Pest categorisation of *Ips typographus*

EFSA Panel on Plant Health (PLH),
Michael Jeger, Claude Bragard, David Caffier, Thierry Candresse, Elisavet Chatzivassiliou,
Katharina Dehnen-Schmutz, Gianni Gilioli, Josep Anton Jaques Miret, Alan MacLeod,
Maria Navajas Navarro, Björn Niere, Stephen Parnell, Roel Potting, Trond Rafoss,
Vittorio Rossi, Gregor Urek, Ariena Van Bruggen, Wopke Van der Werf, Jonathan West,
Stephan Winter, Virág Kertész, Mitesha Aukhojee and Jean-Claude Grégoire

Abstract

The Panel on Plant Health performed a pest categorisation of the eight-toothed spruce bark beetle, *Ips typographus* L. (Coleoptera: Curculionidae, Scolytinae), for the EU. *I. typographus* is a well-defined and distinguishable species, recognised mainly as a pest of spruce (*Picea* spp.) in Eurasia. It also attacks other conifers such as *Abies* spp., *Larix* spp., *Pinus* spp. and *Pseudotsuga menziesii*. Native to Eurasia, *I. typographus* has spread from the native range of spruce to new areas in Eurasia where spruce has been planted, and is now widely distributed throughout the EU (22 Member states). It is a quarantine pest listed in Annex IIB of Council Directive 2000/29/EC for Ireland and United Kingdom as protected zones. Coniferous wood, bark and wood packaging material are considered as pathways for the pest, which is also able to disperse by flight over tens of kilometres. The insects normally establish on fallen trees but can also mass-attack healthy trees, killing millions of spruces. The males produce pheromones that attract conspecifics of both sexes. Each male attracts one to four females; each female produces 2–80 offspring. The insects also inoculate pathogenic fungi to their hosts. There are one to three generations per year. The wide current geographic range of *I. typographus* suggests that it is able to establish anywhere in the EU where its hosts are present. Sanitary thinning or clear-felling are the major control methods. Pheromone mass trapping is presently judged unreliable because of the large dispersal capacity of the pest. Quarantine measures are implemented to prevent entry in yet uncolonised areas. All criteria assessed by EFSA for consideration as potential protected zone quarantine pest are met. The criteria for considering *I. typographus* as a potential regulated non-quarantine pest are not met since plants for planting are not a pathway.

© 2017 European Food Safety Authority. *EFSA Journal* published by John Wiley and Sons Ltd on behalf of European Food Safety Authority.

**Keywords:** Curculionidae, European Union, pest risk, plant health, plant pest, quarantine, eight-toothed spruce bark beetle

**Requestor:** European Commission

**Question number:** EFSA-Q-2017-00195

**Correspondence:** alpha@efsaeuropa.eu
Panel members: Claude Bragard, David Caffier, Thierry Candresse, Elisavet Chatzivassiliou, Katharina Dehnen-Schmutz, Gianni Gilioli, Jean-Claude Gregoire, Josep Anton Jaques Miret, Michael Jeger, Alan MacLeod, Maria Navajas Navarro, Björn Niere, Stephen Parnell, Roel Potting, Trond Rafoss, Vittorio Rossi, Gregor Urek, Ariena Van Bruggen, Wopke Van der Werf, Jonathan West and Stephan Winter.

Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health), Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Jaques Miret JA, MacLeod A, Navajas Navarro M, Niere B, Parnell S, Potting R, Rafoss T, Rossi V, Urek G, Van Bruggen A, Van der Werf W, West J, Winter S, Kertész V, Aukhojee M and Grégoire J-C, 2017. Scientific Opinion on the pest categorisation of Ips typographus. EFSA Journal 2017;15(7):4881, 23 pp. https://doi.org/10.2903/j.efsa.2017.4881

ISSN: 1831-4732

© 2017 European Food Safety Authority. EFSA Journal published by John Wiley and Sons Ltd on behalf of European Food Safety Authority.

This is an open access article under the terms of the Creative Commons Attribution-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited and no modifications or adaptations are made.

Reproduction of the images listed below is prohibited and permission must be sought directly from the copyright holder:

Figure 1: © EPPO
Figure 2: © European Union, 2017. Reuse is authorised, provided the source is acknowledged

The EFSA Journal is a publication of the European Food Safety Authority, an agency of the European Union.
# Table of contents

| Section                                                                 | Page |
|------------------------------------------------------------------------|------|
| Abstract                                                               | 1    |
| 1. Introduction                                                       | 4    |
| 1.1. Background and Terms of Reference as provided by the requestor  | 4    |
| 1.1.1. Background                                                      | 4    |
| 1.1.2. Terms of reference                                             | 4    |
| 1.1.2.1. Terms of Reference: Appendix 1                                | 5    |
| 1.1.2.2. Terms of Reference: Appendix 2                                | 6    |
| 1.1.2.3. Terms of Reference: Appendix 3                                | 7    |
| 1.2. Interpretation of the Terms of Reference                         | 8    |
| 2. Data and methodologies                                             | 8    |
| 2.1. Data                                                             | 8    |
| 2.1.1. Literature search                                              | 8    |
| 2.1.2. Database search                                                | 8    |
| 2.2. Methodologies                                                    | 8    |
| 3. Pest categorisation                                                | 10   |
| 3.1. Identity and biology of the pest                                 | 10   |
| 3.1.1. Identity and taxonomy                                          | 10   |
| 3.1.2. Biology of the pest                                            | 11   |
| 3.1.3. Intraspecific diversity                                        | 11   |
| 3.1.4. Detection and identification of the pest                       | 11   |
| 3.2. Pest distribution                                                | 12   |
| 3.2.1. Pest distribution outside the EU                               | 12   |
| 3.2.2. Pest distribution in the EU                                     | 12   |
| 3.3. Regulatory status                                                | 13   |
| 3.3.1. Council Directive 2000/29/EC                                    | 13   |
| 3.3.2. Legislation addressing plants and plant parts on which *Ips typographus* is regulated | 13   |
| 3.3.3. Legislation addressing the organisms vectored by *Ips typographus* (Directive 2000/29/EC) | 15   |
| 3.4. Entry, establishment and spread in the EU                        | 15   |
| 3.4.1. Host range                                                     | 15   |
| 3.4.2. Entry                                                          | 15   |
| 3.4.3. Establishment                                                  | 16   |
| 3.4.3.1. EU distribution of main host plants                          | 16   |
| 3.4.3.2. Climatic conditions affecting establishment                  | 16   |
| 3.4.4. Spread                                                         | 17   |
| 3.5. Potential or observed impacts in the EU                           | 17   |
| 3.5.1. Potential pest impacts                                         | 17   |
| 3.5.2. Observed pest impacts                                          | 17   |
| 3.5.2.1. Direct impact of the pest                                    | 17   |
| 3.5.2.2. Indirect pest impact (e.g. by bacteria or viruses transmitted by the pest) | 17   |
| 3.6. Availability and limits of mitigation measures                   | 18   |
| 3.6.1. Biological or technical factors affecting the feasibility and effectiveness of measures to prevent the entry, establishment and spread of the pest | 18   |
| 3.6.2. Control methods                                                | 18   |
| 3.7. Uncertainty                                                      | 18   |
| 4. Conclusions                                                        | 20   |
| References                                                            | 23   |
1. Introduction

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

1.1.1. Background

Council Directive 2000/29/EC 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 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, 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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

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

(b) Bacteria

| Taxon                                      | Description                                      |
|--------------------------------------------|--------------------------------------------------|
| Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones | |
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

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

1) Andean potato latent virus 4) Potato black ringspot virus
2) Andean potato mottle virus 5) Potato virus T
3) Arracacha virus B, oca strain 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 8) Peach yellows mycoplasm
2) Cherry rasp leaf virus (American) 9) Plum line pattern virus (American)
3) Peach mosaic virus (American) 10) Raspberry leaf curl virus (American)
4) Peach phony rickettsia 11) Strawberry witches’ broom mycoplasm
5) Peach rosette mosaic virus 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.*

6) Peach rosette mycoplasm
7) Peach X-disease mycoplasm

**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) 3) *Margarodes prieskaensis* Jakubski
2) *Margarodes vredendalensis* de Klerk

(c) Fungi

*Glomerella gossypii* Edgerton  
*Hypoxylon mammatum* (Wahl.) J. Miller  
*Gremmeniella abietina* (Lag.) Morelet
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) **Longidorus diadecturus** Eveleigh and Allen
- *Amauromyza maculosa* (Malloch) **Monochamus** spp. (non-EU)
- *Anomala orientalis* Waterhouse **Myndus crudus** Van Duzee
- *Arrhenodes minutus* Drury **Nacobbus aberrans** (Thorne) Thorne and Allen
- *Choristoneura* spp. (non-EU) **Naupactus leucoloma** Boheman
- *Conotrachelus nenuphar* (Herbst) **Pemnnotyphlus** spp. (non-EU)
- *Dendrolimus sibiricus* Tschetterikov **Pseudopythophthus minutissimus** (Zimmermann)
- *Diabrotica barberi* Smith and Lawrence **Pseudopythophthus pruinosus** (Eichhoff)
- *Diabrotica undecimpunctata howardi* Barber **Scaphoideus luteolus** (Van Duzee)
- *Diabrotica undecimpunctata undecimpunctata* Mannerheim **Spodoptera eridania** (Cramer)
- *Hirschmanniella* spp., other than *Hirschmanniella gracilis* (de Man) **Xiphinema americanum** Cobb sensu lato (non-EU populations)
- *Liriomyza sativae* Blanchard **Xiphinema californicum** Lamberti and Bleve-Zacheo

(b) **Fungi**

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

(c) **Viruses and virus-like organisms**

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

(d) **Parasitic plants**

- *Arceuthobium* spp. (non-EU)

**Annex IAII**

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

- *Meloidogyne fallax* Karssen **Rhizocoeus hibisci** Kawai and Takagi
- *Popillia japonica* Newman

(b) **Bacteria**

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

(c) **Fungi**

- *Melampsora medusae* Thümen **Synchytrium endobioticum** (Schilbersky) Percival

www.efsa.europa.eu/efsajournal 7 EFSA Journal 2017;15(7):4881
Annex IB

(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

*Ips typographus* 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 for the area of the European Union excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Since *I. typographus* is regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone (Ireland and the United Kingdom), thus the criteria refers 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 *I. typographus* 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 EPPO Global Database (EPPO, online). Data about the area of hosts grown in the EU and about the import of commodity types that could provide a pathway for the pest to enter the EU from non-EU European countries were obtained from EUROSTAT.

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 the 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 *I. typographus*, 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 regulated non-quarantine pest in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required as per 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. In such a case, the working group should consider the possibility to terminate the assessment early and to be concise in the sections preceding the question for which the negative answer is reached. Note that a pest that does not qualify as a quarantine pest may still qualify as a regulated non-quarantine pest 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 regards to the principle of separation between risk assessment and risk management (EFSA founding regulation (EC) 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) |
| 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? |
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 to species using conventional entomological keys.

*Ips typographus* is an insect of the family Curculionidae, subfamily Scolytinae.\(^4\)

---

\(^4\) Although the leading taxonomists in the 2000s (Wood, 1982; Bright and Skidmore, 2002) still considered the Scolytidae to be a family distinct from the Curculionidae according to morphological criteria, modern phylogenetics supports the position of scolytine beetles (Scolytinae) within the family Curculionidae (Knížek and Beaver, 2004; Hulcr et al., 2015). This is reflected by the growing number of citations in Scopus (online) referring to Scolytinae (18 in 1990 vs 177 in 2016), as opposed to citations referring to Scolytidae (50 in 1990 vs 15 in 2016). The Scolytinae includes two subcategories, the 'bark beetles' which live in the phloem, and the 'ambrosia beetles' which live in the sapwood.
3.1.2. Biology of the pest

Comprehensive accounts of the biology and ecology of *I. typographus* are given by Chararas (1962), Christiansen and Bakke (1997), Wermelinger (2004) and Kausrud et al. (2011). The adults overwinter in the litter or in the bark of the trees where they developed, and disperse widely in the spring, flying in search for new hosts. Dispersal can be very wide, sometimes over tens of kilometres (Forsse and Solb Recreation, 1985) or even longer distances (> 100 km according to Montano et al., 2016). Upon emergence, the males constitute 30–50% of the population (Lobinger, 1996). They start colonising either weakened (e.g. fallen) or healthy trees and attract conspecifics of both sexes with aggregation pheromones (Bakke, 1970, 1976; Birgersson et al., 1984). Each male that has excavated a nuptial chamber in the phloem is joined by one to four females, which bore each a maternal gallery in the phloem fibres and lay one egg at a time at regular intervals (Anderbrant, 1990), each in a small niche created in the lateral wall of the maternal gallery. Up to 80 eggs can be laid by one female but, at usual densities (1–5 females/dm²), 2–10 offspring/female are produced. After egg-laying, the parent adults often re-emerge, fly away and establish sister broods on new hosts. Each larva excavates an individual gallery perpendicular to the maternal gallery. Pupation occurs in a small niche in the phloem, at the end of each larval gallery. After metamorphosis, the young adults remain under the bark for maturation feeding before they disperse. An adult diapause is sometimes observed in upper latitudes or elevations (Schopf, 1989). There are one to possibly three generations per year. At low, endemic population levels, the beetles mostly establish on weakened hosts. When populations increase, for example after a storm has provided a large amount of undefended material, the beetles start attacking healthy trees, which they mass-attack, thus overwhelming their defences. During this process, pathogenic ophiostomatoid fungi are inoculated to the host (Solheim, 1986; Kirisits, 2004; Linnakoski et al., 2016) and contribute to tree death. These massively attacked trees also attract competitors (Schlyter and Anderbrant, 1993) and natural enemies (Mills, 1983, 1985; Kenis et al., 2004). The major triggers for *I. typographus* outbreaks are the availability of storm-felled timber, summer rainfall deficits and warm temperatures (Grégoire et al., 2015 and refs. therein; Marini et al., 2016). Climate change is predicted to alter the beetles’ voltinism and the trees’ vulnerability, leading to increased damage in the future (Jönsson et al., 2009, 2011; Bentz and Jönsson, 2015 and references therein; Seidl and Rammer, 2016).

3.1.3. Intraspecific diversity

One subspecies, *I. typographus japonicus* is known in China and Japan (Stauffer et al., 1999). In Europe, a phylogeographic analysis has revealed the existence of a northern and a southern group of haplotypes within the species *I. typographus* (Mayer et al., 2015).

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, the organism can be detected by visual searching, often after damage symptoms are seen. The species can be identified by examining morphological features, for which keys exist, e.g. Balachowsky (1949); Grünberg (1979); Schedl (1981); Wood (1982).

The standing trees attacked by *I. typographus* die during the colonisation process. During the attacks, brown sawdust is expelled from the entry holes and, when the broods have metamorphosed and the young adults start feeding on the phloem around the galleries, the bark can flake off, and this phenomenon can be amplified by the action of wood peckers. Within and behind the phloem, vertical maternal galleries and horizontal larval galleries can be seen. The sapwood shows bluestaining due to the fungi introduced by the beetles. The adult insects are dark brown or black in colour, cylindrical, 4.5–5.5 mm long. The larvae are apodous, with a dark amber cephalic capsule.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

*I. typographus* is present in two continents, continental Europe and Asia. The insect is absent from the other continents. It has been repeatedly intercepted at ports in the United States (period 1985–2000;
286 interceptions out of 6,825 records: Haack, 2001) and in New Zealand (period 1952-2000; 43 interception out of 722 records: Brockerhoff et al., 2003). In non-EU Europe, the insect has been reported from Bosnia and Herzegovina, Georgia, Norway, Russia, Serbia, Switzerland, Turkey and Ukraine (Figure 1).

**Figure 1:** Global distribution map for *Ips typographus* (extracted from the EPPO Global Database accessed on 28 February 2017)

### 3.2.2 Pest distribution in the EU

| Country               | EPPO GD                                      |
|-----------------------|----------------------------------------------|
|                       | Last update: 10/3/2016 Date Accessed: 22/2/17|
| Austria               | Present, no details                          |
| Belgium               | Present, no details                          |
| Bulgaria              | Present, widespread                          |
| Croatia               | Present, restricted distribution              |
| Cyprus                | No information                               |
| Czech Republic        | Present, widespread                          |
| Denmark               | Present, widespread                          |
| Estonia               | Present, no details                          |
| Finland               | Present, widespread                          |
| France                | Present, restricted distribution              |
| Germany               | Present, widespread                          |
| Greece                | Present, no details                          |

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

Yes, *I. typographus* is present and widely distributed in the EU; it has been reported from 22 Member States (MSs). The protected zones, Ireland and the United Kingdom, are free from the pest.
### 3.3. Regulatory status

#### 3.3.1. Council Directive 2000/29/EC

*Ips typographus* is listed in Council Directive 2000/29/EC. Details are presented in Tables 3 and 4.

**Table 3:** *Ips typographus* 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 |
| 6 (e)            | *Ips typographus* | Plants of Abies Mill., Larix Mill., Picea A. Dietr., Pinus L. and Pseudotsuga Carr., over 3 m in height, other than fruit and seeds (Coniferales) with bark, isolated bark of conifers | IRL, UK |

**Table 4:** Regulated hosts and commodities that may involve *Ips typographus* 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 |
|-------------------|------------------------------------------------------------------------------------------------------------------|
| 1                 | Plants of Abies Mill., [ . . . ], Larix Mill., Picea A. Dietr., Pinus L., Pseudotsuga Carr. [ . . . ], other than fruit and seeds | Non-European Countries |
### Annex IV, Part B

| Plants, plant products and other objects | Special requirements | Protected zone(s) |
|-----------------------------------------|----------------------|------------------|
| **3.** Wood of conifers (Coniferales) | Without prejudice to the requirements applicable to the wood listed in Annex IV(A)(I)(1.1), (1.2), (1.3), (1.4), (1.5), (1.6), (1.7), where appropriate, and Annex IV(B)(1) and (2):  
  (a) the wood shall be stripped of its bark;  
  or  
  (b) official statement that the wood originates in areas known to be free from *Ips typographus* Heer;  
  or  
  (c) there shall be evidence by a mark ‘Kiln-dried’, ‘KD’ or another internationally recognised mark, put on the wood or on its packaging in accordance with current commercial usage, that it has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, at time of manufacture, achieved through an appropriate time/temperature schedule | IRL, UK |

| **9.** Plants of *Abies* Mill., *Larix* Mill., *Picea* A. Dietr., *Pinus* L. and *Pseudotsuga* Carr., over 3 m in height, other than fruit and seeds | Without prejudice to the provisions applicable to the plants listed in Annex III(A)(1), Annex IV(A)(I)(8.1), (8.2), (9), (10), Annex IV(A)(II)(4), (5) and Annex IV(B)(7), (8), where appropriate, official statement that the place of production is free from *Ips typographus* | IRL, UK |

| **14.6** Isolated bark of conifers (Coniferales) | Without prejudice to the provisions applicable to the bark listed in Annex IV(B)(14.1), (14.2), (14.3), (14.4), (14.5), official statement that the consignment:  
  (a) has been subjected to fumigation or other appropriate treatments against bark beetles;  
  or  
  (b) originates in areas known to be free from *Ips typographus* | IRL, UK |

### 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 *Abies* Mill., *Larix* Mill., *Picea* A. Dietr., *Pinus* L., *Pseudotsuga* Carr. | | |
3.3.3. Legislation addressing the organisms vectored by *Ips typographus* (Directive 2000/29/EC)

Although several phytopathogenic ophiostomatoid fungi are regularly associated with *I. typographus*, (Solheim, 1986; Kirisits, 2004; Linnakoski et al., 2016), there is currently no legislation addressing this issue.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

*I. typographus* attacks mainly spruce (*Picea* spp.) but has also been observed attacking firs (*Abies* spp.), larch (*Larix* spp.), Douglas fir (*Pseudotsuga menziesii*) and pines (*Pinus* spp.) (EPPO, online; CABI, online).

The hosts for which *I. typographus* is regulated are comprehensive of the host range: the pest is regulated on five genera: *Abies, Larix, Picea, Pinus* and *Pseudotsuga*.

3.4.2. Entry

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

Yes, the pest is already established in 22 MSs. Since entry by natural dispersal from the EU areas where the pest is present is possible, only isolated areas (e.g. islands) can be long-term protected zones.

The pest is widely present in 22 MSs of the EU. In addition, it is regularly intercepted in MSs where it is still absent. Between 1994 and 2015, there have been 34 records of interception of *I. typographus* and 26 interceptions of *'Ips sp.'* in the Europhyt database, among which 30 *I. typographus* in the UK and three in Ireland.

The main pathways of entry are:

- wood of *Abies, Larix, Pinus, Picea* and *Pseudotsuga* from countries where the pest occurs;
- wood chips of conifers from countries where the pest occurs;
- bark of conifers from countries where the pest occurs;
- wood packaging material and dunnage from countries where the pest occurs.

Plants for planting should not be considered as a pathway for *I. typographus* because small trees are usually not attacked and if attacked, would be killed. Haack (2001) reports that in the US during the period 1985–2000, *I. typographus* was exclusively intercepted with wood packaging material containing tiles and machinery: crating (230 cases), dunnage (166) and pallets (34). The Europhyt database reports (1994–2015) 29 interceptions on wood and bark, 15 on wood packaging material (pallets, crates and dunnage) and 16 on unclassified plant material.

According to the EUROSTAT database, there are movements of material pertaining to the above pathways from Third countries and EU countries where the pest is present, into the protected zones. For example, concerning the wood pathway, around 41,000 tonnes of coniferous wood including the genera *Picea, Pinus* and *Abies* (Eurostat codes 44032011, 44032019, 44022031, 44032039, 44022091, 44032099), has been imported in the period 2011–2015 from EU countries into protected zones. In the same period, around 9,000 tonnes of coniferous wood were imported into the protected zones from third countries where the pest is present (Bosnia and Herzegovina, Norway, Russia, Serbia, Switzerland, Turkey and Ukraine).
3.4.3. Establishment

**Is the pest able to become established in the protected zone areas of the EU territory?**

**Yes**, the pest is already established in 22 MSs. The climate of the EU protected zones is similar to that of the MSs where *I. typographus* is established, and the pest’s main host plants are present (Figure 2).

### 3.4.3.1. EU distribution of main host plants

The wide distribution of host trees in the EU territory allowed *I. typographus* to establish in most MSs (see Table 2). *Picea excelsa*, *Picea omorika* and *Picea orientalis* are native to Europe and are widely planted outside their original range throughout the EU. Other *Picea* species are widely distributed in the EU territory (Figure 2).

![Figure 2: Relative probability of presence of the genus Picea in the European Union territory (based on data from the species: *P. abies*, *P. sitchensis*, *P. glauca*, *P. engelmannii*, *P. pungens*, *P. omorika*, *P. orientalis*). Left panel: Relative probability of presence (RPP) of species/genera from the European Atlas of Forest Tree Species (de Rigo et al., 2016; San-Miguel-Ayanz et al., 2016), aggregated at 100 km² pixel resolution. RPP is defined as the probability of finding species/taxon in a given area, irrespective of the probability of finding other taxa (de Rigo et al., 2017). As a consequence, the sum of all RPPs for different taxa in the same area need not be 100%. The estimates are based on constrained spatial multi-scale frequency analysis (C-SMFA) (de Rigo et al., 2014, 2016, 2017): this is a spatial multi-scale frequency analysis of field observations (de Rigo et al., 2014, 2016), constrained to enhance the estimates’ consistency with the frequency of broadleaved and coniferous taxa derived from Corine Land Cover (Bossard et al., 2000; Büttner et al., 2012). Right panel: Trustability of RPP. This qualitative measure is based on the multi-scale aggregation of the number of field observations (i.e. the local density of data) for each pixel and taxon. The colour scale of the trustability map is based on the quantiles of this data density (de Rigo et al., 2014, 2016).](image)

**3.4.3.2. Climatic conditions affecting establishment**

Given the current distribution of *I. typographus*, the whole EU area (including protected zones) is suitable for establishment.
3.4.4. Spread

Is the pest able to spread within protected zones areas of the EU territory following establishment? How?

Yes, adults can disperse naturally. They can fly over tens of kilometres or even more. The pest can also spread by human assistance, e.g. with the transportation of wood, wood chips, bark, wood packaging material and dunnage of conifers.

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 a pathway.

As shown in Table 2, *I. typographus* is present in most of the EU, except in Ireland, Portugal, Spain and the United Kingdom, while there is no information from Cyprus and Malta in the EPPO Global Database. The main pathway for spread is the transportation of infested material, but natural spread by flight regularly occurs over large distances (see Section 3.1.2).

3.5. Potential or observed impacts in the EU

Would the pest’s introduction have an economic or environmental impact on the protected zones of the EU?

Yes, the pest is known to have killed millions of trees, after triggering events such as storms or dry summers.

3.5.1. Potential pest impacts

The species is native to Europe, and hence, it is irrelevant to consider impact outside the EU territory.

3.5.2. Observed pest impacts in the EU

3.5.2.1. Direct impact of the pest

*I. typographus* mass attacks standing, healthy host trees, which are killed by the combined effect of the beetles and associated pathogenic ophiostomatoid fungi (see Section 3.1.2). The species is considered as the most damaging forest pest in Europe (Grégoire and Evans, 2004; Grégoire et al., 2015). Scheilhaas et al. (2003) calculated that 8% of all tree mortality in Europe during the period 1850–2000 was due to bark beetles, and mainly to *I. typographus*. In Switzerland between 2000 and 2009, the beetles have killed 8 million m³ of spruce (Meier et al., 2013); in Austria, 18 million m³ were killed between 2002 and 2012 (Steyrer and Krehan, 2009; Krehan et al., 2012).

In addition to these silvicultural damage, large outbreaks of *I. typographus* also have an ecosystemic impact, as tree mortality at this scale negatively influences the ecosystemic services of the forest, as well as the global carbon balance (Kurz et al., 2008; Kautz et al., 2016; Seidl and Rammer, 2016).

3.5.2.2. Indirect pest impact (e.g. by bacteria or viruses transmitted by the pest)

The impact of fungi associated to *I. typographus* has been analysed by many authors (e.g. Solheim, 1986; Yamaoka et al., 1997; Viiri and Lieutier, 2004; Sallé et al., 2005; Linnakoski et al., 2016). Kisrits (2004) provides a review of the ophiostomatoid fungi associated to *I. typographus*: At least 23 species were isolated from the galleries of the beetles: Ceratocystiopsis alba; Ceratocystiopsis minuta; Ceratocystis polonica; Graphium fimbriisporum; Graphium pseudormiticum (= G. fimbriisporum?); Graphium (Pesotum?) pycnocephalum; Leptographium euphyes; Leptographium lundbergii; Leptographium spp.; Ophiostoma ainoae; Ophiostoma araucariae; Ophiostoma bicolor; Ophiostoma cainii; Ophiostoma cucullatum; Ophiostoma flexuosum; Ophiostoma floccosum; Ophiostoma japonicum; Ophiostoma penicillatum; Ophiostoma penicillatum f. chalcographi; Ophiostoma piceae; Ophiostoma cf. piceae; Ophiostoma piceaperdum; (Ophiostoma plurianulatum); Ophiostoma serpens; Ophiostoma stenoceras; Ophiostoma tetropii; Ophiostoma spp.; Pesotum fragrans; Pesotum sp.; Pesotum (Graphium?) spp.

Is the pest able to spread within protected zones areas of the EU territory following establishment? How?

Yes, adults can disperse naturally. They can fly over tens of kilometres or even more. The pest can also spread by human assistance, e.g. with the transportation of wood, wood chips, bark, wood packaging material and dunnage of conifers.

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 a pathway.

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 a pathway.

As shown in Table 2, *I. typographus* is present in most of the EU, except in Ireland, Portugal, Spain and the United Kingdom, while there is no information from Cyprus and Malta in the EPPO Global Database. The main pathway for spread is the transportation of infested material, but natural spread by flight regularly occurs over large distances (see Section 3.1.2).
Some of these species (e.g. *Ceratocystis polonica*) are virulent tree pathogens (Christiansen, 1985), others (e.g. *Ophiostoma bicolor*, *O. penicillatum*, *O. piceaperdum*, *O. piceae*, *Pesotum* sp.) are more innocuous (Solheim et al., 2001).

### 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 of the EU such that the risk becomes mitigated?

**Yes**, in isolated areas (e.g. islands) that cannot be reached by natural spread, measures can be put in place to prevent the introduction with wood, wood products, wood chips, bark and plants for planting. Debarking wood, heat treatment of wood, bark and chips, and inspection of plants for planting are specified in Annex IVBII of 2000/29/EC. When such geographical barriers do not exist, there is no possibility to prevent the entry, establishment and spread of *I. typographus* in new areas. This is illustrated by the gradual and sometimes very recent colonisation on continental EU of areas recently planted with spruce, far from the trees’ area of origin (Belgium, Brittany or Normandy in France, etc.).

Is it possible to eradicate the pest in a restricted area within 24 months after the presence of the pest was confirmed in the PZ?

**No**, when the pest starts killing trees, it has already widely established, inconspicuously living on fallen or broken trees.

#### 3.6.1. Biological or technical factors affecting the feasibility and effectiveness of measures to prevent the entry, establishment and spread of the pest

- In spite of quarantine regulations bearing on round wood, wood packaging material and wood products other than paper, the pest is regularly intercepted at ports.
- It is very difficult, if not impossible, to successfully eradicate the pest from forest areas after an introduction. All infected trees and tree parts (including pieces of fallen or broken material) have to be detected and removed and as a prevention for the possible spread from the affected area all suitable host plants should be removed in a zone of several km.
- Despite sylvicultural control, in areas where it is established, the pest continues to develop outbreaks whenever climatic conditions are favourable.

#### 3.6.2. Control methods

- Silvicultural methods: sanitation thinning and clearfelling with rapid removal of the infested material (Stadelmann et al., 2013; Fettig and Hilszczanski, 2015; Grégoire et al., 2015);
- Pheromone mass-trapping was largely used at the end of the 20th century (Bakke, 1989, 1991; Raty et al., 1995), but is presently judged unreliable because of the large dispersal capacity of the pest (Duelli et al., 1997);
- Log storage under water sprinkling after windstorms, in order to protect them from bark-beetle attack and reduce bark-beetle population growth (Björkhem et al., 1977; Flot and Vautherin, 2002). This could involve millions of m³ (Lindelöw and Schroeder, 2008).

### 3.7. Uncertainty

*Ips typographus* has been exhaustively studied. Its biology, ecology, relationships to its hosts and to natural enemies are well understood. Uncertainty does not affect most of the categorisation conclusions. However, the apparently very low capacity of the pest to invade new areas across a geographic barrier needs to be investigated further.

### 4. Conclusions

*Ips typographus* meets the criteria assessed by EFSA for consideration as a potential protected zone quarantine pest, for the territory of the protected zones: Ireland and the United Kingdom.
**Table 5:** 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 | 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. It can be identified to species using conventional entomological keys | The identity of the pest is established. It can be identified to species using conventional entomological keys | None |
| **Absence/presence of the pest in the EU territory (Section 3.2)** | *I. typographus* is present and widely distributed in 22 EU MSs. The protected zones, Ireland and the United Kingdom, are free from the pest | *I. typographus* is present and widely distributed in the EU, it has been reported from 22 EU MSs. The protected zones, Ireland and the United Kingdom, are free from the pest | None |
| **Regulatory status (Section 3.3)** | The pest is currently officially regulated by 2000/29/EC on plants of *Abies, Larix, Picea, Pinus* and *Pseudotsuga*, over 3 m in height, other than fruit and seeds, wood of conifers (Coniferales) with bark, isolated bark of conifers *I. typographus* is regulated as a quarantine pest in protected zones (Annex IIB): Ireland, United Kingdom | The pest is currently officially regulated by 2000/29/EC on plants of *Abies, Larix, Picea, Pinus* and *Pseudotsuga*, over 3 m in height, other than fruit and seeds, wood of conifers (Coniferales) with bark, isolated bark of conifers *I. typographus* is regulated as a quarantine pest in protected zones (Annex IIB): Ireland, United Kingdom | None |
| **Pest potential for entry, establishment and spread in the EU territory (Section 3.4)** | Entry: The pest is already established in 22 MSs. Since entry by natural spread from EU areas where the pest is present is possible, only isolated areas (e.g. islands) can be long-term protected zones Establishment: The climate of the EU Protected Zones is similar to that of MSs where *I. typographus* is established, and the pest’s main host plants are present Spread: Adults can disperse naturally. They can fly over tens of kilometres or even more. The pest can also spread by human assistance, e.g. with the transportation of wood, wood chips, bark, wood packaging material and dunnage of conifers | Plants for planting are not a pathway; therefore, other criteria for consideration as regulated non-quarantine pest do not need to be assessed | There are 16 records of interceptions on ‘unclassified plant material’ in the Europhyt database |
| **Potential for consequences in the EU territory (Section 3.5)** | The pest is known to have killed millions of trees, after triggering events such as storms or dry summers | Plants for planting are not a pathway; therefore, other criteria for consideration as regulated non-quarantine pest do not need to be assessed | None |

*Ips typographus*: pest categorisation
### References

Anderbrant O, 1990. Gallery construction and oviposition of the bark beetle *Ips typographus* (Coleoptera: Scolytidae) at different breeding densities. Ecological Entomology, 15, 1–8.

Bakke A, 1970. Evidence of a population aggregating pheromone in *Ips typographus* (Coleoptera: Scolytidae). Contributions from Boyce Thompson Institute, 24, 309–310.

Bakke A, 1976. Spruce bark beetle, *Ips typographus*: pheromone production and field response to synthetic pheromones. Naturwissenschaften, 63, 92–92.

Bakke A, 1989. The recent *Ips typographus* outbreak in Norway - experiences from a control program. Holarctic Ecology, 12, 515–519.

Bakke A, 1991. Socioeconomic aspects of an integrated-pest-management program in Norway. Forest Ecology and Management, 39, 299–303.

Balachowsky A, 1949. *Faune de France. 50. Coleoptères Scolytides*. Lechevalier, Paris. 320 pp.

Bentz BJ and Jonsson AM, 2015. Modeling bark beetle responses to climate change. In: Vega FE and Hofstetter RW (eds.). *Bark Beetles. Biology and Ecology of Native and Invasive Species*. Elsevier, pp. 333–353.

Birgersson G, Schlyter F, Lfqvist J and Bergström G, 1984. Quantitative variation of pheromone components in the spruce bark beetle *Ips typographus* from different attack phases. Journal of Chemical Ecology, 10, 1029–1055.

Bjorkhem U, Dehlen R, Lundin L, Nilsson S, Olsson MT and Regnander J, 1977. *Storage of Pulpwood Under Water Sprinkling - Effects on Insects and the Surrounding Area*. Royal College of Forestry, Department of Operational Efficiency, Research Notes 107.

Bossard M, Feranec J and Otahel J, 2000. CORINE land cover technical guide - Addendum 2000. Technical Report 40, European Environment Agency. INRMM-MID:13106045. Available online: https://www.eea.europa.eu/ds_resolveuid/032TFUPGVR

Bright DE and Skidmore RE, 2002. *A catalogue of Scolytidae and Platypodidae (Coleoptera)*, Supplement 2 (1995–1999). NRC Research Press, Ottawa, Canada, 523 pp.

Brockerhoff EG, Knízek M and Bain J, 2003. Checklist of indigenous and adventive bark and ambrosia beetles (Curculionidae: Scolytinae and Platypodinae) of New Zealand and interceptions of exotic species (1952–2000). New Zealand Entomologist, 26, 29–44.

---

| References |  |
| --- | --- |
| Anderbrant O, 1990. Gallery construction and oviposition of the bark beetle *Ips typographus* (Coleoptera: Scolytidae) at different breeding densities. Ecological Entomology, 15, 1–8. |  |
| Bakke A, 1970. Evidence of a population aggregating pheromone in *Ips typographus* (Coleoptera: Scolytidae). Contributions from Boyce Thompson Institute, 24, 309–310. |  |
| Bakke A, 1976. Spruce bark beetle, *Ips typographus*: pheromone production and field response to synthetic pheromones. Naturwissenschaften, 63, 92–92. |  |
| Bakke A, 1989. The recent *Ips typographus* outbreak in Norway - experiences from a control program. Holarctic Ecology, 12, 515–519. |  |
| Bakke A, 1991. Socioeconomic aspects of an integrated-pest-management program in Norway. Forest Ecology and Management, 39, 299–303. |  |
| Balachowsky A, 1949. *Faune de France. 50. Coleoptères Scolytides*. Lechevalier, Paris. 320 pp. |  |
| Bentz BJ and Jonsson AM, 2015. Modeling bark beetle responses to climate change. In: Vega FE and Hofstetter RW (eds.). *Bark Beetles. Biology and Ecology of Native and Invasive Species*. Elsevier, pp. 333–353. |  |
| Birgersson G, Schlyter F, Lfqvist J and Bergström G, 1984. Quantitative variation of pheromone components in the spruce bark beetle *Ips typographus* from different attack phases. Journal of Chemical Ecology, 10, 1029–1055. |  |
| Bjorkhem U, Dehlen R, Lundin L, Nilsson S, Olsson MT and Regnander J, 1977. *Storage of Pulpwood Under Water Sprinkling - Effects on Insects and the Surrounding Area*. Royal College of Forestry, Department of Operational Efficiency, Research Notes 107. |  |
| Bossard M, Feranec J and Otahel J, 2000. CORINE land cover technical guide - Addendum 2000. Technical Report 40, European Environment Agency. INRMM-MID:13106045. Available online: https://www.eea.europa.eu/ds_resolveuid/032TFUPGVR |  |
| Bright DE and Skidmore RE, 2002. *A catalogue of Scolytidae and Platypodidae (Coleoptera)*, Supplement 2 (1995–1999). NRC Research Press, Ottawa, Canada, 523 pp. |  |
| Brockerhoff EG, Knízek M and Bain J, 2003. Checklist of indigenous and adventive bark and ambrosia beetles (Curculionidae: Scolytinae and Platypodinae) of New Zealand and interceptions of exotic species (1952–2000). New Zealand Entomologist, 26, 29–44. |  |
Flot JL and Vautherin P, 2002. Des stocks de bois à conserver en forêt. 

Fettig CJ and Hilszczanski J, 2015. Management strategies for bark beetles in conifer forests. In: Vega FE and Hofstetter RW (eds.). Bark Beetles. Biology and Ecology of Native and Invasive Species. Elsevier, pp. 555–584.

Ferris P, Zahradnik P, Knízek M and Kalinova B, 1997. Migration in spruce bark beetles (Ips typographus L.) and the efficiency of pheromone traps. Journal of Applied Entomology, 121, 297–303. https://doi.org/10.1111/j.1439-0418.1997.tb1409.x

EFSA PLH Panel (EFSA Panel on Plant Health), 2010. PLH Guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk management options by EFSA. EFSA Journal 2010;8(2):1495, 66 pp. https://doi.org/10.2093/j.efsa.2010.1495

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: https://gd.eppo.int [Accessed: 28 February 2017]

EFSA PLH Panel (EFSA Panel on Plant Health), 2010. Pest risk assessment and the identification and evaluation of pest risk management options by EFSA. EFSA Journal 2010;8(2):1495, 66 pp. https://doi.org/10.2093/j.efsa.2010.1495

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: https://gd.eppo.int [Accessed: 28 February 2017]

FAO (Food and Agriculture Organization of the United Nations), 2004. ISPM (International Standards for Phytosanitary Measures) 21—Pest risk analysis of regulated non-quarantine pests. FAO, Rome, 30 pp. Available online: https://www.ippc.int/sites/default/files/documents/1323945746_ISPM_21_2004_E_Manual.pdf

FAO (Food and Agriculture Organization of the United Nations), 2013. ISPM (International Standards for Phytosanitary Measures) 11—Pest risk analysis for quarantine pests. FAO, Rome, 36 pp. Available online: https://www.ippc.int/sites/default/files/documents/20140512/ispm_11_2013_en_2014-04-30_201405121523-494.65%20KB.pdf

Fettig CJ and Hilszczansski J, 2015. Management strategies for bark beetles in conifer forests. In: Vega FE and Hofstetter RW (eds.). Bark Beetles. Biology and Ecology of Native and Invasive Species. Elsevier, pp. 555–584.

Flot JL and Vautherin P, 2002. Des stocks de bois à conserver en forêt ou hors forêt. Revue Forestière Française 136–144, (special issue) “Après les tempêtes”.

Forssé E and Solbreck C, 1985. Migration in the bark beetle Ips typographus L.: duration, timing and height of flight. Zeitschrift für Angewandte Entomologie, 100, 47–57.

Grégoire JC and Evans HF, 2004. Damage and control of BAWBILT organisms—an overview. In: Lieutier F, Day K, Battisti A, Grégoire JC and Evans H (eds.). Bark and Wood Boring Insects in Living Trees in Europe, a Synthesis. Kluwer, Dordrecht. pp. 19–37.

Grégoire JC, Raffa KF and Lindgren BS, 2015. Economics and politics of bark beetles. In: Vega FE and Hofstetter RW (eds.). Bark Beetles. Biology and Ecology of Native and Invasive Species. Elsevier, pp. 585–613.

Grüne S, 1979. Brief Illustrated Key to European Bark Beetles. M. & H Schaper, Hannover, 182 pp.

Haack RA, 2001. Intercepted Scolytidae (Coleoptera) at US ports of entry: 1985–2000. Integrated Pest Management Reviews, 6, 253–282.

Hulcr J, Atkinson T, Cognato AI, Jordal BH and McKenna DD, 2015. Morphology, taxonomy and phylogenetics of bark beetles. In: Vega FE and Hofstetter RW (eds.). Bark Beetles. Biology and Ecology of Native and Invasive Species. Elsevier, pp. 41–84.

Jönsson A, Appelberg G, Harding S and Bärring L, 2009. Spatio-temporal impact of climate change on the activity and volatilism of the spruce bark beetle, Ips typographus. Global Change Biology, 15, 486–499.

Jönsson AM, Harding S, Kroken P, Lange H, Lindelow A, Ökland B, Ravn HF and Schroeder LM, 2011. Modelling the potential impact of global warming on Ips typographus volatilism and reproductive diapause. Climatic Change, 109, 695–718. https://doi.org/10.1007/s10584-011-0038-4

Kausrud K, Økland B, Skarpaas O, Grégoire JC, Erbilgin N and Stenseth NC, 2011. Population dynamics in changing environments: the case of an eruptive forest pest species. Biological Reviews, 87, 34–51. https://doi.org/10.1111/j.1469-185X.2011.00183

Kautz M, Meddens AJH, Hall RJ and Arneth A, 2016. Biotic disturbances in Northern Hemisphere forests - a synthesis of recent data, uncertainties and implications for forest monitoring and modelling. Global Ecology and Biogeography, 26, 533–552. https://doi.org/10.1111/gbe.12558

Kenis M, Wermelinger B and Grégoire JC, 2004. Research on parasitoids and predators of Scolytidae in living trees in Europe – a review. In: Lieutier F, Day K, Battisti A, Grégoire JC, Evans H (eds.). Bark and Wood Boring Insects in Living Trees in Europe, A Synthesis. Kluwer, Dordrecht. pp. 237–290. https://doi.org/10.1007/978-1-4020-2241-8_11

Kirisits T, 2004. Fungal associates of European bark beetles with special emphasis on the Ophiostomatoid fungi. In: Lieutier F, Day K, Battisti A, Grégoire JC, Evans H (eds.). Bark and Wood Boring Insects in Living Trees in Europe, a Synthesis. Kluwer, Dordrecht. pp. 181–235. https://doi.org/10.1007/978-1-4020-2241-8_11
Knížek M and Beaver R, 2004. Taxonomy and systematics of bark and ambrosia beetles. In: Lieutier F, Day K, Battisti A, Grégoire JC, Evans H (eds.). Bark and Wood Boring Insects in Living Trees in Europe, a Synthesis. Kluwer, Dordrecht. pp. 41–54. https://doi.org/10.1007/978-1-4020-2241-8_11

Krehan H, Steyer G and Hoch G, 2012. Borkenkäfer-Situation 2011: Schäden deutlich geringer. Forstschutz Aktuell, 56, 11–15.

Kurz WA, Dymond CC, Stinson G, Rampley GJ, Neilson ET, Carroll AL, Ebata T and Safranyik L, 2008. Mountain pine beetle and forest feedback to climate change. Nature, 452, 987–990.

Lindelow A and Schroeder ML, 2008. The storm “Gudrun” and the spruce bark beetle in Sweden. Forstschutz Aktuell, 44, 5–7.

Linnakoski R, Mahilainen S, Harrington A, Vanhanen H, Eriksson M, Mehtonen J, Pappinen A and Wingfield MJ, 2016. Seasonal succession of fungi associated with Ips typographus beetles and their phoretic mites in an outbreak region of Finland. PLoS ONE, 11, e0155622.

Lobinger G, 1996. Variations in sex ratio during an outbreak of Ips typographus (Col., Scolytidae) in Southern Bavaria. Anzeiger für Schädlingskunde, Pflanzenschutz, Umweltschutz, 69, 51–53.

Marini L, Økland B, Jonsson AM, Bentz L, Carroll A, Forster B, Grégoire JC, Hurling R, Nageleisen LM, Netherer S, Ravn HP, Weed A and Schroeder M, 2016. Climate drivers of bark beetle outbreak dynamics in Norway spruce forests. Ecography, 40, 1–10. https://doi.org/10.1111/ecog.02769

Mayer F, Piel FB, Cassel-Lundhagen A, Kirichenko N, Grumiaux L, Økland B, Bertheau C, Grégoire JC and Mardulyn P, 2015. Comparative multilocus phylogeography of two Palearctic spruce bark beetles: influence of contrasting ecological strategies on genetic variation. Molecular Ecology, 24, 1292–1310. https://doi.org/10.1111/mec.13104

Meier F, Engesser R, Forster B, Odermatt O and Angst A, 2013. Protection des forêts—vue d’ensemble 2012. Institut fédéral de recherches sur la forêt, la neige et le paysage WSL, Birmensdorf.

Mills NJ, 1983. The natural enemies of scolytids infesting conifer bark in Europe in relation to the biological control of Dendroctonus spp. In Canada. Biocontrol News and Informations, 4, 305–328.

Mills NJ, 1985. Some observations on the role of predation in the natural regulation of Ips typographus populations. Zeitschrift Für Angewandte Entomologie, 99, 209–215.

Montano V, Bertheau C, Dolezel P, Krambäck S, Okrouhlík J, Stauffer C and Moodley Y, 2016. How differential management strategies affect Ips typographus dispersal. Forest Ecology and Management, 360, 195–204. https://doi.org/10.1016/j.foreco.2015.10.037

Raty L, Drumont A, De Windt N and Grégoire JC, 1995. Mass trapping of the spruce bark beetle Ips typographus L.: traps or trap trees? Forest Ecology and Management, 78, 191–205. https://doi.org/10.1016/0378-1127(95)03582-1

de Rigo D, Cau dello G, Busetto L and San-Miguel-Ayan J, 2014. Supporting EFSA assessment of the EU environmental suitability for exotic forestry pests: final report. EFSA Supporting Publications 2014:11 (3), EN-434+, INRMM-MID:13114000. https://doi.org/10.2903/sp.efsa.2014.en-434

de Rigo D, Cau dello G, Houston Durrant T and San-Miguel-Ayan J, 2016. The European Atlas of Forest Tree Species: modelling, data and information on forest tree species. In: San-Miguel-Ayan J, de Rigo D, Cau dello G, Houston Durrant T, Mauri A (eds.). European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg. pp. e01aa69+. https://w3id.org/mtf/FISE-Comm/v01/e01aa69

de Rigo D, Cau dello G, San-Miguel-Ayan J and Barredo JJ, 2017. Robust modelling of the impacts of climate change on the habitat suitability of forest tree species. Publication Office of the European Union, Luxembourg, 58 pp. ISBN:978-92-79-66704-6, https://doi.org/10.2760/296501, INRMM-MID:14314400.

Salle A, Monclus R, Yart A, Garcia J, Romary P and Lieutier F, 2005. Fungal flora associated with Ips typographus: frequency, virulence, and ability to stimulate the host defence reaction in relation to insect population levels. Canadian Journal of Forest Research, 35, 365–373.

San-Miguel-Ayan J, de Rigo D, Cau dello G, Houston Durrant T, Mauri A (eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg. ISBN: 978-92-79-36740-3, https://doi.org/10.2760/296501, INRMM-MID:14314400.

Schedl KE, 1981. 91. Familie: Scolytidae (Borken- und Ambrosiakäfer). In: Freude H, Harde KW, Lohse GA (eds.). Die Käfer Mitteleuropas. Goecke & Evers, Krefeld. pp. 34–99.

Schelhaas MJ, Nabuurs GJ and Schuck A, 2003. Natural disturbances in the European forests in the 19th and 20th centuries. Global Change Biology, 9, 1620–1633.

Schlyter F and Anderbrant O, 1993. Competition and niche separation between two bark beetles: existence and mechanisms. Oikos, 68, 437–447.

Schopf A, 1989. The effect of photoperiod on the induction of the imaginal diapause of Ips typographus L. (Coleoptera Scolytidae). Journal of Applied Entomology, 107, 275–288.

Scopus, online. General search: Scolytinae. Available online: https://www.scopus.com/home.uri. [Accessed: 28 March 2017]

Seidl R and Rammer W, 2016. Climate change amplifies the intersections between wind and bark beetle disturbances in forest landscapes. Landscape Ecology. https://doi.org/10.1007/s10180-016-0396-4

Solheim H, 1986. Species of Ophiostomataceae isolated from Picea abies infested by the bark beetle Ips typographus. Nordic Journal of Botany, 6, 199–207. https://doi.org/10.1111/j.1756-1051.1986.tb00874.x
Solheim H, Krokene P and Langstrøm B, 2001. Effects of growth and virulence of associated blue-stain fungi on host colonization behaviour of the pine shoot beetles Tomicus minor and T. piniperda. Plant Pathology, 50, 111–116.

Stadelmann G, Bugmann H, Meier F, Wermelinger B and Bigler C, 2013. Effects of salvage logging and sanitation felling on bark beetle (*Ips typographus* L.) infestations. Forest Ecology and Management, 305, 273–281. https://doi.org/10.1016/j.foreco.2013.06.003

Stauffer C, Lakatos F and Hewitt GM, 1999. Phylogeography and postglacial colonization routes of *Ips typographus* L. (*Coleoptera, Scolytidae*). Molecular Ecology, 8, 763–773.

Steyrer G and Krehan H, 2009. Borkenkäfer-Kalamität 2008: ist ein weiterer Rückgang wahrscheinlich? Forstschutz Aktuell, 46, 9–15.

Vii H and Lieutier F, 2004. Ophiostomatoid fungi associated with the spruce bark beetle, *Ips typographus*, in three areas in France. Annals of forest science, 61, 215–219.

Wermelinger B, 2004. Ecology and management of the spruce bark beetle *Ips typographus* - a review of recent research. Forest Ecology and Management, 202, 67–82. https://doi.org/10.1016/j.foreco.2004.07.018

Wood SL, 1982. *The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph*. Brigham Young University, Provo, Utah. 1359 pp.

Yamaoka Y, Wingfield MJ, Takahashi I and Solheim H, 1997. Ophiostomatoid fungi associated with the spruce bark beetle *Ips typographus* f. *aponicus* [sic] in Japan. Mycological Research, 101, 1215–1227.

**Abbreviations**

- C-SMFA: constrained spatial multi-scale frequency analysis
- EPPO: European and Mediterranean Plant Protection Organization
- FAO: Food and Agriculture Organization of the United Nations
- 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