Pest categorisation of non-EU *Pissodes* spp.

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, Marc Kenis, Virág Kertész and Jean-Claude Gregoire

Abstract

The Panel on Plant Health performed a pest categorisation of the non-EU *Pissodes* spp. (Coleoptera: Curculionidae). They constitute a well-defined taxon, with non-EU species distributed in the USA, Canada, Mexico, Guatemala, El Salvador, China, Japan, Korea, Russia and South Africa, some of which are recognised as severe pests of conifers, mainly *Pinus* spp. and *Picea* spp., or vector pathogens. The immature stages either live in the phloem and cambium of healthy, weakened or dead trees, or in the terminal shoots of living trees. They are listed as quarantine pests in Annex IAI of Directive 2000/29/EC. Plants for planting, branches of conifers and non-squared wood are considered as pathways. The pest can also disperse by hitchhiking, and fly over kilometres. The adults are long-lived (up to 4 years). They feed by puncturing the bark of stems or shoots. Females lay eggs in chewed-out cavities in the bark. The life cycle varies with species and local climatic conditions. At the end of the larval stage, the larva excavates a pupal cell between the sapwood and the bark, in the sapwood or in terminal shoots. *Pissodes* spp. overwinter as adults in the litter or as larvae or teneral adults in the galleries or pupal cells. The current geographic range of the non-European *Pissodes* spp. suggests that many of them may establish in the EU territory, where their hosts are widely present. We list some species which, if introduced to the EU, would most probably have an economic impact on plantations or may interfere with forest ecosystem processes although they are mainly abundant and damaging in intensively managed monocultures. All criteria for considering those non-EU *Pissodes* spp. as potential quarantine pests are met. The criteria for considering them as non-regulated quarantine pests are not met because they are absent from the EU territory.

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**Correspondence:** alpha@efsa.europa.eu
Panel members: Claude Bragard, David Caffier, Thierry Candresse, Elisavet Chatzivassiliou, Katharina Dehnen-Schmutz, Gianni Gilioli, Jean-Claude Grégoire, 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.

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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 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.

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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

| Insects | Mites | Nematodes |
|---------|-------|-----------|
| Aleurococcus spp. | | |
| Anthonomus bisignifer (Schenkling) | | |
| Anthonomus signatus (Say) | | |
| Aschistonyx eppoi Inouye | | |
| Carposina niponensis Walsingham | | |
| Enarmonia packardi (Zeller) | | |
| Enarmonia prunivora Walsh | | |
| Grapholita inopinata Heinrich | | |
| His homonous phycitis | | |
| Leucaspis japonica Ckll. | | |
| Listronotus bonariensis (Kuschel) | | |

(b) Bacteria

| Bacteria |
|----------|
| Citrus variegated chlorosis | |
| Erwinia stewartii (Smith) Dye | |

(c) Fungi

| Fungi |
|-------|
| Alternaria alternata (Fr.) Keissler | |
| 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 | |

(d) Virus and virus-like organisms

| 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 | |

**Annex IIB**

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

| Insects | Mites | Nematodes |
|---------|-------|-----------|
| Anthonomus grandis (Boh.) | | |
| Cephalicia lariciphila (Klug) | | |
| Dendroctonus micans Kugelan | | |
| Gilphinia hercyniae (Hartig) | | |
| Gonipterus scutellatus Gyll. | | |
| Ips amitinus Eichhof | | |

| Insects | Mites | Nematodes |
|---------|-------|-----------|
| 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
Hypoxylon mammatum (Wahl.) J. Miller
Gremmeniella abietina (Lag.) Morelet

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) Rhacochaena japonica Ito
5) Dacus ciliatus Loew 16) Rhagoletis completa Cresson
6) Dacus curcurbitae Coquillet 17) Rhagoletis fausta (Osten-Sacken)
7) Dacus dorsalis Hendel 18) Rhagoletis indifferentens Curran
8) Dacus tryoni (Froggatt) 19) Rhagoletis mendax Curran
9) Dacus tsuneonis Miyake 20) Rhagoletis pomonella Walsh
10) Dacus zonatus Saund.
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 mycoplasma
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 mycoplasma
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 mycoplasma
7) Peach X-disease mycoplasma
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

(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

(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

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**Pissodes** spp.: Pest categorisation

(d) Parasitic plants

*Arceuthobium* spp. (non-EU)

**Annex IIAI**

(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.

*Ralstonia solanacearum* (Smith) Yabuuchi et al.

ssp. *sepedonicus* (Spieckermann and Kotthoff)

Davis 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

*Pissodes* spp. (non-EU) are listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether they fulfil the criteria of quarantine pests or those of regulated non-quarantine pests 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.

The scope of this categorisation covers the non-EU species of the genus *Pissodes*, that is the species which are absent in the territory of the European Union.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

Relevant papers were identified and reviewed by the working group including a topic expert. Further references and information were obtained from the expert, as well as from citations within the references and grey literature.

2.1.2. Database search

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

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

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

2.2. Methodologies

The Panel performed the pest categorisation for *Pissodes* spp., 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 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 in accordance with the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

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

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel, in agreement with 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) |
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 genus Pissodes is a valid genus. The genus contains some species which are important plant pests.

Pissodes is an insect genus in the family Curculionidae (Arthropoda: Coleoptera) which contains several species that differ in distribution, biology, host trees and climatic requirements. The genus is easily identifiable but presents several taxonomic concerns such as cryptic species, hybridisation and undescribed species.

3.1.2. Biology of the pest

Information on the biology of European Pissodes spp. can be found in Day et al. (2004) and references therein, and CABI (2018) and references therein for four non-European species: P. strobi, P. terminalis, P. nemorensis and P. yunnanensis. Biological data for other non-EU species are less abundant and often restricted to single papers (e.g. Deyrup, 1978 for P. fasciatus, Jin, 1989 for P. nitidus).

With the exception of the European Pissodes validirostris, which develops in pine cones, all other species of the genus feed on and develop in the cambium and phloem of conifer stems (Pinaceae). These species can be broadly divided into two groups. One attacks and develops in boles, in which case mostly dead or dying trees are attacked (e.g. Pissodes schwarzi, P. fasciatus, P. piceae). The other group develops in terminal shoots of healthy trees (e.g. P. strobi, P. terminalis, P. nitidus). However, some species can attack both boles and terminals (e.g. P. nemorensis, P. castaneus). Adults feed by puncturing the bark of stems or shoots. There is evidence that, at least in some species, the males produce aggregation pheromones that attract unmated females and other males (Booth et al., 1983). After a maturation period, females lay eggs in groups of 1–15 in chewed-out cavities in the bark and cover them with frass. Adults are long-lived (up to 4 years) and strong fliers. Females can lay several hundred eggs over a lifetime. The life cycle varies with species and local climatic conditions. There are four larval instars, which burrow feeding tunnels in the cambium and phloem of conifer stems. At the end of the larval stage, the larva excavates a pupal cell covered with shredded wood fibre between the sapwood and the bark. When terminals are attacked or when the bark is too thin, the pupal cell is built in the sapwood. Pissodes spp. overwinter as adults in the litter or as larvae or teneral adults in the galleries or pupal cells. Most Pissodes spp. develop without obligatory diapause but a facultative diapause in the larval stage, induced by climatic conditions, is commonly observed and an obligatory diapause has been reported for some species in cold climates, e.g. P. terminalis in the Canadian prairies and P. pini in the Alps.

3.1.3. Intraspecific diversity

The taxonomy of the genus Pissodes is still confusing with several cryptic species that can only be identified using morphological tools and may hybridise (Langor and Sperling, 1997; Wondafrash et al., 2016). Some species also show highly variable host preferences in different parts of their range (Smith and Sugden, 1969).

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?
Yes, the genus is quite recognisable. But distinguishing among species may require molecular tools.

There is no reference that covers the identification of all Pissodes spp. worldwide. In Europe, Freude et al. (1999) provides a key to the genus and to the species (but see Haran et al., 2016 for an
additional species); O’Brien (1989a) describes the genus and provides an identification key for Mexican species; Lu et al. (2007) cover Chinese species. Unfortunately, there is no recent key for North American species. Hopkins (1911) provides a key to adults but some species are missing and others have been synonymised (Smith and Sugden, 1969). The cryptic species of the *P. strobi* species complex, containing the most serious North American pests, can be identified using molecular tools (Langor and Sperling, 1995, 1997; Wondafrash et al., 2016).

3.2. Pest distribution

Species of the *Pissodes* genus are native to North and Central America, Europe and a large part of Asia, where their distribution coincides with that of their coniferous host species (Langor, 1991) (Appendices A and B).

3.2.1. Pest distribution outside the EU

For a detailed list of non-EU *Pissodes* species, please see Appendix A.

Table 2 lists the distribution of species considered to have economic importance based on reports.

**Table 2:** Distribution of *Pissodes* spp. which are considered to be of economic importance (EPPO GD and CABI CPC, accessed on 12/4/2018; other references on the species distribution can be found in Appendix A)

| Continent | Country | State/region | *P. nemorensis* | *P. nitidus* | *P. strobi* | *P. terminalis* | *P. yunnanensis* |
|-----------|---------|--------------|----------------|--------------|-------------|----------------|-----------------|
| Africa    | South Africa | x            |                |              |             |                |                 |
| America   | Canada   | Alberta      | x              | x            | x           |                |                 |
|           |         | British Columbia | x            |              |             |                |                 |
|           |         | Manitoba     | x              | x            | x           |                |                 |
|           |         | New Brunswick | x              |              | x           |                |                 |
|           |         | Newfoundland |                |              |             | x              |                 |
|           |         | Northwest Territories |                |              |             | x              |                 |
|           |         | Nova Scotia  | x              |              | x           |                |                 |
|           |         | Ontario      | x              |              | x           |                |                 |
|           |         | Prince Edward Island | x           |              | x           |                |                 |
|           |         | Quebec       | x              |              | x           |                |                 |
|           |         | Saskatchewan | x              |              | x           |                |                 |
|           |         | Yukon Territory |                |              |             |                | x               |
| Mexico    |         | x            |                |              |             |                |                 |
| USA       | California | x            |                | x            |            |                |                 |
|           | Colorado  |              |                |              | x           |                |                 |
|           | Connecticut |            |                |              |             |                |                 |
|           | Delaware  |              |                |              | x           |                |                 |
|           | Florida   | x            |                |              |             |                |                 |
|           | Georgia   |              |                |              | x           |                |                 |
|           | Idaho     |              |                |              |             |                | x               |
|           | Illinois  | x            |                |              | x           |                |                 |
|           | Indiana   |              |                |              | x           |                |                 |
|           | Iowa      |              |                |              |             |                | x               |
|           | Kentucky  | x            |                |              |             |                |                 |
|           | Louisiana | x            |                |              |             |                |                 |
|           | Maine     |              |                |              |             |                | x               |
The distribution of three of the most economically important species, *P. nemorensis*, *P. strobi* and *P. terminalis* is presented in Figures 1–3; see also Table 2.

| Continent      | Country | State/region | *P. nemorensis* | *P. nitidus* | *P. strobi* | *P. terminalis* | *P. yunnanensis* |
|----------------|---------|--------------|-----------------|--------------|-------------|-----------------|------------------|
| Asia           | China   | Guizhou      |                 |              |             |                 | x                |
|                |         | Sichuan      |                 |              |             |                 |                  |
|                |         | Yunnan       |                 |              |             |                 |                  |
|                |         | Liaoning     | x               |              |             |                 |                  |
|                |         | Jilin        |                 |              |             |                 |                  |
|                |         | Heilongjiang |                 |              |             |                 |                  |
|                | Japan   |              |                 |              |             |                 |                  |
|                | Korea   | Hokkaido     |                 |              |             |                 |                  |
| Europe (non EU)| Russia  | Russian Far east |              |              |             |                 |                  |

*: Note that its occurrence in East Asia has been questioned by some authors (e.g. Lu et al., 2007) and Wondafrash et al. (2016) showed that the species established in South Africa is rather an undescribed species or a hybrid between *P. nemorensis* and *P. strobi*.
Figure 1: Global distribution map for *Pissodes nemorensis* (extracted from the EPPO Global Database accessed on 13 April 2018). (see comment under Table 2)

Figure 2: Global distribution map for *Pissodes strobi* (extracted from the EPPO Global Database accessed on 13 April 2018)
3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?
No, non-EU species of the genus *Pissodes* are not yet present in the EU territory.

For a list of *Pissodes* species present in the EU, please see Appendix B.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

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

Table 3: *Pissodes* spp. in Council Directive 2000/29/EC

| Annex II, Part A | Harmful organisms whose introduction into, and spread within, all member states shall be banned if they are present on certain plants or plant products |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Section I        | Harmful organisms not known to occur in the community and relevant for the entire community |
| (a)              | Insects, mites and nematodes, at all stages of their development |
|                  | Species | Subject of contamination |
| 22.              | *Pissodes* spp. (non-European) | Plants of conifers (*Coniferales*), other than fruit and seeds, wood of conifers (*Coniferales*) with bark, and isolated bark of conifers (*Coniferales*), originating in non-European countries |
3.3.2. Legislation addressing the hosts of *Pissodes* spp

**Table 4:** Regulated hosts and commodities that may involve *Pissodes* spp. 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                                                                                     |
| Plants of *Abies* Mill., *Cedrus* Trew, [*...*], *Larix* Mill., *Picea* A. Dietr., *Pinus* L., *Pseudotsuga* Carr. and *Tsuga* Carr., other than fruit and seeds | Non-European countries |

| Annex IV, Part A | 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 all member states |
|-------------------|------------------------------------------------------------------------------------------------------------------|
| Section I         | Plants, plant products and other objects originating outside the community                                      |
| Special requirements |----------------------------------------------------------------------------------------------------------|
| 1.5               | Official statement that the wood:                                                                            |
|                   | (a) originates in areas known to be free from:                                                              |
|                   | — *Pissodes* spp. (non-European) The area shall be mentioned on the certificates referred to in Article 13.1.(ii), under the rubric ‘place of origin,’ |
|                   | (c) has undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, achieved through an appropriate time/temperature schedule. There shall be evidence thereof by a mark ‘kiln-dried’ or ‘K.D.’ or another internationally recognised mark, put on the wood or on any wrapping in accordance with the current usage, |
|                   | (d) has undergone an appropriate heat treatment to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including at its core). There shall be evidence thereof by a mark ‘HT’ put on the wood or on any wrapping in accordance with current usage, and on the certificates referred to in Article 13.1.(ii), |
|                   | (e) has undergone an appropriate fumigation to a specification approved in accordance with the procedure laid down in Article 18.2. There shall be evidence thereof by indicating on the certificates referred to in Article 13.1.(ii), the active ingredient, the minimum wood temperature, the rate (g/m 3) and the exposure time (h), |
|                   | (f) has undergone an appropriate chemical pressure impregnation with a product approved in accordance with the procedure laid down in Article 18.2. There shall be evidence thereof by indicating on the certificates referred to in Article 13.1.(ii), the active ingredient, the pressure (psi or kPa) and the concentration (%) |
3.3.3. Legislation addressing the organisms vectored by *Pissodes* spp. (Directive 2000/29/EC)

*Pissodes nemorensis* has been reported to vector *Fusarium circinatum* and *Leptographium procerum*; For *F. circinatum*, emergency measures are in place in Commission Decision 2007/433/EC on provisional emergency measures to prevent the introduction into and the spread within the Community of *Gibberella circinata* Nirenberg & O’Donnell.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Nearly all European and non-native cultivated Pinaceae are at risk by at least some of the non-EU *Pissodes* species. Most *Pissodes* spp. attack *Pinus* spp. *Picea*, *Abies* and *Pseudotsuga* are listed as main hosts for some species whereas *Larix* and *Cedrus* are cited as minor hosts (Appendix A).

3.4.2. Entry

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

*Yes.*
The main pathways of entry are:

- Plants for planting: live Pinaceae including Christmas trees (for species attacking terminals). Pathway closed.
- Pinaceae logs, mostly with bark, although, depending on the species and the tree size and species, debarked logs and bark pieces may also contain viable mature larvae, pupae and/or teneral adults in their pupal cells. Pathway closed.
- Cut branches of Pinaceae. Pathway closed.
- Live, long-lived adults can be transported in containers as hitchhikers.
- It cannot be ruled out that immature *Pissodes* spp. may enter with artificially dwarfed plants of conifers (the plants for planting pathway is closed, but there are derogations in place and there is trade in artificially dwarfed plants from Japan and Korea), but it is highly unlikely that *Pissodes* spp. would be able to be introduced or survive the 2 years inspection and treatment regime. It has never been reported in the post-quarantine inspections in the EU.

There is trade of coniferous wood products into the EU from countries where *Pissodes* species are present (USA, Canada, Mexico, China, Japan, Korea, Russia and South Africa). Among these countries, Russia is by far the biggest exporter of wood into the EU (exporting 0.7–1.2 million tonnes of wood products into the EU in 2012–2016, according to EUROSTAT).

There are no records of interception of *Pissodes* spp. in the Europhyt database.

### 3.4.3. Establishment

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

**Yes**, most non-European *Pissodes* spp. would be able to establish in at least some EU countries.

#### 3.4.3.1. EU distribution of main host plants

*Pissodes* spp. attack mostly *Pinus* spp. and other Pinaceae genera. These are distributed throughout the EU territory (Figure 4).

![Figure 4: The cover percentage of coniferous forests in Europe with a range of values from 0 to 100 at 1 km resolution (source: Corine Land Cover year 2012 version 18.5 by EEA)](image-url)
3.4.3.2. Climatic conditions affecting establishment

Most non-EU *Pissodes* spp., including all species known as being severely damaging in their native area, live in temperate climates in North America and East Asia (including *P. punctatus* and *P. yunnanensis* that are found at low latitude but high elevations in China). For these species, most European climates would surely be suitable.

Exceptions include the three tropical species recorded in El Salvador and, possibly, some of the five species occurring in Mexico (See Appendix A). However, the distribution within Mexico of these latter species is too poorly known to allow the assessment of potential establishment in the EU.

3.4.4. Spread

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

**Yes.** *Pissodes* weevils are strong flyers and can easily travel as hitchhikers. Immature stages can be transported in plants for planting and logs.

(Regulated non-quarantine pest) RNQPs: Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects?

**Yes,** should they enter the EU, species attacking terminals or stems of young trees can be easily transported in their immature stages through the movement of live conifer plants, including Christmas trees.

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There are evidences showing that the long-lived *Pissodes* adults are strong flyers (Day et al., 2004) although there is no precise data on their flight capacity. They probably also can easily be transported as hitchhiker in any container.

Species attacking terminals or stems of young trees can be easily transported in their immature stages through the movement of live conifer plants, including Christmas trees. Those attacking boles can be transported in logs with bark, although, depending on the species and the tree, debarked logs and bark pieces may also contain viable mature larvae, pupae and/or tenerals (young immature adults) in their pupal cells.

3.5. Impacts

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

**Yes,** some *Pissodes* spp. would most probably have an economic impact on plantations. They may also interfere with forest ecosystem processes although they are mainly abundant and damaging in intensively managed monocultures.

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?

**Not relevant.** The damaging species are not in the EU.

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All non-EU *Pissodes* species feed on, and develop in the cambium and phloem of conifers (Pinaceae). While the majority of *Pissodes* species attack dead or dying trees and do not cause economic impact in their region of origin, a few are considered as economic pests of conifer plantations, mostly through the destruction of terminal leaders. It must be noted that these latter species are considered pests mainly in monoculture, even-aged plantations and much less so in native and mixed forests.

* Pissodes strobi is considered as the most damaging species of the genus. By feeding on, and infesting terminal leaders of – mostly – young pines and spruces, it causes growth loss, crooked and distorted stems, reducing timber quality. Impact on white pine (*Pinus strobus*) plantations in Eastern North America has been so severe that it strongly affected the planting programme and management practice of this valuable tree species (Gross, 1985). Impacts on Sitka spruce (*Picea sitchensis*) plantations have been similarly severe (Alfaro, 1994). *Pissodes strobi*, as other species affecting conifer terminals are also considered pests of Christmas trees since these do not tolerate aesthetic damages.

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4 See Section 2.1 on what falls outside EFSA’s remit.
• **Pissodes terminalis** is rather similar to *P. strobi* in the sense that it also attacks terminal leaders, which results in crooked forked stems, but attacks are usually less severe and rather restricted to young *Pinus contorta* and *P. banksiana* of 2–6 m. In some cases, the weevil can affect nearly all trees of a plantation. However, deformities have disappeared when trees are harvested and, thus, *P. terminalis* is usually considered as a minor pest, except for Christmas tree plantations (Stevens and Knopf, 1974; Langor et al., 1992).

• **Pissodes nemorensis** attacks mainly boles of dead or dying trees but can also damage living trees, including terminals. In some cases, it may kill apparently healthy trees. It is also considered a pest in nurseries because adults can intensively feed on seedlings (Ollieu, 1971; Overgaard and Nachod, 1971; Phillips et al., 1987). In addition, *P. nemorensis* has been reported to be associated with several tree pathogens, in some cases as vectors, e.g. of *Fusarium circinatum*, the causal agent of pitch canker and *Leptographium procerum*, the causal agent of procerum root disease (see Wondafrash, 2016 for review). The association with *F. circinatum* has also been shown in South Africa, where the beetle has been introduced and causes increasing damage on *Pinus radiata* plantations, mainly through the destruction of terminal leaders. However, recent molecular studies suggest that this species is not *P. nemorensis*, but an unrecognised species of the *P. strobi* complex or a hybrid between *P. strobi* and *P. nemorensis* (Wondafrash et al., 2016).

• **Pissodes fasciatus** attacks dead or dying stems of Douglas-fir, *Pseudotsuga menziesii*, which in itself is not of economic importance. However, Witcosky et al. (1986) showed that the species can act as vector of *Ophiostoma wageneri* Kendrick, the causal agent of black-stain root disease of Douglas-fir, absent from the EU territory. This and the previous example of *P. nemorensis* and pitch canker show the potential of *Pissodes* spp. to become vectors of serious tree diseases.

• **Pissodes nitidus** is a pest of young pines in East Asia. Damage varies among regions, and the most severe damage has been reported on *Pinus koraiensis* in Northern China (Jin, 1989). Similarly to *P. strobi* and *P. terminalis*, it attacks terminals, which reduces annual growth and causes deformities. Several years of attack produce a stem that cannot be used as saw timber.

• Other Asian *Pissodes* spp. are still rather poorly known but are potentially very damaging. Two species recently described from south-western China, *P. punctatus* and *P. yunnanensis*, are reported to cause stem deformities in pine plantations, similar to those caused by the above-mentioned species. *Pissodes yunnanensis* is also able to kill young trees through repeated attacks or even in a single year on very young (3–4 years old) trees (Langor et al., 1999; Zhang et al., 2004). Damage has increased in recent decades, partly as a result of the advent of extensive pine monocultures.

• Similarly, although little is known from Mexican and Central American *Pissodes* spp., damage on pine plantations have been reported, particularly for *P. cibriani* and *P. zitacuarensis* (O’Brien, 1989a).

### 3.6. Availability and limits of mitigation measures

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

**Yes**, measures listed on the annexes of Council Directive 2000/29 directly target *Pissodes* spp. or more generally prevent the introduction of conifer plants for planting and wood with bark from Third countries (see Section 3.3).

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

Non-EU *Pissodes* spp. are not known to occur in the EU so RNQP status is not being considered.

### 3.6.1. Phytosanitary measures

Several measures not directly related to *Pissodes* spp. but targeting coniferous trees and wood from Third countries are included on the annexes of Council Directive 2000/29.
3.6.1.1. Biological or technical factors limiting the feasibility and effectiveness of measures to prevent the entry, establishment and spread of the pest

In case of derogations regarding the importation of living conifers (e.g. artificially dwarfed plants), infestations by *Pissodes* spp. cannot be easily noticed without destroying (debarking) the plant.

3.6.2. Pest control methods

Control methods vary with the species. In the EU, control methods are rarely applied against *Pissodes* spp., which are considered as secondary pests. *P. castaneus* is still considered as pest in young pine monocultures in some regions but much less so in mixed forests and plantations. In general, *Pissodes* spp. are much more prevalent in such monocultures of even-aged, open-grown trees and their importance decrease with the increase of stand complexity.

In North America, control methods are mostly applied against *Pissodes strobi*. These can also be applied to other terminal-infesting species. The methods that have shown some success in limiting the impact include:

- pruning of infested leaders and corrective pruning of attacked trees;
- manipulation of stand densities, composition and shading;
- avoid planting susceptible species in highly favourable sites, using hazard rating systems;
- insecticides;
- selection of resistant varieties.

In South Africa, the control of the invasive *Pissodes* sp. (previously recorded as *P. nemorensis*) also includes:

- Avoidance of stress on pines by planting at sites that are favourable for the planted trees species.
- Removal of breeding material such as slash and dying trees since *Pissodes* sp. mainly develops in dead or dying trees.

3.7. Uncertainty

The main uncertainty is related to the assessment of impact for species that are not yet invasive elsewhere. There are several examples of bark and wood boring beetles (and other insects and pathogens) that are innocuous in their native range and became extremely damaging in their invasion range because they encountered plant species that had not developed resistance mechanisms against the species or because they invaded new regions without their natural enemies. The recent invasion of Eastern USA by the emerald ash borer, *Agrilus planipennis* is a good example. Native to Asia where the local *Fraxinus* species are generally resistant, the pest is presently threatening to eliminate the North American ashes (Herms and McCullough, 2014; Morin et al., 2017). Thus, it cannot be ruled out that some *Pissodes* spp. that are of limited importance in their native range become serious pests in Europe.

The likelihood of beetles entering the EU as hitchhikers is also highly uncertain. *Pissodes* spp. do not aggregate as other beetles or bugs do and, thus, even if a beetle arrives in Europe accidentally, it is likely to arrive alone or in very small numbers, under its Allee threshold, limiting the chance of establishment (Lewis and Kareiva, 1993; Liebhold and Tobin, 2008).

There is a high uncertainty associated with the ability of *Pissodes* spp. to become vectors of tree pathogens. Several cases of *Pissodes*-plant pathogens associations have been reported but in general the importance of the weevils as vectors could not be ascertained.

Finally, there is a significant uncertainty related to the taxonomy of *Pissodes* species. In particular, the *Pissodes strobi* species complex includes cryptic species that interbreed and, since their ranges overlap, their identity as separate species can be questioned. The invasive species in South Africa that belongs to this complex was identified as an undescribed species or a hybrid between *P. strobi* and *P. nemorensis*, highlighting the taxonomic issues related to this group.

4. Conclusions

*Pissodes* spp. (non-EU) that have recorded impacts (*Pissodes strobi, P. terminalis, P. nemorensis, P. yunnanensis, P. nitidus*) do meet the criteria assessed by EFSA to be considered as potential quarantine pests. The impact of some other species (*P. punctatus, P. fasciatus, P. cibiani, P. zitacuarenae*) is less clearly documented.
Pissodes spp. (non-EU) being absent from the EU territory, do not meet the criteria assessed by EFSA for consideration as potential regulated non-quarantine pests (Table 5).

**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 Union quarantine pest | Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest | Key uncertainties |
|----------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------|
| Identity of the pest (section 3.1) | The genus *Pissodes* is a valid taxon                                                               | The genus *Pissodes* is a valid taxon                                                               | The taxonomy within the genus includes several uncertainties. See Section 3.7 |
| Absence/presence of the pest in the EU territory (section 3.2) | The species described in this opinion are by definition absent from the EU territory | The species described in this opinion are by definition absent from the EU territory | None |
| Regulatory status (section 3.3) | The *Pissodes* spp. considered in this opinion are quarantine organisms included in Annex IIAI of Council Directive 2000/29/EC | The *Pissodes* spp. considered in this opinion are quarantine organisms included in Annex IIAI of Council Directive 2000/29/EC | None |
| Pest potential for entry, establishment and spread in the EU territory (section 3.4) | The pest is able to enter into, become established in, and spread within, the EU territory. The identified pathways are: a) conifer plants for planting (closed pathway); b) Pinaceae roundwood with bark or debarked (closed pathway); c) cut branches (closed pathway); d) artificially dwarfed plants of conifers imported under derogation; e) hitchhiking insects | The pest is able to enter into, become established in, and spread within, the EU territory. The identified pathways are: a) conifer plants for planting (closed pathway); b) Pinaceae roundwood with bark or debarked (closed pathway); c) cut branches (closed pathway); d) artificially dwarfed plants of conifers imported under derogation; e) hitchhiking insects | Hitchhiking is a possibility, the adult weevils being long-lived. However, it has never been reported so far |
| Potential for consequences in the EU territory (section 3.5) | Some *Pissodes* spp. would most probably have an economic impact on plantations. They may also interfere with forest ecosystem processes although they are mainly abundant and damaging in intensively managed monocultures | Some *Pissodes* spp. would most probably have an economic impact on plantations. They may also interfere with forest ecosystem processes although they are mainly abundant and damaging in intensively managed monocultures | The fact that new hosts and, possibly, new pathogens would be involved gives some uncertainty regarding damage magnitude. Also, entering new areas, possibly free from natural enemies could increase the pest's damage |
| Available measures (section 3.6) | Entry: most of the major pathways are closed, except artificially dwarfed plants of conifers under derogation Establishment and spread: monitoring for, and destruction of infested material could prevent establishment and spread | Spread: production of plants for planting in a pest free place of production or a pest-free area would prevent or slow the spread. Monitoring for, and destruction of, infested material could contribute to prevent the spread | The cryptic nature of the immature stages makes them often difficult to notice The insects are strong flyers and, hence, spread by natural means can occur |
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**Abbreviations**

| Abbreviation | Definition                                      |
|--------------|-------------------------------------------------|
| DG SANTÉ     | Directorate General for Health and Food Safety  |
| EPPO         | European and Mediterranean Plant Protection Organization |
| FAO          | Food and Agriculture Organization               |
| IPPC         | International Plant Protection Convention        |
| MS           | Member State                                     |
| PLH          | EFSA Panel on Plant Health                       |
| RNQP         | Regulated non-quarantine pest                    |
| TFEU         | Treaty on the Functioning of the European Union  |
| ToR          | Terms of Reference                              |
## Appendix A – List of Pissodes spp. not reported from the EU

This table is largely based on that presented in Wondafrash (2016). Other references are listed in the table.

| Species | Economic damage reported(a) | Distribution-reported from | Reference | Host genera |
|---------|------------------------------|---------------------------|-----------|-------------|
| *Pissodes affinis* Randall | Yes | USA, Canada | O’Brien (1989b), Furniss and Carolin (1977) | *Pinus* |
| *Pissodes ayacahuite* Osella | No | El Salvador | Osella (1977) | *Pinus* |
| *Pissodes barberi* Hopkins | No | USA | O’Brien (1989b), Furniss and Carolin (1977) | *Piceae in Wondafrash, Pinus? in Furniss and Carolin (1977)* |
| *Pissodes burkei* Hopkins | No | USA, Canada | O’Brien (1989b), Furniss and Carolin (1977) | *Abies* |
| *Pissodes californicus* Hopkins | No | USA | O’Brien (1989b), Furniss and Carolin (1977) | *Pinus* |
| *Pissodes cembrae* Motschulsky | Yes | China, Japan | Kulinich and Orlinski (1998) | *Pinus (Larix, Picea, Abies)* |
| *Pissodes championi* O’Brien | No | Mexico | O’Brien (1989a) | *Pinus* |
| *Pissodes cheni* Lu, Zhang and Langor | No | China | Lu et al. (2007) | *Pinus* |
| *Pissodes cibriani* O’Brien | Yes | Mexico | O’Brien (1989a) | *Pinus* |
| *Pissodes coloradensis* Hopkins | No | USA (Wondafrash adds Canada) | O’Brien (1989b), Furniss and Carolin (1977) | *Picea (Furniss and Carolin add Pinus)* |
| *Pissodes costatus* Mannerheim | No | USA, Canada | O’Brien (1989b), Furniss and Carolin (1977) | *Picea (Furniss and Carolin add Pinus)* |
| *Pissodes fasciatus* LeConte | Yes | USA, Canada | O’Brien (1989b) | *Pseudotsuga* |
| *Pissodes fiskei* Hopkins | No | USA, Canada | O’Brien (1989b), Furniss and Carolin (1977) | *Picea* |
| *Pissodes galloisi* Kudo | No | Japan, Russia | EPPO (2005) | *Pinus* |
| *Pissodes guatemaltecus* Voss | No | Mexico, Guatemala | O’Brien (1989a) | *Pinus* |
| *Pissodes incavatus* Osella | No | El Salvador | Osella (1977) | *Pinus* |
| *Pissodes insignatus* Boheman | Yes | Russia | Legalov (2010), EPPO (2005) | *Pinus (Larix)* |
| *Pissodes mexicanus* O’Brien | No | Mexico | O’Brien (1989a) | *Pinus* |
| *Pissodes murrayanae* Hopkins | No | USA | O’Brien (1989b), Furniss and Carolin (1977) | *Pinus* |
| *Pissodes nemorensis* Germar | Yes | USA, Canada (occurrence in South Africa may refer to a different species and references from Russian Far East and Japan may be misidentifications(s)) | O’Brien (1989b), Wondafrash et al. (2016) | *Pinus, Cedrus, Picea* |
| *Pissodes nitidus* Roelofs | Yes | China, Japan, Korea, Russia | Lu et al. (2007), Jin (1989) | *Pinus* |
| *Pissodes obscurus* Roelofs | No | Russia, Japan, Korea | Legalov (2010)/EPPO (2005) | *Pinus (Picea, Abies)* |
| Species                          | Economic damage reported<sup>(a)</sup> | Distribution-reported from | Reference                          | Host genera        |
|---------------------------------|----------------------------------------|-----------------------------|------------------------------------|--------------------|
| *Pissodes ochraceus* Van Dyke   | No                                     | USA                         | O’Brien (1989b)                    | ?                  |
| *Pissodes pilatsquamosus* Lu, Zhang and Langor | No                                     | China                       | Lu et al. (2007)                   | Pinus              |
| *Pissodes punctatus* Langor and Zhang | ?<sup>(h)</sup>                       | China                       | Langor et al. (1999)               | Pinus              |
| *Pissodes puncticollis* Hopkins | No                                     | USA                         | O’Brien (1989b)                    | Picea              |
| *Pissodes radiatae* Hopkins     | No                                     | USA                         | O’Brien (1989b); Furniss and Carolin (1977) | Pinus              |
| *Pissodes robustus* Van Dyke    | No                                     | USA                         | O’Brien (1989b)                    | ?                  |
| *Pissodes rotundatus* LeConte    | No                                     | USA                         | O’Brien (1989b); Furniss and Carolin (1977) | Picea (Pinus, Tsuga) |
| *Pissodes rotundicollis* Desbrochers<sup>(i)</sup> | No                                     | Russia                      | Lu and Zhang (2007)                | ?                  |
| *Pissodes schmutzenhoferi* Osella | No                                     | El Salvador                 | Osella (1977)                      | Pinus              |
| *Pissodes schwarzi* Hopkins     | ?<sup>(j)</sup>                         | USA, Canada                 | O’Brien (1989b); Furniss and Carolin (1977) | Pinus, Larix       |
| *Pissodes similis* Hopkins      | No                                     | USA, Canada                 | O’Brien (1989b); Furniss and Carolin (1977) | Abies              |
| *Pissodes striatulus* (F.)      | No                                     | USA, Canada                 | O’Brien (1989b); Furniss and Carolin (1977) | Abies              |
| *Pissodes strobi* (Peck)        | Yes                                    | USA/Canada                  | O’Brien (1989b); Furniss and Carolin (1977) | Pinus, Picea       |
| *Pissodes terminalis* Hopping   | Yes                                    | USA, Canada                 | O’Brien (1989b); Furniss and Carolin (1977) | Pinus              |
| *Pissodes webbi* Hopkins        | No                                     | USA                         | O’Brien (1989b); Furniss and Carolin (1977) | Pinus              |
| *Pissodes yunnanensis* Langor and Zhang | Yes                                    | China                       | Langor et al. (1999); Xu et al. (2002), Zhang et al. (2004) | Pinus              |
| *Pissodes zitacuarensis* Sleeper | ?<sup>(d)</sup>                         | Mexico                      | O’Brien (1989a)                    | Pinus              |

<sup>(a)</sup>: Economic damage reported: Yes: publications describing economic damage such as yield losses or important mortality and/or management practices; No: No publications suggesting economic damage and/or management practices; ?: doubtful situations, as explained in footnotes.

<sup>(b)</sup>: *Pissodes affinis*: Some old papers, e.g. Martin (1964) associate this species in a complex causing high pine mortality in Canada.

<sup>(c)</sup>: *Pissodes cembrae*: East Asian species still present in several lists although Legalov and Opanassenko (2000) synonymised it with the European *Pissodes pini*. EPPO (2005) considers *P. cembrae* as having low to high impact but does not provide original sources.

<sup>(d)</sup>: *Pissodes cibrani* and *P. zitacuarensis*: O’Brien (1989a) mentions that these species could be important for Christmas tree plantations and *P. cibrani* apparently destroyed *Prunus patula* at one site, but no additional data are provided.

<sup>(e)</sup>: *Pissodes fasciatus*: Only breeds in boles of dead or dying douglas fir, but Wilcosky et al. (1986) showed that the species can act as vector of *Verticicadiella wageneri*, the causal agent of black-stain root disease.

<sup>(f)</sup>: *Pissodes insignatus*: EPPO (2005) mentions low to medium impact but does not cite its sources, which are probably Russian papers.

<sup>(g)</sup>: *Pissodes nemorensis*: Molecular studies showed that the invasive populations in South Africa, previously recorded as *P. nemorensis*, is rather an unrecognised species of the *P. strobi* complex or a hybrid between *P. strobi* and *P. nemorensis* (Wondafash et al., 2016). Records from the Russian Far East and Japan may result from misidentifications of *P. nitidus* (Lu et al., 2007). *Pissodes nemorensis* has been reported to vector *Fusarium cinnatum* and *Leptographium procerum*.

<sup>(h)</sup>: *Pissodes punctatus*: In the first description, Langor et al. (1999) do not provide details on damage. In later papers, the same authors (e.g. Lu et al., 2007) mention it as a serious pest but without providing further details.
(i): *Pissodes rotundicollis*: Russian species appearing in only few publications (e.g., Lu and Zhang, 2007; Wondafrash, 2016), possibly referring to erroneous records. It does not appear in the list of Russian *Pissodes* spp. of Kulinich and Orlinskii (1998).

(j): *Pissodes schwartzii*: This species is part of the *P. strobi* species complex but, in contrast to the three other species of the complex, is usually not cited as damaging healthy trees.
### Appendix B – List of *Pissodes* spp. reported from the EU

This table is based on the EPPO Global Database and Fauna europaea.

| Species                  | Distribution in the EU                                                                 |
|--------------------------|----------------------------------------------------------------------------------------|
| *Pissodes harcyniae* (Herbst) | Austria, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Italy, Latvia, Poland, Slovakia, Sweden, Netherlands (doubtful) |
| *Pissodes scabricollis* Miller        | Austria, Croatia, Czech Republic, Germany, Hungary, Italy, Poland, Slovakia               |
| *Pissodes piceae* (Illiger)          | Austria, Bulgaria, Croatia, Czech Republic, France, Germany, Hungary, Italy, Latvia, Poland, Slovakia, Spain, Netherlands (doubtful) |
| *Pissodes piniphilus* (Herbst)       | Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Poland, Slovakia, Sweden, Netherlands |
| *Pissodes validirostris* Gyllenhali   | Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Netherlands, Poland, Portugal, Slovakia, Sweden, UK |
| *Pissodes irroratus*<sup>(a)</sup> Reitter | France, Italy                                                                              |
| *Pissodes castaneus* (De Geer)       | Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, UK |
| *Pissodes pini* (Linnaeus)           | Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Netherlands, Poland, Slovakia, Spain, Sweden, UK |
| *Pissodes gyllenhali* (Sahlberg)     | Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Netherlands, Poland, Slovakia, Sweden |

(a): A recent finding (Haran et al., 2016) has allowed to add *Pissodes irroratus*, so far known only as an East Russian species, to the EU fauna. The capture of specimens of this species in 2015 in the French Alps led to an inventory of European collection, where a misidentified specimen caught in Switzerland in 1966 was found.