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Plant parasitic nematode associated with sweet potato in Nigeria

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ABSTRACT

Survey of plant parasitic nematodes were carried out in some sweet potato growing areas of Nigeria. The research was design to assess the plant parasitic nematode pests of sweet potato in sweet potato growing areas in Nigeria. Soil samples and sweet potato tubers were randomly sampled from selected farm sites in Oyo, Osun, Kaduna, Kwara, Kogi, Abia, Cross Rivers, Benue, Taraba and Plateau States of Nigeria. Plant parasitic nematodes were extracted from soil and sweet potato tubers following standard methods and identification key for agriculturally important plant-parasitic nematodes was used for the nematode identification. Nematodes were extracted and identified in the laboratory. The plant parasitic nematodes identified in the soil samples and sweet potato tuber were root knot nematode Meloidogyne incognita, reniform nematode Rotylenchulus reniformis, lesion nematode Pratylenchus species, brown ring nematode Ditylenchus destructor and D. dipsaci, stubby root nematode Paratrichodorus spp. and dry rot nematode Scutellonema bradys. Plant parasitic nematodes infected sweet potato tubers have unappealing appearances, cracks, internal lesions and dry rot.

Keywords: Sweet potato, plant parasitic nematodes, Nigeria

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INTRODUCTION

Sweet potato (*Ipomoea batatas* L. Lam) is widely cultivated in the tropics and warm temperate climates which inhabits a large number of plant parasitic nematodes of sweet potato. Sweet potato is a root and tuber crop grown in some ecological zones of the country, but most predominantly in the middle belt of Nigeria. It is rich in carbohydrate, starch, protein, fats, fiber etc, which make it a very good and highly reliable source of food energy, sweeteners and industrial raw materials. Aside quite a high population of nematodes in the soil, nematodes are associated with the planting material and in mostly transferred to other areas (Mistra, 2012).

Sweet potato ranked second most important root tuber and seventh most important food crops in the world. The crop is often referred to as “poor man’s food” or “famine crop” because of its high contributions to food security, poverty alleviation and supplementary alternative staple food for resource poor farmers. Sweet potato in high yielding, short duration, high nutritional value and tolerance to too many production stresses (Mitra, 2010). The production, marketing and utilization of sweet potato have expanded in the last decade to almost all ecological zones of Nigeria, presently between 381,000 and 510,000ha of land area under sweet potato cultivation in Nigeria. Yields have increased from farmers’ pre-research era of 2-3 tones/ha to 30-40 tones due to the availability of improve varieties. Nigeria today is the 1st largest producer of sweet potato in Africa with 3.46mt annually. Globally, Nigeria is now the second largest producer, China being the first on the list with 106, 197, 100MT (FAO, 2008).

Plant parasitic nematodes have been identified as an economic pests of sweet potato (Ames, et al 1997; Olabiyi, 2007). If the necessary precautions are not taken for their control before the distribution/ planting of the planting materials – vines or tubers, these nematodes are capable of causing serious economic loss on sweet potato. However, baseline information on the plant parasitic nematodes of nematode pests of sweet potato in Nigeria is scanty.

The objective of this study is therefore to assess the plant parasitic nematode pests of sweet potato in some sweet potato grown areas in Nigeria.

MATERIALS AND METHODS

Site selection:

Soil samples and sweet potato tubers were randomly sampled from selected farm sites in Oyo, Osun, Kaduna, Kwara, Kogi, Abia, Cross Rivers, Benue, Taraba and Plateau States of Nigeria.

Soil and Tuber Collection:

Soil collection: Soil samples were collected around the roots of sweet potato with auger. Up to 10 soil samples, each 300ml, using systematic randomly collected per 5 m by 5 m field area and were well labelled. Soil sample (for diagnostic purposes) were collected during final harvest of the sweet potato at many locations where sweet potato were planted in Nigeria. Soil samples collected were carefully tagged, labelled and sealed.

Tuber collection: Sweet potato tubers were collected at the same time and from the same locations as for soil sample, and each tuber were put in small bag containing the soil sample, labelled and sealed.

Nematode extraction (soil):

Nematodes were extracted within four hours after soil samples were collected from the field. Extraction tray method (modified Baermann Technique) was used for the extraction of the nematodes in the soil. All containers used for the each soil samples were labelled accordingly following field label in order to avoid mix-up and mistakes. Coarse sieve (2 mm) was used to remove stones, root, leaf and other plant debris from the soil sample and placed in a well labelled plastic container where the soil sample was thoroughly mixed. Tissue paper (paper serviette) was placed in the plastic sieve (extraction plate) and thereafter placed in the plastic plate. Approximately 250 ml soil sample was placed on the tissue in the sieve. Water was gently added to the extraction plate. The whole set up was left undisturbed for a period of 48 hours. Sieve containing the soil and tissue paper were removed and disposed appropriately. The water from the extraction plate were poured into a well labelled beaker and water bottle was used to rinse the ex-

traction plate into the beaker. Samples were left to settle before nematode count. The volume of water in the beaker was reduced by gently pour off the excess. The remaining water containing the nematodes were poured into counting slide using stereomicroscope.

Nematode extraction (sweet potato tuber):

Nematode were extracted within 48 hours after tubers were collected from the field. Modified Baermann technique was used for extraction. Sweet potato tubers were rinsed and peel thinly with knife. The peelings were chopped to 3-5 cm sizes and mixed thoroughly. Approximately 10 gm peel was weighed and macerated using blender. The blended suspension was poured into a labelled beaker and the blender was rinsed out into the beaker. The sample was gently pour onto the tissue paper in the sieve and nematodes were extracted and counted using stereomicroscope.

Nematode identification in soil and on tuber.

Nematodes species were identified by means of morphology and morphometrics coupled with guide by the identification key for agricultural important plant-parasitic nematodes (Mekete, *et al*., 2012). Prominence values (PV) = Population Density × (Frequency of Occurrence) ^{½} × 10^{-1} were calculated for each nematode species (Fourie, *et al*., 2001).

RESULTS

Population of different plant parasitic nematode pests' infestations within the sweet potato rhizosphere and prominence values in some farm site locations in Nigeria were as presented in Table 1. Plant parasitic nematodes found within the sweet potato rhizosphere were root knot nematode, *Meloidogyne incognita*; reniform nematode, *Rotylenchulus reniformis*; lesion nematode, *Pratylenchus* species; brown ring, *Ditylenchus destructor* and *D. dipsaci;* stubby root nematode, *Paratrichodorus* spp. and dry rot nematode, *Scutellonema bradys*. The nematodes were unevenly distributed across the country. The populations of brown ring nematode, *Ditylenchus destructor* and *D. dipsaci* tend to be low in the southern part of Nigeria and high in the north. The population of lesion nematode, *Pratylenchus* species tends to be generally lower than other plant parasitic nematodes within the sweet potato rhizosphere. The population of root knot nematode, *Meloidogyne incognita* and dry rot nematode, *Scutellonema bradys* were higher than other nematodes in the sweet potato growing regions; this accounted for their higher prominence values than those of others.

Population of different plant parasitic nematode pests' infections in the sweet potato peel and prominence values were as presented in Table 2. The associated plant parasitic nematodes found in the sweet potato peel (root knot nematode, *Meloidogyne incognita*; reniform nematode, *Rotylenchulus reniformis*; lesion nematode, *Pratylenchus* species; brown ring, *Ditylenchus destructor* and *D. dipsaci;* stubby root nematode, *Paratrichodorus* spp. and dry rot nematode, *Scutellonema bradys*) were same as those found within the sweet potato rhizosphere. The populations of the nematodes were generally low and unevenly distributed. In some cases, plant parasitic nematodes were not found on sweet potato peels. Root knot nematode, *Meloidogyne incognita* did not cause conspicuous galls on the tubers, as often observed on yam tubers. There were cracks and grooves formation on some sweet potato tubers, as a result of stubby root nematode, *Paratrichodorus* spp. infections. Lesions caused by lesion nematode, *Pratylenchus* species were observed on significant quantity of sweet potato tubers. Dry rot symptoms, as a result of dry rot nematode, *Scutellonema bradys* infection, were observed on few sweet potato tubers.

DISCUSSION

On a worldwide basis, the ten most important nematode genera include *Meloidogyne, Pratylenchus, Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus* and *Helicotylenchus* (Sasser and Freckman, 1987; Whitehead, 1998) and some of which are economic nematode pests of sweet potato (Ames *et al*., 1997; Coyne *et al*., 2007). *Meloidogyne* spp., *Ditylenchus destructor*, *D. dipsaci*, *Rotylenchulus reniformis* and *Pratylenchus* spp. have been confirmed as nematode pests of sweet potato (Ames *et al*., 1997). It is significant to note that the bulk of pathogenic nematodes are soil inhabiting and endo-parasitic in nature (Olabiyi, 2004). Sasser (1989) in a worldwide re-

search survey, ranked root knot nematode *Meloidogyne* species, root lesion nematodes *Pratylenchus* species and cyst nematodes *Heterodera* species as the world's top three plant parasitic nematodes. Reniform nematodes *Rotylenchulus* spp., stubby root nematodes *Trichodorus* spp., lesion nematodes *Pratylenchus* spp., false root-knot nematodes *Nacobbus* spp., and root knot nematodes *Meloidogyne* spp. are plant parasitic nematodes of sweet potato and potato worldwide. The symptoms caused by plant parasitic nematodes are non-specific and often confused with nutrient deficiency, water deficits, salinity or other soil disorders. There are variations in the symptoms expressed based on species of plant parasitic nematodes involved, initial nematode population density, age of the host, plants and various ecological factors (Mangala and Mauria, 2006). Root knot nematode are ubiquitous and over 126 species have been described (Moens *et al*., 2009) but only very few are economically important in agriculture (Sasser, 1980). The most economically important ones are *M. incognita, M. indica, M. javanica, M. hapla, M. graminicola, M. arenaria,* and *M. triiticoryzae* (Mangala and Mauria, 2006).

CONCLUSION

The plant parasitic nematodes identified in the soil samples and sweet potato tuber were root knot nematode *Meloidogyne incognita*, reniform nematode *Rotylenchulus reniformis*, lesion nematode *Pratylenchus* species, brown ring nematode *Ditylenchus destructor* and *D. dipsaci,* stubby root nematode *Paratrichodorus* spp. and dry rot nematode *Scutellonema bradys*. It is important to note that the populations of nematodes are unevenly distributed, and that the nematodes are more densely populated in the soil than in the sweet potato peels. Plant parasitic nematodes infected sweet potato tubers have unappealing appearances, cracks, internal lesions and dry rot which, suggest appropriation of nematode control measures in the nematode endemic areas.

REFERENCES

Ames, T., Smit, N.E.J.M., Braun, A.R., O'Sullvan, J.N., Skoglum, L.G. 1997. Sweetpotato: Major pests, diseases and nutritional disorders. International Potato Center, Peru, 104-111.

Coyne, D.L., Nicol, J.M., Claudius-Cole, B. 2007. Practical plant nematology: A field and laboratory guide. SP-IPM Secretariat. International Institute of Tropical Agriculture (IITA). Cotonou, Benin, 82pp.

F.A.O. 2008. Food and Agricultural Organization: Production year book of the United Nations.

Fourie, H., Mcdonald, A.H., Loot, G.C. 2001. Plant-parasitic nematodes in field crops in South Africa. 6. Soybean. Nematology 3: 447-454.

Mangala, M.S., Mauria, S. 2006. Handbook of Agriculture. Facts and figure for teachers, students and all interested farmers. Indian Council of Agricultural Research, New Delhi 110012. M/S Chandu Press, Delhi 1346 pp.

Mekete, T., Dababat, A., Sekora, N., Akyazi, F., Abebe, E. 2012. Identification key for agricultural important plant-parasitic nematodes. Prepared for the international Nematode Diagnosis and identification course 2012 – A manual for nematology. Mexico, D.F: CIMMYT. 23pp.

Mitra, S. 2012. Nutritional Status of Orange-Fleshed Sweet Potatoes in Alleviating Vitamins A Malnutrition through a Food –Based Approach. J Nutr Food Sci 2:160.doi:10.4172/2155-9600.1000160

Moens, M., Perry, R.N., Starr, J.L. 2009. Root knot nematodes. In: Perry, R.N.; Moens, M. and Starr, J.L (Eds.). CABI International, UK, pp. 1-7

Sasser, J.N. 1980. Root-knot nematodes: A global menace to crop production. Plant Disease 64(1): 36-41

Olabiyi, T.I. 2004. Assessment of the nematicidal properties of extracts from Tagetes erecta, Ocimim gratissimum, Hyptis suaveolens and Crotalaria retusa. Ph.D Thesis submitted to Department of Crop Production, University of Ilorin, Nigeria. 177 pp.

Olabiyi, T.I. 2007. Susceptibility of sweet potato (Ipomea batatas) varieties to root

knot nematode, Meloidogyne incognita. American-Eurasian J. Agric. and Environ. Sci., 2(3): 318-320.

Sasser, J.N. 1989. Plant parasitic nematodes. The farmer's hidden enemy. A cooperative publication of the Department of Plant Pathology, North Carolina State University and consortium for International Crop Protection, 115pp.

Sasser, J.N, Freckman DW. 1987. "World perspective on Nematology: The role of the society", pp. 7-14. In: Vistas on Nematology: A commemoration of the Twenty-fifth Anniversary of the Society of Nematologists, S.A. Veech and D.W. Dickson (Eds.). Society of Nematologists. Inc. Hyattiville, USA.

Tewe, O.O., Ojeniyi, F.E., Abu, O.A. (2003). Sweet potato Production, Utilization, and Marketing in Nigeria. Social Science Department, International Potato Center (CIP), Lima, Peru; 2003.

Whitehead, A.G. 1998. Plant nematode control. CAB International, Wallingford, UK, 384pp.

Table 1: Soil population and prominence value of plant parasitic nematode pests of sweet potato in some farms in Nigeria

Location (States)	M. incognita			R. reniformis			Pratylenchus spp.			D. destructor			D. dipsaci			Paratrichodorus spp			S. bradys		
	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV
Oyo	22.2	128	60.3	9.7	56	17.4	2.6	15	2.4	11.9	69	23.8	1.2	7	0.8	8.1	47	13.4	44.2	255	169.5
Osun	19.4	86	37.9	8.8	39	11.6	3.2	14	2.5	10.7	48	15.7	2.0	9	1.3	7.6	34	9.4	48.3	215	149.4
Kaduna	18.8	115	49.9	8.0	49	13.9	1.8	11	1.5	12.2	73	25.5	1.5	9	1.1	9.1	52	15.7	48.6	275	191.7
Kwara	19.7	150	66.6	8.2	62	17.8	1.7	13	1.7	14.7	107	41.0	1.7	13	1.7	7.5	57	15.6	47.1	358	245.7
Kogi	22.1	189	88.9	7.5	64	17.5	1.4	12	1.4	10.4	90	29.0	20.4	177	79.9	17.4	151	63.0	20.8	181	82.5
Abia	17.5	114	47.7	7.8	51	14.2	2.0	13	1.8	1.6	10	1.3	5.1	31	7.0	9.2	56	17.0	56.8	355	267.5
Cross Rivers	18.6	100	43.1	8.0	43	12.2	2.6	14	2.3	2.8	15	2.5	4.2	23	4.7	8.0	44	12.5	55.8	305	227.8
Benue	19.0	162	70.6	4.0	34	6.8	2.1	18	2.6	21.5	182	84.4	24.9	211	105.3	13.8	117	43.5	14.7	125	47.9
Taraba	19.6	177	78.4	2.1	19	2.8	3.6	33	6.3	20.6	189	85.8	30.7	281	155.7	14.2	130	49.0	9.2	84	25.5
Plateau	17.3	164	68.2	3.7	35	6.7	3.5	33	6.2	17.1	159	65.7	31.1	289	161.2	12.8	119	42.6	14.5	135	51.4

Foot note: FOO (Frequency of occurrence); PD (Population density); PV = Prominence value

Table 2: Population and prominence value of plant parasitic nematode pests in 10 g sweet potato peel in some farms in Nigeria

Location (States)	M. incognita			R. reniformis			Pratylenchus spp.			D. destructor			D. dipsaci			Paratrichodorus spp			S. bradys		
	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV	FOO (%)	PD	PV
Oyo	12.5	2	0.7	6.3	1	0.3	18.8	3	1.3	6.3	1	0.3	0.0	0	0.0	0	0	0.0	56.3	9	6.8
Osun	15.4	2	0.8	7.7	1	0.3	15.4	2	0.8	7.7	1	0.3	0.0	0	0.0	0	0	0.0	53.8	7	5.1
Kaduna	9.1	1	0.3	9.1	1	0.3	36.4	4	2.4	9.1	1	0.3	0.0	0	0.0	0	0	0.0	36.4	4	2.4
Kwara	11.1	3	1.0	7.4	2	0.5	22.2	6	2.8	3.7	1	0.2	0.0	0	0.0	0	0	0.0	55.6	15	11.2
Kogi	14.3	2	0.8	7.1	1	0.3	21.4	3	1.4	0	0	0.0	0.0	0	0.0	0	0	0.0	57.1	8	6.0
Abia	25.0	2	1.0	12.5	1	0.4	25.0	2	1.0	0	0	0.0	0.0	0	0.0	0	0	0.0	37.5	3	1.8
Cross Rivers	20.0	1	0.5	0	0	0.0	20.0	1	0.5	0	0	0.0	0.0	0	0.0	20.0	1	0.5	40.0	2	1.3
Benue	5.9	1	0.2	0	0	0.0	11.8	2	0.7	11.8	2	0.7	41.2	7	4.5	17.6	3	1.3	11.8	2	0.7
Taraba	6.3	1	0.3	0	0	0.0	12.5	2	0.7	12.5	2	0.7	43.8	7	4.6	18.8	3	1.3	6.3	1	0.3
Plateau	9.1	1	0.3	0	0	0.0	9.1	1	0.3	9.1	1	0.7	45.5	5	3.4	18.2	2	0.9	9.1	1	0.3

Foot note: FOO (Frequency of occurrence); PD (Population density); PV = Prominence value