Genomics and interactions between PCN and potato

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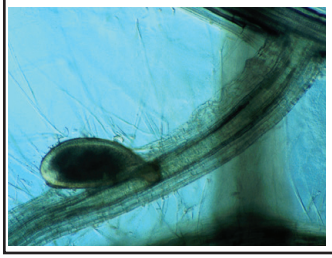
PCN - *Globodera pallida* & *G. rostochiensis*

Many growers will be familiar with the appearance of PCN cysts on the roots of an infected plant (right)

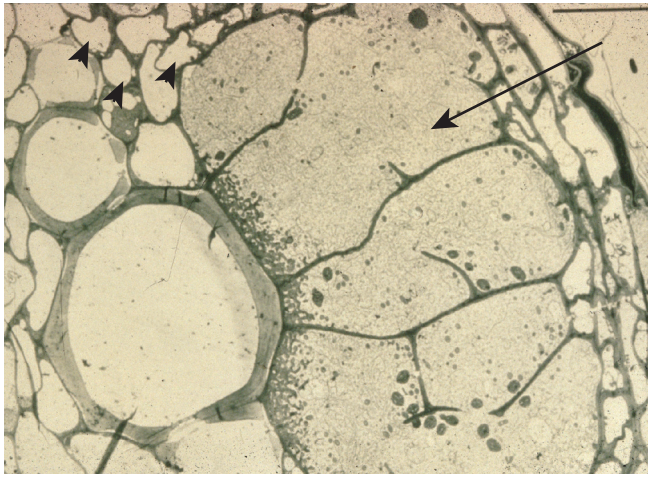
But what happens when PCN infects a crop?



Why is PCN such a difficult pathogen to control?

And why are SCRI part of a team sequencing the genome of the white PCN?

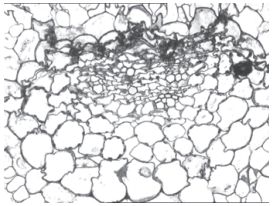
The feeding site & plant defences



After migrating through the root the nematode induces the formation of a complex feeding site in the plant. The feeding site (arrow) is large and contains highly enriched cytoplasm compared to normal plant cells (arrowheads).

The nematode can only induce one feeding site and depends on this single feeding site for the nutrients required to develop to the adult stage.

The nematode therefore needs to keep the feeding structure alive. This requires that plant defences are suppressed by the nematode. Recent work at SCRI suggests there are parallels between the ways that PCN and late blight achieve this suppression of plant defences.



Where suppression of plant defences fails (for example in a resistant plant) the cells attacked by the nematodes may commit suicide, leaving the nematode with no food source.

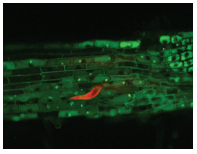
Invasion & migration

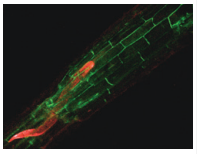
Cysts contain eggs, each of which contains a juvenile nematode.

Juveniles hatch only when they detect a suitable host crop growing nearby.

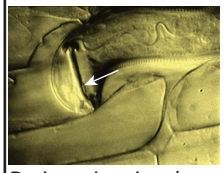
Hatch in PCN is stimulated by a variety of compounds that leach from potato roots.

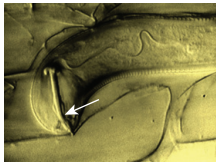
After hatching, nematodes locate and invade roots.

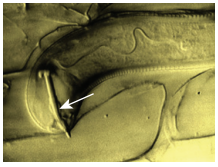




The nematodes then migrate through the root and find a suitable place to feed (see movie)







During migration the nematodes use their stylet (arrows in images above) to physically disrupt plant cell walls and also secrete a cocktail of enzymes that soften the plant cell wall.

Surprisingly, the nematodes have acquired the genes that allow them to make these cell wall softening enzymes from bacteria in a process known as horizontal gene transfer.

Sequencing the PCN genome

SCRI is a partner in a consortium that has received funding to sequence the genome of the white species of PCN *Globodera pallida*. The sequencing will be done at the Sanger Centre - the same UK institution that sequenced the human genome.

In addition to providing scientific advances this project will have numberous practical outputs:

New nematicides
Knowledge of nematode genes and enzyme pathways will provide new targets for chemical control

Understanding of host-parasite interactions
Better knowledge in this area will underpin GM strategies to control PCN and other cyst nematodes

Knowledge of how PCN interacts with natural enemies
Developments in this area will assist development of biocontrol strategies

Improved pest management
Based on a better understanding of dormancy and the molecular basis of resistance breaking by nematodes