



### Potato Cyst Nematodes

## *Globodera pallida* &

## *Globodera rostochiensis*



**Figure 1.** Swollen females of the white potato cyst nematode (*G. pallida*) on potato roots (x10). © Crown copyright, courtesy of Fera Science Ltd

### Background

The potato cyst nematodes (PCN) *Globodera pallida* (the white potato cyst nematode) and *G. rostochiensis* (the yellow or golden potato cyst nematode) are regulated quarantine pests known to be present in the UK. These nematodes are found in countries in many parts of the world, including other parts of Europe. They feed on plant roots which results in plant stunting and crop yield loss, especially to potatoes. However, certain resistant potato cultivars now exist which are helping control the spread and impact of these pests. Not all potato cultivars are resistant, so it is still important to prevent the introduction and spread of these nematodes in addition to monitoring the populations that are already

present. Additionally, new virulent PCN populations outside of the UK could pose a threat to currently resistant cultivars.

## Geographical Distribution

*Globodera pallida* and *G. rostochiensis* both originated in South America in the region of the Andes Mountains. They were introduced to Europe with potatoes most likely in the mid-19<sup>th</sup> century and are thought to have then spread to other regions. They favour cool and temperate areas, with distributions linked to major potato growing areas. These pests are widespread across Europe, and are also present in regions of **Africa**: Algeria, Egypt, Kenya, Libya, Morocco, Rwanda, South Africa, Tunisia and Uganda; **the Americas**: Bolivia, Canada (British Columbia, Newfoundland, Quebec), Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Peru, USA (Idaho, New York), Venezuela; **Asia**: China, India, Indonesia, Iran, Japan, Kazakhstan, Kyrgyzstan, Lebanon, Oman, Pakistan, Philippines, Sri Lanka and Tajikistan; **Australasia**: Australia (Victoria) and New Zealand (Note: both species are not present in all these countries, it may just be one or the other).

## Host Plants

Potato is the most economically important host for both *Globodera pallida* and *G. rostochiensis*. However, PCN also feed on the roots of other solanaceous plants, e.g. tomato, aubergine and, occasionally, weeds such as bitter-sweet (*Solanum dulcamara*). Several other solanaceous species have also been identified as potential host plants in experimental studies. Each species of PCN has several pathotypes; these differ in their ability to multiply on different potato cultivars.

## Description

Severe infestations of PCN are usually noticed as patches of poor above ground growth in a crop with affected plants showing signs of wilting, chlorosis or death of foliage (Figure 2). If plants are lifted, roots appear proliferated (excessive new growth) and pin head-sized spherical objects, known as cysts, may be seen on the roots (Figure 3). These cysts are the bodies of females that have swelled whilst maturing and become filled with eggs. They may be white, yellow or chestnut brown in colour, depending on the lifecycle stage. If potato plants are heavily infested, the tubers will be undersized and exhibit signs of pitting and necrosis (Figure 4) and cysts may occasionally be seen on the surface of tubers.



**Figure 2.** PCN damage to potato crop with patchy growth, with wilting and yellowing foliage. © Crown copyright, courtesy of Fera Science Ltd



**Figure 3.** PCN cysts visible on potato plant roots © 2024 DAFWA



**Figure 4.** Signs of pitting and necrosis on a potato tuber. © Crown copyright, courtesy of Fera Science Ltd

## Biology

Potato cyst nematode second stage juveniles (J2s) and adult male nematodes are soil-borne, worm-like, less than 1 mm long and translucent. J2s establish feeding sites within the roots which are not easily observed. Developing females swell as they mature, becoming almost spherical, and then burst through the root wall from the inside, with only the head of the female remaining embedded within the root. The swollen female is shiny, spherical, less than 1 mm in diameter and initially white or cream-coloured (Figure 5). Following fertilisation by the males, 200-600 eggs will start to develop within each female.



The female of *G. rostochiensis* passes through a prolonged golden-yellow phase as it matures, lasting around 4-6 weeks, whereas *G. pallida* remains creamy-white. When the female of either species dies, its body forms a dark, reddish-brown cyst with a hard skin that protects the eggs inside (Figure 6). At harvest when the plants are lifted, most cysts become detached from the roots and remain in the soil as a source of infestation for future potato crops. When in the presence of potato plants, a proportion of eggs hatch from cysts as they respond to root exudates (chemicals released by the roots) and environmental conditions (Figure 7). In the absence of host plants, the hatch rate is much lower, and any juveniles that do hatch cannot survive long-term without a host. Therefore, over time, if there are no suitable hosts, the population gradually declines, with most eggs having hatched within seven years. However, some eggs can remain viable in the soil for 20 or more years.



**Figure 5.** Immature PCN cyst on potato root © Fera Science Ltd



**Figure 6.** Mature PCN cyst with hardened skin © Fera Science Ltd



**Figure 7.** PCN cyst filled with viable eggs and juveniles © Crown copyright, courtesy of Fera Science Ltd

## Dispersal and Detection

Females and young cysts are only just visible to the naked eye, appearing as white/yellow or brown pin-head-sized cysts on the root surface (Figures 8 and 9). Low level infestations are difficult to detect visually on the roots, and planted tubers may exhibit no obvious above ground symptoms unless there is a high level of infestation. Dispersal of PCN is mainly via cysts in soil adhered to potato tubers, farm machinery or footwear. Natural movement is limited, with juveniles only being able to travel up to 1 m per year, however, cysts may be spread more locally by wind, farm animals and floodwater. The use of certified seed potatoes will help prevent introduction of PCN on tubers.



**Figure 8.** Pin-head sized cysts of *Globodera pallida* (white potato cyst nematode) on potato roots. © Crown copyright, courtesy of Fera Science Ltd



**Figure 9.** Pin-head sized cysts of *Globodera rostochiensis* (yellow potato cyst nematode) on potato roots © Crown copyright, courtesy of Fera Science Ltd

In the UK, as PCN is listed under GB Plant Health legislation as a quarantine organism, there are freedom requirements for seed potatoes and other planting material. There is therefore a nil tolerance for PCN under seed classification schemes in the UK (England, Wales, Scotland and Northern Ireland) on the harvested seed potato crop, with strict restrictions on how infested crops should be handled. For findings of PCN on harvested ware potatoes, there are decontamination procedures in place, including correct disposal of waste soil from grading and processing.

There is also statutory sampling of soil associated with seed and ware potato production land to check for the presence of PCN to ensure there is no infestation. To help prevent spread of PCN in the UK, a finding of viable PCN from field samples means the infested land is scheduled under notice by Defra. Scheduling means that testing, treatment and cleanup regimes must be applied to an area to help control a pest or pathogen. On land scheduled due to PCN, material grown on that land cannot be exported, and land is not eligible for seed potato production and certain other plant species including tomato and aubergine. Planting a ware potato crop is allowed under notice provided a control programme is put in place to suppress development of PCN. Scheduling remains in place

until no live PCN is found on the contaminated land, with a minimum scheduling period of three years.

## Economic Impact

Potato cyst nematodes damage the roots and reduce yield, even when infestations produce no obvious symptoms on the above ground parts of the plant. Such plants are stunted, often chlorotic and typically occur in patches. Potato crops can also be susceptible to secondary infections by *Rhizoctonia* and other fungal diseases which may also contribute to the yield loss. Low level infestations will build over successive years if left unmanaged until it may be difficult to grow a marketable crop. With severe infestations, roots of susceptible and tolerant potato cultivars are more seriously damaged, and plants may be killed.

## Pest Management and Reporting

Where viable PCN is detected on production land, local inspectors can provide advice about potential management options to suppress the PCN population. Information is also available at the [Potato Cyst Nematode Hub](#).

Suspected outbreaks of **potato cyst nematode** or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, York.

Tel: 0300 1000 313

Email: [planthealth.info@apha.gov.uk](mailto:planthealth.info@apha.gov.uk)

For **Scotland**, contact the Scottish Government:

For potato tuber crops contact the local **RPID officer**:

<http://www.gov.scot/Topics/farmingrural/Agriculture/AOcontacts/contacts>

For all other host plants with roots, bulbs and rhizomes email: [hort.marketing@gov.scot](mailto:hort.marketing@gov.scot)

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch**:

Tel: 0300 200 7847 Email: [planthealth@daera-ni.gov.uk](mailto:planthealth@daera-ni.gov.uk)

Web: <https://www.daera-ni.gov.uk/topics/plant-and-tree-health>

For additional information on UK Plant Health please see:

<https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/>

<https://planthealthportal.defra.gov.uk/>

<https://www.gov.uk/plant-health-controls>

<http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases>

<https://www.daera-ni.gov.uk>

[The Seed Potato Classification Scheme - GOV.UK \(www.gov.uk\)](#)

[Seed & Ware Potatoes | SASA \(Science & Advice for Scottish Agriculture\)](#)

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