EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

Pest Risk Analysis for *Xylotrechus pyrrhoderus* (Coleoptera: Cerambycidae), grape borer

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The risk assessment follows EPPO standard PM 5/5(1) *Decision-Support Scheme for an Express Pest Risk Analysis* (available at https://www.eppo.int/RESOURCES/eppo_standards/pm5_pra), as recommended by the Panel on Phytosanitary Measures. Pest risk management (detailed in **Erreur ! Source du renvoi introuvable.**) was conducted according to the EPPO Decision-support scheme for quarantine pests PM 5/3(5). The risk assessment uses the terminology defined in ISPM 5 *Glossary of Phytosanitary Terms* (available at https://www.ippc.int/index.php).

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Based on this PRA, *Xylotrechus pyrrhoderus* was added to the EPPO A1 List of pests recommended for regulation as quarantine pests in 2025. Measures for plants for planting (except seeds, pollen, tissue culture) of *Ampelopsis glandulosa* and *Vitis* are recommended.

Pest Risk Analysis for *Xylotrechus pyrrhoderus* (Coleoptera: Cerambycidae), grape borer

PRA area: EPPO region in December 2024
Prepared by: Expert Working Group (EWG) on *Xylotrechus pyrrhoderus*
Date: 2-5 December 2024. Further reviewed and amended by EPPO core members and Panel on Phytosanitary Measures (2025-04).

Composition of the Expert Working Group (EWG)

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Maps in the climatic suitability section were prepared by J. Tuomola (Ruokavirasto, Finland).

Comments were provided before the meeting by Á. Rodríguez González (Universidad de León, Spain) and after the meeting by S.H. Lee (Imperial College & Natural History Museum London, UK).

All personal communications in this PRA were obtained from July 2024 to December 2024 from: M. Danilevsky (Russia), C. Gent (EWG member – DEFRA, UK), R. Haack (USA), D. Kasatkin (EWG member – VNIIKR, Russia), S.H. Lee (Imperial College & Natural History Museum London, UK), G. Lukácsy (EWG member – Hungarian University of Agronomy and Life Sciences, Hungary), R. Potting (EWG member – NVWA, The Netherlands), A. Roques (INRAE, France), R. Mouttet (EWG member – ANSES, France), J. Tuomola (EWG member – Ruokavirasto, Finland).

The first draft of the PRA was prepared by the EPPO Secretariat.

Ratings of likelihoods and levels of uncertainties were made during the meeting. These ratings are based on evidence provided in the PRA and on discussions in the group. Each EWG member provided a rating and a level of uncertainty anonymously and proposals were then discussed together in order to reach a final decision. Such a procedure is known as the Delphi technique (Schrader et al., 2010).

Following the EWG, the PRA was further reviewed by the following core members: N. Avendaño Garcia, N. Björklund, J. Boberg, G. Fried, E. Gachet, J.M. Guitian Castrillon, M.D.M. Fernandez Gallego, A. Korycinska, A. MacLeod, C. McGee, G. Schrader, N. Üstün, D.J. van der Gaag; as well as by the EPPO Secretariat (J. Martinez, D. Musolin, R. Tanner, O. Tikka).

The PRA, in particular the section on risk management, was reviewed and amended by the EPPO Panel on Phytosanitary Measures on 2025-04. EPPO Working Party on Phytosanitary Regulation and Council agreed that *Xylotrechus pyrrhoderus* should be added to the A1 List of pests recommended for regulation as quarantine pests in 2025.

Summary of the Pest Risk Analysis for *Xylotrechus pyrrhoderus*			
PRA area: EPPO region at December 2024 (Albania, Algeria, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Guernsey, Hungary, Ireland, Israel, Italy, Jersey, Jordan, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tunisia, Türkiye, Ukraine, United Kingdom, Uzbekistan).			
Describe the endangered area: The endangered area corresponds to the potential area of establishment (Fig. 7b in section 9.2.2) where hosts are present (commercial vineyards and hosts in other environments). The endangered area covers parts of most EPPO countries. There is an uncertainty on whether the pest would have an economic impact where climatic conditions are not optimal and on hosts in the natural environment.			
Main conclusions: *Xylotrechus pyrrhoderus* is a pest native to East Asia with confirmed hosts in the family Vitaceae. Because several species and hybrids of *Vitis* are confirmed hosts, including species not native in East Asia, the expert working group (EWG) considered that all *Vitis* spp. are potential hosts. In addition, *Ampelopsis glandulosa* var. *brevipedunculata* (Vitaceae) is a confirmed host. Plants for planting of *Vitis* spp. (for countries that do not prohibit the import of *Vitis*) and *Ampelopsis glandulosa* var. *brevipedunculata*, including propagation material and ornamentals, was identified as the most likely pathway, and overall, the likelihood of entry was rated as low with a moderate uncertainty. The trade of host plants for planting from countries where the pest occurs is expected to be low and this was taken into account in the rating. Hosts of *X. pyrrhoderus* are widespread in the EPPO region, including *V. vinifera* and other *Vitis* spp. They are present in commercial cultivation, gardens, as ornamentals cultivated as climbing plants on buildings and in nature. *Xylotrechus pyrrhoderus* is present under a wide range of temperatures in its native range, and it has a facultative larval diapause and is consequently expected to have some adaptability to environmental conditions. The likelihood of establishment outdoors was rated as very high with a moderate uncertainty. The pest may establish across a significant portion of the EPPO region where temperatures are suitable, and this area also covers the areas of grapevine cultivation. There is uncertainty regarding the northern limit and for the driest areas in the EPPO region. With climate change, the potential area of establishment was assessed to extend northwards. The likelihood of establishment in protected conditions for table grape production was also rated as very high with a moderate uncertainty. The magnitude of spread was rated as moderate with a high uncertainty. There is no information on the dispersal capacity of the pest, and human-assisted pathways may play a role in the spread. Based on knowledge available for the related species *X. chinensis*, the potential spread of *X. pyrrhoderus* by the combination of natural spread and human-assisted pathways is estimated to be up to 10 km per year. The magnitude of impact in the current area of distribution was rated as moderate with moderate uncertainty, also taking into account management costs. Although information is limited (including the absence of recent scientific publications), there are recent reports from the Republic of Korea and Japan indicating that pest management measures are recommended and applied against this insect. In Japan and Republic of Korea, table grapes are a valuable product, and this is possibly why the pest is subject to management. Potential impact was expected to be higher in the EPPO region than in the current area of distribution but was still rated as moderate, with a high uncertainty. After its initial introduction, impact may be high because control methods may not be immediately available. However, the commercial viticulture sector is expected to react fast to a new threat and pest management strategies would be adjusted. Damage is likely to be more important on newly planted and young vineyards, rather than on vineyards in full production. However, control methods would need to be implemented on all vineyards to prevent damage and the build-up of populations. Even after control methods become available against *X. pyrrhoderus*, the pest would have a permanent added cost to production. The presence of galleries may allow attacks by wood pathogens and cause decline. Pruning methods should be adapted to take account of the pest and pruning waste should be systematically destroyed in a manner that prevents the survival of the pest. There would be additional costs of monitoring, treatment and training of labour.			
Phytosanitary risk for the *endangered area*	High ☐	Moderate X	Low ☐

No key uncertainty was identified that could affect this conclusion. The EWG noted that the risk is limited by the low likelihood of entry; however, the suitability of environmental conditions in the EPPO region, potential impact, and the fact that the pest has entered the USA led to an overall moderate rating.			
Level of uncertainty of assessment	High ☐	Moderate X	Low ☐
Other recommendations: Recommendations for further work are provided in section 18.			

CONTENTS

Pest Risk Analysis for *Xylotrechus pyrrhoderus* (Coleoptera: Cerambycidae), grape borer

Stage 1. Initiation

Reason for performing the PRA:
Xylotrechus pyrrhoderus (Coleoptera: Cerambycidae) originates from Asia and is a wood borer of grapevine (*Vitis vinifera*) and other plants of the Vitaceae family. In its native range, *X. pyrrhoderus* is a pest on grapevine. In 2020, it was detected for the first time in North America, in Massachusetts (USA) on wild grape (USDA, 2023). Considering the economic importance of grapevine in the EPPO region, and the fact that this insect has recently been introduced into another continent, it was added to the EPPO Alert List (EPPO, 2024a). In March 2024, the Panel on Phytosanitary Measures (PPM) selected *X. pyrrhoderus* as a possible priority for PRA, and in June 2024 the Working Party for Phytosanitary Regulations selected it for PRA.

The risk assessment follows EPPO Standard PM 5/5 *Decision-Support Scheme for an Express Pest Risk Analysis* (available at http://archives.eppo.int/EPPOStandards/pra.htm), as recommended by the EPPO Panel on Phytosanitary Measures in 2016. Pest risk management (detailed in ANNEX 1) was conducted according to the EPPO Decision-support scheme for quarantine pests PM 5/3(5). The risk assessment uses the terminology defined in ISPM 5 Glossary of Phytosanitary Terms (version as of 29 July 2024; available at https://www.ippc.int).

PRA area: EPPO region in December 2024 (map at https://www.eppo.int/ABOUT_EPPO/eppo_members)

It has not been possible to obtain photos to be included in the PRA. Photos of *X. pyrrhoderus* and damage can be found in publications cited in this PRA, such as Tsuchiya (1988), USDA (2023), Wang (2017), and many websites including CISEH (2024), Noukan (2024) and Shimane Prefecture (2024).

Stage 2. Pest risk assessment

1 Taxonomy

Taxonomic classification: Kingdom: Animalia / Phylum: Arthropoda / Subphylum: Hexapoda / Class: Insecta / Order: Coleoptera / Family: Cerambycidae / Subfamily: Cerambycinae / Genus: *Xylotrechus* / Species: *Xylotrechus pyrrhoderus* Bates, 1873.

Other scientific names:
- *Xylotrechus pyrrhoderus pyrrhoderus* Bates, 1873. This name is the preferred name in Lin et al. (2021), and not in other publications.
- *Xylotrechus pyrrhoderus* f. *hattorii* Ohbayashi, 1958 (Tavakilian & Chevillotte, 2023; GBIF, 2024).
- *Xylotrechus rufilius* Yokohama, 1931 (Han & Lyu, 2010). Note that where *X. rufilius* is mentioned later in this PRA, it relates to the distinct species *X. rufilius* Bates, 1884 (EPPO Code: XYLORF).

Xylotrechus pyrrhoderus includes two subspecies: *X. pyrrhoderus pyrrhoderus* and *X. pyrrhoderus nigrosternus* (Tavakilian & Chevillotte, 2023) based on colour variation of the prosternum and mesosternum (Gressit, 1951; Niisato & Adachi, 2005). In a few cases, publications specify the subspecies (*pyrrhoderus* or *nigrosternus*), but in most cases they do not. This PRA consequently applies to *X. pyrrhoderus* as a whole.

Common names: (from EPPO Global Database – EPPO, 2024b)

English	grape borer, grape tiger longicorn, grape borer beetle
French	perceur de la vigne
Japanese	budo-tora-kamiki
Korean	podo-horang-haneulso

EPPO code: XYLOPY

The genus *Xylotrechus* includes at least 200 species worldwide (Tavakilian & Chevillotte, 2023). There are 108 Palearctic *Xylotrechus* species including 9 species present in Europe (Sarto i Monteys & Torras i Tutusaus, 2018; Danilevsky, 2020). *Xylotrechus arvicola* (Olivier, 1800) has become a pest of vineyards in several wine-producing regions of Spain (Sarto i Monteys & Torras i Tutusaus, 2018; Rodríguez-González et al., 2018b; Á. Rodríguez-González, pers. comm.) and is mentioned in several places in this PRA.

2 Pest overview

The pest overview is based on publications from Japan and the Republic of Korea [from here onwards Korea Rep.], and all information relates to grapevine. Where this PRA refers to 'grapevine', it refers to *Vitis vinifera* and its hybrids. Scientific names are used for other *Vitis* species.

This PRA uses a terminology of grapevine as illustrated in Fig. 1. On grapevine, plant parts with different age have different terms. The cited literature may have used other terms (in particular 'branches', 'twigs'), which were translated to the terms used in this PRA based on the material age indicated in the publications. In particular when the publications referred to 1-year-old 'branches', they were considered shoots (< 1 year) or canes (1–2 years) in this PRA.

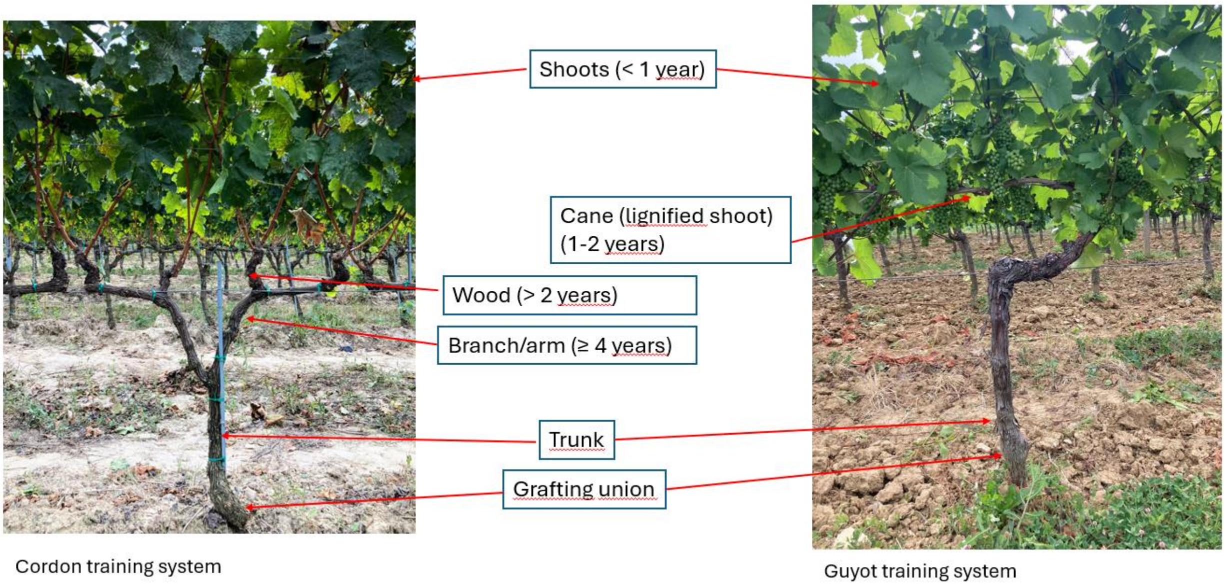

Fig 1. Terminology of grapevine (pers. comm. and photos, G. Lukácsy).

2.1 Morphology

Morphological characters of *X. pyrrhoderus* are summarized in Table 1.

Table 1. Morphological characters of *X. pyrrhoderus*

Stage	Description	Size
Eggs	Milky white (Yamada, 1974; Miyazaki et al., 1977) oblong (Tsuchiya, 1988).	≈ 1 mm (Yamada, 1974; Miyazaki et al., 1977; Kim et al., 1988)
Larvae	Larvae pale yellow, typical for Cerambycidae body shape with the wide prothorax and tapering toward the end of the abdomen, legs present, head is brown (Tsuchiya, 1988).	≈ 1 mm at hatching to mature larvae 17–21 mm (Tsuchiya, 1988)
Pupae	Light yellowish brown, with spherical large pronotum (Tsuchiya, 1988).	8–20 mm (Tsuchiya, 1988; Kim et al., 1988)
Adults	Head black. Pronotum red, as long as wide, with dense and coarse punctures. Scutellum red with distal yellowish pubescence. Elytra black with thick yellowish bands on basal and sub-apical areas; basal yellowish band connected by sharp angle with sub-basal band along elytral suture; sub-apical area with transverse whitish pubescence band. Elytra about 2.1x as long as wide; apice of elytra truncated with outward spine-like projection (Han & Lyu, 2010).	6–15 mm long (Han & Lyu, 2010; Tsuchiya, 1988; Kim et al., 1988). i.e. a relatively small longhorn beetle

Stage	Description	Size
	The subspecies *nigrosternus* has a black prosternum and mesosternum (Gressit, 1951; Niisato & Adachi, 2005).	

2.2 Life cycle

Xylotrechus pyrrhoderus is univoltine (Ashihara, 1982a & b; Yamada, 1974; KRRDA, 2024; Clausen, 1931 citing Matsumoto & Watanabe, 1920; Kim et al., 1988). Pre-imaginal (pre-adult) development extends from the summer / beginning of autumn of the first year to the same period in the following year, at least throughout its distribution in Japan and the Korea Rep. (e.g. Ashihara, 1982a & b; Miyazaki et al., 1977; KRRDA, 2024; Kim et al., 1988).

The phenology/presence of life stages in a typical population are summarized in Fig. 2. Data on the durations of life stages are provided in ANNEX 2.

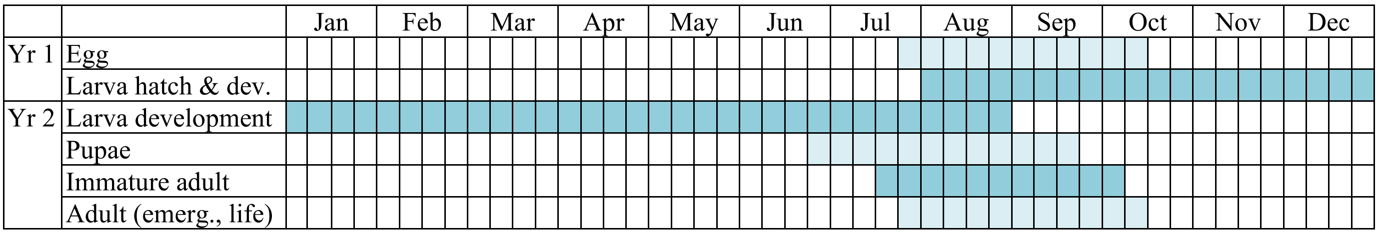

Fig. 2. Outline of the typical life cycle of a population, based on months and duration of life stages in the available literature (data and references in ANNEX 2 and text below), taking into account that development is shorter in summer than in autumn.

Eggs

- Eggs are laid in gaps between the scales of the buds, near the buds, in bark crevices, at the base of the petioles, or between the bud and petioles (Ashihara, 1982a; Miyazaki et al., 1977; Yamada, 1974; KRRDA, 2024; Clausen, 1931 citing Matsumoto & Watanabe, 1920; Hirai & Tsukio, 2022).
- The literature generally mentions that eggs are typically laid on (and larvae develop inn) 1-year-old shoots/canes (Ashihara, 1982a) or young shoots that are 8–10 mm in diameter (Wang, 2017). The expert working group (EWG) understands this to mean that eggs are laid on or around buds on the shoots/canes in summer/start of autumn. Some publications (Tsuchiya, 1988, Miyazaki et al., 1977; Yamada, 1974) mention that larvae can be found in and damage 2- to 3-year-old wood, 4-year-old branches, and trunks. It is not specified if eggs are laid on such wood, but from the biology of the pest, the EWG believes that larvae probably reach these areas from the infested 1-year-old shoots/canes. For this to occur, the distance from the point of entry on the shoot/cane to the older woody part would need to be relatively short (see information on larval gallery length below).
- Noukan (2024) and USDA (2023) report that eggs are laid one at a time, and Kim et al. (1988) reports that females lay 1–3 eggs at a single oviposition point. In Japan, the number of eggs reported in various prefectures varied from 15 eggs in Iwate, 30 in Osaka, to 56–310 in Yamanashi (Yamada, 1974). In experiments with male and female pairs brought indoors and kept at room temperature (temperature not specified), females produced 156 eggs on average, but the variation was huge (ranging 8–430 eggs) (Miyazaki et al., 1977). In Korea Rep., the number of eggs per female is reported to be 15–50 eggs (Kim et al., 1998).
- Eggs are reported to hatch within 5–16 days depending on the temperature and time of the year (see ANNEX 2).

Larvae

- At hatching, larvae start feeding on the buds (Yamada, 1974), then on the cambium under the bark around the buds (Miyazaki et al., 1977, Yamada, 1974; Ashihara, 1982a), and later on the xylem (Yamada, 1974; Ashihara, 1982b). Larvae do not feed in a specific direction (Tsuchiya, 1988).
- Larvae mainly develop in shoots and canes but may reach 2- to 4-year-old wood. This information is derived from observations of damage (see section 2.5).
- There is one mention in the literature of larvae being in roots as well as 'branches' (Australian Department of Agriculture, 2013 & 2014 citing Zhang 2005). However, this is not supported by the other literature. In addition, larval galleries are short and unlikely to reach roots. Therefore, for the purpose of the present PRA, it was assumed that larvae do not occur in roots.

- The gallery of early larval instars measured about 8 mm in length in early October, and 32 mm in early December (Yamada, 1974 – not specified if observations or experiments). In measurements by Shimane Agricultural Experiment Station, larval galleries measured 36 mm at the end of November, about 70 mm by the start of April, and 156 mm in May (Miyazaki et al., 1977). In Yamanashi Prefecture, the galleries of mature larvae in August measured 260–340 mm (Tsuchiya, 1988).
- Overwintering larvae are small (2–5 mm – Noukan, 2024; 3 mm – KRRDA, 2024; 4 mm – Wang, 2017).
- Larvae develop over several months. Development can include a facultative diapause induced by environmental factors (see section 2.3). After diapause, larvae may continue feeding during the winter if daytime temperatures are sufficient but otherwise resume development in spring before grapevine buds burst (Miyazaki et al., 1977).
  - In Fukuoka Prefecture (in the north of Kyushu), development continued slowly throughout winter, while in Yamanashi Prefecture and eastern Japan there was no development during winter (Yamada, 1974).
  - In Hiroshima Prefecture (experiments with temperatures close to those in the field), few individuals continued development during January–February (Ashihara, 1982b).
  - In the Korea Rep. or in Shimane Prefecture, overwintering larvae become more active from early April (KRRDA, 2024; Shimane Prefecture, 2024), and in March in Fukuoka Prefecture (north of Kyushu) (Yamada, 1974).
- In greenhouse cultivation, larvae resume development when heating is applied, and consequently symptoms/impact can be observed earlier than in the field (Shimane Prefecture, 2024).
- In experiments on larval development intraspecific variation was observed, with the number of larval instars required for pupation ranging from 6 to 8, and the overwintering instar varying depending on the timing of egg-laying (Ashihara, 1982b).
- Clausen (1931, citing Matsumoto & Watanabe, 1920) mention that larvae continue feeding on 'dead' tissue in the wilted shoots. However, this is not supported by the other literature. The EWG assumed that mature larvae may be able to continue feeding and complete development on drying canes after cutting (because grapevine canes may retain some moisture for several months), but not on completely dry material.
- In Shimane Prefecture, mature larvae pupate around mid-July (Shimane Prefecture, 2024).

Pupae

- The pupal stage is reported to generally last 10–14 days in the field and in experiments at 25 °C, but reached 18–22 days in experiments at 20 °C and up to 42 days at 15 °C (see ANNEX 2).
- Pupae are formed in a pupal cell in the larval galleries (Ashihara, 1982b).

Adults

- Immature adults remain in the pupal cell for 10–15 days (see ANNEX 2) during which maturation occurs, and unfertilised eggs mature in the ovaries (Iwabuchi 1982). After exiting the plant, adults are reported to live for about 7–25 days (see ANNEX 2).
- After exiting the plant, adults are active during the day (Ashihara, 1982b; Iwabuchi, 1982). They do not feed, unlike most Cerambycidae which require food for egg maturation and oviposition (Iwabuchi, 1988, Tsuchiya, 1988). *Xylotrechus pyrrhoderus* is capable of flight, responding to pheromones, mating and egg-laying at the time of emergence without any additional feeding (Iwabuchi, 1982). Some sources mention that adults feed on host leaves and buds (USDA, 2023), young shoots, buds and leaves (Wang, 2017 citing Guo, 1999). However, this is not confirmed by studies conducted in Japan on the biology of the pest, including those in which all experiments are successfully conducted without feeding adults, and where adults were only observed absorbing moisture (Tsuchiya, 1988). Consequently, in this PRA, it was assumed that adults do not need to feed after they exit the pupal cells.
- In Japan, adults are reported to generally emerge from the end of July to mid-October depending on the region and altitude. Emergence of adults starts earlier in colder areas and at higher altitudes than in warmer areas (Ashihara, 1982b citing Tsuchinatsu, 1967; Yamada, 1974; Miyazaki et al., 1977). In some southern areas of Japan, some emergence is reported in January-February (Miyazaki et al. (1977) for Hamada, plain by the Sea of Japan, Shimane Prefecture; Yamada (1974) probably referring to Fukuoka, northern Kyushu). However, this is not the normal pattern.
- In greenhouses, the peak emergence of adults occurs earlier than in the field: in late July if heating is applied from December; mid-August if heating is applied from February; and late August if no heating

is applied (Shimane Prefecture, 2024 – while outdoors, emergence of adults in Shimane is about early to mid-September in plain, and one month earlier in highland areas).

- Studies on the mating behaviour of *X. pyrrhoderus* have shown that the male releases a sex pheromone to attract females (Iwabuchi et al., 1986). More details about the male sex pheromone are provided in section 2.7.
- In experiments and in the field, females were shown to mate and oviposit soon after emergence (Ashihara, 1982a & b; Miyazaki et al., 1977, Yamada, 1974). In experiments in artificial chambers, most females started laying eggs within one day of emergence, and at a maximum of 3 days of emergence (Ashihara, 1982b). In an experiment where males and females were paired in Petri dishes, the average egg-laying period of a female was 26 days (Miyazaki et al., 1977). This was the longest duration of the adult stage reported in the literature (the shortest being a week; see ANNEX 2).

2.3 Environmental requirements

Throughout the distribution area of *X. pyrrhoderus*, the life cycle is reported to be completed in one year. This is also the case in Aomori Prefecture, northern Honshu (the northern edge of the pest's distribution in Japan; Ashihara, 1982b). No information was found on the duration of the life cycle from other cold places in the distribution of *X. pyrrhoderus* (e.g. northern China). There is no evidence that the pest could develop a generation in more than about one year (i.e. no evidence that the pest could overwinter twice).

Effect of temperature and photoperiod

- The development of eggs was shown in experiments to be affected by temperature (Miyazaki et al., 1977). Similarly, in the field, eggs are reported to develop more rapidly in summer than in autumn (6–7 days in contrast to 10–16 days) (Shimane Prefecture, 2024).
- The development of larvae is affected by temperature, and the onset of diapause and pupation are also affected by photoperiod (Ashihara, 1982a).
  Ashihara (1982a) considers that the facultative larval diapause is induced by decreased temperatures and short days in the autumn. The EWG noted that the data presented in this publication cannot be used to deduce at which temperature diapause is induced.
  The EWG also noted that data from Japan seem to show that in some areas, there is a very distinct peak in the flight period of adults, whereas in other parts emergence is spread over a longer period (Fig. 1 in Yamada, 1974), which indicates adaptability to the local climatic conditions.
- The development period from pupation to adult emergence is thought to be determined almost exclusively by temperature (Ashihara, 1982a). The pupal period lasted from about 10 days at 30°C to 42 days at 15°C, and the immature adult stage lasted between 9 and 24 days at the same constant temperatures respectively (Ashihara, 1982a).
- There are no data on the number of degree-days needed to complete the whole life cycle. Estimates for the egg and pupal stage (Ashihara, 1982b) are provided in Table 2.

Minimum, optimal and maximum temperatures for development

Information on minimum development temperatures for several life stages in the available literature is provided in Table 2.

Table 2. Estimates of the minimum development temperatures and degree-days needed to complete different life stages

Life stage	Lower developmental threshold (°C) (*L*)	Comments	Degree-days to complete the life stage (effective temperature above the threshold temperature *T*)	Reference
Egg hatching	8.2	Estimated in experiments.	–	Miyazaki et al. (1977)
Egg	9.7	Estimated in experiments.	114.1	Ashihara (1982b)
Larvae	7–12	Estimated in experiments. Larvae developed rapidly at 15°C or higher, slowly at 12°C and not at all at 7°C.	–	Yamada (1974)
Pupa	10.5	Estimated in experiments.	187.5	Ashihara (1982b)

The optimal temperature for larval development is not known from the publications available. In experiments in Ashihara (1982a), a delay in pupation was evident at a constant temperature of 20°C, in comparison to 25°C. No data are available for field conditions.

Based on experiments by Ashihara (1982a) (constant temperature, long-day conditions 16L:8D), the maximum temperature for development was between 30°C and 35°C. 30°C was still favourable for the development of all life stages, while at 35°C, few eggs hatched, pre-pupae did not pupate, and pupae transferred to 35°C did not lead to viable adults. Experiments were conducted at a constant temperature, so there is no indication whether the life stages are able to withstand limited periods at such temperatures.

Xylotrechus pyrrhoderus is present in a wide range of different temperature conditions based on the mean monthly temperatures in the known occurrence locations of the pest. For example the mean temperature of the coldest month ranges from –9 to +9°C (with one outlier at –18°C) and of the warmest month from 18°C to 28°C. Data on average monthly temperatures for the years 1970-2000 in 30-second resolution was retrieved from Fick et al. (2017) and cross-referenced with the known occurrence locations of the pest, but the data is not further presented in this PRA. There is an uncertainty associated with these figures as some of the locations were estimated from the literature (see details in section 9.2.1).

Humidity and relative humidity
There is no information on the humidity requirements for *X. pyrrhoderus*. There are high levels of rainfall in the pest's current distribution in Japan.

2.4 Dispersal capacity

Adults can fly, respond to pheromones, and can have a lifespan of about 2–3 weeks (see ANNEX 2). No information on dispersal distances was found in the literature for *X. pyrrhoderus*. Note: information about the dispersal capacity of other species is considered in section 11 (Spread).

2.5 Nature of the damage, plant parts attacked and location of life stages on the plants

Nature of the damage
Damage is due to larval feeding (adults are assumed to not feed, see section 2.2). Before overwintering, larvae are small and damage is minimal. After overwintering, larvae resume feeding in the cambium and later start feeding on the xylem in a circular pattern, and they may girdle canes (mid-May onwards, Shimane Prefecture, 2024).
Feeding by larvae may cause the bud to fail to sprout (Miyazaki et al., 1977).
New shoots sprouting from the infested area to the tip of the cane (which can grow normally unless larvae start feeding on the xylem) may wilt and die within 2–3 days (Yamada, 1974; Hirai & Tsukio, 2022).
Most damage occurs on shoots and canes (i.e. < 2 years old), but it can also be seen on 2- to 3-year-old wood, which can weaken the vine and inhibit the growth of new shoots (Miyazaki et al., 1977).
On 2- or 3-year-old wood, larvae rarely cause dieback (Ashihara, 1982b). As larval damage progresses, sap exudes from the infested area and breakage may happen (Hirai & Tsukio, 2022; Shimane Prefecture, 2024) because of the wind or during cultivation operations (KRRDA, 2024). Breakage due to harvest weight is mentioned for *X. arvicola* in Spain (Rodríguez-González et al., 2019).
Larval feeding on 3- or 4-year-old woody parts or branches causes weakening and, even if the branch survives, the growth of new shoots will be severely stunted (Yamada et al., 1974).
Breakage of canes on young vines has a major influence on pruning and on the future shape of the plant (Shimane Prefecture, 2024).

Factors influencing damage
State of the vines. In Yamanashi prefecture, Tsuchiya (1988) found that damage mostly occurred from planting to young vines of about 4-year-old; however, the pest was also found in some older vineyards. According to Wang (2017), some sources mention that older and poorly managed vines suffer more severe damage (citing Huang & Yang 2002). Damage is higher in vigorous shoots than in weak ones (citing Kim et al., 1991).

Pruning method. In long-cane pruning (leaving minimum 5 or 6 buds on every cane), about 30% of larvae remain on the cane after pruning. The remaining larvae continue to damage the canes, causing a high number of canes to break. In short-spur pruning (leaving maximum 2 or 3 buds on every cane), most larvae are removed, and only about 10% of larvae remain on the vine, resulting in less immediate damage, but long-term damage if the entire bud is damaged (Miyazaki et al, 1977; Yamada, 1974).

Variety. Damage is seen in all grape varieties (Miyazaki et al., 1977). Of 72 varieties surveyed in Yamanashi prefecture (*V. vinifera* or crossings of other *Vitis* species – see section 7), 33 were reported to be heavily damaged, 33 were moderately damaged, and 6 were lightly damaged (Tsuchiya, 1988). Tsuchiya (1988) mentions that serious damage was observed on varieties such as Delaware, Campbell Early, Concord, Niagara, Kyoho, Muscat Bailey A, Pione, Red Millenium and Steuben. Grapevine varieties that are widespread in the EPPO region, such as Merlot, Cabernet Sauvignon, etc. were reported to have high damage (Tsuchiya, 1988). It is, however, not known if higher damage was due to the variety or to other factors (e.g. pruning method).

Similarly, for *X. arvicola* in Spain on grapevine, the level of infestation was found in a few surveys to be influenced by the grapevine variety (Rodríguez-González et al., 2017a), age and pruning method (Armendariz et al., pre-print).

2.6 Signs and symptoms of infestation and detection methods

- *Signs and symptoms*

Blackened and slightly swollen areas may be detected on the bark of branches where larvae feed (Shimane Prefecture, 2024; Yamada, 1974). Insect faeces in the feeding tunnel of larvae cause the epidermis to appear black (Tsuchiya, 1988). The blackening is easier to see on wet branches after rain (Miyazaki et al., 1977). It may be observed from the overwintering period of larvae onwards (Tsuchiya, 1988).

In late spring, when larvae resume feeding actively, signs of presence of the pest are wilting/die-back of shoots and canes, and dark sap oozing from surviving vines. Later during the year, the round exit holes of adults may be observed (Yamada, 1974).

Damage may be confused with that of other wood borers. Larvae are typical Cerambycidae larvae and may be confused with other species. For example, in Far East Russia, the Korean Peninsula, Japan and some areas of China, a complex of species of the genus *Phymatodes* (Cerambycidae, Callidiini), trophically associated with *Vitis*, is widespread. These species mainly develop on *Vitis amurensis*, but some of them also damage *V. vinifera*. These are *Phymatodes murzini* Danilevsky, 1993, *P. maaki* (Kraatz, 1879), *P. jiangi* Z. Wang & L. Y. Zheng, 2003, *P. albicinctus* Bates, 1873 and *P. zemlinae* Plavilstshikov & Anufriev, 1964. According to literature data, they colonize shoots with a diameter of 3–10 mm (Cherepanov, 1988; Plavilstshikov & Anufriev, 1964; Kovalenko & Shamaev, 1993; Lim et al., 2013, 2014). In Central and Southern Europe, as well as Türkiye, Syria and Israel, *P. fasciatus* (Villers, 1789) can be found in dead canes (Plavilstshikov, 1940; Slama, 1998).
Similarly, adults may be confused with other species. Adults of *X. pyrrhoderus* have similar colours (red thorax, black elytra with yellowish bands) to adults of *X. rufilius* (photos in Han & Lyu, 2010; https://www.cerambyx.uochb.cz/xylotrechus_rufilius_rufilius.php; https://insectk.web.fc2.com/zukan/z_ka01/kubiakatora.html), which is present in East Asia but not on grapevine according to the host list in Han & Lyu (2010). Outside the *Xylotrechus* genus, adults of *X. pyrrhoderus* bear a vague resemblance with cerambycid species that have *Vitis* in their host range, such as *Clytus arietis* (Rodríguez-González et al., 2022), present in Europe, or *Neoclytus acuminatus* (Szeőke & Hegyi, 2002), endemic in North America and introduced into Europe.

- *Detection methods*

Xylotrechus pyrrhoderus can be detected by inspecting plants for signs of infestation (as described above). Larvae do not eject frass out of their gallery, and this makes detection difficult at early stages of infestation before other signs appear (Clausen, 1931 citing Matsumoto & Watanabe, 1920; KRRDA, 2024).

Trapping

- The components of the male sex pheromone have been identified and synthetised (Mori & Otsuka, 1985): (2S,3S)-2,3-octanediol and (S)-2-hydroxy-3-octanone (Sakai et al., 1984, Iwabuchi et al., 1986; Iwabuchi et al., 2014). No information was found in the literature on whether the male sex pheromone is available commercially but trapping systems have been partially investigated. Some elements that may allow developing such systems further are discussed in the literature (Sakai et al., 1984; Iwabuchi, 1982; Iwabuchi et al., 1986; Narai et al., 2015):
- No specific information was found on the response of *X. pyrrhoderus* to ethanol, commonly used for trapping beetles, but the first finding in Massachusetts was in a Lindgren trap which contained ethanol lure (CAPS, 2023). In Spain, ethanol traps were developed and are used to improve monitoring and

control of *X. arvicola* on grapevine (Rodríguez-González et al., 2017b, 2018b & 2022, Á. Rodríguez-González, pers. comm.). In the case of *X. arvicola*, the male sex pheromone was in fact not effective in field trials while ethanol was highly attractive to both sexes (Rodríguez-González et al., 2017b).

- In a recent study conducted in several continents (incl. Asia), 19 species of *Xylotrechus* (though not *X. pyrrhoderus*) were trapped using generic attractants for Cerambycidae (Roques et al., 2023).
- No mention was found in the literature on whether adults of *X. pyrrhoderus* are attracted to light.

2.7 Identification

Morphological identification of *X. pyrrhoderus* adults is possible. Han & Lyu (2010) provides characters to distinguish the genus *Xylotrechus* from other Clytini (citing Cherepanov, 1988). Gressit (1951) provides a key for Chinese cerambycids. Bates (1873) and Han & Lyu (2010) provide descriptions of adults. A key to *Xylotrechus* species of the Korean Peninsula is provided in Han & Lyu (2010) and of Beijing (China) in Lin et al. (2021).

The main characters that allow to distinguish *X. pyrrhoderus* from *X. rufilius* are as follows: scutellum red, pronotum more longitudinal, not globe-shaped, pronotal sculpture less coarse than in *X. rufilius*; pro- and mesothoracic sterna red; last hair band on elytra in *X. rufilius* continued to elytral apex along external margin.

Complete descriptions of larvae, pupae and eggs of *X. pyrrhoderus* were not found in the literature. Some morphological characters of *X. pyrrhoderus* larvae are illustrated in Chien (1989) and an outlined description is provided in Tsuchiya (1988). Several identification keys are available to identify larvae of the genus *Xylotrechus* (ANSES, 2023 citing: Villiers, 1978; Duffy, 1953; Duffy, 1968; Svacha & Danilevsky, 1987; Cherepanov, 1988). These keys could probably be used to make a preliminary diagnosis to the genus level, but this remains to be confirmed given that the larva of *X. pyrrhoderus* has not been described in detail.

In the EPPO region, other Cerambycidae have been reported on *V. vinifera*, with a few species reported as pests, such as *X. arvicola* (Sarto i Monteys & Torras i Tutusaus, 2018), *Chlorophorus damascenus* (Ataş et al., 2022), *Clytus arietis* (Rodríguez-González et al., 2022) and *Neoclytus acuminatus* (Szeőke & Hegyi, 2002).

Molecular methods. For *X. chinensis*, ANSES (2023, citing EPPO 2021) states that all life stages can be identified by barcoding (COI mitochondrial gene) and comparison of sequence with those in GenBank, Bold or EPPO Q-Bank. Theoretically, the same approach may be possible with *X. pyrrhoderus*. However, at the moment there is no reliable COI barcode reference (the only barcode sequence in GenBank as of December 2024 is not considered trustworthy enough to perform identification (R. Mouttet, pers. comm.).

3 Is the pest a vector?

Yes ☐ **No** ☒

No species of *Xylotrechus* is known as a vector of pathogen(s) or other associated organism(s) (Sarto i Monteys et Torras i Tutusaus, 2018 citing Jackson et al., 2010). The possible association with pathogenic fungi is discussed in section 13 (Potential impact in the PRA area).

4 Is a vector needed for pest entry or spread?

Yes ☐ **No** ☒

5 Regulatory status of the pest

Xylotrechus pyrrhoderus is not regulated in the EPPO region to date (2024-07).

Information about the regulatory status of *X. pyrrhoderus* elsewhere in the world was sought (at 2024-12) from lists of regulated pests on the International Phytosanitary Portal (https://www.ippc.int/fr/countries/all/regulatedpests/) and from a general Internet search. *Xylotrechus* *pyrrhoderus* is regulated at least in New Zealand (Biosecurity New Zealand, 2024) and in the USA[1] (USDA, 2024a). The information consulted is not exhaustive and *X. pyrrhoderus* may thus be regulated in more countries.

6 Distribution

Xylotrechus pyrrhoderus is native to East Asia. It is present in mainland China, Korea Rep., the Democratic People's Republic of Korea [from here onwards Korea Dem. Rep.] and Japan.

Xylotrechus pyrrhoderus was found in the USA in 2020 in Hampden County, Massachusetts (Aitkenhead, 2021; CAPS, 2023) in a cemetery during a survey of forest pests of hardwood (CAPS, 2023). A survey report from 2022 mentions the capture of two specimens (CAPS, 2023). The pest is considered present in Massachusetts as there have been multiple detections of adults in the same area during trapping surveys conducted in 2021–2023 (CAPS, 2023; PDA, 2023). Surveys in Pennsylvania in 2023 did not detect the pest (PDA, 2023).

The distribution of *X. pyrrhoderus* is illustrated in Fig. 3 and detailed in Table 3.

The northernmost limit of the distribution of *X. pyrrhoderus* in Japan is the Aomori Prefecture (northernmost prefecture of Honshu) (e.g. Ashihara, 1982b), and in China, the province of Jilin (Lin et al., 2021).

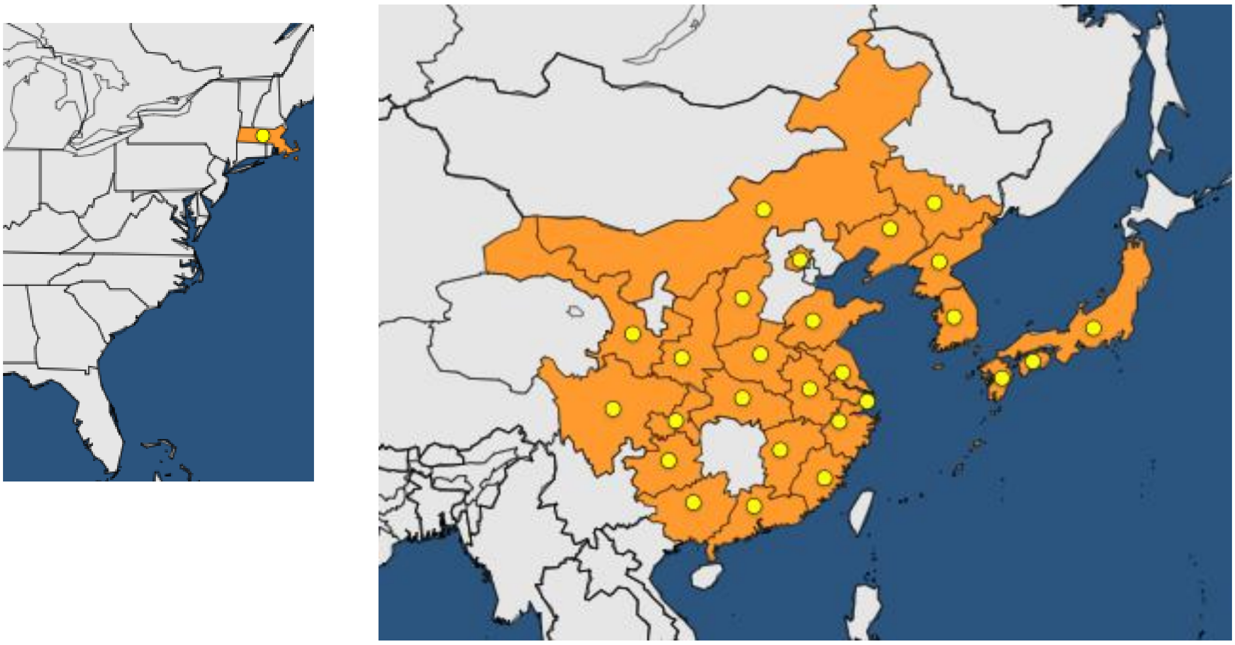

Fig. 3. Distribution of *Xylotrechus pyrrhoderus* from EPPO Global Database (EPPO, 2024b)

Table 3. Distribution of *Xylotrechus pyrrhoderus*
Records are from EPPO Global Database (EPPO, 2024b), which provides original references.

	Countries and states with reports of *Xylotrechus pyrrhoderus*
North America	USA: Massachusetts
Asia	China: Anhui, Beijing, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Liaoning, Neimenggu, Shaanxi, Shandong, Shanghai, Shanxi, Sichuan, Zhejiang.
	Japan: Honshu, Kyushu (incl. Tsushima Isl.), Shikoku
	Korea, Democratic People's Republic
	Korea, Republic

Hokkaido (Japan). *Xylotrechus pyrrhoderus* is mentioned in:

[1] Import of *Vitis, Ampelopsis* and *Celastrus* (*C. orbiculatus* uncertain host) plants for planting is not authorized pending pest risk analysis (except under a controlled import permit for specific material). *Parthenocissus* plants for planting are subject to an import permit and should be accompanied by a PC (USDA, 2025).

- one document of unknown source, a list of beetles in the Prefecture of Hokkaido (https://www.pref.hokkaido.lg.jp/fs/2/2/8/4/9/7/2/_/syuasyumokuroku_konchu.kouchu.pdf),
- a blog (https://blog.goo.ne.jp/necydalis_major/e/07ff160d1fe7bc7ddf2a725ab1d34343).

Due to the nature of these records, the presence on Hokkaido is considered uncertain. The literature generally mentions that the pest does not occur on Hokkaido. Tsuchiya (1988) notes that targeted surveys were conducted. No record for Hokkaido was found, nor mentioned in GBIF records (2024) or iNaturalist. Hokkaido is a major grapevine growing area in Japan.

Invalid record: Russia. Lin et al. (2021) mentions Russia (Siberia). Danilevsky (2012) notes that the record of *X. pyrrhoderus* for Russia in the catalogue of Löbl & Smetana (2010) was 'just a mistake. No records for Russia seem to be ever published before'. No other record for Russia was found in the literature when preparing this PRA.

Doubtful record: Mongolia is mentioned in Lin et al. (2021), as well as in Lin et al. (2019 – checked by M. Danilevsky, pers. comm.). Mongolia is not listed in Han & Lyu (2010), nor in the catalogue of Palearctic Cerambycoidae (Danilevsky, 2024) or systematic list of Cerambycidae of Mongolia (Danilevsky, 2023). Xu et al. (2007), who deal with longhorn beetles from the Mongolian plateau (which extends over China, Mongolia and Russia) recorded this species only in China (M. Danilevsky, pers. comm.). Consequently, it is considered here that there is some doubt about the presence of *X. pyrrhoderus* in Mongolia.

It is noted that GBIF (2024) or iNaturalist do not contain records from countries/subnational units other than those listed in the Table 3.

7 Host plants and their distribution in the PRA area

Confirmed hosts plants of *X. pyrrhoderus* reported in the literature belong to the family Vitaceae. Known hosts (including uncertain hosts) are listed in Table 4 and details on the presence of hosts in the EPPO region are provided in section 9.1.

Table 4. Hosts of *Xylotrechus pyrrhoderus*.
All plant species belong to the family Vitaceae, except where a family is indicated.

Hosts	**Presence in PRA area** (Yes/No)	**Comments**	**Reference**
Vitis vinifera	Yes, widespread for fruit production, in gardens and in nature		Many references, incl. Tsuchiya, 1988; Lin et al., 2021, Lim et al., 2014.
Vitis ficifolia	No, no evidence found	Synonym *Vitis thunbergii* Sieb. et Zucc. Found infested during field surveys on wild grape species in Yamanashi Prefecture (Japan)	Tsuchiya, 1988
Ampelopsis glandulosa var. *brevipedunculata*	Yes, as ornamental	As *Ampelopsis brevipedunculata*. Found infested in field surveys on wild grape species in Yamanashi Prefecture (Japan)	Tsuchiya, 1988
Simple interspecific crossings (between 2 varieties belonging to 2 species)			
Vitis riparia x *V. rupestris*	Yes, as rootstock and naturalized	Infestation on rootstocks 3306 and 3309	Tsuchiya, 1988*
Vitis berlandieri x *riparia*	Yes, as rootstock and naturalized	Infestation on rootstocks T8B and T5BB	Tsuchiya, 1988
Vitis amurensis x *V. vinifera*	Yes, for fruit production	Infestation on Gibrid	Tsuchiya, 1988
Vitis amurensis x *V. riparia*	Yes, for fruit production in private gardens in Russia	Infestation on Buitur (spelled Bujtur in Tsuchiya, 1988)	Tsuchiya, 1988

Hosts	Presence in PRA area (Yes/No)	Comments	Reference
Species involved in complex interspecific crossings (between varieties that are themselves crossings) #			
Vitis labrusca, V. vinifera	Yes, limited for fruit production in gardens, some hybrids partially naturalized	Infestation on Campbell Early#, Kuroshio, Pierce, Takao, Kyoho. Also reports of damage on Niagara#, Pione	Tsuchiya, 1988
Vitis labrusca, V. aestivalis, V. vinifera	Yes, limited for fruit production in gardens	Infestation on Delaware	Tsuchiya, 1988
Vitis lincecumii, V. labrusca, V. vinifera	-	Infestation on Muscat Bailey A#, Rose Ciotat	Tsuchiya, 1988
Vitis amurensis, *V. labrusca*, *V. vinifera*	Yes, for fruit production in private gardens in Russia	Infestation on Russki Concord#@	Tsuchiya, 1988
Vitis amurensis x Severnyi chernyi*	-	Infestation on rootstock Arktik (Severnyi chernyi is a variety with unclear parentage, which may be *V. riparia*, or 'ussuri black' x *V. riparia*)	Tsuchiya, 1988
Uncertain host plants			
Parthenocissus tricuspidata	Yes, as ornamental and in nature (escaped from cultivation)	See comment below the table	See below
Celastrus orbiculatus (Celastraceae)	Yes, as ornamental and in nature (escaped from cultivation)	See comment below the table	See below

* Species and interspecific crossings that could be determined from the table of varieties found infested by Tsuchiya (1988, Table 5) are included above, but not all variety names were found. Interspecific crossings were checked using Röckel et al. (2024) except if marked @ (vinograd.info and Ampelography USSR, 1955). Interspecific crossings for which not all parent species could be retrieved are not included. In addition, not all variety names could be found.

Note that the complexity of interspecific crossings and the part of each *Vitis* species in crossings vary, for example:

- Campbell Early is Moore Early x (Belvidere x Muscat Hamburg), i.e. *Vitis labrusca* x (*V. labrusca* x *V. vinifera*),
- Niagara is Concord x Cassady, one of them an interspecific crossing, i.e. [(*V. labrusca* x *V. vinifera*) x *V. labrusca*] x *V. labrusca*,
- Muscat Bailey A is Bailey x Muscat Hamburg, both complex crosses, i.e. {*V. lincecumii* x [(*V. labrusca* x *V. vinifera*) x *V. labrusca*] x *V. vinifera*} x an hybrid of *V. vinifera*,
- Russki Concord is *V. amurensis* x Concord, i.e. *V. amurensis* x [(*V. labrusca* x *V. vinifera*) x *V. labrusca*] (vinograd.info). Note that Röckel et al. (2024) lists it as *V. labrusca* x *V. vinifera.*

The existence of complex specific interspecific crossings in the EPPO region is confirmed. Old crossings (direct producer hybrids) have limited use for table grapes mostly in home gardens in EU members / EPPO countries. New cold- and fungi-tolerant interspecific hybrids (PIWI-s) are widely utilized in the whole EPPO region for wine and table grape production (G. Lukácsy, pers. comm.).

From the host list in Table 4, *X. pyrrhoderus* attacks various *Vitis* spp. and their crossings originating from different continents, including *V. vinifera* which is not native to East Asia. *Xylotrechus pyrrhoderus* has been recorded in Japan on interspecific crossings containing species that are not native to East Asia, such as *V. vinifera* and North American species and hybrids (*V. labrusca, V. aestivalis*, *V. lincecumii*, *V. riparia*, *V. berlandieri* and *V. rupestris*). Consequently, all *Vitis* spp. are considered as potential hosts and covered in the assessment. Various other *Vitis* species occur in the native area of the pest for which no host record was found: for example, *V. davidii* or *V. quinquangularis* are also used for wine production in China (Wang et al., 2018), *V. coignetiae* is present in nature in Japan, and the Korean peninsula (Nityagovsky et al., 2024; Usenko, 1984 – as well as Sakhalin and Kuriles Islands, see section 9.1).

Uncertain host plants:
Parthenocissus tricuspidata is sometimes mentioned as a host in the literature (EPPO, 2024b). However, it was not possible to find confirmation of *X. pyrrhoderus* infesting this plant. One synonym of *P. tricuspidata* is *V. thunbergii* Druce, while *V. thunbergii* Sieb. et Zucc. is a synonym of the confirmed host *V. ficifolia*. An original record of '*V. thunbergii*' (e.g. this name is mentioned in Shiraki, 1952 without authors) may have been allocated in later publications to *P. tricuspidata* instead of *V. ficifolia*. It is uncertain whether *P. tricuspidata* is host. However, in the absence of further information, this species is considered as an uncertain host in this PRA.

Celastrus orbiculatus **(Celastraceae).** One record in the literature (Jang et al., 2015) relates to the finding of one dead immature adult of *X. pyrrhoderus* in a pupal cell in a vine (S.H. Lee, pers. comm.). There are no further records of this host in the literature. Because this plant is not from the family Vitaceae and the life stage found, and because there is an uncertainty on the identification of the plant, *C. orbiculatus* is covered in this PRA as an uncertain host.

Notes on other uncertainties regarding hosts:
Host plants in Massachusetts (USA) are not known to date (at 2025-01). Surveys on grapes did not detect the pest (PDA, 2023; USDA, 2023).

It is uncertain whether *X. pyrrhoderus* can attack other varieties of *A. glandulosa*, other species in the genus *Ampelopsis*, as well as other Vitaceae species.

8 Pathways for entry

The following pathway for entry of *Xylotrechus pyrrhoderus* is discussed in detail in section 8.1:

- Host plants for planting (except seeds, pollen, tissue cultures) (Table 5).

The following pathways are considered very unlikely and are discussed in section 8.2:

- Cut branches of hosts
- Wood packaging material
- Round wood (with or without bark), furniture and articles entirely or partly made of raw *Vitis* wood or bark
- Leaves of *Vitis vinifera*
- Deciduous wood chips, hogwood, processing wood residues (except sawdust and shavings)
- Hitchhiking
- Natural spread
- Shipping or transport of live adults, for example by collectors

The following commodities from hosts are not considered further in this PRA:

- Seeds, tissue cultures, pollen of hosts, and stored products (raisins): life stages of *X. pyrrhoderus* are not associated with those.
- Sawn wood and bark of hosts: the hosts are not used to produce such commodities.

8.1 Host plants for planting (except seeds, pollen, tissue cultures)

Note that in this section information on import prohibitions and phytosanitary measures is provided only for some countries of the PRA area (see individual pathways).

Table 5. Host plants for planting (except seeds, pollen, tissue cultures)

Pathway	**Host plants for planting (except seeds, pollen, tissue cultures)**
Coverage	This pathway covers plants with roots (in growing medium or bare-rooted) as well as cuttings/buds (rooted or unrooted). It also covers transport of such plants in passenger luggage. The main types of commodities covered in this pathway are ornamental host plants (e.g. *Vitis* and *Ampelopsis glandulosa* var. *brevipedunculata*) and propagation material of host plants (e.g. *Vitis*).
Plants concerned	Host plants in section 7
Pathway prohibited in the PRA area?	Partly, at least in some EPPO countries. • In the EU, import of *Vitis* plants (other than fruit) is prohibited from most countries according to Annex VI of Regulation (EU) 2019/2072 (EU, 2019a). These prohibitions cover countries where *X. pyrrhoderus* is present. *Vitis* plants for planting may be imported under derogation for scientific and breeding purposes following the requirements of the EU Commission Delegated Regulation 2019/829 (EU, 2019b). • -Similar prohibition also applies the UK (Northern Ireland as EU above and Great Britain (assimilated regulation (EU) 2019/2072)). • Import of all Vitaceae plants for planting (vegetative propagation material except seeds) are prohibited in Israel (Annex 7 in Israel Ministry of Agriculture and Rural Development, 2009). Import under post-entry quarantine is allowed for research and breeding purposes (Israel Ministry of Agriculture and Rural Development, 2009). Some EPPO countries do not prohibit the import of *Vitis* plants for planting as is the case for Norway and Russia (EPPO, 2022). The EWG had no information on the requirements of other EPPO countries, but at least *Vitis* plants for planting may be prohibited in additional EPPO countries.
Pathway subject to a plant health inspection at import?	Yes, at least in some EPPO countries. For example, in the EU, plants for planting other than seeds from third countries should be accompanied with a phytosanitary certificate and should be inspected at import (EU, 2019a, 2022a). This would apply to *Ampelopsis glandulosa*. Trees and shrubs for planting (other than seeds and plants in tissue culture) should be free from signs or symptoms of insects, or have been subjected to appropriate treatment to eliminate them (EU, 2019a). These requirements are likely to reduce the likelihood of association of the pest with the commodity as they imply inspection before export and at import, which increases the likelihood of detection. However, *X. pyrrhoderus* is not a quarantine pest in EPPO countries, and detection of the pest on an intercepted commodity may not result in its rejection. *Notes on uncertain hosts:* In the EU, *Celastrus orbiculatus* was assessed to meet the criteria of EU invasive species of Union concern, but its addition to the EU List was subject to a transition period until 2027 (EU, 2022b). When added to the EU List, its trade will be prohibited (EU, 2014, 2016).
Pest already intercepted?	No known interception on this pathway.

Pathway	Host plants for planting (except seeds, pollen, tissue cultures)
Most likely stages that may be associated	Eggs, larvae, pupae and immature adults. Larvae may be associated all year-round (see Fig. 2 in section 2.2). Adults are unlikely to remain on the plants for planting through storage and transport when they have emerged. However, they may emerge during transport.
Important factors for association with the pathway	*Xylotrechus pyrrhoderus* may be associated with types of plants for planting with roots that carry canes, such as ornamental host plants (including grapevine and bonsais). On such plants, early stages of infestation may not be detected (larvae feed inside the cane and symptoms are indistinct). The pest may be associated with cuttings only if those carry buds and are woody. - According to Frison & Ikin (1991), grapevine cuttings should only be collected from 1-year-old canes, preferably as dormant cuttings (in the autumn), although green cuttings may also be taken (e.g. in the middle of the growing season). Some life stages of the pest may be associated with dormant cuttings (see section 2). Grapevine cuttings might be scrutinized at harvest to ensure quality, but the pest is hidden and may not be detected. - Before export / upon receipt, dormant cuttings may be subject to treatments that may affect the pest. For example, Frison & Ikin (1991) recommend a hot water treatment (50°C for 45 min or 45°C for 3 h) of fully dormant material, followed by a dip in a solution of insecticide and fungicide. However, the effect of this treatment on the survival of the pest is not known and such treatment is presumably not applied to all traded material. - Mature larvae are not likely to be associated with dormant cuttings. Young larvae are likely to survive in a cutting in cold storage, especially in cuttings with several buds. If the larva survives after grafting, the new growth will look sick and stunted. No information was found on the abundance of the pest in nurseries growing grapevine or other Vitaceae species (or *C. orbiculatus* – uncertain host) in countries where *X. pyrrhoderus* occurs. In the nursery trade, it is expected that some controls are in place, although there may be less scrutiny for ornamentals (*Vitis* and other hosts) than of *Vitis* for propagation. Plants for planting transported by passengers may come from local production, gardens or nature, where the pest may not be controlled. Travellers may not notice infestation. *Notes on uncertain hosts*: *Parthenocissus tricuspidata* is also propagated with cuttings (G. Lukácsy, pers. comm.).
Survival during transport and storage	Temperature in the consignments may affect the survival and further development of life stages of the pest. Eggs and pupae are expected to survive transport and storage at least at temperatures somewhat below the lower development threshold (which is about 8–11°C for egg and pupae – see section 2.3). Transport at cool temperatures is not likely to affect larvae (as they survive in areas with cold winters). Cuttings intended for propagation are kept with sufficient moisture to preserve the buds and therefore would allow survival of larvae. Cuttings may be stored for up to a few months and at temperatures of 2–6 °C (G. Lukácsy, pers. comm.). There is no data on the cold tolerance of adults.
Trade	The import of *Vitis* or other Vitaceae plants for planting is prohibited in some EPPO countries, but not all (see above). *Vitis vinifera*, if traded into the EPPO region for fruit production, is more likely to be imported as cuttings, and to a limited extend for breeding purposes as tissue culture or seeds. Data on rejected consignments in the EU (data not included in this PRA) show attempts at importing plants for planting of

Pathway	Host plants for planting (except seeds, pollen, tissue cultures)
	Vitis mostly in the form of cuttings/budwood/scion, and in a few cases, seeds, seedlings or 'vine slips, grafted or rooted' (no import was from countries where *X. pyrrhoderus* is present). In 2024, there was no import of *V. vinifera* plants for planting into Russia from the Korean Peninsula, China and Japan (D. Kasatkin, pers. comm.). Data for 2002–2010 gathered in the framework of the ISEFOR project into 14 EU countries (Eschen et al., 2017) showed limited import of *Ampelopsis* in 2010, but only from Ethiopia (about 1800 pieces) Based on a general Internet search, there is no obvious trade of *V. ficifolia* (see section 9). Overall, it seems more likely that plants for planting of hosts are imported as cuttings and very young (not woody) plants. However, it cannot be excluded that plants for ornamental purposes may be traded in the form of rooted, more mature, plants as part of the ornamental nursery trade, especially *Ampelopsis glandulosa*, *Parthenocissus tricuspidata* (uncertain host plant) and *C. orbiculatus* (uncertain host plant), and theoretically also *Vitis* for ornamental purposes (into EPPO countries that do not prohibit *Vitis*). Grapevine are popular plants among the public, and travellers may bring them in their luggage. Grapevine growers may want to introduce a new *Vitis* variety from Asia, but it is expected that the volume of this pathway is very low. *Notes regarding uncertain hosts:* • Partial data from EU TRACES for 2023 showed imports of large quantities of *Parthenocissus* (over 3 million pieces), but only from Africa (as 'rooted cuttings and young plants' or 'other') and not from countries where *X. pyrrhoderus* occurs. • Data for 2002–2010 gathered in the framework of the ISEFOR project into 14 EU countries (Eschen et al., 2017) showed limited import of *Parthenocissus* (over 4800 plants from various origins) over the whole period as well as *Celastrus* (over 20000 plants over the whole period). Among the hosts and origins of *X. pyrrhoderus*, 2 *Parthenocissus tricuspidata* and 18 *Parthenocissus* plants were imported from Japan in 2010 (as 'nursery plants' and 'decorative plants for planting'), and 130 *Celastrus* plants from the United States. • Bonsais of *Parthenocissus* are sold, with origins indicated as from Japan and China, incl. *Parthenocissus tricuspidata* as outdoor bonsais (*Parthenocissus* bonsai references, 2024). • EPPO (2021 – PRA on *Celastrus orbiculatus*) assessed that plants for planting of *C. orbiculatus* are more likely to originate from within the EPPO region, but small numbers of bonsais may be imported from Asia.
Transfer to a host	The pest is already on a suitable host and the life cycle could continue when conditions are favourable. For transfer to occur successfully, the life stages (i.e. eggs and larvae) have to complete their development, the infested plants should not be detected and removed, a male and a female should emerge in the same time frame and mate, and the female should find a host plant.
Likelihood of entry and uncertainty	The EWG rated separately plants for planting of *Vitis* and of other hosts. In both cases, limiting factors for successful entry are the fact that material exported by the nursery trade and for propagation is expected to be subject to some degree of scrutiny, and that successful transfer involves several steps (see above). For *Vitis*: for countries that do not prohibit *Vitis*, the likelihood of entry is low, with a moderate uncertainty: - The trade of grapevine plants for planting (including cuttings for propagation) from countries where the pest occurs is expected to be low.

Pathway	Host plants for planting (except seeds, pollen, tissue cultures)
	Uncertainty Moderate: Association with the pathway at origin, and amount of trade (especially of ornamental grapevines). This pathway is closed for countries that prohibit *Vitis*. For *Ampelopsis glandulosa* var. *brevipedunculata*: Low likelihood of entry, with a moderate uncertainty: - There is a possibility that *X. pyrrhoderus* is introduced with these ornamental hosts, but trade is expected to be small. *Uncertainty*: Moderate: Association with the pathway at origin, and amount of trade.

Rating of the overall likelihood of entry	*Very low* ☐	*Low* X	*Moderate* ☐	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* X	*High* ☐

8.2 Pathways with a very low likelihood of entry

Cut branches of hosts. This pathway covers cut branches intended to be used fresh for decoration or other ornamental purposes. It is not clear if cut branches of any host are used in the EPPO region and traded internationally. Data on consignments rejected in the EU (not included in this PRA) show one attempted import of *Vitis* 'cut tree retaining foliage' (from Lebanon). Nevertheless, no information was found that the Vitaceae hosts are used as fresh foliage. *Ampelopsis glandulosa* var. *brevipedunculata* and *Parthenocissus tricuspidata* (uncertain host plant) are climbing vines that attach to their support and are used as ornamentals to cover vertical structures, and this is also the case for some *V. vinifera* hybrids used as ornamentals. *Vitis vinifera* is unlikely to be used (and traded) as fresh cut branches. No mention was found of *V. ficifolia* or other *Vitis* being used in this manner. It is noted that the prohibition of *Vitis* plants in the EU covers cut branches (Annex VI of Regulation (EU) 2019/2072 (EU, 2019a)). Regarding *Celastrus orbiculatus*, there is no evidence that cut branches have been imported into the EPPO region (EPPO, 2021).
Life stages of *X. pyrrhoderus* could be associated with branches with buds, and the pest could survive in fresh branches. However, the material will eventually dry out.
Uncertainty: low

Wood packaging material. Two interceptions of *X. pyrrhoderus* adults into the USA in 1988 were reported in data related to wood packaging material (Eyre & Haack, 2017). Based on further details on the original data, the EWG considered that the pest was more likely associated with the commodity transported (see *Hitchhiking* below). There is no further information on association with wood.
Uncertainty: low

Round wood (with or without bark), furniture and articles entirely or partly made of raw Vitis wood or bark. There is no indication that any host species are used for wood production or furniture. *Vitis* and Vitaceae in general are not species used for wood production nor traded as wood (Mark et al., 2014). Nevertheless, grapevine branches with or without bark are sold on the Internet (e.g. eBay) for home decoration (e.g. grapevine wreaths), aquaria and terraria, bird perches etc. or as firewood for barbecues (https://www.braaiwooduk.com/product/vine-shoots-grape-vine-bbq-vine-shoots/). If such material is completely dry, the pest is very unlikely to survive. It is likely that such material would be dried before dispatch. Even if it is not, successful transfer would require completing development to adult, a male and a female should emerge in the same time frame and mate, and the female should find a host plant.
Uncertainty: low

Leaves of V. vinifera are used in food preparations. Only adults may be associated with leaves if they land on the plant, but they are unlikely to remain associated with leaves through harvest and packing.
Uncertainty: low

Deciduous wood chips, hogwood, processing wood residues (except sawdust and shavings). The hosts of *X. pyrrhoderus* are not forest trees, although they may be present in the forest or environment. When harvesting forests for wood chips, some host plants may be mixed with the wood of other species. There would presumably be only very small quantities of host wood in these chips. In addition, processes would kill many individuals, and survival is less likely in wood chips than other wood.
Uncertainty: low

Hitchhiking. Adults may hitchhike in trade containers from areas where the pest occurs. In the USA, two interceptions of *X. pyrrhoderus* were reported in September 1988 as live adults (4 adults in each case) associated with wood packaging material carrying unspecified items for consumption from the Korea Rep. (R. Haack, pers. comm; Eyre & Haack, 2017). The EWG considered that *X. pyrrhoderus* is very unlikely

to be associated with wood packaging material and these adults would have been more likely hitchhikers on the commodity.
Smith & Tripotin (2011) observed a large number of *X. pyrrhoderus* being active around a pile of deciduous firewood. Aggregation behaviour may increase the probability of hitchhiking in trade, but apart from this one-off observation, there is no evidence that *X. pyrrhoderus* aggregates, nor that it shows any attraction that would favour hitchhiking.
For successful transfer to occur, there should be either a mated female, or a male and a female would need to mate and find a suitable host plant at destination. Adults of *X. pyrrhoderus* have a very short lifespan (in general about 2 weeks – see ANNEX 2) and this lowers the opportunity of transfer in comparison with plants for planting. The dispersal capacity of adults is not known (see section 11).
Regarding the possible association of adults as hitchhikers on grape bunches, no records were found in the literature (neither during the preparation of this PRA, nor in Australian Department of Agriculture, 2014). Nevertheless, adults are active at the end of summer to autumn, and they may be around at the time of grape harvest. Grapes may be transported in uncooled or cooled conditions (about 0 °C; BMT, 2024), in small packages or in crates (for lower quality grapes; G. Lukácsy, pers. comm.). The time of storage may vary considerably (some varieties can be stored up to 6 months) and the speed of transport may vary from plane to ship (about 30 days from Japan to Europe). Adults may be able to survive at least short transport times and uncooled conditions. It is uncertain if they can survive cooled conditions for a long period of transit time.
In the period 2020–2022, the trade of grapes from countries where the pest occurs was mostly from China to Russia (about 5800 t in 2020, 4100 t in 2021, 3700 t in 2022), Kazakhstan (about 2700 t in 2020, 250 t in 2021, 70 t in 2022) and Kyrgyzstan (about 20 t in 2020 and 2021), and about 1 t to Switzerland in 2022. In 2022, four EPPO countries imported up to 3 t from the Korea Rep., and three countries imported less than 1 t from Japan (FAOStat, 2024).
Uncertainty: moderate (due to lack of data on the cold tolerance and survival of adults; spread capacity of adults; whether undetected hitchhiking occurs).

Natural spread. Given the current distribution, the only EPPO country of relevance in relation to natural spread is Russia (Siberia or the Far East). For entry into Russia by natural spread to succeed, the pest should be able to reach Russia by flying within a reasonable timeframe and it should find a continuum of hosts allowing this. The dispersal capacity of the pest is unknown (see section 11). As for many other species, if it finds hosts, it is less likely to spread at long distance. There are no reports of large populations leading to massive dispersal. *Xylotrechus pyrrhoderus* is probably still far from the Russian border (with some uncertainty). In north-east China, the pest was recorded in Jilin but not in Heilongjiang. It has been recorded in Neimenggu (Inner Mongolia – which only in its northwest corner shares a border with Siberia), while the record in Mongolia (which shares a long border with Siberia) is doubtful (see section 6).
No information was found confirming the presence of *X. pyrrhoderus* in the northwest of Neimenggu, which borders Russia. It is more likely to have been recorded in the centre-south of the province, where farmland is located, while the northern part towards Mongolia is desert, steppes and forests (Li et al., 2017). Grape-growing for wine production in China is not conducted in areas that are close to Russia according to the map in Wang et al. (2018, Fig. 3), nor do such areas cover the main distribution of wild grapes in China according to the map in Wan et al. (2008, figure). However, the map from Tang et al. (2023) (Fig. 4 in section 9.1) indicates a limited presence of grapevine throughout north-east China and in Russia. *Vitis amurensis* (not a confirmed host) is widespread in nature in northern China and the Russian Far-East (see section 9). In any case, deserts, mountains and steppes between the current distribution (e.g. in Mongolia and Neimenggu) and Russia may constitute barriers to spread.

Uncertainty: low (presence in the northernmost parts of China and Mongolia, flight capacity).

Shipping or transport of live adults, for example by collectors. Xylotrechus pyrrhoderus and Cerambycidae species in general are striking insects. It may be exchanged between hobbyist entomologists but is most likely sent dead. *Xylotrechus pyrrhoderus* is unlikely to be used as a pet insect (D. Kasatkin, pers. comm.).
Uncertainty: low.

9 Likelihood of establishment outdoors in the PRA area

9.1 Host plants

Vitis species

Vitis vinifera is grown commercially for fruit (table grapes or wine) in nearly all EPPO countries (ANNEX 3). In the EU, only *V. vinifera* or interspecific hybrids between *V. vinifera* and other *Vitis* spp. can be used for wine production (EU, 2009). Various interspecific hybrids are used. *Vitis vinifera* and its hybrids are also widely grown in gardens, for fruit or for ornamental purposes, also beyond the area of commercial cultivation.
Fig. 4 illustrates the area cultivated with grapevine in the EPPO region (although it is not specified if it relates only to *V. vinifera* and its hybrids). However, it is noted that some countries not shown on the map nevertheless have some commercial grapevine production either at a large scale (Uzbekistan) or in small areas (e.g. Denmark, Sweden, Poland) (see ANNEX 3). From FAOStat data for 2022, countries with more than 100 000 ha vineyards were Spain, France, Italy, Türkiye, Portugal, Romania, Moldova, Uzbekistan and Germany. Fig. 4 presents a broad overview of the distribution and density of grapevine production areas in the EPPO region, although the data does not cover all EPPO countries where grapevine is cultivated (ANNEX 3). Note that it was not possible to find a unique source of comprehensive data/maps on grapevine cultivation in the EPPO region; Data from Tang et al. (2023, 2024) and CORINE Land Cover (EEA (2020) were used[2].

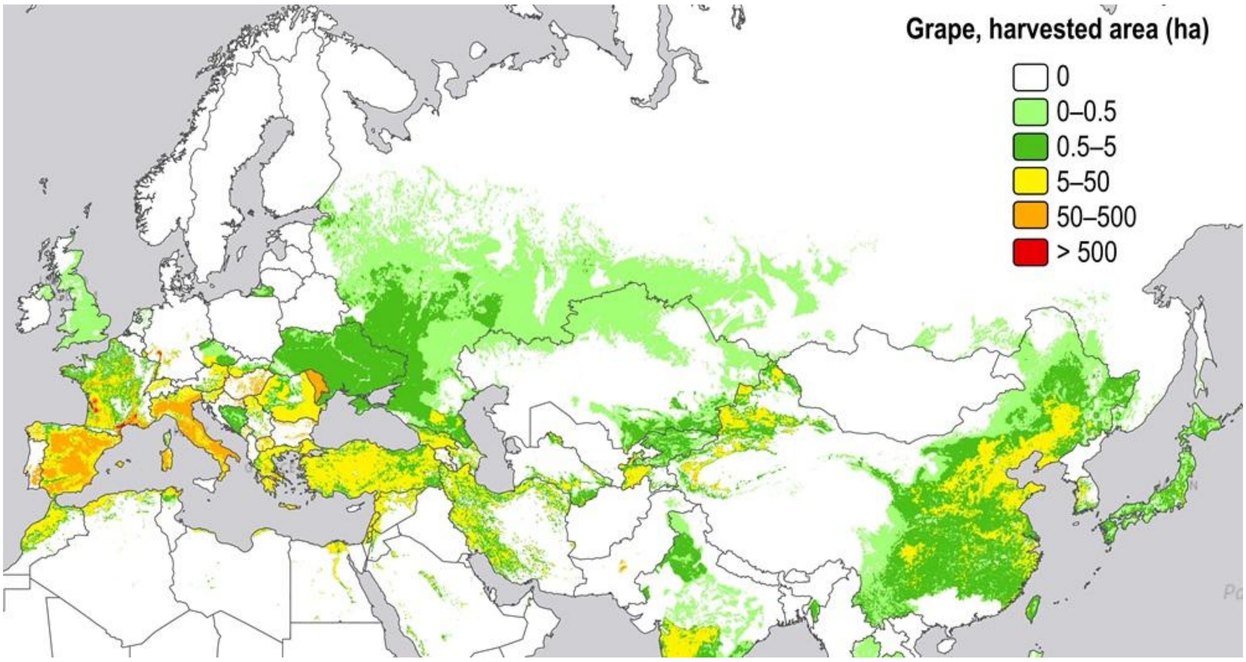

Fig. 4. Grape harvested area in ha. Map prepared by J. Tuomola, based on data compiled by Tang et al. (2024) and retrieved from the dataset provided in Tang et al. (2023). The country borders were sourced from GADM (2020). At the spatial resolution of 0.05° used in Tang et al. (2023, 2024), a grid cell has a size of approximately 5.6 km × 5.6 km, corresponding to about 3000 ha. Consequently, where the map shows for example 0-0,5 ha, it corresponds to 0-0.5 ha grapevine per 3000 ha. Note that data is not provided for some areas where grapevine is grown e.g. most of Germany. See Tang et al. (2023, 2024) for details about the quality of data.

Vitis vinifera* subsp. *silvestris, the wild grapevine, is native to Eurasia and is a critically endangered subspecies for several European countries (France, Czech Rep., Spain and Italy) (Grassi et al., 2006). In Hungary, it is also threatened (Bartha et al., 2012).

[2] For the interactive maps of climatic suitability (section 9.2 and ANNEX 4), CORINE Land Cover data (EEA, 2020) was used to present the distribution of vineyards. Although this data covers only the EU and Turkey, its high resolution makes it better suited for interactive maps that allow exploration of the data on different spatial scales. Additionally, CORINE data distinctly marks vineyards, making it more visually effective for demonstrating distribution areas compared to the Fig. 4., which highlights the density of cultivation in a broader scale. An interactive map presenting both datasets together is available at: https://upload.eppo.int/download/2384o74cd931e8.

Vitis ficifolia is a species native to Asia (not including the Russian Far East), and no evidence was found that it is present in the EPPO region. From a general search on the Internet, few nurseries propose it for sale. It is used for wine production in China (Fan et al., 2015).

- The combination of ***V. berlandieri*** × ***V. riparia*** is among one of the most widely used rootstocks in the EPPO region (G. Lukácsy, pers. comm.), and ***V. riparia*** × ***V. rupestris*** is also used (Gautier et al., 2020). ***Vitis riparia*** and its hybrids, have been widely used as rootstock in the EPPO region. The species or hybrids have escaped cultivation and are naturalized in many EPPO countries, such as in Spain, Hungary, Czech Republic, Russia, Italy and France (André & André, 2016). *Vitis riparia* is a strong competitor of *V. vinifera* subsp. *silvestris* in Hungary (Bartha et al., 2012).

Amongst other potential *Vitis* hosts, several species are present in nature or in cultivation, such as:

- ***Vitis amurensis*** is native to Eastern Asia (Plants of the World Online, 2024). It has a limited cultivation in the Russian Far East (D. Kasatkin, pers. comm. and '*Vitis amurensis* websites' in Reference list) and is widespread in nature. From a general search on the Internet, it is also available as an ornamental in Europe.

Fig. 5. *Vitis amurensis* in Asia (green – native; purple – introduced). Extracted from the map on Plants of the World Online (2024).

- ***Vitis coignetiae*** is present in southern Sakhalin and several Kurile Islands (Russian Far-East) (Nityagovsky *et al*., 2024; Usenko, 1984).
- ***Vitis labrusca*** is a North American species. In Europe, *V. labrusca* sensu stricto is present mostly in botanic gardens or collections, while many hybrids with *V. vinifera* have been cultivated in the past and are naturalised or escaped from cultivation (*V. labrusca* sensu lato and *V. labrusca* x *V. riparia*) (André et al., 2017; Ardenghi & Cauzzi, 2015). In the EU, *V. labrusca* cannot be used for wine production (EU, 2009). *V. labrusca* and its hybrids are popular for home gardens and for table grape (G. Lukácsy, pers. comm.). *V. labrusca* sensu lato is considered invasive in Provence-Alpes-Côte d'Azur (Terrin et al., 2014).
- Many hybrids between *V. vinifera* and other *Vitis* spp. have been used and are now present in the environment, as one example, *V. aestivalis* hybrids in France (André and Lacombe, 2019). Several *Vitis* hybrids or species are considered invasive or potentially invasive in the EPPO region, such as *V. vulpina* and *V. rupestris* in Provence-Alpes-Côte d'Azur (Terrin et al., 2014), *V. rupestris*, *V.* × *instabilis*, *V.* × *koberi*, *V.* × *ruggerii* in Sicily (Ardenghi & Cauzzi, 2015). Naturalised rootstocks compete with *V. vinifera* subsp. *silvestris* (Arrigo & Arnold, 2007).

<u>*Ampelopsis glandulosa* var. *brevipedunculata*</u>

Ampelopsis glandulosa var. *brevipedunculata* is a popular ornamental grown for its climbing vines and decorative leaf colours in autumn. It can also be grown as a greenhouse plant or indoors (RHS, 2024). No detailed information was found on its distribution. However, it is native to temperate areas of Asia (incl. Far East Russia; Plants of the World Online, 2024). No record was found of records of naturalisation of *A. glandulosa* var. *brevipedunculata*. One horticultural cultivar of *A. glandulosa* var. *brevipedunculata* is reported hardy to –20/–15 °C (RHS, 2024). *Ampelopsis glandulosa* has four other recognized varieties (Plants of the World Online, 2024), and at least var. *heterophylla* may be used as ornamental (from a general search on the Internet, 2025-04).

Various other Vitaceae species that are not confirmed hosts are native or cultivated in the EPPO region, such as *Ampelocissus africana*, used as ornamental.

Notes on uncertain hosts
Parthenocissus tricuspidata is also a popular ornamental grown for its climbing vines and decorative leaf colours in autumn. No detailed information was found on its distribution, it is native to temperate areas of Asia (incl. Far East Russia; Plants of the World Online, 2024). *Parthenocissus tricuspidata* is naturalised in the EPPO region (MNHN & OFB, 2003–2024; EuroMed, 2024). In Belgium, it is mostly a relic of cultivation and seldomly self-sown (Manual of the Alien Plants of Belgium, 2024). Its plant hardiness is recorded to a minimum temperature of –35 °C (USDA plant hardiness 8) and tolerating heat up to 120 days per year at about 30 °C (Gardenia.net, 2024), and this species may have a wide distribution in the EPPO region.

Celastrus orbiculatus is native from East Asia, including the Russian Far-East, and is widely introduced and naturalized in North America, including Eastern and Central USA (EPPO, 2021). It is a climbing vine, which was introduced into Europe for ornamental purposes at the end of the 19th century. *C. orbiculatus* has since escaped cultivation in at least 15 EPPO countries, with established populations in nature in some of them, and is possibly cultivated in more countries (EPPO, 2021 – its addition to the EU List of Union concern in the future will have an impact on its use and presence in the EU).

9.2 Climatic suitability

There is limited knowledge on the climatic requirements of *X. pyrrhoderus* (see section 2.3), in particular, on the development thresholds of life stages, the accumulated temperatures required for the development of life stages, the lethal low and high temperature-duration combinations, and the critical times of the year for the life cycle. Consequently, the EWG chose to estimate the suitability of climate by comparing the climate in the known range of the pest to the climate in the EPPO region using Köppen-Geiger climate classification and the “match regional climate” algorithm of the CLIMEX software (Kriticos et al., 2015; Roigé & Phillips, 2021). Because the pest spends most of its life cycle inside the plant, rainfall and relative humidity are not expected to have a major influence on the likelihood of establishment of the pest.

9.2.1 Köppen-Geiger climate match

The prevalent Köppen-Geiger (KG) climate types associated with precise observation points of *X. pyrrhoderus* as well as those found in administrative areas where the pest is known to occur (but with uncertain exact locations), were mapped for a recent climate period (1991–2020) and projected for the period 2041–2070 under Shared Socioeconomic Pathways (SSP) 245 and 370. Details of this analysis are provided in ANNEX 4.

Figure 6a depicts the distribution in the EPPO region of the recent KG climate types that are associated with precise observation points of *X. pyrrhoderus* in its native range. Figure 6b expands on this, showing also the distribution of additional climate types within administrative areas from which there are observations but where information about the precise locations is unavailable.
An interactive map is available at : https://upload.eppo.int/download/2363oca96a3871. The interactive map also illustrates specific locations and the presence of grapevine (see details in ANNEX 4). A file with information about the mapped locations is available at: https://upload.eppo.int/download/2332o28d65b71d. See ANNEX 4 for details regarding the interactive map.

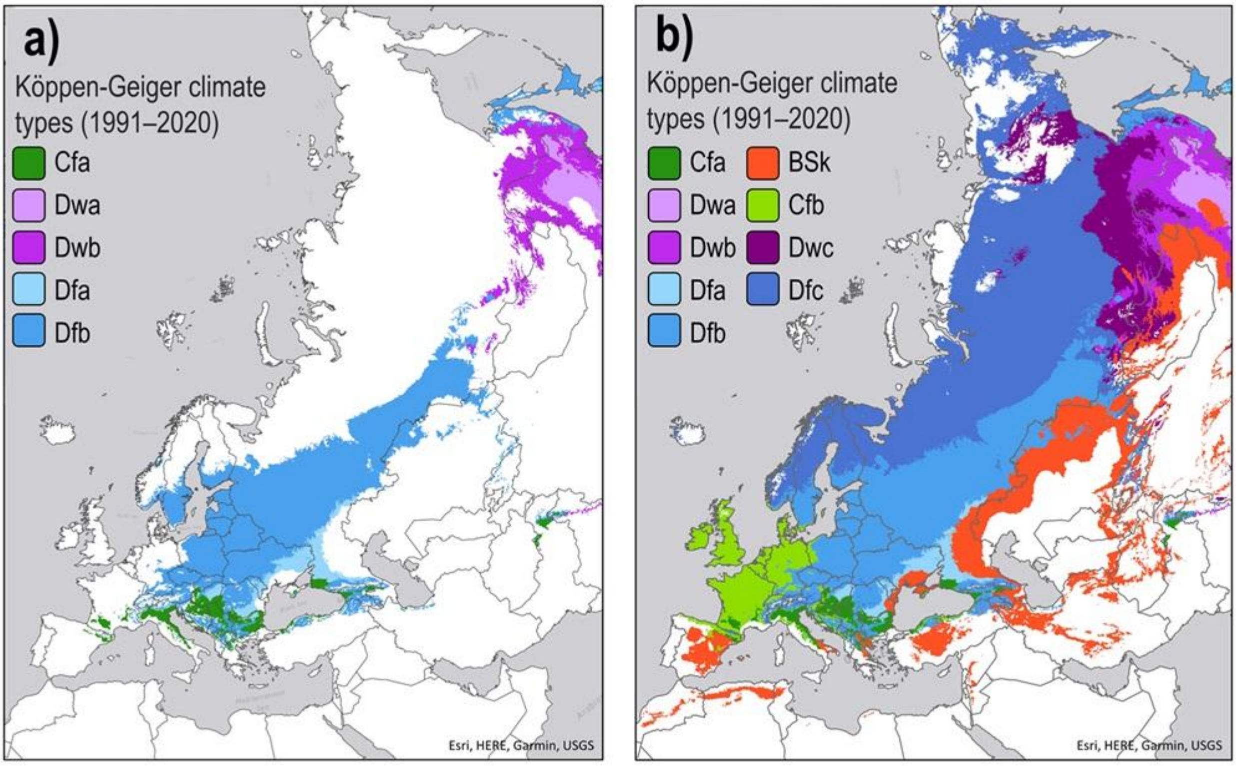

Fig. 6. Köppen-Geiger climate types associated with *X. pyrrhoderus* in the EPPO region
(a) Five climate types at precise observation points that delimit an area where conditions likely favour establishment in the EPPO region.
(b) Same five climate types plus four climate types in administrative areas where the pest is recorded (no precise location records), i.e., including areas with higher uncertainty of establishment.
Distribution in the recent climate (1991–2020). Data for Köppen-Geiger types were sourced from Beck et al. (2023) at a resolution of 0.1° (about 11 km at the equator). The country borders on the map were sourced from GADM (2020). Map prepared by J. Tuomola (Ruokavirasto, Finland).

(a) KG climate types	**(b) same KG climate types, plus the following**
Cfa temperate, no dry season, hot summer	*Bsk* cold arid steppe climate
Dwa cold, dry winter, with hot summer	*Cfb* temperate, no dry season, warm summers
Dwb cold, dry winter, with warm summer	*Dwc* cold, dry winter, cold summer
Dfa cold, no dry season, with hot summers	*Dfc* cold, no dry season, cold summer
Dfb cold, no dry season, with warm summers	

- On Hokkaido (Japan), the presence of the pest is not confirmed (see section 6). Hokkaido falls under cold climate types with no dry season and hot summer (*Dfa* – limited areas in the south of the island), warm summer (*Dfb* – most of the island) as well as cold summer (*Dfc* – limited areas in mountains). The pest is reported from some precise locations that fall under the climate types *Dfa* and *Dfb* (respectively 3 records and 1 record), as well as in Hampden County (Massachusetts), which also falls under these climates (no precise location). The factors that prevent the pest from occurring in colder regions of Japan (Hokkaido), are unknown and the evidence of presence of the pest under these climate types is limited. Consequently, the establishment potential of the pest in cold climate (all *D*) in the EPPO region remains uncertain.

It is uncertain whether *X. pyrrhoderus* could establish under climate types that are not present at origin (such as the Mediterranean climate types *Csa* and *Csb*), and in dry areas, especially in relation to life stages that are exposed to the air (eggs and adults), but establishment in these areas is not excluded. *Bsk* (cold arid steppe climate) is the only dry climate type represented in the EPPO region and in the current distribution of *X. pyrrhoderus*, and only at the level of administrative areas, i.e. not based on precise observation points. The related species *X. chinensis*, which recently was introduced to Europe, was able to establish in places where rainfall and relative humidity in the three warmest months of the year are significantly lower than in its native distribution (45–65% RH compared to 55-75% RH, 0–300 mm rain compared to 300-1100 mm) (ANSES, 2023). It has for example been reported in Valencia (Spain) and Greece (incl. Kriti), respectively under Mediterranean and arid climate types (EPPO, 2024b).

Regarding the future climate in 2041–2070, the distribution of the KG climate types associated with *X. pyrrhoderus* extends northwards in the EPPO region assuming both climate change scenarios (SSP245 and 370) (see ANNEX 4 Maps 2 and 3; an interactive map is available at: https://upload.eppo.int/download/2321o83dc594af).

9.2.2 Matching climate

The CLIMEX software and the "match regional climate" algorithm was used to assess climatic similarity between the precise observation points of *X. pyrrhoderus* ("home" locations – corresponding to precise observation points in 9.2.1) and the EPPO region ("away" locations). The "match regional climate" algorithm compares climatic variables on a weekly basis between all the "away" locations to each of the "home" locations as a separate run and retains the best match from all the runs as a final result for each "away" location (Kriticos et al., 2015). The Composite Match Index (CMI), which ranges from zero (very low similarity) to one (very high similarity), was used to describe the overall degree of climatic similarity. The general rule of thumb is that CMI ≥ 0.7 indicates high enough similarity to allow establishment in the context of PRA (Roigé & Phillips, 2021).

The analyses were run using two different settings of the parameter values. The first run used the default settings of the algorithm (i.e. equal weighting of minimum and maximum weekly temperatures, weekly rainfall pattern and total annual rainfall), and the second run used only the minimum and maximum weekly temperatures. Both analyses were run in a 30-arc minute spatial resolution, using climatological data on the recent climate as 30-year average centred on 1995, acquired from the CliMond climatic database (www.climond.org; Kriticos et al., 2012).

Fig. 7 shows areas in the EPPO region where the CMI ≥ 0.7 according to the analyses. An interactive map is available at https://upload.eppo.int/download/2362o418c3e27d.

The EWG assumed that the analysis, which excludes rainfall data (Fig. 7b) provides more accurate indication of areas suitable for the establishment of *X. pyrrhoderus* compared to the analysis using the default setting. This is because rainfall is not expected to have a significant effect on the establishment (see 9.2.1).

When rainfall data is excluded from the analysis, the CMI decreases for the UK and Ireland (which are not projected to be suitable using this metric) and generally increases in the Mediterranean area and Central Europe. The southern part of the Mediterranean area becomes suitable. The analysis without rainfall also better represents the presence of commercial vineyards in the EPPO region. It also matches better the known occurrence of the pest (higher CMI - see maps in ANNEX 5). It is noted that the CMI is also high in Massachusetts, the only area of known establishment of the pest outside its native range. Climatic conditions appear suitable for the establishment in most grapevine growing areas of the EPPO region.

Regarding the precise observation points of the pest, it is important to note that one observation was excluded from all analyses. This observation, reported by Liu et al. (2021) from Jilin, China, is associated with a climate that is exceptionally cold in winter (mean temperature of the coldest month reaching –18 °C) differing significantly from the winter temperatures at other observation points. Given that the area is mountainous where temperatures can vary greatly even in a small area, it is likely that the pest is present in a warmer microclimate not captured by grid-based climatic data. This particular observation does not influence the results of the KG analysis, but including it in the CLIMEX analysis would have led to a prediction that climate in north of Finland and Sweden may have been considered suitable for the establishment (provided hosts were present there).

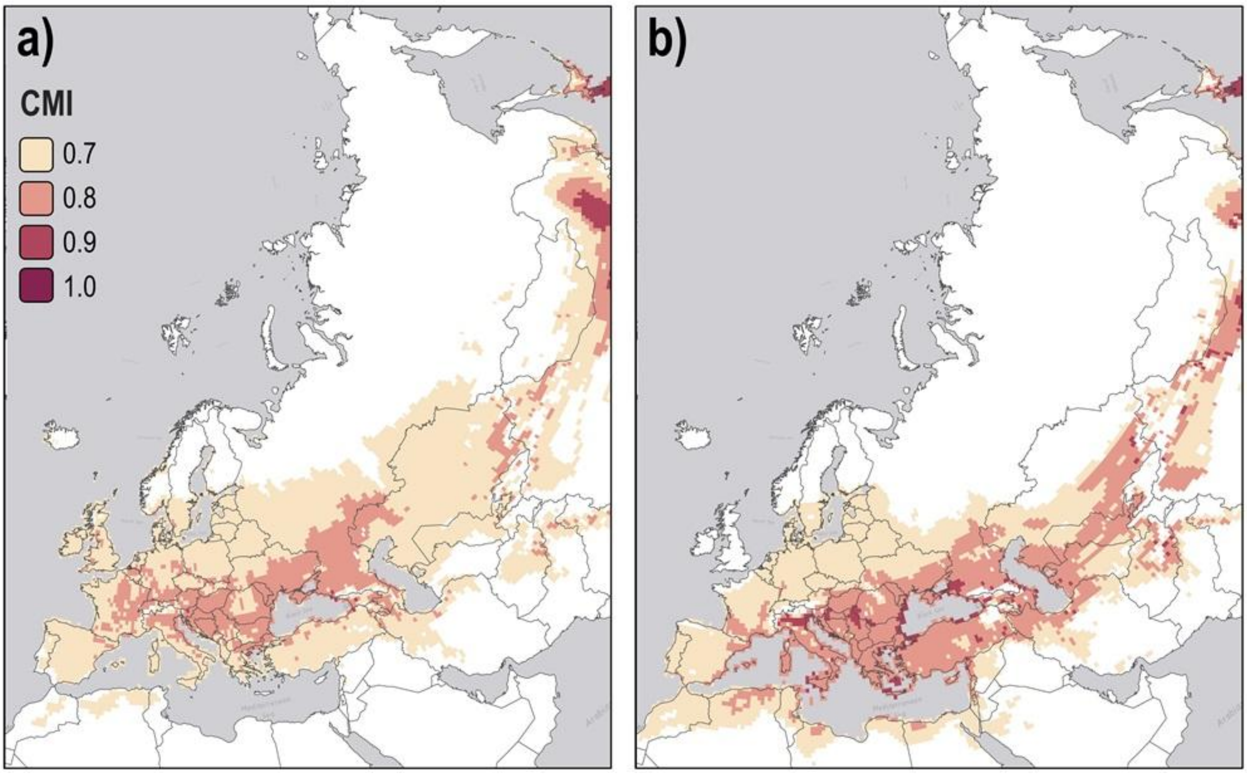

Fig. 7. Similarity of climate between the EPPO region to the climate in the precise observation points of *X. pyrrhoderus* in its native range. The climate similarity was estimated using the "match regional climate" algorithm of the CLIMEX software. Only results where the CMI ≥ 0.7 are presented. The country borders on the map were sourced from GADM (2020).
(a) Climate similarity based on the default parameter values of the algorithm (i.e. equal weighting of minimum and maximum weekly temperatures, weekly rainfall pattern and total annual rainfall).
(b) Climate similarity based on the minimum and maximum weekly temperatures only.

9.3 Other factors

Current pest management practices in the EPPO region are not assumed to prevent the establishment. In commercial vineyards, treatments may be applied against other pests at times when adults of *X. pyrrhoderus* are present. Such treatments may have some effect against *X. pyrrhoderus*. However, *X. pyrrhoderus* populations can have a long flight period (see section 2.2), meaning the pest can arrive at a field over an extended period, and treatments may not eliminate all individuals. Examples of pest management practices in the EPPO regions are:

- Treatments (pyrethroids) applied against *Drosophila suzukii* at the ripening stage of the grapes.
- Plant protection products applied against *Lobesia botrana* adults may have some effect against *X. pyrrhoderus* because there is an overlap of flight periods. However, management of *L. botrana* is achieved through treatments against the larvae, which feeds on the leaves, and, increasingly, through mating disruption (G. Lukácsy, pers. comm.), and these would not affect *X. pyrrhoderus*.
- Treatments applied against *Scaphoideus titanus* in places where grapevine flavescence dorée is present are applied earlier in the season. They would not have an effect over the whole flight period of *X. pyrrhoderus*.

Even if such treatments are applied in commercial vineyards, females could move to host plants in settings with limited pest management, such as gardens, amenity and urban areas, abandoned vineyards, nature, etc.

Winter pruning may also eliminate some larvae provided that pruned material is destroyed (for example burned). However, it may not eliminate all individuals.
In Spain, inspections for *X. arvicola* may detect *X. pyrrhoderus. Xylotrechus arvicola* seems to attack mostly larger branches, and plants over 15 years old (Ocete et al., 2008); low levels of infestation by *X. pyrrhoderus* on canes and small plants may not be detected. Removing branches infested by *X. arvicola* would remove *X. pyrrhoderus* in canes. However, regular surveys are likely carried out only where the pest is causing problems.

The life cycle with a facultative diapause is flexible and adaptable and *X. pyrrhoderus* is present in a wide range of climatic conditions. However, the fact that adults may emerge over a long period and have a short lifespan (2 weeks) could hamper mate location and development of sustainable populations.

The pest has been present in Massachusetts since 2020, which indicates that at least one founder population has been able to maintain itself.

9.4 Conclusion

The EWG concluded that the CLIMEX analysis using temperature only (as in Fig. 7b above) provides a broad illustration of areas where the climate conditions are suitable for the establishment in the EPPO region. The conclusion about the climate suitability was based on the CLIMEX matching rather than the Köppen-Geiger climate type comparison since the CLIMEX matching uses more precise climate data, and the matching was possible to limit to only those climate factors that were expected to influence the establishment. As for other climatic comparison methods (e.g. annual growing degree-days over a threshold of 10°C), there are uncertainties attached to the estimated range limits of the areas suitable for establishment (some potential reasons for uncertainty on range with CLIMEX matching are explained in ANNEX 5). The potential area for the establishment was further defined as regions where both the climate conditions are suitable (illustrated in Fig. 7b) and host plants are present. Grapevine is broadly present in the area illustrated in Fig. 7b (based on sources mentioned in section 9.1 and ANNEX 4) and other hosts are assumed to be present in part of the area.

There is uncertainty concerning the northern limit, because in the area identified by the CLIMEX analysis, the match is lower in northern areas. In addition, there is also an uncertainty on whether there is a sufficient presence of cultivated hosts in the northern part of the region, allowing establishment. It is noted that southern UK and northern France were deemed unsuitable by the matching applied (CMI< 0.7), while they present higher summer and winter temperatures than some northern areas in Europe that were considered suitable (as shown for example by the Europe map of annual growing degree-days over a threshold of 10°C in Orlova-Bienkowskaja & Bienkowski, 2022).

There is also an uncertainty on whether the pest could survive in the driest areas in the EPPO region, because of lack of evidence from its current distribution. However, because the pest spends most of its life cycle inside the plant, rainfall and relative humidity are not expected to have a major influence on the likelihood of establishment. In addition, based on the example of *X. chinensis* establishment in the driest and warmest areas in the EPPO region is not excluded.

The likelihood of establishment outdoors was rated as very high with a moderate uncertainty for the most suitable areas. In certain other areas, the likelihood of establishment will be lower because of less optimal conditions (climate and density of hosts).

The following uncertainties were noted: adaptability of the pest to drier conditions especially in the Mediterranean region; effects of extreme temperatures on the life stages of the insect; Allee effect in connection with the long-life cycle (difficult for small populations to establish); northern limit of the potential establishment.

Rating of the likelihood of establishment outdoors	*Very low* ☐	*Low* ☐	*Moderate* ☐	*High* ☐	*Very high* X

Rating of uncertainty	*Low* ☐	*Moderate* X	*High* ☐

10 Likelihood of establishment in protected conditions in the PRA area

In Japan, where grapes are grown both in the field and in glasshouses/greenhouses, *X. pyrrhoderus* was reported in greenhouse production, and protected conditions led to earlier emergence and damage (Shimane Prefecture, 2024; Australian Department of Agriculture, 2014).

In the EPPO region, commercial grapevine is mostly grown outdoors. However, there is some commercial production of table grapes in greenhouses/glasshouses (small-scaled compared to outdoors production), to protect plants in unfavourable climates or to extend production (e.g. Artale, 2015 and AgroNotizie, 2011 for Italy; Vilt, 2021 for Belgium; Le Corre, 2016 for France; Hueso 2022 and Hueso et al., 2012 for Spain). Private individuals may also grow grapevine plants indoors (https://www.rhs.org.uk/fruit/grapes/indoor-cultivation). Protected conditions would be suitable for the pest, and it may establish under such conditions. However, the pest may be detected earlier than in the field, favouring successful elimination before it establishes.

Grapevine plants for planting are also commonly produced indoors to control pests and quality, but material likely originates from in vitro propagation and is subject to strict plant health controls (https://www.ouest-france.fr/pays-de-la-loire/montreuil-85200/viticulture-mercier-construit-une-mega-serre-en-vendee-7075977; https://www.pepinieres-mercier.com/nos-innovations.php).

Hosts may be grown in protected conditions in nurseries for ornamental purposes but the plants are normally used outdoors. The EWG concluded that the pest is very unlikely to establish in these conditions because, in commercial premises, no host plants would remain in protected conditions for a period sufficient to sustain a viable population. The pest is also likely to be detected, and if found, it may be eliminated.

The rating below applies to table grape production. The likelihood of establishment in protected conditions for the production of grapevine plants for planting and ornamentals is considered to be very low.

Rating of the likelihood of establishment in protected conditions	*Very low* ☐	*Low* ☐	*Moderate* ☐	*High*	*Very high* X
Rating of uncertainty			*Low* ☐	*Moderate* X	*High* ☐

Uncertainty: what would happen in structures where host plants are permanently present, such as collections, botanical gardens, private gardens, zoos, etc.; quality control and monitoring of host plants in nurseries and table grape production, whether current management practices may detect the pest early and eliminate it before it establishes.

11 Spread in the PRA area

Xylotrechus pyrrhoderus may spread naturally and with infested commodities.

Adult females and males can fly, but no information was found on their flight capacity or dispersal speed. Grapevine for commercial production is often concentrated in certain areas, and the EWG assumed that *X. pyrrhoderus* would be able to spread at least at a local and regional scale through natural spread. However, the pest may not spread long distances if host plants are present nearby.

For the related (but larger) species *X. chinensis* (introduced into Europe), ANSES (2023) concludes that it has spread by about 3.5 km per year based on the data on local dispersion in Catalunya, Spain, presented in Sarto i Monteys et al. (2021). However, this could be a combination of natural spread and human-assisted spread at a local scale. In France, in Gironde department, the data of local dispersion indicated 3.4 km per year. In Occitanie region, *X. chinensis* has spread about 70 km within 6 years (DRAAF Occitanie, 2024), which may be a combination of natural and human-assisted spread. Similarly to *X. pyrrhoderus*, *X.*

chinensis has a narrow host range and an adult lifespan of 3 weeks in insectaria (Sarto i Monteys et al., 2024).

Monitoring and control methods commonly used against other pests in commercial vineyards may limit spread as these same controls could be applied to *X. pyrrhoderus*. However, the range of methods applied especially in organic viticulture would be more limited, and grapevine plants are also present and not always managed in gardens and the natural environment. In addition, the other hosts of *X. pyrrhoderus* are ornamentals and infestations may not be noticed.

Host plants for planting are the main commodity likely to transport the pest between EPPO countries. Plants for planting of *V. vinifera* for commercial use would probably be subject to more scrutiny than ornamental host plants. Other commodities may play a role in the local and regional spread of the pest, such as items made of canes if not entirely dried (see section 8.2) and pruning waste.

Based on knowledge available for the related species *X. chinensis*, the potential spread of *X. pyrrhoderus* by the combination of natural spread and human-assisted pathways is estimated to be up to 10 km per year.

Rating of the magnitude of spread	*Very low* ☐	*Low* ☐	*Moderate* X	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* ☐	*High* X

Uncertainty: no information on flight capacity of the pest; if adults find suitable hosts, they may not fly over long distances; whether and how far infested commodities will be traded (plants for planting).

12 Impact in the current area of distribution

Little information about the impact caused by *X. pyrrhoderus* was found in the literature. Although *X. pyrrhoderus* is considered a moderate to severe pest of grapevine in Japan, Korea Rep. and China according to Wang. (2017, citing sources from 1920 to 2009), no recent information was found. USDA (2023) mentions that *X. pyrrhoderus* “has been known to reduce grape production by 10 to 20 percent” (referring to the situation the native range of the pest, no source nor date provided). No information was found on its impact on other hosts, nor in Korea Dem. Rep.

From an economic point of view, the pest may be more important for table grape than for wine production in its native area. At least in Japan and Korea Rep., grapevine is cultivated mainly to produce table grapes.

It is noted that the publications used often mention grapevine generally, and it is not always clear if the species was *V. vinifera* or another *Vitis*.

Japan. *Xylotrechus pyrrhoderus* was considered a pest of grapevine at least as far back as the early 20th century with Clausen (1931) citing studies on the biology of the pest by Matsumoto & Watanabe (1920). Yamada (1974) notes that changes in varieties (using late-harvest varieties) and growing practices led to increases in damage. Matsumoto & Fujiwara (1978) explain that *X. pyrrhoderus* was almost completely eradicated by a “BHC (benzene hexachloride) -based agent”. However, after the use of such products was banned, the pest started causing damage again. Tsuchiya (1988) notes that damage had been ‘extremely severe’ in emerging production areas in mountainous areas (referring to areas above 350 m above sea level), especially in young vineyards, where it was not uncommon that grapevine production in such vineyards was abandoned before the grapevines matured. Because damage mainly occurs from planting up to 4-year-old plants, the pest impacts grapevine training (shaping) and makes it difficult to grow commercially viable plants. Work on control methods was found in the literature from the 1970s-1980s (e.g. Yamada, 1974; Miyazaki et al., 1977; Ashihara, 1982a&b; Tsuchiya, 1988). Nevertheless, *X. pyrrhoderus* is currently a pest for which pest management recommendations are given (e.g. Hirai & Tsukio, 2022; Shimane Prefecture, 2024). In Shimane Prefecture, it is considered a ‘major pest’ of grapevine (Shimane Prefecture, 2024).

Korea Rep. The 'grape tiger longicorn' is one of the major pests of grapes in Korea Rep. (Yun et al., 2012). *Xylotrechus pyrrhoderus* has been occurring frequently and damaging grapevine since the beginning of the 1980s and is still occurring frequently. Damage can be so severe that it is 'almost impossible to harvest' (understood to mean that the yield is greatly reduced) (KRRDA, 2024).

China. *Xylotrechus pyrrhoderus* has been a pest in several vineyards of the varieties 'Cabernet Sauvignon' and 'Chardonnay' since the beginning of the 1990s (Rodríguez-González et al., 2022 citing Armendáriz et al. 2008 and Sakai et al., 1984). In some vineyards, between 20 and 90% of grape plants were infested by the pest, depending on management level and plant age (Wang, 2017 citing Huang & Yang 2002).

Massachusetts (United States). No damage has been reported in Massachusetts to date. Grapevines are cultivated in Massachusetts (Massachusetts Natural Resources Collaborations, 2023).

The literature available does not report on whether *X. pyrrhoderus* also has impact linked to an association of pathogenic fungi (see section 13). Environmental impact is not reported in the literature.

12.1 Control methods

In the current area of distribution of the pest, the strategies below are described in recent recommendations to grape growers. References are from Japan, except where another country is indicated. The most common management measures for this pest are cultural and chemical control (Wang, 2017 citing: Kim et al., 1991; Miao, 1994; Guo, 1999; Huang and Yang, 2002).

Cultural methods

The main cultural method is removing damaged/infested 'branches' during pruning (KRRDA, 2024; Wang, 2017 citing others; Liu, 2014). In particular, 'branches' that show brown areas near buds should be cut (Hirai & Tsukio, 2022). Pruned material should be destroyed; however, to be effective, this should be carried out in all vineyards of an area (Yamada, 1974).

Other cultural methods are mentioned:

- destruction of 'neglected' grapevine plants in the vicinity of vineyards (Yamada, 1974);
- removing larvae during winter pruning (Clausen, 1931 citing Matsumoto & Watanabe, 1920; Liu, 2014; Noukan, 2024). Yamada (1974) specifies this is done with a knife or similar tool, scraping around buds that have been eaten and turned black and stabbing larvae. On young vines, the bark of future main branches may also be removed. Killing larvae is labour-intensive and damaging to buds and branches (Yamada, 1974);
- capturing adults manually 'before the dew dries in the morning in August and September' (Liu, 2014).

Chemical control

Treatments are recommended in summer/autumn against adults and eggs, and during grapevine dormancy against larvae. Summer/autumn treatments can also target newly hatched larvae (Wang, 2017 citing others; Noukan, 2024). Where infestations are common every year, complete control can only be achieved if treatments are applied during the adult emergence period and during grapevine dormancy (Noukan, 2024). KRRDA (2024) mention that sprays of plant protection products after grape harvest from late August to early September (the peak period for adult development) should only be carried out in cases of high levels of infestation (cultural methods should be used in other cases).

Treatments against adults and eggs, as well as early larval instars:

- sprays every 7 to 10 days with trichlorfon or dichlorvos (Liu, 2014);
- in the treatment calendar of grapevine in the Nagano Prefecture, *X. pyrrhoderus* is one of the pests targeted by sprays from late August to early October (fenitrothion) (Australian Department of Agriculture, 2014);
- fenitrothion (early to mid-September), acetamiprid*[3] (early to mid-October) (Hirai & Tsukio, 2022);
- fenitrothion 2-3 times every 7-10 days (but not within 21 days before harvest, i.e. not on varieties that are harvested early) (Yamada, 1974).

[3] * Active substances approved in the EU (from EC, 2024).

Treatments during the dormant period of grapevine against larvae:

- injection in larval holes with trichlorfon, and sealing (Liu, 2014 – China). The EWG noted that it is not clear what this refers to;
- in the treatment calendar of grapevine in the Nagano Prefecture, *X. pyrrhoderus* is one of the pests targeted before budswell (fenitrothion, phenthoate) (Australian Department of Agriculture, 2024);
- late October to early November: fenitrothion, phenthoate (Hirai & Tsukio, 2022).

In Japan, pesticide sprays have been used during grapevine dormancy (Ashihara, 1982b citing Yamada et al., 1973; Yamada, 1974).

Natural enemies

The parasitoid wasp *Zombrus bicolor* (Enderlein) is a natural enemy of *X. pyrrhoderus* (Wang, 2017 citing Kim et al. 1991; Cao et al., 2012; Žikić et al., 2023). No information on its efficacy is available.

For the rating of the magnitude of impact, the EWG noted that there are recent references from the Korea Rep. and Japan, indicating that pest management measures are recommended and applied against the pest, but no evidence of major direct impact by this pest. In Japan and Korea Rep., table grapes are a valuable product, and this is possibly why the pest is subject to management and reported impact is currently low. There is historical evidence from Japan that when a management measure was removed, damage increased (Matsumoto & Fujiwara, 1978).

Rating of the magnitude of impact in the current area of distribution	*Very low* ☐	*Low* ☐	*Moderate* X	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* X	*High* ☐

Uncertainty. Not enough information from some countries where the pest occurs, no recent scientific publications. Impact on hosts other than *Vitis,* no quantitative data on yield loss.

13 Potential impact in the PRA area

Will impacts be largely the same as in the current area of distribution? **Yes** / No
The magnitude of potential impact was assessed to be a little higher than in the current area of distribution, but still within the moderate rating.

After its initial introduction, impact may be high because control methods may not be immediately available.

- Even if pest management measures are applied against other pests (see section 9.3 and elements about *X. arvicola* below) they will not fully control *X. pyrrhoderus* but may reduce populations.
- Commercial grapevine growing has a high economic value and the pest may have some economic impact due to loss of fruit or damage on young vineyards.
- The common practices of leaving pruning material mulched at varying lengths on the field may favour the increase of pest populations. In addition, mechanical pruning is increasingly used, and this will delay the detection of the pest.
- In organic farming, which is assumed to be more developed in part of the EPPO region than in the current distribution of the pest, impact could be high. For example, in Europe in 2019, certified organic vineyards accounted for 84% of the world's total certified organic vineyard surface area, with Spain, Italy and France accounting for 75% (about 342.000 ha in total, and over 13 % of the grape-growing area under organic cultivation in these countries) (OIV, 2021). As a comparison, there were 14.000 ha organic vineyards in China in 2019 representing 3% of the world's total certified organic vineyard surface area (OIV, 2021).

However, the commercial viticulture sector is expected to react fast to a new threat and pest management strategies would be adjusted. The costs incurred may be significant and it may be more difficult to find strategies for organic farming.

In relation to control methods, strategies using some techniques described in the native range (see section 12), or investigated against *X. arvicola* on grapevine in Spain may be considered (see below) but their efficacy against *X. pyrrhoderus* should be tested. It may be possible to develop trapping systems (see section 2.6). Traps baited with ethanol are used in vineyards affected by *X. arvicola* in Spain in order to detect the emergence of adults (Á. Rodríguez-González, pers. comm.). Effective pesticides may not be registered (see section 12.1) or may be deregistered in the future (acetamiprid). The application of plant protection products on grapevine during the period when adults or eggs are present may be subject to restrictions linked to fruit harvest.

Damage is likely to be more important on newly planted and young vineyards, rather than on vineyards in full production, because the pest may damage the structural part of the vines. However, mature vineyards may also be exposed to major yield losses due to attacks of fruiting canes. The plant material attacked is a major difference between *X. arvicola* and *X. pyrrhoderus*, because the former attacks mostly stem and branches on plants over 15 years old (Ocete et al., 2008). When *X. arvicola* has attacked the same vineyards over several years, affected plants or parts of plants have to be cut back, trunk and branches have to be reshaped, leading to loss of grape production in the following year. In the case of *X. pyrrhoderus*, mostly shoots/canes are attacked; there may be yield losses in one year but the plants are expected to recover.

Regarding control of *X. arvicola* on grapevine in Spain, limited methods are available. There is currently no registered active substance for the management of adults and eggs of *X. arvicola*. The only current cultural techniques consist of removing the rhytidome (dead phloem at the surface of the bark) of grapevines to prevent egg-laying or/and pruning branches below the affected area, so that the plant structure can rebuild again, but these techniques are expensive and the former one is not sustainable at a large scale. The restructuring of branches is easier in the 'bush/gobelet vine' training system than in the 'bilateral cordon' training system (Ramírez-Lozano et al., 2024 citing others). The EWG reviewed measures applied against *X. arvicola*, but did not think they would be effective against *X. pyrrhoderus* (which mostly infests shoots/canes rather than trunks and branches).

Some promising results with biological insecticides (spinosad and *Beauveria bassiana*) were obtained in assays against eggs, neonate larvae and adults (Armendariz et al., pre-print citing Rodríguez-González et al., 2016).

Even after control methods become available against *X. pyrrhoderus*, the pest would have a permanent added cost to production. In particular, mechanised pruning, which is commonly used, may not be possible anymore in areas where *X. pyrrhoderus* needs to be controlled. The presence of galleries may allow attacks by wood pathogens and cause decline. Galleries of *X. arvicola* on grapevine in one area of La Rioja (Spain) were found to be colonised by 20 species of fungi, including 7 species associated with grapevine decline diseases (such as the esca disease complex), 2 grapevine pathogens, and 4 species related to other plant diseases (García Benavides et al., 2013). Pruning methods should be adapted to take account of the pest and pruning waste should be systematically destroyed in a manner that prevents the survival of the pest. There would be additional costs of monitoring, treatment and training of labour.

It is uncertain if some impacts reported for *X. arvicola* on grapevine in Spain, and not reported for *X. pyrrhoderus* in the available literature, may happen, such as:

- Decay and death of affected branches, and eventually premature death of the plant (García Benavides et al., 2013 citing others);
- Impact on wine quality, with lower alcoholic percentage and higher organic acid concentration (García Benavides et al., 2013 citing others).

There may be impact on *Vitis vinifera* subsp. *silvestris*, which is present in nature and is considered endangered in several EPPO countries (see section 9.1).

The grapevine-growing industry is much larger in the EPPO region than in the native area of the pest. However, the rate of spread is not expected to be high, and impacts may not affect all parts of the EPPO region equally. Hosts (*Vitis* and others) that are not managed (abandoned vineyards, garden plants, hosts in nature) may provide reservoirs for the pest. Measures should be applied on other hosts, which are generally not managed. Damage to ornamental hosts may incur costs for private owners, but the EWG did not expect serious outbreaks in ornamental nurseries.

The variation in climatic conditions within the EPPO region means that not all areas are equally favourable for population growth and subsequently impacts will vary within the region. Natural enemies in the EPPO region may suppress the pest populations. However, no information was found on the ability of native parasitoids to parasitize *X. pyrrhoderus.* The native stephanid wasp *Stephanus serrator* (Fabricius, 1798) is a likely parasitoid of *X. chinensis* larvae in Spain (Sarto i Monteys & Torras i Tutusaus, 2018).

In conclusion, the EWG expects the impact in the EPPO region to be higher than in the native distribution, which is partially linked to permanent additional management costs, especially if the pest reaches major grapevine growing areas in favourable climatic conditions. However, for the EPPO region overall, the impact was still considered to be within the moderate rating, including the permanent additional costs that the establishment of this pest would lead to. The EWG assessed that the uncertainty is higher for the potential impacts in the EPPO region than for the impacts in the native area, and it was therefore rated as high.

Rating of the magnitude of impact in the area of potential establishment	*Very low* ☐	*Low* ☐	*Moderate* X	*High* ☐	*Very high* ☐
Rating of uncertainty			*Low* ☐	*Moderate* ☐	*High* X

Uncertainty: whether the pest would have economic impact where climatic conditions are marginally suitable; role of non-managed hosts in population build-up and whether the pest would have impact on hosts in natural environments; behaviour of the pest outside its native area (control by natural enemies and potential new host species); spread rate from the first outbreaks; effectiveness of current pest management practices; impact on hosts other than *Vitis*.

14 Identification of the endangered area

The endangered area corresponds to the potential area of establishment (Fig. 7b in section 9.2.2) where hosts are present (commercial vineyards and hosts in other environments). It includes parts of most EPPO countries. There is an uncertainty on whether the pest would have an economic impact where climatic conditions are not optimal and on hosts in the natural environment.

15 Overall assessment of risk

Summary of ratings**:**

	Likelihood	**Uncertainty**
Entry (overall)	Low	Moderate
Host plants for planting (except seeds, pollen, tissue cultures)		
- *Vitis* (where not prohibited)	Low	Moderate
- Other hosts	Low	Moderate
Establishment outdoors	Very high	Moderate
Establishment in protected conditions for table grape production	Very high	Moderate
Magnitude of spread	Moderate	High
Magnitude of impact in the current area of distribution	Moderate	Moderate
Magnitude of potential impact in the PRA area	Moderate	High

Xylotrechus pyrrhoderus is a pest native to East Asia with confirmed hosts in the family Vitaceae. Because several species and hybrids of *Vitis* are confirmed hosts, including species not native in East Asia, the EWG considered that all *Vitis* spp. are potential hosts. In addition, *Ampelopsis glandulosa* var. *brevipedunculata* (Vitaceae) is a confirmed host.

Plants for planting of *Vitis* spp. (for countries that do not prohibit the import of *Vitis*) and *Ampelopsis glandulosa* var. *brevipedunculata*, including propagation material and ornamentals, was identified as the most likely pathway, and overall, the likelihood of entry was rated as low with a moderate uncertainty. The trade of host plants for planting from countries where the pest occurs is expected to be low and this was taken into account in the rating.

Hosts of *X. pyrrhoderus* are widespread in the EPPO region, including *V. vinifera* and other *Vitis* spp. They are present in commercial cultivation, gardens, as ornamentals cultivated as climbing plants on buildings, and in nature. *Xylotrechus pyrrhoderus* is present under a wide range of temperatures in its native range, and it has a facultative larval diapause and is consequently expected to have some adaptability to environmental conditions. The likelihood of establishment outdoors was rated as very high with a moderate uncertainty. The pest may establish across a significant portion of the EPPO region where temperatures are suitable, and this area also covers the areas of grapevine cultivation. There is uncertainty regarding the northern limit and for the driest areas in the EPPO region. With climate change, the potential area of establishment was assessed to extend northwards. The likelihood of establishment in protected conditions for table grape production was also rated as very high with a moderate uncertainty.

The magnitude of spread was rated as moderate with a high uncertainty. There is no information on the dispersal capacity of the pest, and human-assisted pathways may play a role in the spread. Based on knowledge available for the related species *X. chinensis*, the potential spread of *X. pyrrhoderus* by the combination of natural spread and human-assisted pathways is estimated to be up to 10 km per year.

The magnitude of impact in the current area of distribution was rated as moderate with moderate uncertainty, also taking into account management costs. Although information is limited (including the absence of recent scientific publications), there are recent reports from the Korea Rep. and Japan indicating that pest management measures are recommended and applied against this insect. In Japan and Korea Rep., table grapes are a valuable product, and this is possibly why the pest is subject to management.

Potential impact was expected to be higher in the EPPO region than in the current area of distribution but was still rated as moderate, with a high uncertainty. After its initial introduction, impact may be high because control methods may not be immediately available. However, the commercial viticulture sector is expected to react fast to a new threat and pest management strategies would be adjusted. Damage is likely to be more important on newly planted and young vineyards, rather than on vineyards in full production. However, control methods would need to be implemented on all vineyards to prevent damage and the build-up of populations. Even after control methods become available against *X. pyrrhoderus*, the pest would have a permanent added cost to production. The presence of galleries may allow attacks by wood pathogens and cause decline. Pruning methods should be adapted to take account of the pest and pruning waste should be systematically destroyed in a manner that prevents the survival of the pest. There would be additional costs of monitoring, treatment and training of labour.

It is noted that with climate change, the potential area of establishment was assessed to extend northwards.

The phytosanitary risk for the endangered area (based on a three-level scale) was assessed to be moderate with a moderate uncertainty. No key uncertainty (see section 17) was identified that could affect this conclusion. The EWG noted that the risk is limited by the low likelihood of entry; however, the suitability of environmental conditions in the EPPO region, potential impact and the fact that the pest has entered the USA led to an overall moderate rating of risk.

Based on all the information in this PRA, the EWG identified management options for *X. pyrrhoderus*.

Stage 3. Pest risk management

16 Phytosanitary measures

16.1 Measures on individual pathways to prevent entry

Considering the likelihoods of entry and uncertainties, the EWG recommended that measures should be recommended for the following pathways: plants for planting (except seeds, pollen, tissue cultures).

Measures are recommended for all *Vitis* spp. and *Ampelopsis glandulosa*. If other species are proved to be hosts, measures should be extended to these species. To increase the level of protection, NPPOs may consider whether measures should also apply to the uncertain hosts *Parthenocissus tricuspidata* and *Celastrus orbiculatus*.

Measures were studied in detail for the pathway host plants for planting (except seeds, pollen, tissue cultures) (see ANNEX 1).

Pathway	**Measures identified**
Plants for planting (except seeds, pollen, tissue culture) of *Ampelopsis glandulosa* and *Vitis*	Pest free area (PFA) (ISPM 4, ISPM 29) (see requirements below) OR Pest-free production site[1] for the specified pest, established according to EPPO Standard PM 5/8 *Guidelines on the phytosanitary measure 'Plants grown under physical isolation'* + Stored in conditions preventing infestation OR Plants for planting which have not developed lignified parts yet OR Post-entry quarantine for one full cycle of vegetation (in the framework of a bilateral agreement)

[1] *The choice between pest free place of production and pest free production site is a decision to be taken by the NPPO based on the operational capacities of the producers and biological elements.*

Requirements for establishing a PFA:
Xylotrechus pyrrhoderus has a limited distribution in countries where it is present.

- The potential spread of *X. pyrrhoderus* by the combination of natural spread and human-assisted pathways was estimated to be up to 10 km per year (section 11). However, this data is not sufficient to recommend a minimum distance between a PFA and the closest area where the pest is present.
- To establish and maintain the PFA (ISPM 4, ISPM 29), a general surveillance in the area in the three years prior to establishment of the PFA and continued every year at suitable periods may be sufficient. This general surveillance should take account of data arising from grapevine production, as well as nursery production for other hosts of *X. pyrrhoderus*.
- In specific cases and in countries where the pest has been reported, specific surveillance should also be carried out in the zone between the PFA and known infestation to demonstrate pest freedom. The detection surveys to establish and maintain the PFA should be targeted for the pest and should be based on visual examination of host plants and the use of trapping in vineyards (however specific trapping systems are not currently available and would need to be developed – see section 2.6).
  Detection surveys should include high risk locations, such as places where potentially infested material may have been imported, commercial vineyards, areas with high use of climbing ornamental vines, abandoned vineyards.
  Awareness campaigns should be conducted especially at the edge of the proposed PFA when the pest is reported to be present locally.
- There should be restrictions on the movement of host material (originating from areas where the pest is known to be present) into the PFA, and into the area surrounding the PFA, especially the area between the PFA and the closest area of known infestation.

In addition, the plants for planting should be packed in conditions preventing infestation during storage.

16.2 Eradication and containment

Early detection would be essential for the eradication of *X. pyrrhoderus* but is complicated by:

- Possible confusion (larvae, pupae) with other Cerambycidae species requiring rearing to adult and identification.
- Early larval stages are small and do not produce clear signs of infestation. Low levels of infestation in a vineyard may be difficult to detect, even after budbreak, and even more on ornamental hosts.
- The male sex pheromone is known, but the possible trapping systems have apparently not been fully investigated. For successful eradication, this should be studied before the pest enters the EPPO region (see section 18).
- If the pest enters and establishes on its other host plants, it may build up populations that would then reach vineyards when the pest is well established and difficult to eradicate or control. Other hosts known to date are climbing plants, for which there is normally limited management, apart from cutting them down when they grow too large.
- The pest may reach *Vitis* spp. in nature, before action can be taken.

The adult is highly conspicuous, and awareness campaigns may be conducted for growers and the public, as launched in the USA (USDA, 2023; Massachusetts Natural Resources Collaborations, 2023).

If the pest is detected, thorough inspection and intensive trapping should be performed to delimitate infested areas (however trapping systems are not currently available and would need to be developed – see section 2.6). A suitable buffer zone should be established. No data on the dispersal capacity of *X. pyrrhoderus* is available, but data on *X. chinensis* indicates a spread (combined natural and human-assisted) up to 10 km per year. An initial inspection of a few kilometres around a first finding may be sufficient for the initial delimitation. The distances necessary would depend on the host presence in the vicinity (especially grapevine, in vineyards or other environments), environmental conditions in the area, and any factor that may reduce spread (e.g. natural barriers, absence of host plants within flight distance around grapevine production areas).

Eradication may be possible in limited settings, such as detection in a greenhouse or a nursery. In areas where the pest can establish outdoors, eradication would be difficult once adults have spread from the initial outbreak. It would also depend on the type of area (i.e. limited presence of hosts). Containment in an isolated area may be possible.

Intensive monitoring of the site and its surroundings, destruction of host plants in an area may be necessary (for vineyards, it should be considered if cutting-back the infested plant parts down to the woody part that is not infested), and chemical treatments should be used. There should be restrictions on the movement of plants and plant products (e.g. no canes should be moved from infested vineyards). Public information and outreach campaigns may help earlier reporting and better implementation of measures.

17 Uncertainty

The EWG used the categories of main sources of uncertainties (under development) discussed by the EPPO Panel on Phytosanitary Measures in October 2023:
- *Key uncertainties*: likely to significantly affect the overall conclusions (including overall risk and overall uncertainty) of the PRA (i.e. the determination of whether the pest has the characteristics of a quarantine pest, and the pathways that should be managed);
- *Other main uncertainties*: not likely to affect the overall conclusions of the PRA but likely to impact conclusions of individual part(s) of the risk assessment or risk management.

Key uncertainties	**Other main uncertainties**
None	Host range (incl. *Parthenocissus tricuspidata*)
	Dispersal capacity of adults
	Climatic suitability
	Whether objects made of canes are completely dried before dispatch (but transfer still unlikely)
	Potential impact, in particular given the lack of information on damage in the current distribution
	Volume of trade of hosts

18 Remarks

The EWG noted that the following work would address some main sources of uncertainty in the PRA, or improve detection and response to outbreaks in the EPPO region:

- Pheromone trapping including trap design and trapping protocols, and investigation of the efficacy of ethanol to trap *X. pyrrhoderus*;
- Reference sequences to perform molecular identification, especially of larvae and pupae;
- Biology: critical threshold temperatures and degree-days required for development of all life stages;
- Host range studies;
- Dispersal studies;
- More information from Massachusetts (hosts, distribution, possible pathways);
- Presence or absence on Hokkaido;
- Current situation (especially current impact) in the native area.

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ANNEX 1. Evaluation of possible phytosanitary measures for the main identified pathways, using EPPO Standard PM 5/3

The table below summarizes the consideration of possible measures for the pathways 'host plants for planting (except seeds, pollen, tissue cultures)' (based on the EPPO Standard PM 5/3).

When a measure is considered appropriate, it is noted "yes", or "yes, in combination" if it should be combined with other measures in a systems approach. "No" indicate that a measure is not considered appropriate. A short justification is included.

Option	Host plants for planting (except seeds, pollen, tissue cultures)
Existing measures in the PRA area	Partly. Some EPPO countries prohibit the import of *Vitis* or Vitaceae plants for planting.
	Options at the place of production
Visual inspection at place of production	Yes, in combination. Detection by visual inspection is unlikely to be completely effective and needs to be used within a systems approach. In that case, plants should be found free from signs and symptoms of infestation. Signs of the presence of larvae may be observed by inspecting around buds. Early infestations and low levels of infestation may be missed. There are no details on where to look for symptoms on other hosts; however, the elements above probably apply. Adults may be observed in summer/autumn. Although the male sex pheromone has been identified, there is no evidence that trapping systems are in use.
Testing at place of production	No. Systems for detecting larvae of certain Coleoptera species inside trees (e.g. sniffer dogs) exist (Eyre & Haack, 2017), but no reference on research or application for *X. pyrrhoderus*. Larvae are very small, especially on dormant plants, and such methods may not apply.
Treatment of crop	Yes, in combination. Current control relies partly on the application of plant protection products. Sprays can be applied against adults, eggs and early larval stages in summer/autumn, and against larvae during grapevine dormancy. However, they are not fully effective in controlling the pest. As for *Saperda candida* (EPPO, 2011), surveillance and forecasting should be in place to detect first emergences and be sure to cover the entire oviposition period taking into account persistence of insecticides.
Resistant cultivars	No. No resistant variety.
Growing under physical isolation	Yes. Plants for planting could be grown under protected conditions with sufficient measures to exclude the pest (following the EPPO Standard PM5/8(1) Guidelines on the phytosanitary measure 'Plants grown under physical isolation' – EPPO (2016)). Physical isolation during part of the growing season is not considered sufficient. The flight period of adults can differ depending on years, and it is not possible to determine a period in all locations and situations.
Specified age of plant, growth stage or time of year of harvest	<u>Size and age of plant:</u> Yes, for green cuttings or plants for planting without lignified parts. No for others. *Xylotrechus pyrrhoderus* attacks plants of different ages. <u>Growth stage/time of the year</u>: No. Life stages can be associated with plants for planting throughout the year.
Produced in a certification scheme	Not relevant (only if certification scheme fully conducted under physical isolation – see pest free production site below)
Pest freedom of the crop	See several options related to pest freedom of the crop are already reviewed in this table under: - Treatment of crop; - Growing under complete physical isolation;

Option	Host plants for planting (except seeds, pollen, tissue cultures)
	- Specified age of plant, growth stage.
Pest free production site	Yes, for grown under physical isolation (see Growing under physical isolation). No, for grown outdoors. Within a pest free production site, preventive treatments could be applied regularly to maintain the site as pest free, and regular inspections conducted. However, treatments would not be completely effective. A pest-free production site should be isolated from the infested area with a buffer zone, free from the pest and regularly surveyed. • There is no evidence on the flight capacity of *X. pyrrhoderus* (see section 2.4), and a pest-free production site may not be possible. • Theoretically, it may be possible to maintain a buffer zone without host plants or with surveillance around an infestation. The suitable size of the buffer zone cannot be determined as no data is available on the flight capacity of *X. pyrrhoderus*. A pest free production site outdoors may be reconsidered if data becomes available on the dispersal capacity of *X. pyrrhoderus*.
Pest free place of production	As for pest-free production site. As recommended by the EPPO Panel on Phytosanitary Measures, the choice between PFPP and PFPS is a decision to be taken by the NPPO based on the operational capacities of the producers and biological elements
Pest free area	Yes. *Xylotrechus pyrrhoderus* has a limited distribution in countries where it is present. • The potential spread of *X. pyrrhoderus* by the combination of natural spread and human-assisted pathways was estimated to be up to 10 km per year (section 11). However, this data is not sufficient to recommend a minimum distance between a PFA and the closest area where the pest is present. • To establish and maintain the PFA (ISPM 4, ISPM 29), a general surveillance in the area in the three years prior to establishment of the PFA and continued every year at suitable periods may be sufficient. This general surveillance should take account of data arising from grapevine production, as well as nursery production for other hosts of *X. pyrrhoderus*. • In specific cases and in countries where the pest has been reported, specific surveillance should also be carried out in the zone between the PFA and known infestation to demonstrate pest freedom. The detection surveys to establish and maintain the PFA should be targeted for the pest and should be based on visual examination of host plants and the use of trapping in vineyards (however specific trapping systems are not currently available and would need to be developed– see section 2.6). Detection surveys should include high risk locations, such as places where potentially infested material may have been imported, commercial vineyards, areas with high use of climbing ornamental vines, abandoned vineyards. Awareness campaigns should be conducted especially at the edge of the proposed PFA when the pest is reported to be present locally. • There should be restrictions on the movement of host material (originating from areas where the pest is known to be present) into the PFA, and into the area surrounding the PFA, especially the area between the PFA and the closest area of known infestation. In addition, the plants for planting should be packed in conditions preventing infestation during storage (see below Prevention of infestation by packing/handling method).
	Options after harvest, at pre-clearance or during transport
Visual inspection of consignment	Yes, in combination. Signs of presence may be observed. However, the absence of frass makes detection more difficult than for other wood borers. At low levels of infestation, the pest will be difficult to detect in large consignments. Larvae would be inactive in plants for planting transported at the dormant stage and in cool temperatures. Destructive sampling could be used but may miss young larvae if they are in another bud on the plant and would also decrease the value of the plants.
Testing of commodity	No. There is no information about methods that could be used for this pest. Methods that might

Option	Host plants for planting (except seeds, pollen, tissue cultures)
	detect Cerambycidae larvae (such as acoustic methods, sniffer dogs, laser vibrometry; Eyre and Haack, 2017) are not fully developed.
Treatment of the consignment	No. Hot water treatments can be used for *Vitis* plants for planting against pests (PM 10/16 Hot water treatment of grapevine to control *Viteus vitifoliae* (52 °C, 5 min), PM 10/18 Hot water treatment of grapevine to control Grapevine flavescence dorée phytoplasma (50 °C, 45 min). This second treatment is meant to be effective against several other grapevine pests (Annex II of PM 4/8 *Pathogen-tested material of grapevine varieties and rootstocks*). However, there is no data on the efficacy of hot water treatment on *X. pyrrhoderus* or other wood borers (Cerambycidae) of *Vitis*. A USDA treatment with methyl bromide fumigation in a vacuum exists against *Otiorhynchus* and *Brachyrhinus* borers in deciduous woody dormant plants (T201-a-2 in USDA treatment manual; USDA, 2024b). No treatment schedule exists for *X. pyrrhoderus*, and more importantly EPPO does not recommend phytosanitary measures using methyl bromide.
Pest only on certain parts of plant/plant product, which can be removed	No. The pest is present around buds. Removing buds and canes/shoots on which those are may remove the value of the plants for planting.
Prevention of infestation by packing/handling method	Not needed during transportation. It is unlikely that adults will infest plants during transport. Yes for storage, this should be combined with relevant measures. Plants for planting should be packed in conditions preventing infestation during storage. Plants could be stored outside of the flight period of the pest, but this period cannot be defined as there is incomplete data on emergence of adults in different locations. Handling and packing methods can prevent infestation during storage (e.g. packing the plants in facilities with screen houses). Infestation is most likely to happen in the production site. Storage of *Vitis* propagation material generally happens in screenhouses or in rooms at low temperature.
	Options that can be implemented after entry of consignments
Post-entry quarantine	Yes, in the framework of a bilateral agreement. Plants may be kept in post-entry quarantine for a sufficient time in conditions that are favourable to the development of the pest to detect signs of larval activity or adult emergence (a full cycle of vegetation to ensure the pest is detected if there were only eggs on the plants). This measure is likely to be applicable only for small scale imports of high value plants. Some countries require grapevine planting material to be treated before import into post-entry quarantine (e.g. Israel). The Panel on Phytosanitary Measures considered that this measure should only be proposed in the framework of a bilateral agreement.
Limited distribution of consignments in time and/or space or limited use	No. Plants for planting are destined to be planted, and if adults emerge, they could fly and find hosts in the vicinity. Limiting the distribution to areas where the pest is not likely to establish is not possible.
Surveillance and eradication in the importing country	No. Detection is difficult, especially at early stages of infestation. Signs of infestation are caused on grapevine by other wood borers in the EPPO region. Other hosts may have grown very high and would be impossible to inspect.

Possible combinations of measures identified as 'Yes in combination'

*The individual measures identified above as 'Yes in combination' were:

Host plants for planting
Visual inspection at the place of production
Treatment of the crop
Visual inspection of the consignment
Prevention of infestation by handling and packing methods

The EWG considered that these measures could not be combined to achieve a suitable level of protection because there are too many uncertainties on the effectiveness of the individual measures.

ANNEX 2. Duration of life stages of *Xylotrechus pyrrhoderus*

Some figures below are rounded. See original articles for precise figures. Similar information was not available for larvae and information is in the text. Figures in original publications are provided as means or estimates ('about').

Stage	Duration	conditions	reference
Egg	20 days at 15°C 11 days at 20°C 7 days at 25°C 6 days at 30°C	Laboratory experiment (16 h light: 8 h dark or 11:13 photoperiod)	Ashihara, 1982a (means)
	16 days at 15°C 10 days at 20°C 7 days at 25°C	Laboratory experiment (dark conditions)	Miyazaki et al., 1977
	6–7 days in summer 10–16 days in autumn	General statement	Shimane Prefecture, 2024
	About 1 week	summary of existing literature	Ashihara, 1982a
	About 6 days	General statement	Yamada, 1974
	About 5 days	General statement	KRRDA, 2024
	About 5 days	General statement	Clausen (1931, citing Matsumoto & Watanabe, 1920)
	7 days in late August – early September; 13 days in late September	Laboratory experiments with temperature and day length almost the same as in the field	Ashihara, 1982b
	7 to 12 days	General statement	Kim et al., 1988
Pupa	42 days at 15°C (16:8) 18–22 days at 20°C (both) 11–14 days at 25°C 10 days at 30°C (16:8)	Laboratory experiments (16:8 or 11:13 photoperiod)	Ashihara, 1982a
	10–14 days	Summary of existing literature	Ashihara, 1982a
	Range 10–14 days	Recovered from branches left outdoors (temperatures ranging from 23.9 to 27.9 °C)	Ashihara, 1982b
	About 10 days	General statement	Shimane Prefecture, 2024
	12 to 15 days	General statement	Kim et al., 1988
Immature adult in pupal cell (adult emergence to emergence from the cell)	24 days at 15°C (16:8) 9–12 days at 20°C (both) 9–12 days at 25C° 9 days at 30°C (16:8)	Laboratory experiments (16:8 or 11:13 photoperiod)	Ashihara, 1982a
	About 10 days	General statement	Ashihara, 1982a
	About 10 days	General statement	Miyazaki et al., 1977
	Range 9–12 days	Recovered from branches left outdoors (temperatures ranging from 23.8 to 27.9°C)	Ashihara, 1982b
	About 2 weeks	From pupae reared in the lab at 25°C with photoperiod 14 h light: 10 h Dark	Iwabuchi 1982
Adult after exiting the pupal cell (emergence from the cell to death)	About 2 weeks	General statement	USDA, 2023
	About 18–20 days at 25°C	From pupae reared in the lab at 25ºC with photoperiod 14 h light: 10 h Dark	Iwabuchi, 1988
	[26 days average egg-laying period of a female]	Experiments with males and females brought indoors	Miyazaki et al., 1977
	About 1 week	General statement	Clausen, 1931 citing Matsumoto & Watanabe, 1920
	About 15 days in the field. Wide range in experiments (4–24 days)	Experiments with males and females indoors (conditions not specified)	Tsuchiya, 1988
	24–41 days	General statement. This figure is understood to include the immature adult	Kim et al., 1988

ANNEX 3. Grapevine area in the EPPO region

Figures are from FAO Stat (area harvested grapes in ha) but see the notes for figures from other sources.

Country	Area (ha) (or note)	
	2021	2022
Spain	929390	922920
France	757830	757550
Italy	702670	709890
Türkiye	390221	384537
Portugal	175620	175790
Romania	163610	159740
Moldova Rep.	111871	114811
Uzbekistan	109585	113083
Germany	100710	100870
Greece	89840	84260
Georgia	76002	80579
Russian Fed.	76507	77878
Algeria	63443	64720
Hungary	59070	58010
Austria	42840	42840
Morocco	39336	39271
Ukraine	34700	29000
Bulgaria	28530	28470
FYR North Macedonia	23776	23047
Tunisia	19709	22976
Croatia	21210	20600
Serbia	20113	19973
Czechia	16360	16420
Azerbaijan	15100	14813
Switzerland	14629	14606
Slovenia	14900	14420

Country	Area (ha) (or note)	
	2021	2022
Kazakhstan	12626	12865
Albania	10548	10652
Belarus	8808	8427
Israel	8130	8214
Slovakia	7750	7790
Cyprus	6160	6100
Kyrgyzstan	4330	4160
UK[1]	3750	3928
Jordan	3151	3166
Bosnia & Herzeg.	4533	2873
Montenegro	2787	2519
Luxembourg	1230	1220
Poland	1000	1100
Belgium	560	680
Malta	460	460
Netherlands	190	210
Sweden[2]	90	90
Denmark[3]		100
Lithuania[4]		50
Latvia[5]		25
Estonia[6]		See note
Finland[7]		See note
Ireland[8]		See note
Norway[9]		See note

1 for 2021, estimated from Fig. 1 in Nesbitt et al. (2022); for 2022, Wine GB (2023). Replacing figures from FAO Stat.

2 170 ha in Southern Sweden. 300 vineyards, incl. 25 commercial vineyards approved by the authorities. (Kviklys et al., 2023)

3 >100 ha of commercial vineyards (Kviklys et al., 2023)

4 "grape growing", figure for 2021 (Kviklys et al., 2023)

5 "grape plantings" (Kviklys et al., 2023)

6 few producers. e.g. https://veinimae.ee/ has 2500m^2 protected area (long plastic tunnels), which can hold about 1200 2–5-year-old plants. In 2020, approx. 1.000 plants in open land.

7 about 50 respondents to a survey of the Finnish wine growing association on grapevine growing representing about 1500 acres in total grapevine amongst members of the (Viininkasvattajat, 2024)

8 few producers and amateurs (e.g. https://www.theoldroots.com/; https://www.rte.ie/news/ireland/2024/0626/1456671-wine-ireland/; https://www.thomaswalk-vineyard.com/home-english/history/; https://wineintro.com/regions/ireland/; http://irishgrapevines.ie/)

9 ≈40000 plants cultivated by ≈100 producers, most amateurs. 10 commercial plantations (Kviklys et al., 2023)

ANNEX 4. Köppen-Geiger climate types associated with *Xylotrechus pyrrhoderus* in its current range and their distribution in the EPPO region

The prevalent Köppen-Geiger (KG) climate types associated with precise observation points of *X. pyrrhoderus* as well as those found in administrative areas where the pest is known to occur (but with uncertain exact locations), were mapped for the recent climate period (1991–2020) and projected for the years 2041–2070 under Shared Socioeconomic Pathways (SSP) 245 and 370. Data for KG types were sourced from Beck et al. (2023) at a resolution of 0.1° (about 11 km at the equator).

- *Precise observation points*: from various publications (coordinates mentioned in few articles or estimated based on locations described in others). Observations in GBIF (2024) were also used[4].
- *Administrative areas where the pest occurs*: because the limited number of precise observation points does not fully represent the distribution recorded at the level of countries. These administrative areas were provinces of China and prefectures of Japan in Honshu, Shikoku and Kyushu (section 6), and the whole of Korea Rep. and Korea Dem. Rep. It is noted that the presence in Hokkaido is not confirmed.

To further explore the suitability of climate for *X. pyrrhoderus* within the grapevine production areas in the EPPO region, the distribution of major vineyards in Europe and Türkiye was cross-referenced to KG climate types associated with the pest. The data on the distribution of vineyards was retrieved from the CORINE Land Cover 2018 database (EEA, 2020). This data covers 'areas planted with vines and vineyard parcels covering >50% and determining the land use of the area' (Kosztra et al., 2019). Note that this data does not show areas where the coverage is < 50% nor vineyards in a large part of EPPO (North Africa, Middle East, Central Asia, Russia). This data is presented in the interactive maps (links in section 9.1 and 9.2). Fig. 4 in section 9.1 also illustrates grapevine cultivation in the EPPO region. See note in section 9.1 relating to data sources for grapevine cultivation.

KG climate types considered favourable for the establishment
According to the analysis, *X. pyrrhoderus* is present in the following KG climate types that are also present in the EPPO region:
- temperate, no dry season, hot summer (*Cfa*);
- cold, no dry season, with hot summers (*Dfa* – only 3 records) as well as cold, no dry season, with warm summers (*Dfb* – only 1 record). Hampden county in Massachusetts also falls under these climates (no precise location);
- cold, dry winter, with hot summer (*Dwa*) as well as cold, dry winter, with warm summer (*Dwb* – only 2 records.

The following climate types are present within the known range of the pest, but do not occur in the EPPO region: temperate, dry winter, with hot summer (*Cwa* – from precise observation points) and with warm summer (*Cwb* – from administrative areas).

The five climate types above delimit an area where conditions likely favour establishment in the EPPO region, i.e. limited parts of Italy and southern France, to Central and Eastern Europe, Black Sea, Russia and limited parts of Central Asia (see Fig. 6a in section 9.2.1; an interactive map can be downloaded at https://upload.eppo.int/download/2363oca96a3871. The interactive map and Table 1 further below show widespread grapevine presence under climate types *Cfa*, *Dfa* and *Dfb* in Europe/Türkiye, while areas with *Dwa* and *Dwb* (Far East Russia and Siberia) probably do not include major grapevine-growing areas.

Common to all these climate types are the hot or warm summers. Most records fall under *Cfa* and *Dwa*, i.e. with hot summers. 'Hot summer' for all climate types above are defined in Beck et al. (2023) with the air temperature of the warmest month $T_{hot} \geq 22$ °C, and 'warm summer' as not as above (i.e. air temperature of the warmest month $T_{hot} < 22$ °C) and the number of months with air temperature >10 °C (unitless T_{mon10}) ≥4.

KG types present in administrative areas where the pest occurs, and also in the EPPO region (no precise observation points found under these climate types):
- temperate, no dry season, warm summers (*Cfb*);
- cold arid steppe climate (*BSk*);
- cold, dry winter, cold summer (*Dwc*);

[4] with general uncertainties linked to such observations, and possible issues with identification.

- cold, no dry season, cold summer (*Dfc*).

These four climates delimit an area where conditions may favour establishment in the EPPO region, but with a higher uncertainty than above. The area concerned covers most of the EPPO region except a large part of the Iberic Peninsula, the Mediterranean Basin and parts of Türkiye and Central Asia (see Fig. 6 b in section 9.2.1; interactive map as above). In particular, *BSk* represents major areas of grapevine cultivation in EPPO (see interactive map and Table 1 below). As for above climate types, unknown factors probably influence establishment under cold climates.

The following climate types occur in administrative areas where *X. pyrrhoderus* is known to occur but were excluded from further analyses because the range of the pest presumably do not extent to these areas. Arid, steppe, hot climate type *Bsh* occurs in a very tiny area in the southwest corner of the Sichuan province.

- Tropical climate types *Af* and *Am* (rainforest and monsoon) occur only at the subtropical and tropical islands of Japan (e.g. Ogasawara Islands) that are apparently part of the Tokyo prefecture but located around 1000 km of Honshu; and *Aw* (savannah) occurs at the same subtropical and tropical islands of Japan and at the southernmost coastline of Xuwen county (Guangdong province) in China;
- Arid, desert, cold climate type (*BWk*) occurs only at the Gobi Desert (part of Neimenggu and Gansu provinces of China);
- Polar climates *ET* and *EF* (tundra and frost).

All climate types at precise observation points and in the administrative areas in the current range and in EPPO are presented in Map 1 below.

Table 1. Area of grapevine under the different Köppen Geiger climate types in Europe and Türkiye
Calculated by cross-referring the CORINE data with the KG data by Beck et al. (2023) (J. Tuomola, pers. comm.).

KG_type	Vineyards, km^2	Proportion of the total area %
Climate types at precise observation points		
Cfa	5473	13.40
Dfa	1662	4.07
Dfb	1279	3.13
Additional climate types at administrative areas		
Cfb	6833	16.73
BSk	11199	27.43

KG_type	Vineyards, km^2	Proportion of the total area %
Climate types not in the distribution of the pest		
Csa	12723	31.16
Csb	1411	3.46
BWk	112	0.28
BWh	54	0.13
Dsa	54	0.13
BSh	19	0.05
Dsb	12	0.03
Total	**40832**	**100**

KG types present in the EPPO region but not in the current distribution
The following climate types are not present in the current distribution of the pest, and it is uncertain if the pest could establish.

Climate types	Presence in EPPO	Relevance for the PRA
Temperate, dry, with hot or warm summer (*Csa* & *Csb*)	Mediterranean, Iberic peninsula, and parts of Central Asia	major grapevine-production areas in EPPO (see Table 1 in this annex)
Arid, steppe, hot (*BSh*)	limited areas of North Africa, Israel, Jordan and Cyprus	Grapevine probably grown
Arid, desert, hot (*BWh*)	desert areas of North Africa, the Middle East and Central Asia	Limited presence of grapevine (at least in Europe/Türkiye – see Table 1 in this annex)
Temperate, no dry season, cool summer (*Cfc*)	limited distribution in some mountain ranges (e.g. in Norway and Scotland)	Grapevine probably limited
Cold, dry summer with hot summer (*Dsa*), warm summer (*Dsb*), cold summer (*Dsc*), or very cold winter (*Dsd*)	limited distribution in some mountain ranges	Grapevine probably limited
Cold, dry and very cold winter (*Dwd*)	northern-central continental parts of Far-East Russia	Grapevine probably limited
Cold, no dry season, very cold winter (*Dfd*)	northern-central continental parts of Far-East Russia	Grapevine probably limited

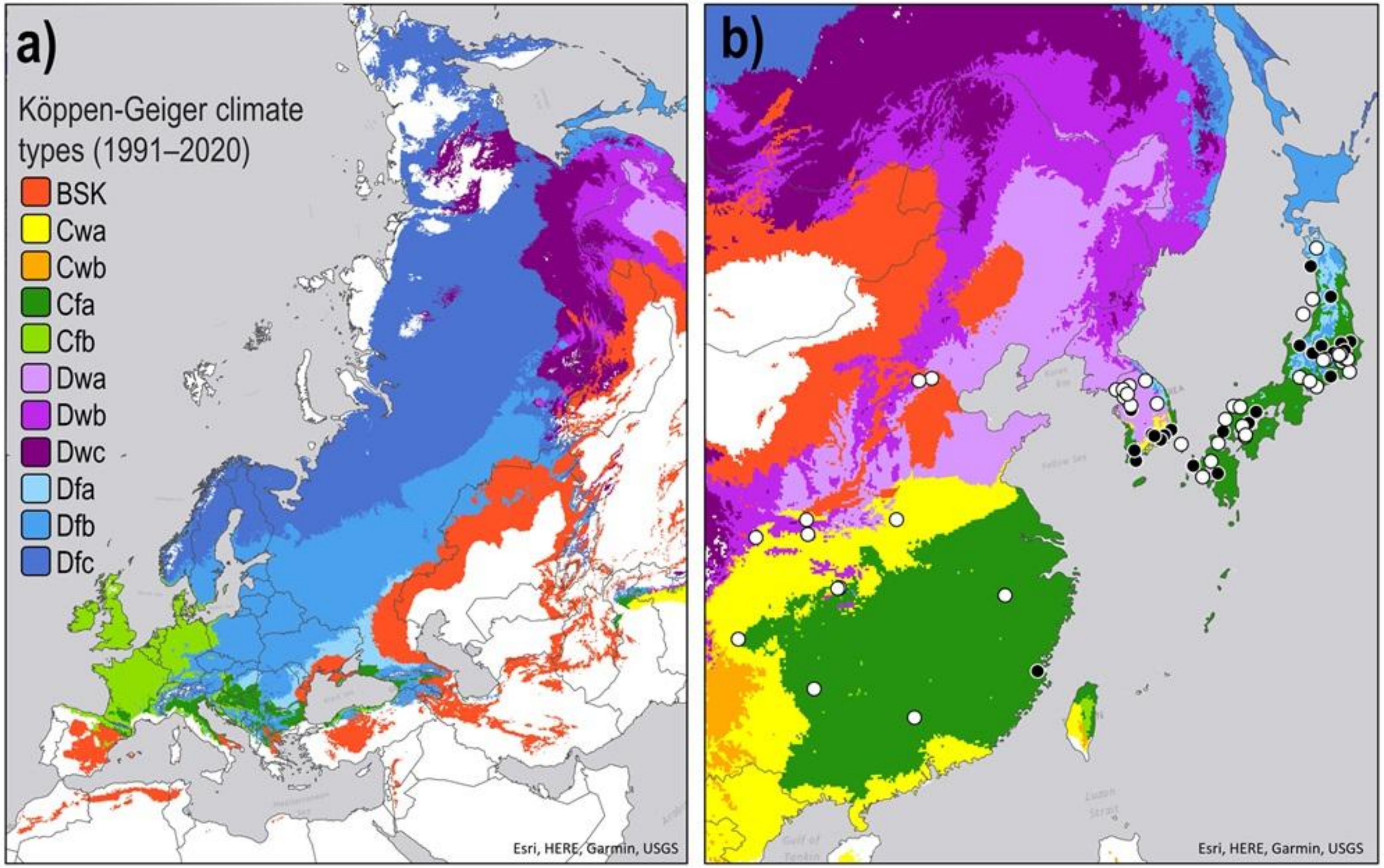
Map 1. Köppen-Geiger: climate types associated with *Xylotrechus pyrrhoderus* in the recent climate (1991-2020), based on observations from GBIF (2024) and various publications (prepared by J. Tuomola - Ruokavirasto, Finland).

Distribution in the recent climate (1991–2020). Data for Köppen-Geiger types were sourced from Beck et al. (2023) at a resolution of 0.1° (about 11 km at the equator).

(a) KG types present in the EPPO region matching those at precise observation points and administrative areas in the pest's distribution (same map as in Fig. 6b)

(b) Precise records retrieved from GBIF (2024) [black dots] and various publications (coordinates mentioned in the articles or estimated based on locations mentioned in the articles) [white dots] are displayed.

The country borders on the map were sourced from GADM (2020). A file with information about the mapped locations is available at: https://upload.eppo.int/download/2332o28d65b71d. Note that the following climates are not present in the EPPO region: *Cwa*, *Cwb*. Data on grapevine cultivation are provided in section 9.1 and in interactive maps (links in sections 9.1 and 9.2).

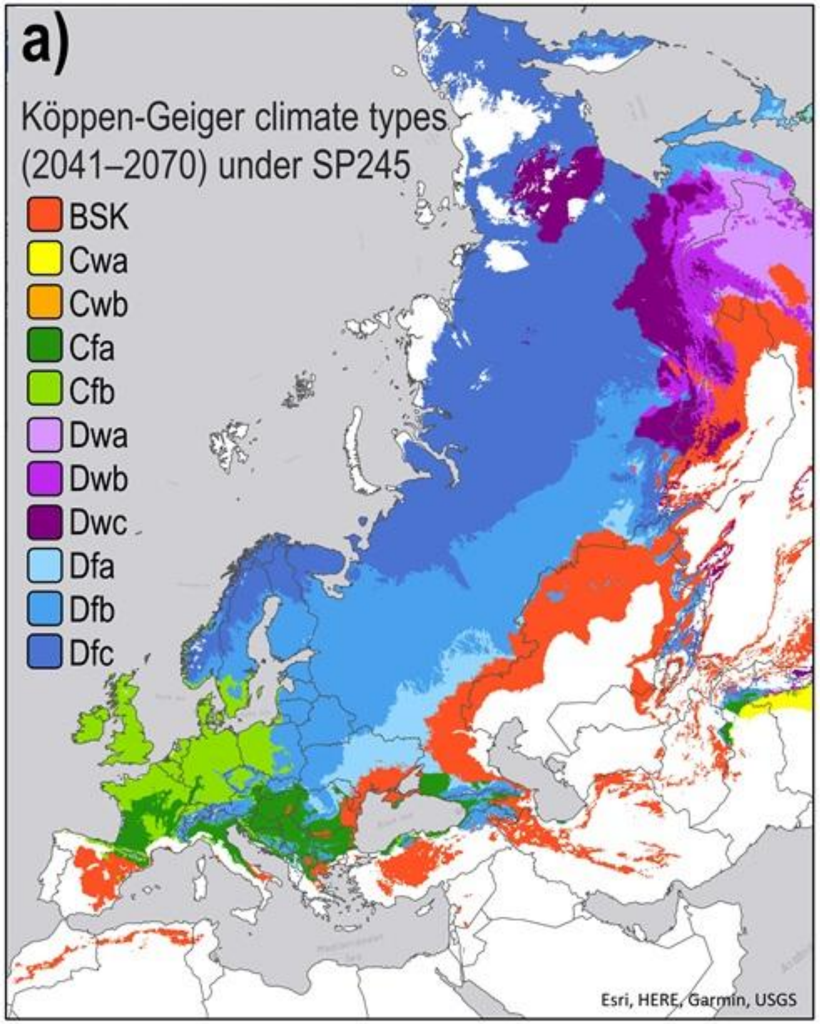


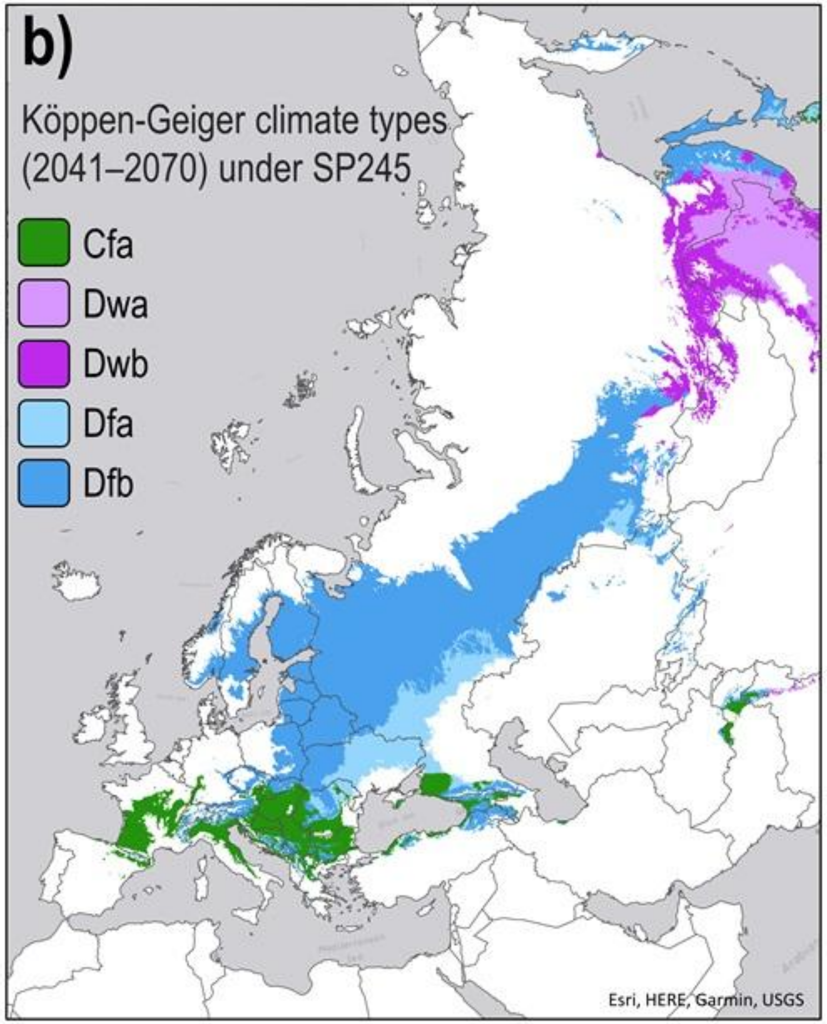
Map 2. Projection of Köppen-Geiger climate types for the EPPO region for the years 2041-2070 under the scenario SSP 245 (prepared by J. Tuomola - Ruokavirasto, Finland). (prepared by J. Tuomola - Ruokavirasto, Finland).

(a) All climate types associated with *X. pyrrhoderus*. Note that the following climates are not present in the EPPO region in the projection for the years 2041-2070: *Cwa*, *Cwb*.

(b) The 5 Köppen-Geiger climate types that delimit the area where conditions are likely favourable to establishment in the EPPO region (see Fig. 6 in section 9.2.1 for the map showing the current distribution of these climate types in the EPPO region).

Data on grapevine cultivation are provided in section 9.1 and in interactive maps (links in section 9.1 and 9.2).



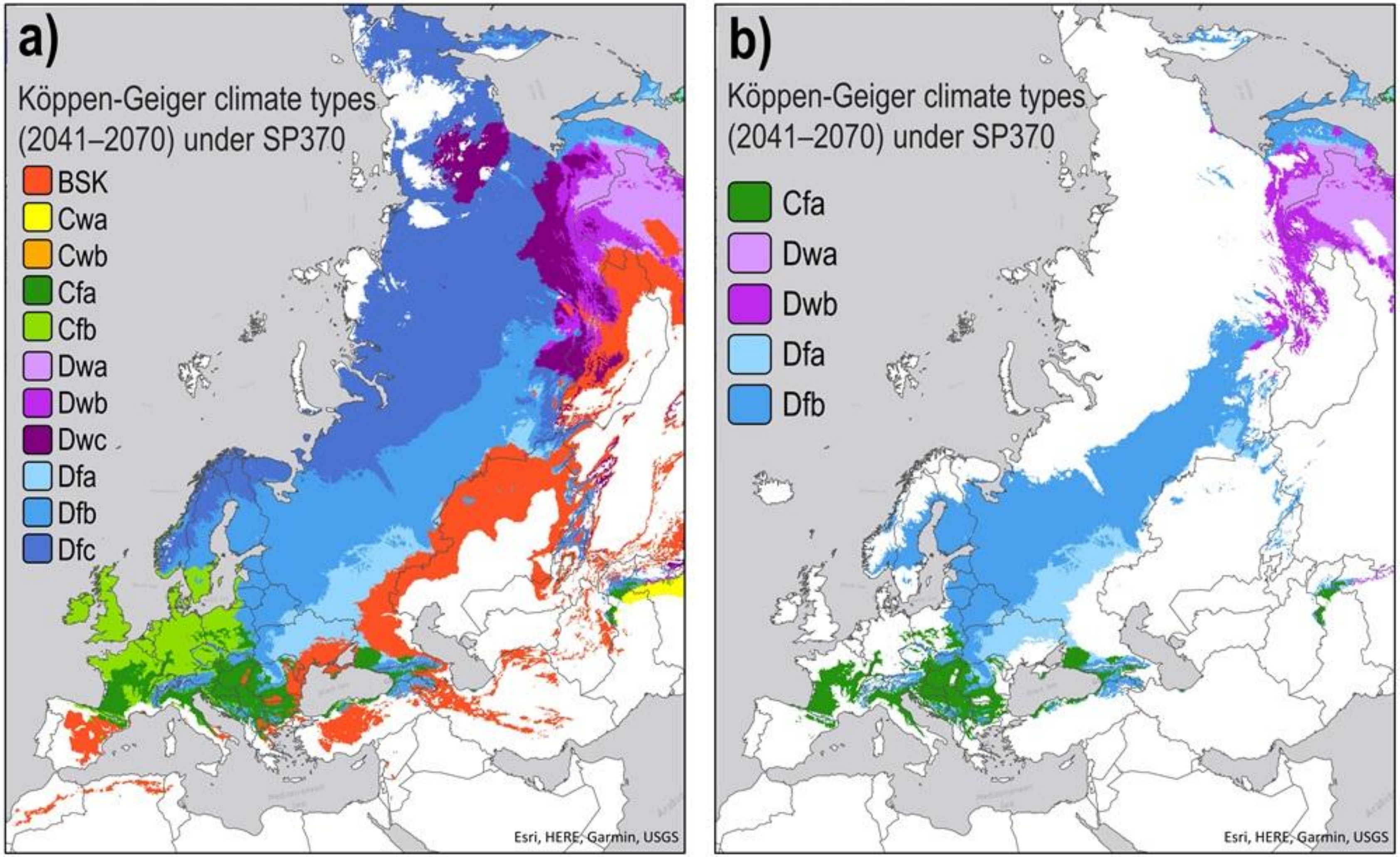


Map 3. Projection of Köppen-Geiger climate types for the EPPO region for the years 2041-2070 under the scenario SSP 370 (prepared by J. Tuomola - Ruokavirasto, Finland).

(a) All climate types associated with *X. pyrrhoderus*. Note that the following climates are not present in the EPPO region in the projection for the years 2041-2070: *Cwa*, *Cwb*.

(b) The 5 Köppen-Geiger climate types that delimit the area where conditions are likely favourable to establishment in the EPPO region (see Fig. 6 in section 9.2.1 for the map showing the current distribution of these climate types in the EPPO region).

Data on grapevine cultivation are provided in section 9.1 and in interactive maps (links in sections 9.1 and 9.2).



ANNEX 5. Climate matching

The CLIMEX software and the “match regional climate” algorithm was used to assess climatic similarity between the precise observation points of *X. pyrrhoderus* (“home” locations – corresponding to precise observation points in 9.2.1) and the EPPO region (“away” locations). The “match regional climate” algorithm compares climatic variables between all the “away” locations to each of the “home” locations as a separate run and retains the best match from all the runs as a final result for each “away” location (Kriticos et al., 2015). The Composite Match Index (CMI), which ranges from zero (very low similarity) to one (very high similarity), was used to describe the climatic similarity. The general rule of thumb is that CMI ≥ 0.7 indicates high enough similarity to allow establishment (Roigé & Phillips, 2021).

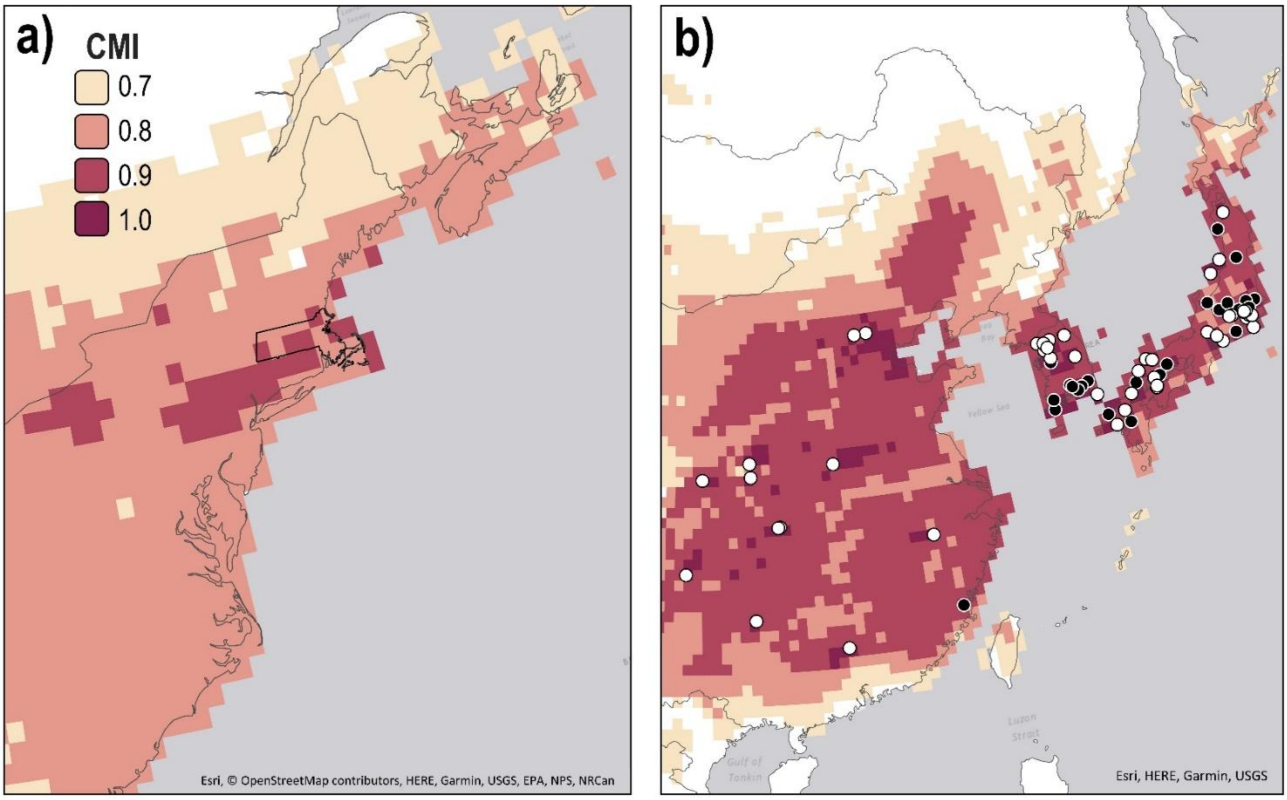
The analyses were run using two different settings of the parameter values. The first run used the default settings of the algorithm (i.e. equal weighting of minimum and maximum weekly temperatures, weekly rainfall pattern and total annual rainfall), and the second run used only the minimum and maximum weekly temperatures. Both analyses were run in a 30-arc minute spatial resolution, using climatological data on the recent climate as 30-year average centred on 1995, acquired from the CliMond climatic database (www.climond.org; Kriticos et al., 2012).

This Annex presents the climate match more detail in the native area of *X. pyrrhoderus* and in Massachusetts, the USA. **Map 1** presents the climate match when the default settings of the CLIMEX “match regional climate” algorithm were used, and **Map 2** presents the match when only the minimum and maximum weekly temperatures were used. Precise observation points of *X. pyrrhoderus* retrieved from GBIF (2024) [black dots] and various publications (coordinates mentioned in the articles or estimated based on locations mentioned in the articles) [white dots] are displayed on the maps. The country borders on the maps were sourced from GADM (2020).

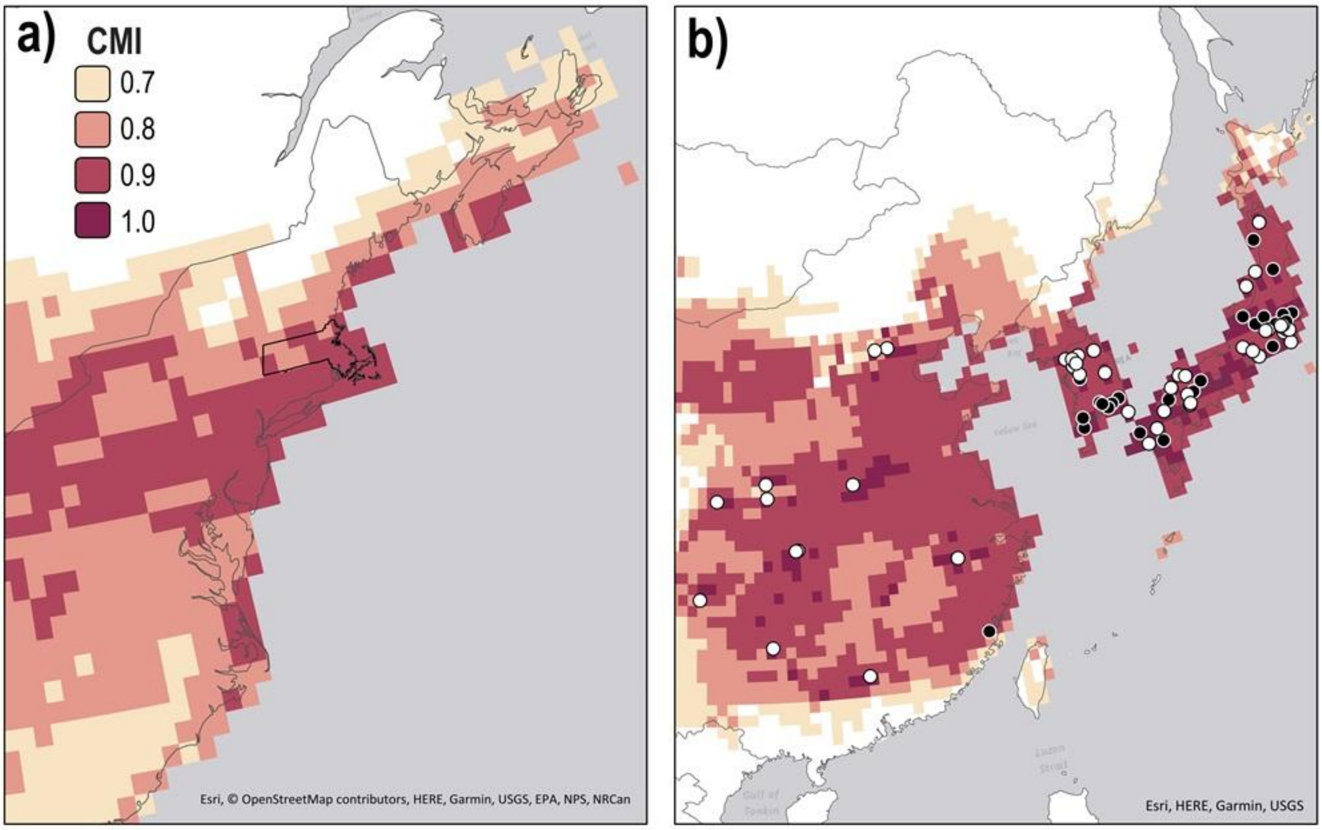
(a) Climate matching in Massachusetts, the USA, and in the surrounding areas
(b) Climate matching in the native area of the pest.

Data on grapevine cultivation are provided in section 9.1 and the interactive maps (link in section 9.2). A file with information about the mapped locations is available at: https://upload.eppo.int/download/2332o28d65b71d

Map 1. Climate match with default setting



Map 2. Climate match with only the minimum and maximum weekly temperatures



Potential reasons for uncertainty on range:

- The overall range considered suitable for establishment based on CLIMEX matching depends on the climatic variables and their weights used in the analysis. Changes in the variables and their weight would automatically change the estimated range of the pest (e.g., see the difference in Fib 7a and 7b). The settings used in this assessment applied equal weighting to minimum and maximum temperatures.
- CLIMEX matching is based on the temporal patterns of climate variables. Significant differences in these patterns between compared locations might yield CMI values lower than 0.7 (generally considered unsuitable for establishment), even if the overall temperatures are similar between the compared locations and consequently potentially suitable for establishment.
- The CLIMEX matching was based on a limited number of occurrence records of the pest, which may not represent the full range of climatic conditions in which the pest occurs, and which are consequently suitable for it. Adding more records to the analysis might expand the area suitable for establishment in the EPPO region.