IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN: 2278-3008, p-ISSN:2319-7676. Volume 9, Issue 4 Ver. II (Jul -Aug. 2014), PP 143-146
www.iosrjournals.org

Root-Knot Nematode (Meloidogyne Species) Distribution in Some Tomato Fields in Makurdi

Bem, A.A[1], Antsa, R.T.[2], Orpin, J.B[1], Bem, S.L[2],
And Amua, Q.M[1]

[1.] *Department of Biological Sciences Federal University, Dutsin-Ma Katsina State Nigeria.*
[2.] *Department of Biological Sciences Benue State University Makurdi, Benue State Nigeria.*

Abstract: *Studies were conducted to assess the distribution of root-knot nematode in some tomato fields in Makurdi from October 2010 to January 2011. Tomato plants were surveyed for infection based on symptoms such as stunted growth, yellowing of leaves and wilting in farmers' farm for determining disease incidence. Number of knots (NK) and root knot index (RKI) was used for disease severity. Disease plant Samples were collected and taken to the laboratory for extraction. Perineal patterns were prepared and examined under the microscope and species identified using appropriate keys. The result shows incidence range from 20%-60% in October, 2010 and 20%-80% January, 2011 while the severity of the disease ranged from 1-3 in October, 2010 and 1-4 in January, 2011. Significant differences (P=0.05) in the study areas. Egg Mass Index (EMI) and Gall Index (GI) ranged from 1.0 - 4.0. Meloidogyne incognita and M. javanica were identified to be the causes of infection. It is suggested that control methods should be applied in the nematode management in farmers fields so as reduce nematode population and increase yield.*

Key words**:** *Disease symptoms, Root Knot, Perineal Pattern, Meloidogyne, Tomato*

I. Introduction

Tomato (Lycoperiscon esculentum) is one of the most important vegetable crops grown throughout the world for consumption in various forms. A number of viral, bacterial, fungal and nematodes attack tomato and cause diseases of economic consequences.(Sasser, 1979; Taylor and Sasser, 1978). Some pathogenic species known to cause various damage to tomato plants include Meloidogyne species, reniforms nematodes (Pratylenchulus reniforms), and Globodera rostochiensis as reported by Taylor and Sasser (1978).Tomato is regarded as the most favourable host for knot nematodes and yield losses caused by the root-knot nematode, Meloidogyne incognita, were assessed in different part of the world (Nagesh, et al., 2005). About 2000 plants are susceptible to infection by the root-knot nematodes and they cause approximately 5% of global crops loss (Sasser and carter, 1985). Root-knot nematode larvae infect plant root, causing the development of root galls that drain the plant photosynthetic component and nutrients. Infection of young plants may be lethal, while infection of mature plants causes decrease in yield. All the four major species of Meloidogyne including; M .javanica, M. arenaria, M.incognita and M. hapla are known to readily attack tomato crops in outdoor as well as in indoor cultivations. (Nagesh et al., 2005). Studies have shown that root-knot nematodes can cause suppression in yield of tomato as high as 85% (Sasser, 1979; Taylor and Sasser, 1978). Nematodes of M. incognita were isolated from crop roots of paprika plant and M. hapla was isolated from galls of vegetables grown in the open field in Jublijana (Sirca, et al., 2004).

It has been reported that about 2000 plants are susceptible to infection by root-knot nematodes and they cause approximately 5% of global crop loss (Sasser and Carter, 1985). Formation of galls on roots of affected plants especially in tomatoes has become necessary due to various damages in the field by producing poor yield; therefore, there is need to determine the incidence and severity of damage on tomato crops and to isolate and identify the nematode species causing disease in tomato in some growing regions of Makurdi.

II. Materials And Methods

This study was carried out in Makurdi, Benue State of Nigeria. All tomato samples were collected from different localities which are Wadata, Mu, North Bank, Modern Market, Lower Benue, Logo II, Adeke and Achusa from December 2010 to January 2011.

Makurdi town is the capital city of Benue in the Middle Belt region of Nigeria. The town is located between latitude 7^0 38 and 7^0 50'N, and longitude $8^0$24 and $8^0$38'E and the inhabitants of the town are mostly peasant farmers.

Survey And Collection Of Diseased Plant Samples

A survey was conducted in different localities in Makurdi, Benue State to assess the incidence of root-knot disease on tomato crop. During the survey, advocacy visit was made to the proposed sites to intimate the farmers of tomato on the relevance of the study and to solicit permission to assess their farms.

A total of 160 samples were collected from sample sites at random based on symptoms like wilting, yellowing of leaves and stunted growth. Root samples were kept in polythene bags and properly labeled and were taken to the Biology laboratory in Benue State University and examined thoroughly for the presence of galls in root.

Extraction Of Egg Masses From Galled Root

The roots were thoroughly washed with distilled eater and cut into pieces and put into a 1000ml measuring cylinder. 200ml of 0.5% sodium hypochlorite solution (house hold bleach) at the ratio of 1:40 was poured into a measuring cylinder tightly capped and was shaken vigorously for about ten minutes to dissolve the gelatinous matrix. The eggs were collected in a beaker after sieving through a mesh and were washed with distilled water. (Eisenback and Triantaphyllou, 1991).

Identification Of The Species

Identification of the nematode species from the sampled plant from each locality was done by perineal pattern method (Eisenback et al., 1981). Mature females were dissected out from large galls on the roots of tomato plants. Perineal pattern slides from each sample or locality were prepared and examined under the microscope to study their characteristics. The species were identified on the basis of their characteristic morphology involving the vagina, anus, plasmids, tail terminals, lateral lines and annulations. (Eisenback et al., 1981). Number of egg masses per root system was then counted. Gall index (GI) and egg mass index (EMI) were determined on the following scale as described by Taylor and Sasser (1978).

Number of knots (NK)	Root-knot index (RKI)
0	0
1-2	1
3-10	2
11-30	3
31-100	4
>100	5

The frequency of occurrence (percentage) of the disease in each locality was calculated by the following formula.

$$\text{INCIDENCE} = \frac{\text{Number of fields with root-knot nematode infection}}{\text{Number of fields surveyed}} \times \frac{100}{1}$$

Experimental Design And Analysis

The design used for analysis was the randomized complete block design (RCBD) replicated 5 times per treatment. ANOVA was used to analyze the data and the least significant differences were obtained.

III. Result

Disease Incidence On Tomato In Eight Locations Of Makurdi

Table 1 shows the disease incidence on tomato in eight locations of Makurdi from the month of December 2010 to January 2011. The lowest incidences were found in Mu, Lower Benue, Logo II, and Achusa of 20%, while the highest incidence was recorded in Wadata with 60% followed by North Bank and Modern Market with 40% in the month of December 2010.

In the month of January 2011, Lower Benue, Logo II maintained the 20% incidence rate and Modern Market indicating the lowest disease incidence of 20%, while the highest incidences were recorded in Wadata and North Bank with 80% followed by Mu with 60% and Achusa with 40% accordingly.

Table 1: Disease Incidence on the Tomato Plant in Eight Localities in Makurdi.

	December 2010	January 2011
Localities	Incidence (%)	Incidence (%)
Wadata	60.0c	80.0d
Mu	20.0a	60.0c
North bank	40.0b	80.0d
Lower Benue	20.0a	20.0a
Logo II	20.0a	20.0a
Achusa	20.0a	40.0b
Modern market	40.0b	20.0a

Table 2 shows the severity of the disease on the tomato plant in the 8 localities from December 2010 to January 2011. The severities of the disease on tomato in these localities were considered using the appropriate scale described by Taylor and Sasser (1978) as shown below table 2. In the month of December 2010, Wadata and North Bank recorded the highest severity of 4.0, followed by Mu, Lower Benue, Logo II and Achusa with severity of 3.0 respectively. In January 2011, the severity was 4.0 in Wadata, Mu, North Bank and Achusa with 4.0 while Lower Benue and Logo II recorded a severity of 3.0 respectively.

Table 2: Severity of the Disease in the Eight Localities Sampled.

Localities	GI October 2010	EMI October 2010	GI January 2011	EMI January 2011
Wadata	3.0	3.0	4.0	4.0
Mu	1.0	1.0	2.0	2.0
North bank	2.0	2.0	3.0	3.0
Modern market	1.0	1.0	1.0	1.0
Lower Benue	1.0	1.0	1.0	1.0
Logo II	1.0	1.0	1.0	1.0
Adeke	1.0	1.0	1.0	1.0
Achusa	1.0	1.0	2.0	2.0

Key:
GI = Gall index
EMI = Egg mass index

Table 3 shows the nematodes isolated and identified in the 8 localities in Makurdi Local Government from the month of December 2010 to January 2011. Identification of the species was done on the basis of perineal pattern characteristic, Meloidogyne incognita and Meloidogyne javanica were identified in mixed population in Wadata and North Bank. Meloidogyne incognita was identified in Mu, Modern Market, Lower Benue, Logo II and Adeke singly while Meloidogyne javanica was identified singly in Achusa.

Table 3: Nematodes Identified in the 8 localities Sampled

Localities	Pathogens isolated
Wadata area	Meloidogyne incognita, M. javanica
Mu	Meloidogyne incognita
North bank	Meloidogyne javanica, M. incognita
Modern market	Meloidogyne incognita
Lower Benue	Meloidogyne incognita
Logo II	Meloidogyne incognita
Adeke	Meloidogyne incognita
Achusa	Meloidogyne javanica

IV. Discussion

This study was conducted to assess the distribution and identification of some plant parasitic nematodes of the genus Meloidogyne in Makurdi Local Government Area of Benue State, Nigeria. Results obtained in table 1 showed that all tomato crops sampled were infected with root-knot nematodes. Therefore, overall incidence of the disease was 100%. Locality wise, variations in the incidence of the disease were however found in the month of December 2011 with highest incidence of 60% found in Wadata area closely followed by North bank and Achusa areas with incidences of 40% respectively.

The lowest incidence (20%) was found in Mu area, Modern market, lower Benue, Logo II area and Adeke area. The severity of the disease on tomato in these localities based on the average gall index and egg mass index was generally low. Areas with variations were, hoe ever, noticed; both gall index and egg mass index average ranged between one to three. The highest egg mass index and gall index was 3 and was found in Wadata. The gall egg mass indices was 2 in North bank area, while Mu, Modern market, Lower Benue, Logo II, Adeke and Achusa were having indices of 1 which is low in severity of the disease.

In the month of January 2011 localities shows variations in the incidence of the disease. The highest incidence (80%) in Wadata and North bank area followed by Mu with (60%) and (40%) in Logo II and Adeke.

The lowest incidence were found in modern market, Lower Benue and Achusa with (20%) (Table1). The severity of the disease on tomato in these localities base on the average gall and egg mass was high in the month of January 2011 due to favorable environmental factors in the field. Both gall index and egg mass index range between 1-4 through 2 and 3. Great egg mass and gall indicate (4) was found in Wadata with highest incidence followed by (3) in North bank and (2) in MU and Achusa. The lowest severities were (1) IN Modern market, Logo II, Lower Benue and Adeke. (Table 2) Identification of the species on the basis of perinea pattern characteristics, Meloidogyne incognita and Meloidogyne javanica, the two species of root-knot nematodes were identified to infect tomato in different areas included.

The species were either found singly or in mixed population. Out of the two; M. incognita was more frequent. It was found in 7 localities out of 8 either singly or concomitantly with M. javanica. In 6 areas (Mu, Modern market, Lower Benue, Logo II, Adeke and Achusa) was encountered alone but in other areas it was present together with M. javanica.

Mixed populations of both species in tomato fields are also common. These observations confirm the result of (Khan et al., 1984) and (Khan and Khan, 1985) who observed the common occurrence of these species with dominance of M. incognita and their mixed population in the area. It further endorses the view of (Khan et al., 1984) that M. incognita is not the only species infecting crops in this area as believed for long time due to lack of pursuance of studies to establish the identity of Meloidogyne species occurring in the area.

A similar survey conducted by (Khan et al,. 1984) also indicated that tomato is the most affected crop and suffers most vegetable growth worldwide due to root-knot nematodes .The present findings confirm their results including severe stunting and extensive rootstock resistance to Meloidogyne incognita, M. javanica and M. arenaria in Northern Switzerland, examination of the root-knot nematodes in large numbers. All methods of identification were consistent with M. eneterolobii. The species M. eneterolobii is of great importance because it is able to reproduce on resistant tobacco, pepper, water melon and tomato. This is the first report of M. enterolobii in Switzerland (Kiewnick et al., 2008).

The result of this study showed no significant difference in the distribution of the nematodes in the tomato growing areas from December 2010 to January 2011 which conforms to the work by (Kiewnick et al., 2008).

But the percentage incidence and severity were increasing from December 2010 to January 2011 in the studied areas from the result.

From the result, it is obvious that pathological stunted growth, wilting and formation of galls on roots of tomato plants is caused by Meloidogyne incognita and Meloidogyne javanica, therefore suggesting that disinfestations of the soil and planting materials with other chemical methods and other disease management methods could be applied to reduce the incidence and severity of the disease.

Among the species of Meloigogyne recorded in association with crops of Agricultural importance in subtropical and tropical regions, M. incognita and M. javanica are considered as common and widespread (Sasser, 1979). The present findings further confirm this contention.

References

[1]. Eisenback. J.D.H,Hirschmann, J.N, Sasser Triantaphyllou A.C. (1981) A more complete characterization of the four most common species of root-knot nematodes (Meloidogyne spp.) with pictorial key. IMP publication Raleigh, N.C.U.S.A

[2]. Khan, A.A Khan, M.W. (1985). Root-knot nematodes infecting some common weeds in vegetable of fields of western Uttar Pradesh (India). Internat. Nematol. Network Newslet. **2**: 15-16.

[3]. Khan, M; Wajid, M.R; Khan, A.A. (1984). Identity of root-knot Nematodes on certain vegetables of Aligarh District in Northern-India. Internat,Newslet. **1**: 6-7.

[4]. Kiewnick, S; Karssen, G; Brito, A; Oggenfuss, M. and Frey J.E (2008). First report of Root-knot Nematode Meloidogyne enterolobii on Tomato and Cucumber in Switzerland. Plant dis., **92**: 1370.

[5]. Nagesh M, Hussaini S.S, Chidanandaswamy B.S, (2005). Incidence of root-knot nematode, Meloidogyne incognita on gherkin, Cucumis sativus and yield losses. Indian J. Plant Prot., **33**:309-311.

[6]. Sasser, J.N. (1979). Economic importance of Meloidogyne in tropical countries. pp. 359-374

[7]. Root-knot nematodes (Meloidogyne spp.) systematics, biology and control (Eds. F. Lamberti and C.E. Taylor). Academic Press, London.

[8]. Sasser, J.N., Carter C.C: Overview of the International Meloidogyne project 1975-1984. In an Advance Treatise on MeltNdngyjie Edited by Sasser J.N. Carter CC Raleigh North Carolina State University Graphics. 1985 19-24.

[9]. Sirca, S; Urek, G; Karssen, G. (2004). The incidence of the root-knot nematode Meloidogyne incognita and Meloidogyne hapla in Slovenia. Acta. Agric. Slovenia, **83**: 15-22.

[10]. Taylor, A.L. and Sasser, J.N (1978). Identification and control of root-knot nematodes (Meloidogyne spp). Crop. Publ. Dept. Plant Pathol, North Carolina State Univ. and U.S Agency Int. Dev. Raleigh, N.C pp. 111.