PLANT AND SOIL NEMATODES

MELOIDOGYNE ENTEROLOBII: A MAJOR THREAT TO VEGETABLES AND OTHER CROPS IN AUSTRALIA

The guava root-knot nematode (*Meloidogyne enterolobii*) was detected on four properties in the Northern Territory in October 2022, and at two locations in Queensland in February 2023. This nematode causes severe damage to many crops in tropical and subtropical regions of the world but had never previously been detected in Australia. This fact sheet summarises what is known about this destructive nematode pest.

Meloidogyne enterolobii

More than 100 species of *Meloidogyne* have been found worldwide but *M. enterolobii* is considered one of the most damaging species. It was first described from Hainan Island, China in 1983 but has since been reported from many countries in North, South and Central America, Africa, and Asia. Occasional interceptions have also been reported in Europe. The common name 'guava root-knot nematode' was given because the nematode caused significant damage to guava fruit trees (*Psidium guajava*) in South America.

M. enterolobii has long been subject to the quarantine and biosecurity measures that are in place to minimise the risk of introducing potentially damaging pests to Australia. Thus, its introduction is a concern, because biosecurity authorities do not know how the nematode arrived in Australia, or why it was found at several locations in two different states.

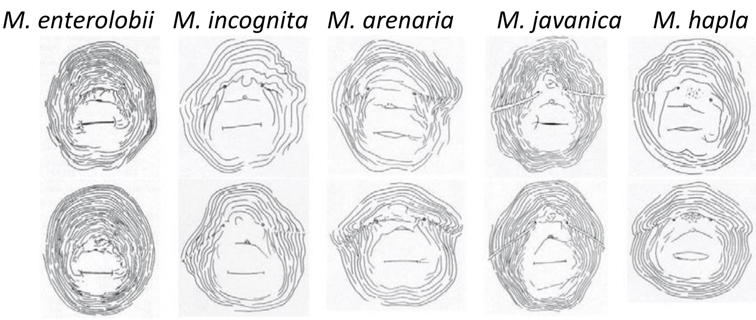
Why is the introduction of *M. enterolobii* a concern?

There are several reasons why the introduction of *M. enterolobii* is a serious concern.

- The nematode is polyphagous, which means it can multiply on a huge range of host plants, including many agronomic and horticultural crops and a large number of weeds. Its principal hosts include bean, coffee, cotton, eggplant, guava, papaya, pepper, potato, soybean, sweetpotato, tobacco, tomato, and watermelon. Only a few crops have been reported to be non-hosts or poor hosts, and they include avocado, cabbage, cashew, citrus, corn, garlic, grapefruit, mango, and strawberry.
- *M. enterolobii* has a high reproductive rate and the capacity to produce more severe symptoms than other root-knot nematode species. On crops where the produce cannot be marketed if it shows signs of nematode damage (e.g. sweetpotato), outright crop failures have been documented.
- *M. enterolobii* can attack root-knot nematode-resistance genes from several sources. Thus, it will multiply on crop genotypes carrying genes that provide resistance to various *Meloidogyne* species, including resistant cultivars of cotton, sweetpotato and tomato (*Mi-1* gene), potato (*Mh* gene), soybean (*Mir1* gene), bell pepper (N gene), sweet pepper (Tabasco gene) and cowpea (R_k gene).

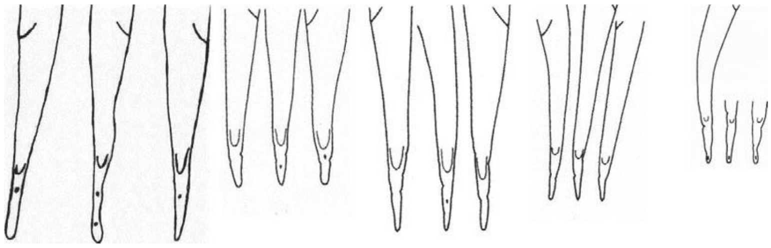
How is *M. enterolobii* differentiated from other *Meloidogyne* species?

M. enterolobii closely resembles other tropical root-knot nematode species such as *M. javanica*, *M. incognita*, and *M. arenaria* and so is difficult to identify using morphological characters. An experienced nematode taxonomist may be able to separate it from other species in the genus by perineal pattern shape, but the perineal patterns of *M. enterolobii* and *M. incognita* are very similar. Other useful characters are the morphology of the male and female stylet, morphology of the male, body length, morphology of the lip region, and morphology of the hyaline part of the tail of second-stage juveniles. Diagrams showing some of these key morphological features are given below. Molecular identification methods can also be used to identify *M. enterolobii*, and several different methods are given by Philbrick et al. (2020).



Perineal patterns of five *Meloidogyne* species (from Yang & Eisenback, 1983)

M. enterolobii   *M. incognita*   *M. arenaria*   *M. javanica*   *M. hapla*



Tails of second-stage juveniles of five *Meloidogyne* species (from Yang & Eisenback, 1983)

What can be done to limit spread in Australia?

As *M. enterolobii* has been found at several locations in the Northern Territory and Queensland, it will be impossible to eradicate the nematode. Thus, Australian states will have to establish quarantine procedures to limit it's spread. This is most likely to occur through the movement of infected plant material, infested soil, and farm equipment that is contaminated with soil from infested sites.

Industries likely to be affected by *M. enterolobii* need to be aware that biosecurity programs of this nature are unlikely to be completely effective. In the United States, for example, *M. enterolobii* was first reported in Puerto Rico in 1988 and found in Florida in 2001. Although biosecurity measures were implemented, the nematode is now causing problems in North Carolina, South Carolina, and Louisiana.

Management of guava root-knot nematode

Once *M. enterolobii* becomes established in an area, rotation with non-host crops is the control tactic that is most likely to maintain nematode populations at non-damaging levels. However, finding appropriate rotation crops will be a challenge due to the broad host range of *M. enterolobii* and the fact that non-hosts may have to be grown for a minimum of three years to reduce populations to levels that will not damage a susceptible crop such as tomato. Nevertheless, grain sorghum and sorghum-sudangrass, pearl millet, brown top millet and Japanese millet are summer crops that could possibly be included in a crop rotation program, as they completely inhibited nematode reproduction in a recent glasshouse study (Khanal and Harshman 2022). However, regardless of the non-host crops chosen, weed management will also be important due to the nematode's capacity to multiply on many weeds.

As mentioned previously, *M. enterolobii* is pathogenic to crop genotypes possessing resistance genes from several sources, and so new sources of resistance and tolerance will have to be found in highly susceptible crops. However, even when resistance genes are identified, it is likely to take at least 10 years for them to be deployed in commercially acceptable varieties.

Biological control strategies that are consistently effective against root-knot nematode have not yet been developed, and so in the short to medium term, nematicides will be the main control method available to growers. Fumigants such as metham sodium and 1, 3dichloroproene are one option, but as they are detrimental to the soil biological environment and subject to increasing regulatory scrutiny, they may not be available in future. Several new non-volatile nematicides have been developed in recent years but it remains to be seen whether they are effective against *M. enterolobii*.

Conclusion

As *M. enterolobii* is likely to be moved from its current locations in coming years, growers should establish on-farm biosecurity procedures to prevent its introduction. Also, industries that may be affected should ensure that research programs aimed at developing sustainable control methods are established in Australia.

Further reading

Anon (2016) PM 7/103 (2) *Meloidogyne enterolobii*. *Bulletin OEPP* 46, 190-210

Khanal C, Harshman D (2022) Evaluation of summer crops for host suitability of *Meloiodgyne enterolobii*. *Crop Protection* 151, 105821. https://doi.org/10.1016/j.cropro.2021.105821

Philbrick AN, Adhikari TB, Louws FJ, Gorny AM (2020) *Meloidogyne enterolobii*, a major threat to tomato production: Current status and future prospects for its management. *Frontiers in Plant Science* 11, article 606395

Yang B, Eisenback J (1983) *Meloidogyne enterolobii* n. sp. (Meloidogynidae), a root-knot nematode parasitizing pacara earpod tree in China. *Journal of Nematology* 15, 381-391

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