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Original Article

PREVALENCE OF ROOT-KNOT NEMATODE (*Meloidogyne*sp) IN LAPAI, LAPAI LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA

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ABSTRACT

Meloidogyne species is a root knot plant parasitic nematode found in the soil when tomato, okro potato and other crops are cultivated and has a great impact on its productivity. This study was conducted to assess the distribution of root knot nematode in three selected farms (Ibrahim BadamasiBabangida University, Kure and Magaji farms) in Lapai, Niger state, Nigeria. Ten samples of tomato plant root bunches with galls were randomly uprooted in each of the farm site. In addition, twenty-five grams soil samples were taken using auger at 10cm to 20cm from the rhizosphere. The isolation of the nematodes present was done using Cobbs sieving and decanting techniques. *Meloidogyne incognita* and *Meloidogynejavanica* were isolated and identified from tomato root and soil in the farms surveyed. Out of the two, *M. javanica*was more frequently isolated while *M. incognita* was not isolated from Ibrahim BadamasiBabangida University, Niger State Nigeria farm. Nematode population was significantly ($P< 0.05$) higher in Kure farm (10.77 ± 1.38) than IBBU farm (4.2 ± 1.65) and Magaji farm (8.44 ± 2.51). The gall index ranged from $3.55\pm2.51$to 4.77 ± 0.94while the egg mass index ranged from $2.95\pm0.31$to 3.94 ± 0.21 bothwere found to be highest in Kure farm. The absolute density ranged from 16.8 to 33.75, relative density ranged from 17.94-46.00while prominence value ranges from 1.68-3.38. For root sample the absolute density ranges from 14.20-19.08, relative density ranged from 41.92-56.33 while prominence value ranged from 1.42-1.91. Absolute frequency and relative frequency of both root and soil sample for all the 3 farms had the same value of 100% and 33.33% respectively. From this study the results showed that occurrence of root knot nematode in tomato farms in Lapai, Lapai LGA, Niger State Nigeria was high and varies with farm. Therefore, cultivation of nematode-resistant cultivars and adequate management is suggested to reduce crop damage, reduce nematode population and increase yield.

Key words: Nematode, Isolation, Productivity. Relative density, Prominence value

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INTRODUCTION

Tomato (*Solanumlycopersicon*), belonging to the nightshade or *Solanaceae*family, is one of the most important vegetable crop grown all over Nigeria. It is the world's largest vegetable crop after potato and sweet potato, with an annual production of nearly 100 million tons of fresh tomatoes in 3.7 million ha worldwide (FAO, 2003). It is a short duration crop, high yielding, economically attractive and its area of cultivation is increasing daily (Kruger *et al.*, 2012). The fruit contain lycopene, antioxidants, vitamins and minerals which may have beneficial health effects, and can be processed into juices, ketchup, eaten raw in salads or cook into stew. Tomato is currently grown in almost every country of the world. The appeal and demand for tomatoes are due to consumer perceptions that they are healthy, tasty, convenient and fresh (Mehdi, 2009)

As tomatos are grown almost throughout the world in plains as well as on hilly tracks both in outdoor and indoor cultivations, it is always under the threat of attack by root – knot nematodes. All the four major species of *Meloidogyne*viz, *M. incognita*, *M. javanica*, *M. arenaria*, *M. hapla* and their known races readily attack tomato crops in outdoor as well as in indoor cultivations. Studies have shown that root-knot nematodes can cause suppression in yield of tomato as high as 85% (Sikora and Fernandez, 2005; Kamran *et al.*, 2012).

Meloidogyne-infected tomato may appear chlorotic, stunted, necrotic, and/or wilted, especially during periods of moisture stress and high temperature. However, diagnostic symptoms appear on roots of infected plants in the form of galls or knots. These galls vary from 1 to 10 mm or larger in diameter, depending on the nematode species involved, location of galls in the root system and the susceptibility of the host plant (Evert *et al.*, 2006; Beatrice *et al.*, 2011;). Severely galled root systems become malformed, with shortened and thickened individual roots. Such roots may appear as a mass of galls. Growth rate of roots and root branching are frequently suppressed by infection with root-knot nematodes. The altered root growth results in reduced root volume and surface area. Thus, the root has a reduced capacity for water and mineral uptake as well as the synthesis of cytokinins, gibberellins, and other growth-determining metabolites. Intensive galling seriously reduces root efficiency and often results in permanent wilting, premature defoliation, and eventually plant death (Abawi and Widmer, 2000; Sikora and Fernandez, 2005; Dong and Zhang, 2006).

Adequate knowledge of root-knot nematode distribution in tomato farm will go a long way in improving the yield of Tomato fruit. Therefore, this research was carried out to determine the prevalence of root-knot nematodes on Tomato in three selected farms in Lapai, Niger state, Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out at 3 different tomato farms: Farm A (Ibrahim BadamasiBabangida University Lapai, Farm), Farm B (Engineer Kure farm along Gulu road, Lapai) and Farm C (AbubakarMagajiFarm along Suleja road, Lapai) in Lapai, Niger State. Nigeria. Lapai is situated in Southern Guinea Savannah agroecologial zone of Nigeria and lies along latitude 09^0.02'N

and Longitude 06°-34' E (Tanko*et al.*, 2012).

Sample Collection

Tomato Farm Soil Sample

A total of ten soil samples (250g per sample) were collected using Auger at 10cm- 20cm from the rhizosphere zone from each of the three selected tomato farms in Lapai, Niger state. Nigeria. Each of the soil sample was poured in a black sterile polythene bag and transported to the Laboratory immediately for the extraction (Bakker, 2003).

Tomato Roots Sample

Ten samples of tomato plant root bunches were randomly uprooted in each of the farm sites. Root samples were kept in polythene bags, properly labelled and brought to the Biological Sciences Department Laboratory at Ibrahim BadamasiBabangidaUniversity (IBBU) Lapai, Niger State, Nigeria.

Extraction and Estimation of Root Knot Nematode from Soil Samples

For the estimation of nematode population in the soil and community analysis, Cobbs sieving and decanting technique was used. The soil (25g) was taken in a container and mixed thoroughly with water. Hard particles and stones, were removed by stirring the suspension, and the soil was then passed through a set of sieves of 20, 60, 355 pore size. The sievates were collected on a tissue paper spread over a wire guaze, which was then placed in a petri dish containing enough water. This assembly was kept for 24 hours. The nematode suspension collected in the petri dish was examined by means of stereo binocular microscope. Different plant parasitic nematodes present in the suspension were identified to the genus level. Their numbers present in the suspension were determined by taking the average number of nematodes present in five different 1ml aliquots of nematode suspension (Nandini*et al.*, 2006).

Extraction and Estimation of Root Knot Nematode from Plant Roots

Roots with galls were washed clean and then 4.0g root samples were measured. The root samples were cut into small pieces and placed in 500ml beaker and, thereafter, immersed in an aqueous solution of phloxin B (0.15 g/lit) for 15 minutes and then washed with tap water to stain egg masses. Number of egg masses per root-system was then counted. Egg mass index (EMI) was determined on the following scale: 0=0, 1=1-2, 2=3-10, 3=11-30, 4= 31-100 and 5=greater than 100 egg masses per root system (Taylor *et al.*, 1982).

Gall index (GI) were determined on the following scale: 0 = no galls, 1 = very few small galls, 2 =numerous small galls, 3 = numerous small galls, some of which were grown together, 4 = numerous small and some big galls, 5 = 25% of roots severely galled, 6 = 50% of roots severely galled, 7 = 75% of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, and 10 = plant and roots dead (Taylor *et al.*, 1982). The percentage frequency of occurrence of the disease in each locality were calculated by the formulae:

$$\text{Absolute frequency} = \frac{\text{number of sample containing a species}}{\text{Number of sample collected}} \times 100$$

$$\text{Relative frequency} = \frac{\text{frequency of a species}}{\text{Sum of Frequency of all samples}} \times 100$$

$$\text{Absolute density} = \frac{\text{num of individual of a species in a sample}}{\text{Volume or mass unit of the sample}} \times 100$$

$$\text{Relative density} = \frac{\text{num of individual of a species in a sample}}{\text{Total of all individual in sample}} \times 100$$

Identification of the Species

Identification of the species of *nematode* collected from each farm site was done by applying perineal pattern method (Eisenback*et al.*, 2009; Hunt and Handoo, 2009).

Data analysis

The data generated from nematode frequency from infected soils and roots were statistically analyzed using SPSS (version 16). The data was given as mean ±SEM using ANOVA and Duncan multiple Range was used to separate the means.

RESULTS

Prevalence of Root-knot in Soil Samples

The results of nematode population in the soil sample survey to assess the incidence of root-knot disease in tomatoes in 3 farm localities within Lapai Local Govt Area are presented in Table 1: The soil sample in all the 3 localities were infected with root-knot nematodes. However, the nematode population was significantly ($p< 0.05$) higher in Kure farm (10.77±1.38) than Magaji farm (8.44±2.51) and IBBU farm Lapai (4.2±1.65).

Data analysis revealed that the Absolute Frequency of the root-knot nematodes for all the 3 farms were 100% and while Relative frequencies variedfrom 27.18% in Magaji farm to 33.33% in IBBU farm and 35.25% in Kure farm Absolute density ranged from 16.8 -33.75, Relative density ranged from 17.94-46.00and Prominence value ranged from 1.68-3.38.

Prevalence of Root-knot in Root sample

Table 2 shows the prevalence of root knot nematode in root samples from 3 tomato farms sampled. The roots of tomato in all the 3 localities were infected with root-knot nematodes. The gall index ranged from 3.55±2.51to 4.77±0.94been highest in Kure farm and lowest in Magaji farm. The egg mass index ranged from 2.95±0.31to 3.94±0.21which was highest in Kure farm and lowest in Magaji farm.

Table 1: Prevalence of root-knot nematodes in soil samples from three tomato farms in Lapai

Farm	Absolute Frequency	*Relative* Frequency	Absolute density	*Relative* Density	*Prominenc e value*	*Num nematode* (mean±SEM n=10)
IBBU	100	33.33	16.8	17.94	1.68	$4.2\pm1.65^{a*}$
Kure	100	35.25	43.08	46.00	4.30	10.77 ± 1.38^{c}
Magaji	100	27.18	33.76	36.05	3.38	8.44 ± 2.51^{b}

*Value of means followed by the same superscript do not differ significantly at $P<0.05$.

Table 2: Prevalence of root-knot nematodes in tomato roots

Farm	A. F	R. F	A.D	*R.D*	*P.V*	(mean±SEM n=10) *Egg-index*	*Gall-index*
IBB U	100	33.33	16.44	48.66	1.64	3.01 ± 0.14^{ab}	$4.11\pm0.99^{b*}$
Kure	100	33,33	19.08	41.92	1.91	3.94 ± 0.21^{b}	4.77 ± 0.94^{b}
Magaji	100	33.33	14.20	56.33	1.42	2.95 ± 0.31^{a}	3.55 ± 2.51^{a}

Key: A.F=Absolute Frequency, R.F= Relative Frequency, AD=Absolute density, R.D= Relative Density & P.V=Prominence value. *Values of means followed by the same superscript in a column are not differ significantly at $P<0.05$.

Data analysis revealed that the Absolute Frequency &*Relative* Frequency of the root-knot nematodes for all the 3 farms are 100%. Absolute density range from 14.20-19.08, *Relative* density range from 41.92-56.33 While Prominence value range from 1.42-1.91

Frequency of the Species

On the basis of perineal pattern characteristics, *M. incognita* and *M. javanica*, the two species of root-knot nematodes were identified to infect tomato root and soil in the farms sampled. Out of the two, *M. javanica*was more frequent in Kure Farm and Magaji Farm, however,*M. incognita* was completely absent in soil sample obtained from IBBU Farm (Figure 1).

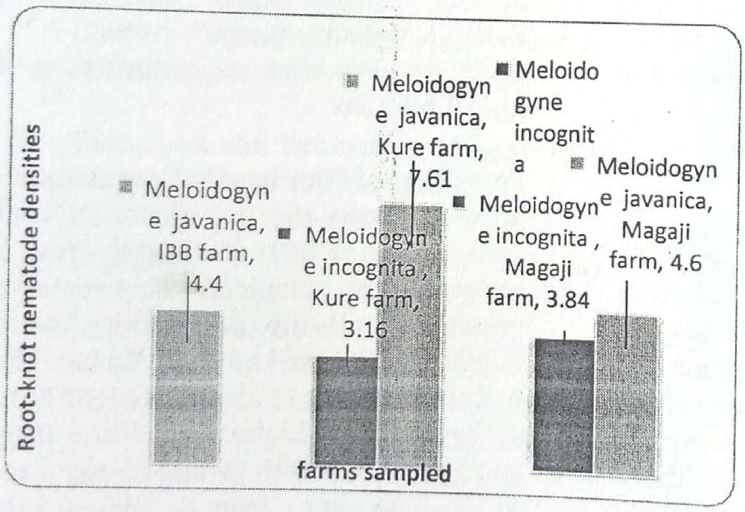

Figure 1: Frequency of *Meloidogyne species* in tomatoes farms sampled in Lapai Local Government Area

DISCUSSION

From this study, *M. incognita* and *M. javanica*were isolated species from tomato farms sampled in Lapai Niger state, Nigeria. This was aligned with the report of Ye *et al.* (2008) that root-knot nematodes (*Meloidogyne*spp.) are common nematodes that parasitize vegetables and cause significant yield reductions when not properly managed. It also established the existing fact thatamong the species of *Meloidogyne*recorded in association with crops of agricultural importance in subtropical and tropical regions, *M.incognita* and *M. javanica*are

considered as common and wild-spread (Mehdi, 2009).

The results also revealed that *M. javanica* was the mostfrequently isolated of the two species. These findings agreed with Mehdi (2009) who also reported that *M. javanica*as the most dominant species effecting tomato plant in tomato field, but contrary to Bem*et al.* (2014) who reported high prevalence of *M. incognita* than*M. javanica* in some tomato farms in Makurdi,Benue State, Nigeria.

The differences in results obtained from the three farms in this present study may be probably attributed to differences in soil characteristics and the weather conditions of the farms as revealed in the report of Munir and Bridge (2003) that soil type influences nematode movement while searching for hosts, penetration of roots, reproduction, and buildup of population densities in fields. The high prevalence and incidence of these nematodes suggests their importance as a potential threat to tomato in Lapai, Niger state, Nigeria.

The significant decrease in root knot nematode population observed in IBBU farm as compared to Kure and Magaji farms might be an indication that there was farm-variation in prevalence of root knot nematode in Lapai, Niger state. These findings were similar to that of Ishrat*et al.*, (2012) who also reported variation in root knot nematode population from different farms in Pakistan.

The results of gall score rating used for host response revealed that nematode mean gall score was lowest in Magaji farm than IBB farm and highest in Kure farm. This finding further ascertained the farm-dependent variation in prevalence of root-knot nematode in tomato farms in Lapai, Niger state.

CONCLUSION

The present study revealed that, the prevalence of root knot nematode in tomatoes farms in Lapai, Niger state was high and varies with farms. Also, of the two *Meloidogyne*sppidentified, *M.javanica*was the most prevalent root knot nematode affecting tomato farms in Lapai.Therefore, Cultivation of nematode-resistant cultivars, to avoid crop damage by nematodes, and to reduce nematode population levels is recommended

REFERENCES

Abawi, G. S. and Widmer, T. L. (2000). Impact of soil health management practices on soilborne pathogens, nematodes and root diseases of vegetable crops. *Applied Soil Ecology,* 15: 37-47.

Bakker, E. (2003). "*Molecular and genetic analyses of potato cyst nematode resistance loci*".Laboratory of Nematology, Department of Plant Sciences Wageningen University.

Béatrice, C., Mireille, N., Gaëlle, P., Thierry, M. and Marc, T. (2011).Root-knot nematode (*Meloidogyne*) management in vegetable crop production: the challenge of an agronomic system analysis, *Crop Protection*, 4:16.

Bem, A. A., Antsa, R. T., Orpin, J. B., Bem, S. L. and Amua, Q. M. (2014).Root-Knot Nematode (Meloidogyne Species) Distribution in Some Tomato Fields in Makurdi.*Journal of Pharmacy and Biological Sciences,* 9(4): 143-146.

Dong, L. Q. and Zhang, K. Q. (2006). Microbial control of plant-parasitic nematodes: a five-party 842 interaction. *Plant Soil,* 288: 31-45.

Eisenback, J. D. and Hunt, D. J. (2009). *General morphology.* Pp. 18–54, In: *Root-knot Nematodes* (Perry, R.N., Moens, M. and J. L. Starr, eds.). CAB International, Wallingford, UK.

Everts, K. L., Sardanelli, S., Kratochvil, R. J., Armentrout, D. K. and Gallagher, L. E. (2006). Root-knot and root-lesion nematode suppression by cover crops, poultry litter, and poultry litter compost. *Plant Disease*, 90: 487-492.

FAO. (2003). Food and Agricultre Organization of the United Nations Statistical Databases. *http://faostat.fao.org.*

Hunt, D. J. and Handoo, Z. A. (2009). *Taxonomy, identification and principal* species. In: Perry, R.N., Moens, M., Starr, J.L. (Eds.), Root-knot nematodes. CABI International, Cambrige, MA 894 (USA), pp. 97.

Ishrat, N., Juan, E., Palomares-Rius, V. B., Saifullah, S.A. and Musharraf, A. (2012).Prevalence, incidence and molecular identification of root-knot nematodes of tomato in Pakistan.*African Journal of Biotechnology,* 11(100): 16556.

Kamran, M., Anwar, N., Javed, S. A. and Ihsan, U.(2012).Field Evaluation of Tomato Genotypes for Resistance to *Meloidogyne incognita. Pakistan Journal of Zoology,* 44(5):1359.

Kruger, G. R., Johnson, W. G., Doohan, D. J. and Weller, S. C. (2012). Dose response of glyphosate and dicamba on tomato (*Lycopersi conesculentum*) injury. *Weed Technol.*, 26:256-260.

Mehdi, N. E. (2009).Distribution and identification of root-knot nematode species in tomato fields. *Mycopathology,* 7(1): 45 – 49.

Munir, A. and Bridge, J. (2003). Rice root-knot nematode *Meloidogyne graminicola* Golden and Birchfield, 1965 from rice in Pakistan. *Pakistan J. Nematol.,* 21:133-135.

Nandini, G. N., Mukewar, P. M. and Mayee, C. D. (2006). Plant parasitic nematodes ofcotton-farmer's hidden enemy.*CICRTechnical Bulletin,* 27:1-28.

Sikora, R. A. and Fernández, E. (2005). *Nematodes parasites of vegetables.* In: Liuc, M., Sikora, R.A., Bridge, J. (Eds.), Plant Parasitic Nematodes in Subtropical and Tropical *Agriculture.* CAB International, Wallingford (GBR), pp. 392.

Tanko, L., Ajani, R. and Adeniji, O. B. (2012).Relative Technical Efficiency of Credit and Non Credit Users in Rice-Based Enterprises in Lavun Local Government Area, Niger State, Nigeria.*International Journal of Agricultural Economics* and *Rural Development,* 5(1):83–92.

Taylor, A. L., Sasser, J. N. and Nelson, L. A. (1982).*Relationship of climate and soil characteristics to geographical distribution of Meloidogynespecies in agricultural soils.*North Carolina State University, USAID, NC Graphics, Raleigh.

Ye, W., Hudak, C. and Troxler, S. (2008). Nematode Management in Cotton.North Carolina Agronomic Division.Nematode Assay Section/October. NCDA & CS.