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Effect of inoculating the seedlings of tomato grown in soil maintained at different soil moisture levels of *Meloidogyne incognita* on growth of plant, root-knot development and morphometrics of perineal pattern of the nematode

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Abstract: In the present investigation when seedlings of tomato CV. Marglobe grown in soil with different soil moisture levels were inoculated with *Meloidogyne incognita*, it was observed that growth of the plant, root-knot development and multiplication of the nematode was highest at 40 percent moisture level. Out of several morphometric characters of perineal pattern studied, it was found that height of dorsal and ventral arches was significantly high in females grown in 30 and 40 percent moisture level as compared to those grown in 10 percent moisture level and therefore different characters to be used for diagnosis of species should be examined in the light of environmental settings.

Keywords: *Meloidogyne Incognita*, Soil Moisture, Morphometric Characters, Root-Knot, Development Perineal Patterns, Dorsal Arch, Ventral Arch

I. INTRODUCTION

Plant nematodes attack a variety of crops taking a heavy toll of Agricultural produce every year (Cramer [1] and Swarup and Seshadri [2]). Reduction in the yield of tomato (*Lycopersicon esculentum*) ranging from 28 percent to 75 percent has been reported by various researchers (Ibrahim *et al.*, [3]; Rajendran *et al.*, [4]). In all large number of plant nematodes have been identified and described and some of them have been found to exhibit great diversity in the forms when obtained from different parts of the world. Root-knot nematode *Meloidogyne* spp. is one which exhibits such diversity. Saxena *et al.* [5] reported that size of the female varies at different moisture level. Adverse environmental conditions such as non host, organic amendments and high or low doses of NPK fertilizers resulted in lower values of body length, neck length, body width and neck width resulted in lower values of morphometric characters. Restoration of favorable environmental conditions resulted in higher values of the characters (Pant [6], Shahab *et al* [7], Shahab [8]). Dropkin [9], while studying the variability of cuticular pattern within species, by making single larval inoculation concluded that cuticular pattern offers quite stable characters for identification of the species. However, Triantaphyllou and Sasser [10] observed considerable variability in cuticular pattern in *Meloidogyne incognita*. In view of contradictory reports regarding the validity of cuticular pattern for species identification, the present study was undertaken to work out the effect of soil moisture on the morphometric of cuticular pattern of *Meloidogyne incognita*.

II. MATERIALS & METHODS

The soil moisture expressed in terms of percentage of water was calculated as follows:

Weight of the water saturated soil at room temp = x gram

Weight of the oven dry soil = y gram

Difference in weight= (x – y) grams

The moisture percentage = [(x-y)/x]*100

Different soil moisture levels were adjusted at 10, 20, 30, 40 and 50 percent by adding required amount of water. The soil adjusted to different soil moisture levels was transferred to plastic bags, kept inside the clay pots. Each day the

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pots containing the plastic bags were weighted and the amount of water lost was adjusted by adding required amount of water. The increase in temperature due to plastic bags, if any was measured which was invariably very insignificant. Seedlings of tomato cv. Marglobe were transplanted in soil maintained at different soil moisture levels and were inoculated with 1000±10 freshly hatched larvae of *M. incognita* and after 40 days plants were uprooted and observations were made.

For posterior cuticular pattern egg-laying females were selected. The posterior end of the females was cut off and the piece of cuticle cleaned from adhering soft parts, trimmed down to the area showing the pattern and mounted in clear lactophenol.

The following characters of the perineal pattern were taken into consideration for studying the morphometrics.

1. Length of dorsal arch
2. Length of ventral arch
3. Lines on left side of the pattern
4. Lines on right side of the pattern
5. Vulval Width (A)
6. Vulval anal distance (B)
7. Ration (B/A)

The data were subjected to statistical analysis, wherever required.

III. RESULT AND DISCUSSION

When seedling of tomato cv. Marglobe grown in soil with different soil moisture levels viz 10, 20, 30, 40 and 50 percent were inoculated with *M. incognita*, the growth of the plant was 1.64, 2.16, 3.64, 3.74 and 2.69 g respectively. The growth of the plant increased with the increase in the moisture levels upto 40 percent followed by a decrease at 50 percent.

Highest root-knot development and multiplication of the nematode was observed at 40 percent moisture levels. The final population of nematode was 217, 490, 870, 1209 and 652 respectively for the corresponding treatments (Table 1). Extremely high and low soil moistures have not been found to favour the nematodes probably because in the former the soil pores are filled with water providing anaerobic conditions and in the later water is practically not available to the nematodes.

TABLE 1: Effect of inoculating the seedlings of tomato grown in soil maintained at different soil moisture levels with single egg mass population of *Meloidogyne incognita* on growth of plants and root-knot development

Treatment	Total dry weight of the plant (g)	Number of galls/plant	Number of egg mass /plant	Population in nematode				Total Population
				In soil		In root/5g		
				Larvae/250 g soil	Meta-morphisizin g larvae	Nature Female	Nature Male	
10% Soil Moisture								
Uninoculated	2.88	-	-	-	-	-	-	-
Inoculated	1.64	37.60	27.60	53.00	8.00	148.00	8.00	217
20% Soil Moisture								
Uninoculated	3.63	-	-	-	-	-	-	-
Inoculated	2.16	68.00	32.00	240	-	250	-	490
30% Soil Moisture								
Uninoculated	5.18	-	-	-	-	-	-	-
Inoculated	3.64	148.30	91.00	420	-	450	-	870
40% Soil Moisture								
Uninoculated	5.36	-	-	-	-	-	-	-
Inoculated	3.74	168.74	103.00	682	17.00	510	-	1209
50% Soil Moisture								
Uninoculated	4.00	-	-	-	-	-	-	-
Inoculated	2.69	81.00	43.30	305	-	240	7.00	65200
L.S.D. at 5% level	1.96	7.64	9.76	5.16	1.68	4.98	1.36	12.84

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Each figure is an average of five replicate

When the characters of perineal pattern were studied, the height of dorsal and ventral arche was significantly high in females grown in 30 and 40 percent moisture levels as compared to those grown in 10 percent soil moisture level as shown in Fig.1 and Fig.2 respectively. The characters of number of lines on right and left sides of pattern and B/A ratio were highly variable as they showed high C.V. value (Table 2). As compared to other characters Vulval width and Vulval Anal distance were quite stable (Fig.5 & Fig.6) and therefore are more valuable morphometric characters for species identification. These results are in agreement with Pant [6] and Shahab et al. [7].

TABLE 2: Effect of inoculating the seedlings of tomato grown in soil maintained at different soil moisture levels with single egg mass population of *Meloidogyne incognita* on the morphometrics of perineal pattern of females

Treatment/soil moisture level (%) Characters/statistical parameter	10	20	30	40	50	L.S.D. at 5% level
Darsal arch	61.86±3.44 (5.57)	62.68±1.84 (2.94)	66.29±3.20 (4.83)	67.29±3.26 (4.86)	63.36±4.06 (6.40)	2.84
Ventral arch	36.15±2.57 (6.97)	37.65±2.71 (7.20)	40.41±2.67 (6.62)	41.64±1.99 (4.80)	38.49±2.74 (7.11)	2.56
Lines on left side of pattern	12.70±0.64 (5.04)	13.12±1.16 (8.83)	15.40±1.35 (8.80)	15.70±1.18 (7.56)	14.20±0.74 (5.26)	1.02
Lines on right side of pattern	12.70±0.90 (7.08)	13.10±1.13 (9.92)	15.40±1.62 (10.55)	15.80±1.32 (8.39)	13.90±0.70 (5.03)	0.94
Vulval width (A)	23.41±1.69 (7.24)	23.94±1.39 (5.83)	24.47±1.30 (5.33)	24.66±1.36 (5.52)	24.16±1.47 (6.08)	1.34
Vulval anal distance (B)	17.34±0.57 (3.31)	17.91±1.21 (6.77)	17.47±1.01 (5.81)	17.79±0.74 (4.19)	16.86±1.03 (6.16)	1.06
B/A	0.73±0.11 (5.25)	0.74±0.08 (10.87)	0.70±0.11 (16.41)	0.71±0.16 (14.49)	0.69±0.06 (9.66)	0.05

Each figure is the mean of two hundred females

Figure in parenthesis indicate C.V.

C.V.: Coefficient of Variation

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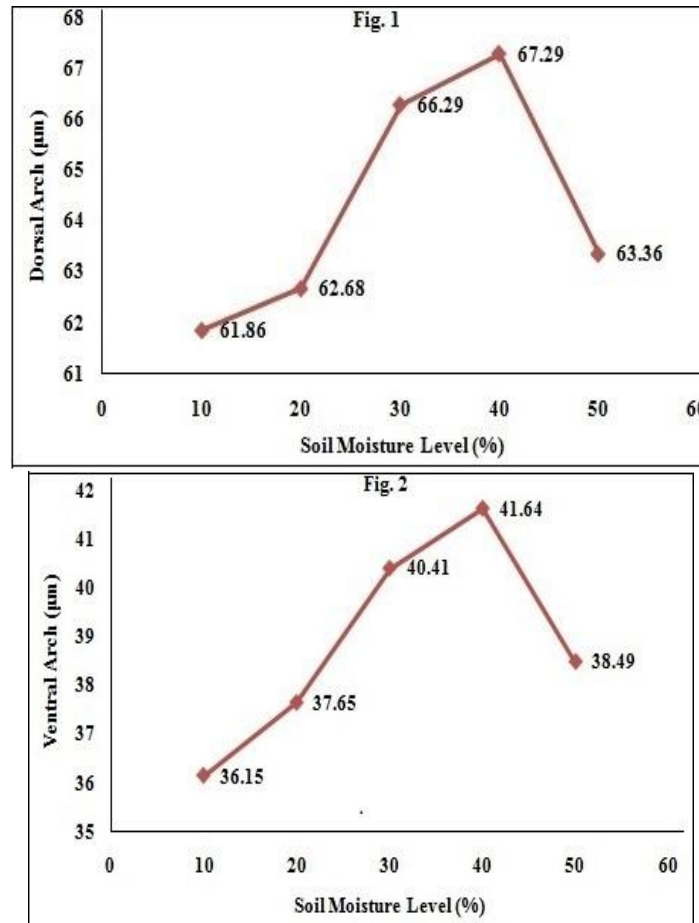


Fig.1 & Fig.2: Effect of Soil Moisture on length of Dorsal and Ventral Arch

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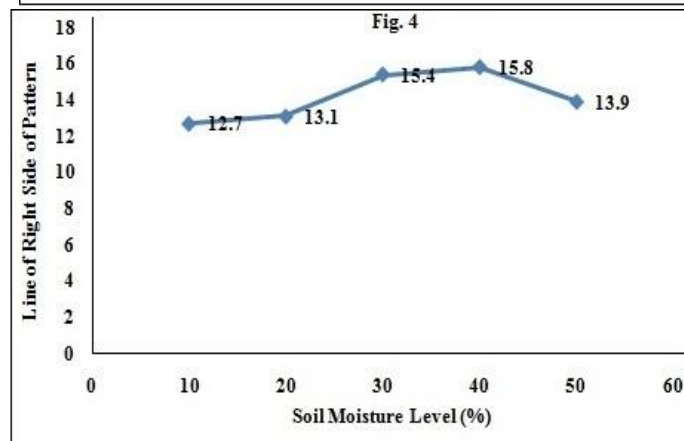
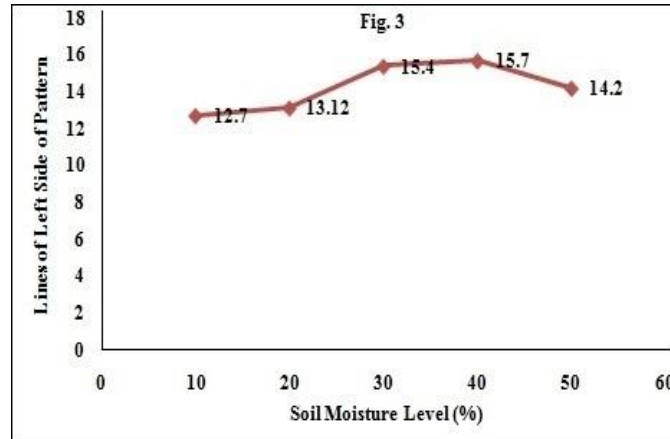


Fig.3 & Fig.4: Effect of Soil Moisture on number of lines on left and right side of the pattern

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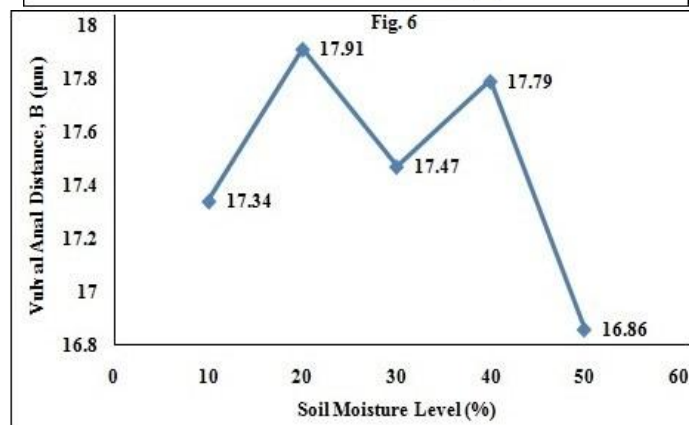
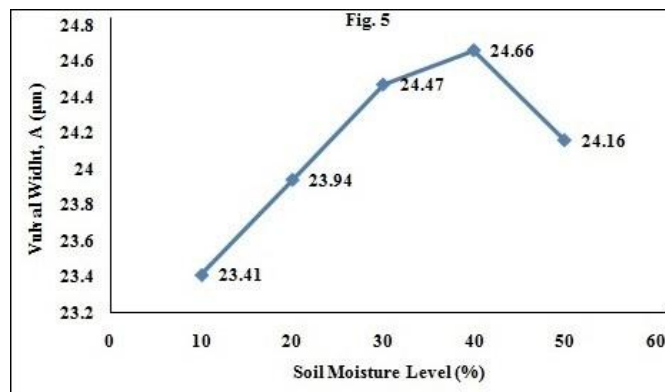


Fig.5 & Fig.6: Effect of Soil Moisture on Vulval Width and Vulval Anal Distance

IV. CONCLUSION

Soil moisture level of 40% has been found most favorable for the development of the disease caused by root-knot nematode. Extremely high and low soil moisture has not been found to favor the nematode. The moisture levels which favour the development of the disease also favor the higher values of various morphometric characters and therefore different characters to be used for diagnosis of species should be examined in the light of environment in which nematode is multiplying. Adverse conditions would give low value and low ranges of different morphometric characters and may thus lead a taxonomist to arrive at a wrong conclusion.

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