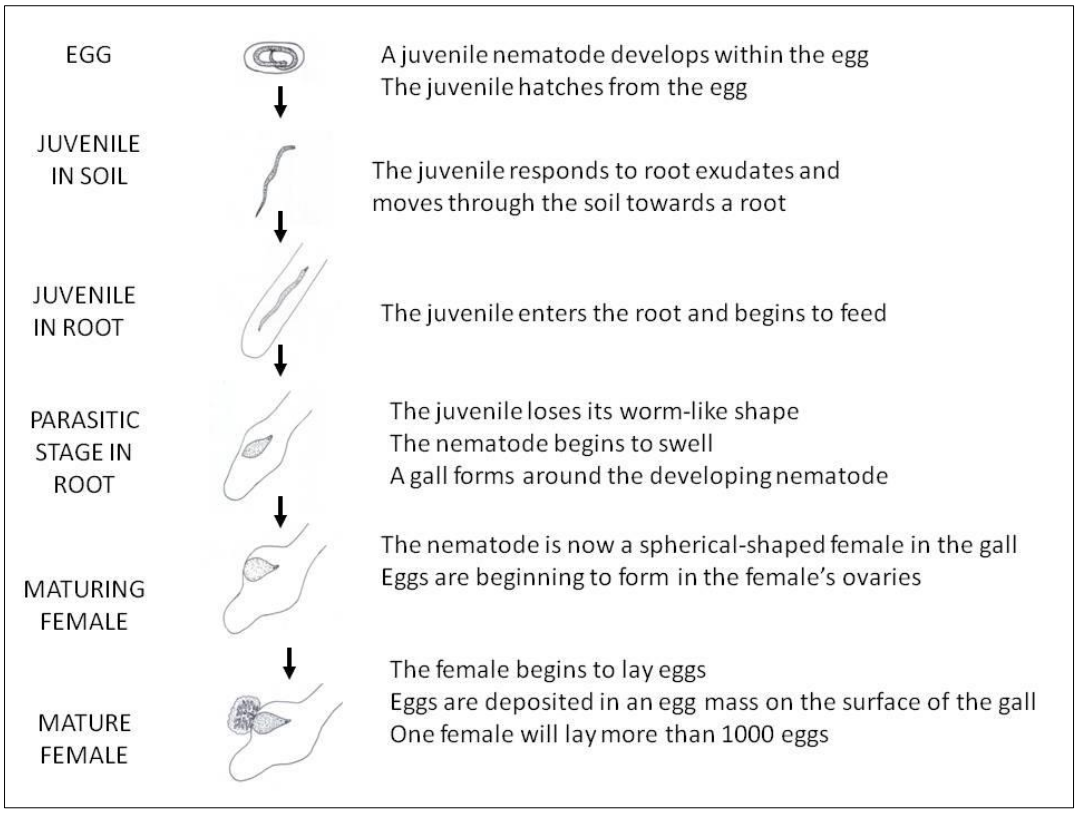
PLANT AND SOIL NEMATODES

LIFE HISTORY OF ROOT-KNOT NEMATODE: AUSTRALIA'S MOST IMPORTANT NEMATODE PEST



Eggs

Root-knot nematode (*Meloidogyne* spp.) commences life as eggs, which are laid by the female on the surface of roots or in root tissue. About 10 days later, a fully developed worm is visible within the egg. As one moult has already occurred, the nematodes that emerge from eggs are known as second-stage juveniles (J2).

Second-stage-juveniles

J2 are the nematode's infective stage and although they are very small (only about 0.5 mm long), they have an extraordinary capacity to locate roots. After hatching from the egg, the juveniles sense substances being exuded from roots and migrate towards them. They may travel more than a metre to find a host plant. Migration occurs in water films around soil particles or on root surfaces. Nematodes do not move when the soil is dry.

The migrating J2 is equipped with a hollow, retractable feeding spear. Once the nematode reaches the tip of a suitable root, the spear extends, wounding the tissue and creating an entry point. The nematode then enters the root and migrates between cells until it reaches its final, permanent feeding site.

Having arrived at its feeding site, a J2 induces the plant to convert some of its root cells into metabolically active 'giant cells'. These specialised cells are the nematode's food source, providing it with a permanent supply of nutrients. Once feeding commences, the J2 loses its wormlike shape and no longer has the capacity to leave the root. It simply stays in the same position and uses its spear to obtain nutrients from the giant cells.

Adults

Over a period of 20-30 days, the J2 develops into an adult. When the environment is suitable and an adequate food supply is available, most nematodes become spherical females about 1 mm in diameter. However, males may also be produced, particularly when the food supply diminishes or environmental conditions are not suitable for reproduction.

The length of the life cycle varies with nematode species and is markedly influenced by temperature. However, the female usually begins laying eggs 4-5 weeks after the J2 establishes a feeding site within the root. The eggs are laid into a protective gelatinous material and are clustered together in an egg mass on the root surface. Root-knot nematodes have an enormous capacity to reproduce, as each female can produce about 1000 eggs.

SYMPTOMS CAUSED BY ROOT-KNOT NEMATODE

The plant responds to the presence of root-knot nematodes by producing gall tissue. The root begins to swell soon after the J2 enters a root and by the time mature females are present, there is an obvious gall around each nematode. These galls are quite small but can be seen with the naked eye.

Once the first generation of females has reproduced, the newly laid eggs begin to develop and a second generation of juvenile nematodes is produced. Some of these nematodes will migrate to other parts of the root system and establish new feeding sites. Others will invade tissue that is already galled and when this occurs, the galls increase in size. On highly susceptible crops such as tomato, the large galls may be greater than 10 mm in diameter.

WHY IS ROOT-KNOT NEMATODE AN IMPORTANT PEST IN AUSTRALIA?

- Roots are often severely damaged and root elongation is reduced. This limits water and nutrient uptake, causing crops to become unthrifty and produce lower yields. Yield losses are particularly high in crops such as carrot, potato and sweetpotato because the nematode damages the marketable product (taproot, tuber, and storage root, respectively).
- Many crops are highly susceptible, including most vegetables (e.g. tomato, capsicum, carrot, potato, sweetpotato, ginger, beans, melons, eggplant), some field crops (e.g. soybean, cotton, mungbean, peanut), many perennial horticultural crops (e.g. peach, almond, grapevine, banana, pineapple, papaya) and a few pasture species (e.g. lucerne, clovers).
- Root-knot nematode is widely distributed because thousands of plant species are hosts. In agricultural situations the nematode multiplies on a wide range of crops and is carried over from crop to crop on weeds and cover crops.
- The nematode multiplies readily in light-textured soils and soils of volcanic origin, and these soils are relatively common in Australia.
- Root-knot nematode thrives in warm climates, multiplying throughout the year in northern regions of Australia. Even in cooler areas such as Tasmania, summer temperatures are high enough for multiplication and damage to occur.

FURTHER READING

Perry RN, Moens M, Starr JL (2009) Root-knot nematodes. CAB International, Wallingford, U.K. 488 pp.

Taylor AL, Sasser JN (1977) Biology, identification and control of root-knot nematodes (*Meloidogyne* species). International *Meloidogyne* project

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