Rapid assessment of the need for a detailed Pest Risk Analysis for *Conogethes punctiferalis* (Guenée)

Disclaimer: 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?

Conogethes punctiferalis (Guenée) (Lepidoptera, Crambidae), yellow peach moth or castor capsule borer.

A frequently used synonym is *Dichocrocis punctiferalis* (Guenée).

This is a complex of species, and incomplete information on their separation has been published to date, with Robinson *et al.* (1994) suggesting that there may be around 20 species in the genus, at least 7 of which may occur in south-east Asia. Two new *Conogethes* species, formerly identified as *C. punctiferalis,* have been identified to date (Inoue & Yamanaka, 2006), but the number of still undescribed species that may be in the complex is unclear. Molecular work suggests that Australian specimens identified as *C. punctiferalis* are dissimilar genetically from Japanese and Chinese specimens by around 6%, indicating the possibility of two species (Armstrong, 2010). However, Zhang *et al.* (2010) studied genetic differences in *C. punctiferalis* from 6 provinces in China (from Beijing to Sichuan), and found they were very similar genetically: some specimens that were geographically distant were more closely related than other specimens from the same province, suggesting a high level of gene flow through interbreeding in the populations studied.

Since the number of species within the complex is unknown and their biology cannot be distinguished, this assessment has been made on information on all putative species within the *C. punctiferalis* species complex. An attempt has been made to separate southern and northern populations in this rapid PRA, which have been assumed to have different levels of cold-adaptation and thus differ in the risk posed to the UK.

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]?

Conogethes punctiferalis is not listed in the EC Plant Health Directive, nor in any of the EPPO lists.

3. What is the reason for the rapid assessment?

Live larvae were first intercepted in England and Wales in 2007 and, in 2011, 13 interceptions of larvae were made (Fera unpublished data), with statutory action recommended on consignments of fruit with the pest. Due to reports of damage to apples in Northern China (CABI, 2011), these UK findings were considered to be significant and a rapid PRA was requested to clarify the threat to the UK. *Conogethes punctiferalis* is a pest of concern to the NPPOs of several countries including New Zealand, South Africa, Canada and the USA.

STAGE 2: RISK ASSESSMENT

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

Conogethes punctiferalis is found in Asia (from India eastwards) and Australasia. The full list of countries the *C. punctiferalis* species complex has been recorded from are: Australia, Brunei Darussalam, Burma, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, North Korea, Papua New Guinea, Philippines, South Korea, Sri Lanka, Taiwan, Thailand and Vietnam (CABI,

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

2011). Interceptions of the pest in fruit from Pakistan have been made by both the Plant Health and Seeds Inspectorate (PHSI) of England and Wales (Fera unpublished data) and the Plant Protection Service in the Netherlands (M. van der Straten, pers. comm.).
While much of the species' distribution is in the subtropics, *C. punctiferalis* has also been recorded from Hokkaido prefecture, north Japan (Inoue & Yamanaka, 2006), and northern China (CABI, 2011).

5. Is the pest established or transient, or suspected to be established/transient in the UK? *(Include information on interceptions and outbreaks here).*
Larvae have been detected inside tropical fruit 18 times in the last 5 years (Table 1), at 3 points of entry. A single additional adult was found in a light trap in Cornwall in 2007 (Truscott, 2007), but this finding was assumed to be an individual that had emerged from imported fruit. There have been no other adults trapped in Europe to date, and there is no evidence of any UK or European populations. The adult is distinctive and therefore unlikely to be overlooked.

Table 1. Interceptions of *Conogethes punctiferalis* by the PHSI in England and Wales between 2007 and 2011(Fera unpublished data)

Host	Origin	Year(s) intercepted
Annona squamosa (sugar apple)	India	2011
Mangifera indica (mango)	India	2011
Psidium guajava (guava)	India	2011
Psidium guajava	Pakistan	2008 (twice), 2009 (twice), 2011 (eight times)
Psidium guajava	Sri Lanka	2011
Psidium sp.	Thailand	2011
Psidium sp.	Unknown	2007

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?
Conogethes punctiferalis is a highly polyphagous pest, the larvae boring into fruit, seeds and stems of plants in many different families.
Economic hosts grown in the UK include *Allium cepa* (onion), *Malus* (apple), *Prunus* (plum, cherry), *Pyrus* (pear), *Vitis vinifera* (grape vine), and *Zea mays* (maize) (Inoue & Yamanaka, 2006).
Other recorded hosts include *Castanea* (chestnut), *Citrus*, *Curcuma longa* (tumeric), *Durio zibethinus* (durian), *Elettaria cardamomum* (cardamom), *Helianthus annuus* (sunflower), *Punica granatum* (pomegranate), *Quercus acutissima* (Japanese chestnut oak), *Ricinus communis* (castor oil plant), *Tectona grandis* (teak), *Theobroma cacao* (cocoa tree), *Zingiber officinale* (ginger), and many others (Robinson *et al.*, 2010).
Reports of *C. punctiferalis* on *Pinus* (pine), *Larix* (larch), *Cedrus* (cedar), *Abies* (fir) and other Pinaceae are likely to be *C. pinicolalis*, a species that was first described in 2006 (Inoue & Yamanaka, 2006). Previous experiments showed that larvae of the 'fruit feeding type' of *C. punctiferalis* did not respond to extracts of conifers (Honda & Matsumoto, 1987).

7. If the pest needs a vector, is it present in the UK?
No vector is required. This is a free-living organism.

8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK and transfer to a suitable host? (*By pathway*):

Immature stages on fruit imported from southern areas of the species distribution.

Viable larvae have been detected on imported fruit in the UK on 18 occasions since 2007, all in tropical or subtropical fruit.

Pathway: southern specimens	Very unlikely	
	Unlikely	
	Moderately likely	X
	Likely	
	Very likely	

Immature stages on fruit imported from northern areas of the species distribution.

No UK interceptions of *C. punctiferalis* have been made in fruit from the more northerly parts of the species distribution.

Pathway: northern specimens	Very unlikely	
	Unlikely	
	Moderately likely	X
	Likely	
	Very likely	

For specimens from all parts of the species range, the number of larvae moved in trade is likely to be small as many damaged fruit will fail quality controls. Larvae feed hidden inside the fruit, and although they have been detected on tropical produce because the holes (with or without secondary rot) are visible, they may remain undetected by inspectors and the fruit will be discarded before or after sale. The wide host range increases the potential for emerging adults to find suitable hosts.

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

More than one larva has been found in fruit so it is possible for a founder population to occur. It is highly polyphagous with several hosts (including apples) grown in the UK.

Conogethes punctiferalis larvae from southern areas in tropical fruit are unlikely to be able to establish in the UK, as the populations are assumed to require higher development temperatures.

Northern populations are recorded from Hokkaido prefecture in northern Japan (Inoue & Yamanaka, 2006) and northern China (CABI, 2011), where mean winter temperatures are much lower than the UK, so cold-adapted specimens from the northern part of the distribution would be capable of overwintering. However, these areas have warmer summer temperatures, so it is possible that UK summers will be too cool for successful development.

Outdoors: southern specimens	Very unlikely	X	Outdoors: northern specimens	Very unlikely	
	Unlikely			Unlikely	
	Moderately likely			Moderately likely	X
	Likely			Likely	
	Very likely			Very likely	
Under protection: southern specimens	Very unlikely	X	Under protection: northern specimens	Very unlikely	X
	Unlikely			Unlikely	
	Moderately likely			Moderately likely	
	Likely			Likely	
	Very likely			Very likely	

The pest has not been recorded in protected cultivation.

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

Southern populations are likely to be limited by temperature, and in order to spread, the pest would need to transfer into new sites of protected cultivation. Larvae feed concealed in fruit, and therefore could be moved in internal trade as their presence may not be detected at harvest, but would then need to transfer to a growing crop to form a new population.

Northern populations will be capable of dispersing naturally outdoors, at least in summer. Adults have wings and can fly, although their natural dispersal capability is not known. As the larvae are highly polyphagous, they are unlikely to be limited by host availability, and, if moved in trade, would be capable of establishment if sufficient numbers could form a breeding population.

Natural spread: southern specimens	Very slowly	X	Natural spread: northern specimens	Very slowly	
	Slowly			Slowly	
	Moderately pace			Moderately pace	X
	Quickly			Quickly	
	Very quickly			Very quickly	
In trade: southern specimens	Very slowly		In trade: northern specimens	Very slowly	
	Slowly	X		Slowly	
	Moderately pace			Moderately pace	
	Quickly			Quickly	X
	Very quickly			Very quickly	

11. What is the area endangered by the pest?

Southern populations are likely to be adapted to higher temperatures, and are very unlikely to establish in the UK outside protected cultivation. However, no information was found on cold-tolerance or the temperatures required for the development of the southern populations.

The northern populations of this pest in Asia survive lower mean winter temperatures than those recorded in most parts of the UK, though the mean summer temperatures are higher in northern Japan and China. A Master's thesis (date unknown) on populations from Hebei Province in northern China calculated threshold temperatures of: 8.4^{o}C for eggs, 7.3^{o}C for larvae and 11.3^{o}C for pupae, but also found that winter mortality in larvae was high. Since summer temperatures may limit development in the UK, southern UK would be most endangered by northern populations.

12. What is the pest's economic, environmental or social impact within its existing distribution?

Impacts appear variable throughout the species range and occur on different hosts. However, few references provide more than anecdotal evidence of damage or isolated field reports of damage on a single crop. Impacts also vary considerably from year to year on the same crop in the same location (Devasahayam *et al.*, 2010). The amount of harm caused by *C. punctiferalis* can also be difficult to determine due to damage by other pests in the same crop, and the attraction of secondary pests and diseases to existing damage (CABI, 2011).

Southern populations in Australia are a minor and irregular pest of sorghum, maize and cotton, with one larva considered to feed on 1 g of seed (Queensland government, 2010), but Astridge (2001) regards *C. punctiferalis* as one of the major pests in north Queensland on *Nephelium lappaceum* (rambutan) and *Durio zibathinus* (durian). CABI (2011) reports it is a major pest of castor with 5% yield loss reported in Chinese maize.

Specific data on damage caused by *C. punctiferalis* in the northern part of the species range have not been published. Honda *et al.* (1979) stated that *C. punctiferalis* is an important pest of chestnut and peach in Japan, and CABI (2011) reported damage to apples in Northern China. The paucity of references suggests that this species is not a major pest.

Southern specimens	Very small	
	Small	
	Medium	X
	Large	
	Very large	

Northern specimens	Very small	
	Small	
	Medium	X
	Large	
	Very large	

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?

The following judgements are highly uncertain, for both populations, due to lack of reliable information on existing impacts and development temperatures. Larvae are cryptic (feeding inside fruit and stems), so low infestations of the pest might not be detected until damage was more severe.

Southern populations of *C. punctiferalis* might cause some transient damage but will be very poorly adapted to conditions in the UK.

Northern populations, while able to survive outdoors, are likely to have fewer generations per year than in warmer regions, and thus UK pest populations would not be expected to build up to high levels. However, damage to high-value crops may be increased by secondary pests and pathogens invading damaged fruit.

Southern specimens	Very small	X
	Small	
	Medium	
	Large	
	Very large	

Northern specimens	Very small	
	Small	
	Medium	X
	Large	
	Very large	

14. What is the pest's potential as a vector of plant pathogens?

Conogethes punctiferalis is not a known vector of any plant pathogen.

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).*

Non-statutory controls – it is possible to monitor *C. punctiferalis* using light and pheromone traps. Adults, though highly distinctive, are nocturnal, and larvae feed inside fruit and stems, making detection of low numbers of the pest problematical. The larvae would be difficult to control by chemical treatments because they can bore into fruit and are hence more difficult to target. In addition, some of the hosts have flowers that attract honeybees and other pollinators. One of the control methods used in China is to put bags over individual fruits. This method would not be economically viable in the UK due to higher labour costs.

Southern populations of *C. punctiferalis* are very unlikely to be found in protected cultivation, where eradication or containment options would probably be successful, with appropriate management.

For northern populations, continued exclusion would be the best management option. Eradication or containment is likely to be difficult for outbreaks outdoors because of the mobility of the pest, the range of hosts and the difficulty of treating the pest inside fruit. Exclusion efforts could be concentrated on imports of temperate fruit from the northern area of the species range (China, Korean and Japan), which are considered to pose a greater risk to the UK. The only UK interceptions to date have been from southern areas, suggesting the northern pathway may be small. Even though larvae feed hidden inside fruit, they have been detected on tropical produce, as holes (with or without secondary rot) are usually visible on the surface. However, the wide host range would make targeting of specific commodities difficult.

16. Summary and conclusion of rapid assessment.

(Highlight key uncertainties and topics that will require particular emphasis in a detailed PRA)

This rapid assessment has a high level of uncertainty since *C. punctiferalis* is a very poorly defined species complex. There is also confusion over the specific identity of the species studied in literature, both recent and historic, due to Japanese work separating new species from the *C. punctiferalis* complex. It is also likely that there are further undescribed species within the species '*C. punctiferalis*' as currently delineated. The division into 'northern' and 'southern' populations of *C. punctiferalis* in this rapid risk assessment is therefore an assumption: published data on the cold-tolerance of 'southern' populations are not available.

This rapid assessment shows:

Risk of entry

The risk of entry for southern and northern populations is moderately likely. Living larvae have been intercepted by the UK in tropical fruit imported from southern parts of the species range. No interceptions from northern areas have been made. At least one adult (origin unknown) has emerged naturally and been caught in the wider environment.

Risk of establishment

Southern populations of the pest are considered to be very unlikely to establish as they could only survive in protected cultivation. If adults from northern populations were able to emerge and form a breeding population (which is considered moderately likely), these populations of the pest appear likely to be capable of persisting outdoors in much of the UK because the species can survive in northern China which has very cold winters. However, summer temperatures in the UK are lower, which may have consequences for development and suggests southern UK would be most at risk.

Economic impact

In the UK, this is likely to be low but this judgement is uncertain. Populations are very unlikely to establish in protected cultivation. Any transient southern population outdoors will cause very minor impacts. Northern populations are unlikely to build up to damaging levels. However, since the damage caused by *C. punctiferalis* may enable secondary pests and pathogens to further damage fruit, the impact has been rated as moderate.

Endangered area

Southern UK is particularly at risk from northern populations of the pest.

Risk management
Southern populations are very unlikely to establish. For northern populations of *C. punctiferalis*, continued exclusion would be the best management option.

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.

No	X

Yes		PRA area: UK or EU		PRA scheme: UK or EPPO	

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

Yes Statutory action	X*	No Statutory action	

For the UK, statutory action is only appropriate for imports from northern populations (i.e., China, Korea and Japan). Statutory action is recommended when the pest is found on plants for planting (on any type of plant) AND on certain temperate fruit produce (e.g. *Malus* (apple), *Prunus* (plum, cherry), *Pyrus* (pear). Statutory action is not recommended when the pest is found on other hosts including tropical or sub-tropical produce, especially those on which the pest has already been detected such as *Annona squamosa*, *Psidium* sp. and *Mangifera*, as the pest would not be expected to survive in the UK.

19. IMAGES OF PEST

Conogethes punctiferalis larva, which reaches a maximum length of around 20 mm.

Conogethes punctiferalis adult. The wingspan is approximately 22–30 mm.

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