The Food & Environment Research Agency

Rapid Pest Risk Analysis for *Aromia bungii*

This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist Risk Managers decide on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.

STAGE 1: INITIATION

1.What is the name of the pest?

Aromia bungii (Faldermann) (Coleoptera, Cerambycidae): the peach red-necked longhorn, plum and peach longhorn or red-necked longhorn beetle.

2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC[1]) and in the lists of EPPO[2]?

Aromia bungii was added to the EPPO Alert list in 2012 following a finding in Germany. It is not listed in the EU Directive.

3. What is the reason for the rapid assessment?

Aromia bungii is a wood boring tree pest. Originating in Asia, an adult was found in Germany in 2011, though evidence of exit holes suggest it may have been introduced in 2008 / 2009 (EPPO, 2012a; Schrader & Schröder, 2012). In September 2012 there was a report from Italy, again with evidence of exit holes (EPPO, 2012b). In both cases eradication measures are being taken against the outbreaks. In 2008 interceptions of *A. bungii* were reported by both the USA (Smith, 2009) and the UK (Reid & Cannon, 2010). This rapid assessment was initiated to provide a UK perspective after *A. bungii* was identified as a pest of concern in the current review of tree health and plant bio-security action plans. Fera has already produced a plant pest factsheet (Ostojá-Starzewski & Baker, R.H.A., 2012).

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?

Secondary sources (Smith, 2009; EPPO, 2012c; Schrader & Schröder, 2012) largely agree on the distribution of the beetle in Asia, from where it originates. However, because much of the original information is restricted to Chinese language sources, it has not been possible to confirm all of the countries named here from original source material. Where such information was available and has been consulted, primary sources are given below.

Asia:

China (Shandong, Shanxi, Henan, Hebei, Beijing, Tianjin, Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Jiangsu, Anhui, Zhejiang, Shanghai, Fujian[a], Jiangxi, Hunan, Hubei, Sichuan, Yunnan, Guizhou, Gansu, Guangdong[a]) (Chiang, 2009), The secondary sources report that the beetle is more prevalent in northern and central provinces, but note that Guangdong is the most southerly province on the Chinese mainland). ([a]: also Duffy, 1968)

[1] http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf
[2] http://www.eppo.org/QUARANTINE/quarantine.htm

South Korea (Duffy, 1968, as Korea)
North Korea (Duffy, 1968, as Korea)
Mongolia (Danilevsky, 2004); report uncertain
Taiwan
Vietnam

North America:
USA: Absent, intercepted only. Single interception of one adult female in a manufacturing plant in Seattle, Washington, in July 2008 (Smith, 2009)

Europe:
Germany: A single male was found in July 2011 on an old damson plum tree in a private garden near Kolbermoor in the south of Bavaria, with exit holes reported and there have been anecdotal reports of sightings of two further specimens from the garden owners. The origin of the infestation is unknown, but it seems that eggs must have been laid by a female *in situ* in 2008 or 2009 (Burmeister *et al*., 2012; EPPO, 2012a). Its current official status is: transient, only at one location, under eradication.

Italy: Frass, exit holes and larvae were discovered in September 2012 on several plum and apricot trees in parks and gardens in an urban area located between Napoli and Pozzuoli (Campania region) (although treated as an official report, note that technically the species determination is subject to confirmation by molecular analysis) (EPPO, 2012b). Additionally, Garonna (2012) reports that adults were photographed in Italy in both 2010 and 2011, but no further details are given. Its current official status is present, under eradication.

EPPO PQR provides a map (copied in the Appendix) but this excludes the findings in Italy.

5. Is the pest established or transient, or suspected to be established/transient in the UK? *(Include summary information on interceptions and outbreaks here).*
Aromia bungii is not present in the British Isles.

It has been intercepted by the UK plant health authorities on one occasion: 3 adults (2 live and 1 dead) were found associated with wooden pallets carrying steel at a warehouse in Bristol in July 2008. The pallets were from a Dutch supplier but were believed to originally have had a Chinese origin. The pallets were destroyed (Fera, unpublished).

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?
Again, the list below has been compiled from secondary sources (Smith, 2009; EPPO, 2012c; Schrader & Schröder, 2012) which largely agree with each other. As before, because much of the original information is restricted to Chinese language sources, it has not been possible to confirm much of the information here from original source material.

Ebenaceae: *Diospyros virginiana* (persimmon)

Juglandaceae: *Pterocarya stenoptera* (Chinese wingnut)

Meliaceae: *Azadirachta indica* (neem)

Oleaceae: *Olea europaea* (olive)

Poaceae: *Bambusa textilis* (weavers bamboo)

Punicaceae: *Punica granatum* (pomegranate)

Rosaceae:
Prunus spp. incl.

P. americana (American plum)
P. armeniaca (apricot)
P. avium (cherry)
P. domestica (plum)
P. domestica ssp. *institia* (damson or damson plum) (the host in the Germany outbreak)
P. mume (Japanese apricot) (Duffy, 1968)
P. persica (peach) (Duffy, 1968)
P. japonica (Korean cherry, flowering almond or Oriental bush cherry) (Duffy, 1968)

Salicaceae:
Populus spp. incl.
P. alba (abele or white poplar)
P. tomentosa (Chinese white poplar)

Theaceae: *Schima superba* (no common name)

The main hosts in the beetle's home range are reported to be *Prunus* species, in particular peach and apricot, and to a lesser extent plum and cherry (Wu & Li, 2005; EPPO, 2012c). However, primary source information about the extent and damage to the wider range of hosts is not available.

Schrader & Schröder (2012) suggested that the range of host plants already reported suggest that the true range may be greater still. Note therefore, that the Google translation of the relevant information given on one website (Chiang, 2009) additionally refers to "willow ... elm ... oak ... pine ... maple ... walnut ... crabapple ...", but clearly neither the quality of the translation nor the original accuracy of the intended usage of the common names can be validated.

Host genera such as *Prunus* and *Populus*, including known host species in these genera, occur very widely in much of the UK (BSBI Tetrad maps). As well as wild species, many of these trees have been planted as ornamentals in parks and private gardens, as well as for domestic and commercial cultivation (*Prunus* spp.), or as windbreaks (*Populus* spp.). *Prunus* spp. and *Populus* spp. account for c. 5% and 0.8% respectively of trees and shrubs in urban areas in England (Britt & Johnston, 2008). The area in the UK planted commercially for various plums has remained consistent over the past 5 years, at between 850 and 890 hectares. Cherry production covers approximately 400 hectares but accurate figures are not available (Basic Horticultural Statistics, 2012).

7. If the pest needs a vector, is it present in the UK?
Aromia bungii does not need a vector.

8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK? (*By pathway*):
In 2008 three *A. bungii* adults were found between wooden pallets in a warehouse (Reid & Cannon, 2010) suggesting that solid wood packaging is likely to be an important pathway for the entry of this pest. In the same year *A. bungii* was intercepted in the United States in a manufacturing plant which imports products from China and Taiwan (Smith, 2009). Association with wood packaging was not specifically mentioned, but this or hitch-hiking with the imported products could be the pathway for this interception.

In Germany *A. bungii* was found on a plum tree in a private garden, however this was an old tree and the origin of the infestation in Germany is not known (EPPO, 2012a). Similarly there is no information at present on the origin of the reported outbreak in Italy.

The lifecycle of *A. bungii* is reported as 2-3 years, with the beetle attacking the trunk and larger branches (Yu Gui-ping & Gao Bang-Nian, 2005; Wang Jing-tao *et al.*, 2007; EPPO,

2012c). Duffy (1968) states that the larvae feed sub-cortically in the sapwood until nearly mature and then penetrate the heartwood to pupate.

Of the pathways considered below the pest is most likely to be associated with solid wood packaging and plants for planting. However the analysis of phytosanitary certificates of plants for planting imported from third countries suggests that the known host species are unlikely to be imported directly from South East Asia, where this beetle is present. The only recent record of an import was of *Punica* from Japan, where the beetle has not been recorded. Imports of plants for planting within the EU are likely to be higher risk, in particular from Italy, from which trees are regularly imported (e.g. http://www.europlants.net). Hitch-hikers are potentially possible on any import or conveyance of imported goods, however the risk would be limited to the adults and association of more than one adult with a consignment is very unlikely. Plants for planting and cut branches with foliage of *Prunus* are prohibited from non-European countries but dormant plants and cut wood could be a risk, and all could be a risk from areas of the EU with outbreaks. Wood chippings are less likely to provide a pathway due to the size of the insect and the lack of transfer possibilities. Additionally the wood from the known hosts is not commonly used for timber, packaging or firewood, with the exception of *Populus*. Solid wood packaging material is often made using wood from poplar trees (*Populus* spp.) because poplar grow relatively quickly and produce timber suitable for the manufacture of pallets, boxes, crates and dunnage, collectively termed solid wood packaging material (Heilman, 1999). Solid wood packaging is the most risky pathway, despite the regulations for treatment of packaging materials, as this is a proven pathway for entry of longhorn beetles into Europe. Estimates based on the number of shipping containers moving goods from China to the EU suggest that approximately 4 million shipping containers containing solid wood packing material arrive in the EU annually from China.

	Very unlikely	Unlikely	Moderately likely	Likely	Very likely
Solid wood packaging:	☐	☐	✓	☐	☐
Plants for planting:	☐	✓	✓	☐	☐
Wood:	☐	✓	☐	☐	☐
Hitch-hiker:	✓	☐	☐	☐	☐

9. How likely is the pest to establish outdoors or under protection in the UK?

Host genera such as *Prunus* and *Populus*, including known host species in these genera, are widely distributed in much of the UK (BSBI tetrad maps). Infestations of trees in the wider environment have occurred in Germany and Italy (EPPO, 2012a; EPPO, 2012b). While the source of the two European infestations are not known, it seems likely that they originated from specimens associated with Asian imports that were able to locate suitable hosts outdoors.

Aromia bungii is native to areas that include the northern provinces of China, where mean winter temperatures are much lower than those recorded in the UK, thus the potential distribution is unlikely to be limited by survival of overwintering larvae. However, mean summer temperatures in the native distribution are much higher than in any part of the UK,

and this may limit the pest's development and hence establishment, particularly in northern areas of the UK. Evidence of larval development and subsequent adult emergence in planted trees has been found in both Germany (EPPO, 2012a) and Italy (EPPO, 2012b). This suggests that summer temperatures lower than those in parts of northern China did not prevent at least some individuals from completing their development. Although summer temperatures in Bavaria, and especially the Naples area of Italy, are much warmer than southern UK, establishment outdoors in the UK is considered to be likely because this species spends most of its life cycle inside trees where it is buffered from outside temperatures. The reported length of the larval stage in China is 2–3 years (Yu Gui-ping & Gao Bang-Nian, 2005; Wang Jing-tao *et al.*, 2007). Species with similar life cycles from the same area of Eastern Asia, e.g. *Anoplophora glabripennis* and *A. chinensis*, have been able to complete their life cycle in the UK (*A. glabripennis*) and the Netherlands (*A. glabripennis* and *A. chinensis*) and the larvae of these species show variable development times depending on the environment. It is possible, therefore, that, in cooler summer temperatures, the larval stage of *A. bungii* may be capable of extending the length of its lifecycle to compensate.

The potential distribution map produced by the USA (Smith, 2009) does not indicate that the UK is at risk. However, since it was produced a few years ago based on restricted distribution data from China and also excludes Italy from the area at risk, this map now needs to be revised.

Establishment is considered to be very unlikely under protection, because the majority of suitable hosts are grown outdoors. Occasionally host trees may be grown in botanical glasshouse collections, but establishment in these sites is considered unlikely due to the comparative scarcity of suitable hosts and the lack of an obvious pathway for introduction.

	Very unlikely	Unlikely	Moderately likely	Likely	Very likely
Outdoors:				✓	
Under protection:	✓				

10. How quickly could the pest spread in the UK?

Although there is no information in the literature, the dispersal abilities and habits are likely to be similar to *A. glabripennis.* *Anoplophora glabripennis* will tend to disperse from its host tree less than 100m or not at all at low population densities, but can disperse 1 or 2 km, especially at high population densities. As host genera are commonly grown in the UK, host availability is unlikely to limit natural spread.

In Italy, there are seven records west of Naples (Massaro & Passari, 2012) with adults being found since 2010 (Garonna, 2012). It is not known how long *A. bungii* has been present in Italy, but surveys to date have not found evidence of the pest beyond these localities (Massaro & Passari, 2012).

As the larvae are internal feeders in trees, low infestations and/or young larvae may be undetected and thus be moved in trade with growing trees or wood. However, to form a breeding population, a sufficient number of larvae would have to be moved to the same location. Although this may reduce the rate of spread, Garonna (2012) provides a photo of a heavily infested tree trunk.

	Very slowly	Slowly	Moderate pace	Quickly	Very quickly
Natural spread:		✓			
In trade:			✓		

11. What is the area endangered by the pest?
In the absence of further data on the biology of this pest, any area where the hosts are prevalent would be considered to be endangered, with the greatest risk to trees and commercial orchards in southern England and ornamentals in urban areas.

12. What is the pest's economic, environmental or social impact within its existing distribution?
In China the main hosts of *A. bungii* are considered to be peach and apricot, although it also causes considerable damage to plums and attacks other tree species, most notably for the UK, cherry and poplar (EPPO, 2012c; Liu, 2007; Wu & Li, 2005). In China it has been reported that *A. bungii* can damage 30-100% of the fruit trees (Liu *et al*., 1997), although there is no record of tree or crop losses. Some authors indicate that members of the genus *Aromia* prefer young trees, infesting healthy and slightly stressed trees, and this is borne out by the preferences of the European species, *Aromia moschata* (Uhthoff-Kaufmann, 1990; Ostojá-Starzewski & Baker, 2012).

Very small		Small		Medium		Large	✓	Very large	

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?
Prunus and *Populus* are widespread in the UK: in commercial fruit orchards (plums, cherries and poplars often used as windbreaks), parks, private gardens and the wild. The value of plums alone to the UK markets is over £12 million (Basic Horticultural Statistics, 2012). From the information available, damage to young trees would be expected and therefore newly planted areas would be particularly at risk. There may also be problems with safety of these trees, particularly along roadsides, as weakened trees may fall down causing accidents and injury.

The impact for the UK is rated as medium due to the uncertainties over the effects of lower summer temperatures on high population densities and lack of definitive data from its native range.

Very small		Small		Medium	✓	Large		Very large	

14. What is the pest's potential as a vector of plant pathogens?
Aromia bungii is not known to vector any plant pathogens.

STAGE 3: PEST RISK MANAGEMENT

15. What are the risk management options for the UK? *(Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors).*

Tree boring beetles are difficult to eradicate. Exclusion of this pest would be the most effective way of managing the risk, however, due to the length of the life cycle and the cryptic nature of the larvae *A. bungii*, like other Cerambycid beetles, is likely to be difficult to detect on infested plants and wood.

Exclusion

Wood packaging

Since the adoption of ISPM 15 (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. In theory, treatments applied to wood packaging material if undertaken according to ISPM 15 *Regulation of Wood Packaging Material in International Trade* (FAO, 2009) should destroy the pest (methyl bromide fumigation or heat treatment at 56° C for 30 minutes throughout the entire profile of the wood including the core). However, concerns have been raised about the efficacy of heat treatment against another wood boring insect (*Agrilus planipennis*) because recent studies indicate that ISPM 15 heat treatment might not be 100% effective (Goebel *et al*., 2010). Therefore investigation of the heat treatment requirements needed to kill *A. bungii* would be recommended. Ionizing irradiation (EPPO standard PM 10/8(1) "Disinfestation of wood with ionizing radiation") has been suggested as a risk management option for other wood boring insects e.g. *Agrilus anxius*.

Wood

EPPO recommends two treatments for wood with or without bark against wood-related insects:

- Irradiation: see EPPO Standard PM 10/8 *Disinfestation of wood with ionizing radiation,* (EPPO, 2009a), this should be effective, but may not always be practical.
- Heat treatment: until the core temperature reaches at least 56°C for at least 30 minutes (EPPO Standard PM 10/6 *Heat treatment of wood to control insects and wood-borne nematodes,* (EPPO, 2009b)). However, in the case of *A. planipennis*, some recent studies indicate that heat treatment at 56°C (or 60°C) for at least 30 minutes might not be 100% effective (Goebel *et al*., 2010). It is not known whether this heat treatment would be effective against *A. bungii*.

Other options which could be considered are:

- Storage in the country of export for sufficient time to allow the adults to emerge: this is impractical because members of this family may delay emergence and it would also be impossible to check compliance.
- Import of wood outside the flight period with processing before the next flight period: this is likely to require too many controls to be practical.

Plants for planting

The existing prohibition in Annex III 2000/29/EU applies only to *Prunus* with leaves, therefore dormant *Prunus* for planting are permitted. *Aromia bungii* is just as likely to be present in dormant trees as those with leaves so this does not offer any protection from this pest. Host plants from other genera would be unrestricted. Due to the difficulty associated with detection and eradication of the pest a prohibition of the hosts from the area where *A. bungii* is known to occur would be the best means of exclusion of the pest from the UK. Alterations to the legislation would be necessary to exclude hosts of risk.

Other options which could be considered to exclude the pest from wood packaging, imported wood and plants for planting are:

Pest free area: the establishment of a pest free area within the range of *A. bungii* from which imports could be made. This may not be feasible because of the unreliability of surveys due to the difficulty of detection.

Pest free place of production: It is unlikely to be feasible to establish a pest free place of production. The growing of plants under complete physical protection to exclude the adults could be considered possible in theory. However when physical protection has been allowed in the past to exclude similar insects from plants for planting it has not been successful. Therefore we do not recommend this as an option.

Eradication and containment

Based on experience with other non-native cerambycids, eradication of *A. bungii* is likely to be difficult and would involve the destruction of infected trees and any other hosts in the

surrounding area. In Italy, infested plum and apricot trees have been destroyed, intensive surveys are being carried out and information campaigns to raise public awareness have been initiated (EPPO, 2012b).

In China entomopathogenic nematodes (*Steinernema spp*.) have been used for the biological control of *Aromia bungii*. Although further examination of some of the Chinese papers on how extensively and effectively they have been used would be useful (Liu *et al*., 1993; Liu *et al*., 1997; Liu *et al*., 1998) this is unlikely to be recommended as a risk management option as it would not give full control.

Insecticide sprays may be effective against adults, but only if direct contact is made, or they consume treated foliage. Injecting trees with systemic insecticides may provide some protection, but no products are currently approved for this use in the UK (Ostojá-Starzewski & Baker, 2012).

16. Summary and conclusion of rapid assessment.
(Highlight key uncertainties and topics that will require particular emphasis in a detailed PRA) General / overall summary and conclusion and then specific text on each part of assessment...

This rapid assessment shows:

Risk of entry: Moderately likely on wood packaging, especially *Populus*, despite the regulations regarding treatment. Unlikely to moderately likely on plants for planting, due to the risks posed by existing EU outbreaks, unlikely on wood and very unlikely as a hitch-hiker.

Risk of establishment: Likely to establish outside in southern UK, based on the availability of hosts and completion of life-cycle in Germany and Italy.

Economic impact: Medium, based on the importance of *Prunus* and *Populus*, two of the host genera, in the UK, both commercially and to the environment, but also the uncertainties regarding the effects of lower summer temperatures on high population densities and lack of definitive data from its native range.

Endangered area: May be limits on the development of this pest in northern parts of UK, but in the absence of further data on the pest's biology any area where the hosts are prevalent would be considered to be endangered.

Risk management: Tree boring beetles are difficult to eradicate due to the length of their life cycle and their cryptic nature. Exclusion would be the most effective way of managing risk and destruction of infested plant material would be necessary in the event of an outbreak.

Key areas of uncertainty:
Note: most publications are written in Chinese. Some of these may be useful in providing additional information and have been listed as extra sources, however translation would be necessary and for the purposes of the time available for this rapid assessment this has not been possible. The lack of information leads to some uncertainties over this assessment

1. Climatic requirements for the development of this pest – the map produced by USA (Smith, 2009) does not show the UK at risk, but taking other information into consideration this is likely to be incorrect.
2. The length of its life cycle and ability to develop under different climatic conditions; particularly its ability to extend the duration of its life cycle for additional years.
3. Full access to the Chinese literature and detailed distribution data from which climate modelling can be undertaken.
4. Specific information on the dispersal capacity of *A. bungii*.
5. Control methods used and their effectiveness in China.
6. List of hosts may not be fully known

17. Is there a need for a detailed PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used. *(for PH Risk Management Work stream to decide)* ✓ *(put tick in box)*

Despite a lack of detailed information in some topics, in particular relating to climate and the pest's life cycle, and the possibility that translating some Chinese references may yield more information, it is not considered that a more detailed PRA would substantially alter the assessment of risk of this pest to the UK. However, to help decide what action is appropriate at the EU level, a PRA that considers the risks to all EU member states is required and this will require more detailed study.

No	

Yes	✓	PRA area: UK or EU	EU	PRA scheme: UK or EPPO	To be discussed

18. IMAGES OF PEST

Figure 1. Adult *Aromia bungii* © Crown copyright.

See also the Fera Pest Factsheet (Ostojá-Starzewski & Baker, 2012). Good photos can also be found in Garonna (2012).

19. Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Yes Statutory action	✓	No Statutory action	

Given the known host range, potential for establishment and damage caused by this pest, statutory action is considered to be justified on all findings of this pest. Despite the EU legislation designed to stop this pathway, the greatest risk is still from *Populus* wood packaging from the pests' native range in Eastern Asia, as demonstrated by continuing interceptions of Cerambycids. Since imported plant material from areas where the pest is

present in the EU may also provide a route of entry, measures are also needed to block this pathway. It is suggested that the recent Plant Health (England) (Amendment) Order 2013[3] that requires prior notification of all *Castanea*, *Fraxinus*, *Platanus* and *Quercus* plants for planting imports from the EU be extended to *Prunus* and *Populus*. National measures could also be considered against imports of Italian host trees in particular, by requiring imports only from pest free areas and by actively targeting plant material for inspection.

[3] http://legislation.data.gov.uk/uksi/2013/23/made/data.htm?wrap=true

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Appendix

Map 1: Distribution of *Aromia bungii* (Source EPPO PQR, 5.0.8855, 28th August 2012)