



Extraction and Isolation of Nematodes Associated with Carrots Obtained from Zaria Local Government

¹Kabuk A. D., ²Aminu A. M., ³Adams A. D.

¹Department of Science Laboratory Technology
Nigerian Institute of Leather and Science Technology, Zaria

²Department of Science Laboratory Technology
Nuhu Bamali Polytechnic, Zaria

ABSTRACT

Plant-parasitic nematodes are an important constraint to yield and quality of carrot worldwide. Several species of nematodes are well known to reduce carrot yield and cause poor quality taproots. Soil and root samples were examined from dakaci and bizara carrot fields and plant-parasitic nematodes were detected in both fields. The nematodes in the carrot and the soil samples were extracted using the Baerman's Pan Method. *Pratylenchus* spp. and *Meloidogyne* spp., were observed to be the most common plant-parasitic nematodes observed from the carrot fields isolated from the two fields in the survey. Other genera detected in the carrot fields were *Hoplolaimus* spp., *Trichodrus* spp., *Xiphinema* spp., *Belonolaimus* spp., *Longidorus* spp., *Ditylenchus* spp., *Aphelenchoides* spp., *Radopholus* spp., *Anguina* spp., *Paratrichodorus* spp., and *Helicotylenchus* spp. The carrot sample from the Bizara field has the highest number of nematodes detected while the soil sample from Dakaci carrot field has the lowest number of nematodes detected. These plant-parasitic nematodes were detected in very low numbers in both carrot fields, and were unlikely to be limited carrot production in the fields.

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INTRODUCTION

Nematodes are aquatic roundworms that belong to the phylum Nematoda and can be found in almost every location around the world [7]. Most of the members of this phylum are free-living and consume fungi, bacteria or alga but other species specialize in the parasitism of other organisms. Approximately 15% of the nematode species are known to parasitize plants [7]. Most plant-parasitic nematodes occur in soil around roots and are ectoparasitic, but many endoparasitic species are found abundantly in rhizosphere

soil. Some plant-parasitic species are not important economically since they do not cause significant damage to plants. When they do cause noticeable damage they are considered pathogenic [3]. Soil inhabiting ectoparasitic forms become important when their population inflates to reach the so-called economic threshold. For any control programme, whether chemical, biological, physical or cultural, accurate nematode identification is of the utmost importance. Even determining pathotype or race may become important in a particular group, e.g. Heteroderidae. It is also



important to know the hosts of a species and how important it is pathologically to plant growth and 25,000 have been described, of which more than half are parasitic, the total number of nematode species has been estimated to be about 1 million [4].

EXPERIMENTAL

Sample Collection

Plant and soil samples were collected at random from the farm. Soil samples were collected from a depth of 25cm by extracting soil cores into a clean container. Carrot tubers were removed using a shovel, the foliage was separated from the crown by hand and then the roots and crown were placed in a clean polyethylene bag.

Nematode Extraction (Baermann Funnel Method)

The plant sample was carefully washed and cut into about 1 cm sized pieces. About 10 – 15g of the cut sample was wrapped in a piece of cheesecloth to form a loose ball. A clean funnel was placed in a stand, the funnel was then closed with a rubber tube clip and filled with water until it reaches up to 1 cm below the rim. Air bubble was avoided by tapping some water from the tube. The cheesecloth containing the sample was hanged in the funnel so that the sample is totally submerged, without touching the bottom of the funnel. It was then allowed to stand for about 48hours undisturbed to allow the nematodes crawl out of the material into the water and settle. After a period of 48hours the nematode suspension was tapped by opening the squeezer clip. Regular tapping and addition of water was done so as to increase nematode vitality [9].

RESULTS AND DISCUSSION

Table 1: Results of the distribution of nematode in carrot tuber from Dakaci carrot field

Nematode genera	No of nematodes Isolated	% Occurrence
<i>Pratylenchus spp.</i>	1	4.4%
<i>Hoplolaimus spp.</i>	10	41.7%
<i>Xiphinema spp.</i>	1	4.2%
<i>Trichodurus spp</i>	8	33.3%
<i>Meloidogyne spp.</i>	4	16.7%

Table 2: Results of the distribution of nematode in soil from Dakaci carrot field

Nematode genera	No of nematodes Isolated	% Occurrence
<i>Pratylenchus spp.</i>	11	84.6%
<i>Meloidogyne spp.</i>	2	15.4%

Table 3: Results of the distribution of nematode in carrot tuber from Bizara carrot field

Nematode genera	No of nematodes isolated	% Occurrence
<i>Ditylenchus spp.</i>	5	19.2%
<i>Pratylenchus spp.</i>	7	26.9%
<i>Longidorus spp.</i>	4	15.4%
<i>Radopholus spp.</i>	6	23.1%
<i>Anguina spp</i>	3	11.5%
<i>Helicotylenchus spp.</i>	1	3.9%

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Table 4: Results of the distribution of nematode in soil from Dakaci carrot field

Nematode genera	No of nematodes isolated	% Occurrence
<i>Meloidogyne spp.</i>	1	12.5%
<i>Belonolaimus spp.</i>	2	25.0%
<i>Aphelenchoides spp.</i>	3	37.5%
<i>Anguina spp.</i>	1	12.5%
<i>Paratrichodorus spp.</i>	1	12.5%

DISCUSSION

Plant-parasitic nematodes are an important constraint to yield and quality of carrot worldwide. Several species of nematodes are well known to reduce carrot yield and cause poor quality taproots. Soil and root samples were examined from both carrot fields and plant-parasitic nematodes were detected in both fields.

Table 1.0 shows the distribution of nematodes in the carrot tuber from Dakaci carrot field, the result revealed that *Pratylenchus spp.*, *Hoplolaimus spp.*, *Xiphinema spp.*, *Trichodurus spp.* and *Meloidogyne spp.* were detected in the carrot tuber. *Pratylenchus spp.* causes taproots to be branched and reduced, side roots with lesions and dead tips above ground parts of the plant to be thin and chlorotic [8]. Its percentage occurrence in the carrot sample was 4.2%. *Xiphinema spp.*, is particularly problematic because it can harbour and transmit plant viruses. Because of the virus transmission, this type of nematode in low numbers can still be very damaging to plants [5]. The percentage occurrence of *Xiphinema spp.* was also 4.2%. *Meloidogyne spp.* are generally considered the most important nematode parasites of carrot worldwide, being geographically widespread and capable of complete crop loss, was found to occur only in 16.7%. *Hoplolaimus spp.* was observed to be highest in carrot sample, followed by *Trichodurus spp.*, with both occurring 41.7% and 33.3% respectively.

Table 2.0 shows the distribution of nematodes in the soil from Dakaci carrot

field, the result revealed that only two nematodes were detected i.e. *Pratylenchus spp.*, and *Meloidogyne spp.* The percentage occurrence of the nematodes was 84.6% and 15.4% respectively. *Pratylenchus spp.* was found to occur the most in the soil from the field. Table 3.0, shows the distribution of nematodes in the carrot tuber from Bizara carrot field, the result shows that *Ditylenchus spp.*, *Pratylenchus spp.*, *Longidorus spp.*, *Radopholus spp.*, *Anguina spp.* and *Helicotylenchus spp.* were detected in the carrot tuber. The percentage occurrence of these nematodes in the carrot tuber are 19.2, 26.9, 15.4, 23.1, 11.5 and 3.9% respectively. *Ditylenchus spp.* attacks the upper and lower parts of plants. They use water films to migrate up the stem of the plant and therefore are more damaging under wet conditions [5]. *Longidorus spp.* feed deep within the roots using their long stylets. Weischer and Brown (2000) reported distortion of carrots (thumb like branch roots) and bending of taproots caused by *Longidorus spp.* [5] reported that, *Radopholus spp.* spend much of their time migrating through root tissues destructively feeding on plant cells. These nematodes cause massive plant tissue necrosis because of their migration and feeding. When they feed from the plant, they simply suck out the plant cell cytoplasm using their stylet, killing the plant cell and moving ahead of the lesion. *Anguina spp.* were the first plant-parasitic nematodes to be described in the scientific literature in 1743. These nematodes migrate as J2s in water films to the leaves of

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plants where they feed as ectoparasites at the tips, causing distortion of the leaves. *Helicotylenchus spp* are ectoparasites that are also capable of partially penetrating the root and feeding. *Pratylenchus spp.* was found to be the most predominant in the carrot from the field.

Table 4.0 reveals the result of the distribution of nematodes in the soil from Bizara carrot field, the result shows that *Meloidogyne spp.*, *Belonolaimus spp.*, *Aphelenchoides spp.*, *Radopholus spp.*, *Anguina spp.* and *Paratrichodorus spp.* were detected in the soil. The percentage occurrence of these nematodes in the carrot tuber are 12.5, 25.0, 37.5, 12.5, and 12.5% respectively. *Belonolaimus spp* has been documented on carrot and celery in the United States. Carrot plants are typically stunted, chlorotic and wilted and young plants can die from heavy infection [2]. *Aphelenchoides spp.* causes characteristic interveinal chlorosis and necrosis of the leaf, ultimately killing it. The nematodes are able to move from leaf to leaf if the proper (moist) environmental conditions exist and can severely damage a plant [5]. *Paratrichodorus spp* can cause stunting of the taproot of and forking of carrot. However, carrot is considered a relatively poor host of this nematode, and control is seldom necessary [2]. *Aphelenchoides spp.* was observed to occur most in the soil from the field.

was also observed that the carrot samples from Bizara field has the highest number of nematodes detected while the soil samples from Dakaci carrot field has the lowest number of nematodes detected. Unlike many other carrot producing areas, plant-parasitic nematodes were found in very low numbers in both carrot fields, and were unlikely to be limiting carrot production in the fields. Both carrot fields used pre-planting fumigation to control soil borne pathogens but not specifically nematodes. This may have contributed to

the low populations detected in the carrot fields.

CONCLUSION

Many plant-parasitic nematodes feed on the roots of plants. The feeding process damages the plant's root system and reduces the plant's ability to absorb water and nutrients. Typical nematode damage symptoms are a reduction of root mass, a distortion of root structure and/or enlargement of the roots. Nematode damage of the plant's root system also provides an opportunity for other plant pathogens to invade the root and thus further weakens the plant. *Pratylenchus spp.* and *Meloidogyne spp.*, were observed to be the most common plant-parasitic nematode observed from the carrot fields isolated from the 2 fields in the survey. Other genera detected in the carrot fields were *Hoplolaimus spp.*, *Trichodrus spp.*, *Xiphinema spp.*, *Belonolaimus spp.*, *Longidorus spp.*, *Ditylenchus spp.*, *Belonolaimus spp.*, *Aphelenchoides spp.*, *Radopholus spp.*, *Anguina spp.*, *Paratrichodorus spp.* and *Helicotylenchus spp.* The carrot sample from the Bizara field has the highest number of nematodes detected while the soil sample from Dakaci carrot field has the lowest number of nematodes detected. Unlike many other carrot producing areas, plant-parasitic nematodes were found in very low numbers in both sampling sites, and were unlikely to be limiting carrot production. Both carrot fields used pre-planting fumigation to control soil borne pathogens but not specifically nematodes. This may have contributed to the low populations detected in the carrot fields.

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