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Studies on different species of plant parasitic nematodes attacking vegetable crops grown in Afikpo North L.G.A, Nigeria

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Research Paper

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Studies on the prevalence of different species of plant parasitic nematodes attacking vegetable crops grown in Afikpo North L.G.A., Ebonyi State, Nigeria was carried out from October 2011 to September, 2012. A total of 200 soil, roots, stems and leaf samples were collected from different farm sites in Afikpo North L.G.A., including; Amasiri, Akpoha, Enohia, Afikpo town, Unwana, Ndibe, Ibii Ozizza and Kpogirikpo. Nematodes were extracted and isolated from 100g soil samples, using a simple bucket sieving method with the aid of a strainer. This was done in order to recover actively migrating nematodes attacking vegetable crops. A total of seven different species of nematodes were recovered during the study. These include; endoparatic and ecto parasitic nematodes. There were four endo parasitic nematodes recovered, including; *Meloidogyne incognita* with the highest prevalence of 45 (37.50%), *M. hapla* 32 (26.67%), *Pratylenchus spp.* (migratory) 25 (20.83%) and *Heterodera* spp. 18(15.00%). The other three species of nematodes recovered were ectoparasitic nematodes, including; *Xiphinema* spp., with the highest prevalence of 20(41.67%) which is a migratory nematode; *Dolichorus* spp. (also migratory) 16(33.3%) and *Trichodrous* spp. 12(25.00%). However, okra, cucumber, garden eggs, alfalfa, tomatoes, pepper, fluted pumpkin, etc where some vegetable crops attacked by nematodes from the study area.

Key words: *Nematodes, vegetables, Meloidogyne incognita, Trichodorous species, Heterodera species ,endoparasitic, ectoparasitic.*

INTRODUCTION

Vegetable gardening is a popular part-time occupation for many people around the world. In addition to being fun, vegetables just seem to taste better when they are homegrown and also serve as a source of income (Steinmetz and Potter, 1996).

Vegetables can be described as the edible plant or part of a plant, but usually excludes seeds and fruits. This typically means the leaf, stem or root of a plant (Steinmetz and Potter, 1996). Some vegetables can be consumed raw, some may be eaten cooked and some must be cooked in order to be edible. Typical examples of vegetables include melon, peppers, tomatoes, fluted pumpkin, artichokes, okra, cabbage, lettuce, eggplant, potato etc. All these crops are prone to vegetable attack (Norman, 1992). Vegetables are eaten in a variety of ways as part of main meals and as snacks. The nutritional contents of vegetables vary considerably, though generally they contain little protein or fat and varying proportions of vitamins such as Vitamin A, Vitamin K, Vitamin B6, pro-vitamins, dietary minerals and carbohydrates (Norman, 1992).

Some vegetables also contain fibers important for gastrointestinal functions and contain important nutrients necessary for healthy hair and skin as well. However, humans are not the only ones that eat vegetable crops. There are certain organisms which are microscopic that attack these vegetable crops, causing severe damage and can be very hard to control. They are referred to as Plant -parasitic nematodes (Eisenback and Ulrich, 1997).

Nematodes are believed to be one of the most common animals in the planet earth within the animal kingdom, nematodes ranks second to arthropods in species diversity and in numerical strength (Ngele, 2010).

Nematodes are microscopic round worms (eel – like worms), different from earthworms and other familiar worms that are segmented (annelids) or in most cases, flattened and slimy (flatworms) (Eisenback and Ulrich, 1997).

They are parasites of almost every species of plants and animals. Some are free – living found in the soil, freshwater and marine habitats. They may be bacterial feeders, fungal feeders, herbivores, omnivores, parasites or predators and some may be used as biological control agents to manage important insect pests in the farm. Nematodes living in the soil are minute and some can only be seen with a microscope. There are many types or species of nematodes found in the garden soil or farm (Stirling et al., 2002). These groups of nematodes that are found in the soil are detrimental as they feed on the plants, they are known as plant parasitic nematodes (Stirling et al., 2002). All plant – parasitic nematodes have a stylet, or mouth spear that is similar in structure and function to a hypodermic needle (Fawole, 2009). The nematode uses its stylet to puncture plant cells and then inject digestive juices and ingest plant fluids through it (Ngele, 2010).

Plant – parasitic nematodes that are important on vegetable crops grown in various farms or gardens feed mainly on leaves, roots and the below – ground parts of the vegetables some plant – parasitic nematodes remain in the soil and feed by inserting only their stylet into the root, these are called Ectoparasitic nematodes (Sirling et al., 2002; Ngele,2010). Some endoparasitic nematodes continually burrow round inside the root; these are known as Migratory Endoparasitic nematodes (William and Robert, 2007).

Examples of Endoparasitic: sedentary nematode are; - *Globodera* spp. (Cyst Nematode), *Heterodera* spp. (Cyst Nematodes), *Anguina* spp. (Leafgall Nematode), *Meloidogyne* spp. (Rootknot Nematode), Migratory Endoparasitic Nematodes are; *Pratylenchus* spp. (lesion nematode), *Radophulus* spp. (Burrowing nematode), *Ditylenchus* spp. (Stem nematode) (Ngele, 2010).

Examples of Ectoparasitic Migratory Nematodes are - *Xiphinema* spp. (Dagger nematode), *Longidorus* spp. (Needle nematode), *Trichodorus* spp. (Stubby Nematode). Examples of sedentary ectoparasitic nematodes are; *Criconemoides* spp. (Ring nematode), *Hemicriconemoides* spp. (Sheath nematodes) (Ngele, 2010).

Vegetable crops attacked by nematodes are symptomized by yellowing of leafs, necrosis, formation of galls at the root of the crop, stem twisted etc (Ngele, 2010, Norman, 1992). The research work is aimed at identifying different nematodes attacking vegetable crops in Afikpo North L.G.A., and its prevalence. Plant parasitic nematodes can be controlled using different management practices such as regulatory practices(quarantine), cultural practices, biological method, use of resistant varieties (plant cultivars), and chemical control method etc, (Ngele,2010).

MATERIALS AND METHODS

Description of the study area

Studies on different species of nematodes that attack vegetable crops grown in Afikpo North L.G.A., Ebonyi State, Nigeria, were carried out from October, 2011 to September, 2012. Afikpo North is located between 5°4′N and 6°3′N and 7°5′E and 7°55′E (NPC, 2006). There are two main seasons in the area, rainy season which is between April to October and dry season which is between November to March. The annual rainfall is about 160-220 mm with maximum precipitation occurring between July and September. The people are predominantly farmers producing in large quantities okro, pepper, tomatoes, garden eggs, cucumber, broad leaf pumpkin, fluted pumpkin, rice, yam, palm oil etc. There are different bodies of water in the area including ; Ndibe beach, Unwana beach, Ozizza beach, Iyi Enohia, Akpoha river etc, which are used in irrigating vegetable crops grown during the dry season.

Collection of samples

Soil samples were randomly collected from nine communities in Afikpo North L.G.A., from different sites. Ten soil samples including suspected root and stem samples were collected from each community. A total of ninety soil samples were collected from Afikpo North L.G.A. The communities include; Unwana, Afikpo town, Ibii, Amasiri, Akpoha, Ozizza, Enohia, Kpogirikpo and Ndibe. About 250–300 g of soil samples from around roots were collected in a polythene bag and data on host, locality, and soil type was tagged.

Care was taken in order to ensure that the soil samples were moist while on transit.

Also about 100 g of roots (which included the attacked and well – attacked parts) were collected from the sample sites. A similar quantity of shoots showing apparent damage was also collected and stored in polythene bags.

The soil was dogged 10 -15 cm deep in order to collect the soil sample. Soil from roots of adjoining grasses and weeds were not allowed to get mixed with the samples. Shovel and auger were used to obtain soil cores for population studies at different depths. While digging, care was taken so that soil samples were not mixed with

soil from above or below the segment to be analyzed.

Extraction and isolation of nematodes

Samples were processed soon after collection and the left over samples were stored at 4°c in the refrigerator for not more than seven days. Extraction was done or directed towards isolating all stages of nematode developments. A simple bucket – sieving method for isolating nematode from soil samples of about 100 g, using a large bucket and a 45 – 53 mm aperture sieve was used. The aim was to recover actively migrating nematodes.

The nematodes extracted were thus, separated from the debris and mineral particles by pouring the suspension into a wire mesh covered with tissue paper and submerged in a water trough.

The active nematodes passed through the filter paper into clean water and were concentrated by centrifugation. Also, for plant materials (roots and shoots), the centrifugal salt flotation technique was employed so as to obtain all stages of active and inactive nematodes (Cheesbrough, 2003, Mai et al., 1996).

Fixation

The nematodes obtained were killed by pouring hot water (85^0 – 95^0) over them in doing so; the nematodes were in the smallest possible quantity of water so that they were exposed to instant heat.

After this process, they were fixed in 3-5% formaldehyde solution and were preserved in the same medium. The nematodes were later identified using hand lenses, dissecting microscopes and guides of nematology (Eisenback and Ulrich 1997, Handoo, 2000., Handoo and Golden 1989; Mai et al., 1996).

RESULTS

Seven species of plant parasitic nematodes were recovered during the study.The endoparasitic nematodes that were recovered from Afikpo North L.G.A. and the vegetable crops they attacked are seen in (Table 1). *Meloidogyne incognita* had the highest prevalence of 45 (37.5%) and *Heterodera* spp., with the least prevalence of 18(13.00%). Other species of nematodes found were; *Meloidogyne hapla* 32 (26.67%) and *Pratylenchus* spp., 25(20.83%). All these are endoparasitic nematodes, the species of ectoparatics nematodes recovered from the study include; *Xiphinema* species (dagger nematode) with the highest prevalence of 20(41.67%), followed by *Dolichodorus* species (awl nematode) 16 (35.33%) and the least being *Trichodorus* species (stubby root nematode) 12 (25.00%) (Table 2).

DISCUSSION

Seven different species of nematodes were found to attack vegetable crops in Afikpo North L.G.A., during the course of study. Four of the nematodes recovered from the study were endoparasitic nematodes and they include *Meloidogyne incognita* (Root-Knot), a sedentary endoparasitic nematode with the highest prevalence of 45 (35.5%), followed by *M. hapla* (root knot) also a sedentary endoparasitic nematode with 32(26.67%) prevalence. Others include *Pratylenchus* spp. (migratory endoparasitic nematode), causing lesions on vegetable crops with prevalence of 25(20.83%), while *Heterodera* spp. (sedentary endo-parasitic nematode), causing cyst formation on roots of vegetables had 18(15.00%) prevalence (Maina et al., 2009; Waceke, 2007) made similar observations from their different research works carried out in Kenya. William and Robert, (2007) working in Florida, USA made similar observations from their research works.

Ectoparasitic nematodes recovered from vegetable crops in the study areas include, *Xiphinema* spp., a migratory ectoparasitic nematode (dagger nematode) causing stunted growth and wilting of crops, with a prevalence of 20 (41.67%) which was the highest among the ectoparasitic nematodes of vegetable crops recovered. This was followed by *Dolichodorus* species also a migratory ectoparasitic nematode causing streaks on leaves and stems of vegetable crops and had a prevalence of 16 (33.00%) and *Trichodorus* spp., (migratory ectoparasitic nematode, which causes stubby root, leaf necrosis on vegetable crops studied, and had a prevalence of 12 (25.00%). The results obtained from the study is in line with earlier works done by (Tribe and Brown, 2000; Brown et al., 2004; Waceke, 2007; Mennan and Handoo, 2006).

Vegetable crops found to be attacked by the nematodes, include; okra, pepper, garden egg, fluted pumpkin, alfalfa, etc (Bello et al., 2004; Pattison et al., 2006). The high prevalence of both endo and ecto parasitic nematodes found in the study area was as a result of the high rate of rainfall and high relative humidity in the study area. Nematodes thrive effectively well during the rainy season. It is also during the rainy season that vegetable crops and other crops are planted or grown in the field. Therefore, nematodes find it convenient to proliferate because they had enough crops to attack and the rainy season gives room for high rate of reproduction. Nkoko, (1996), made similar observations of environmental conditions like rainfall, humidity, and soil types etc as factors that help to encourage the proliferation of nematodes in the field.

Table 1. Endoparasitic nematodes recovered from vegetable crops grown in Afikpo North L.G.A. and the vegetable crops they attack.

Species of nematodes	No of nematodes recovered	% prevalence	Crops attack	Symptoms below ground
Meloidogyne Incognita (Sedentary endoparasitic)	45	37.5	Okra, pepper, garden eggs, melons, alfalfa, potatoes	Root knot Formation
Meloidogyne hapla (Sedentary endoparasitic)	32	26.67	Fluted pumpkin, okra, pepper	Root knot Formation
Pratylenchus spp. (Migratory endoparasitic)	25	20.83	potatoes, okra, pepper, alfalfa, fluted pumpkin	Formation of Lesions on the crops
Heterodera spp. (Sedentary endoparasitic)	18	13.00	Melon, pepper, fluted pumpkin, broad leaf pumpkin etc	Cyst formation on the root

Table 2. Ectoparasitic nematodes recovered from vegetable crops in Afikpo North L.G.A.

Species of nematodes	No of nematodes recovered	% prevalence	Crops attack	Visible symptoms above ground
Xiphinema spp.[Migratory ectoparasite]	20	41.67	Pepper, garden egg, cucumber	Stunted growth, yellowing of leaves, wilting e.t.c.
Dolichodorus spp.[Migratory ectoparasite]	16	33.33	Tomatoes, okra, melon	Streaks on leaves and stem, yellowing of leaves.
Trichodorus spp.[Migratory ectoparasite]	12	25.00	Fluted pumpkin, *Amaranthus* spp., Pepper.	Stubby root, leaves necrosis, wilting.

Also, during the dry season, the indigenes of Afikpo North embarked massively on irrigation farming, taking advantage of the many beaches and rivers around their area. These help to encourage the population of nematodes in the area. This gave room for all year round planting of vegetable crops and other crops, leading to constant multiplication of plant parasitic nematodes in the area (Bello, et al., 2004).

CONCLUSION

Vegetable crops in Afikpo North L.G.A. were attacked by different species of nematodes which include ecto and endo-parasitic nematodes, which are migratory and stationary endo and ecto parasitic nematodes. *Meloidogyne incognita* had the highest prevalence of occurrence, 45(37.50%) for endoparasitic nematodes while *Xiphinema spp.,* had the highest prevalence of occurrence for ectoparasitic nematodes. *Heterodera* spp., sedentary endoparasitic nematode and *Trichodorus* spp. (migratory endoparasitic nematodes had the least prevalence of infections 18(13.0%) and 12(25.0%) respectively. Vegetable crops attacked by nematodes from the study area include; okro, tomatoes, pepper, garden egg, cucumber, pumpkin and alfalfa. However, we recommend that much attention should be paid to the damages caused by these species of nematodes in Afikpo North L.G.A, as well as educating the farmers within the communities involved on the control measures that ought to be applied in controlling the nematodes.

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