

Incidence of root-knot nematodes (*Meloidogyne* spp.) in Fiji: a preliminary investigation

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1 INTRODUCTION

Root-knot nematodes, *Meloidogyne* species, are parasitic on a wide variety of plant hosts and especially common in warmer regions. They form galls on the roots of the host plant. Vegetable crops usually are among the most susceptible and worst affected by these nematodes. Other underground parts such as edible roots, rhizomes, tubers (carrots, ginger, and potatoes) can become disfigured by the root-knot disease and lose their market value. The aboveground symptoms of root-knot nematode infection are often mistaken for nutrient deficiency symptoms.

Root-knot nematodes (RKN) are among the most damaging of plant parasitic nematodes. The genus *Meloidogyne* has more than 80 known species (Karssen, 2002) but the most common and damaging species in the tropics and the subtropics include *M. incognita*, *M. javanica* and *M. arenaria* (Sikora and Fernandez, 2005). Kirby (1977) had reported the occurrence of these three species in Fiji and also recommended the use of integrated pest management for RKN control. Orton Williams (1980), in a report on plant parasitic nematodes based on an extensive survey, recorded the presence of the three most common and damaging species in Fiji. This report also mentioned that this group of nematodes required further investigation in these islands. Severe ginger damage by root-knot nematodes in Fiji has been reported, with infected rhizomes rendered unacceptable for export (Graham, 1971; Haynes *et al.*, 1973; Butler, 1974; Orton Williams, 1980; and personal communication, Koronivia research station). Vilsoni and Kirby (1980), based on a study on the host status to RKN, concluded that 9 of 16 graminaceous forage crops and 13 of 18 legume species in Fiji were hosts of one or more RKN species.

Not much has been reported on these nematodes since, in Fiji and other Pacific Island countries. Bridge, 1988 reviewed the plant parasitic nematodes of the Pacific and listed the occurrence of RKN on a number of economically important crops. A revised pest advisory leaflet by SPC outlines the biology, ecology, and host status of common crops and control strategies of RKN (Gowen *et al.*, 2005).

The people in the Pacific rely a lot on agriculture to meet their daily food requirements and RKN can adversely affect crop production. Considering their economic importance, this study was undertaken to determine the occurrence and current distribution of RKN in agricultural areas on Viti Levu Island, Fiji.

2 METHODS

A total of 185 randomly chosen farms or gardens from 10 different localities around Viti Levu were surveyed for the presence of root-knot nematodes. The sampling was done in 2003-2004. Soil samples were taken from the root rhizosphere region of infected plants along with some root system and placed in polythene bags. Samples were labeled indicating the host plant, locality, date and farmer's name. The soil samples were also used to propagate the nematode populations in pots for taxonomic and nematode management studies. The incidence of root-knot nematodes was detected through visual examination of plant roots for characteristic root galls while the severity of RKN infection was determined by observing the extent of galling on the root system. The data is summarized in Table 1.

Tentative identifications were done based on the perineal patterns (cuticle markings around the anus-vulva region of the female nematodes). Permanent microscope slides of the perineal patterns were prepared using standard procedures (Barker *et al.*, 1985; Shurtleff and Avere III, 2000). The female nematodes were dissected out from the root galls and placed in 45% lactic acid solution for clearing. After 24 hrs, each nematode was removed to a drop of anhydrous glycerol on a clean glass microscope slide. The perineal patterns were carefully cut, trimmed, and mounted in clean glycerol. Identifications were based on microscopic examination of morphological features of perineal patterns (Taylor and Sasser, 1978; Eisenback *et al.*, 1981 and Siddiqui, 2000).

3 RESULTS AND DISCUSSION

The overall incidence of root-knot nematodes was found to be 28.7% (N =185). The percentage incidence from the different localities ranged from 6.7% in Lautoka up to 88% in Suva. The detailed RKN distribution according to the localities is shown in Figure 1. A total of 13 different commonly grown crop plants and 2 species of weeds were found infected by root-knot nematodes (Table 1). The levels of infestation by RKN was not quantified but ranged from severe to moderate based on direct examination of the infected plant root system. These results, though based on a random survey, indicate the existence of root-knot nematode populations in agricultural areas throughout Viti Levu.

Table 1 RKN hosts

Crop hosts	Locality
Tomatoes (<i>Solanum lycopersicum</i>)	1, 2, 3, 4, 6, 7, 8, 9, 10
Cabbage (<i>Brassica campestris</i>)	1, 2, 4, 7
Okra (<i>Abelmoschus esculentus</i>)	5, 6, 7, 8, 10
Bean (<i>Phaseolus vulgaris</i>)	1, 3, 5, 6, 7, 9, 10
Lettuce (<i>Lactuca sativa</i>)	2, 6, 7
Egg Plant (<i>Solanum melongena</i>)	5, 6, 7, 8
Cucumber (<i>Cucumis sativus</i>)	4, 5, 7, 8
Ginger (<i>Zingiber officinale</i>)	1
Bele (<i>Hibiscus manihot</i>)	1
Pawpaw (<i>Carica papaya</i>)	3
Coriander (<i>Coriandrum sativum</i>)	1, 3
Radish (<i>Raphanus sativus</i>)	2
Pumpkin (<i>Cucurbita maxima</i>)	5

Weed hosts	Locality
Rattlepod (<i>Crotalaria</i> spp.)	2
Pigweed (<i>Amaranthus</i> spp.)	1, 2, 3, 4, 5, 7, 8

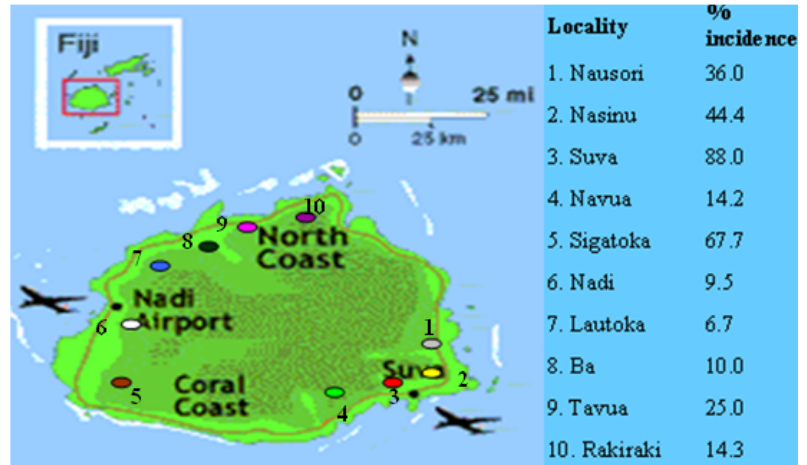


Figure 1: The percentage incidence of RKN based on the random survey of the localities.

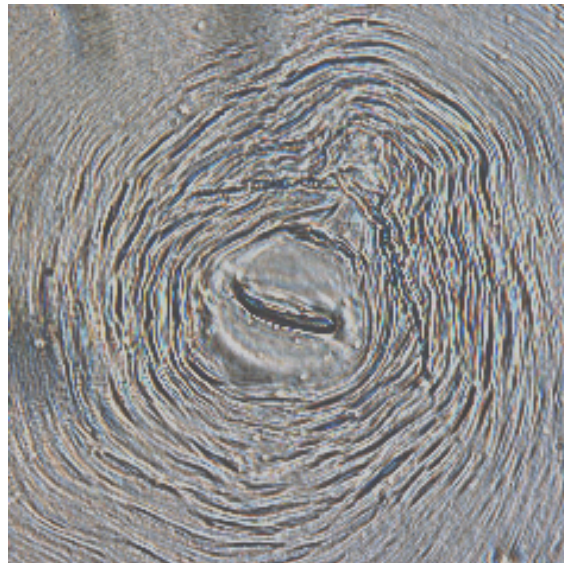


Figure 2: *M. incognita* perineal pattern

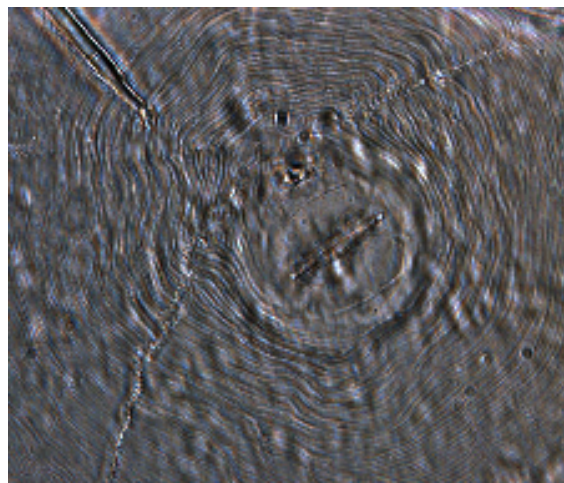


Figure 3: *M. javanica* perineal pattern

The percentage incidence in this investigation is based on the direct examination of root-knots and it is likely to be higher if soil samples are also examined for larval population. A more detailed RKN survey in Fiji is expected to reveal many more crops and weeds as hosts. The populations tentatively identified included *Meloidogyne incognita*, *M. javanica* (Figures 2-3) and *M. arenaria*. Based on these identifications, *M. incognita* was more common in the sampled areas.

The current overall incidence of 28.7% of RKN in the agricultural areas of Viti Levu is close to the incidence (31%) reported by Orton Williams (1980) from approximately 700 samples from Fiji. One of the factors possibly responsible for the fairly widespread distribution of RKN in Fiji is the lack of awareness among growers about RKN and the unintentional spread through sharing of seedlings and farm implements. The tropical climatic conditions in Fiji and other island countries in the Pacific also favour the buildup of RKN populations. The extensive host range, including weeds, of these nematodes may render relatively ineffective the cultural pest management practices such as crop rotation and fallow fields.

This preliminary random survey provided the baseline data about the present root-knot nematode distribution on the mainland, Viti Levu. This has led to undertaking a more systematic and detailed investigation, that is ongoing, on this important group of nematodes in Fiji.

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