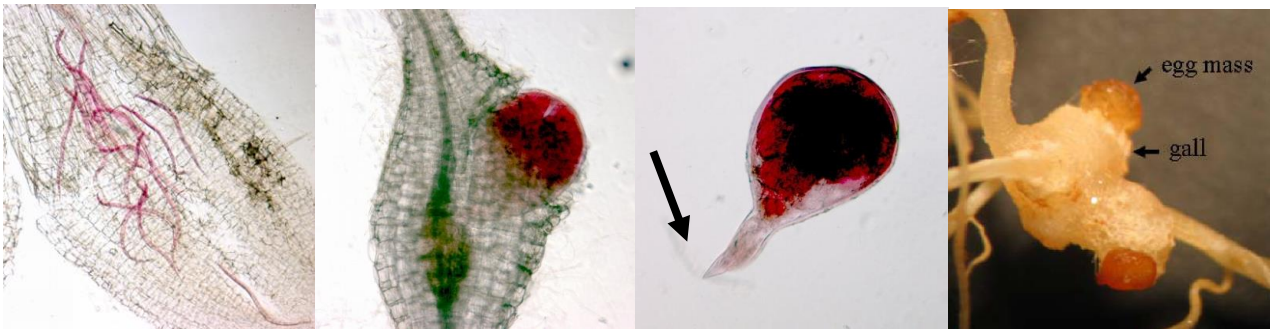
PLANT AND SOIL NEMATODES

FEEDING HABITS OF PLANT-PARASITIC NEMATODES

More than 4,300 nematode species in about 200 genera are known to feed on plants. Most of these nematodes cause little damage because they either feed superficially on root hairs or cells on the outer surface of roots, or live in environments where their populations are regulated by naturally occurring parasites and predators. Nevertheless, hundreds of species are important pests of agricultural crops. These nematodes are commonly subdivided into four groups based on their feeding habits and life histories.

SEDENTARY ENDOPARASITES

This group of nematodes have developed specialised mechanisms for feeding within plant roots. Instead of remaining worm-like throughout their life cycle, they enter the root and then develop into swollen obese females that are fully or partly embedded in the root tissue. Root-knot nematode (*Meloidogyne*) is a good example (see figure below). Juveniles (stained red) enter a root and begin to feed. They then lose their capacity to move and gradually swell up to become an obese female. In the third figure, the female nematode has been removed from the root to show the head and neck region where its feeding spear is located (arrow). Finally, the female deposits hundreds of eggs that are held together by gelatinous material in an egg mass.



Cyst nematodes (*Heterodera* and *Globodera*) have a similar life history to root-knot nematodes but differ in two respects. First, the mature female protrudes from the root into the soil and so it is not fully embedded within the root. Second, eggs are not laid in an egg mass but are instead retained within the body. The external covering of the body then hardens to become a thick-walled cyst, a protective structure that helps the eggs survive adverse conditions or periods when a host plant is absent.

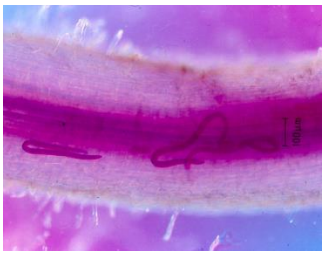
Golden-coloured cysts of potato cyst nematode (*Globodera rostochiensis*) protruding from potato roots

Two other nematodes are termed sedentary semi-endoparasites because the anterior portion of the nematode penetrates into the root and remains vermiform (i.e. wormlike) whereas the posterior portion becomes obese and remains outside the root. Eggs are then deposited in a gelatinous matrix on the root surface. The two most important nematodes in this group are reniform nematode (*Rotylenchulus*) and citrus nematode (*Tylenchulus semipenetrans*).

A semi-endoparasite: The kidney-shaped female of reniform nematode feeding on roots and laying eggs

MIGRATORY ENDOPARASITES

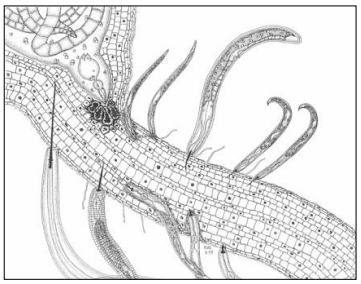
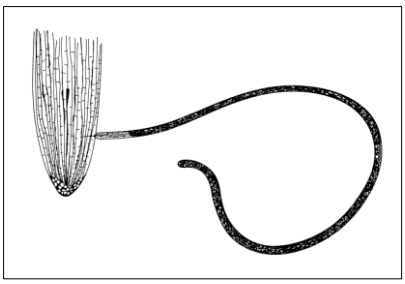
These nematodes remain vermiform throughout their lives, which allows them to move freely through root tissue and feed on root cells as they go. Once all the cells in the root are destroyed the nematode moves on and invades another root. The two most important nematodes in this group are lesion nematode (*Pratylenchus*) and burrowing nematode (*Radopholus*).

Root-lesion nematodes outside and inside root tissue

ECTOPARASITES

This group of plant-parasitic nematodes remain in soil throughout their life cycle. They do not enter roots but feed externally, damaging root tips and reducing root elongation. Many genera are capable of causing damage, including dagger (*Xiphinema*), stubby root (*Paratrichodorus*), sting (*Ibipora*), needle (*Paralongidorus*), stunt (*Tylenchorhynchus* and *Merlinius*) and ring nematode (various genera in the family Criconematidae). Others such as spiral (*Helicotylenchus*) and pin (*Paratylenchus*) only cause crop losses at very high population densities.

Examples of ectoparasitic nematodes feeding on roots (Courtesy Oregon State University), and a needle nematode feeding on a rice root

ABOVE-GROUND PARASITES

All plant-parasitic nematodes live in soil but when their host plant is covered with a film of water, some species move upwards and feed on aboveground tissues. For example, the stem and bulb nematode (*Ditylenchus dipsaci*) can invade and multiply in the leaves and stems of onion and garlic; species of *Aphelenchoides* feed on the leaves, flowers and buds of chrysanthemum and strawberry; and species of *Anguina* produce galls in the seeds, leaves, and other aerial parts of their host plant.

Author: Graham R Stirling, Plant and Soil Nematodes. **Contact details:** graham.stirling@biolcrop.com.au