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Rate of Root Knot Disease Complex on Two Crops *Eryngium foetidium* and *Calocacia gigantica* of Manipur

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***Abstract*: *Eryngium foetidium* and *Calocacia gigantica* are indigenous crops of Manipur. The two crops was heavily infected by root knote nematode *M. incognita*. An experiment was conducted at the PG Department of Zoology, DM College of Science from March 2019 up to November 2019. Plants with inoculums levels of 1000 and 10000 juveniles showed not only reduction in plant growth but stunting, yellowing of leaves and wilting appearance. The control plants i.e. uninoculated were free from root knot galls. An increase in the level of nematode inoculums from 10 to 10000 juveniles resulted in a significant increase in host infestation as indicated by number of root knot galls. Maximum root knot galls were recorded at the inoculation level of 10000 2nd stage juveniles/pot which was least at the level of 10 2nd stage juveniles/pot. The rate of multiplication was found inversely proportional to the population density. The host infestation rate and nematode multliplication pattern of root knot nematode on *Eryngium foetidium* and *Calocasia gigantica* was studied using different inoculum viz. 0, 10, 100, 1000 and 10,000. The economic damage of threshold level was 100 nematode which caused 31.54% reduction on the fresh root weight formed over control. Maximum disease incidence and retardation in plant growth was found in 1000 and 10,000 nematode per plant.**

***Keywords*: *Calocacia gigantic*, Disease complex, *Eryngium foetidium*, *M. incognita*.**

1. Introduction

Root knot nematodes are an important and cosmopolitan group of pest on different crops throughout the country. The first record of injury of root knot nematode to vegetables was given by Berkeley, 1855. The sites for infestation and disease incidence for this pest occur in root system and spend most of their lives in roots or soils. The root note nematode was heavily infected with different crops and a major threat to certain vegetable crops according to, Perry et.al. 2008, Trinh QP et.al. 2019, Rahmani et.al. 2015, Ali et.al. 2017 and thus the following experiment was taken up to evaluate their disease infestation rate with different inoculums levels.

In Manipur some preliminary work has been started by Joymati et.al. (1999) and from their work these two host plant species i.e. *Eryngium foetidium* & *Calocacia gigantica* were found infested with root knot nematode and they were identified as *M. incognita* from the perennial cuticular pattern of female. *Eryngium foetidium* is one of the important condiment plants as well as medicinal plants which grows in north eastern region of India (Sinha, 1996). This plant is commonly used for making different types of dishes. It is a herb hardly and cultivated. Local medicine men use the root of this plant for reducing blood pressure. Leaf juice mixed with salt is prescribed for stomach ulcers. *Calocasia gigantica* is also one of the important commonly used vegetable crops of Manipur (Sinha, 1996). This plant can be used for making different types of dishes and both corm and stem of the plant are edible. It is a herb with root stock and stolons. The juice of petioles is styptic, stimulant and rubifacient. After child birth, lactating mother take soup of this plant for gaining extra calcium. These two plant are commonly cultivated in both plain and hilly areas for their different purposes and another important point is that the root portion of these two plant are used for their different purposes. Thus due to their importance specially for their uses and also review to the perusal literature revealed that no detailed investigation have not been done so far to determine the extent of damage caused by root knot nematode *M. incognita.* Thus, the present work has been taken up to evaluate the host infestation and nematode multiplication patterned caused by root knot nematode *M. incognita* on *Eryngium foetidium* and *Calocasia gigantica.*

2. Materials and Methods

Experiments for assessing the effect of *M. incognita* on *E. foetidium* & *C. gigantica* conducted in pot experiments kept in a net house. The soil used was sandy loam type and sterilized in earthen pots of 15 cm diameter by autoclaving. The test plants were propagated in nursery plots. Healthy nursery plants were collected from *M. incognita* free healthy fields. One plant was planted in each earthen pot having 500 gm of sterilized soil. Seven days after plantation of the experimental plants, the freshly hatched second stage larvae of *M. incognita* were collected from culture pots and inoculated in a logarithmic series of 10,100, 1000 and 10,000 larvae per pot at a depth of 3 cm & covered with sterilized soil followed by light watering. After inoculation regular watering was done till the harvesting of the plants. All the treatments along with control were

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replicated five times.

Hundred days after inoculation of nematode, all the treated plats were carefully uprooted and observation on plant growth number of galls, larval population in both root and soil, root knot index and reproduction factor were recorded. For dry weight of shoot and root, the plant parts were cut into small pieces separately and kept in an oven at 58± 2^0C. The dry weights of the shoot were recorded after every 24 hours till a constant weight was obtained. Numbers of galls were recorded per plant per root system. For counting nematode population of root, the infected root was stained with phenol and acid fuschin. For soil population the entire amount of soil from each pot was processed for the extraction of nematodes by Cobb's (1918) Sieving and decanting method followed by modified Baermann's funnel technique.

3. Results and Discussion

The results presented in Table 1(i), 1(ii), 2(i) and 2 (ii) shows influence of different inoculums levels (0,10,100,1000,10000) juveniles on *E. foetidium* & *C. gigantica*. The findings revealed that the increase in nematode inoculums was associated with progressive reduction in various plant growth parameters, which gave conclusive evidence that *M. incognita* is a potential pathogen for these crops. Plants treated with 10000 juveniles/500 gm of soil shows significant reduction in shoot and root lengths and shoot and root fresh weights. But, the other growth parameters like shoot and root dry weights, number of leaves and number of root knot galls on the roots showed variations in different inoculums levels. Plants with inoculums levels of 1000 and 10000 juveniles showed not only reduction in plant growth but stunting, yellowing of leaves and wilting appearance.

The control plants i.e. uninoculated were free from root knot galls. An increase in the level of nematode inoculums from 10 to 10000 juveniles resulted in a significant increase in host infestation as indicated by number of root knot galls. Maximum

Table 1
Pathogenecity of *M. incognita* in *Eryngium foetidium* on different plant growth parameters

Inoculum level	Shoot Length	Reduction Over Control	Root Length	% of Reduction	Fresh Root Wt.	% of Reduction	Fresh Shoot Wt.	% of Reduction	Dry Root Wt.	% of Reduction	Dry Shoot Wt.	% of Reduction
0	29.75	11	16.75	-	1.68	-	3.76	-	0.67	-	.43	-
10	19.6	34.11	14.85	17.34	1.56	7.14	2.31	38.56	0.56	16.41	.36	16.27
100	18.5	37.81	12.76	23.82	1.15	31.54	1.34	64.36	0.37	44.77	.16	62.14
1000	15.5	47.89	9.65	42.38	0.93	44.64	1.15	49.41	0.31	53.73	.13	69.76
10000	12	59.66	5.60	66.56	0.72	57.14	0.93	75.26	0.22	67.16	.11	74.41
C.D at 5%	1.235	-	1.175	-	0.269	-	0.069	-	0.161	-	0.144	-

Table 2
Effect of inoculum levels of *M. incognita* on host infestation and nematode multiplication on *Eryngium foetidium*

Inoculum Level	Galls/ Plants	Root Knot Index	Nematode population		Total	Reproduction Factor
			Soil	Root		
0	0	0	0	0	0	0
10	10.5	2	27	19	46	46
100	18.3	2	706	54	760	7.6
1000	25.1	3	4780	312	5092	5.09
10000	32.3	3	10400	430	10830	10.830
C.D. at 5% C.D. at 1%	0.366 0.506		2.004 2.772	1.116 1.543	1.839 2.544	0.297 0.411

Table 3
Effect of different inoculums of *M. incognita* on plant growth parameters of *C. gigantica*

Treatment	Shoot Length cm	% of reduction over control	Root Length cm	% of Reduction Over control	Fresh Root Wt.	% of Reduction Over control	Fresh Shoot Wt.(g)	% of Reduction Over control	Dry Root Wt.(g)	% of Reduction Over control	Dry Shoot Wt.	% of Reduction over control
0 (control)	43	-	22	-	25	-	51	-	3.99	-	5.42	-
10	30	30.23	14.5	34.9	22	12.0	25	50.98	1.85	53.63	3.23	40.40
100	26	39.53	10	54.55	18	28.0	20	60.78	1.01	74.68	2.72	49.81
1000	22	48.8	9	59.09	10	60.0	12	76.47	0.30	92.48	1.87	65.49
10000	17	60.46	8	63.63	5	80.0	7	86.27	0.19	95.23	0.39	92.80
CD at 5%	0.185	0.224	0.199	0.204	0.510	.643	0.432	0.177	0.809	0.200	.729	0.272

Table 4
Effect of different inoculum levels of *M. incognita* on host infestation and nematode multiplication on *C. gigantica*

Initial Inoculum	Galls/ Plants	Root Knot Index	Nematode population		Total	Reproduction Factor
			Soil	Root		
0	0	0	0	0	0	0
10	18.3	2	131.3	324.2	455.5	45.55
100	42.1	3	376.4	613.4	989.8	9.898
1000	71.1	4	453.6	961.2	1414.8	1.4148
10000	83.1	4	898.1	1348	2246.1	0.224
Cd at 5%	0.516		0.601	0.466	0.509	1.748

root knot galls were recorded at the inoculation level of 10000 2nd stage juveniles/pot which was least at the level of 10 2nd stage juveniles/pot. The number of root knot galls on roots, number of 2nd stage juveniles in soil and number of different stages i.e. eggs, J_2, J_3 and adults of *M. incognita* inside the root tissue were observed to be increasing with increase in the levels of inoculation.

The rate of multiplication was found inversely proportional to the population density. The rate of multiplication in the population of various development stages recorded from the roots revealed that *E. foetidium* & *C. gigantica* are good host for root knot nematode *M. incognita*. The work is in conformity with Bora and Phukan (1982) in which highest nematode multiplication was recorded at the lowest inoculum levels on jute. The results can be compared with the finding of Sharma et. al. (1999) on pathogenecity of *M. incognita* on groundnut who reported that as an inoculums level increased, soil population also increased significantly. Similar results also reported by Singh and Goswami, 2000 on cowpea where significant plant growth reduction over control was observed with an initial population of 1000 nematode per 500 g of soil which was established as potential pathogenic level of *M. incognita*. Haidar et. al. (2001) also reported the effect of different inoculums levels of *M. incognita* on two species, *Carum copticum* and *Nigella sativa*. Minimum plant growth was recorded at 10000 level for both the crops. Likewise, similar results were obtained during the course of study.

From the above investigation it can be concluded that these two indigenous plants of Manipur is a good host for this root knot nematode and there is a constant increase in the nematode population both in root and soil with increasing population has a positive correlation with reduction in plant growth.

4. Conclusion

This paper presented an overview on rate of root knot disease complex on two crops *Eryngium foetidium* and *Calocacia gigantica* of Manipur.

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References

[1] Ali N, Tavoillot J, Mateille T, Chapuis E, Besnard G, Bakkali A.E.I., 2017. A new root knot nematode parasitizing kiwi fruit in china. PLos One; 12(8): 1-22.

[2] Bora, B.C. and Phukan, P.N., 1982. Studies on the pathogenecity of root knot nematode, *M. incognita* on jute, J. *Res. Assam. Agric. Univ*. 3:176-180.

[3] Cobb.N.A., 1918. Estimating the nema population of the soil. *Agric. Tech. Cic. Bur. Pl. Ind. U.S. Dep. Agric. No. 1*, 48 pp.

[4] Haidar, M. G; Nath, R. P. and Srivastava, S. S., 2001. Evaluation of Brinjal (*Solanum melongena L.*) Germplasm for resistance against *M. incognita* Race 2. Indian J. Nematol. 31 (1): 93-94.

[5] Joymati. L; Romabati, N and Dhanachand, Ch., 1999. Distribution of host range studies of *M. incognita* (Kofoid & white, 1919) Chitwood, 1949 in medicinal plants of Manipur Part 1. *Indian J. Nematol* 19(1): 79-80.

[6] Perry, R. N., Moens & F. J. starr Eds, 2008, Root knot nematode-CAB International, Wallingford U. K.

[7] Rahmani M, Bakhshi D, Qolov, M. 2015. Impact of pruning severity and training system on red and white seedless table grapes. Aust. J. Crop Sci. 9(1):55-61.

[8] Sitaramaiah, K., 1984. Plant parasitic nematodes of India. Today and Tomorrows printers and publishers 24 B/5. Desh Bandhu Gupta Road, New Delhi. 43 pp.

[9] Sharma, S, Siddiqui, A.U. and Parihar A., 1999. Pathogenicity of root knot nematode *M. incognita* (Kofoid and White, 1919) Chitwood, 1949 on groundnut. *Indian J. Nematol.* 29 (2): 240.

[10] Singh S and Goswami B. K., 2000. Pathogenecity of *M.incognita* on cow pea. *Indian J. Nematol.* 30(2): 249-250.

[11] Sinha, S. C., 1996. Medicinal plants of Manipur. Mass and Sinha Association for science and Society (MASS). 238pp.

[12] Trinh Q. P, Le T. M. L, Nguyen T. D, Nguyen H. T, Leibanas G, Nguyen TAD, 2019. Meloidogyne daklak ensis n. sp. A new root knot nematode associated with Rousta Coffee. In western Highland Vietnam, J. Helminthol: 93(2)242-254.