

A Survey of Plant Parasitic Nematode Associated with Avocado (*Persea americana*) In Gembu Sardauna Local Government Area of Taraba State

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ABSTRACT

Plant parasitic nematode causes damages to Agricultural crops which includes plantations and horticultural crops among others. It is in this regard a survey was conducted to identify the different plant parasitic Nematodes genera, frequency of occurrence and population density of the plant parasitic nematode associated with avocado (*Persea americana*) in Gembu ward (A and B) Sardauna local government area of Taraba state Nigeria in the month of May/June, 2022. About 120 soil samples were collected at random from the rhizosphere of avocado plant. A total of ten composite soil samples were obtained from each wards out of which 250cm of soil was used for the nematode extraction using modified Tray-method. Followed by identification of plant parasitic nematode genera which was done using pictorial key to genera. The results of the microscopic analysis of the soil samples in the surveyed areas reveal the existence of eight (8) genera, including: *Meloidogyne*, *Helicotylenchus*, *Xiphenema*, *Pratylenchus*, *Aphelenchus*, *Radopholus*, *Trichodorus* and *Rotylenchus*. *Meloidogyne* was the most widely distributed with frequency of occurrence value in percentage (16.26) and (19.11), and the least frequent genera was *Rotylenchus* (8.94) and (7.72) and population density value in percentage *Meloidogyne* (16.3) and (19.1), followed by *Helicotylenchus* (14.6) and (17.3) and the genera with least population density was *Rotylenchus* (8.9) and (7.7) respectively.

Keywords: Avocado, Survey, PPN, *Meloidogyne*, Extraction

1.0 INTRODUCTION

Avocado (*Persea americana*) is a medium to large evergreen tree belonging to the Lauraceae family, within the order Laurales. The fruit is pear-shaped, featuring a single large seed (often referred to as a pit) and a leathery, dark green to black skin. (Wikipedia, 2025). Avocado is originated in Mexico and is the largest producer accounting for 25% of world production follows Chile 8.5% (FAO, 2019). Whereas Brazil has significantly increased its avocado production in recent years, solidifying its position among the top global producers. According to data from the Food and Agriculture Organization (FAO), Brazil produced approximately 338,238 tonnes of avocados in 2022, marking a 12.4% increase from the previous year and positioning the country as the seventh-largest avocado producer globally (Helgi Library, 2024). Avocado (*Persea americana*) cultivation thrives in well-drained sandy loam soils with a slightly acidic to neutral pH, typically between 5.5 and 6.5. These soil conditions promote optimal root development and nutrient uptake. Poorly drained or saline soils are unsuitable, as they can lead to root diseases and reduced tree vigor. (Rentería *et al.*, 2024), rainfall of 102-127 cm, however abundant rainfall during flowering phase of avocado prolong the flowering period and delay fruit production. (Li *et al.*, 2018)

Avocado (*Persea americana*) is a nutrient-dense fruit that can be consumed fresh and is recognized for its high energy content and numerous health benefits (Dreher, 2020). According to the United States Department of Agriculture (USDA), 100 grams of fresh avocado pulp provides approximately 167 kilocalories, primarily derived from its healthy monounsaturated fats, particularly oleic acid USDA, (2025). These fruit have both nutritional and medicinal benefit. The nutritional benefits are; avocado contains carbohydrate 8.53g/100g fresh fruit weight, dietary fibre (both soluble and insoluble) is 6.7g/100g fresh fruit weight and total sugar is 0.66g/100g fresh fruit weight, it is also reported to have potassium and fat, while the fruit leaves and seeds are used in medicine and oil from the fruit are used in cooking food. According to United States Department of Agriculture (USDA, 2025). Medicinally; Avocado contains different oil levels in the pulp that is widely used in pharmaceuticals because it has been reported to contain bio compounds, and for obtaining commercial oils similar to olive oil, because of their similar fatty acid composition, avocado oil has a high amount of oleic acid, which has been shown to lower blood pressure, lower cholesterol and contribute to good heart health, but avocado oil also may be able to help reverse the inflammatory processes associated with cardiovascular risk. In addition, this fruit has been recognized for its

health benefits, especially due to the compounds present in the lipid fraction such as omega fatty acids, phytosterols, tocopherols and squalene. Santos *et al.* (2015). Several biological activities of the avocado seed have been reported such as antioxidant, antihypertensive, fungicidal, larvicidal, hypolipidemic, and recently amoebicidal and giardicidal activities. Avocado (*Persea americana*) leaves have been documented to exert cardiotoxic effects in various mammalian and avian species, primarily due to the presence of the toxin persin. (Kovalkovičová, *et al.*, 2022). Recent studies have investigated the genotoxic effects of avocado (*Persea americana*) fruit and leaf extracts on human lymphocytes (Silva, *et al.*, 2022).

Avocado seed is of interest to the manufacturing industry as a source of bioactive compounds. is rich in bioactive compounds, including phytosterols, fatty acids, triterpenes, and glucosides of abscisic acid. (Setyawan *et al.*, 2021). The antioxidants and anti-inflammatory agents in avocado oil help the skin stay smooth, strong, and elastic. Calm itchy skin, heal chapped skin, replenish dry skin, hydrate and moisturize skin, shield skin from ultraviolet radiation, protect against skin damage.

The production of these important fruit has been constrained as a result of pests and diseases, among the various pests limiting the successful production is plant parasitic nematode which are non-segmented microscopic, eel-like round worms, obligate parasite possesses stylets that live in soil causing damage to plants by feeding on roots or plant tissues. Zemtmyer *et al.* (2018). Gembu sardauna local government area of Taraba state is one of the major production area of avocado fruit in the north eastern Nigeria and there is Unpublished work donework done on the survey of plant parasitic nematode associated with avocado, it is in these regards the research was conducted with the following objectives; (1) to identify the different genera of plant parasitic nematode associated with avocado (*Persea americana*). (2) to determine the most prevalence nematode in the study area.

2.0 MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out at Gembu Sardauna Local Government of Taraba state of Nigeria with locational coordinates of Latitude 6°43'32.02" N and Longitude 11°15'23.47" E. Gembu is a town found on the Mambilla Plateau in Taraba state of Nigeria. Gembu, the administrative headquarters of Sardauna Local Government Area (formerly Mambilla LGA) in Taraba State, Nigeria, is situated on the Mambilla Plateau at an elevation of approximately 1,348 meters (4,423 feet)

above sea level. This elevation makes it one of the highest towns in Nigeria. The town's high altitude contributes to its temperate climate, characterized by moderate temperatures throughout the year. Gembu is also known for its rich cultural heritage and diverse ethnic composition, including the Mambilla, Kaka, Fulani, Kambu, and Panso communities (Adah, 2020).

2.2 Sampling Criteria

Avocado farm was purposely selected from each location using Agricultural Development Project (ADP) structure as a guide to locate the representative of Avocado fields in the state and local government area. The criteria for selecting Avocado farms for sampling was based on the accessibility, availability of farmers and willingness of the farmers to allow the sample collection (Ononuju, 2015).

2.3 Sampling Method and Collection of Samples

Soil samples for the surveying work were collected randomly (using random sampling method) from the rhizosphere of each plant showing symptoms of retarded growth and stunted growth by digging a hole near the base of the root 3-6 cm deep, during the process care was taken to ensure that the soil samples were not mixed with soil from above and below the segment analyzed. 500 g of soil was taken from each plant sample, stored in polythene bags separately and sealed tightly, labelled with details of the location of the farm and was transported to the Crop Protection Department laboratory. Modibbo Adama University Yola for microscope examination and identification. A total number of 120 soil samples were collected (Mekete. *et al.* (2022).

2.4 Nematode Extraction

Nematodes in the soil samples were extracted from 250 cm composite soil using a modified Tray-technique as described by Bilgrami and Gaugler (2014); a tissue paper was placed underneath a sieve and the soil was poured into the sieve. The sieve was then placed in a tray and water was poured gently on the tray and the setting was left undisturbed for 24 hours. Active nematodes which passed through sieve were collected. The extracted nematodes were identified and counting of nematode genera was done under the light microscope using a counting petri dish and the mean was recorded. The identification of the plant-parasitic nematode was carried out using a pictorial key to genera, following the method outlined by Mekete. *et al.* (2022).

2.5 Data collection

Data was collected on different genera and prevalence of plant parasitic Nematodes, that is frequency of

occurrence and Nematode population density (Emafiador and Mukoro, 2016).

The data collected was analyzed according to the prevalence of Nematode population based on these following factors; Occurrence and Geographical Distribution of plant parasitic Nematodes, Frequency of occurrence and population Density.

i. The Frequency of Occurrence (FO) of the Nematode genus was calculated as a percentage of the total number of samples examined, which was analysed using the percentage Nematode frequency of occurrence formular described by (Emafiador and Mukoro, 2016). The formular is indicated below:

$$FO = \frac{n}{N} \times 100\%$$

Where n= number of time an individual nematode occurred in the sample

N = sample size

ii. The population densities (PD) of the Nematode genus was analysed using the percentage population density formular described by Bill *et al.*, (2014), The formular is indicated below:

$$PD = \frac{INN}{TNS} \times 100\%$$

Where;

INN = individual number of nematode genera

TNS = Total number of extracted nematodes in the sample

3.0 RESULTS

3.1 Occurrence and Geographical Distribution of Plant Parasitic Nematodes in Gembu Wards (A and B)

Eight plant parasitic Nematodes genera identified to be associated with Avocado soil in Gembu ward A and B were recorded in Table 1. From the Table, Gembu ward A and B were recorded with eight genera of Plant Parasitic Nematodes namely: *Meloidogyne*, *Helicotylenchus*, *Xiphinema*, *Pratylenchus*, *Aphelenchus*, *Radopholus* and *Trichodorus*. In both locations all the eight plant parasitic nematodes genera were present as shown in Table 1.

3.2 Frequency of occurrence of Plant Parasitic Nematodes in Gembu ward (A and B)

Table 2 indicates that *Meloidogyne* were the most frequently found as higher populations were occurring in all the the studied location. In Gembu ward A, *Meloidogyne* was the *most* frequently occurring plant parasitic Nematode genera with the frequency of occurrence value in percentage (16.26), followed by *Helicotylenchus* (14.63), *Xiphinema* (14.09), *Pratylenchus* (13.27), *Aphelenchus* (12.19) *Radopholus*

(10.84), *Trichodorus* (9.76) and the least frequent genera was *Rotylenchus* (8.94) were shown in Table 2.

Gembu B, similar trends were observed in which *Meloidogyne* was the most frequently occurring genera in the soil with frequency of occurrence value in percentage (19.11), followed by *Helicotylenchus* (17.27), *Xiphinema* (13.24), *Pratylenchus* (12.50), While *Aphelenchus* (11.03), *Radopholus* (10.29), *Trichodorus* (8.82) and lastly *Rotylenchus* having lowest frequency of occurrence value (7.72) as shown in Table 2.

3.3 Population Density of Plant Parasitic Nematode Genera Associated with Avocado in Gembu ward A

The population densities of plant parasitic nematodes recorded from the soil of in Gembu ward A shows high population of *Meloidogyne* were observed and recorded with a population density of 16.3 in soil. This was followed by *Helicotylenchus* having a population density of 14.6 in soil, *Xiphinema* was the third rate which attained a population density of 14.1 in soil. However, other genera were also observed and recorded in their varied forms namely; *Pratylenchus* (13.3), *Aphelenchus* (12.2), *Radopholus* (10.8), *Trichodorus* (9.8), and *Rotylenchus* (8.9) all in Table 3.

3.4 Population Density of Nematodes Genera Associated with Avocado in Gembu ward B

From Table 3, *Meloidogyne* had the highest number of Nematodes as well as population density of 19.1 in soil. This was followed by *Helicotylenchus* with 17.3 in soil, *Xiphinema* was the third rate which attained a population density of 13.2 in the soil. The lowest plant parasitic nematodes population in the soil samples collected were observed amongst *Pratylenchus* (12.5), *Aphelenchus* (11.0), *Radopholus* (10.3), *Trichodorus* (8.8), and lastly *Rotylenchus* (7.7)

Table 1: Percentage Frequency of Occurrence of Plant Parasitic Nematode in Gembu A and B

S/N	Nematode Genera	Gembu A	Gembu B
1	<i>Meloidogyne</i>	16.26	19.11
2	<i>Helicotylenchus</i>	14.63	17.27
3	<i>Xiphinema</i>	14.09	13.24
4	<i>Pratylenchus</i>	13.27	12.50
5	<i>Aphelenchus</i>	12.19	11.03
6	<i>Radopholus</i>	10.84	10.29
7	<i>Trichodorus</i>	9.76	8.82
8	<i>Rotylenchus</i>	8.94	7.72

Table 2. Population Density of Plant Parasitic Nematode (PPN) Associated with Avocado in Gembu Ward A

S/N	Nematode Genera	Number of PPN in 250cm ³ of soil	Population Density (%)
1	<i>Meloidogyne</i>	60	16.3

IJS GS FUGUSAU VOL. 11(2)				WEBSITE: https://fugus-ijsgs.com.ng
2	<i>Helicotylenchus</i>	54	14.6	<p><i>Longidorus</i> and <i>Xiphinema</i> on kenaf in all the surveyed locations.</p> <p>Followed by <i>Helicotylenchus</i> (14.63), <i>Xiphinema</i> (14.09), <i>Pratylenchus</i> (13.27), <i>Aphelenchus</i> (12.19) <i>Radopholus</i> (10.84), <i>Trichodorus</i> (9.76) and the least frequent genera was <i>Rotylenchus</i> (8.94). While in Gembu ward B, similar trends were observed in which <i>Meloidogyne</i> was the most frequently occurring genera in the soil with frequency of occurrence value in percentage (19.11), followed by <i>Helicotylenchus</i> (17.27), <i>Xiphinema</i> (13.24), <i>Pratylenchus</i> (12.50), While <i>Aphelenchus</i> (11.03), <i>Radopholus</i> (10.29), <i>Trichodorus</i> (8.82) and lastly <i>Rotylenchus</i> having lowest frequency of occurrence value (7.72). The findings of this study are similar to an earlier report by Saltaren <i>et al.</i> (2019) who detected the genera of <i>Meloidogyne</i> in a survey of avocado nurseries and orchards in Colombia with the highest frequency of occurrence among the other genera.</p>
3	<i>Xiphinema</i>	52	14.1	
4	<i>Pratylenchus</i>	49	13.3	
5	<i>Aphelenchus</i>	45	12.2	
6	<i>Radopholus</i>	40	10.8	
7	<i>Trichodorus</i>	36	9.8	
8	<i>Rotylenchulus</i>	33	8.9	
	Total	369		

Table 3. Population Density of Plant Parasitic Nematode (PPN) Associated with Avocado in Gembu Ward B

S/N	Nematode Genera	Number of PPN in 250cm ³ of soil	Population Density (%)
1	<i>Meloidogyne</i>	52	19.1
2	<i>Helicotylenchus</i>	47	17.3
3	<i>Xiphinema</i>	36	13.2
4	<i>Pratylenchus</i>	34	12.5
5	<i>Aphelenchus</i>	30	11.0
6	<i>Radopholus</i>	28	10.3
7	<i>Trichodorus</i>	24	8.8
8	<i>Rotylenchulus</i>	21	7.7
	Total	272	

4.0 DISCUSSIONS

4.1 Plant Parasitic Nematodes Genera in Gembu ward A and B

The microscopic examination of the soil samples in this study indicates that eight (8) genera of plant parasitic nematodes were associated with avocado in both the two locations (Gembu ward A and B) of Tabara state. The genera includes: *Meloidogyne*, *Helicotylenchus*, *Xiphinema*, *Pratylenchus*, *Aphelenchus*, *Radopholus*, *Trichodorus*, and *Rotylenchulus*. Among the genera *Meloidogyne* appears as the most abundance in occurrence. This might be due to favorable environmental conditions such as soil, moisture, temperature and relative humidity which in turn favor the active multiplication of these parasitic nematodes. This is in line with the findings of Maryam *et al* (2020) whose studies revealed the presence of eight genera of plant parasitic nematodes on kenaf.

4.2 Frequency of occurrence of Plant Parasitic Nematodes (PPN) in 250 cm³ in soil (Gembu Ward A and B)

In related development from this surveyed work, *Meloidogyne* had the highest frequency of occurrence in all the studied locations. In Gembu ward A, *Meloidogyne* was the most frequently occurring plant parasitic Nematode genera with the frequency of occurrence value in percentage (16.26). This report is in line with the work of Yahaya *et al.* (2020) whose surveyed worked revealed that *Meloidogyne* appears to be more in abundance in occurrence than *Pratylenchus*, *Scutellonema*, *Tylenchulus*, *Globodera*, *Hoplolaima*, *Helicotylenchus*,

4.3 Population Density of Plant Parasitic Nematodes (PPN) in 250cm³ in soil (Gembu Ward A and B)

The population densities of plant parasitic nematodes recorded from the soil of Gembu ward A shows high population of *Meloidogyne* and recorded population density of 16.3 in soil. Similarly, in Gembu ward B, *Meloidogyne* had the highest number of Nematodes as well as population density of 19.1 in soil. This result is in line with the work of Tiyagi *et al.* (2015) whose surveyed work revealed that *Meloidogyne* has the highest population density in all the locations than the other genera. However, the presence of these several nematodes genera in the soil samples adds pressure of parasitism and this might be as a result of inappropriate land preparation and soil treatment prior to planting or raising of seedlings in the location (Tiyagi *et al.*, 2015).

5.0 CONCLUSION

Based on the findings from this surveyed work, it can be concluded that eight (8) genera of plant parasitic nematodes are found to be associated with Avocado soil among which *Meloidogyne* appears to have the highest frequency of occurrence as well as population density. i. The presence of different plant parasitic nematodes even at low population density could eventually result in great reduction of crop yield.

6.0 RECOMMENDATIONS

Based on the findings from these research work, the following recommendations were suggested:

- i. There is need to enlighten farmers in the study areas about the threat of plant parasitic Nematodes pose on their crops.

- ii. The presence of Nematodes means that there is need to step up Nematode control measures by Agricultural Extension workers or the state Agricultural development program in the zone to avoid crop losses.

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