



STUDIES ON PLANT PARASITIC NEMATODES ASSOCIATED WITH FLUTED PUMPKIN IN BORONGI AND BOKGARE LGA, ADAMAWA STATE NIGERIA

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ABSTRACT

A survey of plant-parasitic nematode PPN genera associated with rhizospheres of Fluted pumpkin was conducted in Borongi and Bokgare LGA, Adamawa State Nigeria, during 2021–2022 farming season. In this respect, a total of Sixty (60) rhizosphere soil samples each from the two (2) location were collected at a depth of 10 - 15cm using auger. The soil samples were then transported to Crop Protection Department Laboratory, Modibbo Adama University Yola for extraction and identification at the generic level using the standard identification keys. Results showed a total of ten and eight genera of PPNs were identified from the soil samples collected from around the root of fluted pumpkin in Borongi and Bokgare respectively. These genera, in a general descending order of occurrence frequency (FO %) were: *Tylenchulus* (59.00), *Helicotylenchus* (28.00), *Pratylenchus* (41.00), *Rotylenchulus* (25.00), *Trichodorus* (20.00), *Melodogyne* (19.00), *Radopholus* (14.00), *Longidorus* (11.00) *Xiphinema* (8.00) and *Scutellonema*. (6.00). Among the plant-parasitic nematode identified, *Tylenchulus specie* appears to be the most abundant and population density on the citrus orchards surveyed in the two location with a frequency of occurrence of 59.00 and 52.00 and a population density of 924 and 53 in Borongi and Bokgare respectively. While *Scutellonema* and *Rotylenchulu* are the least frequently occurred nematodes in both Borongi and Bokgare. Based on the obtained result, it was concluded that the occurrence of PPN is probably because the local environmental and soil conditions are more suitable for their growth.

Keywords: Rhizosphere, Genera, Fluted pumpkin, Nematode

INTRODUCTION

Fluted pumpkin (*Telfairia occidentalis* Hook F.) belongs to the family Cucurbitaceae regarded as one of the most important vegetables that is cultivated widely in southern parts of Nigeria Odiaka *et al.* (2008). However now becoming popular in other parts of Nigeria Ndor *et al.* (2013) modified by Atungwu *et al.* (2018). The major producers of fluted pumpkin are Nigeria, Ghana, and Serra-leone Ononuju *et al.* (2015). Fluted pumpkin grows best on a well-drained sandy-loam soil that is properly tilled for roots penetration and proper germination. It requires an annual day time temperature range of 21-30°C, a mean annual rainfall range of 1900-2200mm and a pH range of 4.0-6.0. Fluted pumpkin is regarded as seed and leaf vegetable crop of commercial importance. The seeds of fluted pumpkin can be consumed by cooking, roasting, grounded and/or added as condiment to soup Atungwu *et al.* (2018). The leaves serve as vegetable ingredient of a Nigerian soup Ononuju *et al.* (2015). Fluted pumpkin plays an important role in human nutrition. Nutritionally; fluted pumpkin seeds are high in oil (30%), contains high level of potassium (39%) and iron (35%), crude protein (27%) and fat (53%) (Fashina *et al.*, 2002). The leaves contain high amount of antioxidant and hepatic-protective and anti-microbial properties. The leaves also contain 29% protein, 18% fat and 20% minerals and vitamins. The oil extracted from fluted pumpkin seed can be used in industrial soap making and cooking (Fashina *et al.*, 2002) modified by Atungwu *et al.* (2018). Medicinally; it has been discovered to be blood purifiers and could therefore be useful in maintaining good health (Aletor *et al.*, 2002).

Vegetable production in Adamawa state, Nigeria, mostly is dominated by small scale farmers who produce vegetables consumed in the state and country at large. Fluted pumpkin in Adamawa state is mostly practiced along the river banks cut across cities and towns. Yola south and Yola north local government area of Adamawa state serves as one of the cultivation sites for fluted pumpkin production as they provide good source of fluted pumpkin to residents of Adamawa state.



Fluted pumpkin is reported as highly susceptible to root knot nematode coupled with the continuous production of the vegetable in the areas gives rise to the build-up of pest and diseases which in turn reported to have negative effect on its productivity (Naveh *et al.*, 2014). Among the pest build-up is plant parasitic nematodes. Plant parasitic nematodes are round microscopic worms when attack on vegetables affect not only the quantity but also the quality. (Ononuju *et al.* 2015). Root knot nematode has been reported to be a limiting factor to the production of fluted pumpkin in Nigeria (Ononuju *et al.* 2015). The symptoms associated with plant parasitic nematode infections on fluted pumpkin includes conspicuous galls on the root that disrupt water and nutrient uptake which in turn weakens the plant roots. (Naveh *et al.*, 2014). modified by Ononuju *et al.* (2015). However, this study on Plant Parasitic Nematodes associated with fluted pumpkin in Borongi and Bokgare was carried out with the following objectives (i) to identify different plant parasitic nematode genera associated with fluted pumpkin. (ii) to determine the most prevalence nematode genera in the study area.

MATERIALS AND METHODS

Description of Study Area

The Survey of Plant Parasitic Nematodes associated with Fluted Pumpkin was carried out in Boronji, River Benue of Yola north and Bokgare of Yola south, Adamawa state. They are the major areas of the fluted pumpkin production in Adamawa state. The study areas lies in the Northern Guinea savannah ecological zones of the which is in Latitude 9°17'11.8"N and Longitude 12°28'00.8" E, Latitude 9°20'35.16"N and Longitude 12°27'49.54"E for Borongi and Bokgare respectively. Global Positioning Map Data (GPS).

Sampling Criteria

The criteria for selecting the farms were based on accessibility, availability of farmer on the farms or escort on the farms and the willingness of the farmer to allow sample collection from their farms. A total of thirty farms were sampled from the two locations.

Sample Collections

Soil Sample Collection

Soil samples for the survey were collected from the rhizosphere of fluted pumpkin plants with the aid of soil auger at a depth of 10-15cm with a radius of 25cm from the base of the fluted pumpkin plants. (60) Sixty samples each of soil around the roots and root sample were randomly taken from fluted pumpkin farms in Boronji and Bokgare and were baled to form a composite sample. Each composite sample was thoroughly mixed and passed over a 10mm diameter mesh sieve to remove all stones and debris that might be present and were transported to the laboratory of Crop Protection department of Modibbo Adama University, Yola for Nematode extraction. Soil samples collected were stored in bags and properly labelled with attention to the date of collection, time, location and field from which samples were collected.

Root Sample Collection

The roots of fluted pumpkin showing symptoms of root knot (galls) were collected from sampled plants .

Extraction of Nematodes from Soil and Root samples

Nematode were extracted using the method described by White head and Hemming (1965) Modified by Hernandez-chavarma *et al.* (2001). About 250cm³ of each of the composite soil samples were placed in the upper sieve of the modified Baermann tray set up, made up of double ply facing tissue sandwich and between a pair of plastic sieve followed by pouring 500ml of water (Mcsorley *et al.*, 2008). The setup was allowed to remain undisturbed for 24 hours after which the sieve was gently lifted up, this forms nematode suspension. While the collected root samples were gently washed to remove soils adhering to the root and then cut into pieces. About 20g of the root pieces were used for Nematode extractions.

Data Collection

Data were collected based on Plant Parasitic Nematode genera and prevalence of Plant Parasitic Nematodes, which were calculated using the Percentage frequency of occurrence as described by Bill *et al.* , (2014).



$$FO = n/N \times 100/1$$

Where: FO is the frequency of occurrence

n is the number of times an individual nematode occurred in all the samples and

N is the sample sizes.

While the percentage of nematodes population density were calculated using the formula described by Trudgill (1992).

$$In/Tn \times 100/1$$

Where: In = Individual nematode genera population

Tn = Total number of nematodes extracted in the samples.

RESULTS AND DISCUSSION

Nematode Genera in Bokgare and Borongi

The results for Plant Parasitic Nematodes genera is presented in table 1. The results revealed that, Bokgare recorded eight different genera of Plant Parasitic Nematodes which includes; *Scutellonema*, *Meloidogyne*, *Pratylenchus*, *Trichodorus*, *Helicotylenchus*, *Heterodera*, *Tylenchus* and *Rotylenchulus*. The Borongi on the other hand recorded seven different genera of Plant Parasitic Nematodes which includes; *Meloidogyne*, *Scutellonema*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Rotylenchus* and *Heterodera*.

Frequency of Occurrence of Plant Parasitic Nematode in (250 cm³) Soil of Fluted Pumpkin in Bokgare and Borongi

The results for Frequency of Occurrence of Plant Parasitic Nematodes associated with Fluted Pumpkin in the soil is presented in table 2. Among the Eight genera of plant parasitic nematodes encountered in soil samples collected from Bokgare, *Scutellonema* recorded the highest frequency of occurrence (70%) followed by *Meloidogyne* (65%), *Pratylenchus* (60%), *Helicotylenchus* (45%), *Trichodorus* (37%), *Rotylenchulus* (24%), *Tylenchus* (21%). However, the least occurring Plant Parasitic nematode genera was *Heterodera* (19%). Among, the seven genera of Plant Parasitic Nematodes encountered in Borongi, *Meloidogyne* recorded the highest frequency of occurrence (65%), followed by *Scutellonema* (45%), *Pratylenchus* (35%), *Aphelenchoides* (30%), *Helicotylenchus* (25%), *Heterodera* (15%). However, the least occurring plant parasitic nematode genera was *Rotylenchus* (10%).

Frequency of Occurrence of plant parasitic nematodes in root of fluted pumpkin in Bokgare and Borongi

The results for frequency of occurrence of Plant Parasitic Nematodes on fluted pumpkin roots is presented in table 3. Among the Eight genera of Plant Parasitic Nematodes encountered in root samples collected from Bokgare; *Scutellonema* recorded the highest frequency of occurrence (60%), followed by *Meloidogyne* (55%), *Pratylenchus* (45%), *Trichodorus* (28%), *Helicotylenchus* (22%), *Rotylenchulus* (24%), However, the least occurring nematode genera is *Tylenchus* and *Heterodera* (9%) respectively. Among the seven genera of plant parasitic nematode encountered in root samples collected from Borongi, *Meloidogyne* recorded the highest frequency of occurrence (55%), this was followed by *Scutellonema* (35%), *Pratylenchus* (35%), *Aphelenchoides* (30%), *Heterodera* (26%), *Helicotylenchus* (20%). However, the least nematode genera were *Rotylenchus* with a frequency of occurrence (15%).

This survey has demonstrated the presence of eight plant parasitic nematode genera in Bokgare while seven plant parasitic nematode genera in Borongi associated with Fluted Pumpkin and as well has shown the most prevalence nematode genera in the study areas. In Bokgare, the plant parasitic nematode genera include; *Scutellonema*, *Meloidogyne*, *Pratylenchus*, *Trichodorus*, *Helicotylenchus*, *Heterodera*, *Tylenchus* and *Rotylenchulus*, while in Borongi, the plant parasitic nematodes include; *Meloidogyne*, *Scutellonema*, *Pratylenchus*, *Aphelenchoides*, *Helicotylenchus*, *Rotylenchus* and *Heterodera*. The prevalence of plant parasitic nematodes can be determined through the frequency of occurrence and population density of the different genera. These findings is in line with the findings of Maryam *et al.* (2020) whose findings portrayed the different and unequal genera of plant parasitic nematodes from different locations. This might be as a result of variations in



climatic, soil and cropping systems of the study locations differences. These findings also corroborate the reports of Atungwu *et al.* (2005), who reported association of these plant parasitic nematodes with vegetable crops in Federal University of Agriculture, Abeokuta.

The findings from this studies further reveals that *Scutellonema* appears as the most frequently occurring and had the highest population density than other plant parasitic nematode genera encountered in Bokgare. Whereas, in Borongi, *Meloidogyne* was recorded as the most frequently occurring plant parasitic nematode genera with highest population density than other plant parasitic nematode genera. These findings corroborate with the findings of Ngele and Kanu, 2015. which further reveals seven different species of nematodes which were found to attack vegetable crops in Afikpo North local government area during the course of study (Maina *et al.*, 2009).

Table 1: Frequency of Occurrence of Plant Parasitic Nematode in (250 cm³) Soil of Fluted Pumpkin in Bokgare and Borongi

Nematode genera	Bokgare	Borongi
<i>Scutellonema</i>	70	45
<i>Meloidogyne</i>	65	65
<i>Pratylenchus</i>	60	35
<i>Trichodorus</i>	37	-
<i>Helicotylenchus</i>	45	25
<i>Heterodera</i>	19	15
<i>Tylenchus</i>	21	-
<i>Rotylenchulus</i>	24	
<i>Aphelenchoides</i>	-	30
<i>Rotylenchus</i>	-	10

Table 2: Frequency of Occurrence of Plant Parasitic Nematodes in (20g) Root of Fluted Pumpkin in Bokgare and Borongi

Nematode genera	Bokgare	Borongi
<i>Scutellonema</i>	60	35
<i>Meloidogyne</i>	55	55
<i>Pratylenchus</i>	45	35
<i>Trichodorus</i>	28	-
<i>Helicotylenchus</i>	22	20
<i>Heterodera</i>	9	26
<i>Tylenchus</i>	9	-
<i>Rotylenchulus</i>	24	-
<i>Aphelenchoides</i>	-	30
<i>Rotylenchus</i>	-	15

Population Density of Plant Parasitic Nematodes in (250cm³) Soil of Fluted Pumpkin in Bokgare and Borongi

The results for Percentage Population Density of Plant Parasitic Nematodes associated with Fluted Pumpkin in the soil is presented in table 4. Among the Eight genera of plant parasitic



nematodes encountered in soil samples collected from Bokgare, *Scutellonema* recorded the highest percentage population density (16.5) followed by *Meloidogyne* (15.0), *Pratylenchus* (11.6), *Helicotylenchus* (10.2), *Trichodorus* (8.0), *Rotylenchulus* (8.7), *Tylenchus* (7.0). However, the least occurring Plant Parasitic nematode genera is *Heterodera* (5.0). Among, the seven genera of Plant Parasitic Nematodes encountered in Borongi, *Meloidogyne* recorded the highest percentage population density (26.3), followed by *Scutellonema* (22.2), *Pratylenchus* (18.0), *Aphelenchoides* (9.3), *Helicotylenchus* (5.1), *Heterodera* (1.8). However, the least occurring plant parasitic nematode genera was *Rotylenchus* with a population density of (4.7).

Population Density of Plant Parasitic Nematodes in (20g) root of Fluted Pumpkin in Bokgare and Borongi

The results for Percentage Population Density of Plant Parasitic Nematodes associated with fluted pumpkin roots is presented in table 5. Among the Eight genera of Plant Parasitic Nematodes encountered in root samples collected from Bokgare. *Scutellonema* recorded the highest population density (20.4), this is followed by *Meloidogyne* (18.0), *Pratylenchus* (14.3), *Trichodorus* (9.0), *Helicotylenchus* (8.0), *Rotylenchulus* (8.3). However, the least occurring nematode genera was *Tylenchus* and *Heterodera* (3.8) respectively. Among the seven genera of plant parasitic nematode encountered in root samples collected from Borongi, *Meloidogyne* recorded the highest population density (22.3), this was followed by *Scutellonema* (15.1), *Pratylenchus* (15.1), *Aphelenchoides* (13.4), *Heterodera* (8.1), *Helicotylenchus* (6.8). However, the least nematode genera were *Rotylenchus* with a frequency of occurrence (6.4).

Table 3: Population Density of Plant Parasitic Nematodes in (250cm³) Soil of Fluted Pumpkin in Bokgare and Borongi

Nematode Genera	Bogkare	Borongi
<i>Meloidogyne</i>	15.0	26.3
<i>Scutellonema</i>	16.5	22.2
<i>Pratylenchus</i>	11.6	18.0
<i>Aphelenchoides</i>	-	9.3
<i>Helicotylenchus</i>	10.2	5.1
<i>Rotylenchus</i>	-	4.7
<i>Trichodorus</i>	8.0	-
<i>Tylenchus</i>	7.0	-
<i>Rotylenchulus</i>	8.7	-
<i>Heterodera</i>	5.0	1.8



Table 4: Population Density of Plant Parasitic Nematodes in (20g) Root of Fluted Pumpkin in Bokgare and Borongi

Nematode Genera	Bogkare	Borongi
<i>Meloidogyne</i>	18.0	22.3
<i>Scutellonema</i>	20.4	15.1
<i>Pratylenchus</i>	14.3	15.1
<i>Aphelenchoides</i>	-	13.4
<i>Heterodera</i>	3.8	8.1
<i>Helicotylenchus</i>	8.0	6.8
<i>Rotylenchus</i>	-	6.4
<i>Tylenchus</i>	3.8	-
<i>Rotylenchulus</i>	8.3	-
<i>Trichodorus</i>	9.0	-

CONCLUSION AND RECOMMENDATION

The result of the research confirmed the presence of Plant Parasitic Nematodes, and in varied forms, this may constitutes serious impediments to the growth and yield of fluted pumpkin (*Telfairia occidentalis*) in the study location, whereas the genus *Scutellonema* and *Meloidogyne* have the highest frequency of occurrence as well as percentage population density in comparison with other plant parasitic nematodes. The presence of Plant Parasitic Nematodes on Fluted pumpkin even at low frequency and population density indicates a problem on fluted farms.. There is a need to enlighten the farmers on the danger of these plant parasitic nematodes in the study locations. More so, the study suggests that serious management strategy should be put in place to prevent possible damages of plant parasitic nematodes on fluted pumpkin.

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