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Status of *Meloidogyne graminicola* under different organic carbon regimes of rice growing districts of Karnataka

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ABSTRACT : Rice is grown in all the districts of Karnataka except Bangalore Urban under different agro-climatic conditions. Root-knot nematode, *Meloidogyne graminicola* has become a potential threat for all types of rice production systems in Karnataka. Random surveys were conducted in all the districts where rice is being cultivated. The survey revealed that all the districts are infected with rice root-knot nematodes; however, there level of incidence differs in different districts. Among the districts, more severe incidence of rice root-knot nematode was observed with root knot index of 5 in Shimoga and 4 in Chickmagalure, Mandya and Hassan districts. Moderate infection was noticed in districts viz., Davanagere, Dakshina Kannada, Udupi, Uttar Kannada, Mysore, Kodagu and Haveri with root knot index of 3, whereas, the Northern districts of Karnataka shows least root-knot index of 1, where the type of soil is black or vertisols. In all the rice growing districts, the organic content varied from <0.5 to >0.5. With regard to organic carbon content, no correlation was observed whether it was <0.5 or >0.5 as the same tendency of root-knot index and population levels were noticed in the districts where gall indices varied from 3 to 5 and population levels.

Key Words : Rice, *Meloidogyne graminicola*, organic carbon.

Rice (*Oryza sativa* L.) is one of the most important staple food crops of India. Projection of India rice production target for 2025 AD is 140 mt, which can be achieved only by increasing the rice production by over 2 mt per year in the coming decade and this has to be achieved against back drop of diminishing natural resource such as land and water. The expected future demand for rice from increased population can no longer be met only by higher yields from irrigated areas, but also from rainfed situation (Ravindra *et al.,* 2014)

Rice is grown in Karnataka in different Agro-climatic zones with a rainfall pattern varying from 600 to 3000 mm Only around 44 per cent of the total acreage is under irrigation while the rest is under the regime of monsoon. In some areas, only one crop is grown and in certain other areas three crops are raised. The unique feature of rice culture in the state is that either sowing or transplanting is seen in all seasons of the year. The duration of the rice varieties cultivated in the state varies from 100 to 180 days depending on season and agro-climatic locations (Ravindra *et al.,* 2014)

Among the biotic stresses, rice root-knot nematode is a serious problem in the nurseries and upland rice but has been recently found to be widespread in the deepwater and irrigated rice also, in many states of India (Prasad *et al*., 1985). In India, the losses due to *M. graminicola* have been estimated to 16-32% and yield loss due to poorly filled kernels to 17-30% (MacGowan, 1989; Jain *et al.,* 2007).

The nematode occurs in patches within nursery or main field and consequently, reduced crop yields and it appeared in devastating form in parts of major rice growing areas of Shimoga during 2001, which was a first report from Karnataka and subsequently reported from Mandya district of the state (Krishnappa, *et al.,* 2001). Severe outbreak of root-knot nematode is also observed in Shimoga, Karnataka (Sehgal *et al.,* 2012). Initially, it was noticed only in aerobic condition. Since 2011, it has been observed in anaerobic condition also and appearing in all types of rice cultivating situations. Hence, survey was conducted in all the districts of Karnataka to know the level of infection in different areas under different climatic conditions, soil types with special reference to organic carbon content and its effect on rice root-knot nematode. However, the literature scanning revealed that there is no information available in this regard.

Materials and Methods

In all the districts of Karnataka, where, rice is being grown, random surveys were conducted. Measures were taken to visit all types of soils and climatic conditions where rice has been grown extensively. Visits were made in each districts and all the talukas and root and soil samples were collected from different villages and analyzed in the lab to know the population of rice root-knot nematodes. 1-5 scale was used to score root-knot index. (Taylor and Sasser, 1978). Organic carbon content were collected from Soil Fertility Atlas for Karnataka, India (Wani *et al.,* 2011). Two categories of organic content viz., <0.5 or >0.5 were considered for the study.

Results and Discussion

The random survey revealed that all the districts of Karnataka are infected with rice root-knot nematodes (Table-1 and Fig.-1). However, the level of incidence differs in different districts. With regard to the effect of organic carbon content levels (Table-2), either at <0.5 or >0.5 on root-knot nematode index and population levels, the districts were grouped as follows

At <0.5 levels on gall index

Five districts *viz.*, Gulburga, Bijapur, Raichur, Koppal and Yadgiri recorded gall index of 1.0, Seven districts namely, Chithradurga, Gadag,

Table-1 : Effect of Organic Carbon (<0.5) on Root-knot index and Population of *Meloidogyne graminicola.*

Sl.No.	District Name	Organic Corban (OC)	RKI
Number of juveniles/ 100 ml of Soil			
1	Davanagere	< 0.5	3	600
2	Chitradurga	< 0.5	2	400
3	Gadag	< 0.5	2	300
4	Gulbarga	< 0.5	1	100
5	Bijapur	<0.5	1	200
6	Raichur	< 0.5	1	100
7	Koppal	< 0.5	1	100
8	Hassan	<0.5	4	700
9	Chamrajanagar	<0.5	2	300
10	Mysore	<0.5	3	500
11	Tumkur	< 0.5	2	200
12	Kolar	< 0.5	2	300
13	Ramnagara	< 0.5	2	300
14	Bangalore Urban	< 0.5	2	300
15	Yadgiri	< 0.5	1	200

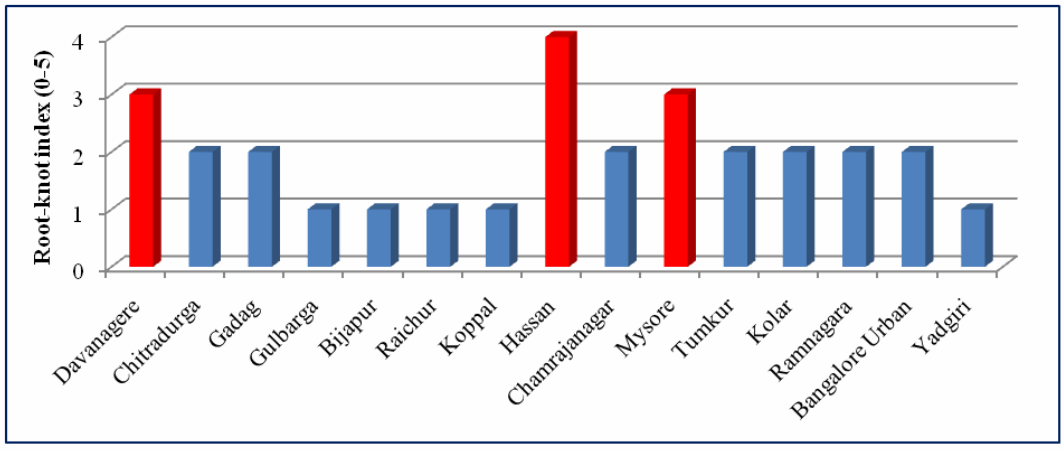

Fig.-1 : Effect of organic carbon (<0.5) on root-knot index of *Meloidogyne graminicola.*

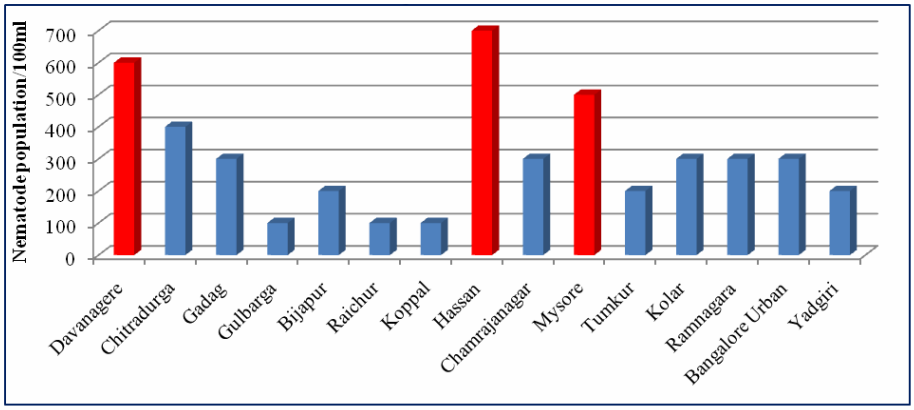

Fig.-2 : Effect of organic carbon (<0.5) on population of *Meloidogyne graminicola.*

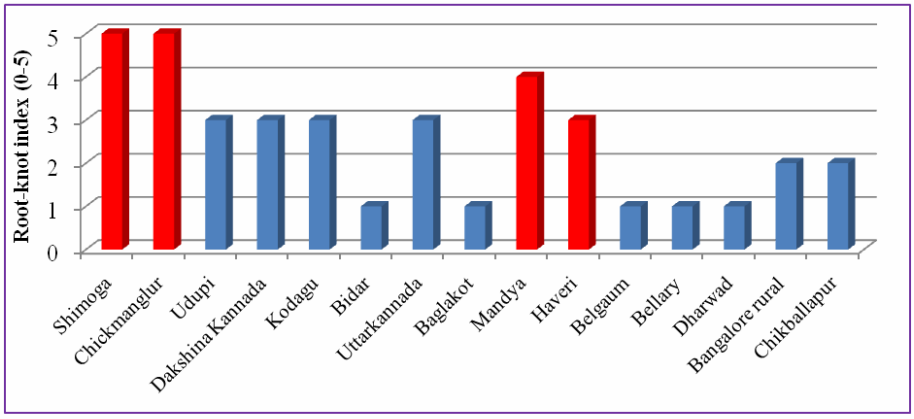

Fig.-3 : Effect of organic carbon (>0.5) on root-knot index of *Meloidogyne graminicola.*

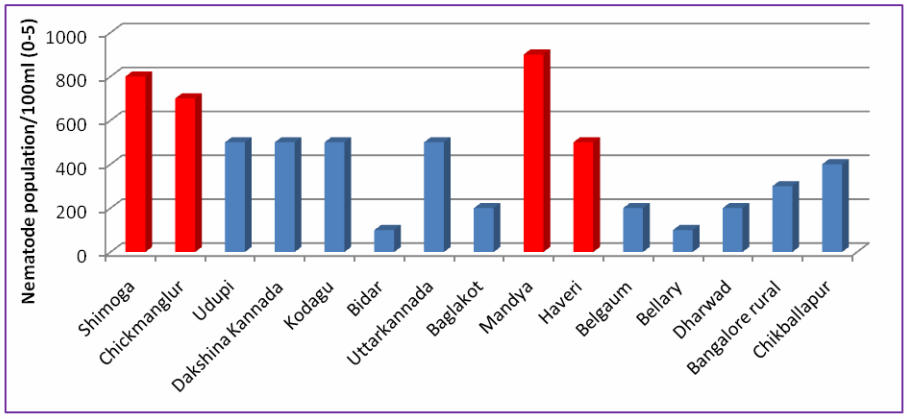

Fig.-4 : Effect of organic carbon (<0.5) on population of *Meloidogyne graminicola.*

Table-2 : Effect of organic carbon (>0.5) on root-knot index and population of *Meloidogyne graminicola.*

Sl.No.	District Name	Organic Corban (OC)	RKI
Number of juveniles/ 100 ml of Soil			
1 Shimoga	> 0.5	5	800
2 Chickmanglur	> 0.5	5	700
3 Udupi	> 0.5	3	500
4 Dakshina Kannada	> 0.5	3	500
5 Kodagu	>0.5	3	500
6 Bidar	> 0.5	1	100
7 Uttarkannada	>0.5	3	500
8 Baglakot	>0.5	1	200
9 Mandya	>0.5	4	900
10 Haveri	> 0.5	3	500
11 Belgaum	> 0.5	1	200
12 Bellary	> 0.5	1	100
13 Dharwad	> 0.5	1	200
14 Bangalore rural	> 0.5	2	300
15 Chikballapur	>0.5	2	400

Chamarajanagar, Tumkur, Kolar, Ramnagar and Bangalore Urban recorded gall index of 2.0, while, two districts Davanagere and Mysore recorded gall index of 3.0 and only one district, Hassan recorded gall index of 4.0.

At <0.5 levels on Nematode population

Three districts *viz.*, Gulbarga, Raichur, Koppal recorded population of nematodes at 100. Three districts, Bijapur, Tumkur and Yadgiri scored population at 200. Five districts *viz.*, Gadag Chamarajnagar, Kolar, Ramanagara and Bangalore Urban registered population level at 300, Chithradurga at 400 while, Mysore, Davanagere and Hassan recorded >500.

At >0.5 levels on gall index

Five districts Bidar, Bagalakot, Belgaum, Bellary and Dharwad recorded gall index of 1.0. Two districts, Bangalore Urban and Chikballapur showed gall index of 2.0. Five districts *viz.*, Udupi, Dakshina Kannada, Kodagu, Uttar Kannada and Haveri revealed gall index of 3. Three districts, Shimoga, Chickmagalur and Mandya recorded gall index of >4

At >0.5 levels on Nematode population

More than 100 nematode population were recorded in two districts, *viz.*, Bidar and Bellary. Three districts, Bagalkot, Belgaum and Dharwad recorded 200 nematode population. Bangalore Rural (300), Chikballapura (400). Five districts, *viz.*, Udupi,

Dakshina Kannada, Kodagu, Haveri, recorded 500, while, Shimoga, Chikmagalur and Mandya recorded >700 nematode population.

With regard to organic carbon content at <0.5 on root-knot index and nematode population, the results indicated that the northern districts *viz.*, Gulbarga, Bijapur, Raichur, Koppal and Yadgiri recorded gall index of 1.0 with population level ranging from 100 to 200 followed by, Chithradurga, Gadag, Chamarajanagar, Tumkur, Kolar, Ramnagar and Bangalore Urban with gall index of 2.0 and population levels between 200 and 400. Gall index between 3 and 4 and population levels >500 were noticed in Davanagere, Mysore and Hassan districts.

Based on the effect of organic carbon content at >0.5 levels on root-knot index and nematode population levels (Fig.-2,3,4), the districts were categorized as follows–

Bidar, Bagalakot, Belgaum, Bellary and Dharwad recorded gall index of 1.0 and nematode population ranging between 100 to 200 followed by Bangalore Urban and Chikballapur with gall index of 2.0 and population levels varying from 300 to 400. Five districts *viz.*, Udupi, Dakshina Kannada, Kodagu, Uttar Kannada and Haveri revealed gall index of 3 with population levels of 500, while, three districts, Shimoga, Chickmagalur and Mandya recorded gall index of >4 and population of >700.

The trend indicated that in northern districts of Karnataka, gall index of *Meloidogyne graminicola* was still at 1.0 with low population densities and as we progressed towards southern districts of Karnataka, starting from Haveri, there was an increase in the gall indices ranging from 2 to 5 irrespective of levels of organic carbon content either at <0.5 or > 0.5. Thus, it can be concluded that with regard to effect of levels of organic carbon content presently prevailing either at <0.5 or > 0.5 with respect to root-knot index and population levels, have no effect. However, more work in this line is needed to confirm the present observation.

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