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Investigation of rice root-knot nematode and weeds interactions in rice agro ecosystem

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ABSTRACT

Interactions between root knot nematode Meloidogyne graminnicola and weeds of rice agro ecosystem in Karnataka were investigated. Studies were conducted to examine the preference and performance of root knot nematode on 15 weeds commonly found in rice agro ecosystem. The extensive surveys were conducted during 2013 in rice growing fields in Shivamogga, Chickmagalore and Davanagere districts indicated that the 15 weeds belongs to different genera and different families both monocotyledons and dicotyledons severely infested which are all annuals. All the weeds had distinct root galling and egg masses, however their numbers and size and pattern may be quite different among the 15 weeds. The weeds of poaceae are classified as good hosts whereas other weeds are poor hosts. These observations suggests that these 15 weeds are alternate host for rice root knot nematode populations and provide a means of survival for the different stages of nematodes and help the nematode to multiply and increase the nematode population in the rice growing areas in the Karnataka or throughout India.

Keywords : Rice, root kont nematode and weed

Rice is one of major crop cultivated in various parts of Karnataka. Due to favourable ecological niche in rice growing fields a numbers of weeds were noticed even with healthy rice crop. However these weeds are regards as one of important pest as they compete for biotic and abiotic factors needed for good rice cultivation. These weeds are also recognized as alternative hosts for rice knot nematodes and causes huge economic loss and some countries it was recorded upto seven billion dollars per year. Davidsom and townshed, 1967, Belour and Benott.1996; Tedford and Fortnum, 1988; Venkatesh *et. al*., 2000; Sehgal, 2001 Castillo *et. al.*, 2008; Anwar, 2009). Plant parsitic nematodes were also considered as one of the limiting factor in rice production (Sehgal and Gaur, 1999 , Sehgal *et.al.*, 2001, 2012) . In India *Meloidogyne graminicola* is well known to cause 13-17 percent loss to the rice crop in Karnataka (Sehgal *et.al.*2012) and its wide host range includes many weeds. The interaction of weeds and nematodes can have negative impact on crop production by reducing the nematode suppressive benefits of crop rotations (Bélair and Benoit, 1996; McSorley, 1996; O'Bannon *et al*., 1982) and nematode resistant crops (Wong and Tylka, 1994). However the presence of number of weed species and the amount of nematode reproduction on these species determines the extent of the negative effect of the weeds has on nematode population densities. In the present study the association of *M. graminicola* with fifteen weed species and their host status was studied.

MATERIALS AND METHODS

Extensive surveys were conducted in major rice growing districts of Karnataka *viz*, Shimoga, Chickmagalore and Davanagere to determine the association of root knot nematode problem in the rice fields. During the survey of these three districts where the majority of rice fields has the association of the test nematodes with rice crop. The nematodes were also observed with weeds growing among rice fields were infested with root knot nematodes (Table1). In each field, ten separate samples of each prevalent weed species and soil around these were collected, amounting to total of 150 samples for nematological analysis. Each sample was comprised of the aerial part of the plant and the corresponding roots with adhering soil collected between the 5 and 30cm depth. Weeds sample were collected separately and identified by well known agronomist. After identification of the plant to species level all root samples were carefully washed under tap water to remove adhering soil particles and they were properly stained and observed under the microscope and assessed for the presence of different life cycle stages of nematodes including the egg masses. The root knot gall indices were determined on 0 to 5 scale, where 0 = no gall, 1 = 1-2, 2 = 3-10, 3 = 11- 30, 4 = 31-100, and 5 = >100 galls per root system (Quesenberry *et. al.*, 1989). The nematode populations in soil were estimated. Nematodes were identified using perineal patterns of adult females as well as the morphology of second-stage juveniles (Hartman and Sasser, 1985; Jepson, 1987). The host status of weeds observed to *M.graminicola*. Data were statistically analyzed.

RESULTS AND DISCUSSION

A random survey in anerobic rice fields of Shimoga, Chickmagalore and Davanagere districts of Karnataka

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revealed that fifteen weeds species belonging to different genera and different families infesting anaerobic rice were collected from farmers' fields. Among fifteen weeds studied all were annual weed species (Table I). Prominent root galling and egg masses were observed on the roots of all the fifteen weed species, thus indicating these weeds are alternate hosts of root- knot nematodes *M.graminicola* and these weeds are carrier of inoculums for the next crops. It is also observed that the size and number of galls per plant vary in different weed species of monocots and dicots. However, monocots supported root-knot nematode with more number of galls with relatively small size where as in case of dicots less number of galls with large size galls. It was also observed that the gall size may vary with the root system. *Echinochloa crusgalli* a monocot recorded maximum RKI (4) with other monocots like *Echinochloa colonum, Eleusine indica, Eragrostis unioloides* registering RKI (3). However, a dicot weed, *Cyanotis cucullata* showed maximum RKI (4). It seems that second- stage juveniles (J2) penetrated and reproduced more readily in weeds with soft-textured roots of monocots as compared with hard-textured roots of dicots (Anwar and McKenry, 2002). Although the roots of all fifteen weeds species produced root galls, their number varied significantly ($P < 0.05$) among the weed population. For *M. graminincola*, the roots of *Echinochloa crusgalli and Cyanotis cucullata* had 75 times more galls compared to that of *Hydrilla spp.* and other unknown spp. Adult females also produced significantly ($P < 0.05$) greater egg masses on the roots of *Echinochloa colonum*, *Cyanotis cucullata* and *Eragrostis unioloides* than on the other weeds (Table 2). *Digitaria longifolia, Panicum repens* and *Sida accuta* were moderate hosts of *M. graminicola* relative to Hydrilla and other unknown species of weeds because of less root galling and egg masses. Rice root-knot nematode *M. graminicola* has become a major threat for rice cultivation in Karnataka in all type of rice situation. We have noticed and here with reporting as many as 15 weeds both monocotyledon and dicotyledon in rice fields severely infected with *M. graminicola.* Our observation is supported by Golden and Birchfield (1965) who observed *M. graminicola* on roots of barnyard grass, *Echinochloa colonum* (L.) They stated that no symptoms were visible in the tops of infected barnyard grass and concluded that the host and parasite had a long-standing relationship. Birchfield found *M. graminicola* to be primarily a parasite of grasses and to prefer hosts such as *E. colonum, Avena sativa* L., *Poa annua* L., *Eleusine indica* (L.) Gaertn, and *Aleopecurus carolinianus* Walt. *Phaseolus vulgaris* L. 'Henderson Greenpod' is the only reported dicotyledonous host. Many dicotyledonous plants such as sweet potato, cucumber, tomato, cotton, watermelon and peppers grown in fields infested by *M. graminicola* are not hosts of this nematode. *M. graminicola* has a 23-27 day life cycle (egg to egg) at 26^0C and occurs in many rice growing regions, including Laos, India, Thailand and the southern United States. We believe that this is the first report from the rice fields of Karnataka and would like to continue in this line in future.

Table 1: Different weeds and their RKI value

Sl . No.	Name of Weeds	RKI
1.	*Eragrostis unioloides*	3
2.	*Cyanotis cucullata*	4
3.	*Digitaria longifolia*	2
4.	Unkown	1
5.	Unkown	3
6.	*Panicum repens*	2
7.	Unkown	1
8	Unkown	1
9	*Hydrilla spp.*	1
10	*Sida acuta*	2
11	*Echinochloa crusgalli*	4
12	*Echinochloa colonum*	3
13	Unknown	3
14	Unknown	2
15	*Eleusine indica*	3

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Weeds found in rice fields infected with *Meloidogyne graminicola*

Eragrostis unioloides

galls on Eragrostis unioloides

Cynotis culculata

galls on Cynotis culculata

Digitaria longifolia

Galls on *Digitaria longifolia*

Unknown

Unknown

Panicum repense

Galls on *Panicum repense*

Unknown

Unknown

Hydrilla spp.

Galls on Hydrilla spp.

Sida accuta

Galls on *Sida accuta*

Echinochloa crusgalli

Galls on *Echinochloa crusgalli*

Echinochloa colonum

Galls on *Echinochloa colonum*

Unknown

Unknown

Elucina indica

Galls on *Elucina indica*

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