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Pest categorisation of *Xylotrechus chinensis*

EFSA Panel on Plant Health (PLH),
Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe Lucien Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Jean-Claude Gregoire, Chris Malumphy, Virag Kertesz, Andrea Maiorano and Alan MacLeod

Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Xylotrechus chinensis* (Coleoptera: Cerambycidae) for the EU territory. This species is not included in the EU Commission Implementing Regulation 2019/2072. *X. chinensis* is native to China, Japan, the Korean peninsula and Taiwan. It has recently been reported from Spain (Catalonia; Region of Valencia), Greece (Athens; Crete) and France (Hérault; Gironde). *X. chinensis* attacks and kills *Morus* spp. in Europe and is also a pest of *Malus domestica*, *Pyrus* sp. and *Vitis vinifera* in Asia. This last species, however, was not confirmed as a host in an experimental study in Spain. The pest is univoltine. The adults are 1.5–2.5 cm long; they emerge between May and August. Each female produces approximately 80 eggs which are laid on the bark. The larvae live in the phloem and tunnel into the xylem where they pupate. Infested trees show injuries including longitudinal slits in the bark, caused by larval activity next to the surface and round exit holes from which frass emerges. The females respond to a male sex pheromone, which has not been developed into a detection method. The adults spread by flight as suggested by the local expansion of damage in Europe. However, wood packaging material and wooden objects can also be a pathway as suggested by interceptions in Germany and the USA. In Greece and Spain, hundreds of *Morus* trees have already been attacked within a few years, and often killed. The infested area has been observed to expand from 44 to 380 km^2 within 2 years in Spain (Catalonia). Phytosanitary measures are available to inhibit further introductions and slow the spread within the EU. *X. chinensis* satisfies all the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.

Keywords: *Morus*, pest risk, plant health, plant pest, quarantine, tiger longicorn beetle

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Correspondence: alpha@efsa.europa.eu

Panel members: Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent, Jonathan Yuen and Lucia Zappalà.

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Table of contents

1. Introduction

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

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1E (for more details see mandate M-2021-00027 on the Open.EFSA portal). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the Open.EFSA portal). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the Terms of Reference

Xylotrechus chinensis is one of a number of pests listed in Annex 1 to the Terms of Reference (ToR) (1.1.2.1) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the EU 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, and so inform European Commission decision-making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/ 2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

1.3. Additional information

This categorisation was initiated by reports of interceptions and/or outbreaks of the pest notified by the Member States to the European Commission.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *X. chinensis* 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. Papers relevant for the pest categorisation were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), the CABI databases and scientific literature databases as referred above in Section 2.1.1.

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 and TRACES databases were 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 SANTÉ) of the European Commission as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

2.2. Methodologies

The Panel performed the pest categorisation for *X. chinensis*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) is given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee, 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

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, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3(d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

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 (article 3)
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?
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
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.
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 for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impact?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.

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/or to be transmissible?

Yes, the identity of the species is established and *Xylotrechus chinensis* (Chevrolat) is the accepted name.

Xylotrechus chinensis (Figure 1) is an insect within the order Coleoptera and family Cerambycidae. It is commonly known as the tiger longicorn beetle, though this name is also applied to other black and orange cerambycids.

According to the principal taxonomic catalogues of Cerambycidae (Tavakilian and Chevillotte, 2015; Danilevsky, 2020), the species belongs to the subgenus *Xyloclytus* within the genus *Xylotrechus*. In taxonomic studies, the name *Xylotrechus* (*Xyloclytus*) *chinensis* (Chevrolat) would thus be preferred (G. Tavakilian, 2021, MNHN, Paris, personal communication in email of 5.7.2021). For the common use, the species is designated as *Xylotrechus chinensis* (Chevrolat).

The Holarctic genus *Xylotrechus* is very large, with more than 270 species and subspecies and five subgenera in addition to the nominal subgenus *Xylotrechus* (*Xyloclytus*) (Tavakilian and Chevillotte, 2015).

The EPPO code[1] for this species is: XYLOCH (EPPO, online).

[1] An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed, the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger & Roy, 2015; EPPO, 2019a)

Figure 1: *Xylotrechus chinensis* adult. Size: 15–25 mm. Courtesy: Leivadara et al., 2018

3.1.2. Biology of the pest

The biology of *X. chinensis* in Catalonia has been described by Sarto i Monteys and Torras i Tutusaus (2018). The pest is univoltine (one generation per year) in Europe as well as in Asia. The adults emerge in May–June (Crete: Leivadara et al., 2018) or in July–August (Catalonia: Sarto i Monteys & Torras i Tutusaus 2018). The males produce a sex pheromone with three components: 2, 3-octanediol, 2-hydroxy-3-octanone and 3-hydroxy-2-octanone (Iwabuchi et al., 1987; Kuwahara et al., 1987) which attracts the females. Mating occurs on the bark rapidly after emergence. Each female produces approximately 80 eggs, which are laid on the bark surface. The young larvae enter the bark and feed in galleries extending longitudinally in the phloem and cambium (Figure 2), where they overwinter. At the end of their development, the larvae tunnel radially into the xylem (Figure 3) and pupate. The adults exit through a round hole, approximately 5 mm in diameter. *X. chinensis* attacks and kills living trees but can also develop in cut logs (Table 2)

Figure 2: Larval galleries of *Xylotrechus chinensis* on a *Morus* sp. tree. Courtesy: Àngels Blanquez (JARDINET S.C.C.L., Ripollet municipality, Spain)

Figure 3: Galleries of *Xylotrechus chinensis* entering the xylem of a mulberry tree. Courtesy: Victor Sarto i Monteys, Servei Sanitat Vegetal DARP/ICTA-UAB Barcelona

Table 2: Important features of the life-history strategy of *Xylotrechus chinensis*

Life stage	Phenology and relation to host	Other relevant information
Egg	Oviposition between May and August, on the bark surface. Each female produces about 80 eggs.	The females prefer to oviposit on larger trees, along the trunks and on base of large branches, often on warmer orientations.
Larva	Immediately after hatching, the young larvae enter the bark, where they feed upon the phloem and cambium. They overwinter in their gallery.	The larval galleries develop longitudinally along the trunk and reach 15–25 cm.
Pupa	Pupation occurs in a chamber that extends radially into the xylem	
Adult	Adults emerge between May and August	Adults take off and fly easily. Flight capacity is unknown, but the rapid spread of infestation spots (Greece, Spain) suggests that the adults can spread locally by flight. Sex ratio (M:F) varies from 0.50 to 1.20

3.1.3. Host range/Species affected

In Korea, *X. chinensis* has been reported by Han and Lyu (2010) and Lim et al. (2014) to attack *Morus alba* L., *M. bombycis* Koidz. var. *bombycis*, *M. australis* Poiret, *Malus pumila* Mill. (= *Malus domestica* L.), *Pyrus* sp. and *Vitis vinifera* L. In Europe, the insect has been reported attacking so far only *Morus* spp. in Greece (Crete: Leivadara et al., 2018; Athens: D. Avtzis, 2021, Forest Research Institute, Hellenic Agricultural Organization Demeter, Vassilika, Thessaloniki, personal communication in email of 26.06.21), *M. alba* L. and *M. nigra* L. in Spain (Sarto i Monteys & Torras i Tutusaus 2018), and *M. bombycis* Koidz. in France (Cocquempot et al., 2019). Sarto i Monteys & Torras i Tutusaus (2018) tried to induce experimentally some insects to establish in cut pieces of *Vitis vinifera*, but these attempts were unsuccessful.

The host range of *X. chinensis* is not entirely known. To date, European populations of *X. chinensis* have been confirmed only on *Morus* spp. Asian populations have been reported on a wider host range (*Morus* spp., *Malus sp*., *Pyrus* sp. and *Vitis vinifera*) and intercepted on *Betula* sp. and *Salix* sp. (Schrader, 2017), wood packaging material (Benker, 2008) and a wooden spool (Philadelphia U.S. Customs and Border Protection, 2011).

3.1.4. Intraspecific diversity

The species includes two subspecies, *Xylotrechus* (*Xyloclytus*) *chinensis chinensis* Chevrolat and *Xylotrechus* (*Xyloclytus*) *chinensis kobayashii* Fujita, 2010. Fujita (2010) describes a third subspecies, *Xylotrechus* (*Xyloclytus*) *chinensis kurosawai* Fujita (2010), but this subspecies is not mentioned by Danilevsky (2020), nor by Tavakilian and Chevillotte (2015).

Xylotrechus (*Xyloclytus*) *chinensis chinensis* includes three varieties[2]: *griseofasciatus* Pic, 1943b, *kurosawai* Fujita, 2010 and *laterufescens* Pic, 1913a (Tavakilian and Chevillotte, 2015; Danilevsky, 2020).

The European literature refers only to *Xylotrechus chinensis*, and it is unclear whether the subspecies of *Xylotrechus* (*Xyloclytus*) *chinensis* and the varieties of *Xylotrechus* (*Xyloclytus*) *chinensis chinensis* differ in their damage and symptoms.

For the purposes of this pest categorisation, we assume that intraspecific diversity makes no difference to the risk and that all subspecies can be considered together.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?
Yes, it is possible to detect the pest by visual symptoms. Identification is possible using morphological features and molecular methods based on COI sequencing.

Morphological identification keys are provided by Cherepanov (1982) and, for the Korean fauna, by Han and Lyu (2010). Molecular identification is possible by sequencing a fragment of the mitochondrial gene COI. Two sequences are deposited in the GenBank database: accessions No MH191402 (Crete: Leivadara et al., 2018) and No MK098127 (France: Cocquempot et al., 2019).

The presence of the pest in a tree can be detected visually by round emergence holes, 5–6 mm in diameter (Figure 4), by bark wounds oozing tree sap and larval frass (Figure 5), in places where the larval galleries are very close to the bark surface, and by longitudinal slits (Figure 6) where the bark cracked above older galleries (Sarto i Monteys et al., 2021). Heavily attacked trees eventually die.

The male pheromone is known (Iwabuchi et al., 1987; Kuwahara et al., 1987) but a specific formulation for practical use in monitoring has not yet been developed. However, four adults were caught in 2019 in Ripollet (Catalonia) and 27 in Heraklion (Crete), and three adults were caught in 2020 and 10 more in 2021 near the harbour of Sète (A. Roques, 2021, INRAE, Orléans, personal communication in email of 14.10.2021.; EPPO, 2021; Roques et al., 2021), using traps baited with a mixture of eight pheromones to attract a wide range of insects (Fan et al., 2019).

[2] There is one subgenus (*Xyloclytus*), two or three subspecies and three taxonomic categories within the *Xylotrechus* (*Xyloclytus*) *chinensis chinensis* subspecies that taxonomists such as Danilevsky (2020), and Tavakilian and Chevillotte (2015) describe as varieties.

Figure 4: Emergence holes of *Xylotrechus chinensis*. Courtesy: Glòria Torras, Ajuntament de Barberà del Vallès (Barcelona)

Figure 5: Bark injury caused by beetle larvae. Courtesy: Jordi Serra, Ajuntament de Barberà del Vallès (Barcelona)

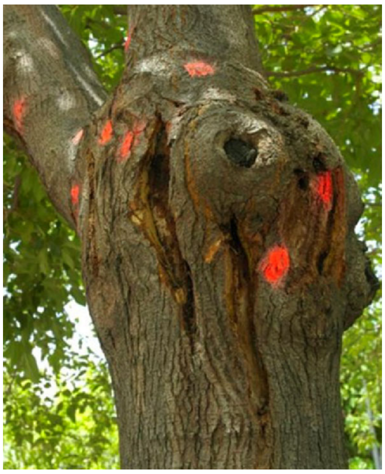

Figure 6: Gallery slits caused by beetle larvae. Courtesy: Victor Sarto i Monteys, Servei Sanitat Vegetal DARP/ICTA-UAB Barcelona

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

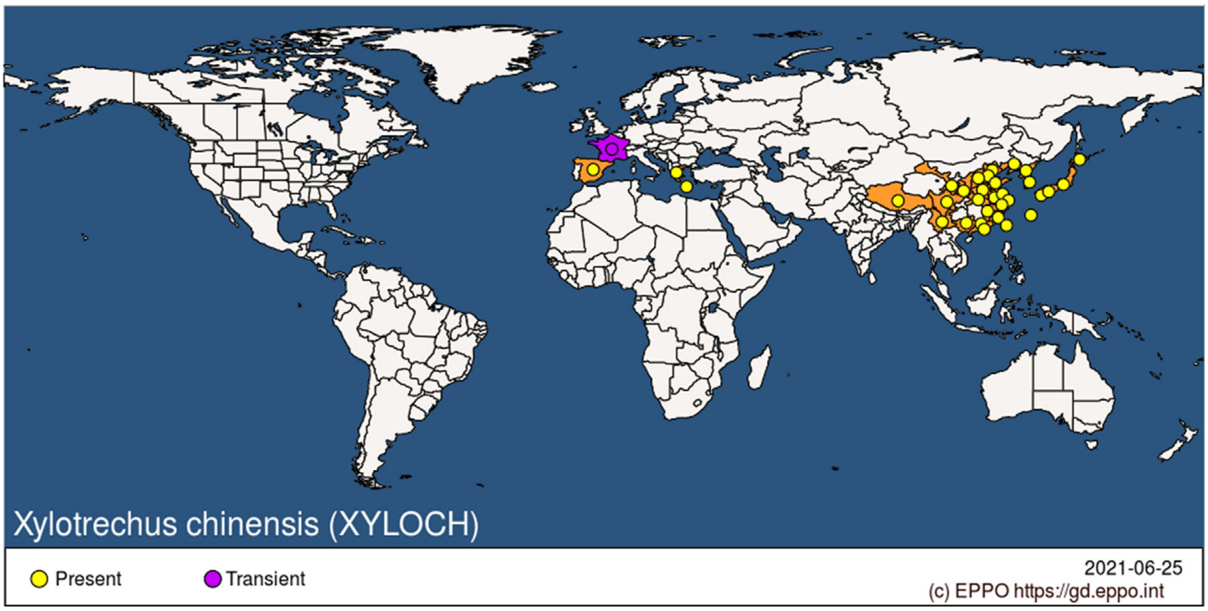

Figure 7: Global distribution of *Xylotrechus chinensis* (Source: EPPO Global Database accessed on 25 June 2021)

X. chinensis is native to China, Japan, the Korean peninsula and Taiwan (Appendix A) (Figure 7).

3.2.2. Pest distribution in the EU

> *Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?*
>
> **Yes**, *X. chinensis* is present in the EU with restricted distribution in Spain and Greece. It is transient, actionable, under surveillance in Spain.

- Present, restricted distribution in Spain:
  - Catalonia (Sarto i Monteys & Torras i Tutusaus 2018; EPPO, 2018a): 378.1 km^2 in 2020 (Sarto i Monteys et al., 2021);
  - Region of Valencia (Sarto i Monteys et al., 2021);
- Present, restricted distribution and under official control in Greece (EPPO GD, online):
  - Crete (EPPO, 2018b; Leivadara et al., 2018): 200 trees near Heraklion (Leivadara et al., 2018);
  - Athens (Ekathimerini 2020; Demetriou et al., 2021): 1,300 trees in 2019 (Demetriou et al., 2021);
- Transient, actionable, under surveillance in France:
  - Gironde (Cocquempot et al., 2019; EPPO, 2021);
  - Hérault (EPPO, 2018d, 2019b, 2021; Cocquempot et al., 2019). Three distinct infestation spots were recorded near Sète in 2019 (Valladares et al., 2019) and infested *Morus* sp. trees were found in Sète in 2020 (EPPO, 2021; Roques et al., 2021).

The distribution of the pest in the EU could be wider than currently reported, judging from the fact that many trees (up to several hundred) were already infested when the pest was found established in Greece and in Spain.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

X. chinensis is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, the implementing act of Regulation (EU) 2016/2031.

3.3.2. Hosts of *X. chinensis* that are prohibited from entering the Union from third countries

As specified in Annex VI of 2019/2072, *Malus domestica*, *Pyrus* spp. and *Vitis vinifera*, which are also *X. chinensis* host plants (see Appendix B), are prohibited from entering the EU as plants for planting from countries where *X. chinensis* is known to occur (Table 3).

Table 3: List of plants, plant products and other objects that are *Xylotrechus chinensis* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI)

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
8.	Plants for planting of (...) *Malus* Mill., (...) *Pyrus* L. (...) other than dormant plants free from leaves, flowers and fruits	ex 0602 10 90 ex 0602 20 20 ex 0602 20 80 ex 0602 40 00 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey and Ukraine

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
9.	Plants for planting of *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, and *Fragaria* L., other than seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 90 30 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries, other than: Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, New Zealand, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine and United States other than Hawaii
10.	Plants of *Vitis* L., other than fruits	0602 10 10 0602 20 10 ex 0604 20 90 ex 1404 90 00	Third countries other than Switzerland

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways Comment on plants for planting as a pathway.

Yes, the pest is able to enter the EU territory (see Section 3.2.2).
X. chinensis has been observed to oviposit preferentially on larger trees and could thus use large potted host trees (especially mulberries) as a pathway.

The potential pathways of entry of *X. chinensis* are presented in Table 4.

Table 4: Potential pathways for *Xylotrechus chinensis* into the EU 27

Pathways	**Life stage**	**Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]**
Description (e.g. host/ intended use/source)		
Wood packaging material	Larvae and pupae	None*
Wooden objects	Larvae and pupae	None
Plants for planting of *Morus* spp., *Malus domestica*; *Pyrus* spp., *Vitis vinifera*	All immature stages (eggs, larvae, pupae)	For prohibition, see Table 3

*: ISPM 15 is applicable for wood packaging material.

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As at 29 June 2021, there were three records of *X. chinensis* outbreaks in the Europhyt database:

- 2017: Spain (Catalonia, four localities, 44 km^2, 45% of the local *Morus alba* damaged);
- 2018: France (Sète, Hérault, larvae and one adult in one *Morus* sp.);
- 2018: Spain (Comunidad Valenciana, 11 *Morus* sp. attacked).

Actually, there have been two more outbreaks than those reported by Europhyt: Greece (Crete and Athens). See Section 3.2.2.

In addition, according to the literature, *X. chinensis* has been intercepted three times outside of its natural range:

- In 2007 in Germany (Bavaria) from a wooden packing box (plant species not specified) from China (Benker, 2008);
- In 2011 in the USA (Philadelphia) from a wooden spool (plant species not specified) supporting steel wire from China (Philadelphia U.S. Customs and Border Protection, 2011);
- In 2017 in Germany (Rheinland-Palatinate) in a container transporting decorative wooden objects in birch and willow wood from China (Schrader, 2017).

It remains to be confirmed that plants for planting are a pathway. Wooden objects and wood packaging material in non-mulberry wood (birch, willow, whatever wood the WPM is made of) seem to have been pathways.

3.4.2. Establishment

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

Yes, *X. chinensis* is present, with a restricted distribution in Spain (Catalonia and region of Valencia). In Greece (Crete and Athens), it is present with restricted distribution. In France (Hérault and Gironde), it is transient, actionable and under surveillance. Biotic factors such as host availability, and abiotic factors such as climate suitability suggest that most areas in the EU would be suitable for establishment.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker, 2002). Availability of hosts is considered in Section 3.4.2.1 and climatic factors in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

Morus spp.

Morus nigra, the host plant of the silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae), has been introduced in Europe as early as the Hellenistic Greek period, two or three centuries BCE, for the purposes of the silk industry. It was later followed by *Morus alba* (Vivarelli and Alvisi 1934, in CABI 2015). Nowadays, both species are present in most European countries. They are widely planted as shade trees in southern areas of the EU, e.g. France (Valladares et al., 2019), Spain (Sarto i Monteys et al., 2021) and Greece where there are more than 20,000 mulberry trees in Athens (D. Avtzis, Forest Research Institute, Hellenic Agricultural Organization Demeter, Vassilika, Thessaloniki, personal communication in email of 26.6.2021). However, *Morus* spp. are not very common overall. The frequency of *M. alba* in the E-Forest EFDAC, BioSoil and Forest Focus databases is 0.02% and that of *M. nigra* is below 0.01% (de Rigo et al., 2014).

Malus domestica

Table 5 shows the cultivated area (1,000 ha; 2016–2020) in Europe (source: Eurostat, accessed on 28 June 2021). Appendix C shows the cultivated area (1,000 ha; 2016–2020) in EU MS (source: Eurostat, accessed on 28 June 2021.

Table 5: Cultivation of *Malus domestica* in Europe (1,000 ha; 2016–2020). Source Eurostat, accessed on 28 June 2021

GEO/TIME	2016	2017	2018	2019	2020
European Union – 27 countries (from 2020)	506.48	505.55	507.24	491.35	473.66

Pyrus sp.

Table 6 shows the cultivated area (1,000 ha; 2016–2020) in Europe (source: Eurostat, accessed on 28 June 2021). Appendix D shows the cultivated area (1,000 ha; 2016–2020) in EU MS (source: Eurostat, accessed on 28 June 2021.

Table 6: Cultivation of *Pyrus* spp. in Europe (1,000 ha; 2016–2020). Source Eurostat, accessed on 28 June 2021

GEO/TIME	2016	2017	2018	2019	2020
European Union – 27 countries (from 2020)	115.76	114.84	114.84	111.84	108.83

Vitis vinifera

Table 7 shows the cultivated area (1,000 ha; 2016–2020) in Europe (source: Eurostat, accessed on 28 June 2021). Appendix E shows the cultivated area (1,000 ha; 2016–2020) in EU MS (source: Eurostat, accessed on 28 June 2021.

Table 7: Cultivation of *Vitis vinifera* in Europe (1,000 ha; 2016–2020). Source Eurostat, accessed on 28 June 2021

GEO/TIME	2016	2017	2018	2019	2020
European Union – 27 countries (from 2020)	3,136.04	3,134.93	3,137.17	3,160.68	3,162.48

3.4.2.2. Climatic conditions affecting establishment

A comparison of the eight Köppen–Geiger climate types that occur in countries where *X. chinensis* has been reported and the climate types that occur in the EU suggests that the pest can establish in most of the EU territory (Figure 8).

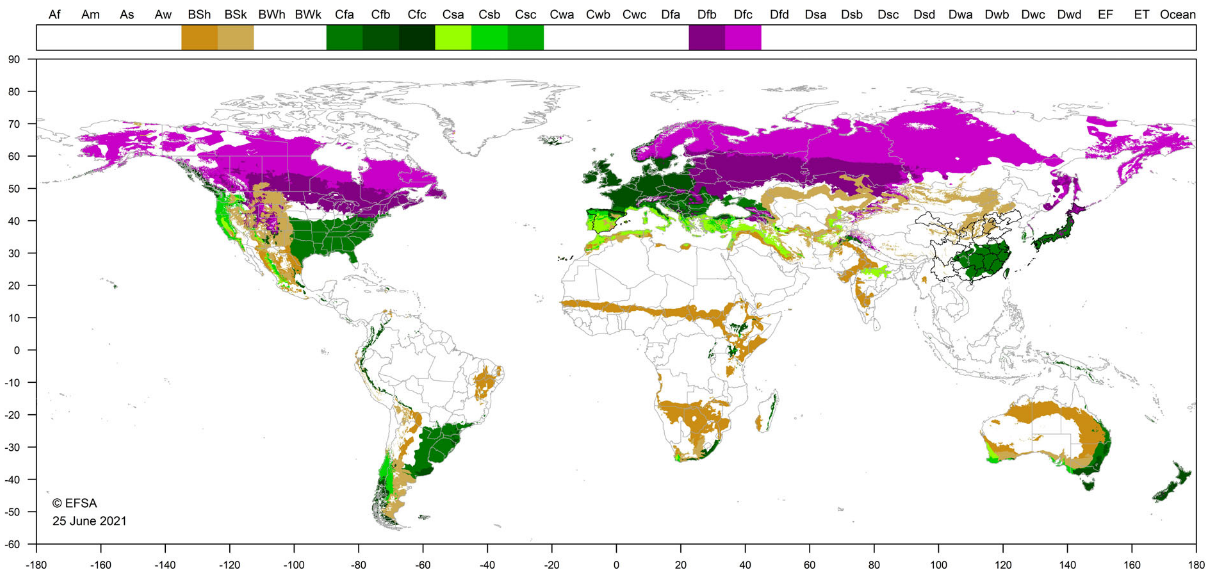

Figure 8: World distribution of eight Köppen–Geiger climate types that occur in the EU and which occur in countries where *Xylotrechus chinensis* has been reported

3.4.3. Spread

Describe how the pest would be able to spread within the EU territory following establishment?

The rapid growth of the infested areas at outbreak foci suggests that the pest can also spread by direct flight. As shown by its multiple entries into the EU territory, *X. chinensis* is often associated with wooden packaging material and wooden objects, that can also serve as spreading mechanisms.

Comment on plants for planting as a mechanism of spread

X. chinensis has been observed to oviposit preferentially on larger trees and could thus use large potted or bare rooted host trees (especially mulberries) as a pathway.

X. chinensis has the potential to spread fast. Sarto i Monteys et al. (2021) report that, in Catalonia, the infestation expanded from 44.1 km^2 in four towns in 2018 to 378.1 km^2 in 12 towns in 2020. In one locality (Barberà del Vallès) that was followed more closely, the proportion of infested trees rose from 16.21% in February 2016 to 59.29% in December 2018. In Athens, 1,300 of the more than 20,000 mulberries in the city were already infested when the outbreak was noticed (Demetriou et al., 2021; D. Avtzis, Forest Research Institute, Hellenic Agricultural Organization Demeter, Vassilika, Thessaloniki, personal communication in email of 26.6.21).

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?
Yes. Within less than 10 years, the pest has already killed thousands of *Morus* spp. grown as shade trees in Spain, Greece, and France.

As with other phloeophagous (phloem feeding) species attacking living hosts, the galleries in the phloem and cambium impede the movements of water and nutrients, gradually weakening the host and, over a certain density threshold, leading to the death of the host.

No impact is recorded from areas of origin, at least from China (EPPO, 2018c). In contrast, in Europe, there is growing evidence that the pest is having an important impact on *Morus* spp. Among the 200 trees recorded as infested in Crete in 2017, 15% had already died (Leivadara et al., 2018). Similarly, there were 300 dead trees out of the 1,300 mulberries found infested in Athens in 2019 (Ekathimerini, 2020; EPPO, 2020).

The European literature refers only to *Xylotrechus chinensis*, and it is unclear whether the subspecies of *Xylotrechus* (*Xyloclytus*) *chinensis* and the varieties of *Xylotrechus* (*Xyloclytus*) *chinensis chinensis* differ in their damage and symptoms.

3.6. Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread and impacts?
Yes, heat treatments or fumigation of wooden objects and host plants for planting imported from countries from where the pest originates.

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to plants for planting of some hosts of *X. chinensis* such as *Malus domestica*, *Pyrus* spp. and *Vitis vinifera* (see Section 3.3.2).

Additional potential risk reduction options and supporting measures are shown in Section 3.6.1.1 (Table 8) and 3.6.1.2 (Table 9).

3.6.1.1. Additional potential risk reduction options

Table 8: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Control measure/Risk reduction option (Blue underline = Zenodo doc)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Require pest freedom	Source imports from pest-free countries.	Entry/Spread
Growing plants in isolation	Used to mitigate likelihood of infestation by specified pest in vicinity of growing site	Entry/Spread
Biological control and behavioural manipulation	One native parasitoid, *Stephanus serrator* (Fabricius 1798) (Hymenoptera, Stephanidae) has been found exiting from infested logs in Catalonia (Sarto i Monteys et al., 2021). As a further prospect, pheromones might perhaps be used in the future for mass trapping or mating disruption.	Spread

Control measure/Risk reduction option (Blue underline = Zenodo doc)	RRO summary	Risk element targeted (entry/establishment/ spread/impact)
Chemical treatments on crops including reproductive material	This approach can be used for eradication or containment. Contact insecticides can be applied on the bark of the trunks in June to kill ovipositing females. Injections of a systemic insecticide, abamectin, have been tried in Catalonia, resulting in a significant reduction of the number of new infestations (Sarto i Monteys et al., 2021).	Establishment/Spread/Impact
Roguing and pruning	This approach can be used for eradication or containment. Attacked trees can be pruned or felled, and the removed material must be burned or chipped.	Establishment/Spread
Chemical treatments on consignments or during processing	Treatment of consignments could reduce the likelihood of entry or spread	Entry/Spread
Physical treatments on consignments or during processing	Chipping has been used against other woodborers, e.g. *Agrilus planipennis* (Coleoptera: Buprestidae).	Entry/Spread
Heat and cold treatments	Heat treatments of consignments could reduce the likelihood of entry and spread	Entry/Spread
Controlled atmosphere	Fumigation of consignments could reduce the likelihood of entry and spread	Entry/Spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 9.

Table 9: Selected supporting measures (a full list is available in EFSA PLH Panel et al., 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Supporting measure	Summary	Risk element targeted (entry/establishment/ spread/impact)
Phytosanitary certificate and plant passport	For plant for planting, provided that *Morus* spp. as P4P become regulated An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade)	Entry/Spread
Post-entry quarantine (PEQ) and other restrictions of movement in the importing country	Considering the long life cycle of the immature stages inside the host and the fact that the hosts must have a minimal size, the measure appears practically limited.	Establishment/Spread
Inspection and trapping	Inspections of material prior to import, on arrival in the EU, and when moving plants for planting within the EU from regions where *X. chinensis* occurs could reduce likelihood of entry or spread.	Entry/Establishment/Spread

Supporting measure	Summary	Risk element targeted (entry/establishment/spread/impact)
Sampling	Necessary as part of other RROs.	Entry/Spread
Certified and approved premises	If material sourced from an approved premises e.g. in a PFA (Table 8), likelihood of commodity being infested is assumed to be reduced (no specific literature in relation to *B. hilaris*)	Entry/Spread
Delimitation of buffer zones	As an organism that is already in the EU buffer zones could be used to inhibit spread.	Spread
Surveillance	As a pest already in the EU, surveillance to guarantee that plants and produce originate from a pest-free area could be an option. Surveys can be operated on *Morus* trees in and around infested areas, based on external symptoms (exit holes, bark injuries, gallery slits, frass). The male pheromone of *X. chinensis* has been identified (Iwabuchi et al., 1987; Kuwahara et al., 1987), and using traps baited with a mixture of eight pheromones to attract a wide range of insects (Fan et al., 2019), adult beetles were caught in Catalonia, Crete and France (A. Roques, INRAE, Orléans, personal communication in email of 14.10.2021; EPPO, 2021; Roques et al., 2021).	Establishment/Spread

Slowing spread/containment/eradication

Surveys can be operated on *Morus* trees in and around infested areas, based on external symptoms (exit holes, bark injuries, gallery slits, frass). The male pheromone of *X. chinensis* has been identified (Iwabuchi et al., 1987; Kuwahara et al., 1987), and using traps baited with a mixture of eight pheromones and kairomones to attract a wide range of insects (Fan et al., 2019), adult beetles were caught in Catalonia, Crete and France (A. Roques, INRAE, Orléans, personal communication in email of 14.10.2021; EPPO, 2021; Roques et al., 2021). Attacked trees can be pruned or felled, and the removed material must be burned or chipped. Contact insecticides can be applied on the bark of the trunks in June to kill ovipositing females. Injections of a systemic insecticide, abamectin, have been tried in Catalonia, resulting in a significant reduction of the number of new infestations (Sarto i Monteys et al., 2021). One native parasitoid, *Stephanus serrator* (Fabricius 1798) (Hymenoptera, Stephanidae), has been found exiting from infested logs in Catalonia (Sarto i Monteys et al., 2021). As a further prospect, pheromones might perhaps be used in the future for mass trapping or mating disruption.

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- The cryptic nature of the immature stages makes visual inspections difficult.
- The fact that the pest was intercepted with wooden objects in birch and willow (Schrader, 2017) suggests that the host range of the pest is wider than reported.

3.7. Uncertainty

The distribution of the pest in the EU could be wider than currently known.

It remains to be confirmed whether plants for planting are a pathway.

The host range of *X. chinensis* may not be entirely known.

There are uncertainties regarding differences in impacts caused by subspecies and varieties of *X. chinensis*.

These uncertainties do not affect the overall conclusions.

4. Conclusions

X. chinensis satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest (Table 10).

Table 10: 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	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the species is established and *X. chinensis* (Chevrolat) is the accepted name.	None
Absence/ presence of the pest in the EU (Section 3.2)	*X. chinensis* is present in the EU. It is present with restricted distribution and under official control in Greece; present with restricted distribution in Spain; and transient, actionable, under surveillance in France.	The pest may be more widespread in the EU than what is actually acknowledged. Due to the cryptic nature and long life cycle of the immature stages, early establishment of the pest can remain unnoticed for long.
Regulatory status (Section 3.3)	*X. chinensis* is not regulated in the EU plant health regulations. It is under official control in Greece.	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	Immature stages of *X. chinensis* can enter with wood packaging material and wooden objects, as well as with plants for planting of its unregulated hosts e.g. *Morus* sp.	It is uncertain whether plants for planting are an important pathway. Host range could be wider than reported.
Potential for consequences in the EU (Section 3.5)	Within less than 10 years, the pest has already killed thousands of *Morus* spp. grown as shade trees in Spain, Greece and France	None
Available measures (Section 3.6)	Heat treatments or fumigation of wooden objects and host plants for planting imported from countries from where the pest originates are important measures. ISPM 15 regulates wood packaging material. Pheromone-based detection methods have been successful in 2020.	None
Conclusion (Section 4)	*X. chinensis* satisfies all the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.	
Aspects of assessment to focus on/scenarios to address in future if appropriate:		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference
WPM	Wood packaging material

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2018)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2018)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2018)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2018)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2018)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units

Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2018)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2018)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2018)
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2018)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2018)

Appendix A – *Xylotrechus chinensis* host plants

Source: EPPO Global Database (EPPO, online)

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Morus* sp.	Moraceae	Mulberry	
	Morus alba	Moraceae	White mulberry	
	Morus bombycis	Moraceae	Japanese mulberry	
	Morus nigra	Moraceae	Common mulberry	
	Morus australis	Moraceae	Korean mulberry	Sarto i Monteys and Torras i Tutusaus (2018)[(A)]
	Malus domestica	Rosaceae	Apple	
	Pyrus sp.	Rosaceae	Pear	
	Vitis vinifera[(B)]	Vitaceae	Grapevine	

(A): Added to those already recorded in EPPO GD (EPPO, online).
(B): By Sarto i Monteys and Torras i Tutusaus (2018) could not prove the host status of grapevine.

Appendix B – Distribution of *Xylotrechus chinensis* outside the EU

Source: EPPO Global Database (EPPO, online).

Region	Country	Subnational (e.g. State)	Status
Asia	China	Anhui	Present, no details
		Beijing	Present, no details
		Fujian	Present, no details
		Gansu	Present, no details
		Guangdong	Present, no details
		Guangxi	Present, no details
		Hebei	Present, no details
		Henan	Present, no details
		Hubei	Present, no details
		Jiangsu	Present, no details
		Jiangxi	Present, no details
		Liaoning	Present, no details
		Shaanxi	Present, no details
		Shandong	Present, no details
		Shanghai	Present, no details
		Shanxi	Present, no details
		Sichuan	Present, no details
		Xianggang (Hong Kong)	Present, no details
		Xizhang	Present, no details
		Yunnan	Present, no details
		Zhejiang	Present, no details
	Japan	Hokkaido	Present, no details
		Honshu	Present, no details
		Kyushu	Present, no details
		Ryukyu Archipelago	Present, no details
		Shikoku	Present, no details
	Korea Dem. People's Republic		Present, no details
	Korea, Republic		Present, no details
	Taiwan		Present, no details

Appendix C – Apple (*Malus domestica*) cultivation in EU MS (1,000 ha; 2016–2020)

Source: Eurostat, accessed on 28/6/2021

GEO/Time	2016	2017	2018	2019	2020
Austria	6.67	6.67	6.74	6.59	6.43
Belgium	6.49	6.16	5.99	5.79	5.48
Bulgaria	4.11	3.97	3.98	4.14	3.56
Croatia	5.89	4.84	4.73	4.95	4.37
Cyprus	0.53	0.37	0.37	0.37	0.38
Czechia	7.49	7.35	7.25	7.32	7.19
Denmark	1.35	1.28	1.42	1.39	1.38
Estonia	0.51	0.48	0.60	0.57	0.62
Finland	0.62	0.63	0.63	0.65	0.67
France	49.65	50.31	50.54	50.37	50.15
Germany	31.74	33.98	33.98	33.98	33.98
Greece	10.04	9.60	10.35	9.82	9.82
Hungary	32.49	32.17	31.84	30.97	25.90
Ireland	0.70	0.70	0.71	0.71	0.71
Italy	56.16	57.26	57.44	55.00	36.14
Latvia	2.40	3.30	3.20	3.44	3.50
Lithuania	9.70	9.82	10.13	10.18	10.74
Luxembourg	0.26	0.27	0.27	0.27	0.27
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	7.30	7.00	6.60	6.42	6.20
Poland	164.76	162.53	166.15	155.62	163.25
Portugal	14.98	14.79	14.58	14.58	14.58
Romania	55.53	55.60	53.94	52.74	53.40
Slovakia	2.31	2.18	2.14	2.06	1.80
Slovenia	2.42	2.36	2.33	2.27	2.18
Spain	30.87	30.55	29.93	29.64	29.49
Sweden	1.54	1.40	1.41	1.52	1.49

Appendix D – Pear (Pyrus spp.) cultivation in EU MS (1,000 ha; 2016–2020)

Source: Eurostat, accessed on 28/6/2021

GEO/Time	2016	2017	2018	2019	2020
Austria	0.46	0.46	0.49	0.50	0.54
Belgium	9.69	10.02	10.15	10.37	10.66
Bulgaria	0.41	0.45	0.57	0.70	0.50
Croatia	0.93	0.71	0.80	0.86	0.72
Cyprus	0.07	0.07	0.06	0.06	0.06
Czechia	0.74	0.71	0.75	0.80	0.83
Denmark	0.30	0.30	0.29	0.30	0.30
Estonia	0.00	0.00	0.00	0.00	0.00
Finland	0.04	0.04	0.05	0.04	0.05
France	5.30	5.25	5.24	5.25	5.61
Germany	1.93	2.14	2.14	2.14	2.14
Greece	4.08	4.07	4.41	4.34	4.34
Hungary	2.87	2.90	2.84	2.81	2.60
Ireland	0.00	0.00	0.00	0.00	0.00
Italy	32.29	31.73	31.34	28.71	25.75
Latvia	0.20	0.20	0.20	0.20	0.20
Lithuania	0.80	0.82	0.82	0.82	0.85
Luxembourg	0.02	0.02	0.02	0.02	0.02
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	9.40	9.70	10.00	10.09	10.00
Poland	7.49	7.26	7.30	7.22	7.39
Portugal	12.62	12.56	12.50	12.50	12.50
Romania	3.15	3.12	3.10	3.08	3.10
Slovakia	0.11	0.11	0.12	0.11	0.10
Slovenia	0.20	0.20	0.21	0.21	0.23
Spain	22.55	21.89	21.33	20.62	20.22
Sweden	0.12	0.12	0.11	0.10	0.13

Appendix E – Grapevine (*Vitis vinifera*) cultivation in EU MS (1,000 ha; 2016–2020)

GEO/Time	2016	2017	2018	2019	2020
Austria	46.49	48.05	48.65	48.72	48.06
Belgium	0.24	0.24	0.30	0.38	0.49
Bulgaria	36.55	34.11	34.11	30.05	28.81
Croatia	23.40	21.90	20.51	19.82	20.63
Cyprus	6.07	5.93	6.67	6.67	6.79
Czechia	15.80	15.81	15.94	16.08	16.14
Denmark	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
France	751.69	750.46	750.62	755.47	758.86
Germany	:	:	:	:	:
Greece	98.09	101.75	100.34	101.85	101.85
Hungary	68.12	67.08	66.06	64.92	62.90
Ireland	0.00	0.00	0.00	0.00	0.00
Italy	673.76	670.09	675.82	697.91	703.90
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	1.26	1.26	1.25	1.24	1.24
Malta	0.68	0.68	0.42	0.42	0.42
Netherlands	0.14	0.16	0.17	0.16	0.17
Poland	0.62	0.67	0.73	0.74	0.76
Portugal	179.05	178.84	178.78	178.78	178.78
Romania	174.17	175.32	172.80	176.34	176.76
Slovakia	8.71	8.47	8.01	7.92	7.73
Slovenia	15.84	15.86	15.65	15.57	15.29
Spain	935.11	937.76	939.92	936.89	931.96
Sweden	0.05	0.04	0.05	0.05	0.06
European Union – 27 countries (from 2020)	3,136.04	3,134.93	3,137.17	3,160.68	3,162.48