in heterogeneous landscapes, such as mountainous regions and areas with many different land use and cover types, where a plot in one location is not representative of many nearby locations (de Rigo et al., 2014). To account for the spatial variation in plot density, the model used here (C-SMFA) considers multiple spatial scales when estimating RPP. Furthermore, statistical resampling is systematically applied to mitigate the cumulated data-driven uncertainty.

The presence or absence of a given forest tree species then refers to an idealised standard field sample of negligible size compared with the 1 km^2 pixel size of the harmonised grid. The modelling methodology considered these presence/absence measures as if they were random samples of a binary quantity (the punctual presence/absence, not the pixel one). This binary quantity is a random variable having its own probability distribution which is a function of the unknown average probability of finding the given tree species within a plot of negligible area belonging to the considered 1 km^2 pixel (de Rigo et al., 2014). This unknown statistic is denoted hereinafter with the name of 'probability of presence'.

C-SMFA preforms spatial frequency analysis of the geolocated plot data to create preliminary RPP maps (de Rigo et al., 2014). For each 1 km^2 grid cell, the model estimates kernel densities over a range of kernel sizes to estimate the probability that a given species is present in that cell. The entire array of multiscale spatial kernels is aggregated with adaptive weights based on the local pattern of data density. Thus, in areas where plot data are scarce or inconsistent, the method tends to put weight on larger kernels. Wherever denser local data are available, they are privileged ensuring a more detailed local RPP estimation. Therefore, a smooth multiscale aggregation of the entire arrays of kernels and data sets is applied instead of selecting a local 'best performing' one and discarding the remaining information. This array-based processing and the entire data harmonisation procedure are made possible thanks to the semantic modularisation which defines the Semantic Array Programming modelling paradigm (de Rigo, 2012).

The probability to find a single species (e.g. a particular coniferous tree species) in a 1 km^2 grid cell cannot be higher than the probability of presence of all the coniferous species combined. The same logical constraints applied to the case of single broadleaved species with respect to the probability of presence of all the broadleaved species combined. Thus, to improve the accuracy of the maps, the preliminary RPP values were constrained so as not to exceed the local forest-type cover fraction with an iterative refinement (de Rigo et al., 2014). The forest-type cover fraction was estimated from the classes of the Corine Land Cover (CLC) maps which contain a component of forest trees (Bossard et al., 2000; Büttner et al., 2012).

The resulting probability of presence is relative to the specific tree taxon, irrespective of the potential co-occurrence of other tree taxa with the measured plots, and should not be confused with the absolute abundance or proportion of each taxon in the plots. RPP represents the probability of finding at least one individual of the taxon in a plot placed randomly within the grid cell, assuming that the plot has negligible area compared with the cell. As a consequence, the sum of the RPP associated with different taxa in the same area is not constrained to be 100%. For example, in a forest with two codominant tree species which are homogeneously mixed, the RPP of both may be 100% (see e.g. the Glossary in San-Miguel-Ayanz et al. (2016), http://forest.jrc.ec.europa.eu/media/atlas/Glossary.pdf).

The robustness of RPP maps depends strongly on sample plot density, as areas with few field observations are mapped with greater uncertainty. This uncertainty is shown qualitatively in maps of'RPP trustability'. RPP trustability is computed on the basis of the aggregated equivalent number of sample plots in each grid cell (equivalent local density of plot data). The trustability map scale is relative, ranging from 0 to 1, as it is based on the quantiles of the local plot density map obtained using all field observations for the species. Thus, trustability maps may vary among species based on the number of databases that report a particular species (de Rigo et al., 2014, 2016).

The RPP and relative trustability range from 0 to 1 and are mapped at a 1 km spatial resolution. To improve visualisation, these maps can be aggregated to coarser scales (i.e. 10 $\times$ 10 pixels or 25 $\times$ 25 pixels, respectively, summarising the information for aggregated spatial cells of 100 km^2 and 625 km^2) by averaging the values in larger grid cells.