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Pest Risk Analysis for

Aromia bungii

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This risk assessment follows the EPPO Standard PM PM 5/3(5) Decision-support scheme for quarantine pests (available at http://archives.eppo.int/EPPOStandards/pra.htm) and uses the terminology defined in ISPM 5 *Glossary of Phytosanitary Terms* (available at https://www.ippc.int/index.php).
This document was first elaborated by an Expert Working Group and then reviewed by the Panel on Phytosanitary Measures and if relevant other EPPO bodies.

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Photo:Adult Aromia bungii. Courtesy Raffaele Griffo, Plant Protection Service Regione Campania, Napoli, (IT)

Pest Risk Analysis for *Aromia bungii*

This PRA follows the EPPO Decision-support scheme for quarantine pests PM 5/3 (5).
A preliminary draft has been prepared by Dr Cocquempot and this served as a basis for the work of an Expert Working Group that met in Napoli on 2013-11-11/15. This EWG was composed of:

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Core members (Mr Guitian Castrillon, Mr Kapitola, Mr MacLeod, Ms Petter, Mr Pfeilstetter, Mr Sletten, Ms Ustun) reviewed the draft PRA between January and February 2014. The risk management part was reviewed by the Panel on Phytosanitary Measures on 2014-03-06. The PRA report was reviewed by Working Party on Phytosanitary Regulations on 2014-06-18.

Content

Stage 1: Initiation

1.01 - Give the reason for performing the PRA
Identification of a single pest
In 2011, the presence of *Aromia bungii* was recorded for the first time in one location in Bavaria, Germany. In 2012, its presence was also reported in Campania, Italy and in 2013 in Lombardia, Italy. In both countries, eradication measures have been taken (see 5.01) but considering the long life cycle of the pest, it cannot be concluded if they have been successful yet. In addition, *A. bungii* has been intercepted in containers or in wood packaging material. As a result, 3 express PRAs have been prepared by Germany, The Netherlands and the UK and they all concluded that *A. bungii* may pose a threat for the stone fruit production in the EPPO region. In 2013, the Working Party on Phytosanitary Measures decided that an EPPO PRA should be prepared.

1.02a - Name of the pest
Aromia bungii

1.02b - Indicate the type of the pest
Arthropod

1.02d - Indicate the taxonomic position
The taxonomic position is as follows:
Domain: Eukaryota
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Hexapoda
Class: Insecta
Order: Coleoptera
Family: Cerambycidae
Subfamily: Cerambycinae
Tribe: Callichromatini
Genus: *Aromia* Audinet-Serville 1834
Species: *bungii* (Faldermann 1835)
Synonyms: *cyanicornis* Guérin Méneville, 1844; *ruficollis* Redtenbacher, 1868.

Aromia bungii (Faldermann, 1835) is a well-defined single taxonomic entity. The genus *Aromia* Audinet-Serville, 1834 is mainly represented in the Palaearctic region with an expansion in the Oriental region. It is a small genus with only four species: *bungii*, *japonica* Podaný, 1971, *moschata* (Linnaeus, 1758) and *orientalis* Plavilstshikov, 1933. All other taxa under the genus *Aromia* are synonyms or subspecies from the four valid *Aromia* species (Gressitt, 1951; Podaný, 1971; Löbl & Smetana, 2010).
The typical adult form of *A. bungii* is easily recognizable with its brightly black elytrae and its red dorsal region of prothorax which is the reason of its common name “red neck longhorn beetle”. The chromatic variety *cyanicornis* Guérin-Méneville, 1845 is entirely brightly black.

Common names: Red neck longhorn beetle, Peach red necked longhorn, Plum and peach longhorn, Peach longicorn beetle, Peach musk beetle, Peach borer (EN), Cerambice cinese delle drupacee (IT), Asiatischer Moschusbock (DE)

1.03 - Clearly define the PRA area
The PRA area is the EPPO region.

1.04 - Does a relevant earlier PRA exist?
yes
Express PRA for Germany (Schrader & Schröder 2012).

Initiation

Quick Scan for the Netherlands (Anonymous, 2012)
Rapid PRA for UK (for the entire EPPO region) (Anderson *et al*. 2013).

In addition, it is noted that *A. bungii* is listed as a quarantine pest in countries such as the USA (USDA Aphis, 2011) and Australia (Biosecurity Australia, 2003).

1.05 - Is the earlier PRA still entirely valid, or only partly valid (out of date, applied in different circumstances, for a similar but distinct pest, for another area with similar conditions)?
not entirely valid
Partly valid. The Panel on Phytosanitary Measures considered that a more detailed PRA was needed to support the recommendation to list this pest as a quarantine pest. In particular more information should be gathered to define the endangered area and the risk management options.

1.06 - Specify all host plant species. Indicate the ones which are present in the PRA area.
Aromia bungii is an oligophagous species. Its host range may be limited to *Prunus* spp. However, a number of other host plants in other families are reported (see table below, under '*Plant species reported as associated with* A. bungii *with limited information, host status needs confirmation'*), mostly without any supporting evidence. Most host plant lists are compilations (e.g. Hua, 2002; Smith, 2009) but these do not provide the references supporting the listing.
Although it has been reported so far on a limited number of *Prunus* species, it should be noted that it has already extended its host range to new *Prunus* species in the outbreaks in Italy and Japan and therefore it is likely to affect many more species in the genus if it establishes in the PRA area.

Scientific name	Common name	Reference/Comments
Main hosts for which there is detailed data		
Rosaceae		
Prunus americana Marshall	American plum	SEAP, 2009
Prunus armeniaca L.	Apricot	Main host in China (e.g. AICD 1975; Liu *et al*., 1999; SEAP, 2009) and in Italy (Garonna, 2012)
Prunus avium (L.) L.	Cherry	New host in Italy (EPPO. 2013c) and in Japan (Anonymous, 2013; EPPO. 2013b)
Prunus cerasifera Ehrh.	Myrobolan	New host in Italy (observation in Campania). Used as rootstock in Italy for stone fruits.
Prunus domestica domestica L.	Common plum	Main host in China (Huang *et al*., 2012) and in Italy (Garonna, 2012)
Prunus domestica institia (L.) C. K. Schneid.	Damson plum	Burmeister, 2012, in Germany
Prunus grayana Maximowicz	Japanese bird cherry	Gressitt, 1951; Hua, 2002; Matsushita, 1941
Prunus japonica Thunb.	Korean cherry, flowering almond or oriental bush cherry	Gressitt, 1942
Prunus mume (Sieb.) Sieb. et Zucc.	Japanese apricot	Gressitt, 1942 Host in Japan (Anonymous, 2013)
Prunus persica (L.) Batsch	Peach	Main host in China (e.g. Gressitt, 1942; AICD 1975, SEAP, 2009) and in Italy (EPPO, 2013a)
Prunus pseudocerasus (Lindley) Loudon	False cherry	Hua *et al*., 1993 Cultivated in China, ornamental in the PRA area
Prunus salicina	Japonese plum tree	Zhao *et al*. (1997) in Fujian province (SE China)

	or nane tree	
Prunus yedoensis Matsumura	Yoshino cherry	Ornamental species Gressitt, 1951; Hua, 2002
Plant species reported as associated with* A. bungii *with limited information, host status needs confirmation		
Ebenaceae		
Diospyros kaki L.	Persimmon	Hua, 2002, Smith, 2009; SEAP, 2009
Diospyros lotus L.	Date plum	Smith, 2009; SEAP, 2009
Diospyros virginiana L.	American persimmon	Smith, 2009
Fagaceae		
Castanea mollissima	Chinese chestnut	Tang *et al.*, 1988: Record in Zhejiang, not noted as a major pest.
Quercus spp.	Oaks	Lei & Zhou (1998) in Hubei, China (cited by Zheng *et al.*, 2006); Hua, 2002
Juglandaceae		
Juglans regia L.	Walnut	Hua, 2002
Pterocarya stenoptera C. de Candolle	Chinese Wingnut	Smith, 2009
Meliaceae		
Azadirachta indica A. Juss.	Neem tree	Smith, 2009
Oleaceae		
Olea europaea L.	Olive	Smith, 2009
Poaceae		
Bambusa textilis Mc Clure	Weavers bamboo	Smith, 2009
Punicaceae		
Punica granatum L.	Pomegranate	Listed in general host lists (e.g. Smith, 2009) Not mentioned in Yu & Mei (2005), but this is only for Guizhou, SE China
Rosaceae		
Pyrus bretschneideri Redh.		Only one record in a commodity PRA (AQIS, 1998; AQIS 2005). Noted as present in Hebei and Shandong.
Rutaceae		
Zanthoxylum bungeanum Maximowicz	Chinese Prickly-ash (Sichuan pepper)	Yu & Mei (2005) (in Guizhou, SE China). Only ornamental in the EPPO region (e.g. as bonsais)
Citrus spp.	Citrus trees	Li-ying *et al*. (2007) for Southern China. The article does not specify the species of Citrus concerned, and list *A. bungii* as a minor pest.
Salicaceae		
Populus spp.	Poplars	Smith (2009). While searching literature on *Apriona germari*, a serious wood borer of poplar in China (EPPO, 2013), no articles were found mentioning *A. bungii*. However Ji *et al*. (2011) mentioned that “There are more than 100 species of poplar longhorn beetles in China, but only a few species are seriously destructive”.
Populus alba L.	White poplar	Wu & Wu (1995), in Zhejiang, China; Lei & Zhou (1998), in Hubei, China. No information of the level of damage.
Populus tomentosa Carrière	Chinese white poplar	Ostojá-Starzewski & Baker, 2012
Salix spp.	Willows	Hua, 2002; included in the list of wood borers and noted as an important pest without details (Chiang, 2009). It may be a confusion with *Aromia moschata ambrosiaca* Steven, 1809 which is a known pest of Salix and has also a red prothorax.

Theaceae		
Schima superba Gardner & Champion		Smith, 2009. Ornamental plant in the EPPO region

Note: *Rubus idaeus* L. (Raspberry) is only reported by Fu (2011) in Liaoning, China. This seems a very doubtful record considering the small size of the stem and the biology of the plant and the pest. In addition it is not a peer-reviewed paper but a report of a master's thesis. Also only the abstract is available and the English translation is quite poor.

1.07 - Specify the pest distribution

Aromia bungii is native mainly from the southeastern Palaearctic ecozone with an expansion in the Oriental region.

Asia.

- China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hong Kong, Hubei, Hunan, Inner Mongolia, Jiangsu, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang) (Bates, 1891; Hua, 2002; Hua *et al*., 2009; Faldermann, 1835; Guérin Méneville, 1844; Redtenbacher, 1868; Ganglbauer, 1887; Li, 2009; Podaný, 1971; Qi, 1999; Yiu, 2009; Löbl & Smetana, 2010; Danilevsky, 2013)
- North Korea (Okamoto, 1927; Matsushita, 1933; Lee, 1982),
- South Korea (Okamoto, 1927; Matsushita, 1933; Lee, 1982, Li *et al.*, 2013),
- Mongolia: *Aromia bungii* is described from East Mongolia (Faldermann, 1835), which is reported also by Plavilstshikov (1934) and Podaný (1971). The confirmation asked by Danilevsky (2004, 2007) is given by Namkhaĭdorzh (2007) who reports the species without doubt from the Mongolian Plateau.

-Vietnam: The occurrence of *A. bungii* in Vietnam is reported by entomologists in some blogs or fora in the province of Ha Jiang (e.g. http://www.cerambycoidea.com/forum/topic.asp?TOPIC_ID=15438) as well as in Biolib (2010). However it was not possible to find a peer-reviewed publication confirming this. The EWG concluded that the pest is probably present in Vietnam.

-Japan: recently introduced (Anonymous, 2013, EPPO, 2013b).

Doubtful records:

- Taiwan: mentioned in Smith, 2009, as well as by others (e.g. Ostojá-Starzewski & Baker, 2012). However, the origin of this record could not be traced back. *A. bungii* is not included in the recent Atlas of Taiwanese Cerambycidae (Chou, 2008).
- Russia: Far East, mentioned by Kolbe (1886) in areas close to China and Mongolia.

EPPO region

-Italy: two outbreaks (under eradication, see answer to question 5.1) in Campania and Lombardia (Garonna, 2012; EPPO, 2012b; Bariselli & Bugiani, 2013; Garonna *et al*., 2013; EPPO, 2013a).

-Germany: one outbreak in Kolbermoor, Bavaria (under eradication) (Burmeister, 2012; Burmeister *et al*., 2012; EPPO, 2012a; Schrader & Schröder, 2012). Intercepted in Baden-Wuerttemberg in 2008-11 (G. Schrader, pers. comm., 2013).

-UK: adults intercepted only (among wooden pallets) (Reid & Cannon, 2010).

America

USA: intercepted only in a warehouse (Smith, 2009) and in an empty container in the port of Blaine (Washington State) on 2010-07-30 with no known information about the prior load in the container (P. Touhey, USDA-APHIS-PPQ, pers. comm., 2013).

Categorization

It was considered that there is no need to answer the questions from the Categorization section as it is clear from the outset (and the Express PRAs already performed, see 1.04) that the criteria in the definition for a quarantine pest are satisfied by *A. bungii*.

Stage 2: Pest Risk Assessment Section B:

2. Probability of entry of a pest

2.01a - Describe the relevant pathways and make a note of any obvious pathways that are impossible and record the reasons.

This answer is structured as follows:

1. Wood and wooden products of *Prunus* spp. from where *A. bungii* occurs
2. Plants for planting of host plants (except seed) from where *A. bungii* occurs
3. Other pathways

1. Wood and wooden products of *Prunus* spp. from where A. bungii occurs
The EWG considered that any wood or wooden products of *Prunus* species which are large enough to sustain the life cycle of the pest to adult emergence and which has not undergone treatment to kill the pest represent a risk.
Questions of the PRA scheme PM 5/3 are answered for wood (see questions 2.03 to 2.11 for pathway 1), but for other commodities (wood packaging, wooden furniture, wood waste, wood chips), the probability of entry is simply described as there is not enough information to answer individual questions.

2. Plants for planting of host plants (except seed) from where *A. bungii* occurs
Eggs may be present in the bark, larvae and pupae in stems or branches (Gressitt, 1942). This pathway covers also the rootstock. Most hosts of *A. bungii* may also be used as bonsais.
Details for this pathway are available in answers to questions 2.03 to 2.11 for pathway 2.

3. Other pathways
Hitch-hiking. There are indications that adults may be hitch-hikers as some beetles were found in premises where goods have been imported but no signs of infestation were found in the associated wood packaging material still present:
- 1 adult female was found in a manufacturing plant at the port of Seattle (WA, USA) importing goods from China and Taiwan in July 2008 (Smith, 2009). No sign of beetle attack was found on the pallets.
- 1 adult was found at the port of Blaine (WA, USA) on 2010-07-30 in an empty Sea Container with no information available about the prior load in the container (Pete Touhey, USDA-Aphis, pers. comm., 2013).
Adults are reported to have a relatively short life span (10 days according to Huang *et al*., 2012; about 15-20 days according to Garonna *et al.*, 2013) compared to the time of transport by sea containers (about 25-35 days between China and Europe according to the website SeaRates[1] but this may be up to 40-50 days including transhipment). However F. Nugnes (pers. comm., 2013) reports that adults can be maintained alive in the laboratory in Petri dishes at 8°C for 2 months (with some food – peach fruit- available). Therefore it can be considered likely that they can survive in refrigerated containers or when the temperature during transport is low. Hitch-hiking is of course also possible for commodities transported by plane.
Hitch-hikers may potentially be present on any import or conveyance of imported goods, however the risk would be limited to the adults, and association of more than one adult with a consignment is unlikely. There is a greater risk of introduction in ports and other points of entry because of the potential bulk storage of imported consignments thereby increasing the probability of several adults being present at the same time and mating occurring.

Adults may become associated with the commodities in or nearby warehouses where goods are stored before exportation. Infestation will be favoured by the presence of infested trees in the neighbourhood (ornamental trees or old orchards). Hitch-hiking can only occur during the flight period of adults. This period is very long and differs between countries according to the geographical location.
Flight periods:
China: mostly in May at Canton (Guangdong province, Southern China) (Gressitt, 1942); in Anhui province (Eastern China) in June (Yu *et al*., 2005); from end of April to beginning of June in Hong-Kong (Southern

[1] http://www.searates.com.

China) (Yiu, 2009)
Mongolia: June and July (Namkhaĭdorzh, 2007).
North Korea: Two pictures of *A. bungii* are dated from June 10 in BioLib.cz website.
Vietnam: Two examples (v. *cyanicornis*) from North Vietnam (Ha Giang) are dated from April.
As a conclusion adults of *A. bungii* can be in contact with goods for exportation from March to August with a maximum risk from mid-May to mid-July.

As it is not possible to regulate this pathway (and it is not considered the main one) the EWG did not continue the assessment of this pathway. A draft ISPM on *Minimizing pest movement by sea containers* (FAO, 2013b) is under country consultation within the IPPC framework. If adopted and implemented it will help preventing the contamination of containers with hitch-hiker pests.

Movement of individuals, shipping of live beetles, e.g. traded by collectors. Cerambycidae are widely collected and *A. bungii* may circulate between hobbyist entomologists but is most likely to be sent as dead specimens.

Natural spread: Natural spread is not relevant for the spread from Asia, except from Far East Russia (see also doubtful records in 1.07). As there is no continuous presence of host plants between Far East Russia and the rest of the country, it is not considered that natural spread could allow entry of the pest in the rest of the PRA area. However, it will be relevant if the pest becomes established in the PRA area (e.g. in Italy).

Cut branches. Cut branches may be imported for ornamental purposes. Eggs and larvae may be present on and in cut branches. However, cut branches will probably be too small for the larvae to complete their development. Therefore the risk of transfer to a host where the pest could complete its life cycle is very unlikely. There is no indication that the *Prunus* or other species as mentioned in 1.06 are used for such purpose (except possibly *Salix* species).

4. Pathways not supporting the entry of *A. bungii*

Bark of host plants. Only eggs may be associated with bark as they are laid in crevices on the bark (Gressitt, 1942). However, the pest will not be able to complete its development in isolated bark, and therefore could not transfer to a suitable host. In addition bark of *Prunus* trees is not known to be a traded commodity.

Fruit, seeds of host plants, soil. The immature life stages of *A. bungii* do not develop on these parts of the hosts or in soil, and are therefore unlikely to be transported on these commodities.

2.01b - List the relevant pathways that will be considered for entry and/or management. Some pathways may not be considered in detail in the entry section due to lack of data but will be considered in the management part.

- Wood and wooden products of *Prunus* spp. from where *A. bungii* occurs
- Plants for planting of host plants (except seed) from where *A. bungii* occurs

Wood and wooden products of *Prunus* spp. from where *A. bungii* occurs

Wood (round or sawn, with or without bark) of host plants
Eggs may be present on or in the bark. Larvae and pupae may be present in the wood. They can also survive in cut wood as demonstrated by the emergence of the pest from the trunk of a peach tree (*P. persica*) which had been felled and stored for a few months as firewood in Lombardia (EPPO, 2013a) and the interception of the pest in wood packaging material in Germany. Round wood is considered more appropriate for survival than packaging material in which larvae are probably more exposed to desiccation than in round wood. This pathway also covers firewood. As late larvae live in the heartwood, squaring logs will not remove them. (see answers to questions 2.01-2.11 for pathway 1)

Wood packaging material. Larvae and pupae may be present in wood packaging material (including dunnage). *A. bungii* was intercepted once in Germany on wood packaging transporting stones (in 2008 in Baden-Wuerttemberg: G. Schrader, German NPPO, pers. comm. 2013). Three adults were also intercepted in the UK, on wooden pallets carrying steel imported from the Netherlands and then delivered to a warehouse in Bristol (Reid & Cannon, 2010). No exit holes in the pallet were reported. However the beetles may have emerged from another piece of wood packaging stored in the warehouse. It is not clear if other cases considered as hitch-hiking (see the pathway “hitch-hiking” below) may in fact be linked to emergence from wood packaging material rather than hitch hiking because it is very difficult to undertake a detailed inspection of all the wood packaging that may be present.
Solid wood packaging is a proven pathway for entry of longhorn beetles into Europe (FAO 2013a, Haack *et al*., 2010). In 2013 the EU Commission has published a Decision “on the supervision, plant health checks and measures to be taken on wood packaging material actually in use in the transport of specified commodities originating in China" (EU, 2013). This decision was taken because recent plant health checks by Member States have shown that wood packaging material used in the transport of certain commodities originating in China (e.g. slate, granite, building stones) has been contaminated by harmful organisms, in particular by *Anoplophora glabripennis*, and this thought to be the source of outbreaks of *A. glabripennis* in several EU countries.
The wood from *Prunus* is not commonly used for wood packaging. *Populus* wood is commonly used but *Populus* is an uncertain host (see 1.06). Estimates based on the number of shipping containers moving goods from China to the EU suggest that approximately 4 million shipping containers containing solid wood packing material arrive in the EU annually from China (Anderson *et al*., 2013).
In places where used wood packaging material is collected in large quantities (e.g. for recycling), the probability of having several infested items increases, and therefore the probability of adults mating. As host plants are present in many places in the PRA area and are commonly planted in urban areas as ornamental species, the probability of transfer to a suitable host after emergence is moderately likely.

Although the EWG considered that this pathway is probably one of the most relevant, it was not studied in detail in this PRA as pest risk management is already in place. Since the adoption of ISPM 15 in 2002 (and its subsequent versions, FAO 2013a), all wood packaging material moved in international trade should be debarked and then heat treated, or fumigated with methyl bromide and stamped or branded, with a mark of compliance. These treatments are internationally considered as adequate to destroy larvae (including Cerambycidae) that are present in wood packaging material at the time of treatment. Interceptions may result from non-compliance (i.e. treatments were not or incorrectly applied or non-effective treatments were applied) or alternatively may possibly suggest that the treatment may not be 100% effective against this pest (and other Cerambycidae).

Furniture and objects made from wood of host plants. Larvae and pupae could be present in furniture and other objects, in particular in wooden parts that are not externally visible (e.g. bed frames). Processing (e.g. sawing) may destroy some of them but not all and late larvae and pupae are more likely to complete their development and emerge than the early life stages. Emergence of beetles from furniture is reported for similar pests such as *Monochamus* spp. (Fera, 2013), and *Semanotus* spp., *Chlorophorus* spp., *Batocera* spp. (Duffy 1968; Cocquempot, 2007; Cocquempot & Lindelöw; 2010; Cocquempot & Gattus, 2013). *A. bungii* is listed by USDA-Aphis (2011) as a species that may be associated with wood décor and craft products from China imported into the USA.

Entry (wood)

There is a very large trade of wooden furniture from China and Vietnam (over 800 000 tonnes, and over 200 000 tonnes respectively, see Appendix 3, Tables 3-6). This trade has expanded over the last 10 years. However it is not known which tree species are used to produce this wooden furniture and if they include wood of host plants of *A. bungii*. Part of this furniture will be made of chipboard which is not a pathway for wood borers.

In places where large quantities of furniture are stored, the probability of emergence of several adults that could mate is higher than when wooden material is dispatched to the final consumer. As host plants are present in many places in the PRA area and are used as ornamentals which may be planted in urban areas, the probability of transfer in a suitable host after emergence is moderately likely.

Objects and furniture for outdoor use makes the transfer more likely than if they are intended to be used indoors (NAPPO, 2012). However, *Prunus* wood is not suitable for outdoor use, except if dried and treated against potential wood dacayers and pests with appropriate fungicides/insecticides (Montecchio, Università di Padova, Italy, pers. comm., 2014).

This pathway was not assessed in detail because of the lack of data.

Wood waste. Wood waste may be more likely to contain the pests than round or sawn wood as it is lower quality wood. However survival of larvae in the wood waste will depend on the size of wood pieces and if they were subjected to processing (e.g. wood waste may be agglomerated in logs, briquettes or similar forms, and agglomeration will further damage the pest).

A single code is used in Eurostat for “wood waste and sawdust and scrap” (custom code 44013080 up to end of 2011 and since 2012, 44013090 – this new code excludes pellets). Sawdust is not a pathway for *A. bungii* as the pest cannot survive in this commodity. Import of “wood waste and sawdust and scrap” is larger than the import of round or sawn wood: 1344 tonnes from Viet-Nam and 858 tonnes from China in 2012 (see Table 2 in Annex 3). Volumes have increased very significantly since 2005. However, it is not possible to know if the wood waste concerned is made of host plants or not, and if this wood waste is processed (e.g. saw mill, broken planks, old crates) or not.

The intended use of imported wood waste is not known. If it is used for energy production, then the probability of transfer is very unlikely. It may be higher if the wood waste is stored outdoors for some weeks in suitable condition for pest emergence in the vicinity of host plants.

This pathway was not assessed in detail because of the lack of data.

Wood chips and particle wood.

Wood chips might be imported for use by pulp mills, for energy production, fiberboard production or as mulch. All life stages of the pest may be associated at the origin with wood chips, at any time of the year. Larvae and pupae may be found in all parts of the wood (heartwood and sapwood). *A. bungii* is reported as being a pest in *Prunus* forests (Wen *et al.*, 2010; Yang & Chen, 1999). Wood chips are often produced from trees of lower quality (compared to trees used to produce logs), which increases the risk of infestation and the probability of a high concentration of *A. bungii*. Consignments of wood chips are often a mix of hardwood species. They might contain a limited amount of wood of host species, which would lower the likelihood of association with the pathway.

The process of producing wood chips, i.e. grinding and chipping, is generally considered as destructive to wood inhabiting insect pests (e.g. for *A. glabripennis* in Wang *et al.*, 2000). However, in experiments on another wood borer, *Agrilus planipennis*, McCullough *et al.*, 2007 noted that a small percentage of larvae may survive the chipping process when the chipping or grinding machines have a sieve larger than 2.5cm.

Late *A. bungii* larvae are about 38-50 mm long, pupae 26-36 mm, adults are 23-37 mm (Gressitt, 1942; Huang *et al.*, 2012). Only late larvae, pupae and callow adults are likely to complete their development if they survive the chipping process. Young larvae are unlikely to carry on their development. Eggs of *A. bungii* are laid on living trees and are unlikely to be laid on wood chips after processing.

The commercial production of wood chips may result in a variety of chip sizes, some being large enough to allow survival and development of the pest to adulthood. There is a wide variation in the size of wood chips (details on this aspect may be found in the EPPO PRA on *Agrilus anxius* - EPPO, 2011). The European Standard on solid fuel (Alakangas, 2010; CEN, 2011) identifies four classes of wood chips according to particle size (i.e. passing through a round-hole sieve of the specified size); in the largest class, at least 75% of wood chips should be comprised in the range 8-45 mm, with a maximum of 6% bigger than 63 mm (but

smaller than 120 mm).
During storage and transport lethal temperatures may be reached within the core (through composting), and some individuals will be killed. However, a proportion of the organisms may survive, especially in the peripheral parts of the pile where the temperatures are lower (VKM, 2013). Transfer would be most likely if the wood chips are shipped soon after production and stored outdoors (i.e. allowing time for the pest to complete development), or used for mulch.
Currently the trade of hardwood wood chips to the PRA area is considered minimal from countries where the pest occurs, even if irregular import of deciduous wood chips is reported in EU trade statistics for 2005-2012, mainly from China (see Table 1 in Annex 3). For the whole EU, 272 tonnes were imported in 2011 from China.
There is no detail on the tree species used to produce wood chips, nor on their intended use.
Signs of presence of the pest in wood chips (e.g. galleries) would not be easy to observe. Sampling rates for a possible detection of such pests in wood chips have not been defined but large samples would be needed to be confident that *A. bungii* is not present (Økland *et al.*, 2012). However, inspection of the consignment may allow a check of chip size.
This pathway was not assessed in detail because of the lack of data and the low probability of entry.

Pathway 1: Wood (round or sawn, with or without bark) of *Prunus* from where *A. bungii* occurs

Only wood of *Prunus* species is considered as they are the only confirmed hosts of *A. bungii*. Other species (see 1.06) are not considered in the entry section because of lack of data. They may need to be considered in the management section.

The EWG considered that the data available was not sufficient to be able to give a precise rating and uncertainty level for each question. As a consequence only an answer is given to each question without ratings.

2.03, 2.04- How likely is the pest to be associated with the pathway at the point(s) of origin taking into account the biology of the pest and *current management* conditions?
Eggs are laid in crevices in the bark, larvae and pupae develop in the sapwood and the heartwood, both in the main stem and in branches. Therefore, all parts of the wood can be infested.
Last instar larvae and pupae can survive several weeks or months in logs after cutting and so are likely to complete their life cycle to develop into adults (E. Ucciero, Italian NPPO, pers. comm. 2013). Early observations in Campania (in the laboratory by Garonna) indicate that even earlier stages (eggs and young larvae) can continue their development in logs after the felling of the tree. Experiments to check if they can develop into adults are ongoing.
Infested trunks often contain larvae at different stages of development.

Wood with obvious galleries is not suitable for manufacturing and cannot be used as veneer. It is supposed that heavily infested wood will not be traded as it will be refused by importers. However, if they are rejected at destination, they need to be properly disposed of to prevent any spread.

2.05 - Consider the volume of movement along the pathway (for periods when the pest is likely to be associated with it): how likely is it that this volume will support entry?
Eurostat provides data on trade on sawn *Prunus* wood 'Cherry "*Prunus* spp.", sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, of a thickness of > 6 mm. Among the countries where *A. bungii* occurs, only China exported wood to the EU, but in a very limited quantity (maximum 50 tonnes in 2010).

Table 1. Quantity of sawn *Prunus* wood imported into the EU by China (in tonnes). Source: Eurostat (2013)

China	
Year	**Quantity (t)**
2012	3
2011	-
2010	50
2009	35

Entry (wood)

2008	42
2007	-
2006	12
2005	-

There is no detailed data on import of logs with bark of *Prunus* to the EU nor for the other EPPO countries.

Other types of wood which may include *Prunus* wood that were imported from countries where the pest occurs are as follows.

Table 2. Quantity of fuel wood and rough wood (see definition below) imported into the EU from countries where the pest occurs (in tonnes). When there was no import for a specific commodity over 2005-2012, it is not reported in the table. Source: Eurostat (2013)

	China		**Vietnam**	**Taiwan**
	Quantity in tonnes			
	Fuel wood	Rough wood	Fuel wood	Rough wood
2012	60	180	1271	344
2011	39	227	289	138
2010	24	656	63	98
2009	395	1453	46	6
2008	651	484	0	3
2007	528	680	0	83
2006	45	215	0	117
2005	5	3215	0	129

Fuel wood (“Fuel wood, in logs, billets, twigs, faggots or similar forms”; Custom code 440110). The category fuelwood does not discriminate between coniferous and non-coniferous species and, therefore; it is not known whether consignments include hosts of *A. bungii*.

Rough wood (“Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives, coniferous wood in general, oak "*Quercus* spp.", Beech "*Fagus* spp." and tropical wood”; Custom code 440399)

There were no data available on trade of *Prunus* wood to EPPO non-EU countries.

2.09 - Under current inspection procedures how likely is the pest to enter the PRA area undetected?

Signs of attack by larvae (excretion holes, frass, and galleries at cross-sections) may be observed on wood if inspections are performed. However only a proportion of wood consignments are inspected and it is unlikely that all infestations would be detected.

In the EU, wood of Prunus is not regulated and therefore will be not be inspected.

2.10 - How likely is the pest to be able to transfer from the pathway to a suitable host?

The probability of transfer will be limited by the fact that the wood is intended for processing. Processing will kill most of the living stages of *A. bungii*. Visual control before processing should show that the wood is infested. Infested logs found after import should be immediately destroyed to prevent the emergence of adults and limit the probability of transfer to a suitable host.

The likelihood of transfer is considered lower for this pathway than for plants for planting as not all larvae will complete their development in wood and emerging adults will need to locate suitable hosts.

2.11 - The probability of entry for the pathway (*Prunus* wood) should be described

The probability of entry with *Prunus* wood is considered unlikely, mainly because of the low volumes of import. Uncertainty is medium because no trade data for the EU is available for wood that is not sawn, and no data is available from non-EU countries in the EPPO region.

Pathway 2: Plants for planting of *Prunus* (except seed) from where *A. bungii* occurs

The EWG considered that only species of the genus *Prunus* are confirmed hosts of *A. bungii*. As the pest has extended its host range within the *Prunus* genus when spreading to new areas, it is considered that all *Prunus* species may be a host. Other species (see 1.06) are sometimes reported as hosts but were not considered in the entry section because of lack of data. They may need to be considered in the management section.

The EWG considered that the data available was not sufficient to be able to give precise rating and uncertainty level for each sub-questions. As a consequence only an answer is given to each question without ratings.

2.03 - How likely is the pest to be associated with the pathway at the point(s) of origin taking into account the biology of the pest?

Plants for planting of host plants can support eggs, larvae, pupae and adults of *A. bungii* (Gressitt, 1942). Early life stages (eggs and larvae) are likely to complete their development after importation of the plant.
Smaller plants are less likely to be infested although there is no documented evidence on the minimum stem size required for the pest to complete its life cycle. In Italy, plants with a main stem measuring about 6 cm diameter were found infested (F. Nugnes, pers. comm. 2013, as well as during the technical visit on the outbreak site by the EWG in November 2013). The female seems to be able to lay eggs in the crevices of the graft scar. A photograph from China showing a branch of about 3 cm diameter with a larval gallery is available in Griffo (2012).

2.04 - How likely is the pest to be associated with the pathway at the point(s) of origin taking into account *current management* conditions?

Although the pest is reported as frequent in fruit orchards, there is no data available on its presence in nurseries (according to the google translation, Zhang *et al*., 2000 recommend to strengthen control measures in nurseries to prevent the spread of the pest). There is little data available on the management conditions to produce plants for planting in the countries in the native range of *A. bungii*. The plants are more likely to become infested while growing outdoors than under protection. The risk of infestation increases with the age of the trees. It is generally considered that trees are particularly attractive to adults if they are lightly stressed or not healthy. However, in Italy all *Prunus* plants present at the non-professional orchards of the outbreak area have been found infested and there is no reason to think that they were stressed or not healthy.

Early infestation may not be detected at inspection, as this is the case for other longhorn beetles (e.g. *Anoplophora chinensis* (Förster, 1848)).

2.05 - Consider the volume of movement along the pathway (for periods when the pest is likely to be associated with it): how likely is it that this volume will support entry?

In the EU and countries following similar phytosanitary regulations, import of *Prunus* species is forbidden from many areas including countries where *A. bungii* occurs (article 18 in Annex III of EU Directive 2000/29/EC). This should prevent direct import to the EU but not the potential indirect import via certain third countries that can trade *Prunus* with the EU.
Other EPPO countries may import *Prunus* plants for planting from areas where the pest occurs but no trade data is available for other EPPO countries.

2.06 - Consider the frequency of movement along the pathway (for periods when the pest is likely to be associated with it): how likely is it that this frequency will support entry?

No data is available.

2.07 - How likely is the pest to survive during transport or storage?

Larvae on plants for planting will survive transport and continue feeding on their host. They live in branches or stems for 2-3 years, whereas transport time for plants from Asia to Europe is about 4 weeks by sea (PRA on *A. chinensis*, van der Gaag *et al.*, 2008). Plants are usually stored at cool temperatures during transport (e.g. 5-10°C). Larvae overwinter in stems or branches at cold temperatures, and are therefore well adapted to survive the conditions experienced during transport. Pupae would also survive, as they are normally present in trees during winter before adults emerge in spring. Moisture is necessary for eggs to survive, but under suitable conditions, eggs could hatch during transport and the larvae could enter the plants.

Other Cerambycidae with a similar biology (e.g. *Anoplophora chinensis*, *Batocera* spp.) have been intercepted alive in Europe in plants for planting from Asia (Van der Gaag *et al.*, 2008; EPPO Reporting Service).

2.08 - How likely is the pest to multiply/increase in prevalence during transport or storage?
A. bungii has a long life cycle (2-4 years) so will not multiply during transport. All stages associated with plants for planting (eggs, larvae, pupae, pre-emerging adults) are likely to continue their development. If late stages are present, adults might emerge, although the cooler temperatures during transport should prevent it (adults normally begin to emerge in spring as soon as temperatures rise).

2.09 - Under current inspection procedures how likely is the pest to enter the PRA area undetected?
In the EU and in other countries following similar regulations, prohibitions are in place for import of *Prunus* species.
In the countries where import of *Prunus* is allowed, eggs and larvae might be detected but this requires careful examination and the early life stages are easily overlooked. Experience with inspection of imported plants for planting for *Anoplophora chinensis* has shown that the hidden stages of such organisms are very difficult to detect (Van der Gaag *et al.*, 2008).

2.10 - How likely is the pest to be able to transfer from the pathway to a suitable host?
A. bungii has hosts that are grown widely in the PRA area, in commercial cultivation, as ornamentals, in forests, parks, gardens or in the wild. The adult beetles can fly some distance (see 4.01). Provided a male and female are in reasonable proximity, it is likely that they would mate and lay eggs on a suitable host.

2.11 - The probability of entry for the pathway *(plants for planting)* should be described
The probability is considered moderately likely with a high uncertainty. There is uncertainty on many factors affecting the association of the pest with the pathway, e.g. the prevalence of the pest, the size of the plants that may be infested, and the trade for non-EU countries.
It is unlikely for the EU (because of the import prohibition of plants for planting of Prunus *spp.): in principle the probability of entry is zero but there is uncertainty on the existence of indirect import from countries where the pest occurs (i.e. an plant which is imported from Asia in a Mediterranean country, and reexported after a while to the EU as the prohibition of Prunus plants into the EU does not apply to Mediterranean countries).*

If in future the pest was to become established in part of the PRA area, this pathway would have to be reconsidered because it could represent a major pathway of spread within the EPPO region.

It should be noted that this assessment only addresses *Prunus* species but there is uncertainty on the host status of some other species (see 1.06). Most of these species are not covered by import requirements that will mitigate the risk of entry of this pest. If these species prove to be hosts, this will increase the risk of entry with plants for planting, and the PRA will need to be updated to cover these species.
Among the species listed in 1.06, according to data gathered in the framework of the EPPO Study on the Risk of Imports of Plants for Planting (EPPO, 2012c), at least plants for planting of the following species have been imported in 2006-2010 into the EU from China and South Korea: *Castanea mollissima*, *Zanthoxylum* spp., *Diospyros kaki*, *D. lotus* and *Punica granatum*.

Overall probability of entry

The overall probability of entry of *A. bungii* into the EPPO region is considered likely. However, this cannot be deduced from the assessment of the two pathways above, but is based on the fact that 3 outbreaks (2 in Italy and 1 in Germany) of the pest have already been detected in the EPPO region. The fact that *A. bungii* was also introduced recently in Japan supports the idea that the pest is moving internationally. In countries where import of *Prunus* plants for planting is not forbidden, this pathway is very likely to support entry if trade occurs from areas where the pest is present.

It should be noted that in theory, entry should be unlikely as the import of *Prunus* plants into many EPPO countries is prohibited, wood packaging material treated according to ISPM 15 does not support the entry of the pest, and the import of wood is minimal. Therefore there is a medium uncertainty associated with this assessment and a high uncertainty on how the pest has been introduced into Europe. As wood packaging material non-compliant with ISPM 15 is regularly intercepted in Europe, the EWG considered that it may be the pathway for the recent introduction of *A. bungii* into Europe.

If in future the pest was to become established in part of the PRA area, plants for planting would have to be considered because it could represent a major pathway of spread within the EPPO region.

3. Probability of establishment

Selecting the ecological factors that influence the potential for establishment
Seven factors may influence the limits to the area of potential establishment and the suitability for establishment within this area:

1. Host plants and suitable habitats
2. Alternate hosts and other essential species
3. Climatic suitability
4. Other abiotic factors
5. Competition and natural enemies
6. The managed environment
7. Protected cultivation

No.	Factor	Column A Is the factor likely to have an influence on the limits to the area of potential establishment?	Column B Is the factor likely to have an influence on the suitability of the area of potential establishment?	Justification
1	Host plants and suitable habitats	YES (see 3.01)	YES (see 3.09)	
2	Alternate hosts and other essential species	NO	NO	*A. bungii* does not need alternate hosts
3	Climatic suitability	YES (see 3.03)	YES (see 3.10)	
4	Other abiotic factors	NO	NO	No such abiotic factors have been identified in the literature available.
5	Competition and natural enemies	NO	NO	Competition is not mentioned in the literature, and does not seem to be a limiting factor at origin. Natural enemies are not likely to have an impact on establishment. They might have an impact on the populations of the pest once it is established. Competition may be less important in the northern part of PRA area because some other wood borers are absent (e.g. *Capnodis tenebrionis*).
6	The managed environment	NO	YES (see 3.14 and 3.15)	In no part of the area is the managed environment such that it would prevent establishment of longhorn beetles, even when some management measures are applied for example in fruit, and ornamental crops. Since stressed trees are more prone to attack, good management practices will make the host less susceptible.
7	Protected Cultivation	NO	NO	The host plants are not cultivated under protected conditions.

Identification of the area of potential establishment

Host plants and suitable habitats

3.01 Identify and describe the area where the host plants or suitable habitats are present in the PRA area outside protected cultivation.

Most of the main host species listed in 1.06 occur in the PRA area. They are grown mainly for fruit production (apricot, peach, plum, cherry), for ornamental purposes in private or public gardens, cities, industrial or commercial parks and also occur naturally in woods or forests (e.g. wild cherry tree).

Prunus species may only be absent in the most Northern part of Scandinavia and of the Russian Federation, as well as Siberia and Far East. Maps of distribution are available in Annex 1.

Almond (*Prunus amygdalus* Batsh.) and sour cherry (*Prunus cerasus* L.) are not reported as hosts so far, but they may be hosts of *A. bungii* and they have, therefore, been added to the table below. Ornamental plants such as cherry laurel *Prunus laurocerasus* L. are widely grown in the PRA area and may also be a host.

The table below summarizes the areas under commercial cultivation in the PRA area for the fruit and nut species that may be a host of *A. bungii*. (Source Faostat, see details in Annex 1)

Fruit crop	**Total ha in the PRA area in 2011**	**Countries with largest areas**
Almond	1 069 232	Spain, Tunisia, Morocco, Italy, Algeria, Turkey
Plums and sloe	585 234	Serbia, Bosnia & Herzegovina, Romania, Russia, Poland, Turkey, Ukraine, France, Moldova
Peach and nectarine	404 415	Italy, Spain, Greece, Turkey, Algeria, Tunisia
Apricot	284 031	Turkey, Algeria, Uzbekistan, Italy, Spain
Cherries	244 042	Turkey, Italy, Spain, Russia, Bulgaria, Ukraine, Poland
Sour cherries	196 216	Russia, Serbia, Poland, Turkey, Ukraine, Hungary

Climatic suitability

3.03 Does all the area identified as being suitable for establishment in previous questions have a suitable climate for establishment?

Yes

In China and Mongolia, the pest is present in areas where the annual number of accumulated degree-days (base 10°C) is above 500 (see Figs 1 and 2 below). Wen *et al.* (2010) reported the presence of the pest in Liaoning province (North-East China) where the climate is cold (annual average temperature is noted as 6-9 °C with a frost-free period of 140-160 days per year). No data was found on the lower temperature that is lethal to the insect but adults can survive in the laboratory at 8°C for several weeks (Nugnes, pers. comm., 2013).

The current distribution includes hardiness zones of 4-13 (Fig 3). This covers a large part of the EPPO region, except Siberia and the Far East in the Russian Federation.

Based on the current distribution, it is assessed that the northern limit of the potential distribution is the southern part of Scandinavia. As the pest is present in warm areas such as Southern China (e.g. Guangdong, Guangxi), it is assessed that the climate in the southern part of the PRA area will not be a limiting factor.

Climex studies carried out for *Anoplophora glabripennis* (Motschulsky, 1853) (which occurs in similar areas to *A. bungii* in China and has a similar life cycle), showed that most of Europe is suitable from the point of view of climatic conditions (MacLeod *et al.*, 2002). It is considered that *A. bungii* would behave as *A. glabripennis*.

As most of the life cycle occurs within the trees, it is considered that the climate is not critical for establishment.

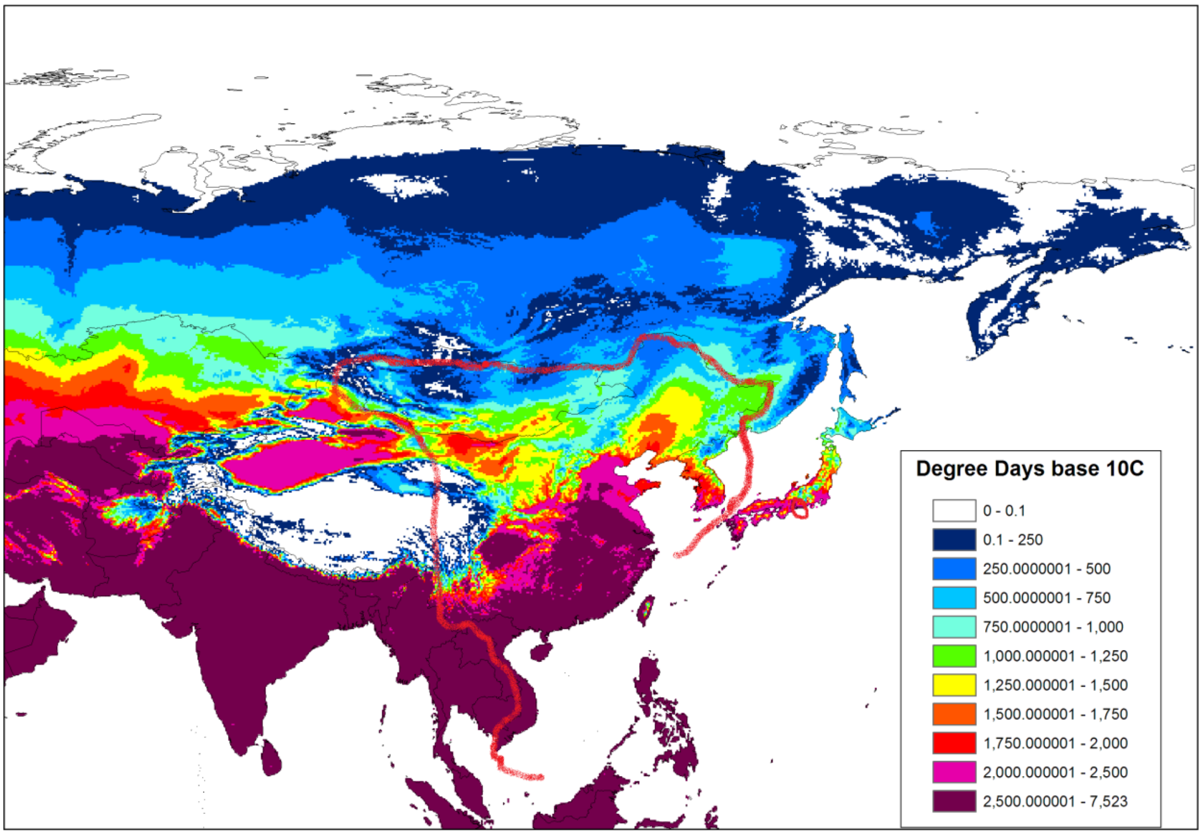


Fig 1. Asian Map of Temperature Accumulation (Degree Days) based on a threshold of 10°C using 1961-90 monthly average maximum and minimum temperatures taken from the 10 minute latitude and longitude Climatic Research Unit database (New *et al*., 2002). A red line has been drawn approximately around the areas where *A. bungii* occurs (it should be noted that the exact distribution in Mongolia and Vietnam is not known).

Establishment

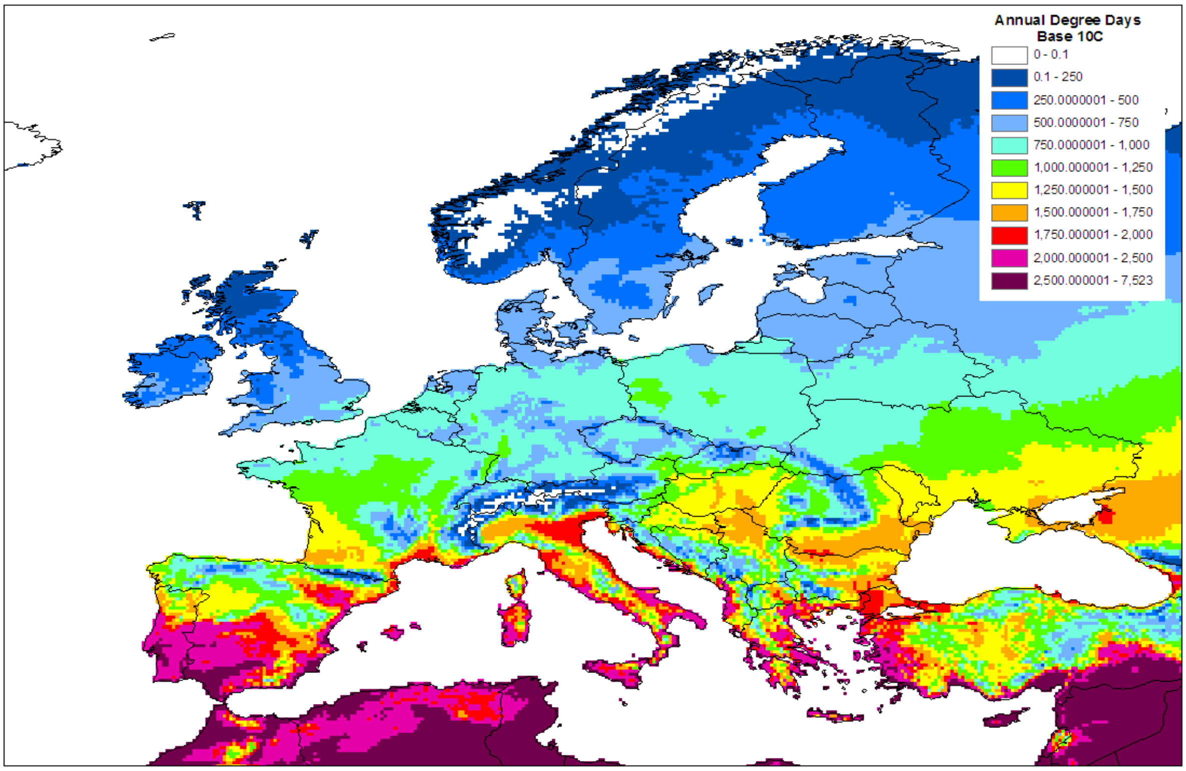


Fig. 2 European Map of Temperature Accumulation (Degree Days) based on a threshold of 10°C using 1961-90 monthly average maximum and minimum temperatures taken from the 10 minute latitude and longitude Climatic Research Unit database (New *et al*., 2002). By comparison with the map above, it is estimated that areas with more than 500 degree days would be suitable.

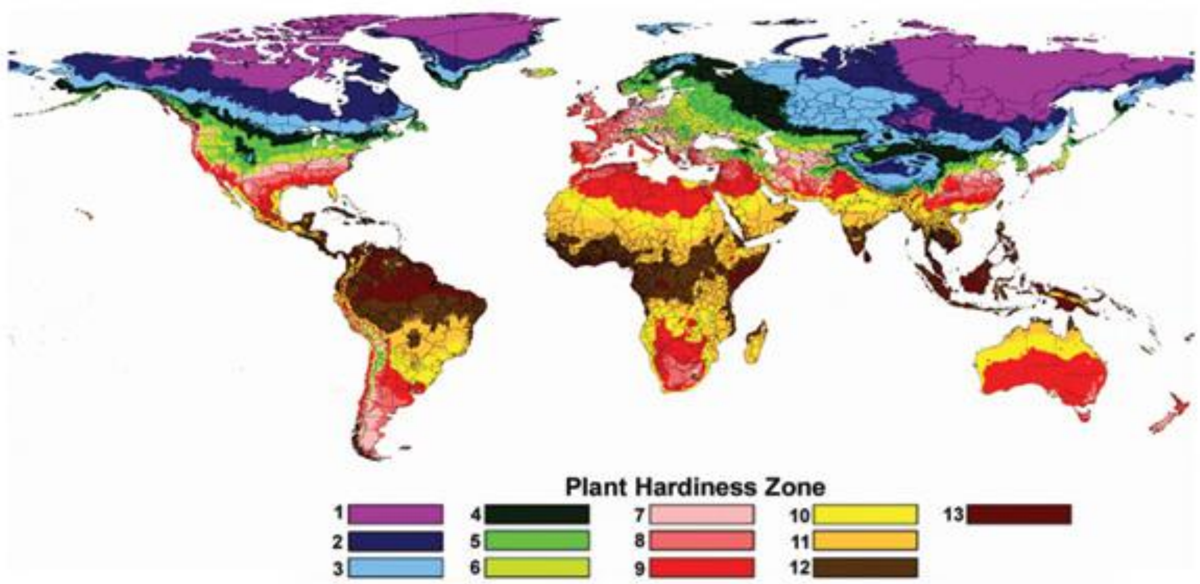


Fig. 3 Global hardiness zone map for the period 1978-2007 (Magarey *et al.,* 2008)

<u>Area of potential establishment</u>

3.08 By combining the cumulative responses to those questions 3.01 to 3.06 that have been answered with the response to question 3.07, identify the part of the PRA area where the presence of host plants or suitable habitats and other factors favour the establishment of the pest.

A. bungii is likely to establish in the entire PRA area, except the most northern and eastern areas (northern parts of Scandinavia, Siberia and the Far East of the Russian Federation).

Establishment

Suitability of the area of potential establishment

Availability of suitable hosts

3.09 How likely is the distribution of hosts or suitable habitats in the area of potential establishment to favour establishment?
Very likely
Level of uncertainty: Low

The host plants cover a large part of the area of the potential establishment and are evenly distributed. They are present in commercial crops but also are used as ornamentals.
Areas with high densities of host plants are more favourable for establishment than areas of low density. For example, it is expected that higher populations will occur in areas with high concentration of peach and apricot orchards. It may therefore be expected that the Mediterranean area would be more suitable.

Peach and apricot trees are most abundant in the Mediterranean area (Algeria, Morocco, Spain, Portugal, Southern France, Italy, Slovenia, Croatia, Albania, Greece, Turkey, Malta, Cyprus, and Israel) see maps in Annex 1. Their density reduced progressively towards Northern countries but their distributions reach the Baltic Sea in Germany and are still frequent in Slovakia, Czech Republic, Hungary, Austria, Serbia, Romania, Bulgaria, Bosnia & Herzegovina, Montenegro, Macedonia, Moldova, Ukraine, Georgia, Armenia, Azerbaijan.
Plum trees and cherry trees are distributed in about the same area but they can also be found in the wild and are also quite widely cultivated in more northern countries such as the United Kingdom, Belgium, the Netherlands, Denmark, Poland, Belarus, Latvia, Estonia up to the southern parts of Norway and Sweden.

3.11 How similar are the climatic conditions that would affect the pest establishment to those in the current area of distribution?
Largely similar
Level of uncertainty: Low

In the southern part of the PRA area (where the accumulation of degree-days per year in base 10 is above 1000), the climate is more suitable than in northern part. In the Southern part, the pest is likely to have a shorter life cycle, and may also have a higher reproductive capacity as has been observed for *A. chinensis* (Adachi, 1988) and *A. glabripennis* (Keena, 2006)

Cultural practices and control measures

3.14 How favourable for establishment is the managed environment in the area of potential establishment?
Highly favourable
Level of uncertainty: Low

The main host trees are used in orchards for fruit production and as ornamentals in public or private areas. Host plants are also widespread in gardens and forests, with minimal management, and in the wild without management. Ornamental trees, private trees and wild trees are likely to play an important role in the establishment of the pest because they may be a source of infestation for commercial orchards.

In Campania, the larger and more mature trees seem to be more prone to attack (Griffo, pers. comm., 2013; observations by the EWG). In commercial orchards in Italy, peach trees are maintained for a relatively short time (about 10-15 years) whereas apricot, plum and cherry trees are kept for longer periods (more than 20 years).
In private gardens and amenity areas, trees are likely to remain for several decades and will be even more suitable for establishment.

In Campania, the pest has been only observed so far on *Prunus* fruit trees and not on ornamental *Prunus* species that are also present in the outbreak area. This is only based on 1 year of monitoring, since autumn 2012.

3.15 How likely is the pest to establish despite existing pest management practice?

Establishment

Very likely
Level of uncertainty: Low

In commercial /professional orchards and nurseries, insecticides may be applied, but the timing of treatment may not coincide with the flight period of the pest. In addition, routine pest control tends to target fruit pests or defoliators, and not wood borers (e.g. EPPO Standard PP 2/33 *Good Plant Protection Practice for stone fruits*, EPPO 2004).

The control of wood borers in fruit trees is difficult (e.g. *Capnodis tenebrionis*, see below). Once the young larva hatch from egg and penetrate beneath the bark, it is not possible to control the pest by spraying insecticides.

The period of egg-laying period is very long and so repeated treatments (possibly every week) would be required over a long period to afford protection. A similar programme would be required to control adults.

The main control measures which could reduce the probability of establishment are those used against *Capnodis tenebrionis* (Linnaeus, 1758) (Coleoptera: Buprestidae). They include prophylactic measures such as the destruction and the removal of damaged trees (Lichou *et al*., 2001) and the use of entomopathogenic nematodes such as *Steinernema carpocapsae* (del Mar Martinez de Altube *et al*., 2007) which is used in China against *A. bungii*. Lichou & Mandrin (2008) noted, however, that damage associated with *Capnodis tenebrionis* is increasing in Mediterranean countries because the current control techniques are not very effective. No products are authorized for this use in France (minor use).

<u>Other characteristics of the pest affecting the probability of establishment</u>

3.17 How likely are the reproductive strategy of the pest and the duration of its life cycle to aid establishment?
Moderately likely
Level of uncertainty: Medium

Aromia bungii has a long life cycle reported as being at least 2 years (2-4 years in Hebei Province (Ma *et al*., 2007)), which may reduce the probability of establishment. However, the fact that the duration of the life cycle varies according to the climate allows the pest to establish under a wide range of conditions.

Emergence and flight periods of adults are very long, which means that entry can occur several times in the same year which increases the probability of introduction.

Under artificial conditions, on average a single female may lay 325-357 eggs (ranging from 91 to 734) according to Wang *et al*. 2007, and about 700 eggs (with a maximum of 1200) according to Griffo (pers. comm., 2013). Adults live for 15 to 20 days. The capacity of flight is not studied but the flying distance may be similar to the Cerambycid *A. glabripennis* (i.e. up to 2.5 km, with 98% only 560 m) (Smith *et al*., 2001, 2004) because they are both longhorn beetles with many similarities and similar body size. In some of the outbreak orchards in Campania, all the *Prunus* fruit trees present have been found to be infested by *A. bungii* (over 100 trees).

3.18 Is the pest highly adaptable?
No, moderately adaptable or less
Level of uncertainty: Medium

It is present in different climatic zones.

There is uncertainty about the host range of the pest. It seems that *A. bungii* is unlikely to adapt to hosts other than *Prunus* spp.

3.19 How widely has the pest established in new areas outside its original area of distribution?
Not widely
Level of uncertainty: Low

Outside of its original range, *A. bungii* has only very recently been reported in a few locations outside of its native range (Germany, Italy and Japan, see 1.07). According to the map provided in CAPRA, they are in the same biogeographic realm as China ('Paleartic') although not in the same zones within this realm.

Establishment

3.20 The overall probability of establishment should be described.
High
Level of uncertainty: low

The overall probability of establishment is considered as high with a low uncertainty. The climatic conditions are favourable as is the presence and distribution of host plants. Management measures are unlikely to prevent establishment except if the pest is discovered soon after its introduction and is submitted to eradication measures.

According to the maps of distribution of the main host plants (apricot and peach trees) and the climatic condition in the PRA area, the probability of establishment of *A. bungii* is likely to very likely in Macaronesia (Canary Islands, Azores, Madeira and Cape Verde), Portugal, as well as in the Mediterranean Basin from Morocco, Algeria, Tunisia, Spain, France, Italy, Slovenia, Croatia, Albania, Greece, Turkey, Cyprus, Malta, Israel) as far as the Black Sea Basin (Bulgaria, Romania, Moldova, Ukraine, Georgia) towards the Caspian Sea (Azerbaijan and Armenia).

There is some uncertainty on the limits of the area of potential establishment, and the host range. All plant species listed in 1.06, especially poplars but also citrus, are also widespread in at least part the EPPO region. If they proved to be hosts, this will increase the likelihood of establishment.

Other uncertainties are linked with the reproduction potential and flight distance of adults.

Conclusion of introduction

Entry was rated as likely with a medium uncertainty. The probability of establishment is considered as high with a low uncertainty. The overall probability of introduction is therefore rated as high with a medium uncertainty.

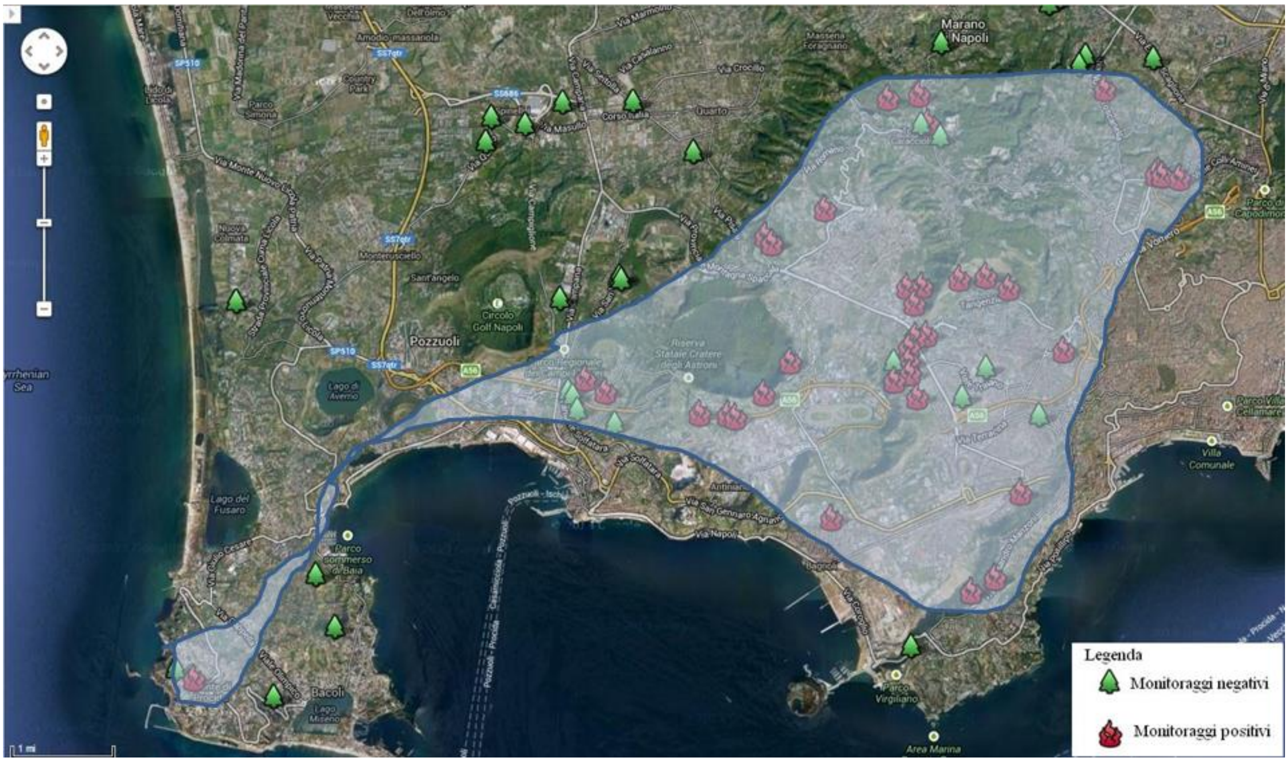
4. Probability of spread

4.01 What is the most likely rate of spread by natural means (in the PRA area)?
Moderate rate of spread
Level of uncertainty: Medium (no direct data, distance extrapolated from *Anoplophora* species)
There are no detailed studies available on the rate of spread by natural means of *A. bungii*. The flight capacity was estimated as being similar to *Anoplophora glabripennis* or *A. chinensis* since these species share similar behaviour: it is estimated to be about 2-3 km per season (Smith *et al.,* 2004) but it depends from the proximity of favourable host trees (Smith *et al*., 2001). When no host is available in the neighbourhood, *A. glabripennis* tends to fly longer distances.
A study on *A. chinensis* in Italy (Lombardia) demonstrated that all new infestations can be found within a radius of 500 m in an urban environment and within a radius of 670 m in an agricultural environment. Cavagna *et al.,* 2013 concluded that distance within which it is possible to find nearly all new infestations (99.2%) is equal to 400 m, and Lethmayer (2013) reported that natural dispersal of most beetles appears to be only very local. They normally infest neighbouring trees and spread over short distances (less than 400 m) but may occasionally infest trees up to a few kilometres away from the tree from which they emerged. Note that the maximum distance of 2.6 km observed for *A. glabripennis* was part of a mark-recapture study in which large numbers of marked beetles were released at one point. Such a situation may no resemble the behaviour of the beetle under more natural conditions but indicates the potential spread distance within a year. Finally, it should be noted that the host range of *A. bungii* seems to be more limited than the one of *A. chinensis* which may result in longer distance of spread to find a suitable host.
Under artificial conditions, a single female of *A. bungii* may lay 325-357 eggs on average (ranging from 91 to 734) according to Wang *et al.* (2007) and about 700 eggs (with a maximum of 1200) according to Griffo (pers. comm., 2013). The fecundity of females in the natural environment is not known but each female lay probably between 30 to 100 fertile eggs on few close trees (30 to 75 for *Osphranteria coerulescens*, another Callichromatini pest on fruit trees; Sharifi *et al*., 1970).

In Campania (IT), it is considered that *A. bungii* may have entered at least 5 years ago but given the scale of the outbreak, possibly much earlier. The outbreak is quite large with about 600 trees infested in 41 garden/orchard sites. The outbreak extends over an area of over 10 km in diameter with a single outlier located around 5 km outside of the main area (see map below). The orchards/gardens are scattered throughout the area: this spread may be the result of a combination of natural and human-assisted spread.

Fig. 4. Outbreak site in Campania. Red signs: monitored and infested sites; Green signs: sites monitored and found non infested. An updated map is available at http://www.agricoltura.regione.campania.it/difesa/aromia.html

Spread



4.02 What is the most likely rate of spread by human assistance (in the PRA area)?
High rate of spread
Level of uncertainty: Medium
Plants for planting, wood (including firewood), and untreated wood packaging can be infested by *A. bungii* and movement of such material within the PRA area may spread the pest. Movement by individuals may also occur as it is a large attractive beetle.

<u>Conclusion on the probability of spread</u>
4.03 Describe the overall rate of spread
High rate of spread
Level of uncertainty: Medium
The overall rate of spread will be a combination of natural and human-assisted spread. The high rate is related to the human assisted spread

The assessor should also give his/her best estimate for the following questions:

4.04 What is your best estimate of the time needed for the pest to reach its maximum extent in the PRA area?
As the EPPO region is very large, it is not possible to answer this question. It will certainly take more than 20 or even 50 years.
Level of uncertainty: Medium

4.05 Based on your responses to questions 4.01, 4.02, and 4.04 while taking into account any current presence of the pest, what proportion of the area of potential establishment do you expect to have been invaded by the organism after 5 years?
Less than 0.1% as the pest has a life cycle of 2-4 years and it needs several years to be detected anyway.
Level of uncertainty: Medium

5. Eradication, containment of the pest and transient populations

5.01 Based on its biological characteristics, how likely is it that the pest could survive eradication programmes in the area of potential establishment?
Moderately likely
Level of uncertainty: Medium

In Campania, the following measures have been applied for eradication (see the official decree, Massaro & Passari 2012):
- monitoring of susceptible host species,
- felling of symptomatic trees and removal of the roots,
- chipping or heat treatment of infested material,
- monitoring of all susceptible plants within 100 m of the infested plants.
-spraying of insecticides within infested orchards to control adults (spraying times: mid-June, end of June, mid-July),
In addition a communication campaign has been implemented to raise awareness of all stakeholders as well as the general public.
Up to know, the eradication campaign had a cost of 75000 euros (E. Ucciero, Italian NPPO, pers. comm. 2013). This includes removal of trees and personnel costs). Considering that the life cycle of the pest is at least 2 years, it cannot yet be evaluated in this eradication campaign was successful. In 2013, new infested trees were found in the outbreak site (on trees that had no signs of the pest in 20121), but no exit holes were observed.

Early detection is the key factor for a successful eradication. An eradication programme against *A. bungii* can probably be successful because:
- its life cycle is at least two years,
- the host range seems to be limited, with *Prunus* spp. being the main or only hosts (whereas *Anoplophora chinensis* and *A. glabripennis* are very polyphagous with hosts in more than 20 families),
- in most cases, natural spread is probably limited to a few km per year,
- symptoms of larval damage is clearly visible at an early stage (frass usually daily emitted few weeks after oviposition) if the trees are regularly monitored. Infestation often starts in the lower part of the main stem of the tree (based on observation in Campania), which is more easily inspected than the upper branches (*A. glabripennis*) or the roots (*A. chinensis*).
- adults are easy to find since they are quite large and diurnal. This could facilitate the detection and reporting by the general public.

The main uncertainty is the possibility to detect infested trees at an early stage, in particular if the pest first establishes in wild trees or non-professional orchards. Indeed, the outbreak in Italy was present for several years before it was discovered. In addition, based on the experience with *A. chinensis* and *A. glabripennis,* it is very difficult in practice to detect all infested trees, especially in the case of large outbreaks.
It should also be noted that early symptoms (e.g. frass, exit holes) are not typical and may be due to other indigenous pests (e.g. *Cossus cossus* (Linnaeus, 1758) (Lepidoptera Cossidae), *Capnodis tenebrionis, Synanthedon vespiformis* (Linnaeus, 1761) (Lepidoptera: Sesiidae), other longhorn beetles)

The EWG discussed possible measures for an eradication programme (based on measures recommended against *A. chinensis* or *A. glabripennis*) and recommended the following:

- intensive monitoring of all *Prunus* spp. in a radius of at least 2 km (buffer zone), but it may need to be more in the case of large outbreaks (up to 5 km) depending on the density of host trees. After detailed monitoring of the 2 km radius, the size of the buffer zone may be reduced to 1 km.
- destruction of symptomatic trees and precautionary felling of all *Prunus* spp. within 100 m together with detailed inspection of all the felled trees for the presence of the pest.
- application of insecticide treatments targeting adults and eggs (see 6.03).
- ensure inspection and implementation of measures also in all private gardens in the buffer zone.
- destruction and safe disposal of infested material.
- prevention of movement of *Prunus* plants for planting out of the buffer zone.

- prevention of movement of *Prunus* wood out of the buffer zone.

More specific data are needed to define the size of the buffer zone and the need for precautionary felling. Experience from Campania will be useful in this framework. In particular it may be useful to keep some *Prunus* trees in the infested area (and monitor them) so that the pest is not forced to fly further to find host trees.

Some eradication campaigns against *Anoplophora* spp. have been successful and so the prospects for the successful eradication of an infestation of *A. bungii* should be good because it is probably an easier pest to detect and control (as the host range is more limited). Nevertheless, some uncertainty remains because of the lack of information about potential non-*Prunus* hosts.

5.02 Based on its biological characteristics, how likely is it that the pest will not be contained in case of an outbreak within the PRA area?

Moderately likely

Level of uncertainty: Medium

The facts that the pest has a long (2-4 years) life cycle, a limited host range, a short flight distance and that larval damage can be easily detected makes the containment of *A. bungii* moderately likely in the case of an outbreak.
Similar measures as for eradication may be applied, except for the implementation of precautionary felling.

5.03 Are transient populations likely to occur in the PRA area through natural migration or entry through man is activities (including intentional release into the environment) or spread from established populations?

Very unlikely

Level of uncertainty: Low

This is not relevant for this pest because of its long life cycle.

6. Assessment of potential economic consequences

Economic impact "sensu-stricto"

6.01 How great a negative effect does the pest have on crop yield and/or quality of cultivated plants or on control costs within its current area of distribution?

Major

Level of uncertainty: Low

The economic importance of *A. bungii* is mainly known in China on cultivated apricot, peach and plum trees in orchards. It is considered to be very destructive on peach and apricot but it also causes considerable damage to plums and can be a serious pest of cherry. Liu *et al*. (1997) reports that the pest "can damage 30% to 100% of the fruit trees". Recent articles mention this pest as emerging (e.g. Zhang *et al.,* 2000; Huang *et al.,* 2012). It seems that there is no record of serious damage on non *Prunus* species mentioned in 1.06 (Gressitt, 1942; Duffy, 1968; Wu & Li, 2005; SEAP, 2009). Gressitt (1942) noted that *A. bungii* is able to kill rapidly peach, apricot and plum trees. This is confirmed in the recent outbreak in Italy for these species as well as cherry trees (Garonna, 2012; Garonna *et al.*, 2013, observations in Campania, Griffo pers. comm., 2013). There is no data available on its presence in nurseries (although according to the google translation of Zhang *et al.*, 2000 strengthening control measures in nurseries is recommended to prevent the spread of the pest).

It should be noted that although possible species listed in 1.06 (e.g. poplars, kaki, pomegranate) are monitored in the outbreak area in Campania, they have not been found to be infested. However, this is based on only one year of monitoring.

A. bungii is also considered as a pest for forest *Prunus* (Wen *et al*., 2010; Yang & Chen 1999).

Quantitative information about the damage and economic impact is generally lacking. Some data may be available in original Chinese articles but in most cases only the summary in English could be read by the EWG.

Nature of Damage

Information about damage is available only for *Prunus* spp. The nature of the damage is the same for all fruit trees.

The main damage is caused only by the larvae, which bore into the wood soon after hatching, producing tunnels in the branches and the trunk (Gressitt, 1942). Feeding of the larva produces abundant frass that can often be observed on the ground at the base of the tree, on the top of branches or attached to the surface of the bark. Galleries are in the cambium zone, stop the circulation of the sap, killing the associated tissues, weakening the tree and reducing the fruit production. Extensive infestations result in tree death. The diameter of the most attacked branches seems to be about 10 cm in diameter but thinner branches or stems may be attacked (observations in Campania of 6 cm stems infested, and there are pictures in China of a 3-4 cm diameter branch with a large gallery). Wu & Li (2005) reported that egg laying occurs mainly at 30 cm above ground level.

Larvae bore in large branches and in the trunk and probably smaller branches from 3-4 cm diameter. There is no record of infestation in the roots (Duffy, 1968; Yu *et al*., 2005; Wu & Li, 2005; Griffo, 2012). The larvae bore down the branches and the trunk under the bark or in the sap wood until pupation. The complete gallery can reach 50 to 60 cm in length. Pupation occurs in the heartwood.

Many authors report that *A. bungii* attacks mainly old, stressed or decayed trees, but always living trees. Fruit production can be considerably affected resulting from the weakening or death of the branches and a heavy attack can kill the whole trees. The observations in Italy show that the pest can also affect young and healthy trees.

6.02 How great a negative effect is the pest likely to have on crop yield and/or quality of cultivated plants in the PRA area without any control measures?

Massive

Level of uncertainty: medium

The impact on stone fruit trees is expected to be similar to the one currently observed in the outbreak area in Campania or in China. As *A. bungii* has extended its known host range to some new *Prunus* species in Europe (see 1.06), impact on other *Prunus* species such as almond (*Prunus amygdalus* Batsh.) and sour cherry (*Prunus cerasus)* may also be expected.

Economic consequences

The production of wood of wild cherry (*P. avium*) may also be affected. Coello *et al.* (undated) note that wild cherry timber is one of the most valued timber in Europe and currently no management is required against wood pests in this *Prunus* species.

There is no information on damage to ornamental trees but losses will include the cost of pruning the dead branches as well as removal and replacement of the dead trees.

It is expected that the potential damage would be higher in the southern part of the PRA area where more *Prunus* orchards are present and where the pest may have a life cycle of 2 years (whereas it may be 3-4 years in the northern part), and therefore the pest is likely to build up higher populations more quickly in the southern part than in the northern part of the PRA area.

There are some generalist parasitoids and predators in the PRA area which could probably attack the different immature stages of *A. bungii*: these include Hymenoptera species (Braconidae (e.g; *Spathius erythrocephalus* Wesmael, 1838 (Bonsignore *et al.*, 2000), Ichneumonidae, Bethylidae) and Coleoptera species (e.g. Cleridae). In Italy, it has been observed that some local parasitoids of other xylophagous insects attack *A. chinensis* and *A. glabripennis* (Hérard *et al.*, 2013), although they cannot control the pest to prevent economic damage.

Some other wood boring pests of *Prunus* spp. that may compete with *A. bungii* are already present in the PRA area. They are the wood borers *Cossus cossus*, *Capnodis tenebrionis*, *Ptosima undecimmaculata* (Herbst, 1784) (Coleoptera: Buprestidae), *Xylotrechus arvicola* (Olivier, 1795) (Coleoptera: Cerambycidae), *Cerambyx scopolii* Fuessly, 1775 (Coleoptera Cerambycidae), *Osphranteria coerulescens* Redtenbacher, 1850 (Coleoptera: Cerambycidae), *Magdalis barbicornis* (Latreille, 1804), *M. cerasi* (Linnaeus, 1758) and *M. ruficornis* (Linnaeus, 1758) (Coleoptera: Curculionidae). It is not expected that species competition would prevent economic damage of A. bungii.

6.03 How great a negative effect is the pest likely to have on yield and/or quality of cultivated plants in the PRA area without any additional control measures?

Major

Level of uncertainty: Medium

Some wood borers pests of *Prunus* spp. (listed in 6.02) occur in the EPPO region. However, it is considered that there are currently no control measures that are regularly implemented in orchards in the PRA area and that could control the pest except perhaps in places where *Capnodis tenebrionis* is present and control measures are being taken.

In commercial orchards where insecticides are already applied, they are expected to decrease the impact of the pest by killing adults. Insecticides applied on the trunk against scales may affect the eggs of *A. bungii* (e.g. insect growth regulators, rynaxypyr).

Some insecticides currently used in orchards in IPM programs could have some efficacy against *Aromia bungii* (see table 3 below) but they may not provide protection for the entire flight period.

Table 3: Insecticides currently used in orchards in IPM programs in Italy, that may be effective against *Aromia bungii* (source: NPPO of Italy - Campania Region – Plant Protection Service -Naples)

Active ingredient	*Crop*	*Target pest*	*IRAC Classification**
Chlorantraniliprole	Apricot	*Anarsia lineatella*	28 Diamides
Deltamethrin	Apricot	*Ceratitis capitata*	3A Pyrethroids
Etofenprox	Apricot	*Anarsia lineatella Ceratitis capitata*	3A Pyrethroids
Emamectin benzoate	Apricot		6 Chloride channel activators
Lambda-cyhalothrin	Apricot	*Ceratitis capitata*	3A Pyrethroids
Mineral oil	Apricot	*Quadraspidiotus perniciosus*	
Phosmet	Apricot	*Ceratitis capitata*	1B Organophosphates
Spinosad	Apricot	*Anarsia lineatella* *Capnodis*	5 Spinosyns
Thiacloprid	Apricot	*Anarsia lineatella*	4A Neonicotinoids
Acetamiprid	Peach	Aphids	4A Neonicotinoids
Alpha-cypermethrin Lambda-cyhalothrin Zeta-cypermethrin	Peach	*Ceratitis capitata*	3A Pyrethroids

Cyfluthrin Deltamethrin			
Azadirachtin	Peach	Thrips	UN
Beauveria bassiana	Peach	Thrips	
Chlorantraniliprole	Peach	*Anarsia lineatella* *Cydia molesta*	28 Diamides
Cyfluthrin	Peach	Thrips	3A Pyrethroids
Etofenprox	Peach	*Anarsia lineatella* *Cydia molesta, Ceratitis capitata* Thrips, Cicadellidae	3A Pyrethroids
Emamectin benzoate	Peach		6 Chloride channel activators
Fluvalinate	Peach	Aphids	3A Pyrethroids
Imidacloprid	Peach	Aphids Cicadellidae	4A Neonicotinoids
Lambda-cyhalothrin	Peach	*Anarsia lineatella, Cydia molesta* *Pseudalacaspis pentagona* *Quadraspidiotus perniciosus* Thrips	3A Pyrethroids
Phosmet	Peach	*Anarsia lineatella* *Cydia molesta Pseudalacaspis pentagona, Ceratitis capitata, Quadraspidiotus perniciosus*	1B Organophosphates
Spinosad	Peach	*Anarsia lineatella, Cydia molesta* Thrips	5 Spinosyns
Thiacloprid	Peach	*Anarsia lineatella* *Cydia molesta*	4A Neonicotinoids
Imidacloprid Acetamiprid	Plum, Cherry	Aphids	4A Neonicotinoids
Mineral Oil	Plum, Cherry	*Quadraspidiotus perniciosus*	
Phosmet	Plum, Cherry	*Quadraspidiotus perniciosus*	1B Organophosphates
Chlorantraniliprole	Plum	*Cydia funebrana*	28 Diamides
Cyfluthrin/Imidacloprid	Plum	Thrips	3A/4A
Deltamethrin Lambda-cyalothrin	Plum	*Ceratitis capitata*, Thrips	3A Pyrethroids
Etofenprox	Plum	*Cydia funebrana*	3A Pyrethroids
Imidacloprid	Plum	*Hoplocampa* spp.	4A Neonicotinoids
Phosmet	Plum	*Cydia funebrana, Ceratitis capitata*	1B Organophosphates
Spinosad	Plum	*Cydia funebrana, Capnodis tenebrionis*	5 Spinosyns
Thiacloprid	Plum	*Cydia funebrana*	4A Neonicotinoids
Etofenprox	Cherry	*Rhagoletis cerasi*	3A Pyrethroids
Phosmet	Cherry	*Rhagoletis cerasi*	1B Organophosphates

*According to the IRAC Mode of Action Classification Scheme (IRAC, 2012). To prevent or delay the evolution of resistance to insecticides, successive generations of a pest should not be treated with compounds from the same MoA group.

In Italy, insecticides are applied up to 6-8 times per season in commercial stone fruit orchards, especially for peach. This varies according to cultivars and pest pressure. Similar programmes are applied in other countries in the PRA area. The insecticides are used to control pests such as *Ceratitis capitata* (Wiedemann, 1824) and *Rhagoletis cerasi* (Linnaeus, 1758) (Diptera Tephitidae)*;* aphid species (Hemiptera Aphididae); *Pseudaulacaspis pentagona* (Targioni Tozzetti, 1886), (*Diaspidiotus perniciosus*, (Comstock, 1881) and *Epidiaspis leperii* (Signoret, 1869) (Hemiptera: Diaspididae); *Parthenolecanium corni* (Bouché, 1844) and *Parthenolecanium persicae* (Fabricius, 1776) (Hemiptera: Coccidae); *Grapholita molesta,* (Busck, 1916), *Grapholita funebrana* Trietschke, 1835 and other Tortricid moths (Lepidoptera: Tortricidae); *Anarsia lineatella* Zeller, 1839 (Lepidoptera: Gelechiidae); *Frankliniella occidentalis* (Pergande, 1895) and other Thysanoptera (Thysanoptera: Thripidae); other pests as mites (Acari), Hymenoptera: Tenthredinidae, Coleoptera: Curculionidae...

In some countries (e.g. France, Spain), cherry and other *Prunus* species are grown under nets to protect them from rain, insects and/or birds. In a field experiment in southern France in cherry trees Charlot *et al.*, 2013 considered that netting between fruit setting and early September had some efficacy against insects, including *Capnodis tenebrionis*. It may therefore be also useful to limit the damage caused by *A. bungii*.

However, host plants grown in organic orchards, in forests, wild or ornamental plantings are not treated with insecticides at all or on a regular basis.
In organic orchards, the impact of the pest is likely to be massive (considering the very high infestation levels observed in private-owned orchards in the Campania region in Italy).

6.04 How great a negative effect is the pest likely to have on yield and/or quality of cultivated plants in the PRA area when all potential measures legally available to the producer are applied, without phytosanitary measures?

Major

Level of uncertainty: Medium

Few control measures are used against *A. bungii* in China (Zhang *et al*., 2000; Hu *et al*., 2007; Wang *et al*., 2007; Hong & Yang, 2010; Wen *et al*., 2010; Huang *et al*., 2012). Most of these papers are in Chinese with an English abstract and need to be translated in order to assess fully the information contained.

Control of a wood borer pest is always difficult and relies mostly on the removal of infested trees. Chemical control of wood borers is difficult, in particular because the hidden life stages cannot be killed by insecticides, but also because the flight period of adults is very long and the use of effective insecticides is prohibited or largely restricted in the EPPO region. The best control strategies include a combination of preventive and curative measures. However, known control measures seem not able to lower the pest population to an acceptable level.

Monitoring - to detect signs of larval presence and living adults

Plants can be inspected visually to detect the presence of the pest: exit holes or the presence of larvae. *A. bungii* larvae excrete frass out of their galleries almost every day (Gressitt, 1942; Liu *et al*., 1999). Young larvae start excreting frass about 2 weeks after hatching. The amount of frass increases with the size of the larva. Frass excretion can be observed on branches and trunks. Monitoring is easy to do in orchards or in many ornamental plantations, but it can become difficult in other conditions when potentially infested parts of the tree are hidden in dense vegetation. Regular monitoring is needed to be able to detect early infestation.
Adults are large beetles (2.5 to 4 cm). They are diurnal and their colour makes them relatively easy to find. Wang *et al*. (2007) and Garonna *et al*. (2013) give a trapping method using attractive liquid (sugar/vinegar mixtures). It is well known that Longhorn beetles are attracted by food liquids but this is mainly effective for wood borers that feed on dead or decaying wood, and less or not effective for many others species, especially those that attack living trees such as *A. bungii*. In fact it is likely that the trap is more effective when the relative humidity of the air is low, because adults look for water. In Italy, liquid food traps attracted many adults in some places but none in others (Nugnes, pers. comm., 2013). It is not yet considered as a reliable or particularly effective technique to ensure detection.
In China an attract & kill trap (based on ultraviolet lamp) is sold to growers (trademark “Bodisun”) but the effectiveness of this is not documented and it is not specific to *A. bungii*. Some research is being conducted in the University of Foggia (Italy) on attractants for mass trapping (E. Ucciero, Italian NPPO, pers. comm. 2013).

Prevention

Zhang *et al.,* 2000 recommend the implementation of strict quarantine requirements on nursery stock to prevent the spread of the pest with nursery plants. Huang *et al*. (2012) recommend the use of more resistant cultivars (without specifying them).

Chemical control

Wang *et al.* (2007) mentioned the following techniques: applying pesticides to tree trunks (as a paint) to control larvae, applying pesticides to the exit hole or blocking the exit hole with cloth (immersed in pesticides first) to kill pupae, larvae and adults, and finally fumigating infested trees with certain pesticides.
Some insecticides are reported by Huang *et al.* (2012) for China.
Recommended active substances include:

- to control larvae already in the trees: dimethoate, omethoate, triazophos, malathion, deltamethrin, zinc phosphide, aluminium phosphide, fenitrothion, dichlorvos, imidacloprid and sulfuryl fluoride.
- to control eggs: fenitrothion, carbaryl, dimethoate, imidacloprid, acetamiprid, cyhalothrin and parathion
- to control adults: dichlorvos, fenitrothion, deltamethrin, phoxim, fipronil, fenvalerate, fenitrothion, chlorbenzuron, and cypermethrin.

Many of the above active substances have restricted uses (e.g. they cannot be sprayed during the flowering period, or long pre-harvest intervals apply) or are prohibited in the EPPO region (e.g. organophosphates such as parathion, phoxim). In addition broad range insecticides such as pyrethroids (e.g. deltamethrin, cypermethrin) may not be suitable for use in IPM in some EPPO countries.

Spraying insecticides is only effective against adults but it requires contact or ingestion. Current insecticides used against indigenous pests (tortricid moths, aphids …) in the PRA area could have some efficacy but they may not provide protection for the entire flight period of *A. bungii*.

Systemic insecticides such as imidacloprid can be used on ornamental trees by injection or soil application, but this application may not be used in fruit trees in many EPPO countries. This treatment is largely preventive and not curative. Injection of systemic insecticides to control *Anoplophora* species has been investigated but is not considered as providing a complete control of the pest (Poland *et al.,* 2006) and it may have undesirable side-effects (Haack *et al.,* 2010). Although it may be possible to apply on some valuable individual trees, it would not be an appropriate treatment for use on a large scale.

Cultural control methods

Ensuring good management of orchards and keeping the trees in good health may help limit infestation and therefore damage. It is the basic measure recommended in most Chinese articles (e.g. Zhang *et al*., 2000; Huang *et al*., 2012).

Removal of infested trees followed by their destruction on site as it is advised for species such as *Anoplophora chinensis* in the EPPO region should help to reduce population sizes. ..

One of the basic control strategies in China is to collect adults by hand, or to insert wires into galleries to kill larvae.

Wang *et al*. (2007) report painting tree trunks to prevent egg laying, or covering the tree trunks before adults emerge with polythene as a control method. Huang *et al.* (2012) suggest painting the trunk with a mixture based on white lime to prevent oviposition. However employing such methods seems very difficult to carry out in the PRA area because they are labour intensive and probably much less effective than the removal of the infested trees. In addition, this seems very difficult to apply in the orchards or urban green spaces of the EPPO region. Some of these approaches could even accelerate the spreading of the pest as adults would be encouraged to fly further to find available host trees.

Early infestations may be controlled by dendrosurgery (removal of the infested parts of the tree where the young larvae are present, followed by appropriate disinfection). However, this necessitates first the early detection of infestation.

Biological control

Experimental methods of biological control have been studied in China (Huang *et al.,* 2012). Hong & Yang (2010) report that 84.2% efficacy on eggs and 68.5% on larval stages by spraying of an aqueous solution of *Lepiota helveola* (fungus) at 20% and 5% respectively in laboratory conditions. The mortality of larval stages in test conditions ranges from 33.9% to 87.5% but this product had no effect on eggs or on adults. It is not known if this method could be used in the field.

Entomopathogenic nematodes (*Steinernema* spp.) (Liu *et al*., 1993, 1997, 1998) and *Beauveria bassiana* (Shi *et al.,* 2009; Huang *et al.,* 2012) have been used in China. Liu *et al*. 1997, 1998 report good efficacy in the field with application of a solution with 40 000 nematodes/ml. Some *Steinernema* species are already used against e.g. *C. tenebrionis* in some EPPO countries (Morton & García del Pino, 2005; del Mar Martinez de Altube *et al*., 2007). These interesting results show that it may be possible to reduce the population of the pest but not to eradicate it.

6.05 How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area in the absence of phytosanitary measures?

Moderate

Level of uncertainty: low

Potential impact of *A. bungii* in the PRA area is assessed to be major in commercial stone fruit production.

Economic consequences

Some targeted measures will be needed, with limited additional costs.
Optimal control management strategies will need to be defined and will result in increased costs in terms of orchard monitoring, equipment, labour and plant protection products. This is most likely to happen for fruit trees of *Prunus* spp. Costs could also be associated with surveillance and dendrosurgery.

Control measures applied in forests and in the wild would be limited, but may involve surveillance and destruction of infested trees.
In urban areas, the costs to local community of managing roadside and urban trees may increase when infested trees present a risk for pedestrians, a deterioration of visual aspect or felling is required to reduce further spread of the pest.

6.06 Based on the total market, i.e. the size of the domestic market plus any export market, for the plants and plant product(s) at risk, what will be the likely impact of a loss in export markets, e.g. as a result of trading partners imposing export bans from the PRA area?

Minor

Level of uncertainty: Medium

The impact may be minor because fruit production and host plants are mainly produced for the market within the PRA area. If the fruit production in the PRA area decreases seriously, export markets will be affected.
Exportation of *Prunus* logs or wood products or *Prunus* plants for planting could be restricted or prohibited by the importing countries where *A. bungii* is listed as a quarantine pest in countries such as the USA (USDA Aphis, 2011) and Australia, (Biosecurity Australia, 2003). However, export of *Prunus* wood to the USA and Australia from the EU is minimal according to Eurostat (it does not occur every year and it was maximum 60 tonnes in 2008 over the last 5 years). Russel (2003) noted that, as there are insufficient supplies of wild cherry wood to meet demand in Europe, black cherry (*P. serotina*) is imported from North America.

6.07 To what extent will direct impacts be borne by producers?

Major (locally).

Level of uncertainty: Medium

Before the pest will be established all over the stone fruit production of the PRA area (which may not happen in a 50-years scale horizon), it is expected that the economic impact of *A. bungii* will be mainly local, and that the pest will hardly affect production at the country level. The affected producers will probably have to bear the cost because consumers will source fruits from other growers and because of the open EU market the prices for fruit are not expected to increase significantly at the country level.

Environmental impact

6.08. How important is the environmental impact caused by the pest within its current area of invasion?

This question cannot be answered.

Outbreaks outside its native area have only been recently reported and no environment damage is reported. Environmental damage is not reported in China but Wen *et al.* (2010) report *A. bungii* as a pest on forest *Prunus* in Liaoning and SEAP (2009) mentioned its control in the Shangdong Afforestation Project.

6.09. How important is the environmental impact likely to be in the PRA area?

Moderate

Level of uncertainty: Medium

The EWG considered that there is not enough information to answer this question. The economic impact '*sensu stricto'* is already major. As *A. bungii* is mainly considered as a pest of fruit trees, the EWG considered that the environmental impact will not significantly increase the rating. If other non-*Prunus* species listed under 1.06 (e.g. poplar, oak) prove to be hosts, the environmental impact will need to be reconsidered as they are keystone species in the PRA area.

Some elements on the possible environmental impact are as follows:

Economic consequences

- Several native *Prunus* species occur in the wild (e.g. *P. avium, P. cerasus*). Attacks of these species by the pest may kill or weaken them.
- *Prunus* species are not keystone species in forests but according to the EUNIS habitat classification (EUNIS, 2012), some habitats rely on the presence of *Prunus* species, such as

-*P. laurocerasus* in the understorey of *Fagus sylvatica* or *Fagus moesiaca* forests of the western and central Balkan Range.

- *Prunus padus* ssp. *borealis* in the subalpine zone of the Alps, the Carpathians, the Jura, the Hercynian ranges

- *Prunus fruticosa in* the dry, continental enclaves of Central Europe, in particular of the rain shadow of the Harz in Sachsen-Anhalt and Thuringia, of the xeric left-bank limestone and loess hills of the Palatine upper Rhine, of the Nida Valley and Lublin uplands of southeastern Poland, of dry hills of the Bohemian basin and of Moravia.

- One *Prunus* species is listed in the IUCN Red list (IUCN, 2013): *P. ramburii* (endemic to Andalusia) is listed as vulnerable.
- Some wild animals, birds and arthropods feed on fruit of wild *Prunus*. Wild *Prunus* also provide nectar and pollen for pollinators.
- Russel (2003) and EEA (2006) notes that wild cherry (*Prunus avium*) is used extensively in Europe for the afforestation of agricultural land.

Social impact

6.10 How important is social damage caused by the pest within its current area of distribution?

Minor

Level of uncertainty: Low

This is not recorded specifically in the literature available.

6.11 How important is social damage likely to be in the PRA area?

Minor to Major

Level of uncertainty: Medium

Social damage caused by the establishment of *A. bungii* in the PRA area depends on how widely it becomes established together with its impact on fruit production and ornamental plantations.

Loss of production or destruction of orchards could cause unemployment locally. This impact could be major in some areas where fruit trees are the main production.

Many fruit trees are grown in gardens for personal consumption. In such cases, the impact will be minor at the scale of the whole PRA area but could be major in some places where personal production is an important component of the food resource.

The aesthetic and recreational value of urban green spaces (private or public) may be affected.

Local *Prunus* cultivars used for fruit production may be lost.

As a conclusion, there might be social impacts upon specific uses of the host plants, especially where fruit production is affected. They may be major at the local level (e.g. in the case of private-owned orchards and organic orchards) but at the scale of the whole PRA area social impacts are assessed to be minor.

Other economic impacts

6.12 To what extent is the pest likely to disrupt existing biological or integrated systems for control of other pests?

Minimal extent

Level of uncertainty: Medium

Organic production for fruit trees is increasing in the EPPO region. Additional insecticide treatments could potentially have an impact on IPM. However, as control measures in the EPPO region are highly variable, it is difficult to answer this question.

Assuming that in most areas insecticides are still applied frequently, the EWG considered that the disruption to IPM will generally be minimal.

Economic consequences

6.13 How great an increase in other costs resulting from introduction is likely to occur?
Moderate
Level of uncertainty: Low

Other costs will be increased because of the management of outbreaks, of the importation controls, of public information and research projects on the biology of the pest or on the development of control methods (biological or chemical).

6.14 How great an increase in the economic impact of other pests is likely to occur if the pest can act as a vector or host for these pests or if genetic traits can be carried to other species, modifying their genetic nature?
Minimal
Level of uncertainty: Low

No information is available on this issue. *A. bungii* is not known as a vector or host of other pests and pathogens. *A. bungii* is mentioned as a vector of *Bursaphelenchus xylophilus* (Steiner & Buhrern, 1934) (pine wood nematode) (Parasitaphelenchidae) in Togashi (2008) (citing Yang *et al*., 2003) but this was not considered reliable as pine is not reported as a host of *A. bungii*.

Conclusion of the assessment of economic consequences

6.15 With reference area of potential establishment identified in Q 3.08, identify the areas which are at highest risk from economic, environmental and social impacts. Summarize the impacts and indicate how these may change in future.
Major
Level of uncertainty: Low

The whole area of potential establishment is at risk of economic impact. *A. bungii* is likely to have major economic impact for peach, apricot, cherry and plum trees in the whole area of production but especially in countries around the Mediterranean and Black Sea. The impact is expected to be higher in the southern part than in the northern part of the PRA area. However, there is some uncertainty as to the total area that may be endangered and the complete range of host plants that may be affected.

Economic impact on ornamental *Prunus* species is considered to be lower. However, there is uncertainty in relation to the host range and the associated damage.

The pest is likely to have a moderate environmental impact throughout the PRA area. Social impact is likely to be major at local scale and minor at the PRA area scale.

Degree of uncertainty
The main uncertainties of the assessment part are as follows:

-biology of the pest (temperature threshold, length of life cycle, distance of spread by natural means, size of plants attacked)
- pathways with which the pest was introduced into the EPPO region and Japan
-host range: ornamental and wild *Prunus*, non *Prunus* species (this will affect the assessment of entry, but also of the economic consequences and the likelihood of eradication)
-efficacy of chemical treatments currently applied in orchards in controlling the pest
-use of traps (why does it work in some areas and not other)

Conclusion of the pest risk assessment

A. bungii has already been introduced into the PRA area on 3 different occasions. The recently discovered but relatively large outbreak in Campania is under eradication and is requiring major efforts of the NPPO. The probability of establishment is rated as high. Eradication and containment are likely to be feasible only in case of early detections. The widespread presence of host plants would help both establishment and spread. Once introduced, it would spread naturally relatively slowly but may spread at a high rate with infested wood and planting material. Once established, the pest would have a major economic impact, both commercially and in gardens. It may also have a social impact which may be major at a local scale, and an environmental impact if it infests *Prunus* species in forests and other natural environments. There would likely be an increase in costs associated with control and research for management, and a limited impact on exports of wood, plants for planting and fruit.

A. bungii is considered to present a particular risk to the main areas producing stone fruits around the Mediterranean and Black Sea. However, there is some uncertainty as to the total area that may be endangered and the complete range of host plants that may be affected.

The EWG concluded that measures should be considered to prevent the further introduction of *A. bungii*. The analysis should continue to Stage 3 Pest risk management.

Stage 3: Pest Risk Management

7.01 - Is the risk identified in the Pest Risk Assessment stage for all pest/pathway combinations an acceptable risk?

no

7.02 - Is natural spread one of the pathways?

no

Natural spread is not relevant for the spread from Asia, except from Far East Russia (see 2.01). However, it will be relevant if the pest becomes established in the PRA area (e.g. in Italy).

Pathway: Host plants for planting (except seeds) of *A. bungii*

7.06 - Is the pathway that is being considered a commodity of plants and plant products?

yes

7.09 - If the pest is a plant, is it the commodity itself?

no (the pest is not a plant)

7.10 - Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest?

no

Level of uncertainty: **low**

The import of *Prunus* plants for planting from the countries where *A. bungii* is present is forbidden in the EU Directive 2000/29/EC.

Fruit trees are well regulated in some countries, which prohibit imports of several fruit hosts from the areas of origin (e.g. *Prunus* for the EU; *Citrus* for the EU and other countries). However, other species mentioned in 1.06 and which might be host plants are not subject to specific import requirements (e.g. *Populus* spp., *Zanthoxylum* spp., *Diospyros kaki*, *Punica granatum*).

In the EU, imports of certain plants from China are subject to emergency measures against *A. chinensis* (EU, 2012), which place specific requirements on conditions at the place of production and require inspections. Species regulated for *A. chinensis* cover some species mentioned in 1.06 such as *Citrus* spp., *Populus* spp., *Prunus laurocerasus*, *Pyrus* spp. and *Salix* spp. These measures may allow the detection of *A. bungii* (although not at the early stages of infestation).

In most countries, imported plants for planting are subject to general requirements (e.g. import permit or phytosanitary certificate). Such requirements ensure that some inspections are carried out, but detection of *A. bungii* can be difficult.

Overall, existing phytosanitary measures applied on the pathways will not prevent completely the introduction of the pest in the PRA area, as demonstrated by the currently known three introductions into the EPPO region.

Options at the place of production

7.13 - Can the pest be reliably detected by visual inspection at the place of production?

yes in a Systems Approach

Level of uncertainty: **low**

Possible measure: visual inspection at the place of production.

The adult beetles are 2-4 cm in length, and they are active during the day.

There are no oviposition scars since eggs are laid in crevices on the surface of the bark and they may be visible externally.

Management: Plants for planting

Symptoms of larval activity can be detected because the larvae produce and extrude large quantities of frass. Frass may be observed on the branches or the stems or on the surface of the ground. There may be several larvae in the main stem or branches. The fully developed larvae are up to 4 cm in length. However, during the early stages of infestation, the presence of larvae might not be easy to detect, especially before the larvae have had an impact on the tree.

Consequently, infestation can be difficult to detect in the early stages. Detection by visual inspection is unlikely to be completely effective and needs to be used within a systems approach.

7.14 - Can the pest be reliably detected by testing at the place of production?

no

Level of uncertainty: **low**

At the moment, this is not yet possible without removing areas of bark that causes damage to or destroys the plants. Systems for detecting larvae within trees are currently the subject of research, but are not yet available.

7.15 - Can infestation of the commodity be reliably prevented by treatment of the crop?

yes in a Systems Approach

Level of uncertainty: **low**

Possible measure: specified treatment of the crop.

Suitable treatments (see 6.04) will lower pest populations, but they do not eliminate the pest. Treatments are not sufficient on their own, but could be used as part of a systems approach.

7.16 - Can infestation of the commodity be reliably prevented by growing resistant cultivars?

no

Level of uncertainty: **low**

There is no information on difference in resistance or susceptibility for host species. An article in Chinese by Huang *et al*. (2012) recommends the use of more resistant cultivars (without specifying them).

7.17 - Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water, etc.)?

yes in a systems approach (see 7.21 pest free sites)

Level of uncertainty: **low**

Possible measure: specified growing conditions of the crop.

Plants for planting can be grown under complete physical protection with sufficient measures to exclude the pest. However, this is not common practice for nurseries of fruit trees. This will be realistic only for small scale production of high value material (e.g. bonsais).

7.18 - Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages?

no

Level of uncertainty: **low**

Larvae may be present within the stems and branches throughout the year.

7.19 - Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)?

no

Level of uncertainty: **low**

Management: Plants for planting

Not relevant for an insect pest.

7.21 – Based on the natural rate of spread (moderate with medium uncertainty), a possible measure is: pest-free place/site of production or pest free area.
Can this be reliably guaranteed?

yes for pest-free area, and for pest-free site under protection

***Level of uncertainty:* high for PFA (in countries where the pest is widespread), medium for pest-free site under protection**

Designation of a PFA is possible in theory, but there is uncertainty as to whether there are areas free of the pest in the countries where *Aromia bungii* originates. It is unknown whether the apparent absence of the pest from certain areas is due to a lack of host plants or a lack of records and an effective trapping system. The EWG expressed concern about the establishment and maintenance of a PFA in practice given the fact that the hosts are widespread in different environments (private gardens, forests). This is especially the case for countries where the pest is widespread and not under official control. Further data are needed on the rate of spread and the potential host range to better define these requirements.

To increase the level of assurance of pest freedom in countries where the pest is established, the following requirements are recommended to establish and maintain a PFA for *A. bungii*:

- A minimum distance of at least 20 km between the PFA and the closest known area where the pest is known to be present. It should be noted that there are currently no international standards to determine the minimum distance between a PFA and the nearest infested area. Besides from the dispersal capacity of the pest, it may also depend on the survey intensity and level of uncertainty about the pest's distribution, presence of natural barriers, etc. Little information is currently available on natural spread distances of *Aromia bungii*. The distance of 20 km was largely debated by the EWG. It is proposed as a precautionary approach, based on the fact that the outbreak in Italy has a radius of about 10 km after 5 years (see 4.01).
- Detailed surveys and monitoring should be conducted in the area in the two years prior to establishment of the PFA and continued every year. Specific surveys should also be carried out in the zone between the PFA and known infestation to demonstrate pest freedom. The surveys should focus on visual examination of *Prunus* trees but also include trapping (e.g. interception traps (Brustel, 2004, 2012; Bouget & Nageleisen, 2009).

An important element should be to raise public awareness about the pest so as to improve pest reporting.

- There should be restrictions on the movement of *Prunus* 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.
- Immediately prior to export consignments of the plants should be subjected to an official inspection for the presence of *A. bungii*.

These recommendations may need to be adapted for countries with limited outbreaks that are under official control in areas previously known to be free from the pest.

Pest free site of production

The EWG considered that given the similarity in the biology of the two pests, the requirements for *Anoplophora chinensis* (EU, 2012) could be adapted, (see below).

The plants should be grown, for their entire life or for at least 2 years, in a site of production established as free from *A. bungii* in accordance with International Standards for Phytosanitary Measures:

(i) which is registered and supervised by the NPPO in the country of origin; and

(ii) which has been subjected annually to at least two official meticulous inspections for any sign of *A. bungii* carried out at appropriate times and no signs of the organism have been found; and

(iii) where the plants have been grown in a site with complete physical protection against the introduction of *A. bungii*, and

(iv) where immediately prior to export consignments of the plants have been subjected to an official meticulous inspection, for the presence of the specified organism plus destructive sampling.

Management: Plants for planting

The plants grown from rootstocks should meet the same requirements, and be grafted with scions which at the time of export are no more than 1 cm in diameter.

The requirements for physical protection are as follows (see doc for Panel on Phyto Measures).

The EU requirements for *Anoplophora chinensis* include an option to grow the plants outdoors with a buffer zone of 2 km and applying preventive treatments. The EWG considered that this option provides a significantly lower level of protection than PFA or complete physical protection. There were concerns that there is little data on the efficacy of insecticide treatments and also that treatments could reduce pest levels without providing complete control and thereby reduce the level of probability of pest detection. There is also uncertainty of the flight distance and the length of the flight period. Therefore this option was not recommended.

A *Prunus* free area (i.e. removing all *Prunus* plants around the nursery) was discussed by the EWG, but was not considered suitable because of the uncertainty about the natural spread of the pest, particularly in areas where *Prunus* is absent, and due to the uncertainty regarding host range.

These requirements are not likely to be applicable for fruit trees but only for small scale production of high value material (bonsais, high grade material in certification schemes etc.).

Options after harvest, at pre-clearance or during transport

7.22 - Can the pest be reliably detected by a visual inspection of a consignment at the time of export, during transport/storage or at import?

yes in a Systems Approach

Level of uncertainty: **low**

Possible measure: visual inspection of the consignment.

The pest would be difficult to detect in a large consignment of plants for planting, although signs of larval activity and the presence of eggs and larvae may be detected on individual plants. Experience with detection of *A. chinensis* has shown that hidden stages are difficult to detect (van der Gaag *et al.*, 2008). Plants for planting are generally traded during the dormant season and transported at cool temperatures, which will make the pest less active and therefore less easy to detect. The presence of frass may be difficult to see as it may be dislodged when the plants are moved.

7.23 - Can the pest be reliably detected by testing of the commodity?

no

Level of uncertainty: **low**

There are methods that can detect wood-boring larvae in branches, stems or roots (e.g. x-rays, acoustic methods, systematic destructive sampling, trained dogs (Goldson *et al.*, 2003; Haack *et al.*, 2010)) but they are not fully developed, and they cannot be applied currently to *A. bungii*.

7.24 - Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?

no

Level of uncertainty: **low**

It is possible to apply treatments to larvae in their galleries (see 6.04), but this requires that all infested trees in a consignment are detected and treated individually. Note that these treatment have no registration in (many) EPPO countries but may be applied in the country of origin. Despite treatment, eggs may remain on the trees.

Treatment with fumigants is probably not effective since the larvae are protected inside woody stems and fumigants will probably not enter the larval tunnels to kill the larvae. Treatment with methyl bromide using a vacuum might kill the larvae inside the woody material (T201-a-2 in USDA Treatment Manual, 2012). Research will be needed to determine the efficacy of this method. This measure is not recommended because methyl bromide will be phased out in 2015 and its use is not favoured in many EPPO countries because of its environmental consequences, see IPPC Recommendation *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (FAO, 2008).

Hot water treatment and irradiation were considered, but rejected for *Saperda candida* (Fabricius, 1787) (Coleoptera: Cerambycidae) (EPPO, 2010) because they would negatively affect the viability of the plants. They are also very unlikely to be effective against *A. bungii*.

7.25 - Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment?

no

Level of uncertainty: **low**

Larvae are in branches or in the stems.

7.26 - Can infestation of the consignment be reliably prevented by handling and packing methods?

no

Level of uncertainty: **low**

The pest is in the plants, therefore handling and packing methods cannot prevent infestation. Handling and packing methods may be included in the requirements for PFA or pest-free site to prevent infestation of the consignment after leaving the place of production.

Options that can be implemented after entry of consignments

7.27 - Can the pest be reliably detected during post-entry quarantine?

yes

Level of uncertainty: **low**

Possible measure: import of the consignment under special licence/permit and post-entry quarantine.
This would require keeping the plants in post-entry quarantine for a sufficient time to detect the symptoms of larval activity (e.g. frass) (a minimum of 4 months at an average temperature above 20°C, otherwise a longer period will be required). This measure is likely to be applicable only for small scale imports and the risks and costs are borne by the importer. The Panel on Phytosanitary Measures considered that post-entry quarantine should not be recommended as all the risk (and cost) are borne by the importing country. Alternatively it may be recommended but only in the framework of a bilateral agreement.

7.28 - Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice?

no

Level of uncertainty: **low**

Plants for planting are destined to be planted, and if adults were to emerge, they could fly and find hosts in the vicinity.

7.29 - Are there effective measures that could be taken in the importing country (surveillance, eradication, containment) to prevent establishment and/or economic or other impacts?

no

Level of uncertainty: **low**

Some measures can be put in place (see 5.02), but they will be effective only in the case of early detection.
It is considered that the best way to prevent establishment and economic damage is to prevent the entry of the pest by import measures.

7.30 - Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?

yes

Q.	Stand alone	Systems Approach	Possible Measure	Uncertainty
7.13		X	visual inspection at the place of production	Low
7.15		X	specified treatment of the crop	Low
7.17		X	specified growing conditions of the crop	Low
7.21	X		Pest-free area	High (in countries where the pest is widespread)
			Pest-free site under complete physical protection	Medium
7.22		X	visual inspection of the consignment	Low
7.27	X		import of the consignment under special licence/permit and post-entry quarantine	Low

7.31 - Does each of the individual measures identified reduce the risk to an acceptable level?

no

***Level of uncertainty:* medium**

Measures identified reduce the risk to an acceptable level:

Pest-free area,

Or

Pest-free site under complete physical protection

or

Post-entry quarantine

7.32 - For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?

no

***Level of uncertainty:* low**

Several measures (treatments of the crop, thorough inspection of the crop, visual inspection of the consignment at export or at import) had been identified as non-sufficient on their own. However, no combination of these measures would reduce the risk to an acceptable level. The possibility to grow host plants under complete physical protection is accepted in a systems approach equivalent to a pest-free site.

7.34 - Estimate to what extent the measures (or combination of measures) being considered interfere with international trade.

***Level of uncertainty:* low**

For *Prunus* trees, importations are already prohibited in the EU from the countries where the pest originates. For other EPPO countries, measures will interfere to a certain extent with trade, but it is thought that trade from countries where *A. bungii* occurs is limited.

If these measures were to be implemented within the PRA area, this will greatly affect trade as there is an extensive exchange of *Prunus* plants within the PRA area.

7.35 - Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.

***Level of uncertainty:* low**

The measures proposed at origin would have costs linked to monitoring and treatment. However, similar measures are applied against other pests in nurseries, and measures are similar to those recommended against *A. chinensis*. Production under protected conditions with conditions ensuring exclusion of the pest might not be feasible for the type of material considered (high cost). However, *A. bungii* could be difficult and costly to eradicate or contain if introduced.

Post-entry quarantine is very expensive and is unlikely to be applied, except in very limited situations (such as tree specimens being imported for botanical collections and new stock). This measure is likely to be applicable only for small scale imports.

7.36 - Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences?

yes

The following measures have been identified:
Post-entry quarantine (for high value material)
or
Pest-free area,
or
Pest-free site under protection (for high value material)

Pathway: Wood commodities: wood (round or sawn, with or without bark) of host plants of *A. bungii*, waste wood and particle wood

7.06 - Is the pathway that is being considered a commodity of plants and plant products?

yes

7.09 - If the pest is a plant, is it the commodity itself?

no (the pest is not a plant)

7.10 - Are there any existing phytosanitary measures applied on the pathway that could prevent the introduction of the pest? (if yes, specify the measures in the justification)

no

***Level of uncertainty:* low**

The pathway seems open to most countries of the PRA area from all origins. Non-squared wood of some tree species is covered by general requirements (e.g. P.C.), requirements targeting other pests and, in a few cases, specific requirements for some species (but not directly targeting *A. bungii*). However, most hosts of *A. bungii* in this pathway are not covered by requirements against other pests.

Options at the place of production

7.13 - Can the pest be reliably detected by visual inspection at the place of production ?

yes in a Systems Approach

***Level of uncertainty:* low**

Possible measure: visual inspection at the place of production

See answer to 7.13 for the pathway of plants for planting.

It is considered that detection is more difficult in a forest than in a nursery.

7.14 - Can the pest be reliably detected by testing at the place of production?

no

***Level of uncertainty:* low**

As for plants for planting.

7.15 - Can infestation of the commodity be reliably prevented by treatment of the crop?

no

***Level of uncertainty:* low**

Not possible for wood production.

7.16 - Can infestation of the commodity be reliably prevented by growing resistant cultivars?

no

Level of uncertainty: low

As for plants for planting.

7.17 - Can infestation of the commodity be reliably prevented by growing the crop in specified conditions (e.g. protected conditions such as screened greenhouses, physical isolation, sterilized growing medium, exclusion of running water, etc.)?

no

***Level of uncertainty:* low**

This is not feasible for large trees grown in plantations and forests.

7.18 - Can infestation of the commodity be reliably prevented by harvesting only at certain times of the year, at specific crop ages or growth stages?

no

***Level of uncertainty:* low**

Larvae may be present in the stems and branches at any time of the year.

7.19 - Can infestation of the commodity be reliably prevented by production in a certification scheme (i.e. official scheme for the production of healthy plants for planting)?

no

***Level of uncertainty:* low**

Not relevant for an insect.

7.20 - Based on your answer to question 4.01 (moderate rate of spread with medium uncertainty), select the rate of spread.

moderate rate of spread

***Level of uncertainty:* low**

Possible measure: pest-free place of production or pest free area.

7.21 - The possible measure is: pest-free place of production or pest free area Can this be reliably guaranteed?

Yes for pest-free area

***Level of uncertainty:* high**

See pathway plants for planting

Production under protected conditions is not possible for wood production.

Options after harvest, at pre-clearance or during transport

7.22 - Can the pest be reliably detected by a visual inspection of a consignment at the time of export, during transport/storage or at import?

yes in a Systems Approach

***Level of uncertainty:* low**

Possible measure: visual inspection of the consignment.

The inspection of consignments of wood is difficult and the pest has hidden life stages. Larval galleries are visible in cross-section and on cut surfaces of sawn wood, and frass may accumulate on or below the wood. However inspection will not guarantee detection as only a sample of the consignment is inspected, and frass may be removed when the material is moved.

For particle wood and wood waste, even if inspection was carried out, it is unlikely to detect the pests, as:
- wood chips or wood waste might contain several tree species (including non-host, which will make the inspection more difficult)
- signs of presence of the pest in wood (e.g. galleries) would not be easy to observe.

Sampling rates for a possible detection of such pests in wood chips have not been defined but large samples would be needed to be confident that the pest is not present (Økland *et al.*, 2012). However, inspection of the consignment may allow the size of the chips to be checked (see 7.24)

7.23 - Can the pest be reliably detected by testing of the commodity?

no

***Level of uncertainty:* low**

As for plants for planting

7.24 - Can the pest be effectively destroyed in the consignment by treatment (chemical, thermal, irradiation, physical)?

yes as stand alone measure

Level of uncertainty: **medium** (exact schedule for heat treatment)

Possible measure: specified treatment of the consignment

The following treatments could be applied:

Heat treatment. According to EPPO Standard PM 10/6(1) *Heat treatment of wood to control insects and wood-borne nematodes* (EPPO, 2009a), Cerambycidae are killed in round wood and sawn wood which have been heat-treated throughout the profile of the wood at least 56 °C for at least 30 min.
It should be noted that wood packaging material with ISPM 15 mark had been found infested with *Aromia bungii* larvae (see 1.01), which may question the efficacy of the heat treatment at 56 °C for 30 min (it might also be that the treatment was not properly applied and the temperatures required were not reached). There has been much debate in recent years regarding the efficient temperature and duration of heat treatment for the buprestid *Agrilus planipennis* in wood. The EU did not retain heat treatment as an option for wood against *A. planipennis*, Canada uses the original schedule (56 °C for 30 minutes) and USA uses 60°C for 60 minutes for firewood but 71.1°C for 75 minutes for logs and lumber (see EPPO PRA on *A. planipennis* for details, EPPO 2013).
There are no specific data on the efficacy of heat treatment against *A. bungii*. A different schedule might be required (higher temperature and/or longer time).

Kiln drying alone was not considered sufficient as a phytosanitary treatment, based on the results from the EUPHRESCO project (PEKID[2]) for other Cerambycidae.

Irradiation. According to EPPO Standard PM 10/8(1) Disinfestation of wood with ionizing radiation, Cerambycidae infesting wood are killed after an irradiation of 1kGy (EPPO, 2009b).
Experimental work on microwave treatment against *A. bungii* is in progress in Campania, Italy (Griffo pers. comm., 2013) after successful results with *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera Dryophthoridae) (Massa *et al.*, 2011). Fleming *et al.* (2003) experimented with the use of microwaves to destroy *A. glabripennis* in wood used for making pallets and crates in China. Initial experiments conducted on blocks of poplar showed that irradiation at 100% power using a 900 W microwave oven kills *A. glabripennis* larvae and pupae in 5 to 30 seconds in dry poplar and 3 minutes or less in wet poplar. Fleming *et al.*, 2005 showed the efficacy of microwave treatment of logs in a commercial microwave equipment to eradicate cerambycid larvae in pine wood. These preliminary data suggest that microwaves could be a feasible, practical alternative for the eradication of exotic wood-boring insects in wood used to construct solid wood packing materials.
However, there is no data on the efficacy of these treatments on logs. They would probably be too expensive for low-value products such as firewood, waste wood or particle wood.

Fumigation. Methyl bromide fumigation of wood is unlikely to be effective, because of the presence of bark and size of the material. According to EPPO Standard PM 10/7(1) *Methyl bromide fumigation of wood to control insects* (EPPO, 2009c), only wood without bark and whose dimensions does not exceed 200 mm cross section can be fumigated to destroy insect pests. In addition, methyl bromide will be phased out in 2015 and its use is not favoured in many EPPO countries because of its environmental consequences, see IPPC Recommendation *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (FAO, 2008).
Haack *et al.* (2010) report that ethanedinitril and sulfuryl fluoride, two candidate fumigants to replace methyl bromide, are highly effective against *A. glabripennis* in wood packaging material (citing Ren *et al*., 2006, and Barak *et al*., 2006 respectively).

Vacuum treatment. High mortality of *A. glabripennis* in wood packaging material had been achieved with and vacuum treatment in laboratory trials (Chen *et al.*, 2008). However, there is no data on the efficacy of this treatment on logs.

[2] **P**hytosanitary **E**fficacy of **Ki**ln **D**rying **(PEKID).** https://www.dafne.at/prod/dafne_plus_common/attachment_download/4b10baefd6252baa1626dd6563acc560/PEKID%20WP3%20Krehan%20Final%20report.pdf

Chipping to a certain size. Wood pieces below a certain dimension will not allow the survival of any stage of the pest. The EWG considered that the current requirements as for *A. glabripennis* would be adequate for *A. bungii* as they are about the same size. It should be noted that there are currently no specific requirements in the EU on wood chips related to *Anoplophora chinensis* or *A. glabripennis* probably because the trade of chips from countries where these pests occur is minimal (van der Gaag *et al*., 2008).
A small experiment with surrogate larvae of *Anoplophora glabripennis* (plastic and up to 40 mm lengths) indicated that about 94-97.5 % of the larvae may be killed when chipping to down to diameter sizes of 6-10 cm (Wang *et al.* 2000). Chipping the wood to pieces of less than 2.5 cm in any dimension is considered adequate to destroy the pest (Kopinga *et al*., 2010).
To prevent spread of *A. glabripennis* in Canada, domestic movement of wood chips made of hosts from a demarcated area should be made by “chipping and/or tub grinding to 1.5 cm or less in size in 2 dimensions” (CFIA, 2012). The EWG considered that this approach provided a similar level of protection than 2.5 cm in all dimensions.

Some treatments (heat treatment, fumigation, irradiation) could be effective but their practical implementation should be defined based on further research. For other Cerambycidae, the Panel on Phytosanitary Measures considered that heat treatment of the wood chips and waste at 56°C for 30 min throughout the material could be recommended.
Wood could also be treated prior to chipping (above), this could be equivalent to treatment of wood chips.

7.25 - Does the pest occur only on certain parts of the plant or plant products (e.g. bark, flowers), which can be removed without reducing the value of the consignment?

no

Level of uncertainty: **low**

The larvae are in the wood.

7.26 - Can infestation of the consignment be reliably prevented by handling and packing methods?

no

Level of uncertainty: **low**

Infestation occurs prior to the felling of trees. Wood could be stored in the exporting country under strict control of the NPPO for a sufficient period to allow all life stage to emerge. However, there are no data of the length of survival of larvae and pupae in cut wood. Experimentations of survival of young stages of *A. bungii* in cut wood are in progress in Campania, Italy (Griffo, pers. comm., 2013).
In addition, given the difficulty to control the application of this measure in practice, it was not considered as an appropriate option for imported material.

Options that can be implemented after entry of consignments

7.27 - Can the pest be reliably detected during post-entry quarantine?

no

Level of uncertainty: **low**

This is not a relevant measure for wood.

7.28 - Could consignments that may be infested be accepted without risk for certain end uses, limited distribution in the PRA area, or limited periods of entry, and can such limitations be applied in practice?

Yes

Level of uncertainty: **medium** (temperature that does not allow emergence of the pests)

Possible measure: import of the consignment under special licence/permit and specified restrictions.

Wood for processing (e.g. pulpmills and fuel wood for energy production), particle wood and wood waste could be imported during periods of the year outside of the flight period of *A. bungii*, and be processed before the next flight period of the pest, provided that conditions in storage do not allow emergence of the pest (e.g. temperatures below

5°C, although there is some uncertainty about the exact threshold for this species). The specific requirements need to be adapted to take into account the flight period in the country of origin and the temperature in the place of destination.
The material should be covered during transport from the point of entry to the processing plant (by using covered truck, containers and railcars) and should not be stored outside.
Waste or by-products from this wood should also be managed before the next flight period in such a way as to prevent adult emergence.
It should be stressed that this measure would be difficult to implement and control in practice. It should be as part of a specific agreement between the importing and exporting countries outlining specific requirements. It should also be noted that part of the endangered area has a climate with mild winters during which the temperatures will not stay long below 5°C.

This measure does not apply to wood for furniture because the processing does not guarantee the destruction of the pest. This measure is not appropriate for firewood, which is often stored for some time before being used.

7.29 - Are there effective measures that could be taken in the importing country (surveillance, eradication, containment) to prevent establishment and/or economic or other impacts?

no

***Level of uncertainty:* low**

Same as for plants for planting.

7.30 - Have any measures been identified during the present analysis that will reduce the risk of introduction of the pest?

yes

Q.	Stand alone	Systems Approach	Possible Measure	Uncertainty
7.13		X	visual inspection at the place of production	low
7.21	X		pest-free area	medium
7.22		X	visual inspection of the consignment	low
7.24	X		specified treatment of the consignment	medium
7.28	X		Import for specific end use and at specific time of the year (part of a bilateral agreement outlining specific requirements)	medium

7.31 - Does each of the individual measures identified reduce the risk to an acceptable level?

no

***Level of uncertainty:* low**

Measures reducing the risk to an acceptable level:
Pest-free area
or
Treatment

- For wood: heat treatment but data is needed to define the exact schedule, or irradiation
- For particle wood and wood waste: heat treatment, or chipped to pieces less than 2.5 cm in all dimensions or 1.5 cm in 2 dimensions.

Or
Import for specific end use and at specific time of the year (wood for processing only)

7.32 - For those measures that do not reduce the risk to an acceptable level, can two or more measures be combined to reduce the risk to an acceptable level?

no

***Level of uncertainty:* low**

Visual inspection at the place of production and at import will not be sufficient to reduce the risk to an acceptable level.

7.34 - Estimate to what extent the measures (or combination of measures) being considered interfere with international trade.
Level of uncertainty: **low**
The volume of trade between the area of origin and the PRA area is small. Interference will be minimal.

7.35 - Estimate to what extent the measures (or combination of measures) being considered are cost-effective, or have undesirable social or environmental consequences.
Level of uncertainty: **low**
Heat treatment may not be cost effective in comparison with the value of the wood.

7.36 - Have measures (or combination of measures) been identified that reduce the risk for this pathway, and do not unduly interfere with international trade, are cost-effective and have no undesirable social or environmental consequences?

yes

The following measures have been identified:
Pest-free area
or
Treatment:

- For wood: irradiation or heat treatment but data are needed to define the exact schedule for the heat treatment and it may not be cost-effective for low value wood such as firewood
- For particle wood and wood waste: heat treatment or chipped to pieces less than 2.5 cm in any dimension or to 1.5 cm in 2 dimensions

or
Import for specific end use and at specific time of the year for wood for processing (part of a bilateral agreement outlining specific requirements)

7.45 - Conclusions of the Pest Risk Management stage.

List all potential management options and indicate their effectiveness.
Uncertainties should be identified.
The EWG believed that measures should be taken for the pathways studied. Although the probability of entry is unlikely for some pathways, this is mostly due to the volume of trade. If established in the PRA area, *A. bungii* would have a major impact in managed and natural environments. It would also be difficult to eradicate if introduced. The measures identified are given in the table below. Measures for wooden furniture and objects made of wood are based on those for the wood.

The main uncertainty for management is:
- the host range of the pest (should measures be applied only for *Prunus* species or all plants listed in 1.06?)
- the concrete requirements for establishing a PFA in a country where the pest is widespread
- heat treatment (exact schedule to kill the pest)
-minimum temperature threshold (to allow import on infested material at certain periods of the year)

PC= Phytosanitary certificate, RC=Phytosanitary certificate of re-export

Pathway	**Measures**
Host plants for planting (excluding seeds)	PC and • Pest-free area (see requirements in 7.21) or • Pest-free site under complete physical isolation (small scale production in authorized facilities) • Post-entry quarantine for 4 months at minimum 20°C in the framework of a bilateral agreement
Wood of host species (round or sawn, with or without bark, firewood)	PC and • Pest-free area see requirements in 7.21) or • Treatment (heat, irradiation) or • Import for processing at specific time of the year (only in the framework of a bilateral agreement)
Hardwood particle wood and wood waste	PC and • Pest-free area see requirements in 7.21) or • Treatment (chipped to pieces of less than 2.5 cm in any dimension or to 1.5 cm in 2 dimensions) or • Heat treatment (56°C for 30 min) or • Import for processing at specific time of the year (only in the framework of a bilateral agreement)
Wood packaging material (including dunnage) containing host wood	• Treated according to ISPM 15
Wooden furniture and objects made of wood	• Heat treatment

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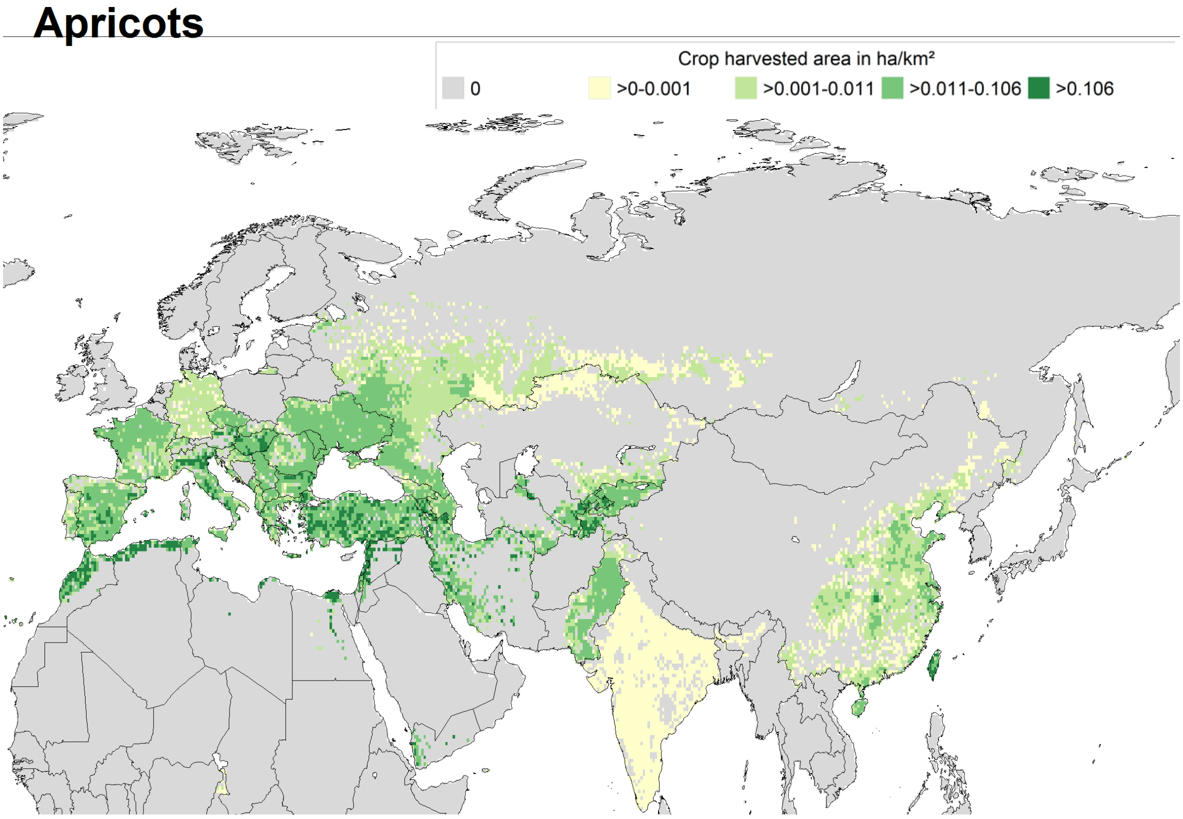
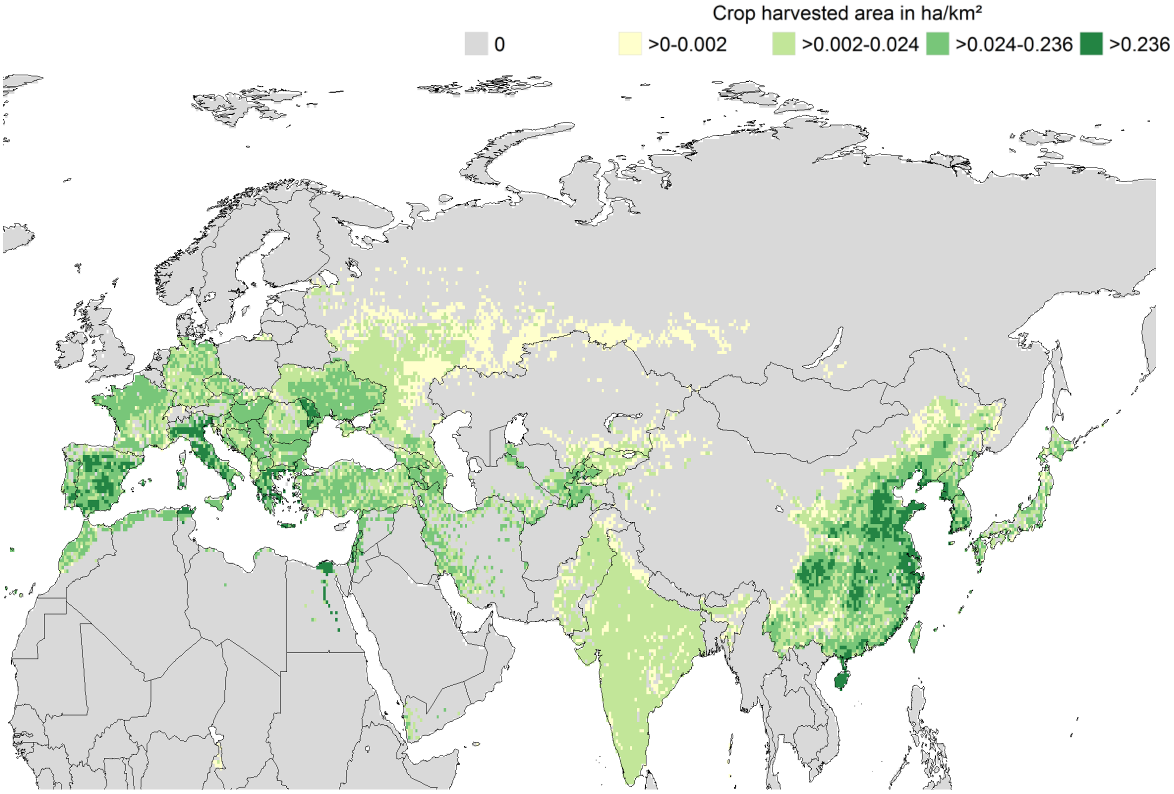
Annex 1. Maps of the main host plants in the EPPO region and in the area of origin of *A. bungii* and surface cultivated in EPPO countries.



Apricot (Area harvested in ha) in 2011 (source FAO stat)

countries	2011	countries	2011
Turkey	59696	Kazakhstan	2100
Algeria	38174	Republic of Moldova	2063
Uzbekistan	36500	Poland	1692
Italy	19595	Czech Republic	1276
Spain	18729	Slovakia	1194
France	13900	Jordan	904
Morocco	12505	Israel	780
Russian Federation	11000	Switzerland	670
Tunisia	10028	Bosnia and Herzegovina	600
Ukraine	9300	Austria	584
Kyrgyzstan	8000	Macedonia (FYR of)	404
Bulgaria	6686	Portugal	390
Egypt	6247	Croatia	375
Greece	6000	Albania	300
Serbia	4600	Cyprus	246
Hungary	4306	Germany	54
Romania	2547	Slovenia	37
Azerbaijan	2541	Malta	8

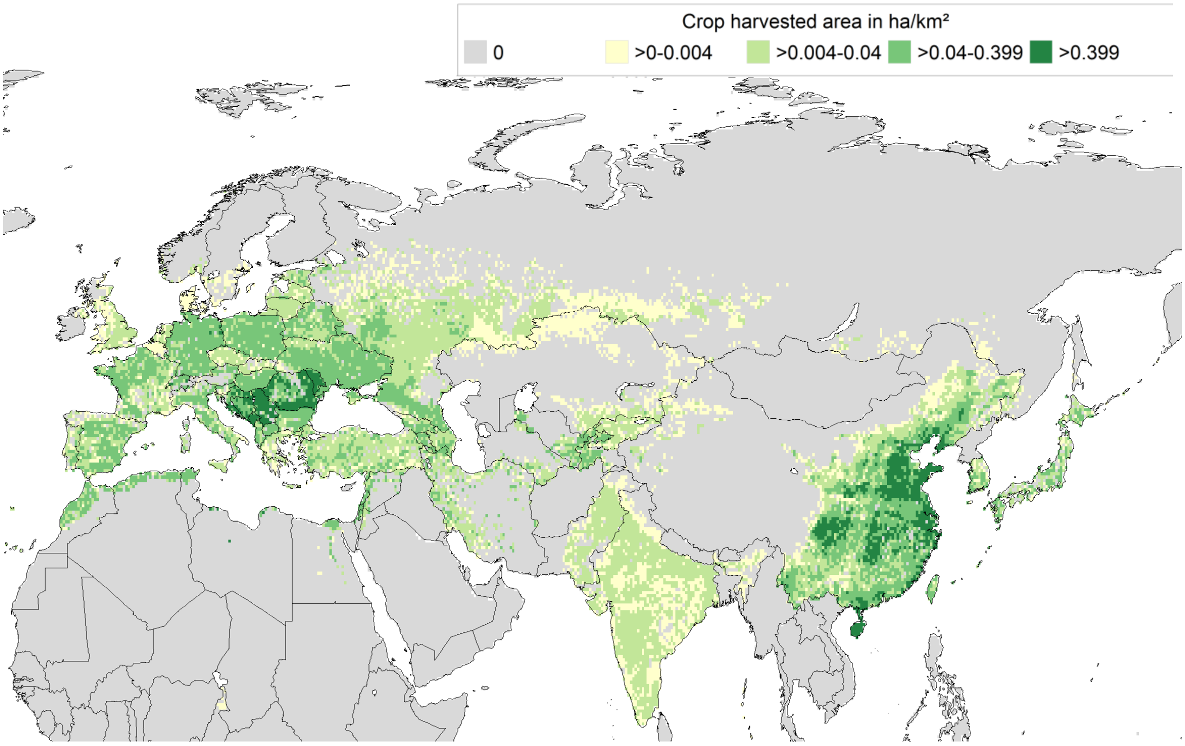
Peaches and nectarines



Peaches and nectarines: Area harvested in ha in 2011

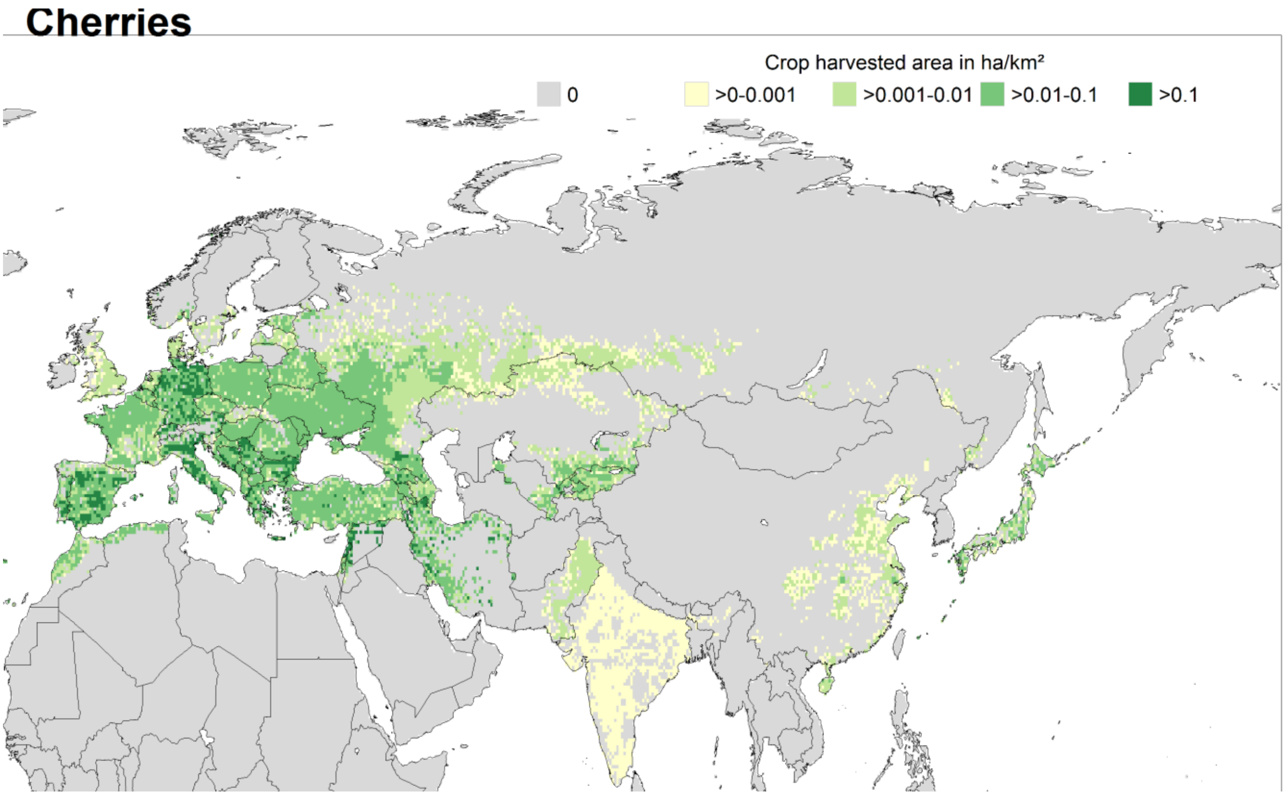
countries	2011	countries	2011
Italy	88580	Azerbaijan	2881
Spain	81374	Jordan	2357
Greece	42200	Israel	2070
Egypt	31255	Romania	2068
Turkey	26894	Bosnia and Herzegovina	2000
Algeria	19091	Croatia	1912
Tunisia	15811	Macedonia (FYR of)	1100
France	12921	Albania	870
Serbia	12000	Austria	840
Uzbekistan	9800	Czech Republic	743
Ukraine	6100	Montenegro	703
Hungary	5809	Slovakia	522
Bulgaria	5645	Cyprus	512
Russian Federation	5500	Slovenia	468
Morocco	5395	Kazakhstan	400
Republic of Moldova	5385	Malta	130
Kyrgyzstan	3800	Germany	94
Portugal	3711	Switzerland	13
Poland	3461		

Plums



Plum: Area harvested in ha in 2011

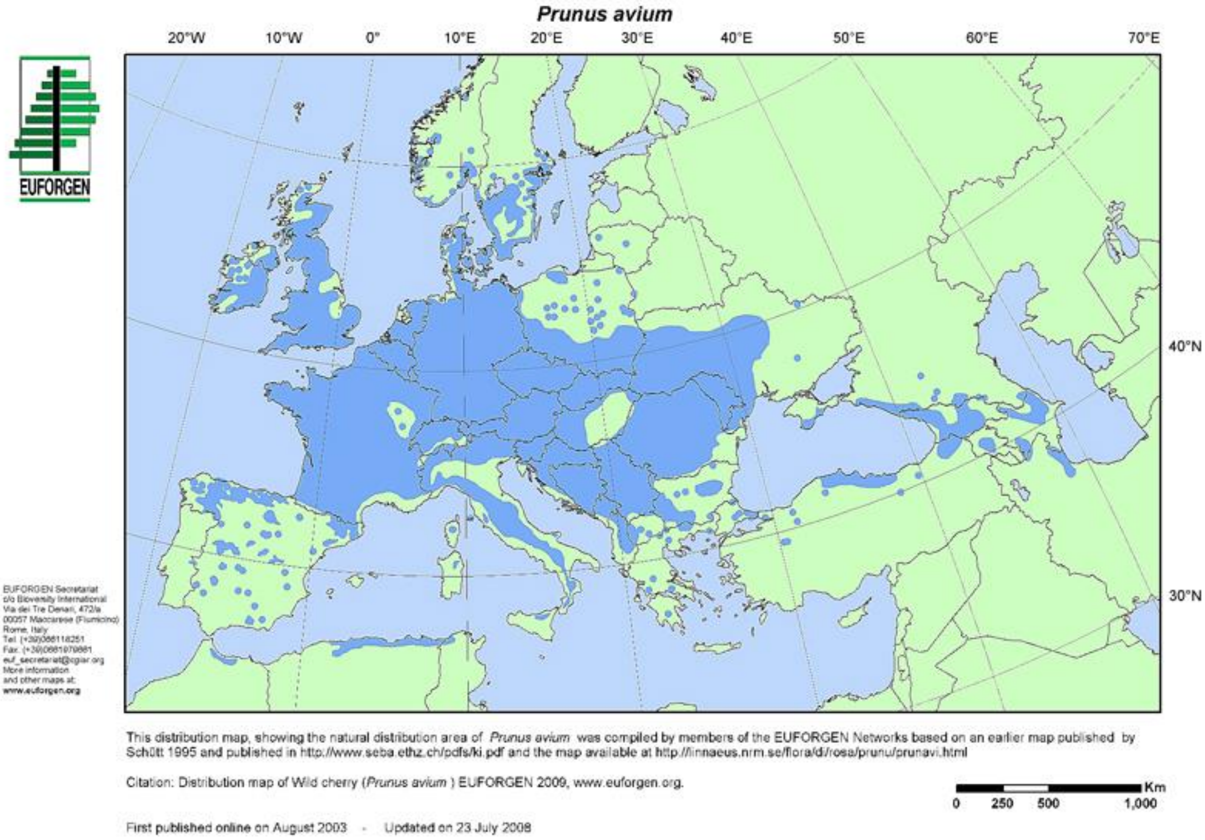
countries	**2011**	**countries**	**2011**
Serbia	168000	Montenegro	2700
Bosnia and Herzegovina	78176	Slovakia	2072
Romania	68197	Kyrgyzstan	2000
Russian Federation	33800	Czech Republic	1958
Poland	20244	Israel	1900
Turkey	19658	Albania	1800
Ukraine	19300	Portugal	1560
France	18331	Greece	1400
Republic of Moldova	18287	Lithuania	1050
Spain	17066	Egypt	1037
Algeria	16515	United Kingdom	850
Bulgaria	14682	Kazakhstan	800
Italy	14200	Jordan	555
Belarus	8053	Cyprus	484
Morocco	7542	Estonia	441
Hungary	7539	Norway	385
Croatia	6490	Switzerland	339
Macedonia (FYR of)	6369	Netherlands	257
Austria	5630	Sweden	100
Germany	4545	Latvia	85
Tunisia	3997	Denmark	69
Azerbaijan	3677	Belgium	55
Slovenia	3002	Luxembourg	37



Cherry: Area harvested in ha in 2011

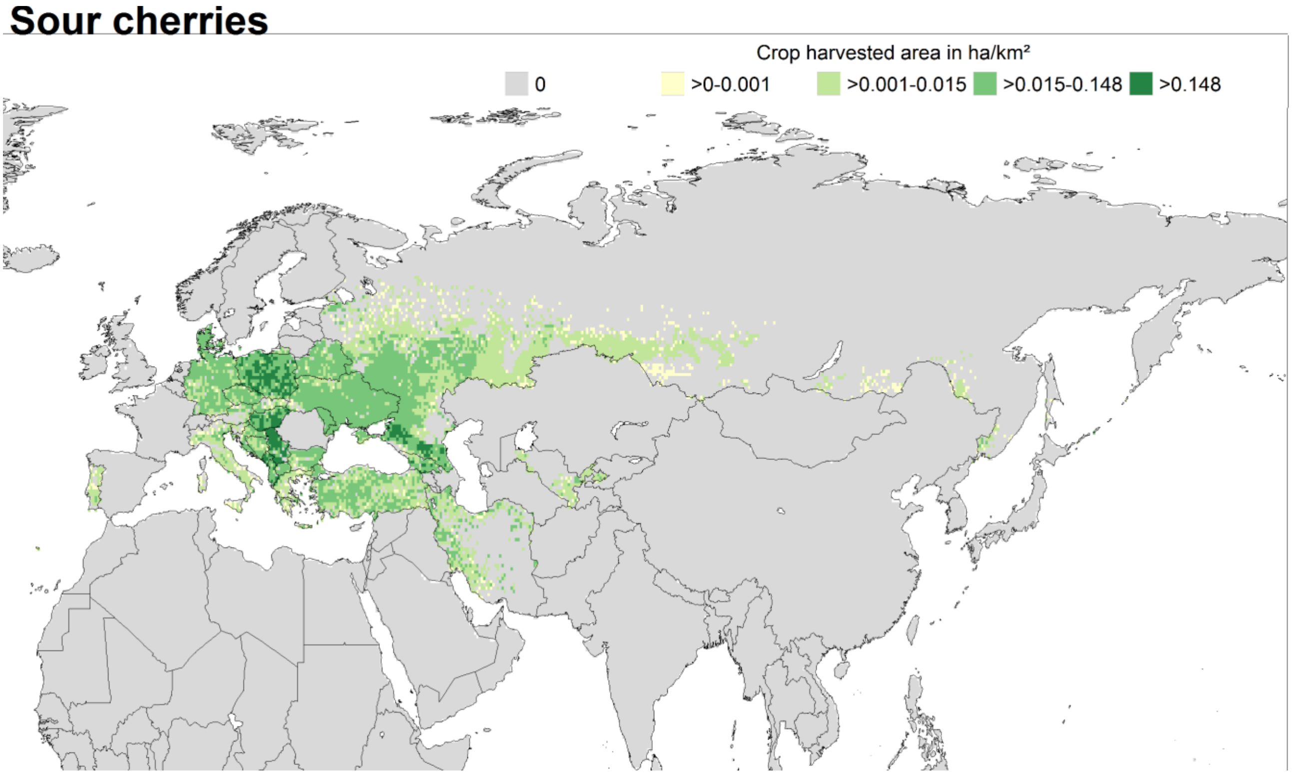
countries	2011	countries	2011
Turkey	45246	FYR of Macedonia	1213
Italy	30207	Slovakia	1184
Spain	24976	Belgium	1142
Russian Federation	16000	Lithuania	1116
Austria	15000	Armenia	1085
Bulgaria	13957	Czech Republic	1074
Ukraine	12500	Tunisia	913
Poland	11555	Croatia	762
Greece	9800	Montenegro	753
France	9643	Netherlands	708
Serbia	9000	Belarus	600
Uzbekistan	8700	United Kingdom	499
Romania	6853	Switzerland	498
Bosnia and Herzegovina	6000	Israel	480
Portugal	5659	Norway	400
Germany	5338	Estonia	275
Algeria	2879	Cyprus	251
Kyrgyzstan	2800	Sweden	180
Rep. of Moldova	2393	Jordan	130
Hungary	2270	Slovenia	124
Morocco	2096	Latvia	120
Azerbaijan	1654	Denmark	120
Kazakhstan	1500	Luxembourg	4
Albania	1400		

Distribution of *Prunus avium* (wild cherry) in the EPPO region (source Euforgen, 2008, http://www.euforgen.org/distribution_maps.html)



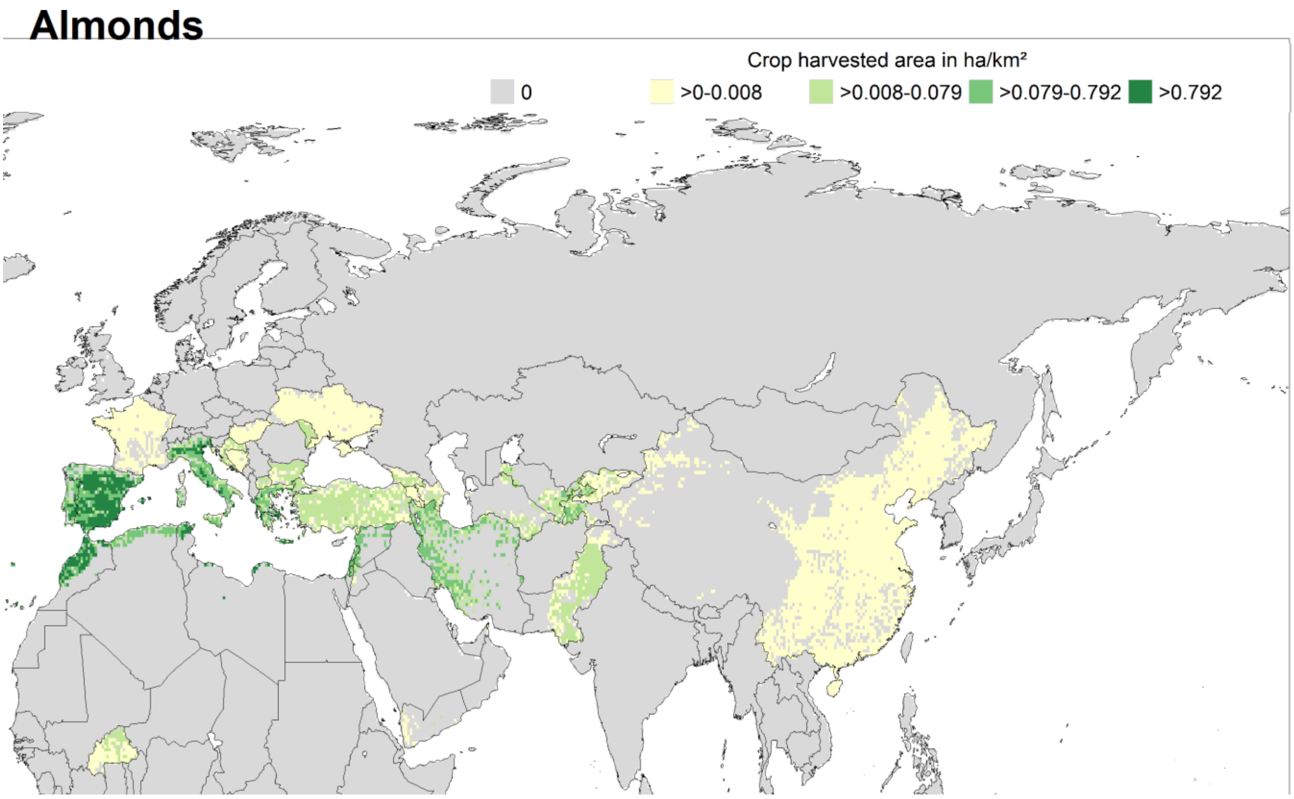
Annex 2. Maps of the other *Prunus* plants that may become hosts in the EPPO region

Prunus cerasus



Sour cherry: Area harvested in ha in 2011

Countries	2011	Countries	2011
Russian Federation	35000	Bulgaria	2823
Serbia	35000	Bosnia and Herzegovina	2100
Poland	33982	Czech Republic	1542
Ukraine	20000	Italy	1493
Turkey	19863	Austria	1450
Hungary	13388	Denmark	1403
Belarus	6474	FYR of Macedonia	1200
Uzbekistan	3500	Spain	600
Croatia	3434	Portugal	432
Azerbaijan	3170	Greece	295
Albania	3000	Slovakia	273
Rep. of Moldova	2885	Kazakhstan	40
Germany	2855	Slovenia	14



Almonds: Area harvested in ha in 2011

Countries	**2011**	**Countries**	**2011**
Spain	536312	Kyrgyzstan	606
Tunisia	190000	FYR of Macedonia	485
Morocco	146325	Azerbaijan	434
Italy	75453	Jordan	313
Algeria	39805	Rep. of Moldova	300
Portugal	26877	Croatia	233
Turkey	21105	Bosnia and Herzegovina	213
Greece	14100	Hungary	162
Uzbekistan	6359	Ukraine	100
Cyprus	3067	Kazakhstan	81
Israel	2500	Hungary	162
France	1255	Ukraine	100
Bulgaria	1136	Kazakhstan	81

Annex 3. Import of wooden commodities in the EU (source Eurostat, 2013)

Table 1: Import of "**sawdust and wood waste and scrap**, whether or not agglomerated in logs, briquettes or similar forms (excl. pellets)" in tonnes for the EU

	China	Vietnam	Japan	Taiwan	Total
2012	859	1344	2	0	**2205**
2011	907	939	23	0	**1869**
2010	1389	397	4	0	**1790**
2009	2740	689	8	0	**3438**
2008	819	1298	3	0	**2119**
2007	1481	80	1	300	**1861**
2006	1201	443	29	0	**1673**
2005	210	23	10	0	**243**

Table 2: Import of "**wood in chips or particles** (excl. those of a kind used principally for dying or tanning purposes, and coniferous wood)" in tonnes for the EU

	China	Vietnam	Japan	Taiwan	Total
2012	33	0	17	0	**49**
2011	272	55	0	0	**327**
2010	189	0	0	0	**189**
2009	52	0	0	0	**52**
2008	56	0	0	0	**56**
2007	29	0	0	0	**29**
2006	86	0	0	0	**86**
2005	2	0	0	3	**5**

Tables 3-6: Import **of wooden furniture** in the EU (source Eurostat, 2013) from countries where *A. bungii* occurs (in tonnes):

- wooden furniture for offices (excl. seats) Code 940330
- wooden furniture for kitchens (excl. seats) Code 940340
- wooden furniture for bedrooms (excl. seats) Code 940350
- wooden furniture (excl. for offices, kitchens and bedrooms, and seats) Code 940350
- seats, with wooden frames (excl. upholstered) Code 940169

China

in tonnes	2012	2011	2010	2009	2008	2007	2006	2005
Wooden furniture for offices	22 908	26 160	31 323	31 086	48 638	51 806	40 493	29 573
Wooden furniture for kitchens	15 287	17 353	17 200	19 239	16 792	25 694	15 443	9 844
Wooden furniture for bedrooms	171 306	170 064	168 010	143 816	150 530	136 345	96 232	59 002
Other wooden furniture	555 988	584 269	621 047	517 051	639 944	641 505	478 847	390 541
Seats, with wooden frames	50 387	58 883	77 998	67 209	80 884	66 790	87 067	53 488
Total	**815 876**	**856 729**	**915 578**	**778 400**	**936 788**	**922 140**	**718 081**	**542 448**

Vietnam

in tonnes	2012	2011	2010	2009	2008	2007	2006	2005
Wooden furniture for offices	767	600	1 029	483	1 050	489	633	1 400
Wooden furniture for kitchens	349	529	652	1 078	1 757	1 166	1 333	1 265
Wooden furniture for bedrooms	38 700	26 399	23 027	22 715	27 700	25 946	16 636	12 879
Other wooden furniture	113 500	116 398	122 569	109 552	150 833	142 469	121 277	108 669
Seats, with wooden frames	62 175	66 164	74 974	55 831	56 367	78 390	59 658	48 349
Total	**215 490**	**210 091**	**222 250**	**189 659**	**237 706**	**248 459**	**199 537**	**172 562**

Taiwan

in tonnes	2012	2011	2010	2009	2008	2007	2006	2005
Wooden furniture for offices	575	397	664	846	785	667	1211	3030
Wooden furniture for kitchens	100	217	59	415	112	151	578	92
Wooden furniture for bedrooms	785	656	995	2840	2652	1047	1689	1552
Other wooden furniture	4840	5929	9098	12571	12551	10901	13497	14572
Seats, with wooden frames	313	718	1174	1790	1223	925	2271	1114
Total	**6 613**	**7 918**	**11 989**	**18 462**	**17 322**	**13 690**	**19 246**	**20 359**

Mongolia

in tonnes	2012	2011	2010	2009	2008	2007	2006	2005
Wooden furniture for offices	0	0	0	0	0	0	1	0
Wooden furniture for kitchens	0	0	0	0	2	0	1	1
Wooden furniture for bedrooms	5	8	9	7	2	2	1	2
Other wooden furniture	13	20	14	37	46	23	19	16
Seats, with wooden frames	1	1	2	0	3	4	1	3
Total	**18**	**29**	**25**	**44**	**53**	**29**	**23**	**22**