Department for Environment Food & Rural Affairs

Rapid Pest Risk Analysis (PRA) for:

Pratylenchus scribneri

December 2015

Summary and conclusions of the rapid PRA

Pratylenchus scribneri, a root-lesion nematode with a broad host range, is not known to be present in the PRA area but has been intercepted in 2000, several times in 2005 and again in 2015. The recent UK Risk Register entry concluded that a rapid PRA would be useful to help decide, whether continued statutory action against future occurrences of the nematode is justified.

In the PRA area, unfavourable climatic conditions make it very unlikely that *P. scribneri* could establish outdoors as a field pest. The nematode poses risks to plants grown under protection when high temperatures are maintained over a sufficiently long period to allow the nematode to reproduce. However, these risks are dependent on the characteristics of specific production systems and consequently are difficult to assess.

This rapid PRA shows:

Risk of entry

Nematode damage can be non-specific and *P. scribneri* could enter undetected in soil and roots of plants for planting or with bulbs and tubers. Ornamental plants imported from regions where the nematode is present represent a significant entry pathway. Entry risks from this pathway are rated as ‘likely’. Bulbs and tubers are rated as moderately likely.

Risk of establishment

In field plants grown in the absence of protection, establishment in the PRA area is rated as ‘very unlikely’. The absence of high summer temperatures in the PRA area for a sufficiently long period to allow reproduction limits the potential for establishment. The nematode has been reported in field crops only from countries that have hotter summers than the UK.

Under protection establishment risks are rated as ‘likely’ reflecting the potential for *P. scribneri* to reproduce when conditions are maintained at a temperature that allows reproduction of the nematode. However this rating has medium confidence because establishment is highly dependent on the conditions of specific horticultural systems.

Economic, environmental and social impact

Economic impacts are rated as small. Establishment risks for field-grown crops are low, which reduces potential impacts. Plants grown under protection are more vulnerable. However, there is considerable uncertainty in predicting the potential economic losses and damage to crops grown under protection and the rating is qualified with a low confidence score. Potential losses would be dependent on the specific characteristics of the production system used.

Endangered area

For plants grown under protection the whole PRA area is at risk from the nematode. Outdoors, establishment risks are greatest in regions with the highest summer temperatures.

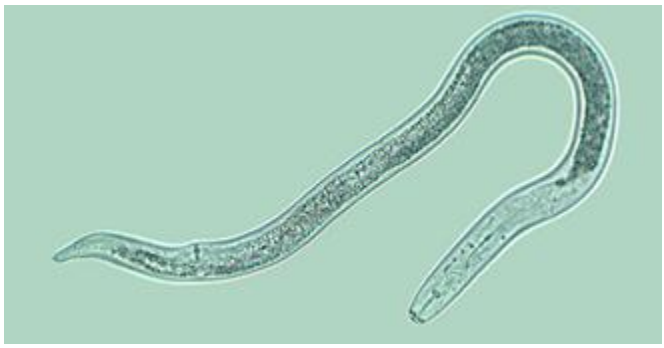
Risk management options

Nematode infestations can be problematic and expensive to control and avoiding introducing *P scribneri* onto production premises is preferable to mitigating damage once introduced. Use of an approved nematicide would help to control infestations of *P. scribneri*. High standards of plant management to reduce risks of nematode spread would help to control *P. scribneri* infestations. Heat treatment has also been used to control *Pratylenchus* nematodes.

Key uncertainties and topics that would benefit from further investigation

Quantitative assessments of damage caused by *P. scribneri* as a horticultural pest of plants grown under protection are very limited and research in this area would help to reduce uncertainty in assessment. However, this research may not be a priority.

Images of the pest

Pratylenchus sp. 
Pratylenchus sp. (© Nemapix).

Is there a need for a detailed PRA or for a more detailed analysis of particular sections of the 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	

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

P. scribneri, which is absent from the PRA area, damages the roots of a wide range of plant hosts and poses a threat especially to plants grown under protection. However, it is not recommended that continued statutory action is taken on interception because the organism cannot establish outdoors and there are limited vulnerabilities to protected crops. Additionally, there is evidence for its presence in Europe, which suggests that prospects to prevent entry to the PRA area are small.

Yes Statutory action		No Statutory action	✓

Stage 1: Initiation

1. What is the name of the pest?

Pratylenchus scribneri Steiner *in* Sherbakoff & Stanley, 1943, a root lesion nematode

2. What initiated this rapid PRA?

Pratylenchus scribneri has been intercepted several times in the PRA area in 2000 and 2005 and again recently in 2015, prompting its inclusion in the UK Plant Health Risk Register. This concluded that a rapid PRA would be useful to more fully assess risks and decide whether continued statutory action against future occurrences of the nematode is justified.

3. What is the PRA area?

The PRA area is the United Kingdom of Great Britain and Northern Ireland.

Stage 2: Risk Assessment

4. 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]?

Pratylenchus scribneri is not listed in the Council Directive 2000/29/EC and is not an EPPO quarantine pest nor is it on the EPPO Alert List.

5. What is the pest's current geographical distribution?

The following distribution and associated references is based primarily on the reviews by Castillo & Volvas (2007) and P.A.A. Loof (CAB 1985), unless otherwise referenced. Northerly records in Europe are only associated with protected cultivation.

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF

[2] https://www.eppo.int/QUARANTINE/quarantine.htm

Table : Distribution of *Pratylenchus scribneri*	
North America:	USA- Widespread including: California, Illinois, Iowa, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, North Carolina Pennsylvania South Dakota and Tennessee. Mexico
Central America:	No records
South America:	Argentina (Doucet, 1988)
Europe:	Under protection: Germany (Sturhan, 2014), Netherlands (Doorduin, 1989), Sweden (Andersson, 1971), Turkey Outdoors: Bulgaria (Katalan-Gateva and Baicheva, 1978), Croatia (Majic *et al*., 2011), Italy (Tacconi *et al*., 1985) and Slovenia (Urek *et al*., 2003).
Africa:	Widespread, including Egypt and South Africa
Asia:	India, Iran (Azimi and Mahdikhani-Moghadam, 2013), Israel, Japan (subtropical district), Jordan, Oman (Mani *et al*., 1997)
Oceania:	No records

6. Is the pest established or transient, or suspected to be established/transient in the UK/PRA Area?

Fera diagnostic services test UK soil samples for nematodes, and this provides an incidental means of surveying for *P. scribneri.* There is no evidence that the nematode is present in field soil in the PRA area (Rebecca Lawson, Pers. Comm 2015).

P. scribneri UK inteceptions

Date	Country of origin	Host
2000	Italy	*Eriobotrya japonica*
2005	United States of America	(Unknown)
2005	United States of America	*Canna* (bulbs)
2015	South Africa	*Imperata*

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

In common with other root lesion nematodes *P. scribneri* has a wide host range, including:

Berberis (barberry), *Citrullus lanatus* (watermelon), *Cydonia oblonga* (quince), *Festuca arundinacea* (tall fescue), *Ficus* (fig), *Fragaria* (strawberry), *Glycine max* (soybean), *Hippeastrum* (amaryllis), *Hordeum vulgare* (barley), *Ipomoea batatas* (sweet potato)*Medicago sativa* (Lucerne), Musa × paradisiaca (banana), *Papaver* (poppy), *Prunus* (stone fruits), *Rosa* (rose), *Saccharum officinarum* (sugar cane), *Solanum lycopersicum* (tomato), *Solanum tuberosum* (potato), *Sorghum, Trifolium* (clover), *Vigna unguiculata* (cowpea) *Zea mays* (maize). Bean and millet are also mentioned, but not the actual species.

In addition *P. scribneri* has been reported from *Phaseolus lunatus* and *P. vulgaris* (Thomason *et al*., 1976) and host range testing by Rich *et al*. (1976) suggested that *Allium cepa* (onion) and *Brassica oleracea* (broccoli and cabbage) were good hosts. It was intercepted in the UK on *Canna* bulbs and *Imperata*, an ornamental grass.

In the PRA area potato, clover, strawberry, bean, tomato, *Prunus,* barley and rose are the most economically significant hosts.

8. What pathways provide opportunities for the pest to enter and transfer to a suitable host and what is the likelihood of entering the UK/PRA area?

Plants for planting (and associated soil)

Soil and roots of host plants may harbour the nematode and consequently this pathway is very important. The difficulty in detecting infestations increases entry risks, and the pest is present in the EU (both in ornamental production under glass, and outdoors in some regions). Material entering from the EU will be subject to fewer quarantine inspections, and the highly polyphagous nature of the pest means it could be associated with many different hosts. It has been intercepted on planting material (*Eriobotrya japonica*), from Italy in the past. For this reason, entry is rated as likely with medium confidence.

Bulbs or Tubers

As a pest of potato (*Solanum tuberosum*), *P. scibneri* could be associated with seed potatoes. However, entry on the seed potato pathway is very unlikely, as there are no records of *P. scribneri* on potatoes in Europe and seed potatoes cannot be imported from third countries other than Switzerland, where the nematode is not recorded as present.

Entry on bulbs of ornamental plants could occur and *P. scribneri* has been intercepted on *Canna* bulbs. This pathway is rated as moderately likely with high confidence.

Soil

Pratylenchus species are migratory endoparasites, meaning they spend the majority of their lifecycle within the roots of the plant. However, they are able to move into soil in order to locate new hosts. Top soil is widely available within the UK and transport costs would make its import prohibitively expensive and this pathway is rated as unlikely with high confidence. Import of soil from third countries is prohibited.

Root Vegetables and Ware Potatoes

Pratylenchus scribneri could enter the PRA area on vegetables or ware potatoes. Given the limited distribution of *P. scribneri* as a field pest in Europe and limited opportunity for the nematode to move to fields (ware potatoes and root veg being mostly for human consumption and fodder being expensive to import) this pathway is rated as unlikely with high confidence.

Plants for planting	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	☑	Very likely	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				
Bulbs or tubers	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely		Very likely	
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐				
Soil	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely	☐
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐				
Root vegetables or ware potatoes	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely		Very likely	
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐				

9. If the pest needs a vector, is it present in the UK/PRA area?

The nematode is not vectored.

10. How likely is the pest to establish outdoors or under protection in the UK/PRA area?

In field crops grown outdoors *P. scribneri* has been reported only from countries that have warmer summer temperatures than those found in the PRA area. The most northerly latitudes from which field infestations of the nematode have been reported are Pennsylvania and South Dakota), Slovenia and Croatia. There are no outdoor records of *P. scribneri* in Canada, despite hosts being widely grown. On soybean, Acosta and Malek (1979), found that the optimum temperature for *P. scribneri* reproduction was 30^{o} C, whilst no population increase occurred at 15^{o} C. Slow population increases occurred between 20-30^{o} C. Thomason and O' Melia (1962) have reported a higher optimum temperature (33-34^{o} C) for population development on *Beta vulgaris* (sugar beet), *Sorghum* × *drummondii* (Sudan grass), *Phaseolus vulgaris* (green bean) and *Nicotiana tabacum* (tobacco). On tomato the minimum soil temperature for stable or increasing population development was determined as 20^{o} C, whereas on soybean this temperature was 27.5^{o} C (Dickerson, 1979), indicating that host species can influence minimum population development. Climatic limitations justify a 'very unlikely' rating for the establishment of *P. scribneri* outdoors.

When plants are grown under protection establishment is likely – and this has occurred in other northern EU countries, such as Germany and the Netherlands. However, this rating is associated with medium confidence reflecting the fact that the characteristics of specific production systems will have a large bearing on establishment potential.

Outdoors	Very unlikely	☑	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
Under Protection	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	☑	Very likely ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

11. How quickly could the pest spread in the UK/PRA area?

Natural spread of *Pratylenchus* nematodes in fields originating from an infected root zone has been reported to be approximately 1-2m per year (Castiillo and Vovlas, 2007). Soil

water content affects natural movement and flooding can increase spread. However, these are unlikely in the UK, as the nematode is unlikely to establish outside. Under protection, activities that spread infested soil will spread the nematode. For example, infested soil adhering to boots, or machinery could spread the nematode, as well as the movement of infested soil / compost between and within protected cultivation sites. Recirculating irrigation systems could also spread the nematode locally.

Plants that are moved by trade will efficiently spread *P. scribneri*.

Natural Spread	Very slowly	☐	Slowly	☑	Moderate pace	☐	Quickly	☐	Very quickly ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
With trade	Very slowly	☐	Slowly	☐	Moderate pace	☐	Quickly	☐	Very quickly ☑
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			

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

As with other root-lesion nematode species, crop and horticultural losses due to *P. scribneri* are difficult to quantify because damage is dependent on a large range of factors. Stress factors that exacerbate nematode damage to plants include high temperatures early in the growing season, inadequate rainfall and the presence of secondary opportunist pathogens (eg. *Verticillium* spp.), which may take advantage of the root damage initiated by the nematode. Lesions can be produced on potato tubers following attack by *P. scribneri.*

The size of nematode populations affects plant damage and the minimum population thresholds required for *P. scribneri* required to produce crop losses have been determined experimentally. Minimum damage thresholds for bean and soybean have been determined as 0.5 and 14 nematodes/cm3 respectively (Thomason *et al*., 1976; Acosta, 1982). In a Nigerian study maize grain yield losses of up to 36.9% were recorded for high *P. scribneri* populations (671 nematodes /100 ml of soil) and 26% yield losses were associated with moderate populations of 168 nematodes /100 ml of soil (Olowe, 2011).

There are few reports of impacts to crops under protection, although widespread *P. scribneri* infestation of *Hippeastrum* was reported under protection, in Sweden in the early 1970s (Andersson, 1971).

The complexity of factors that contribute to direct or indirect damage from *P. scribneri* contributes to a low confidence rating in assessing impacts attributable to the nematode.

Impacts	Very small	☐	Small	☐	Medium	☑	Large	☐	Very large ☐
Confidence	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			

13. What is the pest's potential to cause economic, environmental and social impacts in the UK/PRA area?

Economic impacts to field crops in the PRA area are small because of the low risks of *P. scibneri* establishment due to the cooler summers in the PRA area compared to regions where the nematode is known to be established outside. Additionally, there is a paucity of data regarding potential economic impacts for plants grown under protection, although widespread *P. scribneri* infestation of *Hippeastrum* has was reported in Sweden in the early 1970s (Andersson, 1971), which illustrates the potential for spread of the nematode within the horticultural trade. The potential economic impact for *P. scribneri* has been rated as 'small' but with a medium confidence rating reflecting uncertainties in estimating potential damage and economic losses. Little is known concerning environmental and social impacts of *P. scribneri*.

Economic Impacts	Very small	☐	Small	☑	Medium	☐	Large	☐	Very large ☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
Environ - mental Impacts	Very small	☑	Small	☐	Medium	☐	Large	☐	Very large ☐
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			
Social Impacts	Very small	☑	Small	☐	Medium	☐	Large	☐	Very large ☐
Confidence	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			

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

The nematode does not vector pathogens.

15. What is the area endangered by the pest?

For plants grown under protection the whole PRA area is at risk from the nematode. Outdoors, establishment is very unlikely.

Stage 3: Pest Risk Management

16. What are the risk management options for the UK/PRA area?

(Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors).

Nematode infestations can be problematic and expensive to control and avoiding introducing *P. scribneri* onto production premises is preferable to mitigating damage once introduced. Nematicides have been demonstrated to control *P. scribneri* (Gao, *et al*., 1994) though there use is only approved for certain crops in the UK. Crop rotation could be used to reduce the build-up of *P. scribneri* populations and use and changing of sterilised growing media will reduce infestations. However, the potential for eradication of *P. scribneri* in fields is low. High standards of plant management and bios-security measures to reduce risks of nematode spread (eg cleaning machinery and footware) would help to reduce damage from *P. scribneri* infestations.

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