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PLANT-PARASITIC NEMATODES ASSOCIATED WITH SOME VEGETABLE CROPS IN KWANAR ARE IRRIGATION SITE, KATSINA STATE, NIGERIA

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ABSTRACT: Plant-parasitic nematodes have been reported to constitute serious impediments to crop production especially under irrigation. Information on the occurrence and distribution of these pests at Kwanar Are irrigation site in Katsina State is lacking. A survey of the irrigation site to determine the distribution and population densities of plant-parasitic nematodes associated with some vegetable crops was undertaken. Roots and soil samples were randomly taken from five farms. Analysis of the samples showed that thirteen genera of plant-parasitic nematodes namely, *Scutellonema, Rotylenchus, Meloidogyne, Aphelenchoides, Hemicriconemoides, Hoplolaimus* and *Criconemoides* were found to be associated with the crops. Of the thirteen genera identified, *Scutellonema, Rotylenchus* and *Meloidogyne* were found to be most widely occurring. *Scutellonema* and *Rotylenchulus* formed more than fifty percent of the total nematodes population identified. The preponderance of the nematodes reported in this study portends serious implications on profitable production of vegetable crops. Further investigation is recommended for better understanding of the nematodes associated with the crops in the irrigation site.
Keywords: Vegetable crops, plant-parasitic nematodes, irrigation site, Kwanar Are.

INTRODUCTION

Vegetable crops are widely cultivated in Nigeria, especially in northern parts of the country. These crops are very popular and highly consumed in different ways because of their nutritional value and health concern. Katsina state is one of the northern states with very vast land where vegetables are produced in large quantities in various irrigation sites. Furthermore, small scale farmers highly depend on these crops production because of high cash value and

demand. It is well known that there is a long established trade in vegetables between the north and southern states in Nigeria. However, successful production of vegetables have been hindered to some great extent by several pests and diseases (Plant Resources of Tropical Africa, 2004). While some of the pests and their effects are readily recognizable, nematode pests because of their microscopic sizes and hidden habitat are little known, hardly recognized and usually overlooked as major pests (Luc, Sikora, & Bridge, 2005).

Plant parasitic nematodes are mostly threadlike worms ranging from 0.25mm to > 1.0mm long, with some up to 4mm. They come in variety of shapes and sizes. Females in some species lose their worm-like shape as they mature, becoming enlarged and pear, lemon or kidney-shaped or spherical as adults. (Coyne, Nicol & Cladius-Cole, 2007). About 95 per cent of plant parasitic nematodes live in the soil and feed in or on the plant root systems. Over 4100 species of plant-parasitic nematodes have been identified (Decraemar & Hunt, 2006).

Symptoms and Economic Importance of the Plant-Parasitic Nematodes

Although nematode problems occur in all areas where crops are grown worldwide, such problems are more pronounced and prevalent in tropical and subtropical environments where higher temperatures and longer growing seasons result in more generations per year and thus, higher nematode populations and more crop damage (Luc *et al.*, 2005).

One of the major challenges of identifying nematodes as the cause agents of crop damage is the fact that many of them do not produce highly diagnostic symptoms which are specific and easy to identify. The damage caused by nematodes is often confused with symptoms of other biotic and abiotic stresses. For example, chlorosis may be due to nitrogen deficiency or may be caused by nematodes; poor stands of growth similarly may be caused by poor soil fertility or moisture

stress, or may be due to nematodes. It is therefore highly recommended to assess for nematodes when crops are suffering yield loss and exhibiting the following symptoms (Coyne *et al.*, 2007).

- Chlorosis
- Patchy, stunted growth
- Thin or sparse foliage
- Symptoms of water stress, such as wilting or leaf rolling
- Die-back of perennial or woody plants with little or no new foliage
- Reduced fruits and seed sizes
- Low yields

Accurate yield-loss data due to nematodes are not available for most crops in many nations of Africa including Nigeria (Misari, 1992). However, it is noteworthy that the ten most important nematodes genera (*Meloidogyne, Pratylenchus, Heterodera, Ditylenchus, Globodera Tylenchulus, Xiphinema, Radopholus* and *Helicotylenchus*) worldwide, reported by Sasser and Freckman (1987) are common in Nigeria (Afolomi & Caveness, 1982; Chindo, Emechebe & Marley, 2004). Crop loss estimate due to these nematodes in vegetables and cereal crops range from 20 – 100 per cent.

Irrigation sites in northern Nigeria make conducive environment for the survival and spread of nematodes, as crops are grown all year round in these areas. However, in Katsina state, majority of the affected farmers are unaware of the nature and harmfulness of nematodes infestation in the field. Very few studies on nematodes infestation were conducted in some irrigation sites in the state (Usman, 2012; Usman, 2016; Chindo & Bello, 2009; Jibia, Zurmi, Iliya, Sani & Sanusi, 2016). No information on nematodes infestation at Kwanar Are irrigation sites. It is against this background that the study was initiated to determine the nematode species associated with some crops in the irrigation site, with the hope that the study

will provide the basis for nematodes investigation in the irrigation site.

MATERIALS AND METHODS

The Study Area

This survey was confined to nematode pests associated with vegetable crops (tomato, cabbage and onion) at Kwanar Are Dam in Rimi Local Government, Katsina State (latitude 12°13'N Longitude 7°8'E). The dam is located about 26km from Katsina metropolis, along Katsina-Kano road. The farmers in the irrigation sites cultivate varieties of crops which are supplied to markets in various parts of the state and beyond.

Sample Collection

The survey was conducted in December, 2016. Samples were taken from 5 farms at the irrigation site. In each farm 5 samples were taken making a total of twenty five samples. Five plants of about 6 – 9 weeks after transplanting were randomly selected. Soil samples around the roots of each plant were collected using soil sampling tube along four cardinal directions at the base of each tomato, cabbage or onion plant at the depth of 10 – 15cm. Hand trowel was used to dig up the plant roots. The samples (soil and roots) per farm were pooled and sealed in plastic bags taken care to allow some air in and kept away from direct sunlight (Ricka & Barker, 1992). The samples were properly labeled and immediately taken to nematology research laboratory, Department of Crop Protection Ahmadu Bello University Zaria for analysis and identification of plant-parasitic nematodes.

Extraction and Identification of Nematodes from Samples

Nematodes were extracted from soil samples using the extraction tray method of Whitehead and Hemming (1965). Two hundred and fifty grams (250g) each of the samples was placed in the upper sieve of a modified Baerman tray set up, made up of a double-ply facial

tissues sandwiched between a pair of plastic sieves and placed in a bowl of water with about 500ml of water in it. The set up was allowed to remain undisturbed for twenty four hours after which the sieves were gently lifted off. The resulting nematode suspension in the bowl was poured into a 500ml beaker to remain undisturbed for 5 hours. The suspension was concentrated to 5ml by siphoning excess water. Nematodes were identified and counted from the 5ml using Doncaster counting dish under stereo microscope. The nematodes were observed identified and counted according to their genera. Identification of the nematodes was done using nematode key of Tesfa mariam, Dubat, Sekora, Akyazi and Abebe (2012).
Root samples (100g) were macerated in a warring blender and nematodes were extracted same way as in the soil samples explained above.

Nematode Density Assessment
The following information non plant-parasitic nematodes were determined from the samples collected:

- Nematode genera
- Frequency of occurrence
- Percent frequency of occurrence
- Nematode population
- Percent nematode population

Percent frequency of occurrence (i.e frequency rating) was determined using the formula (according to Ononuju & Fawole, 1999).
Percentage frequency of occurrence = $\frac{n}{N} x \frac{100}{1}$

Where n is the number of times an individual nematode occurred in all the samples and N is sample size (25).
Also the percentage nematode population was calculated using the formula;
Percentage Nematode population = $\frac{ln}{rN} x \frac{100}{1}$

Where ln is individual nematode population in all the samples, where TN is the total population of all the nematodes extracted in all the samples.

RESULT AND DISCUSSION

Percentage frequency of occurrence and population of nematodes identified in soil and roots from Kwanar Are irrigation site are presented in table 1. Analysis of the samples collected revealed the presence of thirteen genera of plant parasitic nematodes. *Scutellonema* has the highest population of 24 and frequency rating of 44 percent. Other genera with high frequency rating (20-40%) include *Rotylenchus*, *Meloidogyne*, *Tylenchus* and *Pratylenchus*. While *Tylenchulus*, *Longidorus*, *Hemicyciophora*, *Aphelenchoides*, *Hemicriconemoides*, *Hoplolaimus* and *Criconemoides* occurred in very low numbers.

Plant-parasitic nematodes have been reported to constitute serious impediment to intensified production of crops in various parts of the world including Nigeria (Sikora, Niere & Kimenju, 2003; Weber, Chindo, Elemo & Oikeh, 1995). *Meloidogyne Pratylenchus* and *Rotylenchus*, identified with high population in this study have been reported among the important plant-parasitic nematodes world-wide by Sasser and Freckman (1987). In Nigeria Chindo (2009) reported eight among the identified species in this study affecting various crops among other nematodes in Mubi region of Adamawa state. Imafido and Mukoro (2016) reported six out of the identified genera in this study affecting yam in various local governments in Rivers State. Some of the plant-parasitic genera identified in this study have been reported in some irrigation sites in Katsina state. Usman (2012) reported *Meloidogyne*, *Pratylenchus*, *Pratylenchus* and *Criconemoides* on tomato and pepper at Ajiwa irrigation sites, with *Meloidogyne* having the highest population and occurrence.

Meloidogyne incognita and M. *javanica* were also reported affecting vegetable crops in some other irrigation sites in Katsina state (Usman, 2016; Jibia *et al.,* 2016).

Table 1: Nematodes recovered from soil and roots of vegetables crops at Kwanar Are Irrigation Site Katsina State

Nematode genus	Frequency of occurrence	% frequency rating	Nematode population	% nematode population
Scutellonema	11	44	24	28.6
Meloidogyne	10	40	20	23.8
Tylenchus	8	32	8	9.5
Pratylenchus	6	24	6	7.1
Aphelenchus	5	20	9	10.7
Tylenchulus	4	16	5	5.95
Longidorus	3	12	3	3.6
Hemicycliophora	2	8	3	3.6
Aphelenchoides	2	8	2	2.4
Hemicrieonemoides	1	4	1	1.2
Hoplolaimus	1	4	1	1.2
Criconemoides	1	4	1	1.2
	1	4	1	1.2

Sample size = 25

CONCLUSION

The result of the research confirmed the occurrence of plant-parasitic nematodes at kwanar Are irrigation site. This study revealed a wide distribution of plant-parasitic nematode where *Scutellonema* and *Rotylenchus* confirmed to have the larger population in comparison with other nematode parasites in the study area. Even though some of the nematodes occurred infrequently and in low numbers in this study, it is possible that they are economically important and population build up could eventually result to crop loss. Further investigation on plant-parasitic nematodes in the irrigation site is recommended to pave way for determination of the economic importance of the nematodes on crops and their sustainable management in the irrigation site.

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