The Food and Environment Research Agency

Rapid assessment of the need for a detailed Pest Risk Analysis of *Otiorhynchus meridionalis*

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 Decision Support Scheme.

This version of the rapid assessment template contains tables developed in the Horizon Scanning Project 'Communicating uncertainty in rapid assessments' (V4PW 1220). The tables serve several purposes:

- *Listing the lines of evidence relevant to each step of the assessment*
- *Helping the assessor to weigh the evidence and take account of uncertainties*

Expressing the outcome of each step in a way that communicates the uncertainty

STAGE 1: INITIATION

1.What is the name of the pest?
Otiorhynchus meridionalis Gyllenhal, Coleoptera, Curculionidae lilac root weevil (US name)

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?
Otiorhynchus meridionalis is not listed in the EC Plant Health Directive and is not included in any EPPO lists of pests recommended for regulation or action.

3. What is the reason for the rapid assessment?
Otiorhynchus meridionalis is a plant feeding weevil species that was notified to EPPO by the German NPPO following a finding in Baden-Württemberg (southern Germany) in May 2008 (EPPO, 2008). Adult *O. meridionalis* were found in large numbers in a neglected garden where severe damage was noted on the leaves of *Cotoneaster, Euonymus, Forsythia* and other ornamental shrubs. The organism is also reported from the USA. No interceptions are known in the UK.

In order to inform decision making regarding whether *O. meridionalis* should be examined in more detail from a UK plant health perspective, a rapid assessment is required.

3a. What is the time period that is being considered in this rapid assessment?
This assessment considers a 10 year time horizon, i.e. until 2021.

[1] http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf

3b. What is the class[2] of pests to which the species under assessment belongs?
Otiorhynchus meridionalis is a root weevil. As larvae, these species feed of the roots of hosts. Adults emerge in the summer and feed on host foliage at night, hiding in the soil during the day. In hot dry weather adults often move indoors seeking a more humid environment. In such conditions large numbers can enter houses and people can regard them as a nuisance (Cranshaw, 2006). Adults do not fly. Unlike other *Otiorhynchus* species, which are mainly parthenogenetic, *O. meridionalis* reproduces sexually (Audemard *et al.,* 1981). Females oviposit eggs on hosts. Eggs hatch after a few weeks and larvae move down into the soil where they continue to develop, overwinter and emerge the following summer. There is one generation per year.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?
Otiorhynchus is a large genus, native to the Palearctic region (Europe / Asia) with around 1,500 species, 23 of which are recorded in the UK (Duff, 2008). However, *O. meridionalis* does not occur in the UK at present but is a European species that mainly occurs around the Mediterranean. It was accidentally introduced into California in the early 20th Century and subsequently spread across western US States.

4: Distribution of *Otiorhynchus meridionalis*		
Continent	**Present/absent (if possible note where native, or introduced)**	**Distribution (list countries, or general indication, e.g. widespread in West Africa)**
North America	Present (introduced)	Reported from California in 1931 (Keifer, 1931), now reported from Utah, Colorado, Idaho, Montana, Nevada, New Mexico and Washington State.
South America	Suspected (introduced)	No details – see Heijerman & Hellingman (2009) who site O'Brien & Wibmer (1982)
Africa	Present (native)	Algeria (Hoffman, 1950) perhaps more widely in north Africa and around the Mediterranean.
Europe	Present (native)	France (mainly in south but as far north as Paris), Spain (north east and south also Balearic Is. Mallorca, Menorca), Italy, Switzerland, southern Germany, Netherlands. Could be more widespread in southern Europe / EPPO region but not recorded.
Asia	No records – Assumed absent	
Oceania	No records – Assumed absent	

References: Beers *et al*., (2003); Cranshaw (2006); Magrini *et al.* (2007); EPPO (2008); Heijerman & Hellingman (2009).

5. Is the pest established or transient, or suspected to be established/transient in the UK?
Otiorhynchus meridionalis is not known to occur in the UK.
It is not suspected to be established or transient in the UK.

[2] Here, class does not refer to the taxonomic rank, but to the type of pest, which could be as general as "wood boring insects" or a bit more specific such as "pests in the same genus following the same life histories".

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

Otiorhynchus meridionalis is polyphagous and has been reported on a range of different hosts. Privet (*Ligustrum*) is perhaps the host most commonly mentioned in literature, other ornamental shrub hosts include *Forsythia*, *Jasminum*, and *Syringa* (lilac). Horticultural crops such as *Fragaria ananassa* (strawberry) and *Lactuca sativa* (lettuce) as well as fruit trees such as *Malus domestica* (apple), *Olea europea* (olive) and rarely *Citrus* are also hosts (Heijerman & Hellingman, 2009).

7. If the pest needs a vector, is it present in the UK?

No vector is needed. 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[3] the UK?

The most likely pathway for international movement of the pest and entry into the UK is via host plants for planting where the soil around the roots of the host plants is infested with larvae. When disturbed, adult root weevils drop readily from plants to the ground. Hence adults are not likely to remain associated with plants when plants are moved.

8. Evaluating likelihood of entry	
Evaluation of likelihood of entry occurring via host plants for planting during the next 10 years	**Influence on conclusion**
Lines of evidence applicable to this class of pests	
• Root weevils have been spread around the world, probably via trade, over recent decades (Heijerman & Hellingman, 2009).	↑
• Larvae are protected whilst they remain in soil around host plants.	↑
• Larvae in soil are difficult to detect.	↑
• Ornamental shrubs are traded internationally and shipped as small plants with roots in soil.	↑
• EU countries where this species occurs export large volumes of shrubs and young trees with soil to the UK each year, providing a potential pathway.	↑
• Within the EU plants can generally be moved fairly freely with minimal impact on trade	↑
Lines of evidence specific to the present species	
• Introduced into USA and subsequently spread.	↑
• Reported as damaging and of concern in Germany in May 2008, suggesting that it was able to spread from southern Europe (however, there are earlier records from Germany).	↑↑
• Now present in NL (NL authors suggest it may become more widespread, eventually infesting export nurseries).	↑↑
Overall conclusion: As a polyphagous pest whose hosts include widely traded and popular ornamental plants, and with life stages occurring in soil around roots of hosts, there is a reasonable likelihood that stock within European ornamental growers will eventually become contaminated and subsequently shipped from mainland Europe to various locations including the UK.	*Insert probability* **0.66 - 0.75**

↑↑↑ or ↓↓↓: line of evidence could be sufficient on its own to be almost sure of entry (approaching 100% likelihood) or of non-entry (approaching 0% likelihood)
↑↑ or ↓↓: contributes importantly towards increasing or decreasing likelihood
↑ or ↓: minor contribution towards increasing or decreasing likelihood
• : no influence on likelihood
? : influence on likelihood too difficult to assess

Likelihood establishment will occur in the next 10 years?
(place block according to judgment based on evidence)

[3] Entry: Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (IPPC Glossary definition, ISPM No. 5)

Host plants for planting:	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	✓	Very likely ☐

9a. How likely is the pest to establish[4] outdoors in the UK?
In strawberry fields in southern France (Vaucluse region in the Province of Alps Cote d'Azur) adults generally emerge in May each year and live until around September (Audemard *et al*., 1981). In southern Germany adults were also found in May (see 3.).

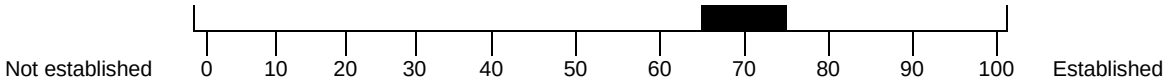
Further north in Europe adults were first found in the Netherlands on privet in September, although it is not known when they originally emerged (Heijerman & Hellingman, 2009).

In North America, adults appear in Utah from June to early July once there has been between 260 and 510 degree days accumulated above a threshold of 10ºC (Murray, 2008). In UK, 260 to 510 degree days above 10 ºC would generally be expected between early July and early August.

Hosts are widely available across the UK.

9a: Evaluating likelihood of establishment outdoors	
Evaluation of likelihood of pest becoming established outdoors in the UK at least once via host plants for planting during the next 10 years	**Influence on conclusion**
Lines of evidence applicable to this class of pests • Root weevils have been spread internationally probably via trade, over recent decades.	↑
Lines of evidence specific to the present species • Introduced into USA and subsequently spread and established in western US including Washington State which has cool summers and mild winters. The climate there is similar to NW Europe. • Recently established in the Netherlands, perhaps spreading from southern Europe. • Sufficient day degrees for development are available in UK • Range expansion could be due to climate change	 ↑↑ ↑↑ ↑↑ ↑
Overall conclusion: Based on the current distribution of *O. meridionalis,* its apparent expansion northwards in Europe (perhaps due to climate change), and thermal sum that predicts adult emergence, it is likely that *Otiorhynchus meridionalis* could establish outdoors in UK.	**Insert probability** **0.66 – 0.75**

↑↑↑ or ↓↓↓: line of evidence could be sufficient on its own to be almost sure of establishment (approaching 100% likelihood) or of non-establishment (approaching 0% likelihood)
↑↑ or ↓↓: contributes importantly towards increasing or decreasing likelihood
↑ or ↓: minor contribution towards increasing or decreasing likelihood
• : no influence on likelihood
? : influence on likelihood too difficult to assess



Given entry, likelihood that establishment will occur outdoors in the next 10 years?
(place block according to judgment based on evidence)

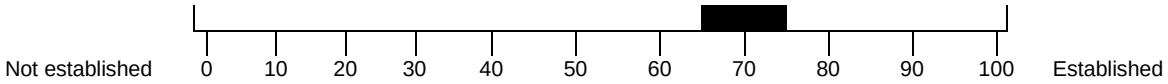
[4] Establishment: Perpetuation, for the foreseeable future, of a pest within an area after entry (IPPC Glossary definition, ISPM No. 5)

9b. How likely is the pest to establish under protected conditions in the UK?
(e.g. in glasshouses, poly-tunnels).

In southern France (Vaucluse region in the Province of Alps Cote d'Azur) adults began to emerge from the soil in plastic tunnels where strawberries were being grown in protection between late February and mid- to late April. After feeding for some weeks, the adults moved to refuges under organic debris, stones or wood where they remained between late April and late May (Audemard *et al.,* 1981).

9b: Evaluating likelihood of establishment in protection	
Evaluation of likelihood of pest becoming established in protected environments (e.g. poly-tunnels, plastic covered strawberries) in the UK at least once via host plants for planting during the next 10 years	**Influence on conclusion**
• Root weevils are carried in the soil ball of ornamental plants which can be stored/ housed in protected environments such as plastic/ poly-tunnels. • Adult root weevils can survive in poly-tunnels.	↑ ↑
Lines of evidence specific to the present species • Has been reported under plastic in France attacking strawberries.	↑↑
Overall conclusion: Imported, infested ornamental nursery stock may be kept in protected conditions, such as glasshouses or poly-tunnels where *O. meridionalis* could survive, as in southern France. During warm dry weather *O. meridionalis* may actively seek out such environments if the humidity therein is higher than outdoors.	**Insert probability** **0.66 - 0.75**

↑↑↑ or ↓↓↓: line of evidence could be sufficient on its own to be almost sure of establishment (approaching 100% likelihood) or of non-establishment (approaching 0% likelihood)
↑↑ or ↓↓: contributes importantly towards increasing or decreasing likelihood
↑ or ↓: minor contribution towards increasing or decreasing likelihood
• : no influence on likelihood
? : influence on likelihood too difficult to assess



Given entry, likelihood that establishment will occur in protected conditions in the next 10 years?
(place block according to judgment based on evidence)

Summary of likelihood of establishment

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

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

10a. Natural Spread

The elytra of *Otiorhynchus* are fused thus adults cannot fly. Natural dispersal therefore occurs primarily as adults walk and search for a mate or host plant. With adults living for a few weeks or months in the summer, natural dispersal is likely to be in the order of a few hundred metres per year, maximum.

10a. Evaluation of potential rate of natural spread following establishment.				**Influence on conclusion**
Lines of evidence applicable to this class of pests • Adults cannot fly • Larvae are soil borne and will not disperse from host plants on which eggs were laid • Adults are active walkers • Adults live for a few weeks or months				- - - + +
Lines of evidence specific to the present species • No specific evidence for *O. meridionalis* that is different to that above.				
CONCLUSION: estimate % of population for each rate				
Very slowly	**Slowly**	**Moderate**	**Quickly**	**Very quickly**
<100m/y	**100m-1km/y**	**1-10km/y**	**10-100km/y**	**>100km/y**
90 - 99%	9 – 0.9%	1 – 0.1%	0 %	0 %

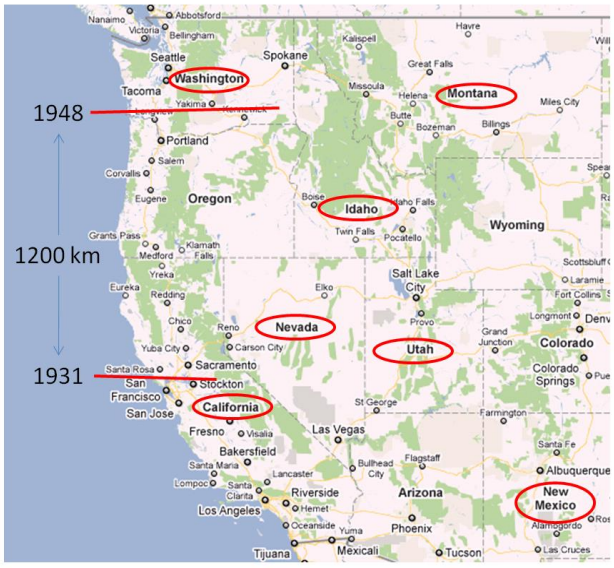
Key for symbols:

+, ++ or +++ : minor, moderate or major influence towards higher rates
-, - - or - - - for minor, moderate or major influence towards lower rates
• : no influence in either direction
? direction and magnitude of influence uncertain
Ranges of symbols may be used to indicate uncertainty about a line of evidence (e.g.+/+++).

10b. Spread in Trade

Otiorhynchus meridionalis was first collected in North America in central California in 1931 (Keifer, 1931). It was found in Washington State (WA) in Pullman in 1948, in Cheney/Spokane (WA) in 1949 and Yakima (WA) in 1958 (Beers *et al*., 2003) (Map 1). This suggests that it had spread approximately 1,200km in at least 17 years. Such spread is likely to have been facilitated via movement of larvae in soil when plants were moved, perhaps in trade and is not likely to have occurred at a linear rate (which would have to have been approximately 70km/year), instead new populations would have been created as satellites from where individuals then spread locally naturally.

Map 1: US States where *Otiorhynchus meridionalis* is recorded.
Note the first report was in central California in 1931. *O. meridionalis* is probably in Oregon but is unrecorded.



10b. Evaluation of potential rate of spread by trade, following establishment.				Influence on conclusion
Lines of evidence applicable to this class of pests • Root weevils have spread internationally via horticultural trade • Given international spread has occurred, domestic trade will also facilitate spread. • Knowledge of % ornamental deliveries from one UK nursery to other UK nurseries at given distances informed rate of spread (see Annex 1)				 + ++ ++
Lines of evidence specific to the present species • In the US *O. meridionalis* has spread over 1,000km in less than 20 years (see Map 1). • In Europe *O. meridionalis* has been spread via trade into northern Europe (Germany & Netherlands).				 ++ ++
CONCLUSION: estimate % of population for each rate				
Very slowly	**Slowly**	**Moderate**	**Quickly**	**Very quickly**
<100m/y	**100m-1km/y**	**1-10km/y**	**10-100km/y**	**>100km/y**
0%	0.1 – 0.3%	0.3 – 3.0%	3.0 – 30.0	66.7 – 96.6%

Key for symbols:

+, ++ or +++ : minor, moderate or major influence towards higher rates
-, - - or - - - for minor, moderate or major influence towards lower rates
• : no influence in either direction
? direction and magnitude of influence uncertain
Ranges of symbols may be used to indicate uncertainty about a line of evidence (e.g.+/+++).

Summary of expected spread

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

11. What is the pest's potential as a vector of plant pathogens?
Otiorhynchus meridionalis is not known to vector plant pathogens.

12. What is the pest's potential to cause economic or environmental impacts in the UK *during the time period being considered for this rapid assessment*?
Four species of *Otiorhynchus* are commonly cited in text books as of economic importance in Europe and the USA. They are *O. ovatus* (vine weevil), *O. sulcatus* (rough strawberry weevil), *O. singularis* (clay coloured root weevil) and *O.rugosostriatus* (no common name). All are already present in the UK (Duff, 2008).

O.meridionalis was occasionally reported as a pest of strawberry in southern France in the 1980s (Audemard et al., 1981; Bues *et al*., 1984) and is one of a suit of three *Otiorhynchus* species that occasionally damage strawberries in Sicily (Vacante, 1989; Magnano & Vacante, 1989). However serious damage to plants is rare (EPPO, 2008). Hoffmann (1950) regarded *O. meridionalis* as a pest of jasmine in Provence. When found in the Netherlands on privet it was not regarded as a serious pest (Heijerman & Hellingman, 2009) since it only caused cosmetic damage (leaf notching caused by adult feeding on leaf margins).

Although *O.meridionalis* has been present in the US since the 1930s it is not included as a pest of economic or environmental importance in standard entomological references such as

Davidson & Lyon (1987), Metcalf & Metcalf (1993) or Arnett (2000) although it has been noted as a minor pest in apple orchards in Washington State with adult feeding causing leaf notching (Beers *et al.,* 2003); however, no economic damage was reported.

12. Evaluation of economic or environmental impact of pest in the UK				**Influence on conclusion**
Lines of evidence applicable to this class of pests • Larval root feeding can seriously damage small plants • Adult weevils can "girdle" young plants causing serious damage or even death of small plants.				+ ++
Lines of evidence specific to the present species • Larval damage is not so significant (perhaps because fewer individuals occur) • Adult leaf feeding damage is reported as cosmetic and does not kill plants • There are no reports of this species causing environmental damage elsewhere, and none is expected if it were to establish in the UK				- - -
CONCLUSION: insert a probability for each level of impact				
Very small	**Small**	**Medium**	**Large**	**Very large**
<£10,000 per annum	>£10,000 p.a.	>£100,000 p.a.	>£1 million p.a.	>£10 million p.a.
99 – 99.9%	1 – 0.1%	0%	0%	0%

Key for symbols:

+, ++ or +++ : minor, moderate or major influence towards higher rates
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• : no influence in either direction
? direction and magnitude of influence uncertain
Ranges of symbols may be used to indicate uncertainty about a line of evidence (e.g.+/+++).

Summary of impact

Economic	Very small	✓	Small		Medium		Large		Very large	

13. What is the area endangered[5] by the pest?

It is considered unlikely that over the next 10 years *O.meridionalis* will become economically significant in the UK. However, if it were to become a noteworthy pest within horticulture, privet and / or strawberries would be the hosts most likely to be damaged.

STAGE 3: PEST RISK MANAGEMENT

14. What are the risk management options for the UK?

Action for keeping the pest out of the UK

Given that entry is most likely via larvae infesting soil around ornamental shrubs, and that such infestation would be difficult to detect, there is no practical steps which can be taken to keep *O. meridionalis* out of the UK.

Options for control if the pest became established

In Italian laboratory tests *O. meridionalis*, was susceptible to the entomopathogenic fungi *Beauveria bassiana* and *B. brongniartii.* Mortality of infected individuals reached 80-100% in

[5] An endangered area is an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss entry (Glossary definition, ISPM No. 5)

the larval stage and 100% in the pupal stage. However, *O. meridionalis*, was not susceptible to *Verticillium lecanii (*Magnano di San Lio & Vacante, 1989). *Beauveria* is a biopesticide currently available for use in UK horticulture. Pyrethroids applied to foliage and around the base of plants can be effective against adults (Cranshaw, 2006). Larvae in soil can be treated with a chemical drench such as imidacloprid (Cranshaw, 2006).

15. Summary and conclusion of rapid assessment

This rapid assessment shows:

Likelihood of entry is: likely via ornamental shrubs from (southern) Europe.

Likelihood of establishment is: likely both outdoors or in protected conditions such as poly-tunnels.

Rate of spread is expected to be: very quick via trade, leading to many satellite populations which would then slowly spread naturally.

Economic impact is expected to be: very small. Cosmetic damage may occur if populations build up in neglected (unmanaged) areas (as was the case in Germany).

Environmental impact is expected to be: NIL

Endangered area: No significant economic impact is expected so no endangered area is identified.

Risk management: The horticultural industry is likely to be able to control *O. meridionalis* just as well as it controls other root weevils i.e. using a mixture of biopesticides and conventional chemical treatments when necessary.

16. Is there a need for a detailed PRA?

Yes ☐ No ☑

If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used.

If this pest is to become regulated across the EU an EU wide PRA will be necessary.

PRA area: UK or EU? ☐ PRA scheme: UK or EPPO? ☐

References

Arnett, Jr., R.H. (2000) American Insects: A handbook of the insects of America North of Mexico, CRC Press, Florida, 1003pp

Audemard H, Drevet C, Villevieille M, Jacquot M (1981) Un nouveau ravageur du fraisier, l'otiorrhynchque méridional. *Phytoma* no. 329, 15-17 http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=caba1&AN=19810586125

Beers EH, Klaus MW, Gebhard A, Cockfield S, Zack R, O'Brien CW (2003) Weevils attacking fruit trees in Washington. Proceedings of the 77th Annual Western Orchard Pest & Disease Management Conference, Portland, US, 2003-01-15/17. http://entomology.tfrec.wsu.edu/wopdmc/2003PDFs/Rep03%20Biology%20Beers.pdf

Bues, R. Toubon, J. F. Villevielle, M. Jacquot, M. (1984) *Otiorrhynchus meridionalis* Gryll., a pest of strawberry in south-eastern France: adult migration, development cycle and preliminary tests on control. *Defense des Vegetaux,* **228**, 224-237.

Cranshaw, W.S. (2006) Root weevils, Colorado State University, Factsheet Home & Garden Insect Series. No 5.551. 2pp.

Davidson, R.H. & Lyon, W.F. (1987) Insect Pests of farm, garden and orchard. 8th Edn. John Wiley, Chichester, 640pp.

Duff, A.G. (2008) Checklist of beetles of the British Isles. http://www.coleopterist.org.uk/checklist2008%20A5.pdf

EPPO (2008) *Otiorhynchus meridionalis* found in Germany EPPO Reporting Service 2008/221

Heijerman, T. Hellingman, S. (2009) *Otiorhynchus meridionalis*, an invasive weevil species new to the fauna of The Netherlands (Coleoptera: Curculionidae). *Entomologische Berichten* **69** (3), 95-100.

Hoffmann A 1950. Coléoptères Curculionides (Première Partie). Faune de France 52: 1-486.

Jones, G.D. (2006) A bio-economic analysis of the spread of a quarantine pest, Western Flower Thrips (*Frankliniella occidentalis*) through the protected agriculture sector of England, 1985-1988. PhD Thesis, University of York. Unpublished, 268pp.

Keifer, H.H. (1931) Miscellaneous insect notes. Another European Brachyrhinus (Otiorhynchus) appears in California. California Dept. of Agriculture Monthly Bulletin, 20, 470-472.

Lapointe, S., Borchert, D.M. & Hall, D. G. (2007) Effect of low temperatures on mortality and oviposition in conjunction with climate mapping to predict spread of the root weevil *Diaprepes abbreviatus* and introduced natural enemies. Environmental Entomology, **36**(1), 73-82

Magnano di San Lio, G. Vacante, V. (1989) Entomopathogenic activity of two species of Beauveria against strawberry weevils. *Difesa delle Piante*. **12** (1-2), 119-126.

Magrini, P. Abbazzi, P. Magnano, L. Baviera, C. (2007) A new *Otiorhynchus* Germar, 1822 from Mount Etna, Sicily (Coleoptera Curculionidae) *Redia*. **90**, 23-27.

Metcalf, R.L. & Metcalf, R.A. (1993) Destructive & Useful Insects, 5th Edn., McGraw-Hill, New York pp

Murray, M.S. (2008) Using degree days to time treatments for insect pests. Utah Pests Fact Sheet IPM-0508, April 2008. www.utah.pests.usu.edu

O'Brien C & Wibmer G 1982. Annotated checklist of the weevils (Curculionidae sensu lato) of North America, Central America, and the West Indies (Coleoptera: Curculionoidea). *Memoirs of the American Entomological Institute*, Gainesville, **34**, 1-382.

Vacante, V. (1989a) The Coleoptera Curculionidae of strawberry in Sicily. First contribution. *Difesa delle Piante*. **12** (1-2), 107-117.

Warner, R.E., and Negley, F.B. 1976. The genus *Otiorhynchus* in America north of Mexico (Coleoptera: Curculionidae). Proc. Entomol. Soc. Wash. **78**: 240-262.

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IMAGES OF PEST

http://www.insectimages.org/browse/detail.cfm?imgnum=1455074

Fig 1: Adult *Otiorhynchus meridionalis* 6.5-10 mm

http://www.insectimages.org/images/384x256/1455078.jpg

Fig 2: Adult feeding damage causes notches in the margins of leaves (*Ligustrum* / privet)

Photo by Theodoor Heijerman in Heijerman & Hellingman (2009)

Fig 3: Adult *Otiorhynchus meridionalis*

More images of damage symptoms are available at:
http://www.insectimages.org/browse/subthumb.cfm?sub=13818

Annex 1

Jones (2006) provides data showing the number of deliveries made from an ornamental nursery site to other nurseries with the approximate distance to the delivery site. Below, the data is used to estimate the % of deliveries that may be made to sites at given distances. Assuming deliveries have an equal chance of being infested, the % of deliveries made to given distances could approximate the spread distance (Table below).

Approx distance between sites (km)	% deliveries made	Cumulative
< 0.1	0.03	0.03
0.1 – 1	0.30	0.33
1-10	3.00	3.33
10-100	30.00	33.33
> 100	66.67	100.00
sum	100.00	