Feb 20

Pathogen of the month – Feb 2020

Radopholus similis (Cobb, 1893) Thorne ,1949

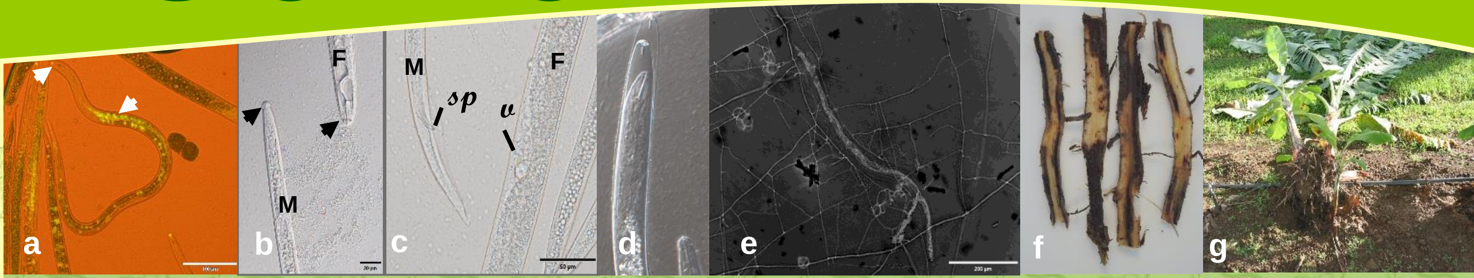

Fig. 1. (a) Mature and juvenile nematodes expressing auto-fluorescent globules/lip region and egg with no autofluorescence; (b) and (c) female (F) and male (M) nematodes highlighting the differences in morphology in the lip region (black arrows) and reproductive organs i.e. (*sp*) spicules and (*v*) vulva; (d) female nematode undergoing molting; (e) Nematophagous fungal growth within a dead burrowing nematode on 1% (w/v) water agar plate; (f) root lesions in *R. similis* infected banana roots and (g) banana plant toppling due to burrowing nematode damage. Scale bars represent 100 μm, 20 μm, 50 μm and 200 μm in (a), (b), (c) and (e) respectively.

Common Name: Burrowing nematode
Disease: Spreading decline (citrus); toppling or blackhead disease (banana); yellows disease (black pepper)
Classification: K: Animalia P: Nematoda C: Secementea O: Tylenchida F: Pratylenchidae

First observed in Fiji in 1893, the burrowing nematode, *Radopholus similis* infects the roots of many commercial crops such as banana, ginger and citrus. A draft genome is available and sequence analysis suggests that it is closely related to cyst nematodes than to root knot or other migratory endoparasitic nematodes such as *Pratylenchus*. Recent work on *R. similis* isolates from Fiji and Australia differed in pathogenicity on ginger and banana, indicating pathotype differences between isolates.

Biology and Ecology: All larval stages and adult females of *Radopholus similis* are infective and feed on root cortical cells. Vermiform adults and juveniles can be in the rhizosphere soil but require a living plant host to survive. All life cycle is completed within the host's root cortex. Reproduction is either by sexual reproduction with males or by hermaphroditism and it is soil moisture and temperature dependent. *R. similis* can survive in root and corm material for up to 6 months. Males have an atrophied stylet and are considered non-parasitic.
Symptoms are linked to the nematode's feeding on the cytoplasm of cells within the cortical parenchyma or rhizome cortex forming cavities leading to reddish-brown necrotic lesions. Water and mineral uptake are reduced, stunting growth, reducing leaf number and size, leaf yellowing, reducing yield and plant toppling The stele is not invaded by *R. similis*. Synergistic effects due to fungal and bacterial invasion of such lesions can lead to root atrophy. Evidence suggests that there are pathotype differences in *R. similis* isolates based on host and location. *Radopholus citrophilus*, previously regarded as a separate species from *R. similis* is now accepted as being synonymous.

Impact: In 2017, total world production was more than 152 M tonnes for banana and plaintains. Asia and Africa are the largest producers of banana (54.2% of the total) and plantains (60.1% of the total) respectively. Australia produced almost 413k tonnes in 2017. North Queensland is the most important production area with 88% of Australia's banana production.

Distribution: It is found in most tropical and subtropical regions of the world. Survey of banana producing regions in Australia found that it was confined to the east coast.

Host Range: Apart from citrus, ginger and banana/plaintain, it has a host range of more than 365 plant species which include coconut, avocado, sugarcane and other grasses as well as ornamentals.

Management options: Damage thresholds are established for banana depending on the proportion of necrotic root tissue. Chemical nematicides are commonly used around the world to manage *R. similis*, even though there is evidence of enhanced biodegradation. An integrative pest management approach to control the burrowing nematode in bananas has been developed, which includes the destruction of previous crops using glyphosate and rotation with non-host crops prior to replanting. Vegetated planting material should be either treated using hot water or nematicides and sourced from accredited clean nurseries or from *in vitro* propagation. Carbon rich organic amendments can help suppress burrowing nematodes during crop growth as part of an integrated approach. Biological controls have been reported to be effective on burrowing nematodes in some circumstances. Development of cultivars resistant to burrowing nematode is occurring through traditional and non-traditional methods. In addition, countries with no *R. similis* impose trade restrictions of produce that may contain soil.

Further Reading: Broadley (1979) Australas Plant Pathol. 8:24-25; Cabrera et al. (2010) Int J Pest Manage. 56: 61-67; Cobon et al. (2019) Australas Plant Pathol. 48: 529–539; EFSA PLH Panel (EFSA Panel on Plant Health), 2014. EFSA J 12(10):3852 (doi:10.2903/j.efsa.2014.3852); FAOSTAT Agriculture data (2017). Available at: http://faostat.fao.org; Mathew R et al (2019) J Nematol. 51. DOI: 10.21307/jofnem-2019-051; Matthew and Opperman (2019) PLOS ONE. 14. e0224391; Mendoza et al. (2007) Nematropica 37: 203-213; Pattison et al. (2011) Australas Plant Pathol. 40: 385-396; Pattison et al. (2008) Appl Soil Ecol. 40: 155-164; Pattison et al. (2002) Int J Pest Manage. 48: 107-111; Stanton et al. (2001) Aust J Exp Agr 41: 675-679; Stirling & Pattison (2008) Australas Plant Pathol. 37: 254-267; Xu C et al. (2014) ZooKeys 444: 69-93; https://abgc.org.au/2018/09/05/plant-parasitic-nematodes-impacting-australian-banana-production/

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