Original Research Article

Incidence of Melodogyne Nematofauna in Some Selected Vegetable Crops in Nukkai Irrigation Field Jalingo, Taraba State, Nigeria.

ABSTRACT

A study to determine the incidence of root-knot nematode (*Melodogyne* spp) in some selected vegetables was conducted in Nukkai Irrigation Field of Jalingo, Nigeria. Samples of Okra (*Hibiscus esculentus*), Spinach (*Amaranthus* spp) and Sorrel (*Hisbiscus sabdariffa*) were collected at 2-weeks old and at maturity (flowering stage). Their roots were cut off and nematodes (*Melodogyne* spp) were extracted using the Baermann method and identified using the female perineal pattern manual. The results showed that *Melodogyne* spp are incident in the study area as 248 (34.44%) stands out of the 720 stands studied were found to be infested by root-knot nematode. The results also showed that two *Melodogyne* spp, *M. javanica* and *M. incognita* were discovered, and had a total number of 535 individuals. *M. javanica* (345) were predominantly higher than *M. incognita* (190). There was no significant difference ($\chi^2_{=0.05}$) between the number of root-knot nematode extracted from vegetables from the three different plots (plots A, B and C), but there is a significant difference ($\chi^2_{=0.05}$) between the number of *M. javanica* recovered and *M. incognita.*

Keywords: *Amaranthus , Hisbiscus ,* Jalingo, *Melodogyne, Nigeria,* Nukkai.

INTRODUCTION

Nematodes are soil dwelling organisms that constitute one of the largest animal phyla in the world, with over half a million species known. It has been estimated that four out of every five living animals on this planet are nematodes [1]. Nematodes can live as obligate parasites of plants and animals and can also alternate a parasitic life, with a free living life style or can be strictly free [2]. Despite the diversity in their life style and habitat, all nematodes are morphologically, anatomically and developmentally similar [3].

Root-knot nematodes (*Meloidogyne* spp) are minute worm-like animals that are very common in the soil and can invade roots of plants. They have a wide host range, and cause problems in many annual and perennial crops; they occur throughout the world infecting all major crops and causing substantial reduction in yield and quality [4]. There are four important species of the genus; *Meloidogyne arenaria*, *Meloidogyne hapla, Meloidogyne incognita and Meloidogyne javanica* which are considered as the most economically important species responsible for causing more damage to agricultural produce [5, 6].

Vegetables are much more important commodities needed in high demand due to their nutritive value for balanced nutrition in many areas of the world but because of root-knot nematode (*Meloidogyne* spp), it is increasingly very difficult and sometimes impossible to grow important vegetable in the tropics and semi tropical countries [2]. In Africa, the yield of vegetables is relatively lower, for which there are many constrains including prevalence of disease caused by different pathogens [7]. Among various pathogens responsible for the low yield, root-knot nematodes are of considerable economic importance [8] and can cause an annual loss of 22% in the tropics [9]. In addition, these parasites also interact with other disease causing organisms to produce a disease complex [10]; break down resistance against other pathogens and reduce plant tolerance to environmental stress [11,12].

It is against this background that this study was designed to determine the incidence of root-knot nematodes of some vegetables cultivated in Nukkai Irrigation Fields of Jalingo, Taraba State.

MATERIALS AND METHODS

Study Area

Nukkai Irrigation Field is an irrigation farming field in Jalingo, Taraba State, which has an area of about 20 hectares. Jalingo is located at latitudes $8^0$47' to 9^0 01'N and longitude 11^0 09' to $11^0$30'E. Nukkai Irrigation Field is located immediately after the Nukkai Bridge south of the Jalingo-Wukari main road in the city of Jalingo (Figure 1).

Sample Collection

All samples were collected using the method adopted by Anwar and McKenry [13]. Samples of Okra (*Hibiscus esculentus*), Spinach (*Amaranthus* spp) and Sorrel (*Hibiscus sabdariffa*) were randomly collected at different growth stages, i.e. seedling stage and matured stage. For each vegetable species, seedling was collected at random when they were aged 2-weeks old and the matured vegetables were also collected immediately they started flowering. All samples collected were washed and cleaned of soil debris. The roots were cut off and kept in the fridge in a plastic container.

Extraction of Nematodes

Nematodes were extracted from roots of plants using the Baermann funnel extraction method as described by Baermann [14]. In the set-up, a funnel was placed in a stand and filled with water until it reached up to 1cm below the rim. A rubber tube was fixed at the mouth of the funnel whose end was tightened using a clip. It was ensured that formation of air bubbles was avoided. The clip ensured it was well closed and the rubber tube did not leak. The sieves with the sample were hung in the funnel so that the sample was totally submerged, without touching the bottom of the funnel. Nematodes crawled out of the sieve into the water and settled. After a period of 16-72 hours, the nematodes suspension was trapped by opening the squeezer clip, regularly tapping and adding water to increase nematodes vitality.

Identification and Counting of Nematodes

Nematodes were identified using the female perineal pattern method manual or guide by [15]. During identification, nematodes were counted directly under microscope using the counting dish.

Statistical analysis

The collected data was analyzed using descriptive statistics of means, percentages and chi-square.

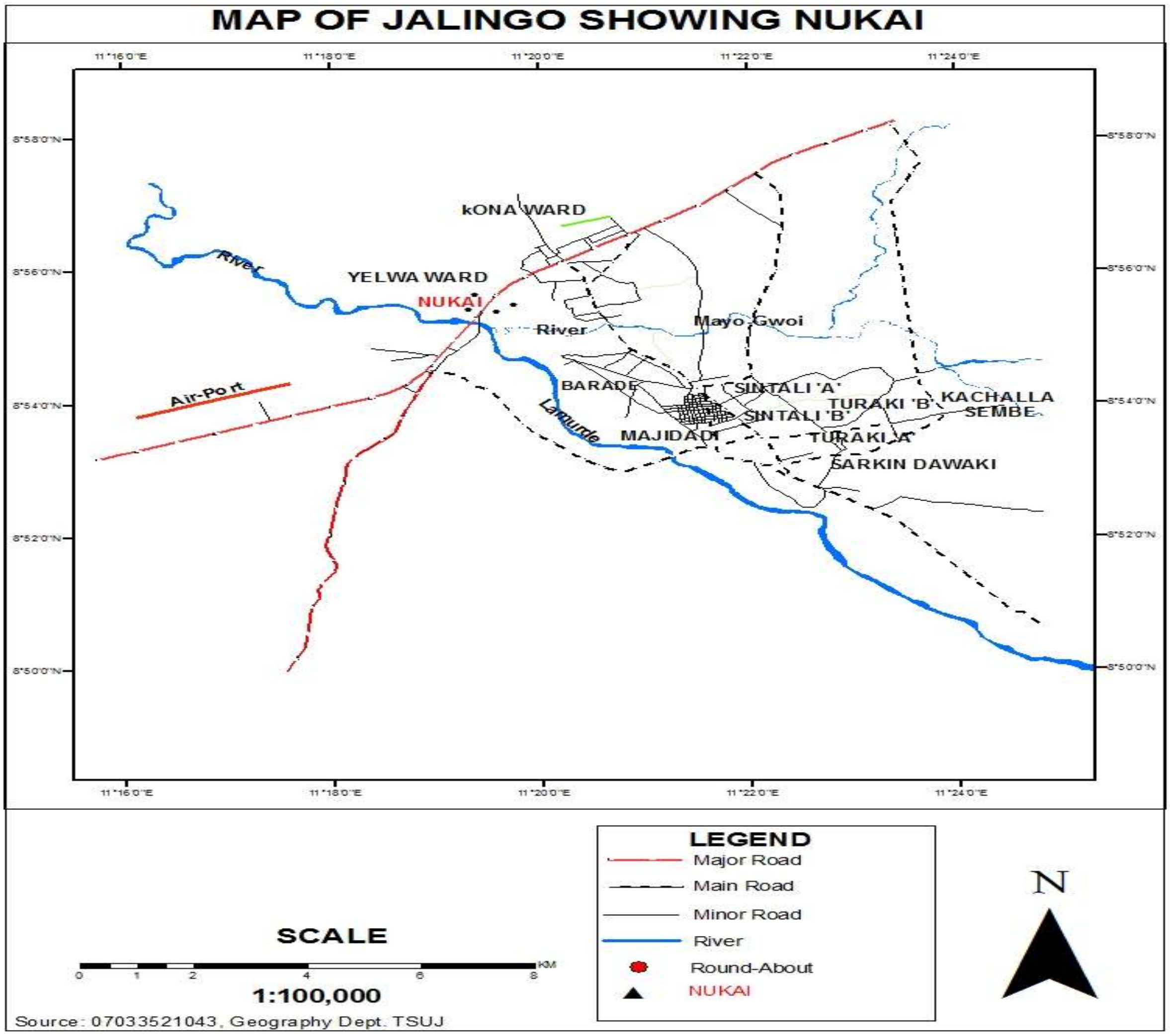

Figure1: The Map of Jalingo showing the study area (Nukkai irrigation field).

RESULTS

Incidence of Infestation

The incidence of infestation of plant by root knot nematodes is shown in Table 1. The result revealed that plant parasitic nematodes are incident in the field of study as they are found in all the studied vegetable. Out of the 120 stands from the three (3) plots sampled, Okra (*Hibiscus esculentus*) had the highest infestation of 60 (50.0%), followed by Spinach (A*maranthus* spp) which had a total infestation of 52 with an incidence of 43.3% while the least infestation (30) was recorded in Sorrel (*Hibiscus sabdariffa*) with a total incidence of 25.0%. Chi-square test also revealed that there was a significant difference ($p>0.05$) between the total number of infested and uninfested stands studied (Table

1). Across all plots, plot A showed highest infestation, with an incidence rate of 42.5%, followed by plot B (40.0%), while the least infestation was observed in plot C (35.8%).

The incidence of infestation of matured stage of the vegetable plants by root knot nematodes is presented in Table 2. Matured Spinach (*Amaranthus* spp) had the highest total infestation of 54 stands out of the 120 stands from the three (3) plots sampled with an incidence rate of 45.0%, followed by Okra (*Hibiscus esculentus*) which had a total infestation of 51 with an incidence of 42.5% while the least infestation of 38 was recorded in Sorrel (*Hibiscus sabdariffa*) with a total incidence of 31.7%. Chi-square test showed that there is a significant difference ($p>0.05$) between the total number of infested and uninfested stands of all the vegetable plants (Table 2). The results also revealed that plot A had the highest infestation rate (40.0%) followed by plot B (39.2%) while the least infestation was recorded in plot C (35.8%), as shown in Table 2.

Table 1: Incidence of Plant Parasitic Nematodes at Seedling Stage in Nukkai Irrigation Field, Jalingo (2016)

Plant species	Plot A		Plot B		Plot C		Total	
	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
Amaranthus spp	19(47.5%)	21(52.5%)	13(32.5%)	27(67.5%)	20(50.0%)	20(50.0%)	52(43.3%)	68(55.7%)
Hibiscus esculentus	20(50.0%)	20(50.0%)	25(62.5%)	15(37.5%)	15(37.5%)	25(62.5%)	60(50.0%)	60(50.0%)
Hibiscus sabdariffa	12(30.0%)	28(70.0%)	10(25.0%)	30(75.0%)	08(20.0%)	32(80.0%)	30(25.0%)	90(75.0%)
Total	51(42.5%)	69(57.5%)	48(40.0%)	72(60.0%)	43(35.8%)	87(64.2%)	142(39.4%)*	218(60.6%)*

Note: Values with asterix are statistically significant ($\chi^2_{=0.05}$)

Table 2: Incidence of Plant Parasitic Nematodes at Matured Stage in Nukkai Irrigation Field, Jalingo (2016)

Plant species	Plot A		Plot B		Plot C		Total	
	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
Amaranthus spp	20 (50.0%)	20 (50.0%)	19 (47.5%)	21 (52.5%)	15 (37.5%)	25 (62.5%)	54 (45.0%)	66 (55.0%)
Hibiscus esculentus	18 (45.0%)	22 (55.0%)	16 (40.0%)	24 (60.0%)	17 (42.5%)	23 (57.5%)	51 (42.5%)	69 (57.5%)
Hibiscus sabdariffa	10 (25.0%)	30 (75.0%)	12 (30.0%)	28 (70.0%)	16 (40.0%)	24 (60.0%)	38 (31.7%)	82 (68.3%)
Total	48 (40.0%)	72 (60.0%)	47 (39.2%)	73 (68.8%)	48 (40.0%)	72 (60.0%)	143 (39.7%)	299 (60.3%)

Note: Values with asterix are statistically significant ($\chi^2_{=0.05}$)

Table 3, showed the abundance of *Melodogyne* spp extracted throughout the study. Out of the 720 stands of vegetables studied across the three plots, 285 stands were found to be positively infested. A total of 535 *Melodogyne* spp of nematode were extracted, out of which *M. incognita* recorded a total of 190 individuals across the three plots with the highest (78 individuals) in Plot B, while the least in Plot C (51). *M. javanica* proved to be more abundant in the study area which had a total of 345 individuals across the three Plots, with Plot A having the highest (115 individuals), followed by Plot C (127 individuals), and the least (103 individuals) was recorded in Plot B (Table 3). The chi-square analysis also revealed that there was no significant difference (p>0.05) between the total number of nematodes extracted across the three plots (Plots A, B and C) but there was a significant difference (p>0.05) between the total number of *M. incognita* and *M. javanica* extracted.

Table 3: Abundance of *Melodogyne* spp Collected During the Studies (2016)

Nematode spp	Plot A	Plot B	Plot C	Total
Melodogyne incognita	61	78	51	190*
Melodogyne javanica	115	103	127	345*
Total	176	181	178	535

Note: Values with asterix are statistically significant ($\chi^2_{=0.05}$)

DISCUSSION

Vascular feeders have become sedentary endoparasites [16]. They usually damage their hosts by redirecting large amount of energy and nutrients from normal cellular activities into their special feeding sites and developmental activities [16]. They also alter tissues and then disrupt the vascular system, which leads to prevention of water transportation and dissolved nutrients upward to the shoots by the xylem and also the translocation of photosynthesized materials to other parts of the plants by the phloem [17]. Roots severely galled by these nematodes could predispose the plants to root rots which could subsequently lead to shorter life span of the plants [18]. Such galled tissues could become succulent, poorly protected from invasion by other disease pathogens and nutrient rich food substance that can easily be colonized by fungi [18]. Anwar and Mckenry [19] reported that damages by root-knot nematodes could lead to poor growth, decline in quality and yield, and reduced resistance to stresses like drought and disease.

As revealed in this study, it is important to note that, there is an increase in number of infestation in each vegetable crop as it ages. This probably signifies that as the plants aged and increases in size, more spaces are created for more nematodes to infest and colonizes the vegetable crops. In all stages of sampling, *Hibiscus esculentus* proved to be more susceptible to infestion, followed by *Amarantus* spp while the least infested was *Hibiscus sabdariff*a. This probably might be due to selection of host by the parasites which favored the attack or infestation of *Hibiscus esculentus* than the rest of the vegetables. It could also be that, Sorrel (*H. sabdariffa*) had the least number of infested stands probably because of its sour nature which hinders the nematodes from infesting it more.

In terms of abundance, this study identified two species of root-knot nematodes from the study area, *Meloidogyne incognita* and *Meloidogyne javanica*. *M. javanica* appeared to be more abundant than *M. incognita* and this could probably be as a result of the nature of the soil in the study area, which might be more suitable for the survival of *M. javanica* than *M. incognita*. It could also be that *M. javanica* is more resistant to stress and other environmental challenges than *M. incognita* which would generally give *M. javanica* reproductive advantage over its cousin (*M. incognita*). This study is in conformity with the works of Haroon and Zylstru [3], Nagesh *et al.,* [20] and Kayami *et al.,* [9] who all reported that root-knot nematodes, *M*. *javanica* is abundantly available than the other species. The result of this study also agrees with the work of many researchers among which are Khan [21], Verdejo-Lucas *et al*. [22], Anwar and McKenry [13] and Kayami *et al*. [9] who all reported availability or incidence and abundance of root-knot nematode in different regions of the world.

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