Distribution of Plant Parasitic Nematodes on Pepper in Ilorin, Kwara State, Nigeria

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KEYWORDS

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ABSTRACT

A survey was conducted in pepper-producing farms in Ilorin, Kwara State between July and November 2021 to study the distribution of plant-parasitic nematodes affecting pepper and to investigate the effects of soil physico-chemical properties on the nematodes. A total of twenty four plant roots and nine soil samples collected from thirty pepper farms were examined. Result showed that seven genera of plant-parasitic nematodes were identified. The location with the highest occurrence was the Ilorin township Stadium with 100% frequency. Relative abundance of Meloidogyne was greater than that of the other nematode species. The results indicate that, apart from the direct influence of the host plant, soil properties play an important role in the abundance, distribution and structure of plant parasitic nematode communities. This validates the potential of nematodes as bioindicator organisms of soil health.

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INTRODUCTION

Pepper (*Capsicum* spp.) is a vegetable and spice crop which belongs to the *Solanaceae* family and is mostly cultivated for consumption (Ogunbo *et al*., 2015). Its history and origin can be traced back to the Americans and today, it is cultivated all over the world (Idowu-Agida *et al*., 2012).

Fresh pepper is cultivated in 126 countries of the world in all the continents. The world's largest producer is China with over 18 million tons annually, followed by Mexico with about 3.5 million tons (FAOSTAT, 2017). The nutritional value of pepper merits special attention as it is a rich source of vitamins A and E (AgMRC, 2011). Both hot (*C. fruitescens*) and sweet peppers (*C. annum*) contain more vitamin C to prevent flu than any other vegetable crop. Despite the importance of pepper crop to the economy, little attention is paid to problems limiting the production of pepper. In general, plant health problems particularly those caused by plant parasitic nematodes are neglected.

Plant Parasitic Nematodes (PPNs) alone or in combination with other factors reduce crop productivity and they cause farmers thousands of naira in crop loss annually (Pokharel *et al*., 2009). Losses due to PPNs are estimated at over $150 billion globally (Abad *et al*., 2008), without considering other losses by interactions

with other pathogens. The damage of crop caused by PPNs depends on agro-climatic conditions, host susceptibility, pathogenicity and other climatic factors.

The main objective of this study was to carryout survey study on the occurrence and distribution of plant parasitic nematodes associated with pepper in Ilorin, Kwara State.

OBJECTIVES

The objectives of this study were to;

i. identify the plant parasitic nematodes associated with pepper;
ii. determine the population density of plant parasitic nematodes associated with pepper and,
iii. evaluate the physical properties of soil around pepper farm.

MATERIALS AND METHODS

Materials used in this study were tray, sieve, auger, tissue paper, sample bottles, paper tape, blender, soil and root samples, polythene bags and electron microscope.

Study Area

The surveyed vegetable sites are located in Ilorin, the capital of Kwara State, North Central of Nigeria. The study area is located approximately on latitude 8º30'N of the equator and longitude 4º35'E of the Greenwich Meridian and has an area of about 100km2. Ilorin experiences a tropical wet and dry climate with mean annual rainfall of 1,200mm. Its temperature varies between 25ºC to 30ºC. The sites for the surveyed vegetable farms are Sango, Sobi, Stadium, Isale-koko, Lasoju, Alalubosa, Oloje, Alagbado and Kulende. They were selected on the basis of the importance of vegetable production, acceptance of vegetable farmers, variability of the vegetable crops produced and geographical distribution. The geographical coordinates of each of the sites were recorded using a Global Positioning System (GPS) and used to plot the map on the next page.

Nematode Extraction from soil and root samples

Nematodes were extracted separately from soil and root for each of the collected samples. Nematodes were extracted from the soil using the modified Baermann tray method as described by Whitehead and Hemming (1965).

Data Analysis

All numeric data obtained were analysed using descriptive statistics and analysis of variance (ANOVA) where mean difference was determined by Duncan's new multiple Range test (DMRT) at 5% level of significance

RESULTS

From the table 1 below it is observed that for soil nematode, *Meloidogyne* was the most abundant with 37.53% followed by *Pratylenchus* with 26.83%, *Helicotylenchus* with 17.96%, *Hopolaimus* with 10.26%, *Radopholus* with 6.75% And *Tylenchus* with 0.61%, while *Xiphinema* recorded the least with 0.05%.

For the root nematodes, there were four nematode genera found in the root of pepper that were obtained from the study area. It was observed that *Meloidogyne* recorded the highest abundance with 51.69 followed by *Pratylenchus* with 32.56 and *Helicotylenchus* with 15.30. *Xiphinema* recorded the least occurrence with 0.45.

Table 1: Relative abundance of soil and root nematode

Genus	Abundance in soil	Abundance in root
Radopholus	6.75	-
Xiphinema	0.05	0.45
Pratylenchus	26.83	32.56
Meloidogyne	37.53	51.69
Hopolaimus	10.26	-
Helicotylenchus	17.96	15.30
Tylenchus	0.61	-

From the Table 2 below, it was observed th*at al*l survey area recorded a mean density of soil nematodes which ranged 0.42 to 1.00. Stadium recorded the highest population density with 1.00 followed by Sango, Isale koko and Oloje with mean density of 0.71. Sobi, Lasoju, Alalubosa and Kulende recorded a mean density of 0.57 while Alagbado recorded the least with mean density of 0.42.

For root nematodes, the mean population density ranged from 0.25 to 1.00. Stadium also recorded the highest mean population density with 1.00 followed by Alagbado with 0.75. Sobi, Isale koko, Lasoju, Oloje and Kulende recorded mean density of 0.50 while Alalubosa recorded the least with mean density of 0.25

Table 2: Mean population density of soil and root nematodes

Survey Area	Soil nematode	Root nematode
Sango	0.71	-
Sobi	0.57	0.50
Stadium	1.00	1.00
Isale koko	0.71	0.50
Lasoju	0.57	0.50
Alalubosa	0.57	0.25
Oloje	0.71	0.50
Alagbado	0.42	0.75
Kulende	0.57	0.50

The soil physical characteristics of the survey area were reported in the Table 3. The surveyed locations were slightly acidic to slightly basic. It was revealed that the textural class of soils for all surveyed locations were sandy, which was detailed from that composition of the clay, silt and sand from the soil analysis carried out. The Table revealed that soil sample collected from Alagbado recorded the highest sand percentage composition with least clay percentage composition 92.00% and 6.45% respectively, closely followed by soil samples collected from Sobi, Stadium, Alalubosa and Oloje with 91.52% and 6.48% respectively, followed by soil samples collected from Sango, Isale koko and Kulende 89.52% and 8.48% respectively while soil sample collected from Alalubosa recorded the least sand percentage composition of 87.52% and the highest clay percentage composition of 10.48%. All soil samples had 2% silt composition irrespective of their survey location.

Table 3: Physical characteristics of soil

Survey Area	% Clay	% Silt	% Sand
Sango	8.48	2	89.52
Sobi	6.48	2	91.52
Stadium	6.48	2	91.52
Isale koko	8.48	2	89.52
Lasoju	10.48	2	87.52
Alalubosa	6.48	2	91.52
Oloje	6.48	2	91.52
Kulende	8.48	2	89.52
Alagbado	6.45	2	92.00

DISCUSSION

A survey study of pepper farms in nine locations in Ilorin, Kwara State of Nigeria revealed some genera of plant parasitic nematode number in soils and roots of pepper plants. The seven nematode genera recovered from the study were *Tylenchus*, *Meloidogyne*, *Pratylenchus*, *Helicotylenchus*, *Radophulus*, *Hopolaimus* and *Xiphinema*. This result is also in agreement with a previous report by Apalowo *et al.* (2023), that most plant parasitic nematodes are usually found in mixed infections.

The biological diversity observed in this study is related to the one reported by Paiko *et al*.(2019), in another study on abundance of plant parasitic nematodes from rhizosphere of pepper plants as influenced by soil

physical and chemical properties. The results of this study showed that pepper is a host to economically important PPN which cut across the nine surveyed locations. All nematodes reported in this study have been infecting pepper in Ilorin, Kwara State and other parts of the world.

The amount of sand in the soil is an important factor that affects the density of root-lesion nematodes. Sandy soil with high pore size is also another factor for nematode penetration and movements through the soil. The high prevalence can be attributed to low quantities of organic matter in the soils. Another reason for this high prevalence was that pepper was grown in lands which was in constant usage last few years. The findings of other researchers also confirmed this fact that fallowing resulted in an increase in the contents of organic matter and consequently caused a decline in nematode populations (Fajardo *et al*., 2011).

CONCLUSION AND RECOMMENDATION

This study has established the occurrence and prevalence of plant parasitic nematodes, which may consequently cause severe yield reduction in pepper. The study has also confirmed soil property influence on the PPNs. There is need to identify the recovered nematode genera using molecular characterisation. Also, extension agents should always create awareness to the farmers.

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