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Evaluation of Maize Varieties against Stunt Nematode *Tylenchorhynchus mashhoodi* under Nethome Conditions

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ABSTRACT

A field experiment was conducted on Screening of maize varieties against stunt nematode, *Tylenchorhynchus mashhoodi*, eight maize varieties Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Laxmi, Dewaki, Ganga safed-2 seeds received from T.C.A., Dholi, Dr. Rajendra Prasad Central Agricultural University, Bihar, Pusa, were evaluated for their reactions to stunt nematode using Completely Randomized Design (CRD) with 5 replications in net house at 8 – 29 °C temperature during *rabi* season 2018-2019. Observations were recorded on plant height, fresh shoot and root weight and final nematode population in each pot. The results revealed that six varieties were found to be susceptible whereas shaktiman-4 and Ganga safed-2 were highly susceptible to stunt nematode.

Keywords: *Fresh shoot and Root weight, Maize, Plant height, Tylenchorhynchus mashhoodi.*

Maize (Zea mays L.), also recognized as "Queen of Cereals or Miracle Crop," has the highest productivity per day and is flexible in nature compared to other cereal crops. Maize acts as the main crop for food safety owing to enormous demographic growth with reducing soil and water supplies. Even after attaining self-sufficiency in food and grain production, about 50% of kids are struggling with malnutrition. Globally, maize offers more than 4.5 billion people in 94 emerging nations with 15 %t protein and approximately 30 percent of food calories. Today, maize has become the main crop in many areas of the globe with its total output exceeding that of wheat or rice by engaging more than 15 million people in agriculture. Furthermore, maize demand is anticipated to double globally by 2050. Higher maize manufacturing needs the hour to satisfy this increasing requirement (Srinivasan *et al*. 2004).

Several biotic and abiotic pressures attack crops has financial significance. The most significant diseases affecting maize are Fusarium stalk rot caused by *Fusarium moniliforme*, Pythium stalk rot caused by *Pythium aphanidermatum* Fitz., late wilt by *Cephalosporium maydis* (Samara, Sabet and Hingorani), charcoal rot caused by *Macrophomina phaseolina*, black bundle illness caused by *Cephalosporium acermonium*, further leaf blight caused by *Helminthpsporium maydis* and northern leaf blight caused by *Helminthosporium maydis* (Anon, 1987-90). Besides these, disease induced by plant parasitic nematodes is also of financial significance.

Out of total known species of nematodes, about 50% are marine, 25% free living, 10% plant parasitic and 15% animal parasitic forms (Ayoub, 1980). Plant parasitic and free living forms are grouped as soil and fresh water nematodes. More than forty nematode species are associated with maize but significant ones belong to the genera cyst nematodes (*Heterodera zeae*), lesion nematodes

(*Pratylenchus spp.*), root knot nematodes (*Meloidogyne incognita* and *M. javanica*), stunt nematode (*Tylenchorhynchus mashhoodi*), spiral nematode (*Helicotylenchus spp.*) and so on (Patel *et al*., 2000) are accountable for crop losses of 10.2 percent (Sasser and Freckman, 1987). Nematodes, apart from causing damages, interact with other diseases causing agents and adversely affect the quality and quantity of maize production. Kumar (2001) reported that screened maize varieties against the spiral nematode *Helicotylenchus indicus* in five varieties with 2000 inoculation of *H. indicus* and results revealed that all the five varieties viz; Shaktiman-1, Pusa early hybrid1, Suwan, Deoki and Lakshmi were categorized as a susceptible. Nelson (1956) growed various hybrids, inbreeds and single crosses of maize in infested soil filled in pots for screening of susceptibility of *T. claytoni* and revealed that twenty-one inbreeds and 11 single crosses showed decrease of shoot and root weights when exposed to high nematode population. Nine inbreeds exhibited some resistance to nematode attack and had shoot and root weights similar to those of controlled and un inoculated.

MATERIAL AND METHODS

A field experiment was conducted on screening of maize varieties against stunt nematode *Tylenchorhynchus mashhoodi*, 8 maize varieties Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Laxmi, Dewaki, Ganga safed-2 seeds received from T.C.A., Dholi, Dr. Rajendra Prasad Central Agricultural University, Bihar, Pusa, were evaluated for their reactions to stunt nematode using Completely Randomized Design (CRD) with 5 replications in net house at 8 – 29°C temperature during rabi season 2018-2019. Three seeds of each maize variety were seeded in 15 cm diameter earthen pots, which are previously disinfested with 4 % formaldehyde (formalin 40 EC) solution and filled with 1 kg sterilized soil. Ten days after seeding, seedlings were thinned down to one/pot. Out of 10 pots five plants were inoculated with 2000 nematodes in the rhizosphere of seedlings by making ring surrounding the stem with spatula. After inoculation, ring was covered with same sterilized soil. Remaining 5 un inoculated plants served as check for comparison purpose. Regular watering and after cares were taken. Plants were depotted carefully and roots were washed with tap water after 90 days of inoculation. Cobb's sieving and decanting method is utilized for estimating final nematode population from 100g of sample collected from each inoculated pot. Observations were recorded on plant height (cm) with scaling method and fresh shoot and root weight (g) was taken by using precision balance.

Estimation of nematode population and reproduction factor

After normalising nematode suspension to 25ml and inserting in 100ml beaker, evenly spread population by blowing through pipette. 5ml of this slurry is pipetted onto a nematode counting dish and counted using a stereoscopic binocular microscope. Five suspensions are counted. Multiplying the average by the volume factor gives the sample's total population. Reproduction factor was estimated by taking the difference between the initial inoculated population with final inoculated population by comparing with plant growth.

RESULTS AND DISCUSSION

Screening of various maize genotypes available for source(s) of resistance against *T. mashhoodi*

The observations and data collected as follows

Table 1. Screening of maize varieties against stunt nematode *Tylenchorhynchus mashhoodi*

Sl. No.	Variety/ Lines	Treatment	Plant Height (cm)	Fresh shoot Wt.(g)	Fresh root Wt.(g)	% reduction over Uninoculated control	Nematode Population (Log x + 1 trans) Reproduction Final	Reproduction factor Rf = Pf/Pi	Reproduction good (G) or Poor (P)	Reaction
1	Shaktiman 1	I	36.00	9.70	9.13		4.446	11.69	G	S
			-38.98	-49.55	-39.20	41.20%	*(27963)			
		UNI	59.00	19.23	15.03					
2	Shaktiman 2	I	33.70	10.67	8.27		4.386	12.18	G	S
			-48.39	-42.00	-41.76	46.24%	*(24369)			
		UNI	65.30	18.43	14.20					
3	Shaktiman 3	I	32.10	10.20	8.40		4.427	13.3	G	S
			-37.79	-44.00	-47.92	42.20%	*(26759)			
		UNI	51.60	18.27	16.13					
4	Shaktiman 4	I	22.40	7.40	4.87		4.566	18.4	G	S
			-51.10	-52.56	-52.30	51.65%	*(36893)			
		UNI	45.90	15.60	10.21					
5	Shaktiman 5	I	41.00	12.33	8.17		4.45	14.1	G	S
			-30.86	-31.99	-46.44	33.74%	*(28210)			
		UNI	59.30	18.13	15.23					
6	Laxmi	I	19.90	8.93	5.73		4.418	15.4	G	S
			-50.60	-45.11	-48.05	49%	*(30289)			
		UNI	40.30	16.27	11.03					
7	Dewaki	I	32..1	11.00	7.70		4.414	12.99	G	S
			-41.87	-39.79	-39.22	41.01%	*(25987)			
		UNI	55.23	18.27	12.67					
8	Ganga safed 2	I	36.30	11.70	8.00		4.452	14.16	G	S
			-36.86	-32.09	-31.79	35.23%	*(28321)			
		UNI	57.50	17.23	11.73					

Character	SEm ±	CD(P=0.05)	SEm ±	CD (P=0.05)	SEm±	CD (P=0.05)	SEm ±	CD(P=0.05)
Variety	0.32	0.85	0.09	0.27	0.07	0.2	0.02	0.08
Treatment	0.15	0.42	0.04	0.13	0.37	0.1	0.1	0.04
V × T	0.42	1.21	0.13	0.39	0.1	0.29	0.03	0.11
CV%	2.23		2.21		2.26		4.09	

Nematode reproduction: G – Good (more than 9000 nematodes per plant); P- Poor (less than 9000 nematodes per plant) Rf – Reproduction Factor; Pf – Final Population; Pi- Initial Population; I-Inoculated; UNI-Un inoculated; S- Susceptible .Figures in parentheses indicate percent reduction over un inoculated control *Figures in parenthesis are retransformed values.

Plant height

There is a significant decrease in plant height due to inoculation of 2,000 *T.mashhoodi* nematodes per plant in all 8 varieties viz., Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Laxmi, Dewaki, Gaga safed-2as against their uninoculated control Average reduction in plant height over control were observed maximum reduction in varieties Shaktiman-4 51.1% and followed by Laxmi-50.6% and minimum reduction in varieties Shaktiman-5 30.86%and followed by Ganga safed-2. (Table 1)

Fresh shoot weight

All 8 varieties show significant reduction in fresh shoot weight. Average reduction in fresh shoot weight over un inoculated control were 52.56%, 49.55%, 45.11%, 44%, 42% , 39.79%, 32.09%, 31.9% in followingShaktiman-4, Shaktiman-1, Laxmi, Shaktiman-3, Shaktiman-2, Dewaki, Ganga safed-2, Shaktiman-5, respectively. (Table 1)

Freshroot weight

Similarly significant reduction will be observed in fresh root weight. Average reduction in fresh root weight over un inoculated control were 52.30%, 48.05%, 47.92%, 46.44%, 41.76%, 39.22%, 39.2%, 31.79%, in following varieties Shaktiman4, Laxmi, Shaktiman-3, Shaktiman-5, Shaktiman-2, Dewaki, Shaktiman-1, Ganga safed-2, respectively. (Table 1)

Nematode reproduction

Final nematode population will be increased / plant / pot varies from 24,336 (Variety Shaktiman-2) to 36,893 (Variety Shaktiman-4) it shows that variable nematode reproduction encouraged by different maize varieties under Screening test. All varieties Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Laxmi, Dewaki, Ganga safed-2 will be have nematode population of more than 9,000 nematodes / plant indicating good nematode reproduction. All the varieties shows susceptible reaction. Reproduction factor will observe maximum in Shaktiman-4 18.4% followed by Laxmi 15.4% varieties and least reproduction factor observed in varieties Shaktiman-1 11.69%and Shaktiman-2 12.18%. (Table.1).

SUMMARY AND CONCLUSION

From the above results, it is found that maize varieties, Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Dewaki, Laxmi, Ganga Safed-2 are susceptible to *T. mashhoodi*. Therefore, there is an urgent need to monitor quite a large amount of maize varieties / accessions / hybrids to find sources of *T. mashhoodi* resistance. Even after that, if resistance sources are not available, tolerant varieties / lines should be exposed to chemical mutations to create genetic variability to search for resistance to nematodes and breeding programmed to incorporate resistance sources into the evolving agronomically suitable cultivars of nematode resistance. As *T. mashhoodi* is a fresh evolving main nematode restricting the profitable cultivation of maize in light as well as heavy (clay) soils and no data is accessible on the management aspects of this maize nematode. Therefore, study work on practically feasible and economically viable management strategies through crop rotation, soil solarization, use of resistant varieties and bioagents, cultural methods, nematicides / fungicides, etc. should be scheduled in an incorporated manner in the future.

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