The Food and Environment Research Agency

Rapid Pest Risk Analysis for

Anthonomus eugenii (the Pepper Weevil)

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?
Anthonomus eugenii Cano (Coleoptera: Curculionidae); the Pepper Weevil

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]?
The pest is not listed in the EC Plant Health Directive but it has been recommended for regulation as an A1 quarantine pest by EPPO since 1994.

3. What is the reason for the rapid assessment?
A serious outbreak on four *Capsicum* glasshouses situated closely together in the Westland area of the Netherlands was reported to the European Commission in July 2012 (first finding on 19th July 2012) raising widespread concerns. A Summary PRA for the UK was written nearly twenty years ago (Baker, 1993) at a time when the EU did not import *Capsicum* from countries where *A. eugenii* was present, i.e. North America. There is now trade in fresh *Capsicum* from North America to Europe and hence an update was considered to be important by the Plant Health Risk Management Workstream in September 2012.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?
North America, Central America and Oceania:
Mexico, USA (Arizona, Arkansas, California, Florida, Georgia, Hawaii, Louisiana, New Mexico, North Carolina, South Carolina, Texas, Virginia), Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Puerto Rico and South Polynesia (CABI, 2012).
Anthonomus eugenii is considered to have originated from Mexico and is now found outdoors across southern USA from Florida to California (Capinera, 2008) with occasional records further north. It has been eradicated from Canadian greenhouses in 1992 (Costello & Gillespie 1993) and 2010 (CFIA, 2010). In 2012 eradication measures have been taken in four Dutch glasshouses.

5. Is the pest established or transient, or suspected to be established/transient in the UK? *(Include summary information on interceptions and outbreaks here).*
Not established or transient. No interceptions have been recorded.

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

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?

Capsicum annuum, the sweet and chilli pepper, is the primary host of most concern to the UK. Other *Capsicum* species, e.g. *C. frutescens* (cayenne pepper), are attacked. Several *Solanum* species, including *S. melongena* (aubergine), are also hosts. One *Solanum* host, *Solanum rostratum* (the buffalo bur), an American invader, has been established in the UK since the 1800s and, although rare, it is now relatively widespread outdoors in southern and central England (Vallejo-Marin, 2012). Other wild *Solanum* species, e.g. *S. dulcamara* and other nightshades, growing widely in the UK may be at risk although they are not recorded as hosts. Although adults may feed on other Solanaceae, including potato, tomato, *Petunia*, *Nicotiana, Physalis* and *Datura,* oviposition and development has not been observed (Patrock & Schuster, 1992). However, Capinera (2008) reports that tomatillo, *Physalis philadelphica*, is a moderately susceptible host.

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? (*By pathway*):

<u>*Capsicum* fruit</u>

The Netherlands Quick Scan PRA implicates *Capsicum* fruit as the main pathway of introduction but the pathway is unknown (Netherlands Plant Protection Organization, 2012). No interceptions of *A. eugenii* have been recorded on *Capsicum* in the EU but larvae have been found by the Netherlands in aubergines from the Dominican Republic in 1999 (De Goffau (1999) cited by Netherlands Plant Protection Organization (2012)). The Canadian PRA (CFIA, 2011) implicated the imports of fresh *Capsicum* from the USA in the outbreaks that occurred. Other pathways, e.g. ornamental *Solanum* that bear attractive fruit, are prohibited by the EC Plant Health Directive.

Only small amounts of fresh or chilled sweet peppers are imported into the EU (Table 1). None of these imports were made by the UK. In 2011, 2,700 kg were imported by Spain from the USA and Mexico and, in 2009, 5,200 kg were imported by the Netherlands from the USA.

Table 1: UK and EU imports of fresh or chilled sweet peppers from US or Mexico (CN 07096010). Quantity in 100kg. Data from EUROSTAT

	UK Imports		EU Imports (EU MS)	%of EU Imports imported by the UK
Year	USA	Mexico	USA & Mexico	
2011	0	0	27 (ES)	0%
2010	0	0	0	-
2009	0	0	52 (NL)	0%
Total	0	0	79	0%

However, EUROSTAT also shows that large quantities of other *C. annuum varieties*, presumably chillies, are imported from the USA and Mexico (Table 2). Imports into the UK account for the majority of the EU trade. Some of these shipments will not be suitable pathways as they are Pimenta, e.g. allspice, though this is a Caribbean export. However, there is still likely to be a significant volume of fresh or chilled chilli imports.

Table 2: UK and EU imports of fresh or chilled fruits of Genus *Capsicum* or *Pimenta* excluding sweet peppers and industrial manufacture (CN 07096099).

Quantity in 100kg. Data from EUROSTAT

	UK Imports		EU Imports	
Year	USA	Mexico	USA & Mexico	%of EU Imports imported to the UK
2011	250	1383	2,699	60.5%
2010	540	750	2,687	48.0%
2009	1344	891	3,565	62.7%
Total	2134	3024	8,951	57.6%

Association with the pathway is likely because *A. eugenii* is an important pest of *Capsicum* in Mexico and southern USA and complete control is difficult to achieve. It may be present in the crop almost year round. In Florida, adults are found throughout the year except in December and January (Burke & Woodruff, 1980) but are commonest between March and June according to the availability of peppers (Capinera, 2008). Adults overwinter (but require continuous fruit because they do not diapause) and are long-lived; 3-5 overlapping generations occur per year (8 can be reared in an insectary) (Capinera, 2008).

Movement in trade is also likely because the pest is very difficult to detect and the conditions for transport of fresh *Capsicum* are not likely to cause survival problems. Eggs are laid in flower buds, young fruit, especially the calyx (Toapanta *et al*. 2005) and occasionally the pedicels (stalks) (Burke & Woodruff, 1980 quoting studies carried out in the 1930's) and will be very difficult to detect. The larvae develop and pupate in the fruit and can also be very easily overlooked on inspection. Development from egg to adult may take three weeks (Burke & Woodruff, 1980; Gordon & Armstrong 1990) with a complete generation taking 20-30 days (Capinera, 2008) indicating that individuals may still be in the fruit on arrival in the UK. The EPPO datasheet (EPPO, 1997) states that "Adults can survive prolonged cool conditions (2-5℃) for over 3 weeks and therefore c ould survive long distance transportation under refrigerated conditions" based on a study by Costello and Gillespie (1993) in British Colombia. Survival on dried Capsicum is also potentially possible. There is a trade in dried chillies from Mexico (Casa Mexico, 2012), and these chillies are dried in the sun, rather than desiccated. No information on the pepper weevil is specifically available, but eggs of some pests, e.g. Indian meal moth (*Plodia interpunctella*) are known to have been intercepted on dried chillis (PHSI *pers comm*.).

Transfer to *Capsicum* or other hosts growing in the UK is moderately likely because it would require close contact between the imported consignment and the production nursery. Although the proportion is not known, packhouses and growers do occur on the same site in the UK, or in close proximity, with produce being brought in from outside the UK to supplement UK production. The risk of transfer would depend on the hygiene measures in place at the packhouses regarding packing, movement of packaging and waste disposal. Hygiene measures in affected packhouses have been tightened up since the detection of the tomato pest *Tuta absoluta*, and this would also lower the risk from this pest. The adult can fly and reinfect crops from wild *Solanum* species in the USA but such weevils are not known to be capable of long distance flight.

Fruit	Very unlikely	☐	Unlikely	☐	Moderately likely	✓	Likely	☐	Very likely	☐

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

Anthonomus eugenii has already demonstrated that it is capable of establishing in protected *Capsicum* crops in Northern USA, Canada and the Netherlands. Without specific measures, establishment would only be prevented if there is a complete host crop break with a careful clean-up. Although there are sufficient degree days for development outdoors (256.4 degree days with a minimum threshold temperature for development of 9.6ºC in Jalapeno peppers (Toapanta *et al*., 2005), this is a warmth loving organism with an optimum temperature for development of 30ºC (Toapanta *et al*., 2005). There is a very restricted range of outdoor plants it could attack in the UK and their fruit is only available for a short period of time. In addition, overwintering outdoors is very unlikely because the pest cannot diapause.

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

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

The pest is not a strong flier but the contamination of four closely situated protected Dutch *Capsicum* crops suggests that it may be able to move between glasshouses, e.g. from piles of discarded fruit. Contaminated fruit can be quickly disseminated by wholesalers to points of sale and then to consumers. At each stage any infested fruit found is likely to be placed in the bin or the compost heap from where adults can emerge. These adults might find wild *Solanum* species, ornamental *Solanum* species, e.g. *Solanum pseudocapsicum*, or home-grown *Capsicum* but these are likely to provide only temporary hosts and the likelihood of finding a *Capsicum* nursery is low.

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

11. What is the area endangered by the pest?

All protected *Capsicum* cultivation in the UK is endangered. In 2010 this amounted to 72 hectares of sweet peppers giving a yield of 266 tonnes per hectare and a total production marketed of 19,200 tonnes; at £1,047.77 per tonne this gives a value of £20,067,000 (Defra, 2011). Over the last ten years, the area grown has increased 1.5 times. There are also a number of specialist chilli pepper growers in the UK (UK Chilli Growers, 2012).

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

Both larvae and adults feed on and destroy buds. Adult oviposition and feeding punctures appear as dark specks on the fruit but, although these are not very damaging (Capinera, 2008), Bruton et al. (1989) found that they can allow entry of *Alternaria alternata* (a fungal pathogen with many hosts) causing internal moulds in otherwise symptomless sweet peppers. Fruit deformation followed by fruit drop caused by internal larval feeding is common. Larvae usually feed on the seed core but occasionally tunnel into the walls. Infested peppers are black inside and full of frass. Riley & Sparks (1998) state that this is a severe pest of *Capsicum* and can result in crop losses of up to 50 percent and "*often, entire pepper fields must be plowed under because too few fruit are left to harvest, and the infestation poses a threat to later pepper plantings. Up to 90 percent fruit loss has been measured in experimental plots infested early in the season and left untreated. Additionally, even moderate infestations late in the season can cause complete loss of fields. Larger fruit do not immediately drop when they become infested, and entire fields are often abandoned because of concern in shipping infested fruit to markets*".

Very small		Small		Medium		Large		Very large	✓

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

Outbreaks in protected *Capsicum* production are likely to have serious impacts because: (a) once infested there is no reliable method of control, (b) serious damage may well have occurred before detection and (c) attempting to market a crop that might contain significant numbers of weevil larvae and pupae that cannot be detected by visual inspection may lead to complete crop rejection and a loss of reputation. As such, the only recourse may be to destroy the crop and clean the glasshouse.

Trade outside the EU is unlikely to be affected because of limited export trade in *Capsicum* to the few countries (Argentina, Brazil, Chile, Paraguay, Uruguay, Jordan and East Africa) for which *A. eugenii* is an A1 listed organism (EPPO, 2012).

Very small		Small		Medium		Large	✓	Very large	

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

Bruton et al. (1989) found a close relationship between pepper weevil and internal mould cause by *Alternaria alternata* in sweet pepper cultivation but the pest may merely be providing this pathogen to enter by wounding the fruit (Capinera, 2011).

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).*

Exclusion

Assuming the pest has been eradicated in the Netherlands and is not present anywhere else in the EU, the most effective measure to prevent the entry of the pest into the UK would be via the listing of *Anthonomus eugenii* in the Annexes of Council Directive 2000/29/EC. It is considered that the most appropriate additions to 2000/29/EU would be to add:

- *Anthonomus eugenii* to Annex IAI
- Requirements for fruit of Capsicum originating in North America, Central America and Oceania to Annex IVAI. These could include requirements for fruit to have originated

either in an area or place of production which is free from *Anthonomus eugenii*. Dried chilli can be safely imported.

The addition of *Anthonomus eugenii* in Annex IAI with IVAI requirements on fruit of Capsicum would mean that Capsicum fruit originating in North America, Central America and Oceania being imported in to the UK would need to be accompanied by a phytosanitary certificate.

Eradication and containment
It is unlikely that the pest could be eradicated from UK pepper crops by using insecticides, because these are only effective against adults and the juvenile stages of the pest occur inside the fruit. In addition, most of the products recommended for the control of the pest in the USA are not registered in the EU. Implementing a crop break and intensive hygiene measures are likely to be the only method that could be used to eradicate the pest. In Canada (CFIA, 2011), the infested glasshouses are kept warm during the crop break (which would be expensive in heating costs) and they have used fumigants (there are no suitable fumigants available in the UK).

Control
There are two active ingredients used for controlling the pest in the USA that could potentially be used in the UK – pyrethrins and *Beauvaria bassiana*. However the use of these alone are unlikely to be sufficient to control the pest in a UK pepper crop. It may be necessary to investigate biological control agents (there are none registered at present for controlling this pest) or try to get approval for the use of other insecticides.

16. Summary and conclusion of rapid assessment.

This rapid assessment shows:

Risk of entry: Entry on *Capsicum* from Mexico, southern USA, central America and Oceania is considered to be moderately likely. Transfer to suitable hosts depends on close contact between the imported consignment and the production nursery and the hygiene measures used at packing sites regarding the packing process, packaging and waste disposal.

Risk of establishment: the likelihood of establishment outdoors in the UK is very low because it is warmth-loving, has no adaptations to over-wintering and limited hosts. Although experience indoors in Canada and the Netherlands suggests that establishment indoors is very likely, survival in glasshouses will depend on the extent to which there is a crop break with rigorous hygiene.

Economic impact: Outbreaks in protected *Capsicum* production are likely to cause serious impacts because detection of even a serious outbreak can be difficult, there is no reliable method of control and the whole crop may need to be destroyed.

Endangered area: All protected *Capsicum* crops are at risk.

Risk management: Without effective control methods, crop destruction is likely to be the only method available. To prevent entry, listing of the pest in Annex IAI and the inclusion of fresh *Capsicum* from North America, Central America and Oceania in Annex IVAI are the only clear risk management options available.

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)*

The risks posed by this species to protected UK *Capsicum* production are clear-cut and a more detailed PRA is unlikely to yield more useful information. However, if proposed for listing as an Annex IAI pest with possible Annex IVAI measures, then the risks to the rest of the EU, particularly southern Europe, may need to be assessed.

No	✓

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

18. IMAGES OF THE PEST

	
John L. Capinera, University of Florida *http://edis.ifas.ufl.edu/pdffiles/IN/IN55500.pdf*	*John L. Capinera, University of Florida* *http://edis.ifas.ufl.edu/pdffiles/IN/IN55500.pdf*

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

To prevent entry, the only clear options would be to add:

- *Anthonomus eugenii* to Annex IAI of Directive 2000/29/EC and,
- Requirements for fresh *Capsicum* fruit from North America, Central America and Oceania to Annex IVAI

Yes Statutory action	✓	No Statutory action	

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