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Screening of coleus cultivars for their resistance to root-knot nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood and yield under conditions in Kerala

M.S. Nisha and M.S. Sheela*

Department of Entomology, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram 695522, Kerala, India
E mail: drnishams@gmail.com; drsheelams@hotmail.com

ABSTRACT: Studies were conducted to find out a resistant variety of *Solenostemon rotundifolius* (Poir) Morton against *Meloidogyne incognita* (Kofoid &White) Chitwood. Two improved varieties (Sree Dhara and Nidhi), five lines from CTCRI (Line-74, 64, 79, 76 and 71) and two accessions (TC-9 and M-131) from Vellanikkara were screened for the relative tolerance to *M. incognita.* The variety Sree Dhara showed significant superiority over the rest of varieties/ lines/accessions in reducing the nematode population (larvae, females, egg masses, eggs per egg mass) in soil and root. This variety had minimum root-knot index of 1.0 and ranked first in yield. The high yielding variety Nidhi closely followed Sree Dhara in yield and resistance to *M.incognita*. Considering the ability to resist nematodes and giving very high yield compared to local variety, Sree Dhara can be the best for cultivation in Kerala followed by Nidhi and CTCRI- 74. © 2015 Association for Advancement of Entomology

Key words: *Meloidogyne incognita*, *Solenostemon rotundifolius, resistant cultivar*

INTRODUCTION

Roots and tubers are among the world's important food crops, with a great potential to improve food security and alleviate poverty in resource poor countries. Koorka or Coleus, *Solenostemon rotundifolius* (Poir) Morton, a short duration under exploited tuber yielding vegetable best suited for multiple cropping, is extensively cultivated in most of the homestead gardens of Kerala and Tamilnadu. Sathyarajan *et al.* (1966) first reported root knot nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood infestation in *S.rotundifolius* from Kerala.

* Author for correspondence

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Due to the attack of the nematode, conspicuous gall like swellings are formed in roots and tubers resulting in malformations rendering the tubers unfit for consumption as well as storage. Since nematodes are soil inhabiting pests, application of chemical pesticides adversely affect soil microflora and also cause high level of pesticide residues in harvested produce. The dependence on pesticides can be avoided by identifying a resistant variety against *M. incognita*. In this context, nine varieties/lines/accessions of the crop was screened against *M.incognita*.

MATERIALS AND METHODS

Two improved varieties (Sree Dhara and Nidhi), five lines (Line-74,64,79,76 and 71 of CTCRI), two accessions (TC-9 and M-131 of Vellanikkara) and one local variety (Palappoor) were screened for their relative tolerance to *M.incognita.* The trial was laid out in completely randomized design with three replications. Since the yield potential of the cultivars under Kerala conditions are not known data relevant to that aspect also were collected. The cuttings were planted in pots containing denematized potting mixture. The soil was inoculated with *M.incognita* at an inoculum level of one second stage larva (juvenile) per g of soil 15 days after planting. Denematized soil was applied forty five days after planting also to promote tuberisation. Biometric characters of five observational plants *viz.* height, number of leaves, number of branches were recorded. Population of *M. incognita* was estimated from soil adopting Cobb's sieving and decanting technique (Cobb,1918). Nematode population characteristics (number of larvae in 5g root and 10g tuber, root-knot count, number of females, number of egg masses and average number of eggs per egg mass were recorded at the time of harvest. The root-knot indexing was worked out (Heald *et al*., 1989). Yield in terms of number of tubers per plant (total and marketable), weight of tubers per plant (total and marketable), number of tubers per kg were recorded at the time of harvest.

Quality parameters viz. protein, starch, sugar and crude fiber content of selected varieties (tubers) were assessed at the time of harvest adopting standard methods suggested by A.O.A.C (1975). The data generated were subjected to analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Data on reaction of germplasm of *S. rotundifolius* to *M. incognita* in terms of nematode population characteristics are presented in Table. 1. The performance of variety Sree Dhara was statistically on par with Nidhi giving 222 and 228 lavae per 250g soil respectively at the time of harvest while the nematode population in the root, Sree Dhara differed significantly from other germplasm recording the least number of larvae (40.00 per five g root). Variety Nidhi and CTCRI line-74 supported the larval multiplication in root with mean of 55.33 and 58.33 larvae per five g root respectively. In the case of nematode population in tuber, the Sree Dhara recorded the least number (16.67 per 10 g tuber).The data on root-knot count revealed that all entries showed significant superiority over the susceptible check, Palappoor local except Vellanikkara accession TC-9. The lowest mean gall number of 8.33 per five g root was recorded

Table 1. Population build up of *M. incognita* associated with different cultivars of *S.rotundifolius* and the extend of galling in the varieties

Treatments	Nematode population in			Number of Root-knot in 5 g root	Root-knot index	No. of females (5 g root)	No.of egg masses (5 g root)	Number of eggs per egg mass
	Soil (250 g)	Root (5 g)	Tuber (10 g)					
CTCRI line – 74	276.67 (16.66)	58.33 (7.70)	78.00 (8.86)	23.00 (4.89)	1.67	23.00 (4.89)	12.33 (3.64)	203.33 (14.28)
CTCRI line – 64	282.33 (16.83)	67.67 (8.28)	83.67 (9.20)	31.00 (5.65)	2.00	36.67 (6.13)	20.00 (4.58)	266.67 (16.35)
CTCRI line – 79	295.33 (17.21)	76.67 (8.81)	110.00 (10.53)	44.33 (6.73)	2.00	41.33 (6.49)	27.67 (5.35)	371.67 (19.30)
CTCRI line – 76	313.33 (17.73)	95.33 (9.81)	141.67 (11.94)	49.00 (7.06)	2.33	48.00 (6.99)	31.67 (5.71)	400.00 (20.02)
Sree Dhara	221.67 (14.92)	40.00 (6.40)	16.67 (4.18)	8.33 (3.05)	1.00	7.67 (2.92)	1.67 (1.58)	56.33 (7.56)
CTCRI line – 71	352.00 (18.79)	120.67 (11.02)	162.33 (12.78)	61.00 (7.87)	3.00	62.67 (7.98)	35.00 (6.00)	520.67 (22.84)
Vellanikkara accession – TC 9	384.67 (19.64)	152.67 (12.40)	191.00 (13.86)	70.00 (8.43)	3.00	77.33 (8.85)	44.33 (6.73)	603.33 (24.58)
Vellanikkara accession – M 131	367.67 (19.20)	105.00 (10.29)	177.00 (13.34)	64.00 (8.06)	3.00	65.00 (8.12)	36.67 (6.13)	531.67 (23.08)
Nidhi	228.33 (15.14)	55.33 (7.50)	26.67 (5.25)	14.67 (3.93)	1.00	13.00 (3.71)	5.67 (2.56)	132.33 (11.54)
Palappoor local	391.67 (19.82)	181.67 (13.51)	206.00 (14.38)	77.67 (8.87)	3.67	84.67 (9.25)	49.00 (7.07)	641.67 (25.35)
CD (0.05)	(0.32)	(0.57)	(0.50)	(0.55)	-	(0.62)	(0.52)	(0.78)

Figures in the parantheses are $\sqrt{x + 1}$ transformed values

in Sree Dhara with lowest root-knot index of one. Minimum number of females per root was recorded in variety Sree Dhara (7.67 per five g root) and it showed significant superiority over the rest of varieties/lines/accessions. Variety Nidhi and CTCRI line-74 were also statistically independent in reaction with mean number of females of 13.00 and 23.00 per five g root respectively. With regard to the number of egg masses per root, lowest number was recorded by variety Sree Dhara (1.67 per five g root). In the case of average number of eggs per egg mass the lowest was recorded by variety Sree Dhara (56.33). Sree Dhara showed significant superiority over other entries in suppressing the nematode build up as seen in no.of larvae in root and tuber, no. of galls, no. of females, no.of egg masses and no.of eggs per egg mass.

There was statistically significant variation in biometric characters *viz.* plant height, number of leaves, number of branches, plant spread at the time of harvest. Sree Dhara, Nidhi and CTCRI lines (74, 64, 79, 76 and 71) were statistically on par with mean plant height ranging from 55.00 to 63.67 cm. Regarding number of leaves, Sree Dhara, Nidhi, CTCRI-74 and CTCRI-64 were statistically on par with mean leaf number of 650, 646.67, 626.67 and 626.67 respectively. Sree Dhara established its superiority over all other lines / varieties / accessions with mean plant spread of 84.67 cm (Table.2)

The yield of coleus germplasm in terms of total number and weight of tuber per plant are presented in Table 2. In the case of number of tubers, all the varieties/lines/accessions, except Vellanikkara accession M-131 (43.33) and TC-9 (43.00) showed significant superiority over the susceptible check, Palappoor local (42.00). Sree Dhara (81.00) came on par with Nidhi (75.67) and CTCRI line-74 (75). Regarding the marketable tubers Sree Dhara, Nidhi and CTCRI line-74 were on par with mean numbers of 44.00, 41.00 and 38.33 respectively. With regard to the number of tubers per kg weight too the variety Sree Dhara, Nidhi and CTCRI line-74 were on par the number being 85.00, 91.00 and 93.67 respectively. Regarding the total weight of tubers per plant Sree Dhara (550.00 g) was statistically on par with Nidhi (521.67g). The same trend was observed in weight of marketable tubers per plant and edible portion (E.P) of tubers

The changes in protein, starch, sugar and crude fibre content of tubers of selected varieties based on yield attributes are presented in Table 3. In the case of protein content, the performance of Sree Dhara was statistically on par with check, Palappor local giving 8.56 and 8.73 g per 100g dry weight of tubers respectively. Regarding the starch content, the varieties Sree Dhara, Nidhi and CTCRI line 79 came on par showing 18.25, 17.97 and 17.67 g per 100 g dry weight respectively.

Sree Dhara and Nidhi had significantly higher content of sugar than CTCRI lines 79, 74, 64 and Palappoor local, the values being 3.61, 3.46, 3.32, 3.20, 2.95 and 2.54 g per 100 g dry weight of tuber respectively. Regarding the crude fibre content, Sree Dhara, Nidhi, CTCRI lines 74, 64, 79 and Palappoor local came statistically on par the content being 1.05 to 1.40 g per 100 g dry weight of tuber.

Table 2. Growth and yield of different varieties / lines / accessions of *S. rotundifolius* exposed to *M. incognita* infestation

Treatments	Height of plants (cm)	Number of leaves	Number of branches	Plant spread (cm)	Total number of tubers per plant	Total number of marketable tubers per plant	Number of tubers per kg	Weight of total tubers per plant (g)	Weight of total marketable tubers per plant (g)	Weight of edible portion of tubers per plant (g)
CTCRI line – 74	58.00	626.67	42.00	76.67	75.00	38.33	93.67	480.00	390.00	253.33
CTCRI line – 64	57.67	626.67	41.33	75.33	67.33	35.33	94.00	426.67	300.00	230.00
CTCRI line – 79	55.67	580.00	40.67	73.67	57.67	28.33	100.33	411.67	296.67	230.00
CTCRI line – 76	55.00	573.33	40.00	72.33	52.33	27.67	107.00	383.33	280.00	213.33
Sree Dhara	63.67	650.00	45.00	84.67	81.00	44.00	85.00	550.00	446.67	370.00
CTCRI line – 71	55.00	543.33	37.67	72.33	50.67	25.33	109.00	336.67	271.67	213.33
Vellanikkara accession – TC 9	46.67	516.67	35.33	68.33	43.00	25.00	105.67	330.00	236.67	203.33
Vellanikkara accession – M 131	53.00	540.00	36.67	69.33	43.33	23.00	109.00	376.67	270.00	210.00
Nidhi	58.33	646.67	43.33	77.67	75.67	41.00	91.00	521.67	410.00	346.67
Palappoor local	35.00	500.00	35.00	59.00	42.00	22.33	110.00	311.67	223.33	200.00
CD (0.05)	9.79	36.13	4.76	6.62	10.39	5.78	8.93	39.97	37.86	33.92

Table 3. Variation in the chemical constituent of tubers obtained from selected varieties/lines/accessions of *S. rotundifolius* after harvest (mean of three replications)

Treatments	Protein (g / 100 g dry weight of tuber)	Percentage decrease of protein over check	Starch (g / 100 g dry weight of tuber)	Percentage increase of starch over check	Sugar (g / 100 g dry weight of tuber)	Percentage increase of sugar over check	Crude fibre (g /100 g dry weight of tuber)	Percentage change of crude fibre over check
CTCRI line – 74	8.07	7.56	17.35	14.90	3.20	25.98	1.09	-7.63
CTCRI line – 64	8.05	7.79	17.47	15.70	2.95	16.14	1.27	+7.63
CTCRI line – 79	7.88	9.74	17.67	17.02	3.32	30.31	1.18	-
Sree Dhara	8.56	1.95	18.25	20.86	3.61	42.13	1.40	+18.64
Nidhi	8.18	6.30	17.97	19.00	3.46	36.22	1.05	-11.01
Palappoor local (Check)	8.73	-	15.10	-	2.54	-	1.18	-
CD (0.05)	0.21	-	0.58	-	0.16	-	0.38	-

Though all the germplasm exhibited galling, some degree of resistance was expressed by the variety Sree Dhara with 89.00 per cent lesser number of galls when compared to susceptible check, Palappoor local. Based on the nematode population in root, tuber, production of females, number of egg masses per root and number of eggs per egg mass, the reaction of the variety Sree Dhara was significantly better than other germplasm. Similar resistance reactions in carrot, brinjal, ginger and african yam cultivars against *M. incognita* were reported earlier by Arya and Tiagi (1982), Ravichandra *et al*. (1988), Eapen *et al*. (1998) and Mohandas *et al*. (1998). They reported moderately resistant varieties / cultivars with a root-knot index ranging from 1 to 1.5. In this study Sree Dhara and Nidhi recorded a root-knot index of one and hence can be categorized as moderately resistant.

Regarding the biometric characters and yield, the variety Sree Dhara performed better than the other entries and it was statistically on par with variety Nidhi and CTCRI-74 in most of the characters. The susceptible check, Palappoor local recorded lowest content of total sugar and starch, while least reduction of the above was observed in moderately resistant variety Sree Dhara. Along with varietal influence the differences in nematode damage also might contribute to the difference in starch and sugar content. Tayal and Agarwal (1982) reported 23.00 and 59.34 per cent reduction in total sugar and starch content of brinjal seedlings (variety Pusa Purple Long) by *M. incognita* infestation.

As shown by the results considering the ability to resist nematodes and giving very high yield compared to local variety/cultivar Sree Dhara can be the best for cultivation in Kerala closely followed by Nidhi and CTCRI- 74.

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