Rapid assessment of the need for a detailed Pest Risk Analysis for *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961

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?

Helicotylenchus dihystera (Cobb, 1893) Sher, 1961

Multiple synonyms. Species in this genus are sometimes difficult to identify because of variation in morphological characters (Krall, 1990).

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]?

Not listed in the EC Plant Health Directive, or any EPPO lists, i.e. the A1 and A2 Lists of pests recommended for regulation as quarantine pests; the EPPO Alert List or the EPPO Action List.

3. What is the reason for the rapid assessment?

This is one of the commonest species detected in samples of soil from bonsai and penjing imported from outside Europe, with identifications in the UK being mostly on imports from China (Fera unpublished data). Whilst the presence of *H. dihystera* in bonsai is often used by NPPOs as a bioindicator that phytosanitary measures have not been met, it has been recorded as present in parts of southern Europe. A rapid assessment has been requested to help inform the decision on whether statutory action against future interceptions is justified, by updating the UK PRA from 1996, looking at the presence of this pest in Europe and determining if this should be considered as a priority harmful organism, not likely to have established in the UK.

STAGE 2: RISK ASSESSMENT

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

In tropical and sub-tropical regions of Africa and Asia (particularly India and Pakistan) *H. dihystera* is widely distributed (Phukan & Saikia, 1983). Krall (1990) records it as present in Southern Russia and the Far East. The pest is also recorded in the USSR and Russia (Sigareva, 1985 and Alalykina, 1971 respectively), Kazakhstan (Baidulova, 1982), China, USA (Georgia) and Egypt, (CABI, 2010). It was recorded in the Ukraine by Sigareva *et al* (2007), although enquiries have confirmed that nematologists there make identifications by morphological means only (personal communication, May 2012).

There are no publications dealing with the distribution of this pest in Europe that describe it in detail, offer a molecular analysis, or otherwise advise on how the species has been identified to give confidence that the pest has been identified correctly. Subbotin *et al*., (2011), published a detailed study of *Helicotylenchus*, including *H. dihystera*, but obtained no

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

populations from Europe. There are many species similar to *H. dihystera* in the genus *Helicotylenchus*, so misidentification is common, and he considered all type localities should be sampled to confirm the type identity with both morphological and molecular tools. In a personal communication (May 2012) he wrote that he continues to work with *Helicotylenchus* in collaboration with several nematologists across the world and has since sequenced some *Helicotylenchus* samples from Europe. He does not have any molecular evidence that there is *Helicotylenchus dihystera* amongst his European samples (number not known) collected from different native locations in Spain, Germany, Switzerland and the UK (collected from the Rothamsted reserve areas). With this in mind a cautious approach has been taken to the literature. A review of this literature can be found in the Appendix.

Based on the available literature, although *H. dihystera* has been recorded in many parts of Europe, it is unclear in most cases whether these were misidentifications and the nematode is actually present or not. The report from Bulgaria appears to be the most concrete, but even this has not been verified by molecular testing.

5. Is the pest established or transient, or suspected to be established/transient in the UK? *(Include summary information on interceptions and outbreaks here).*
This species is not known to be established in the UK. It was recently identified from a UK glasshouse (2010) but only on one species of Cacti – all cuttings from one original old plant of unknown origin.

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?
H. dihystera is highly polyphagous, and is an ectoparasite or semiendoparasite on the roots of several economically important plant families with hosts found in orchard crops, field crops, and protected edible and ornamental crops e.g. apples, Begonias, Brassicas, barley, cucumbers, oats, potatoes, roses, strawberries and tomatoes (CABI CPC, 2012).

7. If the pest needs a vector, is it present in the UK?
N/A. This species is a soil borne migratory ecto-parasite.

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*):
Small and large ornamentals traded with growing media or soil. The proposed likelihood is based on the frequency of interception – at time of writing 387 records of identification since 1996 (Fera, unpublished data) and the fact that the pest is likely to arrive already associated with a host plant and soil.

	Very unlikely	Unlikely	Moderately likely	Likely	Very likely
Trade in ornamentals:	☐	☐	☐	✓	☐

9. How likely is the pest to establish outdoors or under protection in the UK?
If the pest was to contaminate outdoor soil or be spread under protected cultivation by irrigation practices, establishment would depend on many abiotic factors. Soil temperature data for the known geographical distribution is not comprehensive. Although one could consider using air temperature data, extrapolating it to represent soil temperature is a technique that has its disadvantages, as discussed by Baker & Dickens (1993). Not only is soil temperature influenced by air temperature, but also by ground cover, soil texture, wetness, sun angle and day length. In addition, rainfall data often cannot be used because of the added complication of irrigation at monitoring sites (Hockland *et al*. 2006). All this adds uncertainty to any likelihood of establishment.

Based on its known distribution in tropical/sub-tropical parts of the world and locations that have much hotter summers than the UK, the pest is more likely to establish under protection than outside. Recent research in the UK to explore the possibility that nematodes imported with bonsai plants might survive outdoor conditions does suggest that *Helicotylenchus* nematodes may survive exposure to cold temperature, however, further work on this is required as to length and extent of exposure (DEFRA, unpublished data).

	Very unlikely	Unlikely	Moderately likely	Likely	Very likely
Outdoors:		✓ 50	✓ 50		
Under protection:				✓	

10. How quickly could the pest spread in the UK?
The movement of nematodes in soil is influenced by the structure of the soil and by its water content. Natural drainage, water run-off and flood water can all have an effect on movement. However, spread with water would be very slow in comparison to movement of infested soil associated with plant material in trade and contaminated agricultural machinery to other suitable habitats. The nematode is a migratory root ectoparasite/semiendoparasite, and consequently will not be spread with aerial parts of plants, e.g. seeds.

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

11. What is the area endangered by the pest?
Glasshouse crops, in soil or pots, are at risk, but the risk to outdoor crops is not known.

12. What is the pest's economic, environmental or social impact within its existing distribution?
This nematode can feed both on the surface and inside roots of host plants, resulting in cortical lesions which can become necrotic as a result of secondary infection by pathogens. Infestation of olive seedlings by *H. dihystera* resulted in a 78% reduction in top weight and retardation in the development of lateral roots (Diab & El-Eraki, 1968) and reduced growth by 20-50% has been documented in potted Avocado tree seedlings (Saltaren *et al*., 1999). Wallace (1971) reported a significant correlation between the numbers of *H. dihystera* and reduced growth of grass turf. Firoza *et al*., (1995) reported on the nematodes numerical threshold for infection, with 4 nematodes per gram of soil causing chlorosis, sparse root development and stunted shoots in aubergines, tomatoes and wheat. *H. dihystera* can also increase the incidence and severity of bacterial diseases of roots when it is present in soil contaminated with bacteria such as *Pseudomonas caryophylli* or *P. solanacearum* (Stewart & Schindler, 1956; Libman *et al.*, 1964).

Very small	Small	Medium	Large	Very large
		✓		

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?
Assuming its impact is confined to glasshouses and protected cultivation:

Very small		Small	✓	Medium		Large		Very large	

14. What is the pest's potential as a vector of plant pathogens?
H. dihystera is not a virus vector.

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).*

Currently, in the UK, detection thresholds are applied when this species is intercepted, to aid decisions on action to be taken (see Cannon *et al.* 2009). This is mainly applied to potted ornamental plants as this pest is commonly recorded on bonsai. Eradication is difficult; root washing offers the best solution but may be limited in its effectiveness because of the semiendoparasitic habit of this species and the potential damage to plants. Recent research, however, does suggest that it can be effective, with nearly all nematodes being removed by root washing in an investigation conducted using Plant Health protocols (DEFRA, unpublished data). Most systemic insecticides, such as imidacloprid – which can be applied as a drench to containerised ornamentals – would not penetrate the roots (i.e. have no basipetal penetration) and would therefore not be effective against soil nematodes. Oxamyl is probably the only soil-applied systemic insecticide remaining for commercial use in the UK. When applied to the soil, oxamyl can be effective in controlling – but probably not eliminating – populations of plant parasitic nematodes, for example by inhibiting feeding and preventing host finding, leading to the starvation and death of infective juveniles. If the species were to become established outdoors, pesticides are unlikely to be effective in terms of eradicating them and containment measures would be required to prevent spread.
Defining outbreaks, monitoring and surveillance would be challenging. The success of detecting infestations of nematodes depends on the amount and intensity of sampling that can be conducted as well as the climatic conditions. In general, control measures against nematodes, such as crop rotation, green-manure cover crops and nematicides may reduce population levels but are not likely to prevent establishment. Destruction of infested imported material when detected may be the only way to prevent establishment.

Table 1 below shows the known strategies taken by a number of European NPPOs as of June 2009. The information in this table all comes from personal communications. As far as is known, there are no surveys being conducted that would detect this nematode.

Table 1:

Country	**Identification of *Helicotylenchus* species in bonsai**	**Presence of *H. dihystera* in country**	**Action taken by the NPPO**
Belgium		Not detected	Yes, if nematodes are found in imports, as a bioindicator
France	No	Not known	Yes, if nematodes are found in imports, as a bioindicator
Germany	Mostly genus only	Not present	None
Netherlands	Yes, regularly	No	None
Switzerland	No	Not known	None
UK	Yes	Not detected	Yes

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...

The key factor to determine is whether the organism is present in Europe. Definitive proof is awaited for the reasons set out in this PRA. If present, it will probably be restricted to protected crops and areas of Europe with hot summers, but although many reports have been documented no definitive molecular evidence currently exists.

This rapid assessment shows:

Risk of entry: **Likely** based on frequency of interceptions and fact that most of these will be in association with ornamentals and therefore the pest will arrive already associated with a host and growing media.

Risk of establishment: **Unlikely** to establish outside based on known distribution, however there is high uncertainty regarding its ability to survive cold conditions, so establishment could be **moderately likely. Likely** to establish under protection.

Economic impact: **Low impact** based on likelihood of confinement of pest to growing media of potted host ornamentals and protected cultivation.

Endangered area: Glasshouse crops, in soil or pots, are at risk, but the risk to outdoor crops is not known

Risk management: Most treatments may reduce population levels and reduce spread but not eradicate. Difficult to prevent establishment by treatments other than destruction.

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 main uncertainty in this rapid assessment is regarding the distribution of this species, and whether it is present, as reported in a number of papers, within the EU. No confirmation of this has been found, although it may be that further details can be obtained with time. There is also high uncertainty regarding the ability of this nematode to overwinter outside in the UK. More research would be needed to reduce this uncertainty. In both cases the uncertainty would not be reduced by performing a more detailed PRA, therefore this is not appropriate at this time.

No	✓

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?

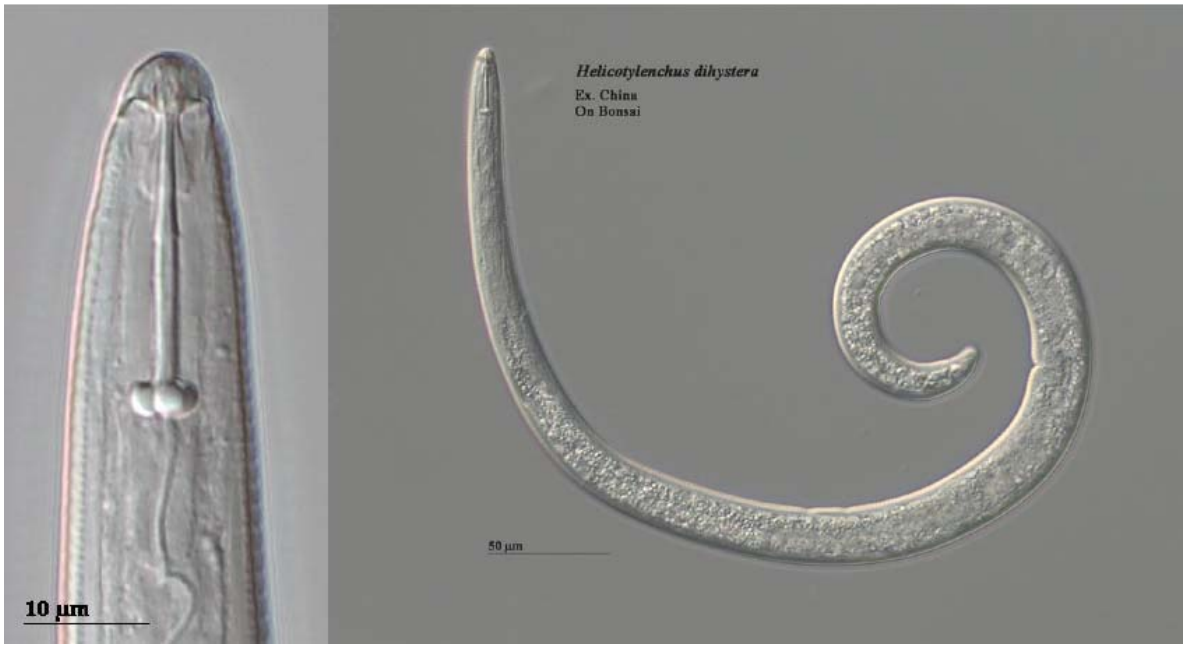
Yes – Statutory action on material from third countries	✓	No – Statutory action on material from the EU	✓

The information currently available suggests that this nematode is unlikely to establish in the UK outside of protected areas. Based on its likely confinement to growing media of potted host ornamentals and protected cultivation its impact is likely to be relatively low. There is also a possibility that the nematode is already present in the EU, from which entry cannot be regulated, although there is much uncertainty around the published records. Taking this into account, the risk to the UK is considered to be low, despite the uncertainties already detailed. However, although statutory action based on the risk of this organism to the UK is not considered justified, its presence in association with soil from third countries is indicative that the import requirements applicable to soil in association with plants have not been met. Therefore action will continue to be taken on material from third countries where agreed detection thresholds of this nematode are exceeded, based on the presence of this pest indicating the potential presence of other harmful organisms. This is in line with the approach taken in some other EU countries such as France and Belgium.

In summary, statutory action will continue to be taken on interceptions from third countries, but will not be taken on interceptions from the EU.

19. IMAGES OF PEST

Photo 1 (pest)



Source/ copyright owner: Fera

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Appendix

A literature search was conducted in April 2012, including the references cited in the latest CABI distribution map (CABI, 2010). The latter records the species as present in Europe, but these records may not be reliable; the records for the UK and The Netherlands, for example, relate to interceptions only. In Germany the CABI records related to interceptions and a glasshouse incursion. One of the UK interceptions referred to a consignment of potatoes (and associated soil) from Denmark, but the species has not been recorded there, nor do we know if contamination had occurred from another shipment (Anon, 1995). Finland was also listed by CABI (Sher, 1966), but this publication did not confirm the presence of the pest there. The species has been recorded as present in Bulgaria (Samaliev & Mohamedova, 2011). A request for more details or a sample to test resulted in confirmation that the species had been recorded in Bulgaria, but that it was not currently being studied in that country, and led to an agreement that a sample would be sent when next obtained (Vlada Peneva, personal communication, April 2012). The reference for the Canary Islands, mentioned in the SQWORM database could not be found (CABI, 2010). Krall (1990) refers to the species as present in Poland, but there is no detail, other than records are referred to as rare. Nesterov & Koev (1972) reported this nematode in Moldova on *Fragaria*, but this record of a symposium presentation has not been seen. In Italy, *H. dihystera* was recorded on Sicily in 1981 (Volvas & Inserra), but has not been recorded anywhere in the country since. This nematode has been recorded in Spain on more than one occasion (Jiménez-Millán *et al.,* 1965; Pinochet & Cisneros, 1986; Castillo & Gomez-Barcina, 1993; Talavera & Navas, 2002). However, in the latter paper, work was done on preserved material collected before 1985. Nico (2002) also recorded the species but the reference, a PhD thesis, is no longer available on line. No responses have been had from any personal contacts in Spain and so at this point no further information is available. A record from Romania (Ivan, 1978) has not been found. It has been recorded in Slovakia by Stollarova (1997) and Liskova *et al.,* (2007); a response to a request for more details of the record is awaited from the latter lead author.