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STUDIES ON POPULATION VARIATION OF *MELOIDOGYNE GRAMINICOLA* USING SOME WEEDS, FORAGE AND VEGETABLE CROPS

POOJA DEVI, R. S. KANWAR* AND ANIL KUMAR

Department of Nematology
CCS Haryana Agricultural University,
Hisar-125 004 (Haryana), India
**(e-mail : kanwarrambir@gmail.com)*

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SUMMARY

On the basis of host reactions, variations in populations of *Meloidogyne graminicola* from Assam, Bihar, Delhi, Haryana and Punjab were studied. Experiment was conducted under screen house conditions, in half kg earthen pots, using autoclaved soil. Five hundred fresh eggs and second stage juveniles of each population were inoculated on 10-day-old plants. Forty-five days after inoculation, data were recorded on number of galls seedling, life cycle stages inside the galls, number of eggs per root system and soil population from each pot. 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. Thus, all the populations showed similar reactions on the tested plant species.

Key words : Rice root-knot nematode, *Meloidogyne graminicola*, population variation, host range, weeds, sorghum, pearl millet

Rice root-knot nematode, *Meloidogyne graminicola* is a pest of international importance and reported to cause 17-30 per cent yield loss (MacGowan and Langdon, 1989). It 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 many states of India (Prasad *et al*., 1985; Bridge *et al*., 1990; Jairajpuri and Baqri, 1991). It causes typical root galls on all the susceptible hosts. *M. graminicola* has a wide host range (Ou, 1972; Sabir and Gaur, 2005) that includes many of the common weeds of rice fields. MacGowan and Langdon (1989) reported 100 host plants of *M. graminicola,* which include food, fodder, fruits, ornamentals and weeds. Dabur *et al*. (2004) 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 multiplication.

Few galls with egg masses were also formed on *Sesbania*. Kanwar *et al*. (2006) studied the reactions of wheat and barley varieties resistant to *Heterodera avenae* against this nematode and found that AUS 15854 and RajMR 1 wheat and BH 393 barley were resistant but BH 75 barley was susceptible.

Wide host range of *M. graminicola* may be the reason for its ability to cause severe losses in different crops and cropping systems. There are several reports indicating variability in the host range among different populations of *M. graminicola* (Yik and Birchfield, 1979; MacGowan and Langdon, 1989; Salalia, 2015). Sahu and Chawla (1986) indicated that Agartala (India) population may be a new biotype. Pokharel *et al*. (2010) compared 10 isolates of *M. graminicola* populations from broad geographic areas, mostly of south-east Asia, by using traditional and molecular methods. They found that Florida isolate differed from the other nine isolates by non-pathogenic behaviour to rice cvs. Labelle, LA 110, Cocodrie and BR 11 or Mansuli, suggesting that *M. graminicola* consists of more than one race. Host range and population variation studies have significance in developing management strategies. Aim of this study was to see variation in five populations of *M. graminicola* from different states of India, on the basis of host reactions.

MATERIALS AND METHODS

Five populations of *M. graminicola*, namely, Fatehabad (Haryana), Jorhat (Assam), Ludhiana

(Punjab), IARI (New Delhi) and Samastipur (Bihar), and 10 plant species (Table 1) were used in the study. The nematode populations were maintained on rice cv. Pusa-1121 in the Department of Nematology, CCSHAU, Hisar during 2015. Half kg earthen pots filled with autoclaved soil were used in the experiment. Seeds of different test plants were sown and after germination one plant per pot was maintained. There were three replications for each plant. When the plants were 10-day-old, 500 eggs and J_2 per pot were inoculated with pipette in pencil holes. The holes were immediately covered with soil and light watering was done. Fresh eggs and J_2 of each population collected separately, by teasing galls from infected rice roots, were used for inoculation. The plants were observed daily and watered depending upon requirement. Weeding was done mechanically to keep the pots free from weeds. The pots of different populations were kept in isolation to maintain the purity of the populations. Forty-five days after inoculation, the plants were depotted, roots were retrieved carefully and washed thoroughly to remove adhering soil particles. The number of galls per seedling, life cycle stages inside the galls and number of eggs per root system were recorded. 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).

RESULTS AND DISCUSSION

Data on number of galls, number of eggs per plant and final nematode population *M. graminicola* populations on different hosts are given in Tables 2 to 4) which indicate that all the five populations multiplied on all the plants, except tomato. Three cultivars of rice i. e. Pusa 1121, PB-1 and PB-1509 showed almost similar level of susceptibility to rice root knot nematode populations. Apart from rice, all the five populations of *M. graminicola* multiplied well on pearl millet (HC-120), sorghum (HJ-541), Barnyard grass, Chotti Savank, Badi Savank and brinjal. Pearl millet (HC-20) showed more susceptibility against Jorhat and Fatehabad populations as more number of galls (34.3 and 30), eggs (1390 and 1483) and final nematode population (410 and 703) were recorded as compared to Ludhiana and IARI population. Sorghum showed more susceptibility to Samastipur population as compared to other four populations as far as number of galls (16.3), eggs (713) and final nematode population (220) are concerned. Among the **kharif** weeds, Chotti Savank was found to be less susceptible to *M. graminicola* as compared to Badi Savank and Barnyard grass against all the populations. Barnyard grass showed less susceptibility to Samastipur population as compared to other four populations. Fatehabad and Jorhat populations produced more galling and eggs as compared to the Ludhiana, IARI and Samastipur populations on all the hosts, except tomato. Among the five populations of *M. graminicola*, Fatehabad population had maximum final nematode population per 200 cc soil as compared to the other populations.

Thus, all the populations behaved in similar fashion and did not differ in their reactions on all tested hosts. All the hosts, 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 (data not given) were also recorded in the roots of all the plants, except tomato.

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. Negretti *et al.* (2014) also observed in the rainfed condition, *E. crusgalli* was the plant where the nematode had a higher reproduction rate, demonstrating

TABLE 1
Different hosts species/varieties used in the study

Common name	Botanical name	Variety
Pearl millet	*Pennisetum glaucum*	HC-20
Sorghum	*Sorghum bicolor*	HJ-541
Barnyard grass	*Echinochloa glabrescens*	Wild species
Chotti savank	*E. colonum*	Wild species
Badi savank	*E. crusgalli*	Wild species
Tomato	*Solanum lycopersicum*	Hisar Arun
Brinjal	*Solanum melongena*	BR-112
Rice	*Oryza sativa*	Pusa-1121, PB-1509, Pusa Basmati No. 1

Fig. 1. Galls formed by some populations of *Meloidogyne graminicola* on different plants.

greater susceptibility, followed by *Cyperus difformis, Cyperus iria, Oryza. sativa*-ARV, *Alternanthera philoxeroides, Cyperus. esculentus* and *Fimbristylis miliacea.*

In present study, brinjal exhibited more galling but poor nematode multiplication, while tomato supported no galling or egg production showing its non-host status for all the populations. 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 multiplication. 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. We observed that all the five populations formed galls and reproduced well on pearl millet and sorghum. Results of this study showed that all the five populations behaved in the same manner on the basis of tested plant species.

TABLE 2
Number of galls per plant by different populations of *Meloidogyne graminicola*

Hosts	*M. graminicola* populations				
	Fatehabad (Haryana)	Jorhat (Assam)	Ludhiana (Punjab)	IARI (New Delhi)	Samastipur (Bihar)
Pearl millet	30	34.3	4.7	17.3	26.3
Sorghum	5.3	6.0	6.3	4.9	16.3
Barnyard grass	33	38.7	30.7	18.7	7.7
Chotti savank	2.5	7.7	13.7	9.0	8.3
Badi savank	17.7	22	28	18.7	11.7
Tomato	0	0	0	0	0
Brinjal	10	5.0	9.7	5.0	13.3
Rice (Pusa-1121)	1.7	3.3	2	2.0	4.0
Rice (PB-1)	2.7	2.0	2.5	2.5	1.5
Rice (PB 1509)	5.0	5.0	3.7	4.0	9

TABLE 3
Number of eggs per plant by different populations of *Meloidogyne graminicola*

Hosts	*M. graminicola* populations				
	Fatehabad (Haryana)	Jorhat (Assam)	Ludhiana (Punjab)	IARI (New Delhi)	Samastipur (Bihar)
Pearl millet	1483	1390	156	343	1350
Sorghum	93	180	153	86	713
Barnyard grass	3100	1850	1706	976	220
Chotti savank	63	320	740	243	150
Badi savank	1533	2306	1160	1166	376
Tomato	0	0	0	0	0
Brinjal	250	90	240	246	413
Rice (Pusa-1121)	100	70	45	26	114
Rice (PB-1)	81	40	63	71	28
Rice (PB 1509)	90	180	130	46	160

TABLE 4
Nematode population in 200 cc soil on different hosts

Hosts	*M. graminicola* populations				
	Fatehabad (Haryana)	Jorhat (Assam)	Ludhiana (Punjab)	IARI (New Delhi)	Samastipur (Bihar)
Pearl millet	703.3	410.0	30.0	150.0	176.7
Sorghum	13.3	63.3	43.3	40.0	220.0
Barnyard grass	640.0	243.3	200.0	50.0	50.0
Chotti savank	36.7	43.3	66.7	108.3	100.0
Badi savank	443.3	283.3	80.0	93.3	93.3
Tomato	0	0	0	0	0
Brinjal	80.0	46.7	86.7	123.3	133.3
Rice (Pusa-1121)	153.3	55.0	39.0	51.3	51.7
Rice (PB-1)	130.0	36.7	30.3	26.7	0
Rice (PB 1509)	333.3	56.7	33.3	23.3	126.7

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