Pathogen of the month – April 2012

Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949

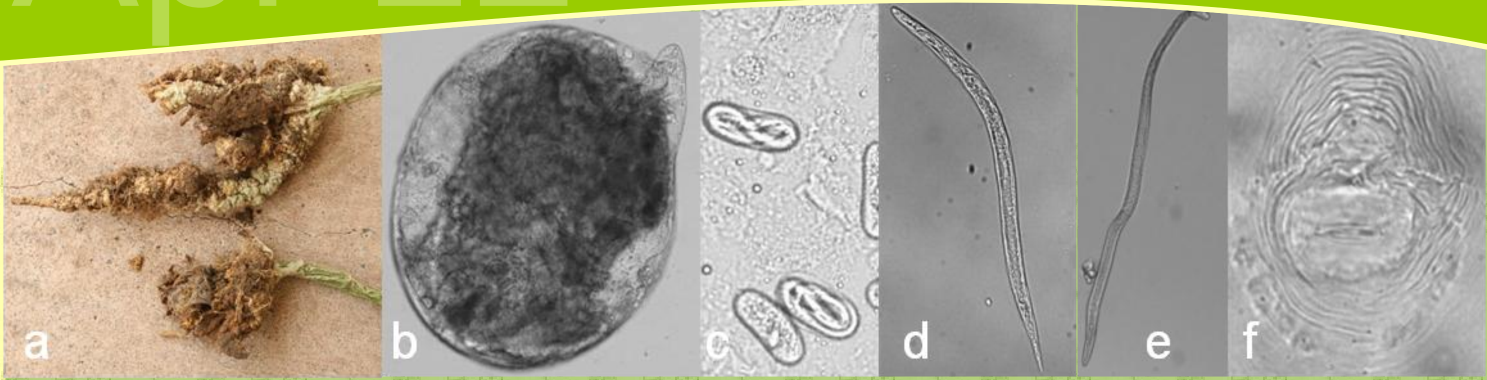

Fig. 1 Bitter Melon root heavily infested with *M. Incognita* (a); Root-knot nematode (RKN) female (b); RKN eggs (c); RKN stage 2 juvenile (d); RKN male (e); and *M. incognita* female perineal pattern (f). Photos are not to scale. Photo credits: B. Conde (a), S. Singh (b, c, d, e & f).

Common Name: Root-knot nematode
Classification: K: Animalia, P: Nematoda, C: Chromadorea, O:Panagrolaimida, SO:Tylenchina, F: Meloidogynidae

Root-Knot nematodes (RKN) are one of the most damaging groups of plant-parasitic nematodes capable of attacking a wide range of crop plants as well as many weed species. With damage thresholds of 1- 2 nematode(s) per gram of soil, *M. incognita* is one of the most destructive species worldwide. The effects of RKN infestation include reduction in number of leaves, decrease in photosynthetic ability, reduction in flowering, and decrease in fruit production, all of which are very similar to symptoms of nutrient deficiency. In addition to direct damage, *M. incognita* is able to form disease complexes with fungal pathogens such as *Fusarium* sp. and can exist in mixed populations with other *Meloidogyne* sp.

Symptoms: A characteristic symptom of RKN is the formation of root galls (Fig. 1a). The galls are outgrowths of the roots themselves and can be differentiated from root nodules by rubbing the galls between fingers. Root nodules come off easily while root galls do not. The above-ground symptoms include poor growth, yellowing of leaves and wilting of plants on hot days.

Lifecycle: The adult female (Fig. 1b) lives inside the root gall where she feeds, matures and lays eggs (Fig. 1c). These are embedded in a protective gelatinous matrix on the part of the female protruding outside the root. The juveniles undergo the first moult within the egg and hatch out at the second moult. The second stage juveniles (Fig. 1d) are attracted to roots by root exudates, and after entering the roots they undergo a third and then a fourth moult into the adult stage. The females are able to reproduce parthenogenetically or sexually when males (Fig. 1e) are present. On average the lifecycle is complete within 6-8 weeks under tropical conditions.

Host range: *M. incognita* is extremely polyphagous, but the level of host susceptibility varies. In Australia, *M. incognita* has been reported from at least 35 plant families; Actinidiaceae, Agavaceae, Amaranthaceae, Apiaceae, Asciepiadaceae, Asteraceae, Balsaminaceae, Begoniaceae, Cactaceae, Caricaceae, Caryophyllaceae, Chenopodiaceae, Convolvulaceae, Cornaceae, Cucurbitaceae, Fabaceae, Geraniaceae, Lamiaceae, Leeaceae, Malvaceae, Mimosaceae, Moraceae, Musaceae, Passifloraceae, Poaceae, Polygonaceae, Primulaceae, Rosaceae, Rubiaceae, Rutaceae, Salicaceae, Scrophulariaceae, Scrophulariaceae, Solanaceae, Vitaceae.

Key Diagnostic Features: RKN species identification requires microscopic examination of adult females, males and juveniles. Due to overlapping morphological characteristics between species, a combination of morphological and molecular methods are required for positive species diagnosis. The perineal pattern is a widely used feature for rapid morphological differentiation of adult females of *Meloidogyne* species. This is a fingerprint-like arrangement of lines around their posterior. The perineal pattern of *M. incognita* has: a high squarish arch on the dorsal side above the anus; striations varying from smooth and wavy to zigzag; and lateral lines absent (Fig. 1f). *M. incognita* has six races which can be differentiated on the basis of host range tests.

Management and control: A range of management strategies are available for controlling RKN, such as using nematicides, green manure and soil amendments, rotations using resistant crops and biological control. Use of nematicides is costly and may be feasible only for high value crops. The use of crop rotations requires careful planning based on the RKN species or race in order to be effective. Nematode-free planting materials, especially for transplanting and vegetative propagation, and good farm sanitation such as cleaning machinery/equipment before moving between farms can help reduce the spread of RKN. Weeds can act as reservoir hosts of RKN. Hence keeping farms clean helps in keeping the nematode population levels low.

Further Reading:

Perry, R.N. Moens, M. and Starr, J.L. 2009. *Meloidogyne* species – a diverse group of novel and important plant parasites *In* Root-knot Nematodes. R.N. Perry, M. Moens, and J.L. Starr (Eds.) CABI Wallingford, UK.

Trudgill, D.L. and Blok, V.C. 2001. Apomictic, polyphagous root-knot nematodes: exceptionally successful and damaging biotrophic root pathogens. Annu. Rev. Phytopathol. 39:53-77.

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