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INVESTIGATIONS ON NEMATODE COMMUNITY DYNAMICS ON PEPPER MONOCULTURE VEGETATIONS IN OTUOKE, BAYELSA STATE, NIGERIA.

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ABSTRACT: *Cultivation of Pepper, a vegetable fruit crop of prominence in Otuoke, is often hampered by parasitic nematode infestation. This negatively affects its economic impact on the rural domestic market. Farmers in Otuoke often ascribe reduced yield to inadequate farming strategy, as they are ignorant of nematode dynamics and resulting damages. This study sought to assay soil and roots of pepper plants for the determination of nematode community dynamics with a view of winging-in rural affordable management option for the agronomical parasites. The soil was collected using a hand trowel and roots were gotten using a knife and the extraction of the parasites was achieved by the use of the modified sieve plate method. The actual assemblage of nematodes was 397 from 11 genera, 205 (51.6%) occurred in farm A and 192 (48.4%) were seen in farm B. Dynamics on nematode diversity and occurrence were seen among species between farms. Meloidogyne species (17.9%) display variable populations between Farms A (19.5%) and B (16.1%). Tylenchorhynchus (11.3%) had a higher number in farm A (14.1%) and unlike in farm B (8.3%). However, Gracilachus (3.0%) and Scutellonema (7.3%)) species were reportedly found in Farm A while Tylenchus (6.5%) Hemicyclophora (5.3%) Pratylenchus (10.1%) and Rotylenchus species (10.1%) were peculiar to farm B. The result suggests that extensive fluctuations in nematode assemblage are possible even in fields with similar characteristics. Nematode occurrence on the root tissue of pepper plants in this study implies danger to quality productivity. Therefore, farmers should adopt poultry filters as manure for the cultivation of crops in the area. Farmers should also adopt exposing agricultural land to direct sunshine for a minimum of three weeks after clearing before tillage. The heat will help inhibit nematode profusion and check population abundance in soil for proper cultivation of crops.*

KEYWORDS: Pepper, community, Nematode dynamics, Monoculture, Vegetation

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INTRODUCTION

Pepper is a vegetable fruit crop of prominence in Otuoke. The viability of the crop is comparable to palm trees. The leaves offer relief as a therapy for sore throat, skin inflammation (Magied *et al*., 2014) and running stomach (Madala and Nutakki, 2020; Varghese *et al*., 2017). The fruits are used as food and as preservatives (Magied *et al.,* 2014; Norman *et al.,* 2009) and constitute significant spices in most Nigerian delicacies. The plant when raised in gardens portrays natural pigments that improve landscape beauty. Freshly plucked pepper has proven an exceptional source of calcium and vitamins (Mueller *et al.,* 2010; Varghese *et al*., 2017). Pepper crop plant is rurally produced but has a global usage. Pepper forms an important ingredient in topical creams intended to ease muscle pain and itching (Nadeem *et al.,* 2011). It has shown some level of economic impact on the rural domestic market. However, cultivation is often hampered by several biotic fauna in soil including parasitic nematodes.

Nematodes are true pests of crop plants (Orluoma *et al*., 2023) and constitute a major threat to farmers in agriculture and food supply. Phyto-parasitic species cause damage of all kinds to the crop and limit production. Severe infectivity could intensify food insecurity and result in financial loss. Nematode infestation has proven an economic threat that must be curbed to achieve quality crop production and a constant food supply. Pepper is vulnerable to nematode infestation and *Radopholus* species have been reported as a species of economic concern on the crop (Pernezny *et al.,* 2005). Nematodes deplete pepper adversely as it can impair nutrient uptake which could inhibit photosynthesis and affect the general performance of the plant (Popovici and Ciobanu, 2000).

Despite the severity of nematode-inflicted injuries on crops, the rural farmer in Otuoke remains ignorant of nematode dynamics and the procedure of instituting harm and has often ascribed damages to inadequate farming strategy. Hence, studies on nematode community dynamics will inform rural farmers of the dangers of under-minding the effects of nematodes in agriculture and better provide insight into farming strategies to circumvent the activities of the phyto-parasites predominant in the area and boost productivity. Therefore, this study is aimed at investigating the soil and roots of pepper to determine nematodes' community dynamics and wing-in a rural affordable management option.

MATERIALS AND METHODS

Study area

The research was carried out in Otuoke, one of the communities with increased oil explorations in Ogbia Local Government Area, Bayelsa State. It is located 17 kilometres from Yenagoa, the Capital of the State. The inhabitants of Otuoke are farmers mostly of vegetable crops (Smith, 2010). The vegetation in the area is typical of tropical rainforests. Its Coordinates are 4°41′22.417″N 7°17′43.470″E.

Collection of soil and root samples

One hundred soil samples from two pepper mono-cultured vegetations designated farm A and farm B were randomly collected from the root region at a depth of 0-15 cm core depth using

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soil auger. In each farm, twenty-five stands of pepper plants were selected and the roots were uprooted simultaneously with soil using a sterilized kitchen knife. The soil and root samples were packed in waterproof bags as bulk samples, labelled against each farm and conveyed to the laboratory.

Nematode extraction

The modified sieve plate technique as described in Ekine *et al.* (2018) was used for nematode extraction. Fifty portions of the soil samples wrapped in filter paper were taken from each sample bag. A 100ml of tap water was measured into a plastic plate and a sieve was placed on the plastic plate and tied with a rubber band. The soil wrapped in filter paper was placed on a sieve supported on the extraction plates. Water was added to the plates ensuring that the sieve and soil in filter paper were touching the water in the extraction plates. The extraction set-up was left undisturbed in the laboratory for 48 hours. The soil was discarded and the nematode suspension was emptied into specimen bottles, fixed with 5% formalin and viewed after it had settled for nematode counting and identification.

The roots of pepper plants were washed in tap water chopped into smaller parts using a kitchen knife and macerated in a clean blender; 10ml of water was added to the blender and blended at low speed for 15 seconds. Sixty samples were made from each farm and the extraction procedure for the soil was also followed.

Nematode identification

Nematode pictorial keys according to Mekete *et al.* (2012) were used for identification while the viewing was done with the light microscope.

Data analysis

Results in this survey were presented by simple percentages and the significance of endemic species was analyzed in SPSS software, version 22, using Analysis of Variance.

RESULTS

Soil and root nematodes of pepper plants in Otuoke

The examination of soil and roots rhizosphere in this survey reported nematodes abundance of 397 from 11 genera and species. Among the 397 nematodes extracted in this study, 205 (51.6%) were recorded in Farm A, while Farm B had 192 (48.4%) nematodes. The nematodes species encountered in this study included *Gracilachus* species, *Scutellonema* species, *Tylenchus* species, *Hemicyclophora* species, *Pratylenchus* species, *Rotylenchus* species, *Meloidogyne* species, *Hoplolaimus* species, *Heterodera* species, *Xiphinema* species and *Tylenchorhynchus* species (Tables 1 and 2).

Table 1: Soil and roots nematodes of pepper plants in Otuoke Farm A

Nematodes	Soil (%)	Roots (%)	Total (%)
Meloidogyne	23 (14.6)	17 (36.2)	40 (19.5)
Scutellonema	20 (12.7)	9 (19.1)	29 (14.1)

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Heterodera	40 (25.3)	0	40 (19.5)
Gracilachus	8 (5.1)	4 (8.5)	12 (5.9)
Xiphinema	17 (10.8)	6 (12.8)	23 (11.2)
Tylenchorhynchus	18 (11.4)	11 (23.4)	29 (14.1)
Hoplolaimus	32 (20.3)	0	32 (15.6)
Total	**158 (77.1)**	**47 (22.9)**	**205 (51.6)**

Table 2: Soil and roots nematodes of pepper plants in Otuoke Farm B

Nematodes	Soil (%)	Roots (%)	Total (%)
Meloidogyne	19 (14.3)	12 (20.3)	31 (16.1)
Rotylenchus	19 (14.3)	21 (35.6)	40 (20.8)
Heterodera	8 (6.0)	2 (3.4)	10 (5.2)
Hemicyclophora	21 (15.8)	0	21 (10.9)
Xiphinema	2 (1.5)	0	2 (1.0)
Tylenchorhynchus	10 (7.5)	6 (10.20	16 (8.3)
Hoplolaimus	3 (1.3)	3 (5.0)	6 (3.1)
Pratylenchus	27 (20.3)	13 (22.00	40 (20.8)
Tylenchus	24 (18.0)	2 (3.4)	26 (13.5)
Total	**133 (69.3)**	**59 (30.7)**	**192 (48.4)**

Nematode dynamics in Farms A and B

Of the 11 nematode genera recorded from A and B farms, *Gracilachus* and *Scutellonema* species were found occurring in Farm A while *Tylenchus. Hemicyclophora, Pratylenchus* and *Rotylenchus* species were peculiar to Farm B and *Meloidogyne, Hoplolaimus, Heterodera Xiphinema, Tylenchorhynchus* were common in both Farms A and B (Fig. 1).

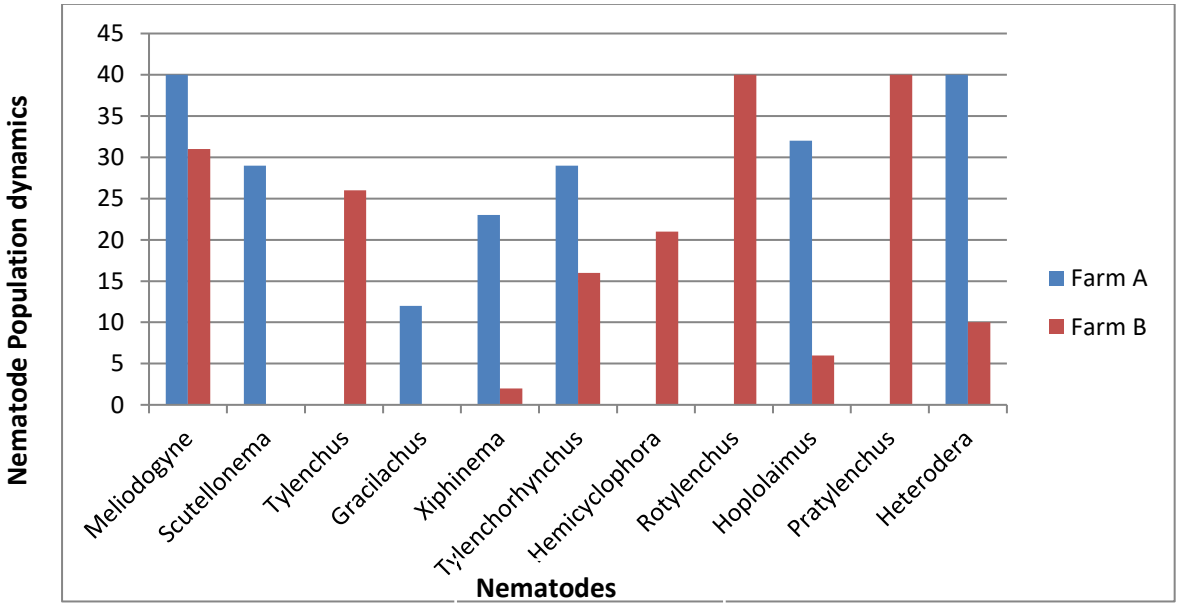

Fig. 1: Nematode Dynamics concerning Farms A and B

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Overall species richness in the study

Nematode species diversity saw *Meloidogyne* species (17.9%) as the most prevalent. Succeeding *Meloidogyne* species in abundance was the *Heterodera* species (12.6%), while *Gracilachus* species (3.0%) recorded the least occurrence (Fig. 2).

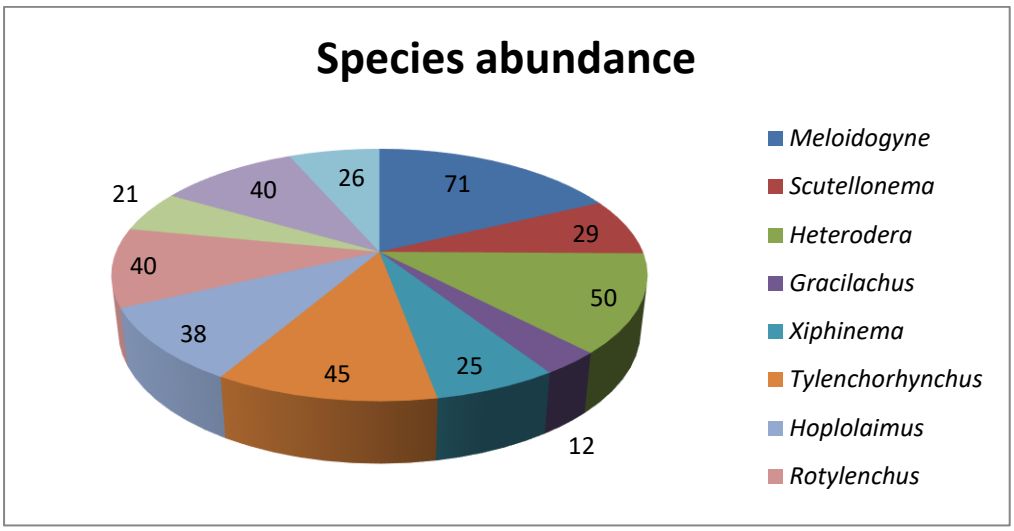

Fig. 2: Overall species richness in the study

DISCUSSION

Soil and roots bioassay reported an actual assemblage of 397 nematodes from 11 genera in Farms A and B. Two hundred and five nematodes (51.6%) occurred in Farm A and 192 (48.4%) nematodes were seen in Farm B. Nematodes richness in this study was low assessing similarity with Orluoma *et al.* (2023) which reported nematodes assemblage of 650 in groundnut plant. The variation in these studies can be attributed to the crop investigated and the season of study. However, the slightly reduced number of nematodes observed in this study is dependent on the unapparent conditions of the research field.

Dynamics on nematode diversity and occurrence were seen among species between farms. For instance, *Meloidogyne* species (17.9%) displayed variable populations between Farm A (19.5%) and Farm B (16.1%). *Tylenchorhynchus* (11.3%) had a higher number in Farm A (14.1%) unlike in Farm B (8.3%). However, *Gracilachus* (3.0%) and *Scutellonema* (7.3%) species were reportedly found in Farm A, while *Tylenchus* (6.5%), *Hemicyclophora* (5.3%), *Pratylenchus* (10.1%) and *Rotylenchus* species (10.1%) were peculiar to farm B. This observation can be ascribed to the unique features impeded in each species for avoidance of extinction. Depending on existing field conditions, nematodes can modify intrinsic features to enable continuous existence (Ekine and Ezenwaka, 2023).

Nematode affluence was higher in Farm A (51.6%) compared to the abundance in Farm B (48.4%). This scenario suggests that the constituent features of Farm A were supportive of nematode propagation, and nematodes encountered reasonable competition in Farm B. The result further implies that extensive fluctuations in nematode assemblage are possible even in fields with similar characteristics. Elsewhere, Chitwood (2003) reported that the soil is a

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difficult system with features that can differ in localities of proximity and propel uneven appearance of nematodes.

Nematode occurrence on the root tissue of pepper plants in this study implies danger to quality productivity. Quality crop performance and limited nematode infectivity with the use of composited poultry dung as fertilizer had been reported by Ekine and Ezenwaka (2023). This stands as an alternative to mitigating the impacts of phyto-parasite infestation on pepper plants, which will in turn improve yield.

CONCLUSION AND RECOMMENDATIONS

This study recorded an actual assemblage of 397 nematodes from 11 genera in Farms A and B. Dynamics on nematode diversity and occurrence was seen among species between farms. Adoption of poultry filters as manure for the cultivation of crops in the area is recommended. Farmers should also adopt exposing agricultural land to direct sunshine for a minimum of three weeks before tilling. The heat from direct sunshine will help inhibit nematode profusion and check population abundance in soil for proper cultivation of crops.

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