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Assessment of Soil Root-Knot Nematodes in Some Selected Plant Cultivated at Nagwamatse Farm, Gusau, Zamfara State Nigeria

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ABSTRACT

This research was conducted to assess the incidence of root-knot disease on cucumber, tomato, and strawberry at Nagwamatse farm along Wanke/ Dan Sadau road in Gusau Zamfara state. Three (3) different samples of soil and roots of Cucumber, Strawberry, and Tomato plant were collected in a polythene bags from Nagwamatse farms for duration of three (3) month. The result showed that the crops there were infected with root-knot nematodes. Highest percentage (%) frequency was found in cucumber plant, closely followed by strawberry plant and the lowest frequency was found in the tomato plant. The greatest egg mass and gall formation was found in cucumber plant, and show high incidence of Nematodes. *Meloidogyne incognita* and *M. javanica*, were identified to infect tomato, *M. javanica* and *M. artellia* were found in cucumber and *M. javanica* and *M. hapla* were found in strawberry. Out of the identify species, *M. javanica* was more frequent as it was found in all the selected plants species.

Keywords: Nematodes, Soil, Cucumber, Tomato, *Meloidogyne*

1.0 INTRODUCTION

Root knot nematode (RKN) is a soil-dwelling microscopic roundworm. This nematode is parasitic on numerous plants, including vegetables, fruits, field crops, ornamentals, and common weeds. RKN can occur in commercial and homeowner farming practice. Root knot nematode is particularly serious when high populations are allowed to build up due to continuous replanting of susceptible plants on the same site (Moens *et al.*, 2009). Nematodes are the most abundant microscopic worms of the metazoan group (Bird *et al.*, 2003; Viaene, 2006; Davies, 2009). They are cosmopolitan, although not all cause damage. In the view of Sasser and Freckman (2007), nematodes contribute about 17-20% of yield losses each year amounting to a yearly estimate of 100 billion US dollars (Bird *et al.*, 2003). Nematodes are classified as animal-parasitic, plant-parasitic or free-living (Nemaplex, 2010). Plant-parasitic nematodes lead to a reduction in crop quantity or quality even though it has been suggested that in agriculture this

is quite difficult to quantify (Moens *et al.*, 2009; Hallmann *et al.*, 2007; Dong & Zhang, 2006). Information on yield losses due to nematodes is not up to date due to the fact that studies on the impact of nematodes on their specific host crops and habitats are not carried out repeatedly for most of the crops (Viaene *et al.*, 2006) and isolation of the effect of a single pest makes yield loss estimation difficult (Nemaplex, 2010). Evidence suggested that assessment of damage is mostly by direct observations of nematode-free and infested crops and that indirect loss are incurred through other means like sanitation, irrigation and high cost of fertilizers (Wesemael *et al.*, 2011) but are not usually considered when estimating losses due to nematodes.

The cucumber plant is a coarse, prostrate annual creeping vine that grows up trellises or any other supporting frames, wrapping around ribbing with thin, spiraling tendrils. The plant has large, prickly, hairy triangular leaves that form a canopy

over the fruit, and yellow flowers which are mostly either male or female. The female flowers are recognized by the swollen ovary at the base, which will become the edible fruit (Wesem *et al.*, 2011).

Solanum lycopersicum, popularly known as tomato, originated in South America and now is used and cultivated in various parts of the world. This product is cultivated in warm climate regions, but can also be planted in a greenhouse during winter. Tomatoes are full of vitamins and antioxidants essential to a healthy body. Since the tomato doesn't need a lot of tending, it's an easy plant to grow. Tomatoes can be consumed in several ways from salads up to sauces and easily harvested, making it the second most consumed vegetable of the American diet and has China being the main country that producer tomatoes in 31% of the total produce in the world (Workman, 2011).

The strawberry belongs to the genus *fragaria* in the rose family, along with apples and plums. The name of the scientific classification was derived from the old latin word for fragrant. The modern Italian word for strawberry is still "fragola" (Jonathan *et al.*, 2000). It is cultivated worldwide for its fruits. The fruit is widely appreciated for its characteristics aroma, bright red color, juicy texture, and sweetness. It is consumed in large quantities either fresh or is such prepared foods as preserves, juice, piece, ice creams, milkshakes, and chocolates (Jonathan *et al.*, 2000).

Artificial strawberry flavorings and aromas are also widely used in many products like lip gloss, candy hand sanitizers, perfumes and many others. The aim of this study is to identify soil root nematodes in selected plant cultivated in Nagwamatse farm. Binocular microscope (Wang *et al.*, 2009).

2.0 MATERIALS AND METHODS

2.1 Study Area

The samples were collected from Nagwamatse farms in Gusau zamfara state, where three (3) different samples of plant root were collected along with the soil beneath them. This farm is located along Wanke/ Dan Sadau road, with latitude of 10.413600299 and longitude of 5.582733399. Gusau is the capital of Zamfara state with a population of 383,162 people (NPC, 2006). The state is bounded with katsina state to the east, sokoto state to the west and Niger Republic to the northern part of state.

2.2 Sample Collection

Three (3) different samples of soil and roots of Cucumber, Strawberry, and Tomato plant were collected in a polythene bags from Nagwamatse farms in Gusau, Zamfara State for duration of three (3) month and was transported to the Laboratory of Biological Sciences Department for laboratory analysis

2.2.1 Experimental Procedure

A survey was conducted in different angles at Nagwamatse farms to assess the incidence of root-knot disease by nematode on cucumber, tomato, and strawberry plants. During the survey of the field at the farm each sample of the roots and soil of the plants were collected randomly after cycling the plant sample and digging the soil to a depth of 2-3 fits. Root samples were uprooted using a clean hand trowel and kept in polythene bags and properly labeled and were brought directly to the laboratory Zoology Laboratory. The samples were washed thoroughly with clean water for about 4-5 times keeping the water and residue separately and then was later sieved to identify the presence of adult root-knot nematodes and number of the nematode's eggs, if present, were counted. This was repeated for the remaining unsieved water. Lugo iodine was used as an indicator for easy identification of the nematodes and finally zinc sulphate solution was used to detect the egg masses and facilitates counting. Egg masses were counted under a

3.0 RESULTS AND DISCUSSION

Table 1: Frequency Distribution of RKN At Nagwamatse Farm In June 2019

S/No	plant species	% species of organism found	egg load
1	Cucumber	45.45	+ve
2	tomato	18.18	+ve
3	strawberry	36.36	+ve

Key= RKN root knot nematode

Table 2: Frequency Distribution of RKN At Nagwamatse Farm, July, 2019

S/No	plant species	% species of organism found	egg load
1	Cucumber	75	+ve
2	tomato	12.5	-ve
3	strawberry	12.5	+ve

Key= RKN root knot nematode

Table 3: Frequency Distribution of RKN At Nagwamatse Farm, August, 2019

S/No	plant species	% species of organism found	egg load
1	Cucumber	62.2	+ve
2	tomato	0	-
3	strawberry	30	+ve

Key= RKN root knot nematode

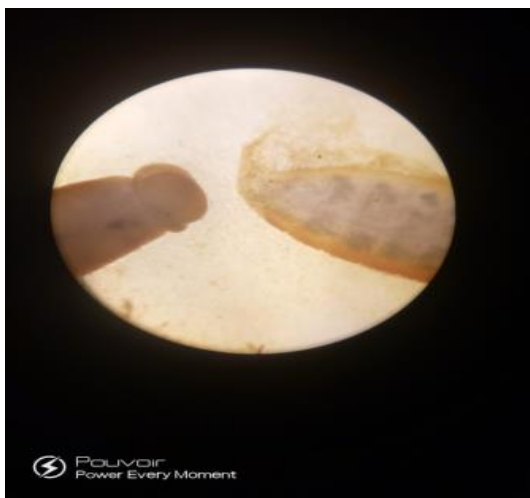


plate1: M. Javanica

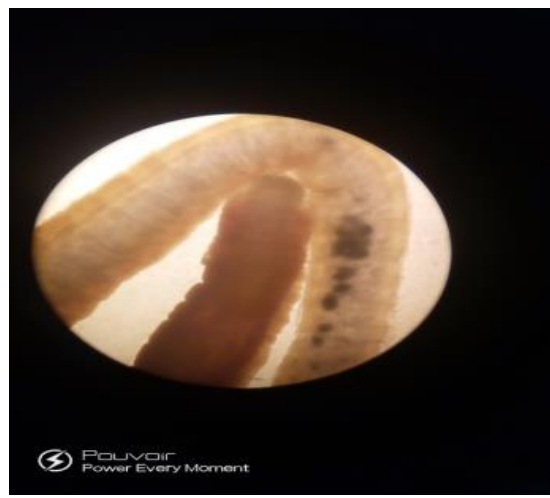


plate2: M. Incognita



plate3: Severe galling with feeding disposition area of *M. Javanica* on the cucumber root

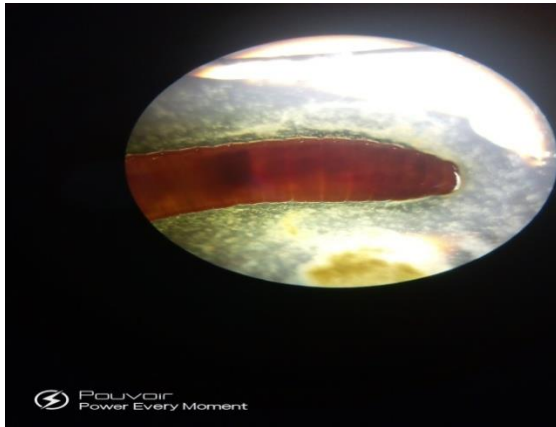


plate4: *M. Hapla*

Present studied revealed that root knot nematode is predominantly associated with green house in Nagwamatse farm. Frequency of occurrence of root knot nematode was observed to be higher in protected cultivation of cucumber as compared to open cultivation of cucumber. From the table 1, 2, and 3 above showed that the occurrence of nematode in cucumber plant increased monthly, which caused the infection on the root (galls) at the second and third months and therefore May leads to the death of the plant. The tomato plant decreased monthly and could not find any traces of nematode at the last month. The strawberry plant tried to fluctuate, because at the first month there were little amount of nematode present, second month decreased drastically with just few numbers of the nematode and the last month increased with high number of the nematode

causing the root to be affected by galls formation

4.0 DISCUSSION

Percentage severity increase was also observed to be higher in cucumber grown in greenhouse. Singh and Karssen (2002) also reported that *M. javanica* was associated with greenhouse cultivation. Though cucumber is highly susceptible crop, the present observation of low nematode infestation in open cultivation of cucumber in four districts of Punjab was due to the recommendation of Punjab Agricultural University where rice, fodder, bajra, wheat were some of the crops taken in rotation in cucumber cultivation in open fields. Abawi *et al* (2000) reported that rotation of beans with grain crops such as corn, wheat, barley, rye or oat decreased the severity and damage of root knot nematode. Siddiqui and Saxena (1987) have reported that

root knot nematode population was found to be suppressed with certain cropping sequences, including non-preferred hosts like mustard, sesame, maize, wheat etc. Higher populations of root knot nematode in greenhouse were due to the conducive environment which helps in buildup of nematode population. Sorribus *et al* (1994) conducted the survey in protected as well as open cultivation and observed that abundance and frequency of *M. javanica* in protected cultivation was higher than in open cultivation.

5.0 CONCLUSION

Highest percentage (%) frequency was found in cucumber plant, closely followed by strawberry plant and the lowest frequency was found in the tomato plant cultivated at Nagwamatse farm. The greatest egg mass and gall formation was found in cucumber plant, and show high incidence of Nematodes. *Meloidogyne incognita* and *M. javanica*, were identified to infect tomato, *M. javanica* and *M. artellia* were found in cucumber and *M. javanica* and *M. hapla* were found in strawberry. This research should be encouraged in relevant areas of the study so that lay men can have knowledge on identifying these parasitic worms and means of controlling them so as to reduce the impact on crop output.

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