The Food & Environment Research Agency

Rapid Pest Risk Analysis for

Diabrotica significata

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?
Diabrotica significata Gahan (Coleoptera, Chrysomelidae), the 3-spotted leaf beetle.
A widely used synonym in South America is *Paranapiacaba significata* (Gahan).

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]?
This pest is not listed in the EC Plant Health Directive and is not recommended for regulation as a quarantine pest by EPPO, nor is it on the EPPO Alert List.

3. What is the reason for the rapid assessment?
Phase I of the UK Plant Health Risk Register in the summer/autumn of 2013 identified this species as a priority pest for updating the previous PRA (MacLeod, 1996), primarily to investigate some of the uncertainties over the risk posed to the UK by this species.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?
Brazil (Bechnyé, 1951), though apparently restricted to the southern areas of the country (Cabrera, 1994); Paraguay (Cabrera, 1994); and northern parts of Argentina (Cabrera, 1994). While more temperate in distribution than many neotropical *Diabrotica* species, it appears to be quite rare in the south, apparently associated with forest relics in the Paraná and Uruguay river basins (Cabrera Walsh, 2005). The most southerly records are specimens from two locations in Buenos Aires, Argentina (Cabrera, 1994).

5. Is the pest established or transient, or suspected to be established/transient in the UK? *(Include summary information on interceptions and outbreaks here).*
Diabrotica significata is not present in the UK, and has not been intercepted in this country to date.

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?
The adults are highly polyphagous, feeding on the leaves, shoots and other parts of the plant above ground. There are long lists of adult hosts reported in the literature, from many different plant families.

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF
[2] http://archives.eppo.int/EPPOStandards/PM1_GENERAL/pm1-02(21)_A1A2_2012.pdf

Field caught adults were found on the following hosts, in order of abundance (and hence assumed preference): sunflowers (*Helianthus annuus*), squash (*Cucurbita maxima*), *Solanum sisymbriifolium,* pigweed (*Amaranthus hybridus*), soya beans (*Glycine max*) (Belorte et al., 2003 also recorded this species as a host) and peanut (*Arachis hypogaea*); but adults were not collected on maize (*Zea mays*) (Cabrera Walsh, 2005).
Other recorded hosts include:
Amaranthus quitensis, groundsel tree (*Baccharis articulata*), pawpaw (*Carica papaya*), *Cayaponia* spp., *Chrysanthemum* spp., *Citrillus vulgaris*, lemon (*Citrus limon*) (Cabrera, 1994), cucumber (*Cucumis sativus*), squashes and pumpkins (*Cucurbita moschata*, *C. pepo*), *Cucurbitella asperata*, cardoon (*Cynara cardunculus*), *Dahlia pinnata*, trumpet flower (*Datura arborea*), carnation (*Dianthus caryophyllus*) (Cabrera, 1994), alpine strawberry (*Fragaria vesca*), cotton (*Gossypium hirsutum*), chamomile (*Matricaria chamomilla*), alfalfa (*Medicago sativa*), tobacco (*Nicotiana tabacum*), rice (*Oryza sativa*) (Cabrera Walsh, 2005), runner bean (*Phaseolus coccineus*), lima bean (*P. lunatus*), French bean or haricot bean (*P. vulgaris*), radish (*Raphanus sativus*), *Solanum bonariense*, aubergine (*S. melongena*), potato (*S. tuberosum*), *S. viarum* and maize (*Zea mays*) (all hosts in this list, unless individually referenced, are from Cabrera Walsh (2003)). The South American weed *Indigofera hirsuta* (Frizzas et al., 2004) is also recorded as a host.
Larvae live in the soil and feed on roots, and their hosts have apparently been less studied. Maize and peanuts were noted as favoured hosts for oviposition by adults, though these plants were not preferred for adult feeding (Cabrera Walsh, 2003); pumpkin was another host chosen for egg laying (Cabrera Walsh, 2005). However, larvae did not seem capable of developing experimentally on cucurbit hosts, and, while prepupae were obtained in laboratory cultures of maize, adults never emerged, though whether this was due to the host, some factor in the laboratory culture, or another reason, isn't known (Cabrera Walsh, 2005). Cabrera Walsh (2005) hypothesises that the larvae may be associated naturally with grasses but provides no further comment.
A number of these hosts are of economic importance to the UK. Potatoes, maize and beans are all commonly grown outdoors, while cucumber, strawberries and *Chrysanthemum* are grown in protected cultivation. Other hosts, such as sunflowers, pumpkins and radishes, are very commonly grown by amateur gardeners.

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*):
Cut flowers, fruit and vegetables: Adults could be associated with a variety of produce, as they are so polyphagous. The UK imports plants and plant products from Brazil and Argentina, and the majority of the imports are in the form of produce. However, only 14 interceptions of beetles were made from these countries between 1996 and 2013, and none of these were from the family Chrysomelidae. No interception records for *D. significata* could be found, for the UK or elsewhere, suggesting this species is not commonly moving in trade. However, this species has very variable adult markings (a range of which is illustrated in Cabrera, 1994), and species determination is likely to require specialist examination and possibly genitalia dissection. Given the difficulties of identification, intercepted adults may not always be identified to species. Adults are around 4.0–5.5 mm long (Cabrera, 1994) and they could potentially be detected at pre-export or import inspections: members of the English Plant Health and Seeds Inspectorate routinely find many smaller insects during the course of their work. Numbers of individuals associated with produce are likely to be low, and the consignments are rapidly dispersed, thus also dispersing the beetles and reducing the chance of a breeding population establishing. The overall rating for the pathway of cut flowers, fruit and vegetables is unlikely.

Plants for planting (with soil): As the larvae of *D. significata* are root-feeding, all pathways that include, or potentially include, soil may pose a risk. As the larval hosts are relatively unknown, it is unclear if some pathways pose more risk than others. Some pathways, such as potato tubers, are prohibited from all countries in South America. There are UK records of

palm trees being imported from both Brazil and Argentina, including *Butia* spp. and *Trachycarpus* spp.; six of these consignments (all in 2006 and 2007) had plant parasitic nematodes detected, with notes on one sample stating the nematodes were extracted from 200 g of soil. Another consignment of *Phyllanthus* sp. from 1996 was again infested with nematodes. Even if the imported species is not a suitable host, weed species associated with the rootball may provide an alternative host, though small larvae are unlikely to find this material sufficient to complete development.
In an analysis of EUROSTAT data on potential soil-containing imports to the EU from South America generally (e.g., bulbs, rhizomes, corms and rooted plants), over 54,000 tonnes in total were imported from 2005 to March 2011 (EFSA Panel on Plant Health (PLH), 2012). However, only some of this material will originate from the native range of *D. significata*; not all material from the native range will be infested; and only a proportion of this trade will end up in the UK. Therefore, the overall rating of the pathway of plants for planting with soil is also judged to be unlikely.

	Very unlikely		Unlikely	✓	Moderately likely		Likely		Very likely	
Cut flowers, fruit and vegetables:										
Plants for planting (with soil):				✓						

9. How likely is the pest to establish outdoors or under protection in the UK?
Larval hosts are almost unknown, but other *Diabrotica* species have polyphagous larvae, and the adults of *D. significata* are known to be highly polyphagous. Therefore, host availability is unlikely to limit the outdoor UK distribution. No studies on specific development temperatures were found for *D. significata*, nor even basic life history information, such as how it overwinters in the southern part of its range, or if it is capable of multiple generations in a year. Using the reported distribution in South America, the beetle is found from south Brazil to north Argentina. The Köppen−Geiger climate classification map suggests that southern parts of Brazil and north-eastern parts of Argentina are in the same climatic classification as the UK, i.e., warm temperate, fully humid with a warm or cool summer (Kottek et al., 2006). However, by their nature, these global climate zones are rather broad categories that hide a lot of variation, and it is unclear if the UK temperatures will in fact prove warm enough to allow development in summer and/or winter survival. Buenos Aires, the most southerly reported location for *D. significata*, has milder winters and hotter summers than the UK, and, on this basis, the beetle is considered unlikely to be capable of establishing outdoors even in southern Britain, except in the warmest years.
In protected cultivation, while adults will feed on strawberries and assorted protected ornamentals, it is unclear if these are suitable larval hosts. *Diabrotica significata* larvae were not able to complete development on cucurbit hosts in a study by Cabrera Walsh (2005), thus UK cucumber seems at less risk than other protected crops. While temperatures will be higher in protected cultivation, there is no obvious pathway from imported plants to protected cultivation. *Diabrotica significata* has not been recorded as a pest under protection and overall, establishment is regarded as unlikely.

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

10. How quickly could the pest spread in the UK?
No data could be found on the dispersal ability of *D. significata*. The adults can fly, but it is not known how far they can travel. *Diabrotica virgifera virgifera*, a North American species

that was accidentally introduced into Europe, has had the rate of spread modelled at 33 km per year (Hemerik et al., 2004), this figure only taking into account natural spread. However, if the temperature requirements of *D. significata* are higher than *D. virgifera* (which seems likely), the rate of spread will be lower (adults will require a certain minimum temperature to take flight).
In trade, the larvae could spread with plant parts that are grown in soil or may be contaminated with soil, e.g., potato tubers, root vegetables or growing plants. As the larvae are hidden in the soil, low infestations may not be detected, allowing the species to be transported before detection.

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

11. What is the area endangered by the pest?
The pest's natural distribution suggests it requires warmer temperatures than are found in the UK: hot summers and/or mild winters, so southern parts of the UK would be more at risk. Larval hosts, on the scanty information available may be quite restricted (Cabrera Walsh, 2005), and thus the species grown in UK protected cultivation may not provide hosts suitable for development throughout the entire lifecycle.
Southern Europe would appear to be more at risk from this pest than any part of the UK, given the current distribution in South America.

12. What is the pest's economic, environmental or social impact within its existing distribution?
There are no records of this species causing economic damage in its native range, and while host lists have been compiled for *D. significata*, the reports that include this species do so as a minor addition to other species studied, i.e., it does not appear to be a significant enough pest to warrant individual investigation. One trapping study in Argentina caught 16,824 specimens of the notorious pest *Diabrotica speciosa* using a sweep net or aspirator, compared to only 18 *D. significata* (with very similar ratios of the two species caught in traps baited with cucurbit extract) (Cabrera Walsh et al., 2008). In two areas of Brazil, *D. significata* was found to be a more significant part of the chrysomelid fauna, but still comprised less than 10% of the total chrysomelid catches in maize, and less than 5% in cucurbit crops (Laumann et al., 2004). However, the ratios of beetle species from these trapping studies could be very artificial and may not reflect the population sizes or relative pest status, as seasonal factors, crops studied, local climatic conditions, etc., may all significantly affect the local fauna. The impact rating of small was assigned with a precautionary approach, including the possibility that larval damage to roots could be wrongly attributed to *D. speciosa*, which has an overlapping range with *D. significata.*

Very small	Small	Medium	Large	Very large
	✓			

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?
Maize appears to be a less favoured host for adults, though females are recorded as preferring this host for egg laying (Cabrera Walsh, 2005). Adults apparently prefer cucurbits (Cabrera Walsh et al., 2008) and sunflowers (Cabrera Walsh, 2005) for feeding. While cucumbers are grown in protected cultivation in the UK, *D. significata* larvae do not appear able to develop on this host (Cabrera Walsh, 2005); sunflowers are only a minor commercial crop in the UK, though they are commonly grown in gardens. The UK temperatures, even in southern England, seem too low for this pest to establish widely outdoors except in very warm years. If it is able to persist in the UK, it seems likely to be on the edge of its climatic tolerance, and thus the impacts are likely to be small as it is unlikely to build up to damaging

populations. However, there is a possibility that the impact of *D. significata* is small in South America because it is outcompeted by native species; when these are no longer present, the impact due to this pest may increase. The potential impact to the UK is thus assessed as very small to small, with considerable uncertainty.

Very small	✓	Small	✓	Medium		Large		Very large	

14. What is the pest's potential as a vector of plant pathogens?
Unknown. Other South American species of *Diabrotica* are known vectors or potential vectors of plant pathogenic viruses and bacteria, but studies have not apparently been carried out on *D. significata.*

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).*
Given the lack of interceptions of this species, continued exclusion would seem to be a realistic option. Adults stand a reasonable chance of being detected during a phytosanitary inspection, and are likely to be present only in very low numbers, making establishment of a viable breeding population less likely. While products with associated soil (growing plants, tubers, corms, etc.) are occasionally imported to the UK from Argentina and Brazil, this pathway is not large and the EC Plant Health Directive (Annex IIIA) prohibits soil and growing medium from South America. Annex IIIA also prohibits many genera of plants for planting from the Poaceae (Graminaceae in the legislation) from South America, although there are many exceptions, mainly of ornamental species[3]. Grasses may be preferred larval hosts, though this is very speculative (Cabrera Walsh, 2005).

The measures available for eradication and containment of *D. significata* are uncertain, due to the lack of research on this species. The soil-living larvae would be difficult to detect and control, as with other *Diabrotica* species, and, due to the insufficient knowledge of larval hosts, crop rotation may or may not prove effective against this species. While there are no specific traps developed to detect *D. significata* adults, males were attracted to traps baited with cucurbit extract being developed against *D. speciosa*, though as the catch of *D. significata* (both by baited trap and by hand) was very low (Cabrera Walsh et al., 2008), no useful statements can be made about the effectiveness of such traps against *D. significata* for control purposes. Contact insecticides such as pyrethroids are used to target adults of *Diabrotica virgifera virgifera* (Beres, 2011) and would probably also provide some control of *D. significata,* although they would not necessarily be approved for all the crops that the pest might damage.

16. Summary and conclusion of rapid assessment.
This rapid assessment shows:
There is very little information available on this species. While this suggests it is not a major pest in its native range, many of the judgements in this rapid assessment are subject to a high level of uncertainty, due to the scarcity of specific data. Larval hosts are almost entirely unknown, leading to further uncertainty in most areas of this PRA, e.g., which commodities may harbour the larvae, or what UK crops are most at risk.

Risk of entry
The pest is judged unlikely to enter the UK in trade, either as adults hitchhiking on produce or as larvae in rooted plants or tubers. The species has not been intercepted in the UK to date, and no interception records from other countries could be found for *D. significata*.

[3] See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF for a complete list of families and genera that are permitted imports

Risk of establishment
The risk of establishment is considered unlikely both outdoors and in protected cultivation. While *D. significata* adults are highly polyphagous, the known distribution in South America suggests that climatically, the beetle will either be unable to establish outdoors in the UK, or only in very warm and sheltered locations, and the populations are not likely to reach damaging levels. Protected crops are theoretically at risk, but the chance of successful transfer into such an environment is judged to be low.

Economic impact
The economic impact of *D. significata* in South America appears to be small (this based on the lack of information, suggesting it is not a serious pest). The potential impact to the UK is judged to be lower still, mainly due to the marginal climatic suitability meaning any populations are unlikely to build up to damaging levels.

Endangered area
Southern parts of the UK would seem most at risk from the pest, although even in these parts, warmer winters and/or hotter summers than are usual in the UK seem likely to be required for economic impacts, or even pest establishment. More generally, southern areas of Europe are more likely to be suitable for the establishment of *D. significata*.

Risk management
As *D. significata* has not been intercepted in the UK and the potential for it to arrive appears to be limited, no further risk management measures are recommended.

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	✓

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

18. IMAGES OF PEST

A picture of a museum set (carded) adult *Diabrotica significata* is available through

http://www.coleoptera-neotropical.org/paginas/2_PAISES/Neotropical/Crysomelidae_neo.html

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

Yes Statutory action		No Statutory action	✓

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