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

**20-25978**

*This PRA document was modified in 2016 to clarify taxonomic issues (yellow note), and in 2021 to clarify the phytosanitary measures recommended*

# Pest Risk Analysis for

# *Apriona germari*, *A. japonica*, *A. cinerea*

Note: This PRA started 2011; as a result, three species of *Apriona* were added to the EPPO A1 List: *Apriona germari*, *A. japonica* and *A. cinerea*. However recent taxonomic changes have occurred with significant consequences on their geographical distributions. *A. rugicollis* is no longer considered as a synonym of *A. germari* but as a distinct species. *A. japonica*, which was previously considered to be a distinct species, has been synonymized with *A. rugicollis*. Finally, *A. cinerea* remains a separate species. Most of the interceptions reported in the EU as *A. germari* are in fact *A. rugicollis*.
The outcomes of the PRA for these pests do not change. However *A. germari* has a more limited and a more tropical distribution than originally assessed, but it is considered that it could establish in Southern EPPO countries.
*The Panel on Phytosanitary Measures agreed with the addition of* Apriona rugicollis *to the A1 list*.

Details on the distribution and host plants of *Apriona cinerea*, *A. germari* and *A. rugicollis* can be retrieved in EPPO Global Database (gd.eppo.int).

September 2013

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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. It was finally approved by the Council in September 2013.

Cite this document as:
EPPO (2013) *Pest risk analysis for Apriona germari, A. japonica, A. cinerea*. EPPO, Paris. Available at http://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm

**20-25978** (16-22171, 13-18692, 13-18460, 12-18119, 12-17610)

# Pest Risk Analysis for *Apriona germari*, *A. japonica*, *A. cinerea*

This PRA follows the EPPO Decision-support scheme for quarantine pests PM 5/3 (5).
A preliminary draft has been prepared by the EPPO Secretariat and served as a basis for the work of an Expert Working Group that met in the EPPO Headquarters in Paris on 2011-12-06/09. This EWG was composed of:
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Core members (Jose Maria GUITIAN CASTRILLON, Pietr KAPITOLA, Alan MACLEOD, Françoise PETTER, Robert STEFFEK, Dirk Jan VAN DER GAAG) reviewed the draft PRA between March and May 2012. The risk management part was reviewed by the Panel on Phytosanitary Measures on 2012-10-04 and 2013-03-06.

**Content** *(click to reach the section selected)*

## Introduction

The genus *Apriona* contains 35 species of medium to large longhorn beetles (Coleoptera: Cerambycidae) occurring in the East Asian and Indo-Pacific geographic regions (Huang *et al.* 2009; Ibáñez Justicia *et al.*, 2010). Three of these species, *Apriona germari*, *A. japonica* and *A. cinerea* are important pests of broadleaved trees in their native areas and are reported to cause significant economic damage (Singh & Prasad, 1985; Esaki, 1995; Huang, 1996). They have a wide host range and many of their host species, or related species in the same genera, are important commercial, ornamental or forest trees in the EPPO region. Pathways exist for the transport and introduction of these *Apriona* spp. into the PRA area, and there are a few examples of larvae or adult beetles being intercepted in association with plants for planting and wood packaging material (Ibáñez Justicia *et al.*, 2010; this PRA).

The interception of two *Apriona* larvae and an adult in the Netherlands in 2008 and 2009 prompted a review and the publication of a short Pest Risk Assement for *A. germari*, *A. japonica* and *A. cinerea* (Ibáñez Justicia *et al.*, 2010, referred to below as the Dutch PRA, 2010). This short PRA focussed on the probability of establishment of *Apriona* spp. in the Netherlands and concluded that the establishment of sustainable populations was highly unlikely and the economic impact would be at most incidental and local, because the climate of the Netherlands is much cooler than the climate of the native areas of the beetles, and this would hinder the beetles' development and survival.

The Dutch PRA indicated however that *A. germari*, *A. japonica* and *A. cinerea* would be able to establish permanent populations in the Mediterranean region, and that in this region the expected damage and impact could be significant. The current PRA has been conducted therefore, to assess the likelihood of introduction and establishment, and the potential impact and management of *Apriona* spp. for the whole of the EPPO region. The PRA has drawn on a wide range of published information sources, but a large part of the literature is written in Chinese, Korean or Japanese and is not easily accessible. Consequently, the current PRA relies heavily on Abstracts, short reports and personal communications.

In considering the literature, *Apriona swainsoni* also emerges as a serious pest in China. Its main host is *Sophora japonica**, but it also attacks *Salix* spp.*, *Caesalpinia sepiaria*, *Butea frondosa*, *Dalbergia hupeana**, *Tectaria subtriphylla*, *Ligustrum lucidurum and Paulownia tomentosa* (Duan, 2001; Liu *et al.*, 2006). It has caused serious damage to roadside and urban *S. japonica* trees in some regions of China and was considered a serious quarantine pest by Tang & Liu (2000). *Apriona swainsoni* is on the forest quarantine pest list of China and it was assessed as presenting a risk to the Beijing area, where it does not occur (Liu *et al.*, 2006). Its distribution however, is more restricted than that of *A. germari* (Liu *et al.*, 2006) and its main host, *S. japonica*, and other reported hosts are trees that are used mainly as ornamentals in the PRA area. The ecological impact in the PRA area would therefore be limited compared to the other species considered. In addition, it is not possible to obtain detailed data on trade of its host species, because there are no specific custom codes for them. For these reasons, *A. swainsoni* is not considered in this PRA but measures identified for the other Apriona species would probably be suitable for *A. swainsoni*. Hosts marked with a * are also host of *A. germari.*

## Stage 1: Initiation

**1.01 - Give the reason for performing the PRA**

### Identification of a single pest

Three species of *Apriona* (Coleoptera; Cerambycidae), *A. germari*, *A. japonica* and *A. cinerea*, are important economic pests of commercial, ornamental and forest trees in parts of eastern Asia (China, Korea, Japan) and on the Indian subcontinent. Two of these species (*A. germari* and *A. japonica*) have been intercepted in countries of the EPPO region and in the USA on a number of occasions (see details below). Following interceptions in the Netherlands in 2008 and 2009, a short PRA was conducted by the Netherlands to evaluate the likelihood of introduction and establishment, and potential economic impact (Ibáñez Justicia *et al.*, 2010). This PRA focussed primarily on establishment and impact in the Netherlands, but it indicated that all three *Apriona* species were more likely to establish in countries in the Mediterranean region, and that their impact there could be significant.

There is a need for a wider PRA encompassing the whole of the EPPO region and the EPPO Panel on Phytosanitary Measures decided in March 2011 that a PRA should be performed.

Note on interceptions:
The Dutch PRA states that 3 *Apriona* were intercepted in the Netherlands in 2008 and 2009:

- 1 larva (2008) and 1 adult (2009) of *A. germari* in wood packaging material from China,

- 1 larva of *A. japonica* in a consignment of *Enkianthus* trees from Japan (2009).

It also reports other interceptions (on wood packaging material):

- 2 *Apriona* sp. intercepted in 2000 in Austria, originating from China
- 1 *Apriona* sp. and 1 *A. germari* intercepted in Germany (Hamburg harbour), between 1991 and 2004
- 2 *Apriona* sp. intercepted in the USA by USDA between 1985 and 2000 (Haack, 2006).

There are also two records of interceptions in GB (Straw, pers. comm. 2011, not previously published):

- 1 adult *A. germari* in wood packaging material from China in 2000,
- 1 adult *A. germari* in wood packaging material from Taiwan in 2009.

- After this PRA was conducted by the EWG (April 2012), the Dutch NPPO reported that multiple items of wood packaging material at four different importing companies were found infested with at least 29 living larvae of longhorn beetles including 10 larvae of *A. germari* (Dutch NPPO 2012)

This gives a total of at least 9 separate interceptions of *Apriona* in Europe and 2 in USA over the last 25 years.

**1.02a - Name of the pest**

***Apriona germari*, *A. japonica*, *A. cinerea***

A description of the life cycles of these species can be found in the corresponding draft EPPO data sheets.

**1.02b - Indicate the type of the pest**

**arthropod**

The pests are insects (wood-boring longhorn beetles)

**1.02d - Indicate the taxonomic position [see note of the first page]**

Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Class: Insecta
Order: Coleoptera
Family: Cerambycidae
Subfamily: Lamiinae
Tribe: Batocerini
Genus: *Apriona*
Species: *germari* (Hope, 1831)
*japonica* (Thomson, 1878)
*cinerea* (Chevrolat, 1852)

*A. germari* is sometimes spelt as “*germarii”*.

**1.03 - Clearly define the PRA area**

The PRA area is the EPPO region (see www.eppo.org for map and list of member countries).

**1.04 - Does a relevant earlier PRA exist?**

**yes**

A short Pest Risk Assessment on *Apriona* spp. *(A.germarii, A.japonica & A.cinerea)* was conducted in 2010 by the Plant Protection Service, Ministry of Agriculture, Nature and Food Quality, the Netherlands (Ibáñez Justicia *et al.*, 2010; the present PRA refers to "Dutch PRA, 2010"). This has been used as the starting point for the current PRA.

A PRA was conducted in Germany in 2003 in relation for *A. germari* on wood packaging material (Schrader, pers. comm. 2011).

**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)? Explain your judgement.**

**not entirely valid**

The Dutch PRA (2010) is partly valid, but it needs to be extended to the whole EPPO region. In addition, further information has become available which was not included in the Dutch PRA (2010), and the documentation needs to be adjusted and re-ordered to comply with the structure of the EPPO PRA scheme.

The German PRA was only on wood packaging material (this pathway was not studied in the present PRA), and only on *A. germari*.

**1.06 - Specify all host plant species (for pests directly affecting plants) or suitable habitats (for non parasitic plants). Indicate the ones which are present in the PRA area.**

*Apriona* species are polyphagous and *A. germari*, *A. cinerea* and *A. japonica* have a wide host range that includes at least 70 plant species, mostly trees, in 21 different families (Betulaceae, Bombacaceae, Cornaceae, Ebenaceae, Ericaceae, Euphorbiaceae, Fabaceae, Fagaceae, Juglandaceae, Lauraceae, Lythraceae, Meliaceae, Moraceae, Platanaceae, Rosaceae, Rutaceae, Salicaceae, Scrophulariaceae, Theaceae, Ulmaceae, Urticaceae) (Annex 1). This list is unlikely to be complete and further literature searches will inevitably add more species. A few uncertain records are listed at the end of this section.

It is difficult to determine which species and genera are major hosts and which are incidental hosts, although publications are more likely to report hosts that are economically or environmentally important. Hosts on which *A. germari*, *A. cinerea* and *A. japonica* are significant pests in the area of origin are as follows:

***A. germari*:** mulberry (*Morus* spp.), poplar (*Populus* spp.), willow (*Salix* spp.), apple (*Malus* spp.), fig (*Ficus carica*), paper mulberry (*Broussonetia papyrifera*), jackfruit (*Artocarpus heterophyllus*) and pagoda tree (*Sophora japonica*) (Qin *et al.*, 1997; Wang *et al.* 1999; Yoon & Mah, 1999; Hussain *et al.*, 2007; Shui *et al.*, 2009; Wang, 2009).

***A. japonica:*** mulberry (*Morus* spp.), poplar (*Populus* spp.), willow (*Salix* spp.), *Malus pumila*, *Enkianthus perulatus,* loquat (*Eriobotrya japonica*), fig (*Ficus carica*), false acacia (*Robinia* pseudoacacia), keaki (*Zelkova serrata*), Japanese beech (*Fagus crenata*) and *Celtis sinensis* (Enda, 1965; Kikuchi, 1976; Kojima & Nakamura, 1986; Esaki, 1995; Koyama & Okada, 2004; Ohashi, 2005; Esaki & Higuchi, 2006; Esaki 2007a & 2007b; Sugimoto, 2007).

***A. cinerea*:** poplar (*Populus* spp.), apple (*Malus domestica*), mulberry (*Morus* spp.), *Prunus* spp. and pear (*Pyrus communis*) (Pruthi & Batra, 1960 in Singh & Prasad, 1985; Singh & Prasad, 1985; Thakur, 1999; Singh *et al.*, 2004; FAO, 2005).

**Uncertainty on the host range**

- There are uncertainties attached to some host records. Doubtful records are marked in Annex 1. In particular:
  - *Pinus* is considered as a doubtful record (Luo, pers. comm. 2011).
  - *Paulownia* is also considered as a doubtful host as the central part of the trunk is hollow and unsuitable for larval development (Singh, pers. comm. 2011).
  - The reference to *A. germari* infesting *Eucalyptus tereticornis* in Karnataka State in India (Kulkarni, 2010) is probably a misidentified species (Singh, pers. comm. 2011). It relates to a new host species (Eucalyptus) in a new geographical location, very far from its northern distribution, which is improbable. The identification was not confirmed by forest entomologists or taxonomists.
  - For similar reasons, the record of *A. cinerea* on *Albizia saman* (new host) in Tamil Nadu (new geographic record, far from its northern distribution in India) (Suresh *et al.*, 1994) is also considered improbable.
- It is not clear whether or not certain hosts are needed for successful completion of the life cycle. Several sources mention that adults need to feed on certain host species (especially *A. germari* on Moraceae) (Esaki 2007a; Gao *et al*., 1994a; Luo pers. comm. 2011) even though the females might later colonize and lay eggs on other species. The implication is that egg laying might not have occurred if the preferred hosts of the adults were not present.

**1.07 - Specify the pest distribution for a pest initiated PRA, or the distribution of the pests identified in 2b for pathway initiated PRA**

**EPPO region**. Absent. See uncertainty below.

*Apriona* species are only present in Asia (see outlined distribution in maps under 3.03). A summary of their distribution is given below. See Appendix 3 of the Dutch PRA (2010) for detailed records and references.

***A. germari*:** Cambodia, China, India (Jammu & Kashmir), Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan (west), Taiwan, Thailand, Vietnam. In China, it is found in the provinces of Shangai (Qin *et al.*, 1997),

Liaoning, Hebei, Shandong, Shanxi, Shaanxi, Gansu, Jiangsu, Zhejiang, Hunan, Hubei, Anhui, Jiangxi, Fujian, Taiwan, Hainan, Guangdong, Guangxi, Guizhou, Sichuan, Yunnan, Xizang (Tibet), Henan (Huang *et al.*, 2009), Heilongjiang (Li, 1996), Inner Mongolia, Beijing, Tianjing, Ningxia, Chongqing, Hongkong (Youqing Luo, draft EPPO data sheet). See a detailed map in Fig 1, Annex 4.
Note: although Japan is mentioned in several publications on *A. germari*, it seems that this pest is not present in that country (see details under "uncertainties" below).

***A. japonica*:** Japan, in Honshu (pref. of Akita (Kondo, 2008); Ishikawa (Esaki & Higuchi, 2006); Ibaraki (Yamanobe & Hosoda, 2002); Nagano (Koyama & Okada, 2004)), Shikoku, and Kyushu (pref. of Nagasaki (Yokomizo & Morita, 1980). See a detailed map in Fig 2, Annex 4.

***A. cinerea*:** India in the north-western states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Hariyana and Punjab (Singh *et al.* 2004); Pakistan in the provinces Rawalpindi, Peshawar and Parachinar (Singh & Prasad, 1985), Khyber Pakhtunkhwa (North West Frontier Province - Chaudhry & Gul, 1986).

**Uncertainties on the distribution:**
***A. germari* - Russia**. One publication mentions *A. germari* in Far East Russia (Danilevsky, 2007) and the same author mentions that it might be present in East Siberia (Danielevsky, 2004 & 2007), quoting an older publication (Breuning, 1962). The record for Far East Russia corresponds to one female with the label "Vladivostok" in the Zoological Museum of Moscow University (Danielevsky, pers. comm. 2011). The reference by Breuning (1962) was not available for checking.
***A. germari* - Japan**. Duffy (1968) mentions *A. germari* in Japan; however he does not mention *A. japonica* as a separate species, and the two species have probably been combined. Huang *et al.* (2009) also indicate the presence of *A. germari* in Japan, but this is probably based on Duffy (1968). Recent publications do not mention the presence of *A. germari* in Japan. Ohbayashi *et al.* (1992) and Ohbayashi & Nisato (2007), in books on longhorn beetles of Japan, indicate only three species of *Apriona*: *A. japonica*, *A. yayeyamai*, *A. nobuoi*. An earlier reference, Kojima (1929), refers to *A. rugicollis*, and this record is thought to have been the current *A. japonica* (Gilmour 1958).
***A. germari* - India. Karnataka**. The reference to *A. germari* infesting *Eucalyptus tereticornis* in Karnataka State in India (Kulkani, 2010) is probably a misidentified species (Singh, pers. comm. 2011). See note under 1.06.
***A. germari* - Asia**. From the data available, there does not seem to be continuity in the distribution of *A. germari* in Asia, and there might be several distinct populations.
***A. japonica* - Taiwan**. http://www.lamiinae.org/index.php?pg=fgrp&id=42506&lg=en indicates the presence of *A. japonica* in Taiwan, which must originate from *Apriona japonica* Thomson, 1878, Rev. Mag. Zool., 3, 6: 59 (nov). However, in a review of the Chinese species of *Apriona,* Huang *et al.* (2009) do not mention this record and only refer to a misidentification of *A. germari* as *A. japonica* in Liaoning province.
***A. cinerea* - India, Tamil Nadu.** The reference to *A. cinerea* infesting *Albizia saman* in Tamil Nadu in India (Suresh *et al.*, 1994) is considered unlikely. See note in 1.06.

## Stage 2: Pest Risk Assessment Section A: Pest categorization

**Identity of the pest (or potential pest)**

**1.08 - Does the name you have given for the organism correspond to a single taxonomic entity which can be adequately distinguished from other entities of the same rank?**

**yes**

*A. germari*, *A. japonica* and *A. cinerea* are single taxonomic entities. It should be noted nevertheless that come authors consider *A. germari* as a synonym of *A. japonica*.

Common names and synonyms:

***Apriona germari* (Hope, 1931)**
Synonyms: *Apriona germari*, *Apriona rugicollis* Chevrolat, 1852 (CABI, 2008a), *Lamia germari* Hope, 1831, *Apriona plicicollis* Motschulsky, 1853, *Apriona deyrollei* Kaup, 1866, *Apriona cribrata* Thomson 1878 (Huang *et al.*, 2009).
*A. germari* is largely used in recent articles, in particular from China. It was considered as a misspelling from *A. germari*.
Common names: brown mulberry longhorn (Duffy, 1968), longhorn stem borer (Parc, 2010), jackfruit longhorn beetle (Hill, 1983), mulberry longicorn beetle (Yoon *et al.*, 1997), mulberry longhorn beetle (Hill, 2008).

***Apriona japonica* (Thomson, 1878)**
Synonyms: *Apriona germari* Matsushita 1933, *A. rugicollis* Matsumura, 1908 (Gilmour 1958); *A. rugicollis* var. *japonica* Aurivillius, 1922, *A. germari japonica*, Matsushita 1933, *A. rugicollis* Bates 1873 (Ohbayashi & Nisato, 2007). Kojima (1929) refers to *A. rugicollis*, but this is now considered to be *A. japonica*. Enda (1965) refers to *A. germari japonica*.
Common names: mulberry borer (Ohashi, 2005; Yamashita *et al.*, 1999), mulberry longicorn beetle (Esaki, 2001).
Some of the earlier literature references appear to combine and confuse *A. germari* and *A. japonica*, giving the former name to *A. japonica* as a misidentification (e.g. Duffy, 1968).

***Apriona cinerea* (Chevrolat, 1852)**
Synonyms: *Apriona cinerea* (Breuning, 1949); *Apriona cinerea newcombei* (Gilmour, 1958)
Common names: apple stem borer (Hill, 2008), poplar stem borer (Singh & Verma, 1998), apple tree borer (CABI, 2008b).

**1.10 - Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?**

**yes (the organism is considered to be a pest)**

Where they occur, *A. germari*, *A. japonica* and *A. cinerea* are considered as pests of hosts that are important economically or environmentally (e.g. poplar, apple, mulberry – see 1.06). They attack a wide variety of trees. The main damage is caused by larvae boring into the branches and stem. This may cause reduced growth, death of branches or trees, and has an impact on the yield and quality of wood. Damage is also caused by adults feeding on the bark of branches. Details on damage are given in 6.01.

**1.12 - Does the pest occur in the PRA area?**

**no**

*A. germari*, *A. japonica* and *A. cinerea* are absent from the PRA area. However, for *A. germari* there is an uncertain record for Far East Russia and East Siberia (see 1.07).

**1.14 - Does at least one host-plant species (for pests directly affecting plants) or one suitable habitat (for non parasitic plants) occur in the PRA area (outdoors, in protected cultivation or both)?**

**yes**

Many of the host species and genera attacked by *A. germari*, *A. japonica* and *A. cinerea* occur in the PRA area. They are grown for fruit production (commercially or in gardens), for ornamental purposes (private and public gardens, landscaping, cities), and occur naturally or are planted in forests, including commercial plantations. Some of the hosts or other species in the same genera grow in the wild in the PRA area. A list of host species and genera is given in Annex 1 and details on the main host species and genera that occur in the PRA area and their uses are given in section 3.01.

One species and five genera are common hosts for all three Apriona species: poplar (Populus spp.), mulberry (Morus spp.), fig (Ficus carica), apple (*Malus* spp.), pear (*Pyrus* spp.) and willow (*Salix* spp.). These hosts occur throughout the PRA area.

**1.15a - Is transmission by a vector the only means by which the pest can spread naturally?**

**no**

*Apriona germari*, *A. japonica* and *A. cinerea* are free-living organisms.

**1.16 - Does the known area of current distribution of the pest include ecoclimatic conditions comparable with those of the PRA area or sufficiently similar for the pest to survive and thrive?**

**yes**

CLIMEX modelling conducted as part of the Dutch PRA (2010) indicated that southern parts of the PRA area, especially the Mediterranean region, had a similar climate to areas where the pests currently occur and would provide a suitable environment for the pests to establish and spread. The wide distribution of *A. germari*, reaching the Himalayas, suggests that more northern areas may also be suitable.

**1.17 - With specific reference to the plant(s) or habitats which occur(s) in the PRA area, and the damage or loss caused by the pest in its area of current distribution, could the pest by itself, or acting as a vector, cause significant damage or loss to plants or other negative economic impacts (on the environment, on society, on export markets) through the effect on plant health in the PRA area?**

**yes**

If any of these three *Apriona* species were to establish outdoors in the PRA area, they could attack a wide range of important plant species (e.g. poplars, willows, apples, loquat, mulberry, fig), in cultivation and in a wide range of natural and semi-natural habitats. The literature indicates that *A. germari*, *A. japonica* and *A. cinerea* attack healthy trees (Duffy, 1968; Esaki, 2006 & 2007a; Singh, pers. comm. 2011), although trees in stressed conditions suffer heavier damage (Ji *et al.*, 2011). The pests could have a significant economic impact (yield loss, death of trees, reduction in wood quality) as well as environmental and social impacts (e.g. Li, 1996; Singh & Prasad, 1985; Esaki, 1995).

**This pest could present a phytosanitary risk to the PRA area.**

**1.18 - Summarize the main elements leading to this conclusion.**

- Known pests of a wide range of tree species that are important for fruit production, forestry and as ornamental trees in the PRA area
- Hosts are widespread in the PRA area and are cultivated commercially in orchards, nurseries and plantations and occur in gardens, forests and various wild habitats.
- Ecoclimatic conditions, at least in the southern part of the PRA area, appear to be similar to conditions in the pest's native area, which would allow establishment and spread.

## Stage 2: Pest Risk Assessment Section B: 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. Explain your judgement**

Aspects of the life cycle relevant to the pathways: adults lay eggs in the bark of branches and stems. Larvae start boring into the xylem shortly after hatching and then tunnel downward through the branch and into the hardwood of the main stem. Larval development takes 2 to 3 years (Bathia *et al.*, 2007; Shui *et al.*, 2009; Yamashita *et al.*, 1999).

The Dutch PRA (2010) mentions plants for planting and wood packaging material of host plants from countries where the pest occurs, as possible pathways. Wood packaging material is not considered in detail in the present PRA for reasons indicated in 2 below.

**<u>1. Pathways studied in detail in this PRA</u>**

Two pathways are studied in detail in the PRA.

- Plants for planting (except seeds) of host plants from areas where *A. germari*, *A. japonica* or *A. cinerea* occur.
- Wood (round or sawn, with or without bark) of host plants from areas where *A. germari*, *A. japonica* and *A. cinerea* occur.

The host plants considered are those in Annex 1, and the origins are countries listed in section 1.06 for each pest. Distinctions between the three *Apriona* spp. are made in the answers where relevant. The two pathways studied represent a large number of individual pathways (combinations of commodity/origin).
For the pathway of plants for planting, the host species/genera associated with each *Apriona* were taken into account (as indicated in Annex 1). However, *Apriona* spp. are very polyphagous, and it cannot be excluded that some hosts of one *Apriona* species may be relevant for another, or that hosts are missing from Annex 1 (see also 1.06).

**Plants for planting (except seeds) of host plants from areas where *A. germari*, *A. japonica* or *A. cinerea* occur**

Eggs may be present in the bark and larvae in stems or branches. One larva of *A. japonica* was intercepted in a consignment of *Ekianthus* trees from Japan in 2009. Cuttings/budwood are also included in this pathway. Tillesse *et al.* (2007) note that exchange of cuttings of poplar and willow can lead to the international movement of sap suckers and stem borers. In addition for *A. cinerea*, poplar cuttings carrying eggs and young plants containing larvae have been shown to be a source of infestation of new sites (Singh, pers. comm. 2011, draft EPPO data sheet). Whole plants may carry eggs and all larval stages, and cuttings/budwood may carry eggs and small larvae. The cuttings themselves will not sustain the development of the pest but the eggs/larvae may carry on their development once the cuttings are grafted.

Most hosts of the three *Apriona* species may be used as bonsais. However, occurence of larvae inside bonsais seems less likely than for bigger plants for planting because the larvae of *Apriona* species feed by boring a gallery downward through the center of the stem. Galleries are long (2-8 m – see 2.03) and linear, and the larvae do not appear to be able to modify their feeding behaviour if the amount of stem material is limited. The EWG considered that bonsais are relatively short trees and therefore that they would not provide sufficient space for the larvae to feed and complete their development (Esaki, pers. comm. 2011, Luo, pers. comm. 2011, Singh, pers. comm. 2011). However, The Panel on Phytosanitary Measures noted that other Cerambicidae such as *Anoplophora chinensis* have adapted to bonsais. In addition larvae of a Cerambicidae were intercepted in 2010 in *Enkianthus perulatus* bonsais from Japan (Finelli, Italian NPPO, pers. comm., 2012). Although they could not be formally identified, they were suspected to be *A. japonica*.

**Wood (round or sawn, with or without bark) of host plants from areas where *A. germari*, *A. japonica* and *A. cinerea* occur**

Larvae may be present and survive in the wood. This is supported by several interceptions on wood packaging material. Round or sawn wood was considered more appropriate for survival than packaging material. Some host species for which wood is used (logs, veneers, biofuel) are: *Artocarpus*, *Populus*, *Malus*, *Pyrus*, *Ulmus, Zelkova.* This pathway also covers firewood. In the PRA for *Anoplophora chinensis*, it was considered that China, Japan and Korea are large importers of wood themselves and as far as is known no tree trunks are exported to the EU (van der Gaag *et al.*, 2008).

**2. <u>Pathways identified but not considered in detail in this PRA</u>**

**Wood packaging material.** Larvae may be present in wood packaging material as shown by records of interceptions (see 1.01). Although this reflects a certain movement on this pathway, and a risk of entry, this is not studied in detail in this PRA as pest risk management is already in place. Since the adoption of ISPM 15 in 2002 (a new version was adopted in 2009: FAO, 2009), 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. The cases of interceptions above probably result from non-compliance (i.e. treatments were not or incorrectly applied or non-effective treatments were applied), or treatments were not required at the time (prior to 2005). For this reason, the EWG did not continue the assessment of this pathway.

**Wood chips.** All life stages of the pest may be associated at the origin with wood chips especially in the presence of bark, at any time of the year. However, the process of producing wood chips, i.e. grinding and chipping, is likely to reduce the concentration of the pest. Wood chips are usually made of the small branches and not of the main trunk and are therefore less likely to be infested according to the biology of the pests. Eggs of *Apriona* are laid on living trees and would not be laid on wood chips after processing.
*Apriona* larvae are over 6 cm long for *A. germari* and *A. cinerea (*Yoon *et al.*, 1997; Singh & Prasad, 1985), pupae are up to 50 mm but adults seem to be more variable in size (26 mm-50 mm in length). Late larvae, pupae and adults may complete development if they survive the chipping process. The commercial production of wood chips may result in a variety of chips size, some being large enough to allow development of the pest.
Currently the trade of wood chips to the PRA area is considered minimal from countries where the pests occur, even if small and irregular import of deciduous wood chips is reported in EU trade statistics for 2006-2010 (see Table 3 in Annex 8).

**Wood waste.** Waste wood 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 waste wood will depend on the size of wood pieces and if they were submitted to processing (e.g. waste wood may be agglomerated in logs, briquettes or similar form and agglomeration will further damage the pest). Import of wood waste (codes 44013080 and 44013090) is larger than import of round or sawn wood with 11381 tonnes from Malaysia, 712 tonnes from India, 529 tonnes from Viet-Nam and 487 tonnes from China in 2011 (Table 5 in Annex 8). In addition, volumes imported increased in recent years. However, it is not possible to know if the wood waste concerned is from host plants or not, and if this wood waste is processed (e.g. saw mill, broken planks, old crates) or not.

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

**3. Pathways less likely, not considered further**

**Cut branches.** 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 and transfer to a host where the pest could complete its life cycle is very unlikely. In addition, there is no indication that the host species considered are used for such purpose (except maybe for *Salix* species), nor that there is a trade to the PRA area from countries where the pests occur.

**Furniture and objects made from wood of host plants.** Larvae and pupae could be present in such objects, although processing (e.g. sawing) will destroy some of them. In addition desiccation would impair their development. Pupae are more likely to complete their development and emerge. Likelihood of transfer is limited, except if those objects are used outdoors. Therefore this pathway was considered unlikely and there is not enough information to consider it in more detail.

**Natural spread.** There are indications that adults of *A. germari* can fly up to 2500 m to find food with an average flight of 250 to 550 m (Pan Hong Yang, 2005) (more details in 4.01). However there is no indication that natural spread has occurred towards the PRA area from countries where *A. germari*, *A. japonica* and *A. cinerea* occur. Natural spread between countries of the PRA area would be possible if the pest establishes; this is covered in the "spread" section (section 4).

**Bark of host plants.** Eggs may be associated with bark as they are laid in crevices or in a niche made by the female on the bark. Shui *et al.* (2009) note that eggs are laid in the phloem. However, the egg stage lasts for about 18 days (for *A. germari;* Yoon *et al.*, 1997). In addition, processes used to produce the bark commodity may destroy eggs, and these would also be exposed to desiccation. If larvae emerged, they would not find wood to feed on. Finally, there is no indication that there is a trade from countries where the pests occur.

**4. Pathways considered as not supporting entry**

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

**Hitch-hiking.** There are no indications that this might be a relevant pathway, even though in theory adults could become associated with other commodities, as they fly and have a long life span (several months, Hill, 2008).

**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.**

- Host plants for planting (except seeds) from areas where *A. germari*, *A. japonica* or *A. cinerea* occur.
- Wood (round or sawn, with or without bark) of host plants from areas where *A. germari*, *A. japonica* or *A. cinerea* occur.
- Wood chips and wood waste of host plants from areas where *A. germari*, *A. japonica* or *A. cinerea* occur (only for management)

## Pathway 1: Host plants for planting (except seeds) from areas where *A. germari*, *A. japonica* or *A. cinerea* occur

**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?**

**likely**

***Level of uncertainty:* medium** (association with the hosts at origin)

The three *Apriona* spp. seem to be quite frequent where they occur. Tillesse *et al.* (2007), in a synthesis of poplar insects, report *A. germari* as "frequently occurring and a particularly harmful species" and *A. japonica* and *A. cinerea* as "important species, occurring quite frequently". In India, *A. cinerea* is very common in North-West Himalaya and adjoining plain regions (FAO, 2005). The relative importance of hosts at origin in general is not known, but at least fig is a major host for all three *Apriona* species and *Malus* is a major host for *A. germari* and *A. cinerea*.

Adults feed on the tender bark of young branches (Tillesse *et al.*, 2007). Females lay eggs on the bark and larvae bore into the wood of the branches. Eggs are laid singly over a long period (*A. cinerea*, Bathia *et al.*, 2007), and many branches may be infested. Yoon *et al.* (1997) found that 0.3 to 3 % of branches of mulberry were infested depending on location. The larvae tunnel downwards in the branches, and continue boring downwards into the main stem (Yoon *et al.*, 1997). Young larvae of *A. germari* initially tunnel upwards at the interface between bark and sapwood for 10 mm, before tunnelling deeper into the wood and turning to bore downwards (Shui *et al.*, 2009). Larvae bore vertical galleries (2-3 m long) and in small trees they can reach the roots (Tillesse *et al.*, 2007; Shui *et al.*, 2009). The longest tunnels can be up to 8 m long (Yan *et al.*, 1994 cited in Shui *et al.*, 2009).

There could be mitigating factors for association:

- These pests were observed to oviposit on plants of a certain size. For example: *A. japonica* on *Zelkova serrata* branches and stems above 10 mm diameter (Esaki, 2007a); stems in the range of 40-50 mm diameter (Esaki, 1995); on fig, branches of ca. 20 mm diameter (Yamashita *et al.*, 1999); *A. cinerea* on poplar, branches 20-30 mm in circumference (Singh & Prasad, 1985), stems 40-49 mm in circumference (Bathia *et al.*, 2007); *A. germari* on mulberry, branches ca. 17 mm diameter (Yoon *et al.*, 1997).
- Occurence of larvae inside bonsais seems less likely than for bigger plants for planting
- Not all hosts are as favorable. For example Esaki (2007a) found that *Zelkova* stems were not as favorable for *A. japonica* larval development as mulberry stems.
- In certain situations, these pests attack trees in certain age ranges, e.g. in India, *A. cinerea* mostly attacks 1-3 years old poplar trees (FAO, 2005), but young and older trees for other species (Singh, pers. comm. 2011).
- Adults seem to have feeding preferences and this might be important for infestation of other host plants (e.g. mulberry in vicinity of *Zelkova* plantations, Esaki, 2007a). Females may feed on some species, but oviposit on other species. It is not clear how the feeding requirements of the adults influence infestation in the native areas. See also 1.06.

**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?**

**likely**

***Level of uncertainty:* medium**

Many of the hosts concerned are wild trees at origin or grown as forest or ornamental trees It is supposed that plants for planting for export would be grown in nurseries. However, the pest is difficult to control and many nurseries of these are likely to be located near sources of infestation. All three *Apriona* spp. are reported to attack relatively small trees (see 2.03) and young trees in nurseries therefore, are liable to become infested.

Some control measures (see 6.04) are applied at origin for some tree species when these pests are a problem. Depending on the level of scrutiny of the plants, symptoms of larval activity, flying adults, signs of oviposition, and eggs may be observed (see description under 7.13).

Uncertainty. Medium. Lack of data on populations at the place of production, and on management at origin.

**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?**
**unlikely**
***Level of uncertainty:* High**

EU import statistics (from Eurostat) are based on broad categories and indicate a small trade of ornamental plants (rooted cuttings and young plants –code 06029045, and trees with roots - code 06029049) and forest trees (code 06029041) from countries where these pests occur (see Tables 1 to 3 in Annex 6). There was no import in the category ”perennial outdoors plants” (code 06029951) according to Eurostat. Imports from countries where *A. cinerea* occurs (India and Pakistan) were extremely low.
EU import statistics (from Eurostat) also indicate a small trade of "trees, shrubs and bushes (grafted or not, of kinds which bear edible fruit or nuts (other than vine)" (code 06022090) from countries where *A. germari* and *A. japonica* occur, and an extremely low trade from India where *A. cinerea* occurs (Table 1 in Annex 7).

In addition, data was provided by some EPPO countries in 2010 regarding dispatch of plants for planting (Tables 4 to 6 in Annex 6 and Tables 2 to 4 in Annex 7). This data was provided by three major plant importers in the EU and therefore provides a partial picture of plants coming into the PRA area. Even if detailed data are missing for many EU countries and non-EU countries, it is not thought that the volume of imports is high (hence the medium uncertainty). In addition, these data generally refer to genera of plants, and the plants may have been a known host plant or another species.
From the data available, only small quantities of *Punica granatum* and *Diospyros kaki* plants for planting were imported from Japan where *A. japonica* occurs. For *A. germari*, the data indicate large imports of *Ficus* from China, and for *A. cinerea* some imports of *Ficus* from India. However, it is not known whether this information on *Ficus* relates to *Ficus carica* or other *Ficus* species, and whether they are hosts. The majority of the large numbers of *Ficus* plants imported from China are likely to be ornamental species other than *Ficus carica.*

However, it can be noted that in 2009 one larva of *A. japonica* was intercepted in the Netherlands in an *Enkianthus* from Japan (Dutch PRA, 2010), showing that entry is possible despite low volumes.

Uncertainty: High. Volumes imported by other EU countries and non-EU countries, even if supposed to be quite low. Whether *Ficus carica*, which is an important host at origin, is imported into the PRA area from these 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?**
**unlikely**
***Level of uncertainty:* medium**

The frequency is unknown, but volumes are relatively low, so frequency is also assumed to be low.

Uncertainty: no data on frequency.

**2.07 - How likely is the pest to survive during transport or storage?**
**likely**
***Level of uncertainty:* low**
Larvae on plants for planting will survive transport and continue feeding on their host. They live in branches or stems for 1-3 years (Dutch PRA, 2010, Appendix 4), whereas transport time for plants from Asia to Europe is about 4 weeks (PRA on *A. chinensis*, van der Gaag *et al.*, 2008). Plants are stored at cool temperatures during transport (EPPO, 2011). Larvae overwinter in stems or branches at cold temperatures in the place of origin (e.g. Heilongjiang province, China), 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 in transport and the larvae could bore into the plants. According to information provided by Turkish importers, the temperature range during transport of plants for planting of fruit trees is 4-6°C (Ustun, pers. comm., 2011). There is no data for transport of ornamental plants.

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

*Entry: plants for planting*

**2.08 - How likely is the pest to multiply/increase in prevalence during transport or storage?**

**very unlikely**

***Level of uncertainty:* low**

*Apriona* spp. have a long life cycle (2-3 years). All stages associated with plants for planting (eggs, larvae, pupae, pre-emerging adults) could continue their development. If late stages are present, adults might emerge. However it is very unlikely that the reproduction process would be completed and further eggs would be laid. Yoon *et al.* (1997) found that mating occurred around 10 days after emergence, afterwhich females laid 1-2 eggs per day. However, the cooler temperatures during transport would tend to prevent emergence (adults normally emerge in spring when temperatures rise).

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

**likely**

***Level of uncertainty:* low**

Some countries have requirements in place for certain hosts (see 7.10 for this pathway). In the EU and in some other countries, prohibitions are in place for import of some fruit tree species (e.g. *Malus*, *Pyrus*, *Prunus*) and these prohibitions would apply to countries where the *Apriona* spp. occur.

However, other hosts may not be subject to prohibitions or specific requirements. Therefore, inspections may or may not be carried out at origin or destination, depending on whether import phytosanitary requirements are in place. However, there are no direct requirements against *Apriona* spp. and current requirements are not sufficient to detect the pest in all circumstances. Eggs, oviposition sites and larvae might be detected (see 2.04 for this pathway), but 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 or habitat ?**

**likely**

***Level of uncertainty:* low**

All three *Apriona* species have hosts that are grown widely in the PRA area, in commercial cultivation, as ornamentals, in forests, parks, gardens or in the wild. Hosts such as *Populus* or *Salix* are present throughout the area. The adult beetles can fly some distance (see 4.01) and it is likely that if adults emerged they would find a suitable host plant. The diversity of habitats in which suitable hosts are found is greater in the southern part of the PRA area than in the north. For example, while figs are grown in gardens in the northern part of the PRA area, they are found in many more habitats in the southern part of the area.

**2.11 - The probability of entry for the pathway should be described**

**Unlikely**

***Level of uncertainty:* medium**

The probability of entry is considered unlikely for *A. germari*,*A. japonica* and *A. cinerea.*This is mainly due to the very low volume of import of host plants.

*Entry: wood*

## Pathway 2: Wood (round or sawn, with or without bark) of host plants from areas where *A. germari*, *A. japonica* or *A. cinerea* occur

**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?**

**likely**

***Level of uncertainty:*** **medium** (data on association with the pathway)

Larvae live inside branches and stems and therefore may be associated with wood. Eggs are laid in the phloem, and could be associated with bark on unprocessed wood. All three *Apriona* spp. are particularly likely to be associated with poplar wood; they all attack this host in the area of origin and high rates of infestation are sometimes reported in poplar forests (see 6.01).

**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?**

**likely**

***Level of uncertainty:*** **low**

The species concerned are not subject to high levels of management. Management measures applied in countries where the pest is present would diminish populations, but not eliminate the pests.

**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?**

**unlikely**

***Level of uncertainty:*** **low**

Unlikely *A. germari.*
Very unlikely *A. japonica* and *A. cinerea*.

Statistics from Eurostat (see Annex 8) indicate small imports of:

- fuelwood (code 44011000)– 502 t in total in 2010, much lower than in some previous years, from China, India (very small volumes), Korea, Malaysia, Thailand, Vietnam (Table 1 in Annex 8) (i.e. from countries where *A. germari* or *A. cinerea* occur)
- poplar wood, rough –only 20 t in 2007 and 42 t in 2010 to Italy from China (Eurostat, poplar wood in the rough, whether or not stripped of bark or sapwood, or roughly squared – code 44039910). (i.e. from where *A. germari* occurs)
- poplar wood, sawn or chipped (code 44079991) –only 329 t in total in 2010 from China and Malaysia (Table 2 in Annex 8) (i.e. from countries where *A. germari* occurs). In addition, it should be noted that this category includes chipped wood, which was not considered as a pathway.

The category fuelwood does not discriminate between coniferous and non-coniferous species and, therefore; it is not known whether consignments include hosts of *Apriona*. FAO (2008) indicates how poplar and willow wood is used in China and India, and from these data it appears unlikely that large quantities of roundwood or sawn wood of these species are exported. In India, 80% of commercial poplar is consumed by the plywood industry and the rest goes to the match industry (with some to packing crates, plywood and hard board). In China, poplar and willow are used for wood panels, pulp and fuelwood. These two countries also import large quantities of wood.

Considering the countries where the pests occur, there was no import from countries where *A. japonica* occurs (Japan), and extremely limited imports (fuelwood only) from countries were *A. cinerea* occurs. The likelihood has therefore been rated as unlikely for *A. germari* and very unlikely for *A. japonica* and *A. cinerea*. This assessment would change if *A. germari* was already present in the PRA area (see uncertainty in 1.06), or if wood exports from countries where these pests occur, especially of poplar, increased.

Countries in the PRA area which report to the International Poplar Commission (IPC) do not indicate any imports of poplar and willow roundwood and wood chips from or exports to countries where the three *Apriona* spp. occur (Table 4 in Annex 8; FAO, 2008)

**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?**

**unlikely**

***Level of uncertainty:*** **medium**

Unlikely for *A. germari.*

*Entry: wood*

Very unlikely for *A. japonica* and *A. cinerea*

It is assumed that the volume is low, and therefore also the frequency. The frequency is irregular over several years but is generally less than 4 months per year for a given origin. There may be years without imports. For fuelwood, import from Malaysia is restricted to November-February.

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

**moderately likely**

***Level of uncertainty:*** **medium** (Lack of data, but possible)

No specific data was found. Given that there are records of live *Apriona* spp. being intercepted in wood packaging material, it is supposed that larvae could also survive in roundwood. The presence of bark would reduce desiccation and facilitate larval survival. Eggs present in bark on wood are likely to suffer particularly from desiccation and would die. Larvae are more likely to survive on unprocessed round wood with bark, than on round wood without bark or sawn wood.

**2.08 - How likely is the pest to multiply/increase in prevalence during transport or storage?**

**very unlikely**

***Level of uncertainty:*** **low**

If pupae close to emergence are present in the wood, adults might emerge but they would not find appropriate food (adults feed on young bark in spring).

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

**likely**

***Level of uncertainty:*** **low**

Signs of attack by larvae (excretion holes, frass and galleries at cross-sections) may be observed on wood if inspections are performed. However, wood from countries where the three *Apriona* species occur is subject to less frequent inspection than wood from North America. In addition, only a proportion of wood consignments are inspected and it is unlikely that all infestations would be detected.

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

**moderately likely**

***Level of uncertainty:*** **low**

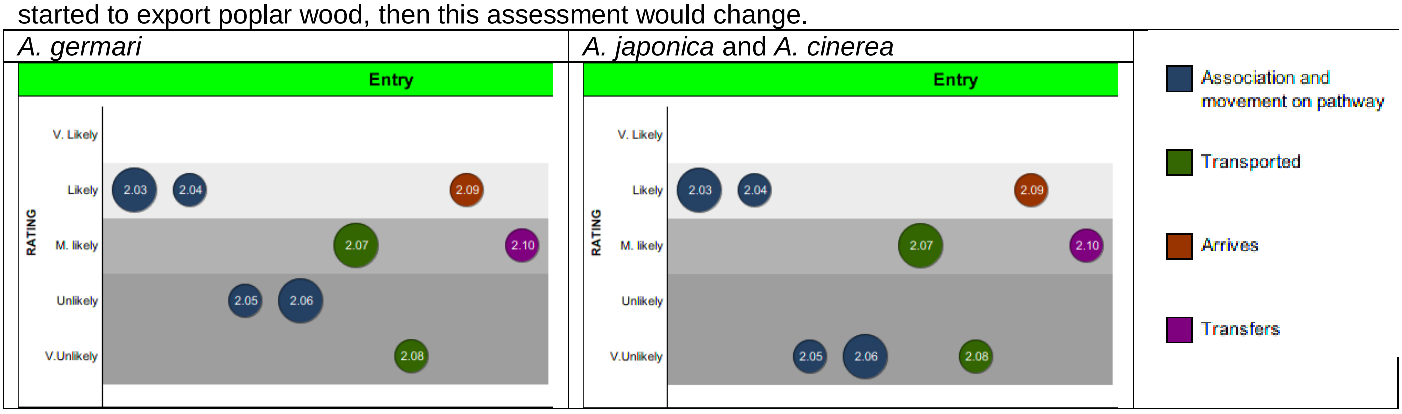
Wood is often stored in the proximity of forests, which in the PRA area would commonly contain suitable hosts. In addition many hosts occur in other habitats. However, the likelihood of transfer is considered lower than for plants for planting as not all larvae will complete development in wood and emerging adults will need to locate suitable hosts.

**2.11 - The probability of entry for the pathway should be described**

**unlikely**

***Level of uncertainty:*** **medium**

The answers are visualized below. The likelihood of entry on wood is considered as unlikely in all cases mainly due to the low volumes of wood of hosts imported from countries where the pests occur, and the lower probability of survival and transfer compared with plants for planting. However, there is high uncertainty on how this pathway might develop in the future. If some countries, for example China or India, started to export poplar wood, then this assessment would change.



## 2.13b - Describe the overall probability of entry taking into account the risk presented by different pathways and estimate the overall likelihood of entry into the PRA area for this pest.

**Unlikely**

***Level of uncertainty:*** **medium**

The probability for entry is considered unlikely with the 2 pathways. However 1 larva of *A. japonica* was once intercepted in a consignment of *Enkianthus* trees from Japan. In addition, even if entry with wood packaging material was not assessed, it should be noted that entry does occur with wood packaging material as interceptions have been reported, even after the implementation of ISPM 15.

There is uncertainty attached to all pathways regarding the volumes imported into the PRA area (although they are considered to be low), as well as for the association of the pest with the pathways at origin. Low volumes of imports are the main reason for the low likelihoods of entry attributed to the pathways, and the assessment would change if volumes increased, especially for wood of poplar.

## Stage 2: Pest Risk Assessment Section B: Probability of establishment

**Select the factors that may influence the limits to the area of potential establishment and the suitability for establishment within this area.**

**For each question which was answered with a "yes", detailed information is provided after the table.**

| No. | Factor | Is the factor likely to have an influence on the limits to the area of potential establishment? | 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) | No | |
| 2 | Alternate hosts and other essential species | No | No | These three species do not need alternate hosts. However, adults of *A. germari* appear to need Moraceae for maturation feeding before they can lay eggs (Luo, pers. comm. 2011). |
| 3 | Climatic suitability | Yes (see 3.03) | Yes (see 3.11) | |
| 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. For example in China, several species of Cerambycidae, including *Apriona germari*, occur on the same host species and are major pests (Ji *et al.*, 2011). For *A. cinerea* in Kashmir, where *A. germari* also occurs, there is no competition between the two species (Singh, pers. comm. 2011).<br>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. Natural enemies are considered in 6.04. |
| 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, forest and ornamental crops. Since stressed trees are more prone to attack, good management practices will make the host less susceptible. |
| 7 | Protected cultivation | Yes (see 3.07) | Yes (see 3.16) | |

## Identification of the area of potential establishment (3.01 to 3.07)

### 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.**

Many of the host species and genera attacked by *A. germari*, *A. cinerea* and *A. japonica* (Annex 1) occur in the PRA area. They are grown for fruit production (commercially or in gardens), for ornamental purposes (private and public gardens, landscaping, cities), occur naturally or are planted in forests, including in commercial plantations. Some of the hosts or other species in the same genera grow in the wild in the PRA area. One species and 5 genera are common hosts for all three *Apriona* spp.: poplar (*Populus* spp.), mulberry (*Morus* spp.), fig (*Ficus carica*), apple (*Malus* spp.), pear (*Pyrus* spp.) and willow (*Salix* spp.). Some occur throughout the PRA area (poplar, willow, *Malus* spp.), while others (mulberry, figs) are particularly important in southern areas, especially in the Mediterranean region.

Most of the host species are also cultivated in nurseries (outdoors or under protected conditions). For example:

- in the Netherlands in 2008, 2,889 ha were occupied by nursery stock of forest plants and plants for hedges, 4,445 ha were occupied by nursery stocks of ornamental trees and 1,326 ha were occupied by nursery fruit trees. There were also 405 ha of glasshouses for nursery material and hardy perennial plants (Dutch PRA, 2010).
- in Germany, in 2008, the total area for nursery stock was 22,597 ha, of which 2,258 ha were occupied by forest plants excluding Christmas trees (1,351 ha deciduous trees or shrubs), 955 by nursery fruit trees/ or shrubs, and 12,146 ha by ornamental trees or shrubs (DeStatis 2009). In 2007, 47,913 ha were cultivated with fruit trees (in total: 77,909 trees), of which 31,762 ha were apple orchards (67,862 trees) (DeStatis 2008). In 2008, there were 1881 ha of nurseries in protected cultivation, including 1453 ha for ornamental trees and shrubs and 41 ha for forestry plants (excluding Christmas trees) (DeStatis 2008).

A detailed list of hosts is given in Annex 1. A summary of host preferences for the three species, as well as details on the main host species and genera that occur in the PRA area, are given below.

***A. germari*** - Numerous hosts are present in forests, in the wild and as ornamentals, such as *Populus*, *Castanea*, *Salix*, *Ulmus* and *Robinia pseudoacacia*. Species of the same genera as those attacked by the pests are widely present in the PRA area and are an important part of forest environments, such as *Alnus* and *Crataegus. Malus* is the most widespread fruit host and is cultivated throughout the PRA area. Other fruit hosts are cultivated commercially (some more limited to the southern part of the PRA area) and are present throughout the area in gardens (e.g. *Castanea*, *Citrus aurantium*, *Eriobotrya japonica*, *Ficus carica*, *Juglans regia, Pyrus*). Finally many ornamentals are cultivated throughout the area in gardens, parks etc. (e.g. *Morus*, *Lagerstroemia*, *Broussonetia papyrifera*).

Given the importance that authors seem to give to mulberry and paper mulberry where *A.germari* occurs (e.g. Gao *et al.*, 1994a), it is important to stress that these are mostly used as ornamentals or private fruit production in the PRA area, i.e. they would be present in a wide range of areas but confined to gardens, parks and nurseries. *Morus* also has limited uses for other purposes (leaves for silkworm, fruit) in the Near East and Central Asia, and it might be more abundant in these areas. It also has a limited presence in forests in Croatia (e.g. FAO, 2008), and presumably in other Mediterranean countries with similar conditions, and it thrives better in the south of the PRA area.

***A. japonica*** – *Populus*, *Salix* and *Robinia pseudoacacia* are important in forests and in the wild, and grow throughout the PRA area. Among the fruit trees attacked, loquat, fig, persimmon, pomegranate, *Citrus*/*Citrus nobilis*, *Pyrus pyrifolia* are used mostly in the Mediterranean area as crops (and as ornamentals or for private fruit production in the rest of the area). Many ornamentals mentioned as hosts of *A. japonica* in Annex 1 are grown throughout the area except maybe in the most Northern and Eastern parts of the EPPO region because of lack of cold hardiness, mostly in gardens and parks (e.g. *Celtis sinensis, Enkianthus perulatus*, *Fagus crenata*, *Morus* sp.*, Zelkova serrata, Platanus* x *hispanica*).

***A. cinerea*** - *Populus* and *Salix* are widespread in forests and in the wild throughout the PRA area. *Malus* is the most widespread fruit host and is cultivated throughout the PRA area. Some other fruit hosts are cultivated commercially mostly in the southern part of the PRA area but present throughout the area in gardens. Of these *Pyrus communis* extends further to the North of the area, while *Prunus persica* and *Ficus carica* are more present commercially in the south of the area. *Prunus* spp. are also identified as hosts and many *Prunus* species are cultivated for fruit production in the PRA area (e.g. plums, cherries). *Morus* spp. is a major ornamental host in the PRA area, and other hosts are used as plantation trees or ornamentals (*Maclura pomifera*) or occasionally in gardens and parks.

In general, there are more hosts in the southern part of the PRA area, and more under commercial cultivation, than in the northern part. The hosts have been separated according to their main use in the PRA area, i.e. non-fruit trees (forest and ornamental trees) and fruit trees, although this allocation is somewhat arbitrary as most species or genera are used for several purposes.

**Non-fruit trees (forest trees and ornamentals)**

- **poplar** (*Populus* spp.) and **willow** (*Salix* spp.) are widely distributed and important species in the PRA area (FAO, 2008). They occur in indigenous forests (pure and mixed) and are grown extensively in commercial plantations for wood production, fibre, pulp and biofuel. The wood is used for construction, furniture, flooring, plywood, packaging, matches and firewood (FAO, 2008). Poplars and willows are also planted for environmental purposes, especially phytoremediation of polluted soils and water, carbon exchange and storage, forest landscape restoration, rehabilitation of degraded lands and combating desertification. Information on the area planted with poplars and willow is provided for countries that are members of the International Poplar Commission (IPC) (Annex 2, Tables 1 to 3). In addition, in Russia there are about 30,000 ha of poplars and 900 ha of willows (Tsarev, 2005); in Sweden, the area of willow plantations for bioenergy has been increasing and there were 16,000 ha by 2005 (Dimitriou & Aronsson, 2005); in Italy there are 4000 ha of short rotation poplar and willow plantations (FAO, 2008). See distribution maps 1a-c in Annex 3 for *Populus*, *Populus nigra* and *Populus tremula.*

Of the *Populus* and *Salix* species mentioned specifically as hosts for *Apriona* (see Annex 1), *S. babylonica* is widely planted in Russia (Tsarev *et al.*, 2005, FAO, 2008), *P.x euramericana*, *P. nigra*, *P. deltoides* and their hybrids are important plantation species, and *P. nigra* and *P. alba* occur in natural forests and riverine woodlands (FAO, 2008). There are also other *Populus* spp. and *Salix* spp. in the PRA area, some of which are widespread and abundant (e.g. *P. tremula*, *P. canescens*) and others which are rare and endangered (e.g. *P. berkarensis*, *P. pruinosa*; see 6.09.05).

- **mulberry** (*Morus* spp.): *M. alba* and *M. nigra* are widely distributed in the PRA area and are grown for their edible fruit, their wood and foliage (for animal feed) (Sanchez, 2000). They are also present in forests (FAO, 2008). In addition, there is a marginal cultivation for silkworm feeding for example in Turkey and Central Asia (Ustun, pers. comm. 2011; FAO, 2003, p37 for Uzbekistan). Fruits of *Morus* are also used, especially in the Near East and Central Asia, for fresh consumption, in the food industry and as dried fruits (Ustun, pers. comm. 2011.). See Maps 2a-b in Annex 3 for *Morus* and *Morus alba*. A larger number of *Morus* spp. are planted as ornamental trees. In the Netherlands, *M. alba* and *M. nigra* are grown on a small scale as part of the assortment of trees in nurseries and are planted in private and public gardens (Potting *et al.*, 2008; Dutch PRA, 2010). Other species used as ornamentals in the PRA include *M. kagayamae, M. bombycis, M. microphylla, M. nigra and M. rubra.*

- **false acacia** (*Robinia pseudoacacia*). This species is widespread. There has been an increase in planting of this fast-growing species in the PRA area in recent years, especially for energy production purposes (FAO, 2008). *Robinia pseudoacacia* also occurs commonly as a street tree and in gardens as an ornamental. It also occurs in forests (FAO, 2008). In some habitats, *R. pseudoacacia* is considered to be an invasive plant (Basnou, 2009).

Regarding other non-fruit trees, several genera with species that are hosts of *Apriona* spp. in the area of origin are represented by native species in the PRA area. Some of these native species are widely distributed and important forest species (*Alnus, Fagus, Ulmus*). Various *Crataegus* species (native and non-native) occur in the wild in the PRA, and several of the native *Crataegus* species are endangered (Christensen & Zielinsky, 2008; see 6.09.05). *Platanus* x *hispanica* is widely used in the PRA area as a road and street tree. *Celtis* and *Zelkova* are also represented in the PRA area by native European species (*C. australis*, *C. tournefortii*, *Z. abelicea* (Crete), and *Z. sicula* (Sicily)) and non-native American species (*C. occidentalis*, *C. laevigata*, *C. reticulata*). *Maclura pomifera* shows as being widely used in large scale cultivation. Some others may have related species in the PRA area (e.g. *Sophora* and *Pterocarya fraxinifolia*). Finally, some are more likely to be grown under protected conditions in most of the PRA area due to their tropical nature (e.g. *Artocarpus heterophyllus*, *Cinnamomum camphora, Bombax malabaricum*). Information on host plants, as well as on their presence or availability as ornamental in the PRA area, is given in Annex 1.

**Fruit trees**

**fig (*Ficus carica*) and other *Ficus* spp.** *Ficus carica* is grown throughout the southern part of the PRA area and in Central Asia for commercial fruit production. It is also widely planted in gardens. The areas harvested in different countries of the PRA area are given in Annex 2. Many cold-resistant varieties of fig are available and they are grown in gardens in northern locations (e.g. the Netherlands, Potting *et al.*, 2008). *Ficus* spp. are widely grown in the PRA area as ornamentals (e.g. *F. repens*) or bonsais (e.g. *F. retusa*). In the Netherlands, there were 74 ha of glasshouses and 80 glasshouse nurseries growing *Ficus* in 2004 (Dutch PRA, 2010). In 2006, about 15 glasshouse nurseries in the Netherlands used *Ficus* plants imported from China (Dutch PRA, 2010). See map 3 for *Ficus carica* in Annex 3.

**apple** (*Malus* spp.): apple trees are grown in all countries of the PRA area, commercially and in gardens (*M. domestica*) (Annex 2). In Russia and the CIS countries (Doronina & Terekhina, 2009), apple trees are grown south of a line joining (roughly) Ladoga lake in the West (60°North) to south of Sakhalin island in the East (circa 45°North). A wide range of other *Malus* spp. are also used in the PRA area as rootstocks for other fruit trees and ornamentals. There are also wild *Malus* spp. in the PRA area (e.g. *M. sylvestris*) and some native and endangered species (see 06.09.05). See map 4 in Annex 3 for *Malus domestica*.

**loquat** (*Eriobotrya japonica*): loquat is cultivated commercially in Cyprus, Egypt, Greece, Italy, Spain Tunisia and Turkey, and is widely distributed in many European countries in gardens. Turkey has 288.000 loquat trees giving a yield of 13,000 tonnes of fruit per year (Taksin & Erdal, 2011). In Morocco in 1993, there were 320 ha producing 2220 tonnes of fruit per year (Walali Loudiyi & Skiredj 2003).

**pear** (*Pyrus communis*): an important host of *A. cinerea*, pears are widely grown in the PRA area (Annex 2). They are widely cultivated in the western part of Russia and CIS countries (Sorokhina & Terekhina, 2009), within the east, pears are cultivated commercially north of a line (roughly) from 50° North in the West to 40° North in Central Asia in the East. Pear is also cultivated in gardens further north. *Pyrus pyrifolia* (Japanese pear), a host of *A. japonica*, has been grown on a limited scale in the Mediterranean area (e.g. Italy, France) since the 1980's. There are also wild species of *Pyrus* in the PRA area, such as *P. pyraster* and some endangered species (see 06.09.05). See maps 12a-b in Annex 3 for *Pyrus communis* and *Pyrus pyraster.*

**peach** (*Prunus persica*): also a host of *A. cinerea*, peach is cultivated as a commercial crop for fruit production (Annex 2) and also occurs in gardens, especially in the southern part of the PRA area. A large number of other *Prunus* species are cultivated for fruit or as ornamentals, or occur in the wild. Several of these are major commercial species (plum, apricot, almond, cherry).

**sweet chestnut** (*Castanea sativa*) and **walnut** (*Juglans regia*): areas cultivated are given in Annex 2. *Castanea sativa* and *Juglans regia* are widely grown for their fruit and they are also present in the wild, in forests as pure or mixed stands (Map). Other *Juglans* spp. are grown in the PRA area as ornamentals (*J. cinerea*, *J. nigra*).

***Citrus* spp., king orange** (*Citrus nobilis*)**, sour orange** (*Citrus aurantium*): *Citrus* spp. and *Citrus nobilis*, hosts of *A. japonica*, are widely cultivated as commercial crops for fruit production and also occur in gardens, especially in the Mediterranean area. Sour orange is cultivated in the Mediterranean area for rootstock, oil, and its use in food products.

**pomegranate** (*Punica granatum*) and **persimmon** (*Diospyros kaki*) are cultivated in the Mediterranean Basin. Azerbaijan, Israel, Italy, and Uzbekistan grow over 17000 ha of persimmon (in 2009, FAOstat 2011).

**tea** (*Thea sinensis)* is cultivated in the South-Eastern part of the PRA area, from Turkey to Southern Russia and Central Asia. The major producer is Turkey with over 75000 ha in 2009 (FAOstat 2011).

## Climatic suitability

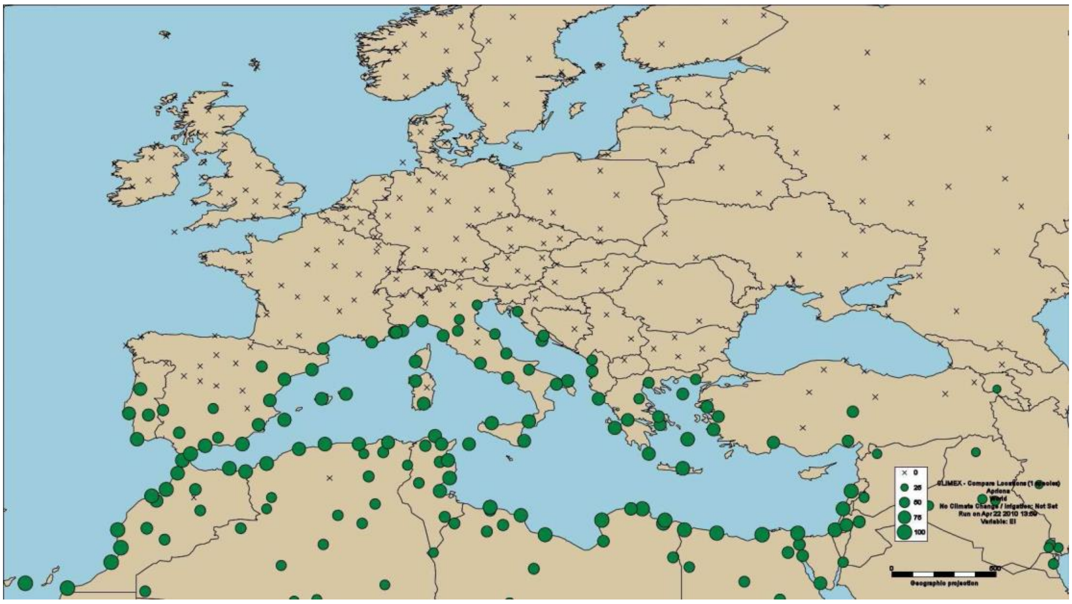
**3.03 - Does all the area identified as being suitable for establishment in previous question(s) have a suitable climate for establishment?**

**No**

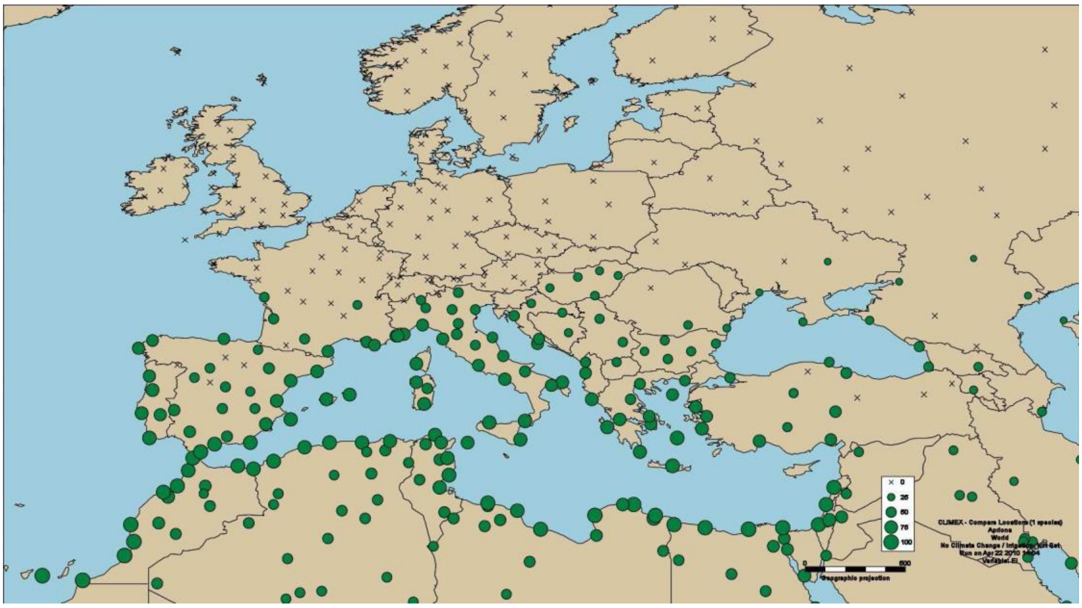
The life cycle of these species generally lasts 2 years, but may last 3 years under certain conditions (Dutch PRA, 2010). All three pests inhabit a range of climatic conditions in their area of origin, but *A. germari* in particular occurs across several climate zones, including tropical areas and areas with cold winters. Other Cerambycidae species from the same areas (e.g. *Anoplophora chinensis* and *A. glabripennis*) have shown an ability to survive in climates of the PRA area (e.g. in Italy, France, Austria, see Haack *et al.*, 2010). Climex studies carried out for *A. glabripennis* (which occurs in similar areas to *A. germari* in China and has a similar life cycle), showed that most of Europe was suitable from the point of view of climatic conditions (MacLeod *et al.*, 2002). *A. germari* also occurs in arid areas where poplar has been used extensively for reforestation (North Forest area of China) (Ji *et al.*, 2011). Such areas might compare with arid regions of the PRA area (such as in Central Asia).

Climate comparisons in the framework of the Dutch PRA (2010) indicate that *A. germari* could establish in the Mediterranean area with a life cycle of 2 years, and South-East Europe (e.g. Balkans), Northern Turkey and oceanic areas of South-West Europe (in Portugal, France and Spain) with a 3-year life cycle (Fig 1, below). In the Northern part of the PRA area, the temperature accumulation is not sufficient to complete the life cycle in 2-3 years, and it is not known whether the pest could extend its life cycle beyond 3 years (i.e. to 4-5 years). The Dutch PRA (2010) notes that *A. japonica* has a development time similar to *A. germari* (265 days at 25°C and 270 respectively).

**Fig 1. Potential distribution of *Apriona germari* in Europe**. Ecoclimatic index (EI) indicating suitability of areas. Crosses indicate unsuitable location (EI=0). Green dots indicate that the area is suitable. Threshold temperature in all models was 12 °C. From the Dutch PRA-Appendix 10 (2010)



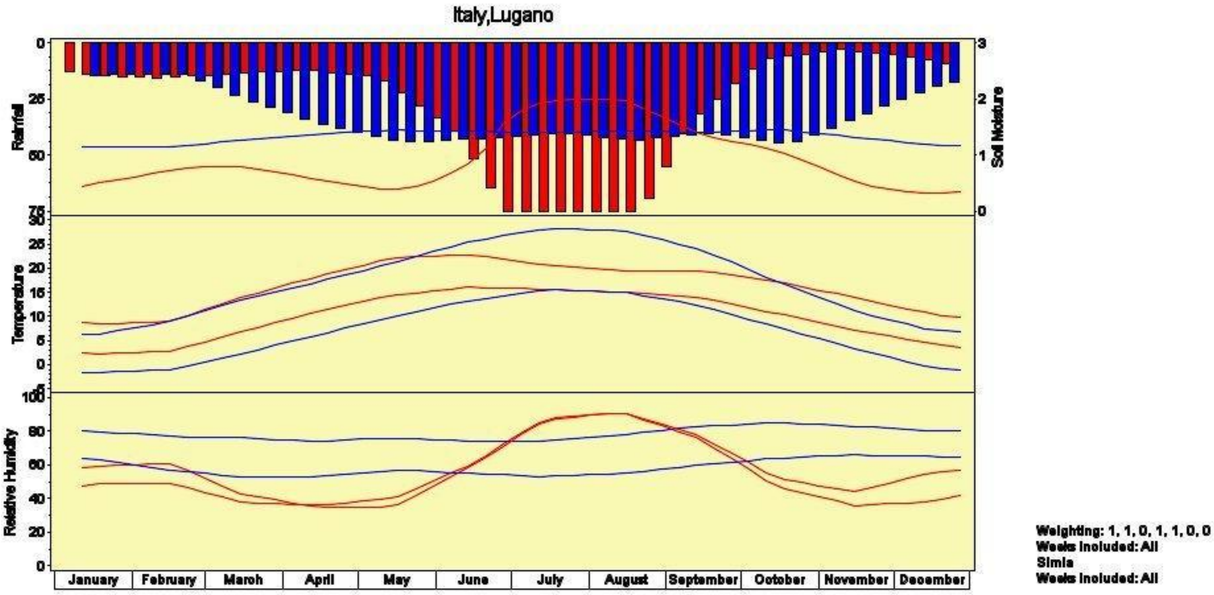
Hypothesis of a 2-year life cycle (1943 DD/year).



Hypothesis of a 3-year life cycle (1295 DD/year)

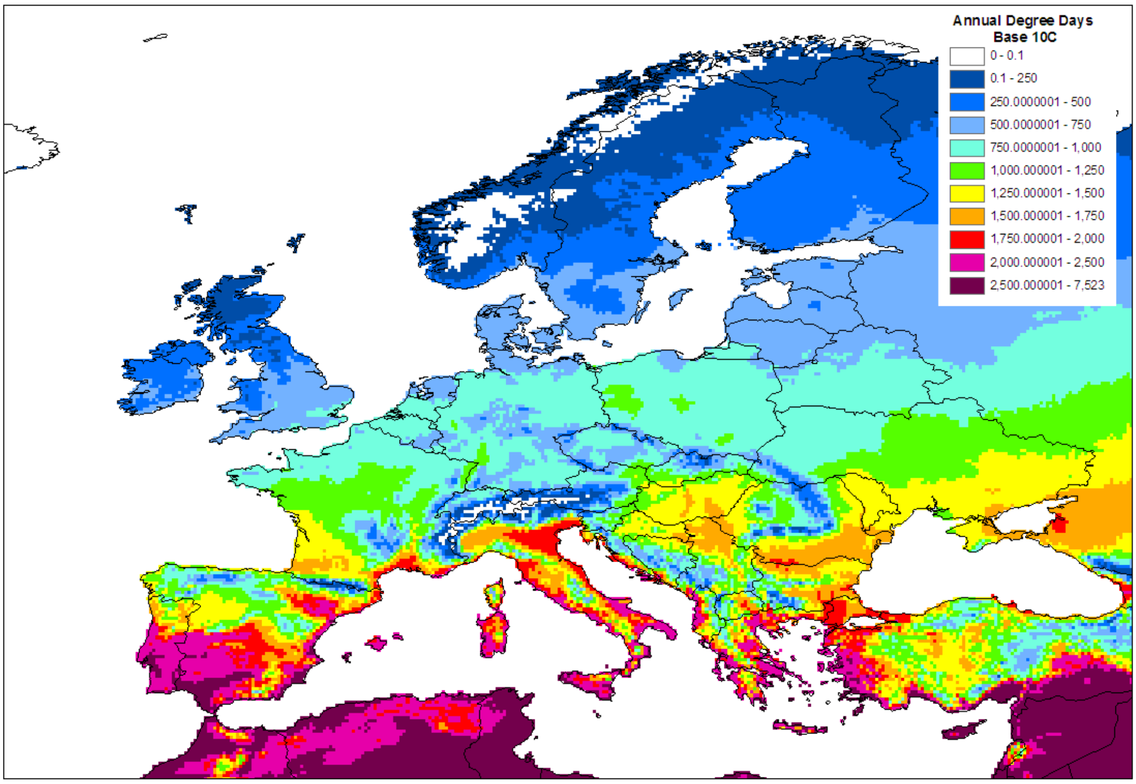
There are no detailed studies of the life cycle of *A. cinerea*. In addition, the area where *A. cinerea* is present is smaller and is very mountainous. It is therefore difficult to compare it with the PRA area, in particular because only one relevant meteorological station exist in Climex. A comparison of climate was made between Simla (India) (where *A. cinerea* is present) and the EPPO region and the climate most similar was found in Lugano (Italy). Ths comparison is presented in Fig. 2. Mean temperatures are very similar, but rainfall is very seasonal in Simla and associated with high humidity. Humidity might influence the life-cycle of *A. cinerea* (A. Singh, pers. comm. 2011), but there are no data on this in the literature.

**Fig 2 Comparison of climate between Simla (India) (where *A. cinerea* is present) and Lugano (Italy)**. Data for Simla in red; for Lugano in blue



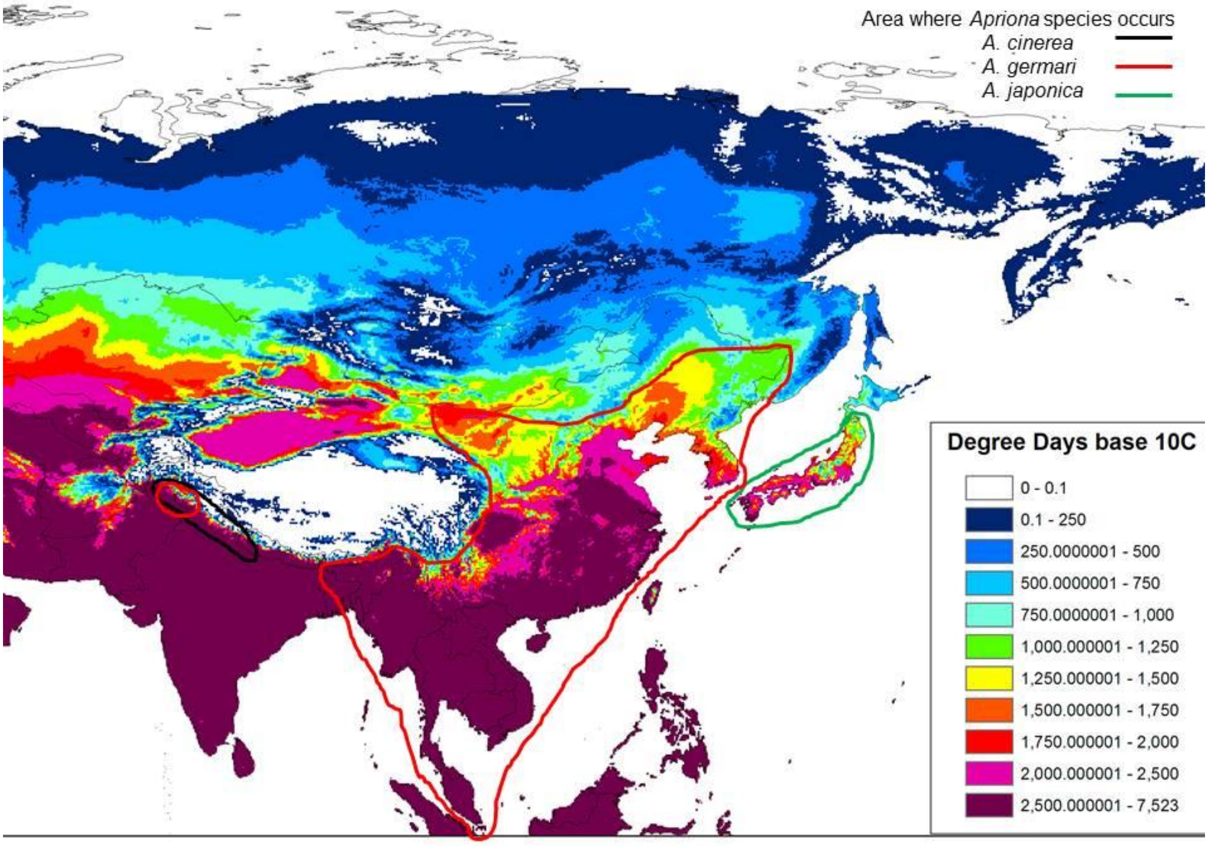

More details are provided in the Dutch PRA on climate comparisons and on details of the life cycle of the three species. The maps of degree day accumulation for Europe and Asia below indicate similarities between parts of the PRA area (Fig. 3) and the areas of origin for all three *Apriona* species (Fig 4.).

**Fig. 3 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).



*Establishment*

**Fig. 4 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). Areas where *Apriona* species occur are outlined.




By combining these data, it can be concluded that climatic conditions are appropriate in part of the PRA area for *A. germari* (Mediterranean area, South-East Europe (Balkans), Northern Turkey and oceanic areas of South-West Europe (Portugal, France and Spain). It may also establish further North but there is a bigger uncertainty. For *A. japonica* and *A. cinerea*, the area suitable for establishment is more uncertain, but would probably include at least the north of the Mediterranean Basin.

## Protected Cultivation

**3.07 - Are the hosts grown in protected cultivation in the PRA area?**

**Yes**

Some hosts are cultivated under protected conditions as part of nursery production, and some ornamental plants are grown in glasshouses because of their tropical requirements. However, no mention was found in the literature of hosts being grown under protected conditions in areas where the pests occur naturally.

**3.08 - By combining the cumulative responses to previous questions 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.**

In the field, the Mediterranean area, South-East Europe (e.g. Balkans), northern Turkey and oceanic areas of South-West Europe (in Portugal, France and Spain). If the pests were able to extend their life cycle to 4-5 years, then northern parts of the PRA area might also be suitable for establishment.

## Suitability of the area of potential establishment (3.09-3.16)

### Host plants and suitable habitats

**3.09 - How likely is the distribution of hosts or suitable habitats in the area of potential establishment to favour establishment?**

**likely**

***Level of uncertainty:* medium**

Areas with high densities of host plants are more favourable than areas of low density. For example, it is expected that higher populations will occur in areas with high concentration of mulberry and in poplar plantations. It may therefore be expected that the Mediterranean area would be more suitable. It is not known whether there are differences of reproductive rate between hosts. However Shao (2007) showed that life span of adults *A. germari* differed significantly depending on feeding (life span of female was 78 days on *Broussonetia papyrifera,* 55 days of *Morus alba*, and 19 days on *Populus* spp.). There is some uncertainty about the need for Morus species for maturation feeding.

### Climatic suitability

**3.11 - Based on the area of potential establishment already identified, how similar are the climatic conditions that would affect pest establishment to those in the current area of distribution?**

**moderately similar**

***Level of uncertainty:*** medium for *A. germari;* high for *A. japonica* and *A. cinerea*, because detailed climate analyses have not been carried out for these two species and they have a more restricted distribution.

The climatic conditions that would affect pest establishment are moderately similar to those in the current area of distribution. The main difference is linked to the amount of precipitations which is higher in parts of the current area of distribution. High humidity may be important, especially for *A. cinerea* (Singh, pers. comm., 2011)*. A. germari* is particularly damaging in arid situations (Ji *et al.*, 2011) but it is not known if it is because host plants are stressed or because pest populations develop better. Particular weather conditions, such as sufficiently high temperatures during the flight period, might influence whether the adults can lay eggs and disperse.

Winter weather conditions might also influence suitability. For *A. japonica*, a period of exposure to low temperature (10°C) for 30 days seems to be required to complete larval diapause (Esaki, 2001). In areas where *A. cinerea* is present, diapause lasts about 3 months at temperatures between 0 and 15°C (Singh, pers. comm. 2011).

### The managed environment

**3.14 - How favourable for establishment is the managed environment in the area of potential establishment?**

**highly favourable**

***Level of uncertainty:* medium** (data are lacking on the management of many of the hosts in the PRA area)

Host plants are grown in plantations, orchards, parks, nurseries, outdoors and under protected conditions where they are subject to limited management. High plant density in orchards will favour establishment. Host plants are also widespread in gardens and forests, with minimal management, and in the wild without management.

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

**likely**

***Level of uncertainty:* medium** (no data on management of some hosts)

In orchards and nurseries, pest management may be applied (EPPO, 2011), but the timing of treatment may not coincide with the period when *Apriona* spp. are susceptible. In addition, pest control tends to target fruit pests or defoliators, and not wood borers.

For poplar and willow (FAO, 2008), some management practices are applied, especially in plantations and nurseries. Pruning, trimming and thinning are carried out (e.g. in Croatia, Turkey, Romania). There is a range of damaging pests on poplar in the PRA area and chemical controls are applied against insects in some countries (FAO, 2008), especially in nurseries or young plantations. For example, insecticide sprays are used against *Lymantria dispar* in Romania, and against poplar woolly aphid and *Operophtera brumata* in Spain. These controls however, are unlikely to reduce populations of wood boring insects, which remain a significant problem in some countries. For example in Italy, 30% of the costs of poplar protection are due to wood borers such as *Cryptorhynchus lapathi*, *Saperda carcharias* and *Cossus cossus*. Insecticides targeting other wood borers are more likely to reduce *Apriona* population than insecticides targeting other pests. Nevertheless, it is not known if the timing of application will be adequate.

Many host plants grow in the wild with no pest management.

As a conclusion, it is unlikely that existing control measures will prevent establishment of *Apriona*, because most of the life cycle stages are too well protected within the host tissues.

## Protected Cultivation

**3.16 - Is the pest likely to establish in protected cultivation in the PRA area?**

**No**

***Level of uncertainty:*** **low**

Climate conditions in glasshouses are probably favourable for establishment (Dutch PRA, 2010). However considering the small size of the plants larvae may not complete development. In addition considering the length of the life cycle, it is considered that signs of infestation (e.g. frass, holes) may be detected during crop production and before a sustainable population may not establish.

**3.17 - How likely are the reproductive strategy of the pest and the duration of its life cycle to aid establishment?**

**likely**

***Level of uncertainty:*** **low**

The pests have a long life cycle (generally 2-3 years), which might reduce the probability of establishment. However, the duration of the life cycle varies according to the host plant and climate, and this allows the pests to survive under a wide range of conditions. In particular, larval development may take from 9-10 months in warm conditions, but 2 years in colder conditions (Hill, 2008). Esaki (2007a) noted that larvae of *A. japonica* could spend more than 3 years in stems of *Zelkova serrata*. Details on the life cycles of the *Apriona* spp. are given in Appendix 4 of the Dutch PRA (2010).

Adults live for several months and the pattern of egg laying might help the pest to establish (Hill, 2008). Females lay moderate numbers of eggs (e.g. females of *A. germari* lay 23-234 eggs, on average 103 eggs, with about 1.6 eggs laid per day; Gao *et al.*, 2000) and they lay their eggs over several weeks on branches of a number of different trees. There is generally one egg per branch, but there might be more than one larvae per trunk (Singh & Prasad, 1985). Consequently a female might lay eggs on several host plants following introduction into the PRA area, decreasing the probability that all infested trees will be found.

Egg mortality is relatively low and is unlikely to limit establishment. Yamanobe & Hosoda (2002) noted that 43–57% of eggs laid on *Fagus crenata* survived and developed into either larvae or adults.

**3.18 - Is the pest highly adaptable?**

**No, moderately adaptable or less**

***Level of uncertainty:*** **medium**

The pests are adapted to many tree species and genera where they occur. *A. germari* is also recorded to cause heavier damage on non-native plant species (e.g. poplar, FAO, 2008). In India, Singh & Prasad (1985) report that *A. cinerea* was known as a serious pest of apple orchards before being reported to attack poplar. Although this PRA is conducted on the known hosts, the pests are likely to attack other species following introduction. *A. germari* is adapted to a very wide range of climatic conditions, but on the other hand might need a Moraceae host for adult feeding, which might restrict establishment.

**3.19 - How widely has the pest established in new areas outside its original area of distribution?**

**Not established in new areas**

***Level of uncertainty:*** **medium** (Not sure if any of the records in Asia are due to spread to new areas)

There are no records of the three *Apriona* species establishing in new countries, either within the PRA area or on other continents. *A. germari* and *A. japonica* have been intercepted (see introduction), but no incursion or outbreak has been reported. However, within the known distribution range, *A. germari* and *A. cinerea* have spread to new areas where susceptible hosts have been planted (e.g. poplar and mulberry).

## 3.20 – Description of the overall probability of establishment

**high**

***Level of uncertainty:* medium**

Host plants are widely present in the PRA area, but climatic conditions will restrict establishment. However, where climatic conditions are appropriate (e.g. Mediterranean area, South-East Europe (Balkans), Northern Turkey and oceanic areas of South-West Europe (Portugal, France and Spain)), there are also numerous hosts, including in commercial cultivation so for these areas probability of establishment is high with low uncertainty. In more Northern areas where the climate will not be so suitable, the probability of establishment is low with a medium uncertainty.

Uncertainty: medium. There are uncertainties of the possible host range if introduced, as well as the limits of the area of possible establishment because of lack of biological data for the 3 species.

## Stage 2: Pest Risk Assessment Section B: Conclusion of introduction

Entry was rated as unlikely. The low volumes of imports (subject to an uncertainty in the case of the plants for planting pathways) are a major reason for the low likelihoods attributed to pathways, and the assessment would change if volumes increased, especially in the case of wood of poplar. Despite the relatively low rating, the pathways present a real risk, as indicated by the records of previous interceptions (see 1.01).

The probability of establishment is considered as high where climatic conditions are appropriate (in the Mediterranean area, South-East Europe (e.g. Balkans), Northern Turkey, oceanic areas of South-West Europe (in Portugal, France and Spain)) because there are also numerous hosts, including in commercial cultivation, in these areas. The limits of the area of possible establishment are uncertain because of lack of biological data for the 3 species, and uncertainties with the current distribution range.

The overall probability of introduction is therefore rated as moderate for the area where climate is most suitable e.g. Mediterranean area, South-East Europe (Balkans), Northern Turkey and oceanic areas of South-West Europe (Portugal, France and Spain) and low for the rest of the PRA area. However, the ratings for entry are partly due to low volumes for all the pathways considered. This is subject to a high uncertainty and the overall probability of introduction may be higher if volumes increase.

A worst-case scenario (with the highest probability of introduction), would be entry of *A. germari* on plants for planting used in conditions of minimal management (e.g. forest, plantation), in the southern part of the PRA area (e.g. Mediterranean area) where the pest can survive outdoors and there are many different hosts grown in the natural environment, in commercial cultivation and in gardens.

## Stage 2: Pest Risk Assessment Section B: 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:*** **low**

A survey in Baoding, Hebei Province suggested that 400m was a safe distance from source sites of *A. germari* (Ma Fengxing *et al.*, 1997; cited in Youqing Luo data sheet). However, another field survey accompanied with bait revealed that adults of *A. germari* can fly as far as 2500m for food, although most individuals were caught between 250 and 550m (Gao Ruitong *et al.*, 1998; cited in Youngqi Luo data sheet). For *A. cinerea*, new plantations more than 1 km from an infestation site are unlikely to be infested during the first two years (Singh & Prasad, 1985).

The Dutch PRA (2010) makes a parallel with *Anoplophora* spp. Due to similar biology, the dispersal behaviour of *Apriona* may be comparable to *A. glabripennis* and *A. chinensis* (which are about 1 cm smaller). Adults of *A. glabripennis* and *A. chinensis* can disperse 1 to 3 km during their life span, although most remain near the tree where they emerged (Dumouchel, 2004; Smith *et al.*, 2001, 2004; Sacco, 2004; Williams *et al.*, 2004; Van der Gaag *et al.*, 2008 cited in Dutch PRA, 2010, Haack *et al.*, 2010).

**4.02 - What is the most likely rate of spread by human assistance (in the PRA area)?**

**high rate of spread**

***Level of uncertainty:*** **low**

Plants for planting, wood (including firewood), bark and untreated wood packaging can be infested with larvae or eggs of *Apriona* spp. and exchange of such material within the PRA area may spread the pest (even bark could transport the pests over short distances, and therefore is included here). However, the main risk of spread would be by the movement of infested plants for planting (including cuttings) between nurseries.

**4.03 - Describe the overall rate of spread**

**high rate of spread**

***Level of uncertainty:*** **low**

As per 4.01 and 4.02 above.

**4.04 - What is your best estimate of the time needed for the pest to reach its maximum extent in the PRA area?**

***Level of uncertainty:*** **high**

In India, *A. cinerea* was first reported attacking poplar in forests in 1964, poplars were introduced in large-scale plantations in the 1970s, and large-scale mortality occurred in the 1980s. Therefore in the PRA area, major damage by *A. germari*, *A. cinerea* or *A. japonica* may be expected within 25 years, but the pests would not be expected to reach their maximum extent in the PRA area before at least 30-40 years. It should be noted that, although there are uncertainties on climatic requirements of the pests, the area of potential establishment is expected to be limited compared to the whole PRA area. Multiple introductions in different parts of the PRA area will speed up this process.

An idea of the rate of spread, even with intensive control measures, can be obtained from the outbreak of *Anoplophora chinensis* in the Milan area of Italy. This outbreak has expanded to approximately 100 $km^2$ in about 15/20 years, accross an area where hosts are present in a mix of environments (gardens, orchards and forests) (Maspero *et al.*, 2007).

Uncertainty: high. It is not sure what a realistic estimate is.

**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?**

***Level of uncertainty:*** **high**

Because of a long life cycle (2-3 years) and moderate rate of spread, the pests would occupy only a relatively small part of the area of potential establishment after 5 years. It will take at least 2 years before the pest starts to spread from the establishment site. However it should be stressed that during the first 5 years, the pests have a high chance of remaining undetected.

## Stage 2: Pest Risk Assessment Section B: 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?**

**Moderatly likely**

***Level of uncertainty:* low**

There is no trapping systems for these pests, but survey and monitoring for *Apriona* spp. should be more effective than for *Anoplophora chinensis,* because of the presence of frass ejection holes produced by the larvae and because the egg-laying scars are more obvious. However, if these three *Apriona* spp. attained a condition favorable for reproduction, they would spread over many different hosts, attacking plants in gardens, natural areas or forests, or in the wild, which would complicate eradication. Early detection in forests would be difficult. Removing all potential hosts around an outbreak would also be very difficult. In addition, adults fly and may spread before eradication is completed. Eradication may be possible in some limited circumstances, such as entry under protected conditions (e.g. glasshouse facility or nursery), or entry and early detection in a nursery. It is assumed that overall eradication might be as difficult as for *Anoplophora chinensis*.

Eradication will depend very much on the time of detection and the willingness apply measures such as cutting trees etc. Removing of hosts is technically not very difficult but can politically or socially be very difficult.Eradication measures will be more difficult to apply in areas where concentration of host plants is important.

**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 ?**

**Moderatly likely**

***Level of uncertainty:* low**

In a similar way as for eradication, if the pest arrives at the end of its larval development and adults emerge, they will disperse. Containment will be complicated due to the large range of host plants. Females also lay eggs over a long period, and on several branches (presumably also plants). It could be best contained if it arrived under protected conditions, i.e. under glasshouse. Containment outdoors would require large buffer zones without hosts and intensive surveys. The size of buffer zones where preferred hosts should be destroyed to manage the pest in poplar plantations is 500-1000m (e.g. *A. cinerea*, Singh & Prasad, 1985).

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

**No**

***Level of uncertainty:* low**

It is not possible to speak about transient populations as the pest has a long life cycle. However, there could be transient individuals if the pest is introduced in an area where conditions are not favourable for the emergence of adults (it could be present but not expected to establish). Adults would emerge in spring. However, if the successive stages cannot accumulate the degree-days needed for their development, the following generation of adults may not emerge.

## Stage 2: Pest Risk Assessment Section B: Assessment of potential economic consequences

**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:* medium**

*A. germari, A. cinerea* and *A. japonica* are generally considered as serious pests, but quantitative information about the damage and economic impact is generally lacking. Some data may be available in original Chinese articles but only the summary in English could be consulted by the EWG.

**Nature of the damage**

The main damage associated with *Apriona* spp. is caused by the larvae, which bore into the wood soon after hatching, creating long tunnels. This affects the growth of the trees and decreases the quantity and quality of the timber and longevity of the trees (*A. germari*, Shui *et al.*, 2009; Li, 1996). Trees may die and stems might be broken (*A. japonica*, Esaki, 2006). The timber becomes unsuitable for commercial use as entry of fungi and pathogens in the galleries cause discoloration of the wood, and this causes weakness, which increases the chances of wind break. Repeated attacks result in forking or mortality (Singh & Prasad, 1985; Singh *et al.*, 1994). Studies made on the impact of *A. germari* on wood quality of *Populus tomentosa* (Cheng *et al.*, 2006) showed negative effects, such as increased moisture content and decreased compressive strength. Death of trees is reported in several articles (e.g. Singh *et al.*, 2004; *A. cinerea*). Damage to orchards (as reported for *A. cinerea* on apple in India) is likely to affect fruit production, but there is no estimate of impact on fruit crops.

In addition, adults of *Apriona* spp. feed on bark. This may cause the death or breakage of branches (*A. japonica*, Esaki, 2006). Singh & Prasad (1985) report that adults of *A. cinerea* cut leaves and girdle young shoots, thus killing them.

*A. japonica* is reported to attack healthy trees (Esaki, 2006 & 2007a), and it seems from other publications that *A. germari* and *A. cinerea* do the same. Trees in stressed conditions suffer even heavier damage, such as poplars in the shelterbelt programme of Northern China, where pure poplar stands were planted in arid areas in the absence of other fauna (e.g. natural enemies) (Ji *et al.*, 2011). Only Hill (2008) mentions that stressed trees are preferred hosts.

Note. The importance of damage on *Morus* at origin is linked to sericulture and the use of this host as food for silkworms. Silk production is still important in India, China and Japan, and continues in parts of the PRA area (e.g. Turkey, some countries of Central Asia).

**Amount of damage**

*Apriona* spp. are mentioned in many reports as stem boring pests, but quantitative information about the damage and economic impact is generally lacking (Dutch PRA, 2010).

- ***A. germari*** is recorded as a serious pest of poplar in China (Li, 1996; Ji *et al.*, 2011, see below for more detail) and Taiwan (Liu, 2002). It is also a serious pest of willow, *Ficus carica,* apple and *Sophora japonica* in China (Li, 1996; Shui *et al.*, 2009; Wang, 2009), and of mulberry in China, North India, Korea and Thailand (Shu Zhaolin *et al.*, 1997 cited in Youqing Luo data sheet, Yoon & Mah, 1999; Hussain *et al.*, 2007; Hill, 2008; Shui *et al.*, 2009). *Broussonetia papyrifera* is also a preferred host (Gao *et al.*, 1994). Finally it is recorded as a minor pest of jackfruit (*Artocarpus heterophyllus* ) in South East Asia (Hill, 2008), and is recorded to cause damage in residential areas (Yan Junjie *et al.*, 1994) and on roadsides (Huang *et al.*, 1994).

On poplar, *A. germari* is one of the main poplar stem-boring pests in Three-North Forest of China, and economic loss due to longhorn beetles in forests (especially *A. germari, Anoplophora glabripennis* and *A. nobilis, Batocera horsfieldi*) was significant (one billion per year [no currency mentioned]) due to the reduction in wood quality and decrease in growth (Li, 1996). The plantations established during the first phase of the Three-North Shelterbelt Programme were nearly destroyed by poplar longhorn beetles and more than 80% of poplar stands planted during the second phase were damaged (without mention of poplar species). Ji *et al.* (2011) note that, despite large-scale control efforts that were undertaken in these regions, the infestations and related economic and ecological losses caused by *A. glabripennis* and *A. germari* have not been significantly reduced. On roadsides, a damage rate of 51% was observed on *Populus tomentosa*, with 1.3 larva per tree in average (Hebei province, China) (Huang *et al.*, 1994). Ma *et al.* (1997) (Hebei province, China) report percentages of damaged plants of 35% in *Populus tomentosa* plantations, as well as

8% in mulberry orchards and 36 % in apple orchards. Huang *et al.*, 1997 note that both growth and timber quality of *P. tomentosa* are affected.

- ***A. cinerea*** is recorded as a serious pest on poplar in Northern India (Singh & Prasad, 1985; Sharma & Bathia, 1996; Thakur, 1999; Bathia *et al.*, 2007), especially exotic poplars (FAO, 2005), including in agroforestry systems, but also in nurseries, plantations and natural stands (Singh *et al.*, 2004). It is recorded as a pest of apple (Pruthi & Batra, 1960 *in* Singh & Prasad, 1985; Hill, 2008). It also feeds on *Prunus persica Pyrus communis,* and *Morus indica* (Singh & Prasad, 1985) but no detailed data of damage is published. On a website for farmers in Pakistan, it is noted that larva of the *A. cinerea* is limiting factor in the production of apples (*Pyrus malus*) in Swat and Azad Kashmir (Pakissan, undated)

*A. cinerea* attacks mostly 1-3 year old poplar plants in India (FAO, 2005). Singh & Verma (1998) noted the incidence of *A. cinerea* on poplar plants in 4 age groups (6 months, 1-2, 2-3 and 5-6 yr), and found no attack on 6 month-old plants, 12% attack on 1-2 yr old trees, 88% attack on 2-3 yr-old plants and 27% attack on 5-6 year old trees. Singh *et al.* (2004) note a high incidence (88%) in 2-3 year old *P. deltoides* plantations in Himachal Pradesh state, 34% in Jammu region and extensive economic losses (including tree mortality), persisting for several years in succession over large areas. During surveys in Jammu, the pest was observed to cause >60% tree mortality in a 2-year old 5 ha plantation.

- ***A. japonica*** is recorded as a serious pest of mulberry (Kikuchi, 1976; Esaki, 2007a) and broadleaved trees in Japan (Esaki, 1995). It is an important pest of loquat, fig, poplar, willow, *Enkianthus perulatus* and *Malus pumila* (Enda, 1965; Kojima & Nakamura, 1986; Ohashi, 2005; Esaki, 2007a; Sugimoto, 2007). Damage has also been recorded on *Zelkova serrata, Fagus crenata, Robinia pseudoacacia* and *Celtis sinensis* (Esaki & Higuchi, 2006; Esaki, 2007a). A summary of the percentages of *Zelkova serrata* trees damaged by *A. japonica* in Japan is provided in Fig. 2 in Annex 4 (Esaki, pers. comm. 2011): the percentage of injured trees recorded is up to 89% in Chiba prefecture.

However, no quantitative data were found on damage to the other main host species. On *Fagus crenata*, all of 35 five-years old beech saplings in a lowland plantation in Ibaraki Prefecture in Japan were damaged (Yamanobe & Hosoda, 2002).

**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?**

**major**

***Level of uncertainty:*** **medium** (effect of climate and host distribution on development of pest populations and damage)

In areas where *Apriona* spp. could establish outdoors, the pests would attack poplars, apples, willows and other crops and plants in the natural environment, commercial orchards, gardens, plantations and urban areas. It is expected that the potential damage would be high in the southern part of the PRA area where the pest is more likely to establish outdoors, especially if it established in the wild on hosts that occurred extensively with or without management (e.g. poplar).

However, the pest has a wide range of hosts, which may diversify the impact of the pest. It is unclear how host preferences influence the development of populations, and whether specific hosts are needed in the life cycle of the pest for adult maturation (such as mulberry or paper mulberry).

**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:*** **high** (Control currently applied on the hosts in the southern part of the PRA area)

Orchards, nurseries and poplar and willow plantations are subject to control measures against other pests in the PRA area, which may allow a certain control of *Apriona* spp. (see 3.15). However, few measures seem to be applied against Coleopteran pests (except sometimes for poplar, see 3.15), especially wood boring species, and the timing of measures may not be adequate to control *Apriona* spp. In addition, hosts of *Apriona* species occur in a wide variety of environments which are subject to minimal control measures (e.g. forests, parks, gardens) and individuals from these environments would reinfest cultivated plants.

**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?**

**moderate**

***Level of uncertainty:* medium**

A wide variety of control measures are used where the three *Apriona* spp. occur, and these are most effective as part of an integrated management programme. Control measures are applied primarily in plantations and nurseries, principally of poplar, and apple orchards, but not in natural forests and wild habitats (Singh *et al.*, 2004; Pan Hong Yan *et al.*, 2005). Ma *et al.* (1997) reported that the combination of control methods in China decreased the proportion of plants damaged by *A. germari* from 35% to 17% in *Populus tomentosa* plantations, 36% to 0 % in apple orchards, and 8% to 2% in mulberry orchards.

Control measures include:

**Monitoring -** to detect adults, signs of oviposition, damage by larvae and frass on the ground. The larvae bore excretion holes at intervals along their tunnels, and these can be observed on branches and trunks. However, these may be difficult to detect in hidden places and on larger trees.

**Chemical control** - Various formulations are mentioned, including sprays or microcapsules targeting the adults or eggs and young larvae, and injections methods targeting older larvae in trunks and branches. A wide range of chemical insecticides are used in the areas of origin (see Annex 5), although many of these are not approved for use at least in the EU. Esaki (2007a & b) mentions that spraying fenitrothion twice at a 3-week interval can kill all adults over nine weeks. In agroforestry in northwestern India, insecticides are applied against *A. cinerea* in areas of high infestation, to the main stem during the winter or just before adult emergence. Yang *et al.* (2005, cited in Dutch PRA, 2010) reported that spraying a 200x dilution of 8% cypermethrin micro capsule solution on the trunk and large branches, and again after 20 days could give good control of the adult stage of *A. germari*. In trials in China, greater than 90% control of *A. germari* in poplar trees was achieved by injecting triazophos and omethoate or deltamethrin into the larval holes (Pan, 1999). Soil applications of carbofuran can also protect nursery plants from borer attack (Singh & Prasad, 1985). The use of chemical impregnated sticks inserted into larval holes is also mentioned as an effective control method (Shui *et al.*, 2009, Pan Hong Yan, 2005).

**Manual control methods -** for example removing adults by hand (Pan Hong Yan, 2005) or physically killing eggs and larvae in trees (Pan Hong Yan, 2005; Esaki, 2007a), but these methods are labour intensive and therefore very expensive, and would also be difficult for large trees. No mention is made of traps in the literature consulted.

**Cultural control methods -** including

- sanitation felling (i.e. destruction of damaged and infested plants, or pruning) (Singh *et al.*, 2004, Pan Hong Yan, 2005, Esaki, 2007a, Bao *et al.* 1999; Singh & Prasad, 1985, Ji *et al.*, 2011 citing many others, Huang *et al.*, 1997);
- choice of plantation sites to avoid heavily infested areas (Esaki, 2007a; Singh *et al.*, 2004;Pan Hong Yan, 2005). Plantation sites should be have favourable conditions for host plants (e.g. avoid dry places for poplar),
- using mixed plantings (with non-host plant species) and host species and clones that are less susceptible (Ji *et al.*, 2011, citing many others, Singh *et al.*, 2004, Pan Hong Yan, 2005, Singh *et al.*, 2004, Wang et al., 2011).
- use of pest-free seedlings and cuttings (Pan Hong Yan, 2005);
- planting trap trees to lure adult beetles and divert oviposition, which are then removed and destroyed (e.g. paper mulberry trees in poplar plantations against *A. germari*) (Gao *et al.*, 1994a; Zhang *et al.*, 1992; Bao *et al.* 1999)
- removing preferred hosts in the vicinity of poplar plantations (500-1000 m) (e.g. *Broussonetia* spp., *Morus* spp.) (Pan Hong Yan, 2005; Singh & Prasad, 1985, Singh *et al.*, 2004, Li Kezheng, 1996, Gao *et al.*, 1994a; Zhang *et al.*, 1992; Bao *et al.* 1999).
- removing weeds to deter oviposition (*A. japonica*, Esaki, 2006 & 2007a)
- proper irrigation and fertilization to maintain tree vigour as vigorous trees are most resistant to attack by wood borers (Singh & Prasad, 1985).

**Biological control -** Application of fungus-containing sheets (*Beauveria brongniartii*) were used to control adults of *A. japonica* during feeding (Takiguchi, 1981 in Abe & Ikegami, 2005; Higuchi *et al.*, 1997; Esaki & Higuchi, 2006; Esaki, 2007a). Injection of *Beauvaria bassiana* into larval holes at the rate of 200 to 300 million spores per mg per hole gave high control of *A. germari* on *Populus tomentosa* in China (Luo, pers.

comm. 2011, Li *et al.,* 2011). Natural enemies found at origin are listed in Annex 5.

The combination of control measures can be highly effective in reducing *Apriona* populations, but these methods cannot be applied in the wild or in other unmanaged environments. Damage might be especially important for forest trees. Despite the range of control methods available, other introductions of cerambycids indicate that it is very difficult to eradicate or completely control particular species. For example the mulberry cerambicyd *Phryneta leprosa* was introduced from Africa into Malta in 2000 (Mallia, 2008) and despite implementation of control, it is now well established.

**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:*** **medium** (Difficult to estimate which additional costs would be incurred)

Optimal control management strategies will need to be defined and will cause increased costs in terms of surveillance, plant protection products, equipment, labour. This is more likely to happen for fruit trees. Control is likely to rely on applications of insecticides. Costs could also be associated with monitoring and the removal of preferred hosts. Control in forests would be limited, but might involve surveillance and destruction of infested trees.

**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?**

**moderate**

***Level of uncertainty:*** **medium**

*A. germari, A. cinerea* and *A.japonica* are regulated pests in New Zealand (BORIC, 2012) and *A. germari* is a quarantine pest for Australia (AQIS, 1998). The EWG was not aware of other countries where they are currently regulated.

At the level of the PRA area, the impact may be minor as many host plants are not the subject of exports. However it may be high for some countries. For example Belgium, Romania and Spain are major exporters of poplar roundwood (FAO, 2008 - Annex 8, table 4), and *Apriona* spp. might have impact on these markets.

*Apriona* spp. could also have an impact on the export market of plants for planting, although this is already submitted to a range of measures. There is an export of plants for planting of poplar from Italy to South America and from France to Ukraine (Augustin, pers. comm. 2011) and of plants for planting of apple, pear and *Prunus* from EU countries to Turkey (Ustun, pers. comm. 2011), and such exports may be affected.

Potentially there could be an impact on fruit production and hence the quantities of fruit available for export.

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

**major extent**

***Level of uncertainty:*** **medium**

Producers will have limited possibilities to increase prices, especially for wood and fruit, as there are other sources. Costs of monitoring and destruction of trees will be borne by producers. However, the highest costs may be borne by organisations in charge of the management of forests and parks, and by private persons, especially with regard to felling host trees in the vicinity of outbreaks and to losses of trees in gardens and public green spaces.

**<u>Assessment of environmental impact</u>**

**6.08.0A - Do you consider that the question on the environmental impact caused by the pest within its current area of invasion can be answered?**

**no, but there is some evidence that the environmental impact may be significant in the PRA area**

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

**Minor**

***Level of uncertainty:*** **medium**

*Apriona* species are a natural component of the forest ecosystem in their native areas, and they are not considered pests in natural forests. They do not have a major impact on natural environments in the area of origin.

However, *Apriona* spp. have an impact in some man-made environments. For example *A. germari* has caused major ecological damage in Northern China where poplars have been planted extensively as part of environmental restoration. Ji *et al.* (2011) noted that damage was due partly to the ecological environment (arid areas, low fauna, pure poplar stands) and human intervention (chemical control based on broad spectrum insecticides).

**Assessment of potential environmental impact in the PRA area**

**6.09.01 - What is the risk that the host range of the pest includes native plants in the PRA area?**

**High risk**

***Level of uncertainty:*** **low**

Many host species and genera are native in the PRA area (e.g. *Populus*, *Salix*, *Crataegus*, etc.). However, there is uncertainty as to the extent to which species belonging to host genera that are present in the PRA area but not in the area of origin might be attacked.

**6.09.02 - What is the level of damage likely to be caused by the organism on its major native host plants in the PRA area?**

**High level**

***Level of uncertainty:*** **medium**

*Apriona* species attack healthy trees and the host plants can be killed. If they reach forests, they are likely to have an impact on a wide range of broadleaved trees and the use of poplar and willow for environmental purposes (see 3.1). However, there is uncertainty as to the extent to which species belonging to host genera that are present in the PRA area but not in the area of origin might be attacked.

Impact on ecosystem patterns and processes

**6.09.03 - What is the ecological importance of the host plants in the PRA area?**

**High importance**

***Level of uncertainty:*** **low**

Willows and poplars along rivers have an important role in mitigating the effects of flooding. Several host genera (incl. willow, poplar, alder, beech, elm, oak, chestnut) are widespread and important components of natural ecosystems in the PRA area, and they support a high diversity of invertebrates and other dependent fauna (e.g. birds, mammals).

Conservation impacts

**6.09.04 - To what extent do the host plants occur in ecologically sensitive habitats (includes all officially protected nature conservation habitats)?**

**High extent**

***Level of uncertainty:*** **medium**

Poplar and willow are an important component of some sensitive habitats (e.g. wetlands, riversides) and are used for environmental purposes (see 3.1). Some species which represent host genera in the PRA area, but which do not occur in the area of origin, might also be attacked (hence medium uncertainty).

**6.09.05 - What is the risk that the pest would harm rare or vulnerable species? (includes all species classified as rare, vulnerable or endangered in official national or regional lists within the PRA area)**

**Medium risk**

***Level of uncertainty:*** **high**

Several species belonging to host genera, such as *Zelkova sicula*, *Salix libani* and *S. tarragonensis* (IUCN, 2011), are registered as being endangered in the area of potential establishment.

In addition several species belonging to genera attacked by *Apriona* spp. in the native area are registered as endangered or near threatened in the PRA area. For example: *Populus berkarensis* and *P. pruinosa, Malus niedzwetzkyana* and *M. sieversii, Crataegus darvasia, C. necopinata* and *C. knorringiana, Pyrus cajon, P. korskinskyi and P. tadshikistanica* (Eastwood *et al.*, 2009).

*Economic consequences*

Impact of pesticides

**6.09.06 - What is the risk that the presence of the pest would result in an increased and intensive use of pesticides?**

**Medium risk**

***Level of uncertainty:* low**

Attempts to control the pest in nurseries, plantations or orchards would require increased use of pesticides (see 6.04). Nevertheless current management is based on a limited number of sprays (e.g. twice during the flying period) or with insecticide applied in trunk injection. It is not expected that pesticides would be applied in the natural environment.

**6.09.0a - Considering the conclusion of the establishment part (on hosts and habitats, climatic conditions, abiotic factors, management methods), are the conditions in the PRA area sufficiently similar to expect a similar impact?**

**no**

***Level of uncertainty:* medium**

The host spectrum and distribution in the PRA area are different than at origin, and some regulating factors (e.g. natural enemies) are likely to be absent. Therefore, impact in the PRA area is expected to differ from that in the area of origin.

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

**Major**

***Level of uncertainty:* medium**

Impact could be major if the pest reaches forests and other environments where poplar, willow, chestnut, *Crataegus*, *Robinia* etc. are present. However, there is uncertainty as to the extent to which species belonging to host genera that are present in the PRA area, but not in the area of origin, might be attacked. The environmental impact therefore, is likely to be major but not catastrophic (as the rating guidance suggests).

**Assessment of social impact**

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

**minimal**

***Level of uncertainty:* medium**

This is not recorded specifically in the literature. Nevertheless serious yield losses (e.g. as reported by Singh *et al.* (2004) for agroforestry farmers in Northern India due to *A. cinerea*) may result in unemployment. There might be marginal social impact.

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

**minor**

***Level of uncertainty:* medium**

Death and removal of host trees in amenity areas might affect the recreational value of such areas. There might also be a social impact in relation to specific uses of particular host plants. Many fruits trees are grown in gardens for fruit consumption. Mulberry is grown for fruit and local silk production in Turkey and Central Asia and has cultural importance (Sanchez, 2000; Ustun, pers. comm. 2011). These impacts may be minor at the scale of the whole PRA area, but they could be major at a local level.

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

**minor**

***Level of uncertainty:* low**

Where such systems are used (e.g. fruit trees), they may be disrupted by the need to use pesticides. It would take some years to integrate new control methods against *Apriona* species into current pest management systems.

**6.13 - How great an increase in other costs resulting from introduction is likely to occur?**

**moderate**

***Level of uncertainty:* medium**

Increased costs would be associated with the need for additional research on host plants, management, biological control, plant protection products, economic thresholds and monitoring programmes.

**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 such effect is documented in the literature.

**6.15a - Describe the overall economic impact**

**major**

***Level of uncertainty:* medium**

All three *Apriona* spp. are likely to have a major economic and environmental impact.

**6.15b - With reference to the area of potential establishment identified in Q3.08, identify the area which at highest risk from economic, environmental and social impacts. Summarize the impact 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. Environmental impact is likely to be major. Impact at the limits of the area of potential establishment (e.g. where one generation may need 3 years to complete) will be lower. Social impact is likely to be minor at the scale of the PRA area.

Climate change might favour the pest because higher temperatures will increase the potential area of establishment and shorten the life cycle. Hotter and drier conditions in parts of the PRA area will increase the number of stressed hosts that are more susceptible to attack.

## Stage 2: Pest Risk Assessment Section B: Degree of uncertainty and Conclusion of the pest risk assessment

**c2 - Degree of uncertainty: list sources of uncertainty**

The main uncertainties are outlined below.

- distribution, especially of *A. japonica* in Japan and *A. germari* in Asia
- the host range for each species, i.e. does the available literature give a good picture of the host range? What are major/minor hosts? Are there more hosts? How likely are these pests to attack other hosts in the PRA area (especially other species in the same genera)?
- quantity of host material imported.
- association with the pathways at origin.
- whether the adults require particular hosts for maturation feeding or can use other hosts when these favoured species are absent (e.g. there is some evidence that adults of *A. germari* might need to feed on mulberry or paper mulberry).
- management measures in the southern part of the PRA area for the different hosts (e.g. mulberry)
- flexibility of the cycle, i.e. can the pest extend its life cycle beyond 2-3 years, which would expand the potential area of establishment.
- the importance of certain climatic factors such as humidity and winter cold (for diapause) for establishment in the PRA area.
- economic impact in the PRA area (quantitative information is lacking for the area of origin).
- whether *Apriona* spp. have been introduced to new areas (new countries or new areas within the broad geographical region where they are recorded as being present).

**c3 - Conclusion of the pest risk assessment**

The probability of introduction was rated as low. If *Apriona* spp. were introduced, they would spread relatively slowly but steadily. The wide range of host plants would help both establishment and spread. Eradication and containment are likely to be feasible only in very limited situations (such as entry under protected conditions, or entry and early detection in a nursery; see 5.01). Once established, the pest would have a major economic impact, both commercially and in gardens, and a major environmental impact if it reached 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. germari, A. cinerea* and *A. japonica* are considered to present a particular risk to the Mediterranean area, South-East Europe (e.g. Balkans), northern Turkey and oceanic areas of South-West Europe (Portugal, France and Spain). However, there is a great deal of uncertainty as to the total area that might be endangered and the complete range of host plants that might be affected.

The EWG concluded that measures should be considered to prevent the introduction of *A. germari, A. cinerea* and *A. japonica.* 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**

## Pathway 1: Host plants for planting (except seeds) of *A. germari*, *A. japonica* or *A. cinerea*

**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**
*Apriona* spp. are not quarantine pests in the PRA area and there are no measures in place that would prevent their introduction along these two pathways.

Fruit trees are well regulated in some countries, which prohibit imports of several fruit hosts from the areas of origin (e.g. *Malus*, *Pyrus*, *Citrus*, *Prunus* for the EU; *Citrus, Eriobotrya* for Morocco). However, other hosts are not subject to specific import requirements (e.g. *Ficus carica*, *Punica granatum*, *Diospyros kaki*).
Some non-fruit trees species are prohibited in certain countries, (e.g. imports of *Crataegus* into Algeria and Morocco), but generally the pathway is open for most hosts. In the EU, imports of certain plants are subject to emergency measures against *A. chinensis* (EU, 2010), which place specific requirements on conditions at the place of production and allow inspections. These measures may lead to *Apriona* spp. being detected (although not at the early stages of infestation).

In most countries, 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 *Apriona* spp. can be difficult. Some specific requirements, applying to known hosts of *Apriona* spp. but not directly targeting *Apriona* spp., are also in place in some countries and might increase the chance of detection. Requirements in EPPO countries are listed in Annex 9.

Overall, existing phytosanitary measures applied on the pathways will not prevent the introduction of the pests in the PRA area.

### 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.

Symptoms of larval activity can be detected more easily than for other wood borers because the larvae produce frass ejection holes at intervals along their tunnels (Singh & Prasad, 1985: every 10-15 mm for *A. cinerea*, closer at early stages than for older larvae). These holes, as well as bleeding sap or frass, may be observed on the branches, stems or just above the ground (Esaki, 2006 & 2007a; Hill, 2008; Shui *et al.*, 2009). In large trees, there may be several larvae in a trunk (for example for *A. cinerea,* more than half a dozen, Singh & Prasad, 1985). The fully developed larvae are large: 6.4 cm on average for *A. germari* (Yoon et al., 1997); 6-7 cm for *A. cinerea* (Singh & Prasad, 1985). However, during the early stages of infestation, the presence of larvae might not be easy to detect, especially before the larvae have produced more than a few excretion / defecation holes or have had an impact on the tree. On *Zelkova*, larvae of *A. japonica* only started expelling frass 17 days after oviposition (Esaki, 2007a).

The adult beetles are easier to find. They are large, dark beetles, 4-6 cm in length, and they feed on the bark during the day and may live for several months (Hill, 2008). The U-shaped oviposition marks are also conspicuous and can be found on the surface of branches and smaller diameter stems (Esaki, 2006). For *A. germari*, they measure ca. 14 mm long to 7 mm width (varying with the diameter of the branch) (Jin *et al.*, 2007). The eggs themselves, although relatively large (2.3 mm x 6.6 mm for *A. germari,* Yoon *et al.*, 1997; 3.0–3.2 mm x 7–8 mm for *A. cinerea,* Singh & Prasad, 1985), are not easy to see because they are hidden under the bark.
Oviposition scars however, are not always easy to locate. For example, *A. japonica* avoids laying eggs on exposed parts of the tree and prefers to oviposit near the base of branches or where weeds cover the stem (Esaki, 2006 & 2007a). 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 destroying the plants. Systems for detecting larvae in 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. No treatments are mentioned to kill eggs.

**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 most host species (whether fruit or non-fruit trees). For poplars, some cultivars have been found to be less susceptible than others to *A. germari* and *A. cinerea,* but none are totally resistant (Zhang *et al.*, 2008; Bathia, 2004). For example, in China, *P. deltoides* clone Danhong was found to be relatively tolerant to attack by *A. germari* (<20% of plants damaged) compared with other clones (Zhang *et al.*, 2008). Cultivars would be difficult to verify at import.

**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 protected conditions with sufficient measures to exclude the pest. However, this is not common practice for nurseries of forest or ornamental trees. This will be realistic only for small scale production of high value material.

**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 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 low uncertainty), a possible measure is: pest-free place of production or pest free area**
**Can this be reliably guaranteed?**

**yes for pest-free area in countries where the pest is not known to occur, and for pest-free site under protection**

***Level of uncertainty:* medium**

The pest has many host plants and would spread naturally. 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 they occur, in particular for *A. germari* in China and *A. japonica* in Japan. It is unknown whether the apparent absence of the pest from certain areas is due to a lack of host plants or a lack records and an effective trapping system.

Measures similar to those required to establish a PFA against *Anoplophora chinensis* may be relevant. This should include specific surveys.
The plants should have been grown throughout their life in a place of production which is registered and supervised by the national plant protection organisation in the country of origin and situated in a pest-free area established by that organisation in accordance with ISPM 4 *Requirements for the establishment of Pest Free Areas*. At least two official inspections for any signs of *Apriona* species should be carried out annually at appropriate times and no signs of the organism should have been found. Immediately prior to export consignments of the plants should be subjected to an official meticulous inspection for the presence of *Apriona* species. This inspection should include targeted destructive sampling.
This will be realistic only for small scale production of high value material.

The maintenance of pest free sites of production in areas where *Apriona* species occur is considered extremely difficult because of natural spread, problems of visual detection, the number of alternative hosts and the absence of monitoring tools. It would be difficult to establish permanent buffer zones around places of production that would last for more than 1-2 years. Only sites under complete physical protection (e.g. equivalent to quanrantine facilities) could remain pest-free. In addition at least two official inspections for any signs of *Apriona* species should be carried out annually at appropriate times and no signs of the organism should have been found. Immediately prior to export consignments of the plants should be subjected to an official meticulous inspection for the presence of *Apriona* species.

## 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 presence and eggs 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 when the last stages of the pest are in diapause and less easy to detect, and transport is usually at cool temperatures, which will keep the larvae quiescent. However, one larva of *A. japonica* was detected in *Enkianthus* plants for planting at import, despite not being a quarantine pest. So specific visual inspection should be able to detect some infested trees.

**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, see Goldson *et al.*, 2003) but they are not fully developed, and they cannot be applied currently to *Apriona* spp.

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

**no**

***Level of uncertainty:* low**

*Management: Plants for planting*

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 has no registration in (many) EPPO countries but may be applied in the country of origin. Despite treatment, eggs may remain on the trees. Other treatments such as fumigation with methyl bromide are not likely to be fully effective, because the larvae are protected inside the plant tissues. Hot water treatment and irradiation were considered, but rejected for *Saperda candida* (EPPO, 2011) because they would negatively affect the viability of the plants. They also very unlikely to be effective against *Apriona* spp.

**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**

Handling and packing methods can prevent reinfestation, but not infestation.

## 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 (ejection holes and frass) (a maximum of 6 months in conditions similar to origin, otherwise longer). This measure is likely to be applicable only for small scale imports.

**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 emerged, 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, but the pest may be detected only once established. Due to the wide host range of the three *Apriona* spp., surveillance and eradication would be difficult, especially when outbreaks are already large at time of detection (see 5.02). Note that by raising public awareness the likelihood to find an outbreak at an early stage can increase significantly.

**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 in countries where the pest is not | medium |

| | | | | |
|---|---|---|---|---|
| | | | known to occur<br>Pest-free site under complete physical protection | |
| 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:*** **low**

Three of the measures identified reduce the risk to an acceptable level:
Pest-free area in countries where the pest are not known to occur,
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**

No combination of treatments of the crop, thorough inspection of the crop, visual inspection of the consignment at export or at import, would reduce the risk to an acceptable level. The possibility to grow host plants under protected conditions 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 fruit trees, importations are already heavily regulated. For other species, measures will interfere to a certain extent with trade, but it is thought that trade from countries where *A. germari*, *A. japonica* and *A. cinerea* occur is limited.
However, there is a large import of *Ficus* plants from China and measures may interfere with this trade.

**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. Production under protected conditions with conditions ensuring exclusion of the pest might not be feasible for the type of material considered (high cost). However, the three *Apriona* spp. could be difficult and costly to eradicate or contain if introduced so it..

Post-entry quarantine is very expensive and is unlikely 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 in countries where the pests are not known to occur,
or
Pest-free site under protection (for high value material)

## Pathway 2: Wood (round or sawn, with or without bark) of host plants of *A. germari*, *A. cinerea* or *A. japonica*

**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. Requirements relating to treatment (including debarking that will speed up drying) might have an effect on *Apriona* spp. Non-squared wood is generally covered by general requirements (e.g. PC), requirements targeting other pests and, in a few cases, specific requirements for some species (but not directly targeting *Apriona* spp.). However, most hosts of *Apriona* spp. in this pathway are not covered by requirements against other pests.
Requirements in countries of the PRA area are given in Annex 9.

### 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.
Detection is difficult on large forest trees, but symptoms of larval presence (e.g. galleries or frass) may be observed at harvest and during transport. No specific trapping method is mentioned for adults.

**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
There is no information on differences in resistance or susceptibility for most host species. For poplars, some cultivars have been found to be less susceptible than others to *A. germari* and *A. cinerea,* but none are totally resistant. For example, in China, *P. deltoides* clone Danhong was found to be relatively tolerant to attack by *A. germari* (<20% of plants damaged) compared with other clones (Zhang *et al.*, 2008). In any case, cultivars would be difficult to verify at import.

**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 low 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 in countries where the pest is not known to occur**

***Level of uncertainty:*** **medium**

The pest has many host plants and would spread naturally. 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 they occur, in particular for *A. germari* in China and *A. japonica* in Japan. It is unknown whether the apparent absence of the pest from certain areas is due to a lack of host plants or a lack records and an effective trapping system. PFA for a specific Apriona species is considered a possible option only from countries where this species does not occur. This should be based on surveys.
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.

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, but generally, inspection will not guarantee detection.

**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:

*Processing*. Conversion of the wood into sawn timber might destroy larvae and pupae, and cause the wood to dry out more quickly, causing mortality. However, some life stages might survive in larger pieces of sawn wood. Processing the wood will also expose the galleries and make it more likely that infestation is detected. Interceptions in wood packaging material show that survival is possible.

*Heat treatment.* According to EPPO Standard PM 10/6(1) *Heat treatment of wood to control insects and wood-borne nematodes* (EPPO, 2008), Cerambycidae are killed in round wood and sawn wood which have been heat-treated until the core temperature reaches 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 *Apriona* larvae (see 1.01), which may question the efficacy of the heat treatment. The Panel on Phytosanitary Measures considered that this infestation was more likely linked to problems of implementation than to efficacy of the heat treatment as such.
Although the larvae and pupae of *Apriona* spp. are reported to die when moisture content of the wood falls. Kiln drying alone was not considered sufficient as a phytosanitary treatment, based on the results from the EUPHRESCO project (PEKID[1]) for other Cerambycidae

*Irradiation*. According to EPPO Standard PM 10/8(1) Disinfestation of wood with ionizing radiation (EPPO, 2008), Cerambycidae infesting wood are killed after an irradiation of 1kGy.

Such treatments might be applied to quality logs but will be too expensive for low-value products such as firewood.

Note: 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, 2008), only wood without bark and whose dimensions does not exceed 200 mm cross section can be fumigated to destroy insect pests.

**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 felling the 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 is no data of the length of survival of larvae an pupae in cut wood. 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?**

**no**

***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. furniture, pulpmills, fuel wood for energy production) could be imported during periods of the year outside of the flight period of *Apriona* species, 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 10°C although there are some uncertainty about the exact threshold for each species, see Dutch PRA, 2010). The requirements need to be adapted to the origin and to the destination. 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. However, this measure would be difficult to implement and control in practice and would require specific agreements. The measure would be very

[1] **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

difficult to apply to firewood, which is often stored for some time before being used. The Panel on Phytosanitary Measures considered that this option should not be recommended as the endangered area has a climate with mild winters during which the temperatures will not stay long below 10°C.

**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**

Surveillance could be put in place at wood processing facilities, but would be complicated because of the wide range of hosts attacked by the three *Apriona* spp. In addition, adults fly and surveillance may not be sufficient to detect outbreaks early enough to ensure eradication (see 5.02).

**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 in countries where the pest is not known to occur | medium |
| 7.22 | | X | visual inspection of the consignment | low |
| 7.24 | X | | specified treatment of the consignment | medium |
| | | | | |

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

**no**

***Level of uncertainty:*** **low**

Two measures reduce the risk to an acceptable level:
Pest-free area
or
Treatment

**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 (but may not be cost-effective for low value wood such as firewood)

.

## Pathway 3: Hardwood wood chips and wood waste

**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**
At least in the EU, there are no phytosanitary measures applied for all host plants.
In the EU, wood chips obtained in whole or part from *Ulmus davidiana*, *Ulmus parvifolia* and *Pterocarya rhoifolia* from China, Japan, Mongolia, Republic of Korea, are regulated as part of the requirements against *Agrilus planipennis* They should come from a pest-free area for *Agrilus planipennis* or be processed into pieces of not more than 2.5 cm thickness and width. The second requirement will cover the risk of introducing *A. japonica* for these host species.

### 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
As for wood.

**7.14 - Can the pest be reliably detected by testing at the place of production?**
**no**
***Level of uncertainty:*** **low**
As for wood.

**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 wood.

**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**
As for wood.

**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**
As for wood.

**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 low 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:*** **medium**

As for plants for planting.

## 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?**

**No**

***Level of uncertainty:*** **low**

Inspection of consignments of wood chips is difficult.
Even if inspection was carried out, it is unlikely to detect the pests, as:
- wood chips or wood waste might contain several tree species
- 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 *A. planipennis* is not present (Økland *et al.,* 2012).

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

**no**

***Level of uncertainty:*** **low**

As for plants for planting pathways.

**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

<u>Chipping down to a certain size</u>

The Panel on Phytosanitary Measures considered that similar requirements to that for *Monochamus* spp., a Cerambycidae of a similar biology and size would be relevant: according to the Commission decision 2012/535/EU[2], wood chips should be chipped into pieces of less than 3 cm thickness and width. This requirement was changed to 'pieces of less than 3 cm in any dimension' to avoid any ambiguity.

Some treatments (heat treatment, fumigation, irradiation) could be effective but their practical implementation should be defined based on further research. 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 (see 7.24 for the wood pathway), this could be equivalent to treatment of wood chips.

[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:266:0042:0052:EN:PDF

**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 felling the trees.

Wood chips and wood waste could be stored in the exporting country under strict control of the NPPO for a sufficient period, i.e. 2 years for wood waste and 1 year for wood chips, since only prepupae, and pupae would be likely to survive the chipping process and should have emerged as adults within this period of time.

The Panel on Phytosanitary Measures considered that given the difficulty to control the application of this measure in practice, it was not 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 chips and wood waste.

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

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

Wood chips or wood waste for processing (e.g. energy production, production of fiberboards or paper) could be imported during periods of the year outside of the flight period of *Apriona* species, 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 10°C although there are some uncertainty about the exact threshold for each species, see Dutch PRA, 2010). The requirements need to be adapted to the origin and to the destination. Chips should be covered during transport from the point of entry to the process plant (by using covered truck, containers and railcars). Additionally, chips should not be stored outside. However, this measure would be difficult to implement and control in practice and would require specific agreements.

The Panel on Phytosanitary Measures considered that this option should not be recommended as the endangered area has a climate with mild winters during which the temperatures will not stay long below 10°C and there are uncertainties on the temperature threshold for development of the 3 species.

**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**

Surveillance could be put in place at wood chips processing facilities, but would be complicated because of the wide range of hosts attacked by the three *Apriona* spp. In addition, adults fly and surveillance may not be sufficient to detect outbreaks early enough to ensure eradication (see 5.02).

**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 in countries where the pest is not known to occur, | medium |
| 7.24 | X | | specified treatment of the consignment | medium |

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

**no**

***Level of uncertainty:* low**

Three measures reduce the risk to an acceptable level:
Pest-free area in countries where the pest is not known to occur,
or
Treatment (chipping to pieces of less than 3 cm in any dimension or heat treatment)

**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 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**

This pest would be difficult to eradicate if introduced, and the measures have lower cost than attempting eradication or bearing the costs of impact by *Apriona* species if they established.

**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 in countries where the pest is not known to occur
or
Treatment (chipping to pieces of less than 3 cm in any dimension or heat treatment)

**7.41 - Consider the relative importance of the pathways identified in the conclusion to the entry section of the pest risk assessment**

The pathways considered are:

- Host plants for planting (except seeds) of *A. germari*, *A. japonica* or *A. cinerea*.
- Wood of host plants of *A. germari*, *A. japonica* or *A. cinerea*.
- Wood chips and wood waste of host plants of *A. germari*, *A. japonica* or *A. cinerea*.

The pathway for wood and wood chips seem to present a lower probability of introducing *Apriona* spp. into the PRA area.

Their relative importance is dealt with in 7.45 in the general conclusion.

7.42 - All the measures or combination of measures identified as being appropriate for each pathway or for the commodity can be considered for inclusion in phytosanitary regulations in order to offer a choice of different measures to trading partners. Data requirements for surveillance and monitoring to be provided by the exporting country should be specified.

7.43 - In addition to the measure(s) selected to be applied by the exporting country, a phytosanitary certificate (PC) may be required for certain commodities. The PC is an attestation by the exporting country that the requirements of the importing country have been fulfilled. In certain circumstances, an additional declaration on the PC may be needed (see EPPO Standard PM 1/1(2) Use of phytosanitary certificates).

7.44 - If there are no measures that reduce the risk for a pathway, or if the only effective measures unduly interfere with international trade (e.g. prohibition), are not cost-effective or have undesirable social or environmental consequences, the conclusion of the pest risk management stage may be that introduction cannot be prevented. In the case of pest with a high natural spread capacity, regional communication and collaboration is important.

## 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 introduced, these three *Apriona* spp. would have a major impact in managed and natural environments. They would also be difficult to eradicate. The measures identified are given in the table below.

The main uncertainty for management is the host list for each *Apriona* species. Therefore the Panel on Phytosanitary measures agreed that measures should be required at the genus level for wood and plants for planting, whereas all hardwood wood chips and waste should be regulated (as several genera may be mixed in one consignment).

| **Pathway** | **Measures** |
|---|---|
| Host plants for planting[1] (excluding seeds) of *A. germari* | PC and, if appropriate, RC[4]<br>and<br><br>• Pest-free area in countries where the pest are not known to occur,<br>or<br>• Pest-free site under protection (small scale production in authorized facilities)<br>or<br>• Post-entry quarantine |
| Host plants for planting[2] (excluding seeds) of *A. japonica* | |
| Host plants for planting[3] (excluding seeds) of countries where *A. cinerea* occurs | |
| Wood of host species[1,2,3] of *A. germari*, *A. japonica* or *A. cinerea.* (round or sawn, with or without bark, firewood) | PC and, if appropriate, RC[4]<br>and<br><br>• Pest-free area in countries where the pest are not known to occur<br>or<br>• Treatment (heat, irradiation) |
| Hardwood wood chips and wood waste, of host species[1,2,3] of *A. germari*, *A. japonica* or *A. cinerea* | PC and, if appropriate, RC[4]<br>and<br><br>• Pest-free area in countries where the pest are not known to occur<br>or<br>• Treatment (chipped to pieces of less than 3 cm in any dimension)<br>or<br>• Heat treatment (56°C for 30 min) |
| Wood packaging material (including dunnage) containing host species[1,2,3] of *A. germari*, *A. japonica* or *A. cinerea* | • -Treated according to ISPM 15 |

1. Known hosts (see Annex 1 for details): *Alnus* spp. *Artocarpus* spp., *Artocarpus* spp, *Bombax* spp, *Broussonetia* spp, *Cajanus* spp, *Camellia* spp, *Castanea* spp., *Celtis* spp, *Cinnamomum* spp., *Citrus* spp., *Cunninghamia* spp., *Dalbergia* spp., *Eriobotrya* spp., *Ficus* spp., *Juglans* spp., *Maclura* spp., *Malus* spp., *Melia* spp., *Morus* spp., *Populus* spp. and hybrids, *Prunus pseudocerasus*, *Pterocarya* spp., *Pyrus* spp., *Robinia* spp., *Salix* spp., *Sapium* spp., *Schima* spp., *Sophora* spp., *Trema* spp., *Ulmus* spp., *Vernicia* spp., *Xylosma* spp.

2. Known hosts (see Annex 1): *Caesalpinia* spp., *Celtis* spp., *Cercis* spp., *Chaenomeles* spp., *Cinnamomum* spp., *Citrus* spp., *Cornus* spp., *Crataegus* spp., *Debregeasia* spp., *Diospyros* spp., *Eriobotrya* spp., *Enkianthus* spp., *Fagus* spp., *Ficus* spp., *Firmiana* spp., *Gleditsia* spp., *Hovenia* spp., *Lagerstroemia* spp., *Malus* spp., *Morus* spp., *Platanus* spp., *Platycarya strobilaceae*, *Populus* sp., *Pterocarya rhoifolia*, *Pterocarya stenoptera*, *Punica granatum*, *Pyrus* spp., *Robinia* spp., *Salix* spp., *Spiraea* spp., *Thea* spp., *Ulmus* spp., *Villebrunea* spp., *Zelkova* spp.

3. Known hosts (see Annex 1): *Debregeasia* spp., *Ficus* spp., *Maclura* spp., *Malus* spp., *Morus* spp., *Populus* spp. and hybrids, *Prunus* spp., *Pyrus* spp., *Salix* sp.

4PC= Phytosanitary certificate, RC=Phytosanitary certificate of re-export.

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**Annex 1. List of host plants of *A. germarii*, *A. japonica* and *A. cinerea* and their presence in the PRA area**

This annex lists the host plants cited in Appendix 2 of the Dutch PRA (2010) and others found during the literature search (reference between brackets). It summarizes their use in the PRA area (details in 1.14) and the pathway under which they are covered (pathways in brackets are for species which are unlikely to be used in the PRA area, but which would be covered under that pathway).

Doubtful records are indicated for each *Apriona* species by "[X]". They relate to:

- Cases judged doubtful by the EWG (*Albizia saman*, *Pinus*, Quercus, *Eucalyptus tereticornis* and *Paulownia* see 1.06). In particular it was not possible to trace back the original publications in which *Quercus* and *Pinus* are described as host of *A. germarii*)
- For *A. germarii*, some records given by Duffy (1968) are repeated in Huang *et al.* (2009). Duffy did not distinguish between *A. germarii* and *A. japonica*, and some records appear to relate to *A. japonica* (i.e. all those indicated in Kojima, 1929)

| Host plant | Family | *A. germarii* | *A. japonica* | *A. cinerea* | Main use and availability in PRA area[3] |
|---|---|---|---|---|---|
| *Albizia saman* (=*Samanea saman*) (Suresh *et al.*, 1994) | Fabaceae | | | [X] | Ornamental[4],([5]) |
| *Alnus formosana* (Cheng & Chang, 1974) | Betulaceae | X | | | Ornamental |
| *Artocarpus chaplasha* (Beeson,1941) | Moraceae | X | | | No data, unlikely[6] |
| *Artocarpus heterophyllus* (jackfruit) (Hill, 2008) | Moraceae | X | | | Ornamental[7] |
| *Artocarpus integra* (Beeson,1941 as *A. integrifolia*) | Moraceae | X | | | No data, unlikely[2] |
| *Bombax malabaricum* (Huang *et al.* 2009) | Bombacaceae | X | | | Ornamental[5,8,(9)] |
| *Broussonetia papyrifera* (paper mulberry) (Beeson,1941, Gao *et al.*, 1994a) | Moraceae | X | | | Ornemental[10,11,(3)] |
| ?*Broussonetia kazanoki* (Zhang XianKai *et al.*, 1992)[12] | Moraceae | X | | | No data, unlikely. |
| *Caesalpinia japonica* (Kojima & Nakamura, 1986) | Fabaceae | | X | | Ornamental |
| *Cajanus cajan* (Gressitt, 1942; Huang *et al.* 2009) | Fabaceae | X | | | No data, unlikely[13] |
| *Camellia oleifera* (Huang *et al.* 2009) | Theaceae | X | | | Ornamental[14, (3)] |
| *Castanea* spp. (chestnut) (Cheng & Chang, 1974) | Fagaceae | X | | | Fruit, forest, ornamental |
| *Celtis sinensis* (Ag. Gressitt, 1942; Aj: Esaki & Higuchi, 2006) | Ulmaceae | X | X | | Ornamental, bonsai |
| *Cercis chinensis* (Sugimoto, 2007)[1] | Fabaceae | | X | | Ornamental |
| *Chaenomeles sinensis* (Sugimoto, 2007)[1] | Rosaceae | | X | | Ornamental |
| *Cinnamomum camphora* (Ag.Huang *et al.* 2009; Aj, Enda, 1965, Kojima & Nakamura, 1986;) | Lauraceae | X | X | | Ornamental [(3)] |
| *Citrus* spp. (Aj Kojima & Nakamura, 1986; Ag: Hua *et al.* 2002) | Rutaceae | X | X | | Fruit, ornamental |
| *Citrus aurantium* (sour orange) (Huang *et al.* 2009) | Rutaceae | [X] | | | Fruit, ornamental |
| *Citrus aurantium var. nobilis (Ag.* Duffy, 1968 citing Saito, 1932) | Rutaceae | [X] | | | |
| *Citrus nobilis* (Kojima & Nakamura, 1986) | Rutaceae | | X | | Fruit |
| *Cornus kousa* (Sugimoto, 2007)[1] | Cornaceae | | X | | Ornamental |
| *Crataegus cordata* (*Crataegus* | Rosaceae | | X | | Ornamental |

[3] The availability of some trees in the PRA area was checked, and information given in footnotes or at the end of the table. Notes between brackets indicate a reference to the availability of species related to the host in the PRA area.
[4] http://www.grainesdumonde.be
[5] http://www.jardinsdugue.eu/encyclopedie-des-plantes
[6] tropical, probably limited to collections or botanical gardens
[7] http://www.binette-et-jardin.com
[8] http://pack.aspeco.net/bdd/1/files/catalogue%20nov2010.pdf
[9] http://pepiniereissa.fr
[10] http://nature.jardin.free.fr/arbre/
[11] http://www.barcham.co.uk/trees-for-sale/
[12] used as bait to control *A. germari*. Full article in Chinese & it was not possible to check if this species was effective or if it was used as control.
[13] Shrub/small tree. Where it occurs, grain crop mainly for seeds for human consumption. http://www.tropicalforages.info/key/Forages/Media/Html/Cajanus_cajan.htm
[14] http://www.piantemati.it/docs/MATI_2011.pdf

| Host plant | Family | *A. germarii* | *A. japonica* | *A. cinerea* | Main use and availability in PRA area[3] |
|---|---|---|---|---|---|
| *phaenopyrum)* (Aj- Kojima, 1929) | | | | | |
| *Cunninghamia lanceolata* (Huang *et al.* 2009) | Pinaceae | X | | | Ornamental [(3)] |
| *Dalbergia sp.* (Huang *et al.* 2009) | Fabaceae | X | | | No data, unlikely[15] |
| *Debregeasia edulis* (Kojima & Nakamura, 1986) | Urticaceae | | X | | No data, unlikely[5] |
| *Debregeasia hypoleuca Ac. Singh & Prasad, 1985* | Urticaceae | | | X | No data, unlikely[5] |
| *Diospyros kaki* (Kojima & Nakamura, 1986) | Ebenaceae | | X | | Fruit, ornamental |
| *Eriobotrya japonica* (loquat) *(*Ag. Gressitt, 1942; Huang *et al.* 2009) (Aj: Esaki, 2007b) | Rosaceae | X | X | | Fruit |
| *Enkianthus perulatus* (Ohashi, 2005) | Ericaceae | | X | | Ornamental |
| *Eucalyptus tereticornis* (Kulkarni, 2010) | Myrtaceae | [X] | | | Forest, ornamental |
| *Fagus crenata* (Yamanobe & Hosoda, 2002) | Fagaceae | | X | | Ornemental |
| *Ficus* spp. (Singh & Prasad, 1985) | | | | X | Fruit, ornamental |
| *Ficus carica* (fig) (Ag: Qin *et al.*, 1997; Aj- Kojima, 1929; Esaki, 2007b; Ac. Singh & Prasad, 1985) | Moraceae | X | X | X | Fruit, ornamental |
| *Ficus hispida* (Beeson,1941) | Moraceae | X | | | No data, unlikely |
| *Ficus infectoria (*Beeson,1941) | Moraceae | X | | | No data, unlikely |
| *Ficus retusa* (Gressitt, 1942; Huang *et al.* 2009) | Moraceae | X | | | Ornamental?, bonsai |
| *Firmiana simplex* (Kojima & Nakamura, 1986) | Malvaceae | | X | | Ornamental |
| *Gleditsia japonica* (Kojima & Nakamura, 1986) | Fabaceae | | X | | Ornamental |
| *Hovenia dulcis* (Sugimoto, 2007) [1] | Rhamnaceae | | X | | Ornamental |
| *Juglans regia* (walnut) (Huang *et al.* 2009) | Juglandaceae | X | | | Fruit, ornamental, forest |
| *Lagerstroemia indica* (*Aj*: Sugimoto, 2007, Kojima & Nakamura, 1986) [1] | Lythraceae | | X | | Ornamental [3, (3)] |
| *Maclura pomifera* (Singh & Prasad, 1985) | Moraceae | | | X | Ornamental, plantations[3] |
| *Maclura tricuspidata* (Wen *et al.*, 2010) | Moraceae | X | | | Ornamental [(3)] |
| *Malus sp.* (Ma *et al.*, 1997) | Rosaceae | X | | | Fruit, ornamental |
| *M. asiatica* (Huang *et al.* 2009) | Rosaceae | X | | | Ornamental |
| *M. domestica* (Ac. Singh & Prasad, 1985) | Rosaceae | X | | X | Fruit |
| *M. prunifolia (Hua et al., 2009)* | Rosaceae | X | | | |
| *M. pumila* (Ag: Huang *et al.* 2009; *Aj* Kojima & Nakamura, 1986) | Rosaceae | X | X | | Fruit?, ornamental |
| *Melia azedarach* (Huang *et al.* 2009) | Meliaceae | X | | | Ornamental [(3)] |
| *Morus* sp. (mulberry) (Ag: Gao *et al.*, 1994a; Aj: Kikuchi, 1976; Ac: Singh *et al.*, 2004) | Moraceae | X | X | X | Ornamental, fruit, feed |
| *M. acidosa* (Duffy, 1968 citing Beeson & Bathia,1939) | Moraceae | X | | | |
| *M. alba* (Aj- Kojima, 1929; Ag: Li *et al.*, 2007, Beeson,1941) | Moraceae | X | X | | |
| *M. indica* (Singh & Prasad, 1985) | Moraceae | | | X | No data |
| *M. laevigata* (Beeson,1941) | Moraceae | X | | | No data |
| *Paulownia* sp. (Huang *et al.* 2009) | Scrophulariaceae | [X] | | | Ornamental, plantations |
| *Pinus massoniana* (Hua *et al.* 2002) | Pinaceae | [X] | | | No data |
| *Pinus yunnanensis* (Hua *et al.* 2002) | Pinaceae | [X] | | | Ornamental |
| *Platanus x hispanica* (syn. x *acerifolia*; Kojima & Nakamura, 1986) | Platanaceae | | X | | Ornamental |
| *Platycarya strobilaceae* (Kojima & Nakamura, 1986) | Juglandaceae | | X | | Ornamental |
| *Populus* sp. (poplar) (Ag: Huang *et al.*, 1993; Aj: Enda, 1965; Ac. Singh & Prasad, 1985) | Salicaceae | X | X | X | Forest, ornamental |
| *P. alba* (Enda, 1965)[1] | Salicaceae | | X | X | |
| *P. casalae* (Singh & Prasad, 1985) | Salicaceae | | | X | |
| *P. ciliata* (Singh & Prasad, 1985) | Salicaceae | | | X | |
| *P. deltoides* (Singh & Prasad, 1985) | Salicaceae | | | X | |
| *P. nigra* (Singh & Prasad, 1985) | Salicaceae | | | X | |

[15] Tropical trees. No reference found to use as ornamentals

Annex 1: Host plants

| Host plant | Family | *A. germarii* | *A. japonica* | *A. cinerea* | Main use and availability in PRA area[3] |
|---|---|---|---|---|---|
| *P. x euramericana* (Ac. Tillesse *et al.*, 1997) | Salicaceae | X | X | X | |
| *P. tomentosa* (Huang *et al.*, 1994) | Salicaceae | X | | | |
| *P. eugenii x euramericana*, *P. robusta*, *P. regenerata*, *P. generosa*, *P. nigratricarpa*, *P. yunnanensis* (Singh *et al.*, 2004) | Salicaceae | | | X | |
| *P. sieboldi, P. deltoides angulata, P. gelrica, P. japano-gigas, P. jacomettis, P. maximowiczii P. nigra x P. maximowiczii, P. alba x P. sieboldi,* (Enda, 1965)[1] | Salicaceae | | X | | |
| *Prunus persica* (peach) (Singh & Prasad, 1985) | Rosaceae | | | X | Fruit |
| *Prunus pseudocerasus* (Huang *et al.* 2009) | Rosaceae | X | | | Ornamental |
| *Prunus* spp. (Singh *et al.*, 2004) | Rosaceae | | | X | Ornamental, fruits |
| *Pterocarya rhoifolia* (Kojima & Nakamura, 1986) | Juglandaceae | | X | | Ornamental |
| *Pterocarya stenoptera* (Aj: Kojima, 1929) | Juglandaceae | | X | | Ornamental [3, (12)] |
| *Punica granatum* (Sugimoto, 2007) [1] | Lythraceae | | X | | Fruit, ornamental |
| *Pyrus* spp. (Ag Hua *et al.*, 2002; Ac Singh *et al.*, 2004) | Rosaceae | X | | X | Fruit, ornamental |
| *Pyrus baccata* (= *Malus baccata)* (Huang *et al.* 2009) | Rosaceae | X | | | Ornamental |
| *Pyrus communis* (Ac. Singh & Prasad, 1985) | Rosaceae | | | X | Fruit |
| *Pyrus pyrifolia* (Kojima & Nakamura, 1986) | Rosaceae | | X | | Fruit |
| *Quercus* sp. (Hua *et al.* 2002) | Fagaceae | [X] | | | Ornamental, forests, wild |
| *Robinia pseudoacacia* (Ag: Huang *et al.* 2009) (Aj: Esaki & Higuchi, 2006) | Fagaceae | X | X | | Ornamental, forest, plantations |
| *Salix* sp. (Ag: Shui *et al.*, 2009; Aj, Kojima & Nakamura, 1986; Ac. Singh & Prasad, 1985) | Salicaceae | X | X | X | Forest, ornamental |
| *Salix babylonica* (Gressitt, 1942; Huang et al. 2009) | Salicaceae | X | | | Ornamental |
| *Salix purprea subsp. amplexicaulis* (Aj-Kojima, 1929) | Salicaceae | | X | | |
| *Salix sieboldiana* (Aj- Kojima, 1929) | Salicaceae | | X | | No data |
| *Salix serissaefolia* (Enda, 1965)[1] | Salicaceae | | X | | |
| *Salix tetrasperma* (Beeson,1941) | Salicaceae | X | | | No data |
| *Sapium sebiferum* (Huang *et al.* 2009) | Euphorbiaceae | X | | | Ornamental[16] |
| *Schima superba* (Hua *et al.* 2002) | Theaceae | X | | | No data, unlikely[5] |
| *Sophora japonica* (Wang, 2009) | Fabaceae | X | | | Ornamental[3, 12, (17)] |
| *Spiraea thunbergi* (Sugimoto, 2007)[18] | Rosaceae | | X | | Ornamental |
| *Thea sinensis* (*Camellia sinensis*, Kojima & Nakamura, 1986) | Theaceae | | X | | Leaves |
| *Trema amboinensis* (Beeson,1941) | Ulmaceae | X | | | No data, unlikely[5] |
| *Trema orientalis* (Cheng & Chang, 1974) | Ulmaceae | X | | | No data, unlikely[5] |
| *Ulmus* sp. (Huang *et al.* 2009) | Ulmaceae | X | | | Ornamental, forest |
| *Ulmus parvifolia, U. davidiana* (Kojima & Nakamura, 1986; Sugimoto, 2007[1]) | Ulmaceae | | X | | Ornamental |
| *Vernicia fordii* ( as *Aleurites fordii* Gressitt, 1942; Huang *et al.* 2009) | Euphorbiaceae | X | | | Ornamental[19] |
| *Villebrunea pedunculata* (Kojima & Nakamura, 1986) | Urticaceae | | X | | Ornamental |
| *Xylosma* spp. (Hua *et al., 2009)* | Salicaceae | X | | | |
| *Zelkova serrata* (Esaki, 1995) | Ulmaceae | | X | | Ornamental, bonsai |

16 http://jardin-nature.over-blog.fr/article-sapium-sebiferum-suif-chinois-arbre-popcorn-79391245.html

17 http://www.florama.fr/florama

18 From table 1 in Sugimoto, 2007 (in Japanese - Table 1 gives the results of a survey in green garden of the Yamaguch prefecture. Column 3 gives the number of trees surveyed for each species; column 4 the number of infested trees).

19 At origin, used for seed to produce oil, as biofuel. Seems uncommon in PRA area (e.g. http://www.les-botaniques-du-val-douve.com/3665-1-val-douve-c-vernicia-fordii-vegetaux-exterieur.html )

## Annex 2. Areas (ha) grown in some countries of the PRA area for poplar, willow and various fruit crops



**Table 1.** Poplar (area in 1000 ha – for those countries reporting under the International Poplar Commission; FAO, 2008)

| Country | Category | 2004 | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Area | Productive | Protective | Other | Area | Productive | Protective | Other |
| Belgium | Planted | 35,0 | 33,3 | 1,8 | 0,0 | 32,5 | 30,9 | 1,6 | 0,0 |
| Belgium | Indigenous | 2,5 | 0,0 | 0,0 | 2,5 | 2,5 | 0,0 | 0,0 | 2,5 |
| Bulgaria | Planted | 18,6 | 13,1 | 5,5 | 0,1 | 18,9 | 13,1 | 5,6 | 0,2 |
| Bulgaria | Indigenous | 1,3 | 0,3 | 1,0 | 0,0 | 1,0 | 0,3 | 0,7 | 0,0 |
| Bulgaria | Agroforestry and trees outside forests | 0,3 | 0,2 | 0,2 | 0,0 | 0,2 | 0,2 | 0,0 | 0,0 |
| Croatia | Planted | 13,0 | 12,1 | 0,9 | 0,0 | 12,0 | 11,2 | 0,8 | 0,0 |
| Croatia | Indigenous | 7,0 | 6,7 | 0,4 | 0,0 | 9,0 | 8,6 | 0,5 | 0,0 |
| France | Planted | 236,0 | 236,0 | 0,0 | 0,0 | 236,0 | 236,0 | 0,0 | 0,0 |
| France | Indigenous | 39,8 | 12,0 | 27,9 | 0,0 | 39,8 | 12,0 | 27,9 | 0,0 |
| Germany | Planted | 10,0 | 10,0 | 0,0 | 0,0 | 100,0 | 100,0 | 0,0 | 0,0 |
| Germany | Indigenous | 1,0 | 0,0 | 1,0 | 0,0 | 1,0 | 0,0 | 1,0 | 0,0 |
| Germany | Agroforestry and trees outside forests | 0,5 | 0,3 | 0,3 | 0,0 | 0,5 | 0,3 | 0,3 | 0,0 |
| Italy | Planted | 118,7 | 95,0 | 23,7 | 0,0 | 118,5 | 94,8 | 23,7 | 0,0 |
| Morocco | Planted | 4,2 | 3,6 | 0,4 | 0,2 | 4,3 | 3,8 | 0,3 | 0,2 |
| Morocco | Indigenous | 2,5 | 0,5 | 2,0 | 0,0 | 2,5 | 0,5 | 2,0 | 0,0 |
| Morocco | Agroforestry and trees outside forests | 0,7 | 0,1 | 0,6 | 0,0 | 0,7 | 0,1 | 0,6 | 0,0 |
| Romania | Planted | 59,7 | 15,3 | 44,3 | 0,1 | 55,3 | 14,1 | 41,1 | 0,1 |
| Romania | Indigenous | 27,4 | 9,7 | 17,6 | 0,1 | 24,3 | 8,1 | 16,1 | 0,0 |
| Romania | Agroforestry and trees outside forests | 0,8 | 0,2 | 0,3 | 0,3 | 0,7 | 0,1 | 0,3 | 0,3 |
| Russian Federation | Planted | 26,0 | 25,0 | 1,0 | 0,0 | 26,0 | 25,0 | 1,0 | 0,0 |
| Russian Federation | Indigenous | 21900 | 15330 | 6570 | 0,0 | 21536,1 | 15075,3 | 6460,8 | 0,0 |
| Russian Federation | Agroforestry and trees outside forests | 5,0 | 0,0 | 5,0 | 0,0 | 5,0 | 0,0 | 5,0 | 0,0 |
| Serbia | Planted | 33,1 | 31,5 | 1,7 | 0,0 | 33,1 | 31,5 | 1,7 | 0,0 |
| Serbia | Indigenous | 1,2 | 0,0 | 1,2 | 0,0 | 1,2 | 0,0 | 1,2 | 0,0 |
| Serbia | Agroforestry and trees outside forests | 3,2 | | 3,2 | | 3,2 | 0,0 | 3,2 | 0,0 |
| Spain | Planted | 94,0 | 84,6 | 4,7 | 4,7 | 98,5 | 88,7 | 4,9 | 4,9 |
| Spain | Indigenous | 22,0 | 3,3 | 17,6 | 1,1 | 25,0 | 3,8 | 20,0 | 1,3 |
| Spain | Agroforestry and trees outside forests | 6,0 | 0,9 | 4,8 | 0,3 | 6,5 | 1,0 | 5,2 | 0,3 |
| Sweden | Planted | 0,2 | 0,2 | 0,0 | 0,0 | 0,3 | 0,2 | 0,0 | 0,0 |
| Turkey | Planted | 125,0 | 125,0 | 0,0 | 0,0 | 125,0 | 125,0 | 0,0 | 0,0 |
| UK | Planted | 1,3 | 1,3 | 0,0 | 0,0 | 1,3 | 1,3 | 0,0 | 0,0 |

**Table 2.** Willow (area in 1000 ha – for those countries reporting under the International Poplar Commission; FAO, 2008)

| | | 2004 | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Country | Category | Area | Productive | Protective | Other | Area | Productive | Protective | Other |
| Bulgaria | Planted | 0,1 | 0,0 | 0,0 | 0,0 | 0,1 | 0,1 | 0,0 | 0,0 |
| Bulgaria | Indigenous | 1,5 | 0,1 | 1,4 | 0,0 | 2,6 | 0,1 | 2,5 | 0,0 |
| Croatia | Planted | 4,0 | 3,6 | 0,4 | 0,0 | 3,0 | 2,7 | 0,3 | 0,0 |
| Croatia | Indigenous | 7,0 | 5,0 | 2,0 | 0,0 | 10,0 | 7,1 | 2,9 | 0,0 |
| France | Indigenous | 66,6 | 20,0 | 46,6 | 0 | 66,6 | 20,0 | 46,6 | 0,0 |
| Garmany | Agroforestry & trees outside forests | 0,5 | 0,3 | 0,3 | 0,0 | 0,5 | 0,3 | 0,3 | 0,0 |
| Germany | Planted | 1,0 | 1,0 | 0,0 | 0,0 | 1,0 | 1,0 | 0,0 | 0,0 |
| Germany | Indigenous | 1,0 | 0,0 | 1,0 | 0,0 | 1,0 | 0,0 | 1,0 | 0,0 |
| Romania | Planted | 21,1 | 4,5 | 16,6 | 0,0 | 20,4 | 4,4 | 16,0 | 0,0 |
| Romania | Indigenous | 16,8 | 1,9 | 14,9 | 0,0 | 15,2 | 1,4 | 13,8 | 0,0 |
| Russian Federation | Indigenous | 285,0 | 199,5 | 85,5 | 0,0 | 242,1 | 169,5 | 72,6 | 0,0 |
| Serbia | Planted | 6,9 | 5,3 | 1,7 | 0,0 | 6,9 | 5,3 | 1,7 | 0,0 |
| Serbia | Indigenous | 7,5 | 0,0 | 7,5 | 0,0 | 7,5 | 0,0 | 7,5 | 0,0 |
| Serbia | Agroforestry & trees outside forests | 0,7 | 0,0 | 0,7 | 0,0 | 0,7 | 0,0 | 0,7 | 0,0 |
| Spain | Planted | 2,0 | 0,4 | 1,6 | 0,0 | 2,5 | 0,5 | 2,0 | 0,0 |
| Spain | Indigenous | 6,0 | 0,1 | 5,7 | 0,2 | 25,0 | 3,8 | 20,0 | 1,3 |
| Sweden | Planted | 15,0 | 14,9 | 0,0 | 0,2 | 15,0 | 14,9 | 0,0 | 0,2 |
| UK | Planted | 2,0 | 2,0 | 0,0 | 0,0 | 2,0 | 2,0 | 0,0 | 0,0 |

**Table 3.** Mixed Poplar and Willow (area in 1000 ha – for those countries reporting under the International Poplar Commission; FAO, 2008)

| | | 2004 | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Country** | **Category** | **Area** | **Productive** | **Protective** | **Other** | **Area** | **Productive** | **Protective** | **Other** |
| Bulgaria | Planted | 0,5 | 0,4 | 0,0 | 0,0 | 0,4 | 0,3 | 0,0 | 0,0 |
| Bulgaria | Indigenous | 1,6 | 0,7 | 0,9 | 0,0 | 1,8 | 0,7 | 1,2 | 0,0 |
| Croatia | Planted | 2,0 | 1,7 | 0,3 | 0,0 | 2,0 | 1,7 | 0,3 | 0,0 |
| Croatia | Indigenous | 0,0 | 0,0 | 0,0 | 0,0 | 14,0 | 9,8 | 4,2 | 0,0 |
| Germany | Indigenous | 0,5 | 0,0 | 0,5 | 0,0 | 0,5 | 0,0 | 0,5 | 0,0 |
| Romania | Planted | 2,4 | 1,5 | 0,9 | 0,0 | 1,8 | 0,4 | 1,4 | 0,0 |
| Romania | Indigenous | 9,1 | 2,1 | 7,0 | 0,0 | 8,1 | 1,6 | 6,5 | 0,0 |
| Spain | Indigenous | 10,0 | 0,5 | 9,0 | 0,5 | 12,0 | 0,6 | 10,8 | 0,6 |
| Spain | Agroforestry & trees outside forests | 2,0 | 0,1 | 1,8 | 0,1 | 2,0 | 0,1 | 1,8 | 0,1 |

**Table 4.** Apple (area harvested in ha. FAO Stat - http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Albania | 7000 | 8800 | 9400 |
| Algeria | 31904 | 33206 | 36616 |
| Austria | 6061 | 6029 | 6051 |
| Azerbaijan | 22498 | 22846 | 23258 |
| Belarus | 63600 | 63836 | 62900 |
| Belgium | 7215 | 7229 | 7067 |
| Bosnia and Herzegovina | 16000 | 15000 | 20000 |
| Bulgaria | 5443 | 5400 | 5190 |
| Croatia | 8000 | 8700 | 9500 |
| Cyprus | 1062 | 943 | 1215 |
| Czech Republic | 8614 | 8754 | 10000 |
| Denmark | 1486 | 1500 | 1450 |
| Estonia | 4331 | 4039 | 4222 |
| Finland | 649 | 668 | 653 |
| France | 53775 | 52200 | 51568 |
| Germany | 31721 | 31800 | 31813 |
| Greece | 13207 | 12000 | 12149 |
| Hungary | 40501 | 43100 | 36644 |
| Ireland | 2100 | 1930 | 1865 |
| Israel | 3200 | 3050 | 2980 |
| Italy | 56020 | 59000 | 58000 |
| Jordan | 2291 | 2291 | 2307 |
| Kazakhstan | 24400 | 25800 | 26000 |
| Kyrgyzstan | 24500 | 20800 | 26100 |

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Latvia | 7369 | 5138 | 4138 |
| Lithuania | 13312 | 11655 | 11553 |
| Luxembourg | 1020 | 990 | 990 |
| Malta | 15 | 15 | 15 |
| Morocco | 25936 | 26752 | 27000 |
| Netherlands | 9400 | 9300 | 9100 |
| Norway | 1652 | 1718 | 1726 |
| Poland | 175595 | 171963 | 173607 |
| Portugal | 20488 | 20600 | 20625 |
| Republic of Moldova | 62693 | 61069 | 65000 |
| Romania | 59017 | 54704 | 52637 |
| Russian Federation | 355000 | 243000 | 350000 |
| Slovakia | 3244 | 3426 | 7760 |
| Slovenia | 2874 | 2874 | 2722 |
| Spain | 36902 | 33362 | 30000 |
| Sweden | 1400 | 1400 | 1500 |
| Switzerland | 4235 | 4195 | 4226 |
| FYR Macedonia | 14000 | 15000 | 13813 |
| Tunisia | 25000 | 23600 | 22700 |
| Turkey | 127700 | 129700 | 133200 |
| Ukraine | 116000 | 113500 | 110000 |
| United Kingdom | 14960 | 15516 | 16000 |
| Uzbekistan | 70000 | 63000 | 80000 |

**Table 5.** Fig (area harvested in ha. FAO Stat- http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Albania | 9600 | 11000 | 12000 |
| Algeria | 48790 | 47273 | 46935 |
| Azerbaijan | 1720 | 1535 | 1519 |
| Bosnia and Herzegovina | 250 | 280 | 285 |
| Croatia | 1000 | 1100 | 1000 |
| Cyprus | 365 | 255 | 220 |
| France | 460 | 441 | 422 |
| Greece | 6319 | 4800 | 4500 |
| Israel | 300 | 360 | 730 |
| Italy | 3863 | 2700 | 3000 |
| Jordan | 195 | 195 | 195 |
| Malta | 70 | 69 | 70 |
| Morocco | 44441 | 42381 | 42000 |

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Portugal | 86382 | 86600 | 86614 |
| Slovenia | 3 | 3 | 4 |
| Spain | 12344 | 12509 | 11500 |
| FYR Macedonia | 20 | 20 | 30 |
| Tunisia | 15000 | 15000 | 15542 |
| Turkey | 61594 | 57944 | 58356 |
| Uzbekistan | 114 | 100 | 150 |

In addition, the first fig orchard in Hungary was planted in 2010 (http://bbj.hu/business/hungarians-plant-first-fig-orchard-in-central-europe_54888 )

**Table 6.** Pears (area harvested in ha. FAO Stat- http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Albania | 488 | 550 | 700 |
| Algeria | 22128 | 22718 | 23417 |
| Austria | 414 | 398 | 398 |
| Azerbaijan | 4075 | 4198 | 4231 |
| Belarus | 5363 | 5359 | 5467 |
| Belgium | 7336 | 7594 | 7944 |
| Bosnia and Herzegovina | 6500 | 6472 | 6800 |
| Bulgaria | 569 | 600 | 300 |
| Croatia | 1396 | 1484 | 2134 |
| Cyprus | 166 | 126 | 120 |
| Czech Republic | 408 | 464 | 600 |
| Denmark | 400 | 323 | 296 |
| France | 8118 | 7288 | 7123 |
| Germany | 2097 | 2090 | 2093 |
| Greece | 4377 | 4000 | 4018 |
| Hungary | 2394 | 2577 | 2644 |
| Israel | 1900 | 1750 | 1700 |
| Italy | 37945 | 40700 | 40300 |
| Jordan | 329 | 329 | 334 |
| Kazakhstan | 1700 | 1700 | 2000 |
| Kyrgyzstan | 1800 | 1800 | 1800 |
| Latvia | 606 | 304 | 226 |

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Lithuania | 1233 | 926 | 890 |
| Luxembourg | 128 | 124 | 124 |
| Malta | 5 | 5 | 5 |
| Morocco | 3883 | 3633 | 3744 |
| Netherlands | 7300 | 7500 | 7800 |
| Norway | 127 | 128 | 129 |
| Poland | 13036 | 13028 | 13152 |
| Portugal | 12827 | 12800 | 12820 |
| Republic of Moldova | 1247 | 1248 | 1800 |
| Romania | 4619 | 4590 | 4538 |
| Russian Federation | 14600 | 10000 | 15000 |
| Slovakia | 134 | 141 | 590 |
| Slovenia | 221 | 221 | 214 |
| Spain | 31891 | 29216 | 24000 |
| Sweden | 168 | 179 | 184 |
| Switzerland | 870 | 845 | 838 |
| FYR Macedonia | 1800 | 1831 | 1686 |
| Tunisia | 11000 | 15000 | 12000 |
| Turkey | 33400 | 32920 | 33060 |
| Ukraine | 14100 | 13700 | 13600 |
| United Kingdom | 1536 | 1472 | 1500 |
| Uzbekistan | 10500 | 9500 | 12000 |

**Table 7.** Chestnut (area harvested in ha. FAO Stat- http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Albania | 150 | 149 | 151 |
| Azerbaijan | 405 | 406 | 472 |
| Bulgaria | 21 | 24 | 25 |
| France | 6965 | 7003 | 7151 |
| Greece | 8921 | 10600 | 10618 |
| Hungary | 684 | 777 | 801 |
| Italy | 24224 | 25000 | 24972 |

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Portugal | 30300 | 30398 | 30456 |
| Romania | 2 | 2 | 3 |
| Slovenia | 5 | 5 | 6 |
| Spain | 9523 | 9800 | 8000 |
| FYR of Macedonia | 240 | 238 | 242 |
| Turkey | 38960 | 38980 | 39040 |
| Ukraine | 92 | 93 | 80 |

**Table 8.** Walnut, with shell (area harvested in ha. FAO Stat- http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Austria | 6700 | 6500 | 6709 |
| Azerbaijan | 2584 | 2629 | 2675 |
| Belarus | 5100 | 5145 | 5125 |
| Belgium | 230 | 233 | 240 |
| Bosnia and Herzegovina | 4252 | 4568 | 4652 |
| Bulgaria | 8935 | 7000 | 2000 |
| Croatia | 6327 | 6945 | 7100 |
| Cyprus | 333 | 280 | 242 |
| Czech Republic | 1409 | 1400 | 1395 |
| France | 16928 | 17126 | 17679 |
| Germany | 5201 | 5262 | 5431 |
| Greece | 9232 | 13700 | 13951 |
| Hungary | 2837 | 3303 | 3531 |
| Italy | 4500 | 4450 | 4445 |
| Kazakhstan | 403 | 382 | 400 |
| Kyrgyzstan | 1200 | 1210 | 1231 |

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Luxembourg | 76 | 76 | 76 |
| Morocco | 4975 | 4999 | 5078 |
| Poland | 19488 | 19583 | 20106 |
| Portugal | 3200 | 3158 | 3159 |
| Republic of Moldova | 3421 | 3581 | 3200 |
| Romania | 2119 | 1726 | 1523 |
| Russian Federation | 7500 | 7566 | 7536 |
| Slovakia | 2780 | 2804 | 2793 |
| Slovenia | 92 | 92 | 105 |
| Spain | 7147 | 7418 | 6000 |
| Switzerland | 1500 | 1517 | 1566 |
| FYR Macedonia | 5315 | 5710 | 5815 |
| Turkey | 82117 | 84917 | 86533 |
| Ukraine | 14060 | 14100 | 13400 |
| Uzbekistan | 3100 | 3125 | 3180 |

**Table 9.** Peach and nectarines (area harvested in ha. FAO Stat- http://faostat.fao.org, August 2011)

| country | 2007 | 2008 | 2009 |
|---|---|---|---|
| Albania | 976 | 1100 | 1300 |
| Algeria | 16684 | 17039 | 17750 |
| Austria | 197 | 190 | 194 |
| Azerbaijan | 2247 | 2406 | 2480 |
| Bosnia and Herzegovina | 1679 | 1700 | 2000 |
| Bulgaria | 6241 | 6000 | 6000 |
| Croatia | 1409 | 1536 | 1602 |
| Cyprus | 764 | 635 | 723 |
| Czech Republic | 1032 | 948 | 950 |
| France | 15508 | 15053 | 14577 |
| Germany | 105 | 110 | 107 |
| Greece | 43318 | 36900 | 38849 |
| Hungary | 6740 | 6487 | 6525 |
| Israel | 2300 | 2160 | 2140 |
| Italy | 86017 | 86062 | 92700 |
| Jordan | 1357 | 2357 | 2357 |
| Kazakhstan | 300 | 300 | 400 |
| Kyrgyzstan | 1300 | 3500 | 1000 |
| Malta | 60 | 57 | 60 |
| Morocco | 4992 | 4900 | 4953 |
| Poland | 3310 | 3176 | 3354 |
| Portugal | 5779 | 5770 | 5763 |
| Republic of Moldova | 5807 | 5641 | 7000 |
| Romania | 1785 | 1610 | 1711 |
| Russian Federation | 9000 | 6500 | 9000 |
| Slovakia | 718 | 710 | 694 |
| Slovenia | 513 | 513 | 509 |
| Spain | 80587 | 75425 | 72000 |
| Switzerland | 13 | 13 | 12 |
| FYR Macedonia | 1300 | 1322 | 1217 |
| Tunisia | 17000 | 16800 | 16500 |
| Turkey | 29400 | 28200 | 27900 |
| Ukraine | 7500 | 6700 | 6100 |
| Uzbekistan | 9300 | 8400 | 10000 |

**Table 10.** Citrus (area harvested in ha. FAO Stat- http://faostat.fao.org, December 2011)

| countries | item | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Albania | Lemons and limes | 200 | 400 | 200 |
| | Oranges | 770 | 800 | 802 |
| | Tangerines, mandarins, clem. | 113 | 112 | 260 |
| Azerbaijan | Citrus fruit, nes | 350 | 800 | 800 |
| | Lemons and limes | 541 | 290 | 315 |
| | Oranges | 1050 | 654 | 660 |
| | Tangerines, mandarins, clem. | 1500 | 1000 | 865 |
| Bosnia and Herzegovina | Oranges | 243 | 250 | 254 |
| | Tangerines, mandarins, clem. | 231 | 230 | 234 |
| Croatia | Lemons and limes | 110 | 110 | 110 |
| | Oranges | 1050 | 1102 | 1142 |
| | Tangerines, mandarins, clem. | 8403 | 9200 | 7500 |
| Cyprus | Citrus fruit, nes | 42 | 37 | 35 |
| | Grapefruit (inc. pomelos) | 485 | 446 | 472 |
| | Lemons and limes | 714 | 657 | 696 |
| | Oranges | 2632 | 2420 | 1283 |
| | Tangerines, mandarins, clem. | 740 | 680 | 720 |
| France | Grapefruit (inc. pomelos) | 236 | 236 | 236 |
| | Lemons and limes | 36 | 35 | 34 |
| | Oranges | 45 | 44 | 43 |
| | Tangerines, mandarins, clem. | 1575 | 1575 | 1525 |
| Georgia | Lemons and limes | 400 | 450 | 448 |
| | Oranges | 900 | 500 | 400 |
| | Tangerines, mandarins, clem. | 22000 | 12000 | 22000 |
| Greece | Citrus fruit, nes | 105 | 100 | 106 |
| | Grapefruit (inc. pomelos) | 289 | 100 | 101 |
| | Lemons and limes | 10306 | 10000 | 10032 |
| | Oranges | 39891 | 39500 | 40000 |
| | Tangerines, mandarins, clem. | 6986 | 7000 | 7114 |
| Israel | Citrus fruit, nes | 650 | 726 | 741 |
| | Grapefruit (inc. pomelos) | 5340 | 4310 | 4180 |
| | Lemons and limes | 1735 | 1760 | 1670 |
| | Oranges | 5540 | 5120 | 5140 |
| | Tangerines, mandarins, clem. | 5320 | 5340 | 5300 |
| Italy | Citrus fruit, nes | 1535 | 1500 | 1525 |
| | Grapefruit (inc. pomelos) | 255 | 300 | 305 |
| | Lemons and limes | 29000 | 30100 | 30000 |
| | Oranges | 104000 | 102301 | 102800 |
| | Tangerines, mandarins, clem. | 36124 | 38000 | 38300 |
| Jordan | Grapefruit (inc. pomelos) | 535 | 524 | 543 |
| | Lemons and limes | 1703 | 1797 | 1805 |
| | Oranges | 2587 | 2546 | 2556 |
| | Tangerines, mandarins, clem. | 1948 | 1936 | 1937 |
| Kazakhstan | Citrus fruit, nes | 50 | 53 | 55 |
| Kyrgyzstan | Citrus fruit, nes | 5 | 30 | 30 |
| | Lemons and limes | 2 | 2 | 2 |
| Malta | Citrus fruit, nes | 60 | 43 | 46 |
| | Lemons and limes | 40 | 40 | 40 |
| | Oranges | 75 | 80 | 81 |
| | Tangerines, mandarins, clem. | 6 | 6 | 6 |
| Montenegro | Oranges | 600 | 700 | 800 |
| Portugal | Grapefruit (inc. pomelos) | 203 | 210 | 220 |
| | Lemons and limes | 1000 | 979 | 979 |
| | Oranges | 19900 | 20100 | 20067 |
| | Tangerines, mandarins, clem. | 4230 | 4237 | 4237 |
| Russian Federation | Oranges | 100 | 100 | 100 |
| Spain | Citrus fruit, nes | 3794 | 2242 | 3000 |
| | Grapefruit (inc. pomelos) | 1232 | 1640 | 1500 |
| | Lemons and limes | 41996 | 46809 | 42500 |
| | Oranges | 145856 | 153429 | 146000 |

Annex 2: Areas of host plants in the PRA area

| countries | item | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| | Tangerines, mandarins, clem. | 121727 | 119875 | 122000 |
| Turkey | Citrus fruit, nes | 180 | 170 | 180 |
| | Grapefruit (inc. pomelos) | 3730 | 3750 | 3780 |
| | Lemons and limes | 20820 | 20930 | 21160 |
| | Oranges | 40730 | 43480 | 44650 |
| | Tangerines, | 29790 | 29920 | 30770 |

| countries | item | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| | mandarins, clem. | | | |
| Uzbekistan | Citrus fruit, nes | 139 | 100 | 150 |
| | Grapefruit (inc. pomelos) | 105 | 100 | 120 |
| | Lemons and limes | 70 | 100 | 92 |
| | Tangerines, mandarins, clem. | 157 | 100 | 180 |

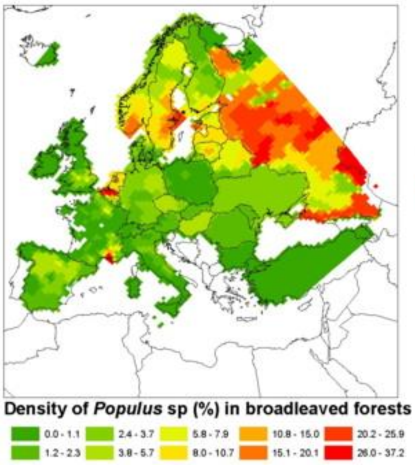
## Annex 3 – Maps of distribution of host species/genus and some related species in the PRA area

Maps were extracted from the following sites:

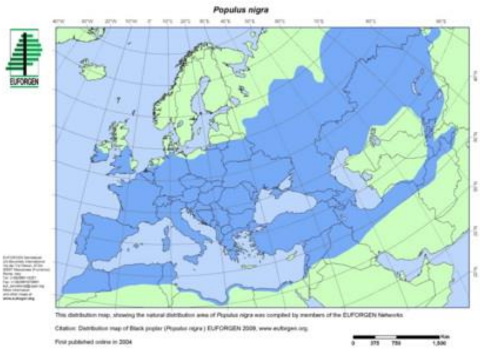
- EUFORGEN. http://www.euforgen.org/distribution_maps.html — Marked with * after plant name
- Global Crop Maps. Monfreda *et al.*, 2008. http://capra.eppo.org/maps.php. — Marked with ^ after plant name
- Tree species inventories. Skjøth *et al.*, 2008. DMU. http://www.dmu.dk/en/air/models/background/trees/ — Marked with @ after plant name
- Project Euro+Med. Euro+Med PlantBase. http://ww2.bgbm.org/EuroPlusMed/query.asp. — No symbol after plant name

### Maps 1 – Populus

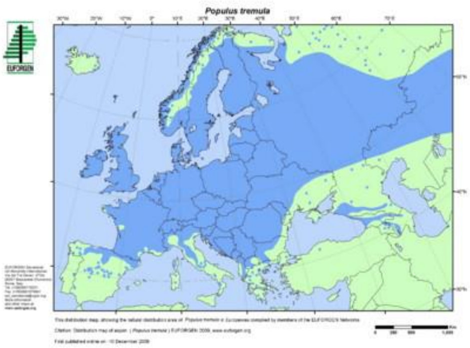
**1a. *Populus*@**




**1b. *Populus nigra****

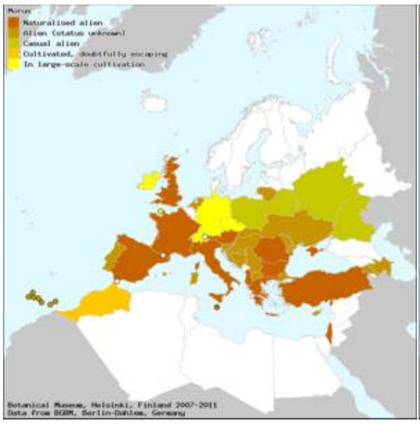



**1c. *Populus tremula****

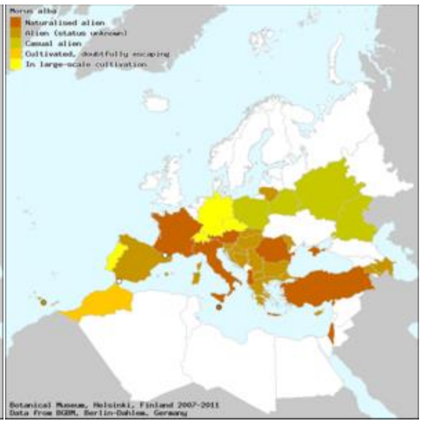



### Maps 2 – *Morus*

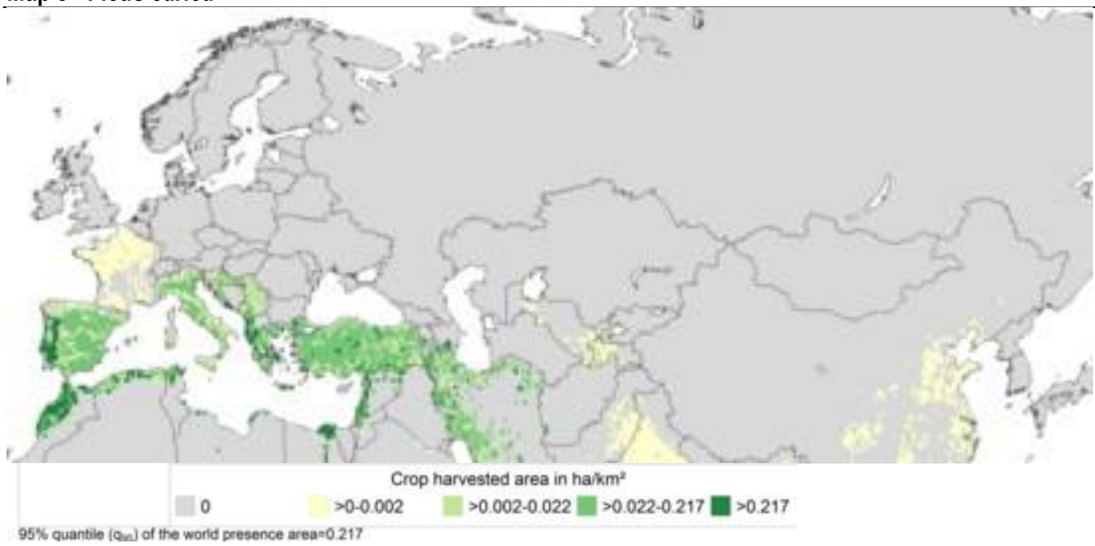
**2a. *Morus***



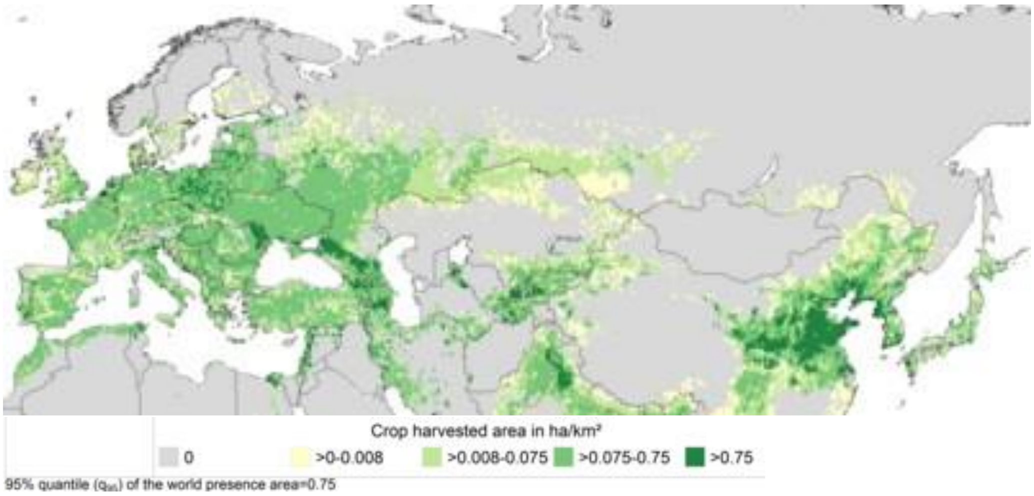

**2b. *Morus alba***




### Map 3 - *Ficus carica*^

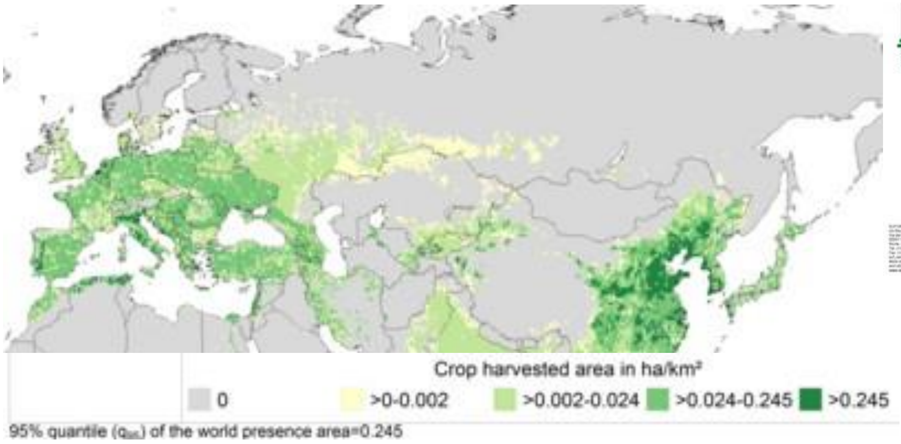



### Map 4 - *Malus domestica*^

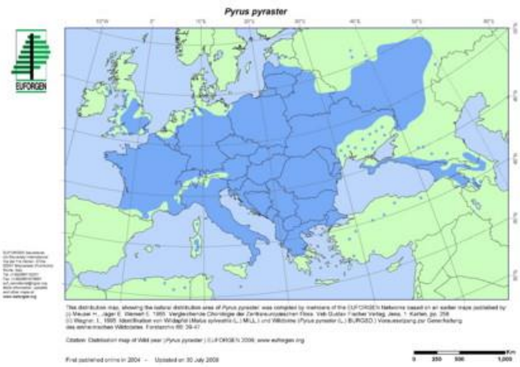



**Maps 5 - *Pyrus***

**12a. Pear (probably *Pyrus communis* and *P. pyrifolia)*^**




**12b. *Pyrus pyraster****



## Annex 4 – Maps of distribution of *A. germarii* in China and of *A. japonica* in Japan

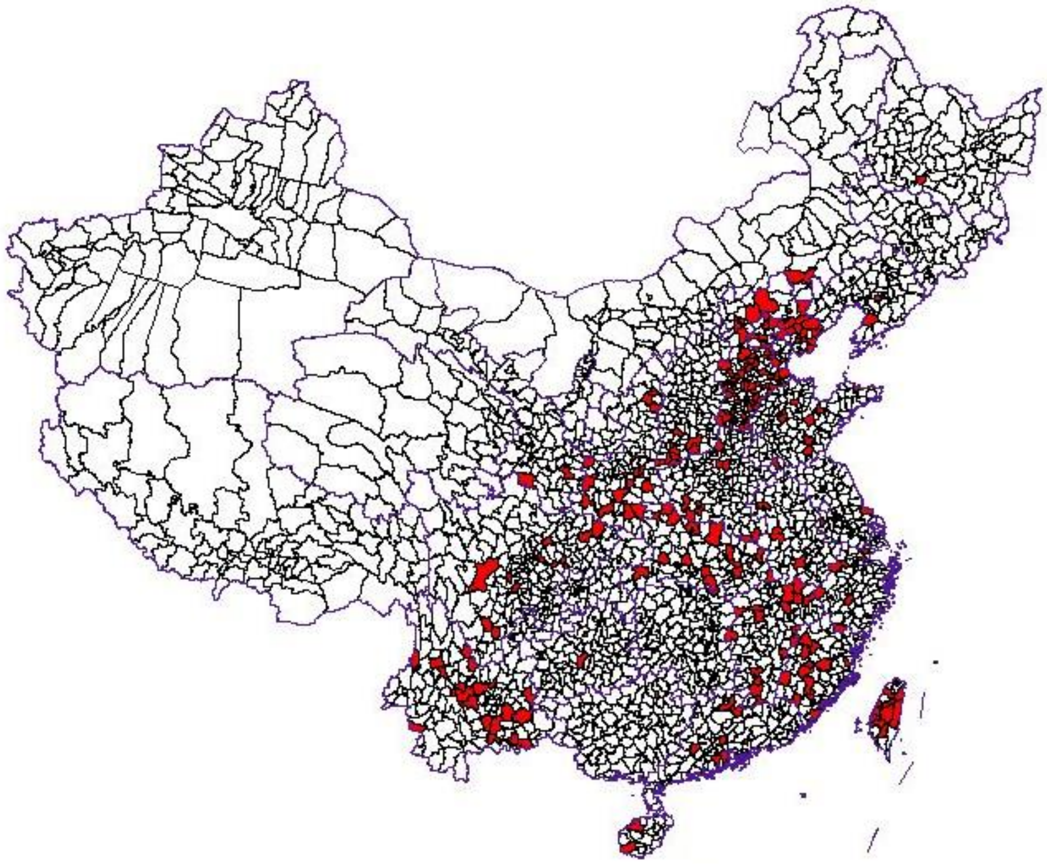


**Fig. 1.** Distribution of *A. germarii* in China produced by Dr Luo (pers. comm. 2011) (based on Chinese litterature)

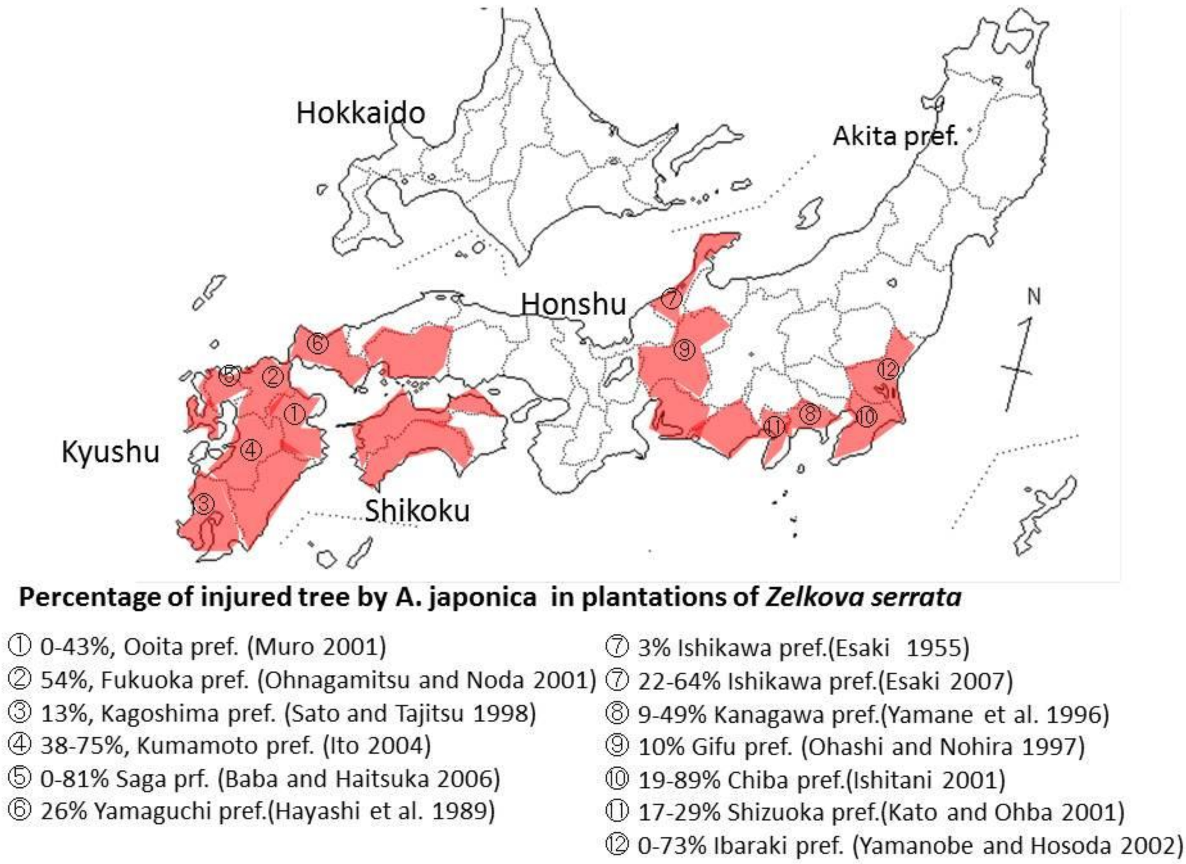



**Fig. 2.** Distribution of economic damage caused by *A. japonica* in plantations of *Zelkova serrata* in Japan. Map produced by Dr Esaki (pers. comm. 2011) (based on Japanese literature).

## Annex 5 –Control of *Apriona* species

### Insecticides used against *Apriona* species in Asia

The active substances below are mentioned in the (available) literature as used in the field or in successful trials against various *Apriona* on various hosts (from Esaki, 2007a & b; Hill, 2008; Pan Hong Yan, 2005 reviewing many articles; Shan *et al.*, 2010; Wang, 1999; Zhao *et al.*, 2001; Zhu & Min, 1990; Yamashita *et al.*, 1999).
It is worth noting that insecticide availability is limited in the EU.

- Active substances marked with an * are listed as authorized in at least some EU countries (EU (2011) http://ec.europa.eu/sanco_pesticides/public/index.cfm), but this would not always be for the hosts considered (and it is likely that none of these would be registered for use in forestry).
- Active substances marked with @ are not authorized.

aldicarb@, alphamethrin*, azadirachtin*, buprofezine* (in combination with diflubenzuron*), carbofuran@, cyhalothrin@, cypermethrin*, deltamethrin*, dichlorvos@, dieldrin@, diflubenzuron*, esfenvalerate*, fenitrothion@, fenpropathrin@, fenvalerate@, fipronil*, furadan@, imidacloprid*, methamidophos@, demeton methyl@, lindane@, monocrotophos@, omethoate@, p-di-chloro-benzene@, parathion@, permethrin@, phorate@, phosphamidon@, quinalphos@, triazophos@, trichlorfon@.
Chemical impregnated stick: aluminium phosphate@, zinc phosphide*

### Natural enemies

The following natural enemies of *A. cinerea* and *A. germarii* are mentioned in the literature:

- *A. cinerea:*

| ***Species*** | **Familly / Mode of action** | **Source** |
|---|---|---|
| *Scleroderma guani* | Hymenoptera: Bethylidae parasitic wasp | Pan Hong Yan 2005 |
| *Dastarcus helophoroides* | Coleoptera: Bothrideridae insect predator | Wei *et al.* 2008 |
| *Aprostocetus prolixus*<br>*Aprostocetus fukutai* | *Hymenoptera*: Eulophidae | LaSalle & Huang 1994 |
| *Beauveria bassiana* | Entomopathogen (Ascomycete) | CABI 2008b |
| *Neoaplectana* spp. | Entomophagous nematodes | Chaudhry 1986 |
| *Alaus* sp. | Coleoptera:Elateridae | Chaudhry 1992 |

- *A. germarii :*

| ***Species*** | **Familly / Mode of action** | **Source** |
|---|---|---|
| *Aprostocetus prolixus*<br>*Aprostocetus fukutai* | Hymenoptera: Eulophidae | Li *et al*, 2007; CABI, 2008a; Yan *et al.*, 1994. |
| *Bacillus thuringiensis* | Entomophatogen (Bacillus) | Li *et al*, 2007; CABI, 2008a |

## Annex 6 - Import of non-fruit trees from countries where *A. germarii*, *A. cinerea* or *A. japonica* occur

**Table 1.** Outdoor rooted cuttings and young plants of trees, shrubs and bushes (excl. fruit, nut and forest trees) (06029045) (host and non-hosts plants) into EU Member States in 2006-2010 (quantity in 100 kg) (Eurostat, accessed 25 August 2011). Note: EU countries without imports were deleted from the table below.

| | China (*A. germarii*) | | | | | India (*A. germarii, A. cinerea*) | | | | | Japan (*A. japonica*) | | | | | Korea, Rep. (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | | Taiwan (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 06 | 2007 | 08 | 2009 | 10 | 2006 | 2007 | 2008 | 09 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 10 |
| Austria | : | : | : | : | : | : | : | : | : | : | : | 3 | 3 | 4 | : | : | : | : | : | : | : | : | : | : | : | : | 1 | : | : | : | : | : | : | : | : |
| Belgium | 1 | : | 45 | 1 | : | : | : | : | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Bulgaria | : | : | : | : | 2 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 2 | 2 | 2 | : | : | : | : | 1 | 1 | 3 | : | : | : | : | : |
| Czech Rep. | 50 | 100 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Denmark | : | : | : | : | 1.060 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 18 | 678 | 2.068 | 1.587 | 2.637 | : | : | : | : | : |
| France | 29 | : | : | : | 3 | 0 | 0 | 0 | 0 | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 8 | 9 | 4 | 41 | 376 | 380 | : | : | : |
| Germany | : | 1 | 61 | 23 | 134 | 0 | : | 3 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 0 | 5 | : | 2 | 1 | : | : | : | 0 | : | : |
| Hungary | : | : | : | : | 3 | : | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Italy | : | : | : | 185 | 73 | 0 | : | : | : | 47 | : | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : | 0 | : | : | : | 8 | : | : | : | : |
| Malta | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 0 | : | 0 | : | 0 | 0 | 0 | 0 | : | : | : | : | : |
| Netherlands | 360 | 1.812 | 421 | 104 | 195 | : | : | : | : | : | : | : | : | : | : | : | 44 | : | : | : | : | : | : | : | : | 0 | : | 0 | : | : | 2 | : | 345 | 0 | : |
| Poland | 9 | 11 | 70 | 26 | 67 | : | : | : | : | : | : | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Romania | : | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Spain | 8 | 22 | 88 | 5 | 13 | 3 | 3 | 5 | 5 | 5 | 1 | 0 | 0 | 0 | 0 | : | : | : | 4 | : | : | : | : | : | : | 5 | 6 | : | 2 | 1 | 75 | 4 | : | : | : |
| Sweden | : | : | 1 | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| UK | : | 80 | 394 | 0 | 12 | 0 | 0 | : | : | 0 | : | 1 | 1 | 22 | 6 | : | : | : | : | : | : | : | : | : | : | : | 0 | 12 | 2 | : | : | : | : | 37 | : |

**Table 2.** Outdoor trees, shrubs and bushes, with roots (excl. cuttings, slips and young plants, and fruit, nut and forest trees) (06029049) (host and non-hosts plants) into EU Member States in 2006-2010 (quantity in 100 kg) (Eurostat, accessed 25 August 2011). Note: EU countries without imports were deleted from the table below.

| | China (*A. germarii*) | | | | | India (*A. germarii, A. cinerea*) | | | | | Japan (*A. japonica*) | | | | | Korea, Rep. (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | | Taiwan (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 08 | 09 | 10 | 2006 | 2007 | 2008 | 2009 | 2010 | 06 | 2007 | 2008 | 2009 | 10 | 2006 | 07 | 08 | 09 | 10 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Belgium | 82 | 872 | 220 | 172 | 152 | : | : | : | : | : | 401 | 159 | 0 | 137 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 0 |
| Bulgaria | : | : | : | : | 240 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | 741 | 2.690 | 3.438 | 1.956 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 1 | : | : | : | : | 111 | : | 64 | 213 | 470 | : | : | : | : | : |
| Czech Rep. | : | 247 | 55 | 190 | : | : | : | : | : | : | 150 | 250 | 171 | 243 | 502 | : | : | 6 | 20 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Denmark | : | 1 | : | : | : | : | : | : | : | : | : | : | 89 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Finland | : | : | 3 | 4 | 4 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| France | 551 | 486 | 623 | 350 | 269 | : | : | : | : | : | : | : | 7 | : | 100 | : | : | : | : | : | : | : | : | : | : | 3 | 320 | : | 190 | 0 | : | : | : | : | : |
| Germany | 538 | 197 | 443 | 937 | 918 | : | : | : | : | : | 1.005 | 1.374 | 1.181 | 1.397 | 521 | : | : | : | 102 | : | : | : | : | : | : | : | : | 4 | 1 | 2 | : | 99 | : | : | : |
| Greece | : | 390 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Hungary | 200 | : | : | 140 | : | : | : | : | : | : | 26 | 20 | 37 | : | 25 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Ireland | : | : | : | : | : | 4 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Italy | : | 459 | 1.913 | 667 | 236 | : | : | : | : | : | 604 | 1.773 | 2.651 | 1.880 | 1.537 | : | : | 185 | : | : | : | : | : | : | : | : | : | 521 | 40 | 139 | : | : | : | : | : |
| Lithuania | : | : | : | : | : | : | : | : | : | : | : | : | 257 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| NL | 113 | 2.956 | 1.244 | 3.266 | 4.384 | : | : | : | : | : | 226 | 552 | 413 | : | : | : | 250 | : | 550 | : | : | : | : | : | : | : | 5 | : | : | : | : | : | : | : | : |
| Poland | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 0 |
| Portugal | 179 | 556 | 287 | 157 | 221 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 1 | 3 | 1 | 0 | : | : | : | : | : | : | : | : | : | : | : |
| Romania | : | : | 59 | 70 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Slovenia | : | : | : | : | 119 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Spain | 8.597 | 6.838 | 5.584 | 4.663 | 5.762 | : | : | : | : | : | 165 | 258 | 211 | 99 | 42 | : | : | 229 | : | : | : | : | : | : | : | : | : | 2 | : | : | 24 | : | 13 | 25 | 23 |
| UK | 126 | : | 82 | : | 411 | : | 0 | : | : | : | 77 | 8 | 68 | 1 | 126 | : | : | 130 | : | : | : | : | : | : | : | 1 | : | : | : | : | : | : | : | 39 | : |

**Table 3.** Forest trees (06028641) (host and non-hosts plants) into EU Member States in 2006-2010 (quantity in 100 kg) (Eurostat, accessed 25 August 2011) Note: EU countries without imports were deleted from the table below.

| Partner | China (*A. germarii*) | | | | | Japan (*A japonica*) | | | | | Korea Rep. (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reporter/Period | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Belgium | : | 3 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | : | : | : | 119 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Germany | : | : | : | 155 | : | : | 12 | 7 | : | : | : | : | : | : | : | : | : | : | : | 1 | : | : | 67 | 55 | : |
| Ireland | : | : | : | : | : | : | 0 | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Italy | : | : | : | : | : | : | : | 7 | 70 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Netherlands | : | : | : | 37 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Poland | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 334 | : | : | : | : | : | : |
| Spain | : | 183 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| UK | : | : | : | : | : | 55 | 129 | : | : | : | : | 42 | : | : | : | : | : | : | : | : | : | : | : | : | : |

**Table 4 to 6. Plants for planting of the three *Apriona* spp. as dispatched to 3 major EU plant importers in 2010.**
**Note**: Quantities mentioned with * were indicated in the data for a genus, not for the specific host species; these plants may have been a host species or another species.

**Table 4.** Plants for planting of host species of *A. germarii* in trade (2010, number of plants)

| **Plant / origin** | **From where *A. germarii* occurs#** | **Others (Asia)** | **Others (non-PRA area)** |
|---|---|---|---|
| *Camellia oleifera*[1] | China 1700*<br>Thailand 514* | Japan 333* | |
| *Celtis sinensis*[2] | China 100* | | USA 6* |
| *Cinnamomum camphora*[3] | | Sri Lanka 5* | |
| *Crataegus cordata*[4] | | Japan 24* | |
| *?Eucalyptus tereticornis* | India 800* | | |
| *Melia azedarach* | Thailand 10 | Sri Lanka 25* | |
| *Morus* spp. | | Indonesia 113 | USA 2 |
| *?Paulownia* sp. | Inde 500 | | Australia 12780 |
| *Populus* sp. | | | USA 2000 |
| *Prunus pseudocerasus*[5] | | | |
| *Ulmus* sp. | Taiwan 3 | | USA 200 |

# Myanmar, China, Japan, Korea, Vietnam, Laos, Cambodia, Malaysia, Pakistan, India, Taiwan, Thailand, Nepal.
* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.
1. Other *Camellia* in trade: *C. japonica* (Japan 1, USA 79, China 2000), *C. sasanqua* (Japan 19), *C. sinensis* (China 20000, USA 3).
2. Other *Celtis* species in trade: *Celtis occidentalis* (150 USA).
3. Other *Cinnamomum* species in trade: *C. zeylanicum* (Thailand 40)
4. Other *Crataegus* in trade: *Crataegus cuneata* (Japan 21)
5. Only other *Prunus* in trade: *P. persica* (details in table 2 above), *P. avium* (China 9000), *P. laurocerasus* (USA 15)

**Table 5.** Plants for planting of host species of *A. japonica* in trade (2010, number of plants)

| Plant / origin | Countries where *A. japonica* occurs (Japan) | Others (Asia) | Others (non-PRA area) |
|---|---|---|---|
| *Caesalpinia japonica*[1] | | Thailand 100* | |
| *Celtis sinensis*[2] | | China 100 | USA 6 |
| *Cercis chinensis*[3] | | China 3000*<br>India 13000* | USA 800*<br>New Zealand 48* |
| *Chaenomeles sinensis*[4] | Japan 63* | China 8500* | Korea Rep. 58* |
| *Cinnamomum camphora*[5] | | Sri Lanka 5* | |
| *Cornus kousa*[6] | Japan 2250* | | New Zealand 144*<br>USA 133 + 20439* |
| *Enkianthus perulatus* | Japan 84 + 26* | China 15629 + 119686*<br>Indonesia 458*<br>Taiwan 550*<br>Korea Rep. 56* | USA 485 |
| *Gleditsia japonica*[7] | | China 500* | USA 26* |
| *Lagerstroemia indica* | | Indonesia 12* | USA 259* |
| *Morus* spp. | | Indonesia 113 | USA 2 |
| *Populus* sp. | | | USA 2000 |
| *Ulmus parvifolia, U. davidiana* | | Taiwan 3* | USA 200* |
| *Spiraea thunbergi* | | | Canada 3000*<br>USA 1000* |
| *Zelkova serrata* | Japan 124 + 17* | | |

* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.

1. Other *Caesalpinia* species in trade: *Caesalpinia pulcherrima* (Thailand 10)
2. Other *Celtis* in trade: *Celtis occidentalis* (USA 150).
3. Other *Cercis* in trade: *Cercis canadensis* (USA 444)
4. Other *Chaenomeles* in trade: *Chaenomeles japonica* (Japan 1), *C. speciosa* (Japan 8)
5. Other *Cinnamomum* species in trade: *C. zeylanicum* (Thailand 40)
6. Other *Cornus* species in trade: *Cornus florida* (USA 60)
7. Other *Gleditsia* species in trade: *Gleditsia triacanthos* (USA 100)

**Table 6.** Plants for planting of host species of *A. cinerea* in trade (2010, number of plants)

| Plant / origin | From where *A. cinerea* occurs (India, Pakistan) | Others (Asia) | Others (non-PRA area) |
|---|---|---|---|
| *Morus* spp. | | Indonesia113 | USA 2 |
| *Populus* sp. | | | USA 2000 |

* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.

## Annex 7 – Import of fruit trees from countries where *A. germarii*, *A. cinerea* or *A. japonica* occur

**Table 1.** Eurostat. Trees, shrubs and bushes, grafted or not, of kinds which bear edible fruit or nuts (excluding vine slips) (06022090) into the European Union in the period 2006-2010 (quantity in 100 kg) (host or non-host plants) (accessed 25 August 2011)
Note: EU countries with no imports were deleted from the tables below.

From China India Japan, Korea Rep.

| Partner | China (*A. germarii*) | | | | | India (*A. germarii, A. cinerea*) | | | | | Japan (*A. japonica*) | | | | | Korea Rep. (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reporter/Period | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Bulgaria | : | 3 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | : | 240 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Germany | 0 | 98 | : | 62 | 109 | : | : | : | : | : | : | : | : | : | 19 | : | : | : | : | : |
| Denmark | : | : | 3 | : | : | : | : | : | : | : | : | 144 | : | : | : | : | : | : | : | : |
| Spain | : | 221 | 281 | 72 | : | 480 | : | : | 0 | : | 454 | 1.240 | 309 | : | : | : | : | : | : | : |
| France | 200 | 41 | 1 | : | : | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : |
| UK | : | : | 67 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Hungary | : | : | : | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Italy | : | 1 | : | 73 | 46 | : | : | : | : | : | 3 | : | : | : | : | : | : | : | : | : |
| Netherlands | : | : | 0 | 5 | : | : | : | 0 | : | : | : | : | : | : | : | : | : | 0 | 1.090 | : |
| Poland | 120 | 179 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Portugal | : | 11 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Romania | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |

From Malaysia, Thailand, Taiwan, Vietnam

| Partner | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | | Taiwan (*A. germarii*) | | | | | Vietnam (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reporter/Period | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Austria | : | : | : | : | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Belgium | : | : | : | : | : | : | : | : | 0 | 0 | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | : | : | : | : | : | 225 | : | : | : | : | : | : | : | : | : | : | : | : | 14 |
| Czech Rep. | : | : | : | : | : | : | : | 1 | : | : | : | : | : | : | : | : | : | : | : | : |
| Germany | : | : | : | : | : | : | : | : | : | : | : | : | 46 | : | : | : | : | : | 1 | : |
| Denmark | : | : | : | : | : | 0 | : | : | : | : | : | : | 0 | : | : | 1 | : | : | : | : |
| Spain | : | : | : | : | : | 30 | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| France | : | : | 2 | : | : | : | 1 | 25 | 1 | 40 | : | : | : | : | : | : | : | : | : | : |

**Table 2 to 4. Plants for planting of fruit trees of the three *Apriona* spp. as dispatched to 3 major EU plant importers in 2010.**
**Note**: Quantities mentioned with * were indicated in the data for a genus, not for the specific host species; these plants may have been a host species or another species.

**Table 2.** Plants for planting of host species of *A. germarii* in trade (2010; number of plants)

| **Plant / origin** | **Countries where *A. germarii* occurs#** | **Others (Asia)** | **Others (non-PRA area)** |
|---|---|---|---|
| *Ficus carica*[1] | India 500*<br>China 3111408*<br>Taiwan 800*<br>Thailand 10* | Indonesia 286*<br>Sri Lanka 207124* | Chili 5400*<br>Costa Rica 230517*<br>Guatemala 48*<br>Kenya 60560*<br>Mexico 48*<br>Uganda 194791*<br>Tanzania 350557*<br>USA 76* |
| *Malus* sp.$ | | | Costa Rica 600* |
| *Malus pumila*$ | | Japan 10 | |

# Myanmar, China, Korea, Vietnam, Laos, Cambodia, Malaysia, Pakistan, India, Taiwan, Thailand, Nepal.
* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.
$ These are subject to prohibition in the EU from this origin and would have been rejected.
1. Other *Ficus* species in trade: *F. benjamina* (Costa Rica 30, USA 9); *F. deltoidea* (China 2), *F. macrocarpa* (China 88771), *F. pumila* (Guatemala 107000).

**Table 3.** Plants for planting of host species of *A. japonica* in trade (2010; number of plants)

| Plant / origin | Countries where *A. japonica* occurs (Japan) | Others (Asia) | Others (non-PRA area) |
|---|---|---|---|
| *Ficus carica*[1] | | China 3111408*<br>India 500*<br>Indonesia 286*<br>Sri Lanka 207124*<br>Taiwan 800*<br>Thailand 10* | Chili 5400*<br>Costa Rica 230517*<br>Guatemala 48*<br>Kenya 60560*<br>Mexico 48*<br>Uganda 194791*<br>Tanzania 350557*<br>USA 76* |
| *Diospyros kaki*[2] | Japan 4 + 22* | China 6000<br>Korea Rep. 50 | USA 1* |
| *Malus pumila*[$] | Japan 10 | | |
| *Punica granatum* | Japan 24 | Korea Rep. 43<br>Indonesia 6* | Egypt 2000*<br>USA 8 |

[$] These are subject to prohibition in the EU from this origin and would have been rejected.
* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.
1. Other *Ficus* species in trade: *F. benjamina* (Costa Rica 30, USA 9); *F. deltoidea* (China 2), *F. macrocarpa* (China 88771), *F. pumila* (Guatemala 107000), *F. retusa* (China 12666).
2. Other *Diospyros* species in trade: *D. virginiana* (USA 3)

**Table 4.** Plants for planting of host species of *A. cinerea* in trade (2010; number of plants)

| Plant / origin | Countries where *A. cinerea* occurs (India, Pakistan) | Others (Asia) | Others (non-PRA area) |
|---|---|---|---|
| *Ficus carica*[1] | India 500* | China 3111408*<br>Indonesia 286*<br>Sri Lanka 207124*<br>Taiwan 800*<br>Thailand 10* | Chili 5400*<br>Costa Rica 230517*<br>Guatemala 48*<br>Kenya 60560*<br>Mexico 48*<br>Uganda 194791*<br>Tanzania 350557*<br>USA 76* |
| *Malus domestica*[2$] | | | Costa Rica 600* |
| *Prunus persica*[3$] | | China[$] 18000 | |

* for these, the plant traded was indicated only at the genus level, i.e. it could have been the host species or not. In certain cases, species are indicated and related species that are traded are indicated below.
[$] These are subject to prohibition in the EU from this origin and would have been rejected.
1. Other *Ficus* species in trade: *F. benjamina* (Costa Rica 30, USA 9); *F. deltoidea* (China 2), *F. macrocarpa* (China 88771), *F. pumila* (Guatemala 107000), *F. retusa* (China 12666).
2. Other *Malus* sp. in trade: *M. pumila* (Japan[$] 10)
3. Other *Prunus* in trade: *P. avium* (China[$] 9000), *P. laurocerasus* (USA 15)

## Annex 8 – Imports of wood from countries where *A. germarii*, *A. cinerea* or *A. japonica* occur

**Table 1 -** Import of fuelwood (44011000) (host and non-hosts plants; deciduous and non-deciduous) into EU members in 2006-2010 (quantity in 100 kg). Note: EU countries for which there was no import where deleted from the table below.

| Partner | China (*A. germarii*) | | | | | India (*A. germarii*, *A. cinerea*) | | | | | Korea, Rep. (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | | Viet-Nam (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reporter/Period** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** |
| **Belgium** | : | : | : | : | 1 | : | : | : | 1 | : | : | : | : | : | : | : | 318 | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Czech Rep.** | : | : | : | 210 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Denmark** | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 1.092 | : | : | : | : | : | : | 461 | : | : | : |
| **France** | : | : | 15 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Germany** | : | : | 13 | 190 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | : | : | : | : | : | : | : | : | : | : | : |
| **Greece** | : | : | 36 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 500 | 868 | : | : | : | : | : | : | : | : | : | : |
| **Ireland** | : | 282 | 6.450 | 2 | 5 | : | : | : | : | : | : | : | : | : | : | : | 24.349 | 12.257 | 398 | 1.149 | : | : | : | 4 | : | : | : | : | : | 230 |
| **Italy** | 2.508 | 3.573 | : | : | : | : | : | : | : | : | 240 | : | 240 | : | : | : | : | : | 435 | : | : | : | : | : | : | : | : | : | : | : |
| **Netherlands** | 2.675 | 21 | : | : | 41 | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 233 | : | : | : | : | : | : |
| **Romania** | : | 78 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Sweden** | : | | : | : | : | : | : | : | : | : | : | : | : | : | : | 160 | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **UK** | 100 | : | : | 43 | 190 | : | : | 19 | 15 | : | : | : | : | : | : | : | : | 302 | : | 1.040 | : | : | : | : | : | : | : | : | : | 402 |

**Table 2.** Import of poplar wood sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, of a thickness exceeding 6 mm (44079991) into EU members in 2006-2010 (quantity in 100 kg) Note: EU countries for which there was no import where deleted from the table below.

| Partner | China (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Reporter/Period | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Belgium | : | : | : | : | 54 | : | : | : | : | : |
| Denmark | 440 | : | : | : | : | 171 | : | : | : | : |
| Spain | : | 563 | : | : | 671 | : | : | : | : | : |
| United Kingdom | 458 | : | : | : | : | 1.406 | 976 | : | : | : |
| Ireland | : | : | 82 | : | : | : | : | : | : | : |
| Italy | 769 | 1.156 | 771 | 310 | 238 | : | : | : | : | : |
| Netherlands | : | : | : | : | 203 | : | : | : | : | : |
| Portugal | : | : | 492 | : | 2.124 | : | : | : | : | : |

**Table 3.** Import of deciduous wood chips (44012200) (host and non-hosts plants) into EU members in 2006-2010 (quantity in 100 kg) Note: EU countries for which there was no import where deleted from the table below.

| Partner | China (*A. germarii*) | | | | | India (*A. germarii*, *A. cinerea*) | | | | | Korea, Rep. (*A. germarii*) | | | | | Malaysia (*A. germarii*) | | | | | Thailand (*A. germarii*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reporter/Period** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006** | **2007** | **2008** | **2009** | **2010** |
| **Austria** | 9 | | | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Belgium** | : | : | 3 | 16 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | 1 | 3 |
| **Denmark** | | 2 | : | : | : | : | : | : | : | : | | : | : | : | : | : | : | : | 20.045 | : | : | : | : | : | : |
| **Finland** | 9 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 9 | : | : | : | : |
| **Germany** | : | 305 | 156 | 219 | 5 | : | 8 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Hungary** | 48 | : | : | : | : | : | : | 220 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Ireland** | : | : | : | 295 | 878 | : | : | : | : | : | : | : | : | : | : | 635 | : | : | : | : | : | : | : | : | : |
| **Italy** | 60 | 2 | 203 | 299 | 650 | : | : | : | : | : | : | : | : | : | : | : | 2 | : | : | : | : | : | : | : | : |
| **Lithuania** | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| **Netherlands** | 150 | 17 | 202 | 31 | 3 | : | : | : | : | : | : | 19 | 19 | 12 | 3 | : | : | : | : | : | : | 22 | : | : | 15 |
| **Sweden** | 9 | | | 4 | 1 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 143 | : | : | : | : |
| **Uk** | : | 192 | : | : | 350 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |

**Table 4.** Imports/exports of poplar and willow roundwood and wood chips (data extracted for countries of the PRA area from Table 6, p65 of FAO. 2008)

| Country | Category | $m^3$ | tonnes | Countries of origin/destination (in order of importance |
|---|---|---|---|---|
| Bulgaria | Import wood chips | | 516 | Romania |
| Belgium | Import roundwood | 228.000 | | Netherlands, France, Germany |
| Bulgaria | Import roundwood | 34.223 | 6.800 | Romania, Serbia, Ukraine |
| Croatia | Import roundwood | | 18.701 | Serbia, Hungary, UK, Macedonia, Bosnia and Herzegovina |
| Italy | Import roundwood | 457.000 | | Hungary, France |
| Spain | Import roundwood | 5.400 | | France, Portugal, Ukraine |
| France | Import roundwood | | 242.449 | Italy, Spain, Morocco |
| Bulgaria | Import others | 12.206 | 8.300 | Romania |
| Spain | Import others | 1218 | | USA, Romania, Brazil, Ukraine |
| | | | | |
| Belgium | Export roundwood | 209.000 | | France, Italy, Netherlands, North Africa |
| Croatia | Export roundwood | | 13.560 | Italy, Slovenia, Bosnia and Herzegovina, Austria, Bulgaria |
| Italy | Export roundwood | 1500 | | Hungary, France |
| Romania | Export roundwood | 44.429 | | Bulgaria, Syria |
| Spain | Export roundwood | 12.886 | | France, Portugal |
| Serbia | Export roundwood | | 106.013 | Italy |
| France | Export roundwood | | 127.380 | Belgium, Luxembourg, Spain, Germany |
| Spain | Export others | 69 | | Portugal, Romania |

**Table 5.** Import of waste wood ("wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms (excl. Sawdust and pellets", codes 44013080 and 44013090) (host and non-hosts plants) into EU members in 2006-2010 (quantity in 100 kg). Note: EU countries (and/or years) for which there was no import where deleted from the table below. Less than 2 tonnes were importedfrom Laos and Korea Rep. between 2006-2011

| | China (A. germarii) | | | | | | India (A. germarii, A. cinerea) | | | | | Malaysia (A. germarii) | | | | | | Thailand (A. germarii) | | | | | | Viet-Nam (A. germarii) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORTER/ PERIOD | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2006 | 2008 | 2009 | 2010 | 2011 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| Eu27 | 13 345 | 17 850 | 4 974 | 3 033 | 3 936 | 4 866 | 2 | 2 400 | 4 768 | 7 071 | 7 120 | 15 952 | 71 621 | 33 244 | 71 911 | 86 819 | 113 812 | 737 | 2 191 | 535 | 1 026 | 6 | 564 | 804 | 5 021 | 12 979 | 3 253 | 2 031 | 5 289 |
| Austria | : | : | : | 0 | : | : | 1 | : | : | : | : | : | 0 | : | : | : | : | : | : | : | : | 6 | 27 | : | : | : | : | 5 | : |
| Belgium | 88 | 2 | 387 | 318 | 415 | 83 | : | : | : | : | : | 48 | 947 | 4 353 | 2 725 | 4 757 | 2 676 | : | : | : | : | : | : | 169 | 169 | 675 | 507 | 576 | 179 |
| Bulgaria | : | 5 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Cyprus | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 162 | : | 391 | : | 196 | : | : | : | 750 | : | : |
| Czech republic | 142 | : | : | : | 165 | : | : | : | : | : | : | : | : | : | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : |
| Germany | : | 244 | 317 | 179 | : | : | : | : | : | 70 | 1 284 | 460 | 5 502 | 1 064 | 2 426 | 74 | : | : | : | : | : | : | : | : | : | 11 424 | 815 | 750 | 864 |
| Denmark | 168 | 552 | 1 241 | : | : | 1 740 | 1 | : | 460 | : | : | 5 426 | 43 821 | 1 560 | 60 751 | 81 343 | 96 123 | 737 | 1 626 | 428 | 595 | : | : | 635 | 4 835 | 740 | : | : | 703 |
| Spain | : | 40 | 1 442 | : | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 723 |
| Finland | 91 | : | 3 | 9 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| France | 0 | 186 | 71 | 255 | 53 | 48 | : | : | : | : | : | 813 | 485 | 3 030 | : | : | : | : | 176 | : | : | : | 0 | : | : | 24 | : | : | : |
| UK | : | 1 586 | 43 | 1 072 | 2 185 | 1 775 | : | : | : | : | : | 80 | 1 931 | 21 998 | 2 314 | : | 15 013 | : | : | : | : | : | 135 | : | : | : | 1 144 | 462 | 2 820 |
| Greece | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 197 | : | : | : | : | : | : |
| Hungary | : | 152 | : | 1 | 13 | 11 | : | 2 400 | 4 308 | 6 799 | 4 347 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 0 | : | : | : |
| Ireland | : | 2 015 | 274 | 24 | 830 | : | : | : | : | 202 | 5 | 9 028 | 18 631 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 238 | : |
| Italy | 12 843 | 12 309 | 1 001 | 778 | 4 | : | : | : | : | : | : | 67 | 1 | : | 3 604 | : | : | : | 227 | : | : | : | : | : | 17 | 116 | : | : | : |
| Lithuania | : | : | : | : | : | 42 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Malta | : | : | : | : | : | : | : | : | : | : | : | 30 | : | : | 8 | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Netherlands | 9 | 725 | 195 | 397 | 271 | 1 161 | : | : | : | : | : | : | 141 | 287 | 82 | 0 | : | : | : | 107 | 40 | : | 9 | : | : | : | 20 | : | : |
| Poland | : | 0 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Sweden | 4 | 34 | : | : | 0 | 6 | : | : | : | 0 | 136 | : | 162 | 952 | 1 | 645 | 0 | : | : | : | : | : | : | : | : | : | : | : | : |
| Slovenia | : | : | : | : | : | : | : | : | : | : | 1 348 | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| Slovakia | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | 17 | : | : |

## Annex 9 –Phytosanitary requirements in EPPO countries for the pathways

These requirements were checked from EPPO collection of phytosanitary regulations - for non-EU countries, 1999 to 2003 depending on countries - and EU Directive 2000/29

Requirements for Plants for planting (except seeds) of non-fruit crops

- **Albania**. All plants: IP, PC.
- **Algeria**. Fruit or ornamental plants of species not indigenous or cultivated in Algeria: IP; *Crataegus*: prohibited; Conifers: free from *Ips* spp.; *Pinus*: free from some specified pests. *Prunus*: IP; free from some specified pests; place of production freedom for some pests.
- **EU, Norway, Switzerland.** *Pinus:* prohibition (also applying to countries where these *Apriona* occur). *Quercus, Crateagus:* prohibited with leaves/non dormant. Imports of plants are also subject to emergency measures against *A. chinensis* (EU, 2010), that make specific requirements on the conditions of production of the plants and imply inspections. These may allow to detect the presence of *Apriona* spp. (but not at early stages of infestation). All trees and shrubs are also subject to general measures (Annex IV.A.I.39, 40), in particular ensuring that they are dormant and free from leaves and grown in nursery. A PC is required and consignments would be inspected. Specific requirements in relation to certain pests: *Quercus* (non-Eur. *Cronartium* spp., *Cryphonectria parasitica), Ulmus davidiana and U. parvifolia* (from China, Japan, Korea, Taiwan; *Agrilus planipennis*) *Pterocarya rhoifolia* (from China, Japan, Korea, Taiwan; *Agrilus planipennis*), *Populus* (*Melampsora medusae*), *Crataegus* (*Monilinia fructicola, Erwinia amylovora, Phyllosticta solitaria), Camellia (Ciborinia camelliae).*
- **Israel.** All plants: IP, PC, free from soil, sand, organic manure or compost (except peat); Plants originating in tropical or subtropical countries: prohibited.
- **Jordan.** All plants: IP, PC; free from soil.
- **Kirghizstan.** All plants: IP, PC, free from soil, PFA for quarantine pests, place of production and buffer zone inspected during the last growing season and found free from quarantine pests); Plants with growing medium: growing medium free from specified nematodes.
- **Morocco.** All plants: PC; Plants with soil: pest free; *Crataegus*, *Eucalyptus*: prohibited; *Prunus*: import permit, requirements in relation to certain diseases (e.g. peach rosette phytoplasma, *Xanthomonas arboricola* pv. *pruni*).
- **Moldova.** All plants: PC, IP, disinfection; Plants with roots: free from soil.
- **Russia.** All plants: import permit, PC, prohibition from countries where some specific pests occur (e.g. *Thrips palmi, Bemisia tabaci*); Plants with roots: free from soil; *Crataegus*: prohibited from where *E. amylovora* or *Q. perniciosus* occur; *Morus*: prohibited from countries where *Hyphantria cunea* occurs; *Pinus*: prohibited from countries where *Bursaphelenchus xylophilus* occurs; *Prunus*: prohibited from countries where plum American line pattern ilarvirus, *Q. perniciosus*, *H. cunea*, *Pseudaulocaspis pentagona*, *Grapholita molesta*, *Carposina niponensis*, peach American mosaic virus, plum pox potyvirus occur. *Quercus*: prohibited from countries where *Ceratocystis fagacearum* occurs; Salix: prohibited from countries where *Q. perniciosus* occurs.
- **Tunisia.** All plants: PC, free from *F. occidentalis*; Plants from countries where *F. oxysporum* f.sp. *albedinis* occurs: prohibited; Forest trees: prohibited; *Crateagus*: requirements for *E. amylovora*, viruses & *Q. perniciosus*, & prohibited from countries where *E. amylovora* occurs; *Fagus, Populus, Salix, Ulmus*: free from or fumigation for countries where *Q. perniciosus* occurs; *Prunus*: Derived from material free (by testing) from relevant quarantine pests, specific requirements for plants originating from countries where *X. arboricola* pv. *pruni*, *Monilia fructicola*, *Q. perniciosus* occur. *Quercus*: PFA for *Ophiostoma piceae* and *C. parasitica* for some specified origins.
- **Turkey.** All plants: requirements regarding growing medium, import permit, PC, free from soil, free from pests and treated; Plants with roots: PFA for several soil pests; Woody plants: dormant and free from leaves, flowers and fruit; Conifers: free from specified pests; *Crataegus*: requirements for *Q. perniciosus*, *E. amylovora*, *M. fructicola*; *Fagus*: requirements for *Q. perniciosus*; *Pinus*: specific requirements for some pests; *Populus*: specific requirements for *Q. perniciosus*; *Prunus*: specific requirements for some pests (e.g. *Q. perniciosus*, *M. fructicola*, many viruses and phytoplasmas; *Quercus:* requirements for *Ceratocystis fagacearum*; *Salix*: requirements for *Q. perniciosus*; *Ulmus, Zelkova:* requirements for elm phloem necrosis phytoplasma, *O. ulmi*, *Q. perniciosus*.
- **Ukraine**: All plants: import permit, PC, free from quarantine pests or disinfested at the points of entry.

Requirements for Plants for planting (except seeds) of fruit crops

- **Albania.** All plants: IP, PC.
- **Algeria.** Fruit or ornamental plants of species not indigenous or cultivated in Algeria: IP; *Citrus*: prohibited; *Castanea, Eriobotrya, Juglans*: IP; *Ficus*: IP, practically free from pests; *Malus*: IP, free from some specied pests, place of production freedom or PFA for some specified pests; some cultivars of *M. domestica* prohibited; *Prunus*: IP; free from some specified pests; place of production freedom for some pests; *Pyrus*: IP; free from some specified pests; some cultivars of *P. communis* prohibited.
- **EU, Norway, Switzerland.** *Citrus*, *Malus*, *Prunus*, *Pyrus:* prohibited (also applying to countries where *Apriona germarii*, *A. cinerea* or *A. japonica* occur). *Castanea:* prohibited if with leaves. A few hosts subject to specific requirements for specified pests: *Castanea* (non-European *Cronartium* spp. *Cryphonectria parasitica)*, *Juglans mandshurica* (from China, Japan, Korea, Taiwan; *Agrilus planipennis*), *Eriobotrya* (*Erwinia amylovora).* All trees and shrubs are also subject to general measures (Annex IV.A.I.39, 40), in particular ensuring that they are dormant and free from leaves and grown in nursery. A PC is required and consignments would be inspected. Measures against *A. chinensis* would also apply to some hosts and would ensure inspection.
- **Israel.** All plants: IP, PC; free from soil, sand, organic manure or compost (except peat); Plants originating in tropical or subtropical countries: prohibited
- **Jordan.** All plants: IP, PC; free from soil; *Prunus domestica, P. persica*: free from virus and virus-like diseases.
- **Kirghizstan.** All plants: IP, PC, free from soil, PFA for quarantine pests, place of production and buffer zone inspected during the last growing season and found free from quarantine pests; plants with growing medium: growing medium free from specified nematodes.
- **Morocco.** All plants: PC; Fruit trees: free from Ag*robacterium tumefaciens;* Plants with soil: pest free. *Citrus, Eriobotrya*: prohibited; *Malus, Pyrus*: IP, specific requirements (e.g. Erwinia amylovora, viruses and virus-like organisms), dormant and not more than one year after grafting, declaration of date of grafting, prohibition of import between certain dates; *Malus domestica*: specific requirements in relation to apple proliferation phytoplasma; prohibition of some cultivars; *Pyrus communis*: prohibition of some cultivars. *Prunus*: IP, specific requirements in relation to diseases (e.g. peach rosette phytoplasma, *X. arboricola* pv. *pruni*, *M. fructicola*, *X. fastidiosa*); many specific requirements for individual *Prunus* spp. *P. persica*: specific requirements for plum pox potyvirus, *Pseudomonas syringae* pv. *persicae.*
- **Moldova.** All plants: PC, IP, disinfection; Plants with roots: free from soil.
- **Russia.** All plants: IP, PC, prohibition from countries where some specific pests occur (e.g. *T. palmi, B. tabaci*; plants with root: free from soil); *Eriobotrya*: prohibited from countries where *E. amylovora*, *G. molesta* or *C. niponensis* occur; *Malus*: prohibited from countries where cherry rasp leaf nepovirus, *E. amylovora*, *Q. perniciosus*, *H. cunea*, *P. pentagona*, *G. molesta*, *C. niponensis*, *Rhagoletis pomonella*, *Agrilus mali* occur; *Prunus*: prohibited from countries where plum American line pattern ilarvirus, *Q. perniciosus*, *H. cunea*, *P. pentagona*, *G. molesta*, *C. niponensis*, peach American mosaic virus, plum pox potyvirus occur; *Prunus persica*: prohibited from countries where peach yellows phytoplasma occurs; *Pyrus:* prohibited from countries where *E. amylovora, Q. perniciosus, H. cunea, P. pentagona, G. molesta, C. niponensis, Numonia pyrivorella* occur.
- **Tunisia.** All plants: PC, free from *F. occidentalis*; Plants from countries where *F. oxysporum* f.sp. *albedinis* occurs: prohibited. *Castanea*: requirements for *C. parasitica*, *C. fagacearum* and *O. piceae*; *Juglans*: from countries where *Q. perniciosus* occurs: free from or fumigation; *Malus, Pyrus:* requirements for *E. amylovora*, viruses, *Q. perniciosus,* prohibited from countries where *E. amylovora* occurs; *Prunus*: Derived from material free (by testing) from relevant quarantine pests, specific requirements for plants originating from countries where *X. arboricola* pv. *pruni*, *M. fructicola*, *Q. perniciosus* occur.
- **Turkey.** All plants: requirements regarding growing medium; import permit, PC, free from soil, free from pests and treated; plants with roots: PFA for several soil pests; woody plants: dormant and free from leaves, flowers and fruit; *Castanea:* requirements for many pests (incl. *C. parasitica*); *Citrus*: specific requirements for certain pests (e.g. *Xanthomonas axonopodis* pv. *citri*); *Eriobotrya*: specific requirements for *M. fructicola*; *Juglans*: specific requirements (e.g. *Q. perniciosus)*; *Malus, Pyrus*: specific requirements (e.g. *Q. perniciosus*, *E. amylovora*, virus and virus-like diseases, *Anarsia lineatella*, *G. molesta*); *Malus domestica*: specific requirements for countries where apple proliferation phytoplasma occurs; *Pyrus communis:* from countries where pear decline phytoplasma occurs; *Prunus*: specific requirements for some pests (e.g. *Q. perniciosus*, *M. fructicola*, many viruses and phytoplasmas); requirements for many individual *Prunus* spp.; *P. persica*: with regards to virus and virus-like diseases.
- **Ukraine**: All plants: IP, PC; free from quarantine pests or disinfested at the points of entry.

Additional measures for bonsais

In the EU, there are additional measures for bonsais targeting ”naturally or articially dwarfed plants”. They imply that the plants should be grown in registered nurseries prior to dispatch (at least 2 years), and there are requirements regarding growing conditions, growing medium, treatments, at least six visual inspections per year in the nursery and its vicinity, packing requirements. In addition, the EU had derogations (EU, 2002a &b) for bonsais of *Chamaecyparis*, *Pinus* and *Juniperus* from Korea Rep.and Japan (reconducted in 2008 for Japan).

Requirements for wood

- **Albania**. All non-squared wood: import permit (IP), PC
- **Algeria**. All non-squared wood: PC; *Castanea* from countries where *C. parasitica* occurs: treatment; Conifers, *Pinus*: free from some specified pests.
- **EU countries, Norway, Switzerland**. Specific requirements for wood of conifers from countries where *B. xylophilus* occurs: heat treatment, fumigation or chemical pressure impregnation; from other countries: bark-free and free from grub holes, kiln-drying, fumigation, heat treatment or chemical pressure impregnation) wood of *Juglans mandshurica, Ulmus davidiana, Ulmus parvifolia* and *Pterocarya rhoifolia* originating in Canada, China, Japan, Mongolia, Republic of Korea, Russia, Taiwan and USA: PFA for *Agrilus planipennis* or squared. Note: wood of poplar is subject to measures only for North American origins.
- **Israel.** All non-squared wood: IP, PC.
- **Jordan.** All non-squared wood: IP.
- **Khirghistan.** All non-squared wood: IP, PC, place of production and buffer zone inspected during the last growing season and found free from quarantine pests, fumigation before dispatch.
- **Moldova.** All non-squared wood: PC, IP, disinfection.
- **Morocco.** All non-squared wood with bark: PC.
- **Russia**. *Pinus (*prohibited from countries where *Bursaphelenchus xylophilus* occurs).
- **Tunisia**. All non-squared wood: PC.
- **Turkey**. All non-squared wood: PC; Sawn non-squared wood: kiln drying; Sawn non-squared wood (except Coniferae): debarking and free from pests; Non-squared wood (free from pests and debarking or fumigation); Firewood (except coniferae: free from pests and fumigation if foliage); *Castanea, Quercus*: free from *C. parasitica*; Conifers: debarking and specific requirements for several pests, firewood prohibited.