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HOST SUITABILITY OF FORAGE, VEGETABLE, CEREALS AND WEEDS TO *MELOIDOGYNE GRAMINICOLA*

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SUMMARY

Root-knot nematodes (RKNs), *Meloidogyne* spp. and particularly rice root-knot nematode (*M. graminicola*), are serious pests of rice, being, probably, the most economically important plant-parasitic nematode in this crop. *M. graminicola* is an obligate sedentary endoparasite adapted to flooded conditions. Due to its wide polyphagia, *M. graminicola* survives and reproduces in off-season and during rice cultivation in the next season. Thus, the aim of this research was to check the host suitability of plant species, most often found off-season and during rice cultivation to *M. graminicola.* The response of the *M. graminicola* population to differential hosts was evaluated in the screen house, Department of Nematology, CCS HAU, Hisar during Kharif season, 2019-20. All the plants *viz., Oryza glaberrima* line 06, *Oryza glaberrima* line 33, *Oryza glaberrima* line 44, sorghum (HJ 541), pearl millet (HHB 67), brinjal (BR 112), *Dactylocteniuma egyptium, Leptochloa chinensis* and rice (PB 114), except onion and tomato, were found host of *M. graminicola*. Although, variation occurred in respect of number of galls/plant, final nematode population and reproduction factor in different plant species. Minimum number of galls/plant were obtained in brinjal (3.75) followed by sorghum (13.75), *Dactylocteniuma egyptium* (14.50) and *Leptochloa chinensis* (15.25). Maximum reproduction factor was observed in crop where rice (PB 114) followed by pearl millet (HHB 67), *Oryza glaberrima* line 33 and *Oryza glaberrima* line 44.

Key words : Forage, host range, *Meloidogyne graminicola, Oryza sativa*, plant-parasitic nematode, weeds

Rice root-knot nematode (*Meloidogyne graminicola*) is a common plant-parasitic nematode (PPN) to the Poaceae crops globally. The main host of *M. graminicola* in the family of Poaceae includes rice, wheat, barley, oat and sorghum (Vaish and Pandey, 2012). Rice is the third most important cereal crop in the world, just behind wheat and maize, playing a strategic role in solving food security issues. *M. graminicola* is a serious problem in the nurseries and upland rice but has been found to be widespread in the deep water and irrigated rice also in India. *M. graminicola* is a pest of international importance and reported to cause 17-30% yield loss (Mac Gowan and Langdon, 1989). The above ground symptoms of *M. graminicola* infections often appear as patch patterns in a field, with the infected plants showing growth reduction, less vigor, yellowing of leaves, wilting and poor yield (Mantelin *et al.,* 2017). Below ground symptoms, the second stage juvenile (J2) of the this nematode invades rice roots tips and the infected root tips would swell and form hooks shaped galls, as the female develops and lays eggs within the roots.

Due to its wide polyphagia, *M. graminicola* survives and reproduces in off-season on weeds and forage crops growing on fallow plants, contributing to the increase of inoculum in the soil and then parasitizing rice cultivation in the next season (Pokharel *et al.,* 2007). In addition to the main host, rice, *M. graminicola* has a wide range of alternative hosts, including cereals and grasses, as well as dicotyledonous plants (Torrini *et al.,* 2020). The barnyard grass (*Echinochloa* spp.) and other weeds are reported as good host of *M. graminicola.* There are several reports indicating variability in the host range among different populations of *M. graminicola* (Salalia, 2015). However, little is known about the development and reproduction of this nematode in different host in Haryana. In this context, the aim of this research was to check the host suitability of plant species, most often found off-season and during rice cultivation to rice root-knot nematode, *M. graminicola.*

MATERIALS AND METHODS

The response of the *M. graminicola* population to differential hosts was evaluated in the screen house of the Department of Nematology, CCS HAU, Hisar during kharif season, 2019-20, where 11 species of forage, vegetable, cereals crops and weeds were evaluated for determination of host races to *M. graminicola*. The differential host set includes *Oryza glaberrima* line 06, *O. glaberrima* line 33, *O. glaberrima* line 44, sorghum (HJ 541), pearl millet (HHB 67), brinjal (BR112), tomato (Sel-120), onion (kharif), *Dactyloctenium egyptium, Leptochola chinensis* and rice (PB 114). Rice (var. PB 114) plants were used as susceptible control. Steam sterilized sandy loam soil were filled in 15 cm dia. earthen pots (one kg soil capacity). Three seeds of each crops and weeds were sown in each pot. One week after germination, one plant was retained per pot and inoculated with 2000 freshly hatched second stage juveniles (J2) of *M. graminicola.*

In this experiment, the design was completely randomized (CRD) with three replications. After forty five days of inoculation, all the plants were uprooted carefully from the earthen pots. The roots of plants were retrieved carefully and kept under running tap water to clear it from adhering soil particles and observations recorded on nematode multiplication such as number of galls/plant, final nematode population (number of eggs and J2/plant in root and final nematode population in the soil) and reproduction factor (RF). For estimating soil population, 200 cc soil from each pot, was also processed by Cobb's sieving and decanting method combined with modified Baermann's funnel technique (Christie and Perry, 1951).

Computation of reproduction factor (RF):- The reproduction factor was computed with the following formula.

$$RF = \frac{\text{Number of eggs and J2s (root) + final nematode population (soil)}}{\text{Initial nematode population (Pi)}}$$

RESULTS AND DISCUSSION

Eleven species of forage, vegetable, cereal crops and weeds were evaluated for determination of host races to *M. graminicola* under screen house condition and data is presented in Table 1. All the plants *viz., Oryza glaberrima* line 06, *O. glaberrima* line 33, *O. glaberrima* line 44, sorghum (HJ 541), pearl millet (HHB 67), brinjal (BR 112), *D. egyptium, L. chinensis* and rice (PB 114), except onion and tomato, were found host of *M. graminicola*, although variation occurred in respect of number of galls/plant, final nematode population and reproduction factor in different plant species.

Minimum number of galls/plant were obtained in brinjal (3.75) followed by sorghum (13.75), *D. egyptium* (14.50) and *L. chinensis* (15.25). Maximum number of galls/plant was observed in rice (PB 114) followed by pearl millet (HHB 67), *O. glaberrima* line 33 and *O. glaberrima* line 44 having 57.00, 42.00, 33.50 and 31.50, respectively. Perusal of data in Table 1 indicated that lowest number of nematode population was obtained in brinjal (678.75) followed by sorghum (2057.57), *D. egyptium* (4196.50) and *L. chinensis* (5268.75).

Fig. 1 depicted that maximum RF was observed in crop where rice (PB 114) followed by pearl millet (HHB 67), *O. glaberrima* line 33 and *O.*

TABLE 1
Response of different forage, vegetable, cereals crops and weeds against *Meloidogyne graminicola*

S. No.	Hosts	No. of galls/plant	Final nematode population	Reaction (Host/Non host)
1.	*Oryza glaberrima* line 06	31.25	8578.00	Host
2.	*Oryza glaberrima* line 33	33.50	10530.50	Host
3.	*Oryzaglaberrima* line 44	20.50	5420.00	Host
4.	Sorghum (HJ 541)	13.75	2057.25	Host
5.	Pearl millet (HHB 67)	42.00	15663.75	Host
6.	Brinjal (BR112)	3.75	678.75	Host
7.	Tomato (Sel-120)	0	0	Non-Host
8.	Onion (kharif)	0	0	Non-Host
9.	*Dactyloctenium aegyptium*	14.50	4196.50	Host
10.	*Leptochola chinensis*	15.25	5268.75	Host
11.	Rice (PB 114)	57.00	17827.00	Host

glaberrima line 44. The value of RF was directly proportional to number of eggs/plant and final nematode population in the soil. The minimum RF was found in tomato and onion.

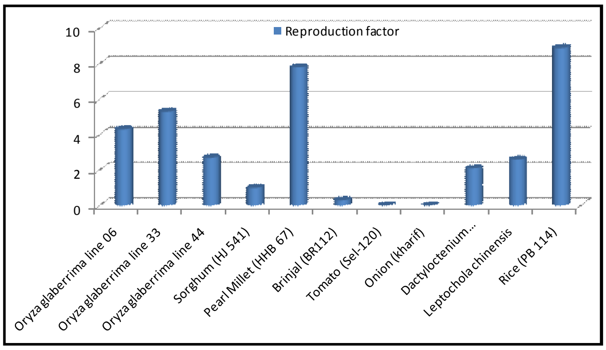

Fig. 1. Reproduction factor (RF) of rice root-knot nematode, M. graminicola on different host.

All the hosts, except tomato and onion, were found susceptible to *M. graminicola*, although variation occurred in respect of number of galls as well final nematode population. Our results are in conformity with those of Dabur *et al.* (2004) who reported that rice, sorghum, pearl millet, oats and wheat were good hosts of *M. graminicola* but brinjal, okra, tomato, greengram and barley did not support its reproduction and multiplication. Same findings with the support of Devi *et al.,* 2016 whose observed that all the plants (pearl millet, sorghum, barnyard grass, chotti savank, badi savank, brinjal and rice), except tomato, were found susceptible to all the five populations of *M. graminicola,* although variation occurred in respect of number of galls as well as root and soil population. Developmental stages of nematode were also recorded in the roots of all the plants, except tomato. *M. graminicola* is frequently found associated with other cereals, as well as dicotyledonous and grassplants, including many weeds that may constitute a major reservoir of nematodes (Rich *et al.,* 2009).

The inherent capability of a plant or variety to resist or susceptible to nematodes is determined by a number of factors. Resistant to nematodes is a term that refers to plants that do not support or poorly favour nematode reproduction and this is distinct from tolerance (Trudgill, 1991). Variation in infection and reproduction of nematodes on different hosts is a common phenomenon in nematode species, of which *M. graminicola* is not an exception. Thus, differences in adverse reactions to the same weed species can be credited to two hypotheses: intraspecific variability of weeds or physiological variation in populations of the nematode (Pokharel *et al.,* 2010).

Roy (1977) assessed 46 weeds commonly grown in or around rice fields of Assam and many weeds was found as moderate to good hosts of *M. graminicola*. *M. graminicola* also has several alternative/collateral hosts such as *Echinochloa colonum*, *Cyperus compressus, Brachiaria ramose, Cyperus rotundus*, *Ranunculus pusillus* etc. These weeds are commonly encountered in rice fields of the Southern US and South-East Asian countries (Jain *et al.,* 2012). Khan *et al.* (2004) recorded 17 weeds associated with kharif and boro rice grown in Nadia district of West Bengal (India) and all these were supporting *M. graminicola* for their survival and multiplication in field situations. Some of the weeds like *Bothriochloa intermedia*, *Physalis minima, Alternanthera sessilis, Agropyron repens, Dactyloctenium aegyptiacum*, and *Sporobolus diander* were reported as new hosts of *M. graminicola.*

Mac Gowan and Langdon (1989) also reported 100 host plants of *M. graminicola*, which includes food, fodder, fruits, ornamentals and weeds. Bajaj and Dabur (2000) found that *Cyperus difformis* as a host of *M. graminicola* and demonstrated it could multiply on the weed under rice-wheat crop sequence. Salalia (2015) when studied 14 populations of *M. graminicola* from India, observed that six varieties of rice, two kharif weeds and brinjal were hosts, tomato (hybrid PKM 1) was non-host for all the populations; but status of pearl millet and sorghum was not clearly discernible. All the tested cultivars used in the study were infected by *M. graminicola,* except cotton and okra no galls are observed on these cultivars. While, tomato (5.33), tobacco (12.40) and peanut (8.00) showed least galls on root system and least RF value (0.035), (0.061) and (0.21) respectively. However, no galls were observed on cotton and okra and RF value was nil (Narasimhamurthy *et al.,* 2020).

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