Infestations of root-knot nematodes, *Meloidogyne* species, associated with selected vegetable crops in Matara District in Sri Lanka.

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Abstract

A survey on infestations of root-knot nematodes, Meloidogyne *spp. was conducted on seven vegetable crops, i.e., bitter-gourd, bottle-gourd, egg-plant, chili, okra, pumpkin and snake-gourd, at 13 localities representing vegetable growing regions in Matara District in Sri Lanka. At least 10 individual root systems of each vegetable crop per locality were assessed at the mature stage for the percentage of root system galled and a root-gall severity was determined.* Meloidogyne *species were identified based on the morphology of perennial pattern of mature females.* Meloidogyne *infestations were detected only on bitter-gourd, egg-plant, chili and okra. Three* Meloidogyne *species namely* M. incognita, M. javanica and M. arenaria, *were identified. However, species composition differed with respect to vegetable crops and locality. All the three* Meloidogyne *species were detected on okra at Denipitiya and Malimbada, and on bitter-gourd at Welipitiya as mixed populations. The frequency of occurrence of* Meloidogyne *species also varied among the vegetable crops tested. Overall,* M. incognita *was found to be the most prevalent species detected on all infested vegetable crops. The highest root gall severity was recorded on okra and egg-plant.*

Key words: *Meloidogyne* nematodes, vegetables, root-galling, Matara, Sri Lanka.

Introduction

Vegetables form a major component in Sri Lankan's daily food consumption. A large extent of land in southern Sri Lanka has been occupied for vegetable cultivation. Previous investigations have shown that nematode pests act as an important constraint in Sri Lankan agriculture and among them root-knot nematodes, *Meloidogyne* species, are prominent. Infested plants show an abnormal development of the root system characterized by the formation of typical galls, which affect uptake of water and nutrients (Abad *et al.*, 2003). Farmers in southern Sri Lanka have a poor knowledge of nematode infestations and they confuse nematode problems with the nutrient deficiencies and other plant diseases. In addition, to date, only few investigations have been focussed on *Meloidogyne* infestations associated with vegetable crops in southern Sri Lanka. Therefore, the present study was aimed to determine the species composition, damage levels and distribution of *Meloidogyne* nematodes associated with selected vegetable crops in Matara district in southern Sri Lanka to adopt a sound basis for effective management strategies.

Materials and methods

A survey was conducted in 13 vegetable growing localities, i.e., Akuressa, Dandeniya, Denipitiya, Diyalape, Hiththatiya, Kirimatimulla, Malimbada, Mirissa, Pasgoda, Radampola, Talalla, Urubokka and Welipitiya, representing small and medium-scale farms and home gardens in Matara district, during June – November 2005 (Figure 1). Seven vegetable crops, i.e., bitter-gourd (*Momordica charantia*), bottle-gourd (*Luffa aegyptiaca*), egg-plant (*Solanum tuberosum*), chili (*Capsicum annum*), okra (*Abelmoschus esculentus*), pumpkin (*Cucurbita maxima*) and snake-gourd (*Trichosanthes anguina*), were selected for the study. Each vegetable crop was sampled at least from two localities. 10%

of the total mature crop roots of individual plants showing visual symptoms, i.e., plants showing chlorosis, wilting and poor growth vegetable crops, were examined for the presence of root galls based on visual symptoms, and/or at random where no symptoms were evident. At least 10 individual root systems were randomly selected per each vegetable crop and washed free of soil. Subsequently, the root-gall severity (*RGS*) was assigned on a 0-5 scale: 0 = no galls; 1 = 1-2 galls; 2 = 3-10 galls; 3 = 11-30 galls; 4 = 31-100 galls; and 5 = more than 100 galls (Taylor and Sasser, 1978). *Meloidogyne* nematodes were identified up to the species level by examining the perennial pattern morphology of mature females (Eisenback, 1985). At least 20 perennial patterns were checked per root system.

Frequencies of occurrence of different *Meloidogyne* species among the vegetable crops were compared using one-way ANOVA at 5% significance level with aid of SAS statistical package (SAS Institute, 1999).

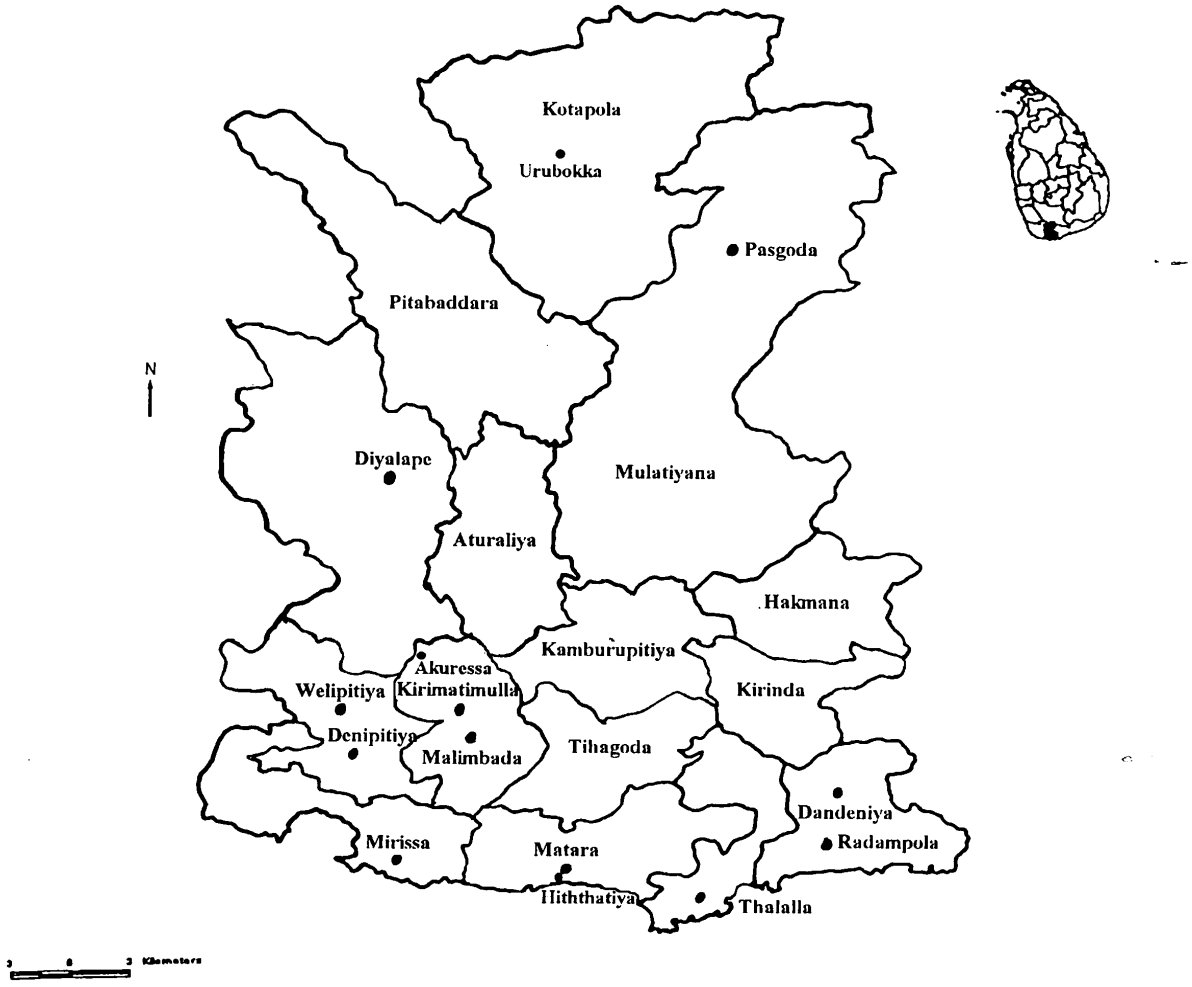

Figure 1. Study sites

Results and discussion

Meloidogyne infestations were detected on bitter gourd, egg-plant, chili and okra. bottle gourd, pumpkin and snake gourd were found to be non-infested. Three *Meloidogyne* species were identified, i.e., *M. incognita* (Kofoid and White) Chitwood, *M. javanica* (Treub) Chitwood and *M. arenaria* (Neal) Chitwood (Table 1). However, species composition differed with respect to vegetable crops and localities. *Meloidogyne incognita* was detected on all the infested vegetable crops. All three *Meloidogyne* species were found together as mixed populations on okra at Denipitiya and Malimbada, and on bitter gourd at Welipitiya. At Radampola, Welipitiya and Tallala, 100% of the okra plants sampled showed *Meloidogyne* attacks. At Diyalape *Meloidogyne* nematodes were not detected associated with any of the vegetable crops tested. The frequency of occurrence of *Meloidogyne* species significantly varied ($P < 0.05$) among the vegetable crops (Figure 2). Overall, *M. incognita* showed significantly higher frequency of occurrence. The highest root gall severity (i.e., 5) was found on okra at Denipitiya, Welipitiya and Tallala, and egg-plant at Radampola and Welipitiya.

An extensive nematological survey made by Ekanayake and Toida (1997) in Sri Lanka reported four predominant *Meloidogyne* species, i.e., *M. incognita*, *M. hapla, M. javanica* and *M. arenaria* mainly associated with vegetable crops. However, in the present study, *M. hapla* was not found and this could be due to the fact that *M. hapla* is mostly adapted to cooler climate which does not frequently prevail in Matara district of southern Sri Lanka. The first root-knot nematode survey was conducted by Lamberti *et al.*, (1987) who found *M. incognita* as the dominant species confirming our findings. Moreover, Ekanayake and Toida (1997) reported the prevalence *M. incognita* and *M. arenaria* in Matara district, but not *M. javanica.*

Previous investigations confirmed the prevalence of *M. javanica, M. arenaria* and *M. incognita* on egg-plant (Ekanayake and Toida, 1997; Lamberti et al., 1987). By contrast, in the present study *M. arenaria* was not detected on egg-plant. On bitter gourd *M. arenaria* and *M.incognita* have been reported while *M. incognita, M. javanica and M. arenaria* were detected as a mixed population dominated by *M. incognita*. Infestations of *M. arenaria*, *M. javanica* and *M. hapla* have been reported on chili (Lamberti *et al.*, 1987; Ekanayake and Toida, 1997). However, the present study revealed that chili was susceptible only to *M. incoginta* and *M. javanica*. In the case of okra, though *M. javanica, M. arenaria and M. incognita* co-occurred, the two previous surveys recorded only *M. javanica and M. arenaria* infestations. Although in our study *Meloidogyne* infestations were not detected on pumpkin, bottle gourd and snake gourd in Matara district, Lamberti *et al.*, (1987) and Ekanayake and Toida (1997) found that snake gourd was infested by *M. javanica* and *M. arenaria*, bottle gourd by *M. incognita* and pumpkin by *M. incognita* and *M. arenaria*.

The vegetable crops grown in Diyalape did not act as hosts for *Meloidogyne* nematodes, most probably due to the use of compost as fertilizers which suppresses plant-nematodes in soil. The occurrence of *Meloidogyne* infestations at twelve localities clearly showed the widespread distribution of these nematodes in Matara district. The overwhelming dominance of *M. incognita* in bitter-gourd, egg-plant, chili and okra indicates its importance as a potential threat for the growth and the yield. *Meloidogyne arenaria* showed a rare occurrence, but frequently in a mixture with *M. incognita* and *M. javanica.*

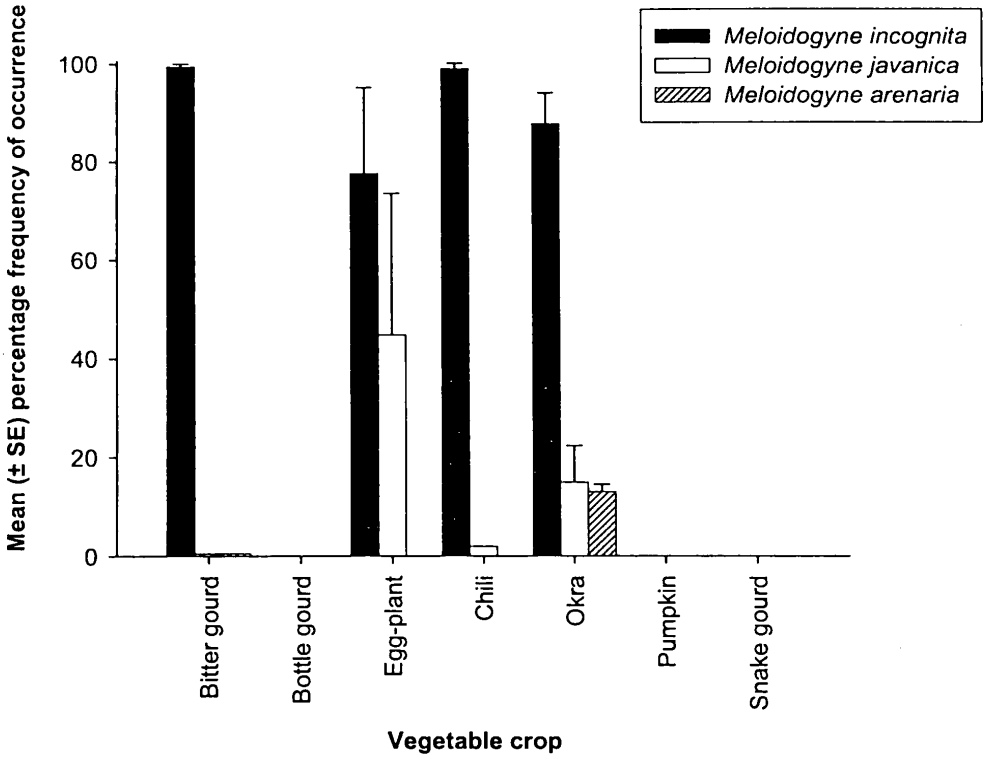

Figure 2. Mean (± SE) percentage frequency of occurrence of three *Meloidogyne* species associated with seven different vegetable crops at 13 different localities in Matara district.

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Table 1: Number of vegetable plants checked for the presence of root galls, percentage of plants with root galls, average root gall severity and *Meloidogyne* species found at 13 localities in Matara District.

Vegetable	Locality	No. of plants checked	Percentage of plants with root galls	*Meloidogyne* species found	Average root gall severity
Bitter gourd	Denipitiya	6	5	*M.incognita, M.javanica*	4
	Diyalape	6	0	-	0
	Welipitiya	6	3	*M.arenaria, M.incognita, , M.javanica*	4
Bottle gourd	Denipitiya	6	0	-	0
	Diyalape	10	0	-	0
	Mirrissa	6	0	-	0
	Welipitiya	6	0	-	0
Egg-plant	Dandeniya	12	0	-	0
	Mirrissa	12	0	-	0
	Pasgoda	15	20	*M.incognita*	2
	Radampola	12	60	*M.incognita, M.javanica*	5
	Talalla	10	60	*M.incognita, M.javanica*	3
	Welipitiya	15	90	*M.incognita*	5
Chili	Dandeniya	10	0	-	0
	Diyalape	6	0	-	0
	Kirimatimulla	12	0	-	0
	Radampola	15	0	-	0
	Malimbada	10	0	-	0
	Pasgoda	20	5	*M.incognita, M.javanica*	3
	Tallala	6	0	-	0
	Urubokka	15	2	*M.incognita*	2
Okra	Akurresa	25	3	*M.incognita, M.javanica*	3
	Denipitiya	15	80	*M.arenaria, M.incognita, M.javanica*	5
	Diyalape	6	0	-	0
	Hittatiya	10	0	-	0
	Malimbada	8	40	*M.arenaria, M.incognita, M.javanica*	4
	Mirrissa	50	80	*M.incognita, M.javanica*	5
	Radampola	15	100	*M.incognita, M.javanica*	3
	Talalla	10	100	*M.incognita, M.javanica*	5
	Welipitiya	20	100	*M.incognita*	5
Pumpkin	Denipitiya	5	0	-	0
	Diyalape	8	0	-	0
	Malimbada	10	0	-	0
	Mirissa	25	0	-	0
	Radampola	10	0	-	0
	Welipitiya	6	0	-	0
Snake gourd	Denipitiya	6	0	-	0
	Mirrissa	10	0		0
	Welipitiya	6	0	-	0