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Short Communication

Incidence of Plant Parasitic Nematodes under Kenaf Cropping System

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Plant parasitic nematode populations were monitored in kenaf cropping system under humid rainforest, derived savannah and Northern Guinea savannah agro ecologies of South West Nigeria. Fifteen genera of plant parasitic nematodes were observed from humid rainforest agroecology and eighteen genera of plant parasitic nematodes were observed from both derived savannah and Northern Guinea savannah agroecologies. Of the number of plant parasitic nematodes present in the three agroecologies, five genera of plant parasitic nematodes of economic importance, *Meloidogyne* spp, *Pratylenchus* spp, *Rotylenchulus* spp, *Hoplolaimus* spp *and Helicotylenchus* spp were found present in all the agroecologies. With the commitment of the Federal Government of Nigeria in diversifying the economy of the country from depending on oil production to agriculture, kenaf is a single fibre crop that has high import for harnessing the potentials necessary as a panacea in revamping the Nigerian agro-based economy and construction sub-sectors of the economy through value chains development. Hence there is urgent need to control or reduce the population of plant parasitic nematodes in kenaf cropping system.

Key Words: Kenaf, plant parasitic nematodes, humid rainforest, derived savannah, Northern Guinea savannah, agro- ecologies and nematode populations

INTRODUCTION

Kenaf (*Hibiscus cannabinus* L.) is an important fibre crop in several countries with tropical to sub-tropical climates (Starr *et al.,* 2005). Kenaf is a fibre plant native to East-Central Africa and a member of the mallow (*Malvaceae*) family, with okra and cotton as relatives. Kenaf plants grown in dense stands are largely unbranched with straight thin stem and grow to a height of 1.5 m. The word kenaf is believed to have originated from Persia. However, India is the world's leading producer of Kenaf followed by Bangladesh. India's annual output of nearly 350,000 tonnes constitutes more than 60% world production (Stricker *et al.,* 2001). Kenaf is a photo period sensitive plant, requiring day length which is shorter than 12 h for flowering to occur (Balogun *et al.,* 2008). Kenaf is non-woody plant of a very short growth cycle of between 100-130 days (Bada and Kalejaiye, 2010). It is a renewable fast growing annual crop capable of being grown twice with the aid of irrigation. Kenaf is adapted to a wide range of soil types, but performs best on neutral, well drained, rich sandy-loam soil and high in humus (Bada and Kalejaiye, 2010). As the cultivation area of kenaf expands, pests and diseases problems are increasing in incidence and severity.

Kenaf is resistant to most plant diseases; however, nematode is the most serious potential problem while Anthracnose and other soil borne pathogens are also important pests' constraint to Kenaf production (Adegbite *et al.,* 2008). In order to help farmers combat these disease problems, the management of kenaf pests have been studied with adequate control measures evolved

(Fadare and Amusa, 2005). However, information on build-up, distribution and severity of plant parasitic nematodes on kenaf in Nigeria is scanty. Hence, the need to investigate in order to determine and document the build-up, distribution and severity of plant parasitic nematodes associated with kenaf in humid rainforest, derived savannah and northern Guinea savannah agro-ecologies of South Western Nigeria.

MATERIALS AND METHODS

Two field experiments were conducted at Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, Ibadan, Nigeria located at E3°54$_1$ and N7°30$_1$ Ilora located at E4°30$_1$ and N7°50$_1$ derived savannah agroecology and Kish located at E5°30$_1$ and N7°60$_1$ Northern Guinea savannah agroecology in 2015 and 2016 respectively using Cuba 108 variety of kenaf susceptible to plant parasitic nematodes (Adegbite *et al.,* 2008). The experimental sites for the study had been previously cultivated for 1year with kenaf in order to increase plant parasitic nematode population.

The experiments were established on 6th April, 2015 and 7th April, 2016 respectively and arranged in a randomized complete block design. The preparation of the experimental sites involved ploughing and harrowing. Planting was done on (10×10) m plots at the spacing of (10 ×25) cm and replicated four times. The seeds were not treated with pesticides.

Weeds were controlled manually at 3 and 6 weeks after planting. A basal application of fertilizer was applied at 2 weeks after planting using NPK fertilizer at a rate of 120 $kgha^{-1}$ of N, 50 $kgha^{-1}$ of P_2O_5 and 50 $kgha^{-1}$ of K_2O.

Soil samples were taken from experimental plots at planting and after harvest (19 weeks after planting) and analyzed for nematode population counts in order to determine the initial and final populations of the nematodes (Pi and Pf). Soil samples from around the roots of each plant were collected using soil anger along the four cardinal directions at the base of each plant in order to cover as much of the rhizosphere as possible. Soil samples were collected to a depth of 15-30 cm with garden trowels. Samples from each location were pooled and sealed in plastic bags and protected from the sun (Ricka and Barker, 1992).

The samples were properly labeled and taken to Plant Protection Laboratory of the Institute of Agricultural Research and Training, Moor Plantation, Ibadan-Nigeria for analysis and for identification of plant parasitic nematodes. Plant parasitic nematodes were extracted from the soil using the pie-pan modification of the Baerman Funnel Method (Southey, 1986).

Each composite soil samples was mixed thoroughly and plant parasitic nematodes were extracted from 200 ml sub-sample. The set-up was left undisturbed for 24 h before decanting the suspension into a beaker. Ten extraction trays were set up per sample. Plant parasitic nematodes in each suspension were killed by adding an equal volume of hot water to the nematode suspension and each sample was then adjusted to a desired volume. The suspension was thoroughly mixed using a magnetic stirrer and 5 ml aliquot was drawn from each suspension into a Don caster counting dish for identification and quantification of the extracted nematodes. Temporary mounts of nematodes were prepared prior to nematodes identification. Identification of the plant parasitic nematodes to the generic level was done using the Lucid-key of Bell, (2004). Mean values, standard deviation of means were calculated using Statistical Packages for Social Sciences (SPSS, 2010).

RESULTS AND DISCUSSION

Fifteen genera of plant parasitic nematodes occurring in varying densities were identified to be associated with kenaf in soils obtained from Ibadan, humid forest agro-ecology and eighteen genera of plant parasitic nematodes occurring in varying densities were identified to be associated with kenaf in soils obtained from derived savannah and Northern Guinea savannah agro ecologies of the South West Nigeria respectively (Table 1). In the three agro-ecologies, about 20% of the soil samples collected contained a single genus while the rest were polygeneric. Soil samples obtained from Ibadan did not contain *Hemicriconemoides* species, *Trichodorus* species and *Hirschmanniella* species in which their populations were high in the two agro-ecologies (derived and Northern Guinea savannah) (Table 1). Plant parasitic nematodes population densities in both derived savannah and Northern Guinea Savannah agro-ecologies were higher than that of humid rainforest agro-ecology. Five genera *Meloidogyne, Pratylenchus, Rotylenchulus, Hoplolaimus* and *Helicotylenchus* occurred more frequently than the other genera. These findings corroborate the reports of Caveness, (1967); Adamson *et al.* (1975); Starr *et al.* (2005) and Adegbite *et al.* (2008) who reported association of these plant parasitic nematodes with kenaf. The widespread occurrence of these nematodes in kenaf based systems indicates that the nematodes may be economically important in kenaf production. Post-crop soil samples contained more population of plant parasitic nematodes than pre-crop soil samples from the three agro-ecologies. While *Meloidogyne* species for instance may be higher than *Pratylenchus* species in one agroecology, *Pratylenchus* species may have higher population density in another agro-ecology. This indicates that, nematode genera differ in their response to existing agro-ecological field conditions. Similar observations were reported by Schmitt and Norton, (1972); Starr *et al.* (2005) and Adegbite *et al.* (2008). Effective monitoring and control of these plant

Table 1. Plant parasitic nematode genera population from pre-planting and post-harvest 200 ml soil samples from Ibadan, Ilora and Kishi.

	IBADAN				ILORA				KISHI			
	2015		2016		2015		2016		2015		2016	
Nematode Genera	**Pre Crop**	**Post Crop**	**Pre Crop**	**Post Crop**	**Pre Crop**	**Post Crop**	**Pre Crop**	**Post Crop**	**Pre Crop**	**Post Crop**	**Pre Crop**	**Post Crop**
Pratylenchus spp	315±5	1135±10	486±5	1352±3	300±5	1235±2	1685±2	1685±2	328±5	1512±5	402±5	1690±2
Helicotylenchus spp	310±10	985±5	505±2	1450±5	450±1	1455±3	501±1	2110±5	405±3	2100±10	435±2	2450±1
Tylenchus spp	105±2	140±5	215±4	298±5	89±6	238±5	210±10	487±5	106±5	208±2	150±2	438±5
Aphelenchoides spp	86±5	132±10	105±10	215±5	132±2	286±3	195±4	406±5	148±4	384±1	184±5	481±2
Hemicriconemoides spp	-	-	-	-	415±8	1214±5	381±5	1531±10	428±5	1838±2	480±1	2000±5
Xiphinema spp	22±1	45±2	55±3	68±5	75±5	198±2	210±5	439±2	186±2	389±5	285±5	521±1
Croconemoides spp	45±5	87±5	101±2	186±3	85±2	142±5	99±2	185±1	90±1	176±2	102±5	386±5
Trichodorus spp	-	-	-	-	305±2	998±4	409±5	1501±5	410±5	1818±1	450±10	2110±5
Hirschmanniella spp	-	-	-	-	120±1	845±5	205±5	426±6	250±4	532±2	305±1	685±6
Paratylenchus spp	254±5	438±10	385±5	1222±5	305±1	1488±5	387±5	1732±10	381±1	1721±5	401±2	1991±1
Meloidogyne spp	432±2	1345±5	535±10	1456±2	415±5	1650±8	503±2	2010±5	425±2	1989±1	480±2	2011±5
Rotylenchulus spp	385±5	1265±10	586±5	1600±5	403±6	1962±5	538±5	2115±8	430±5	2010±2	445±2	2350±3
Hoplolaimus spp	305±2	1468±5	450±4	1780±7	311±5	1987±5	498±3	1981±5	380±10	1970±5	408±5	2117±2
Scutellonema spp	175±10	285±5	388±2	598±5	273±2	631±1	302±5	698±2	238±1	589±5	385±1	816±2
Longidorus spp	125±5	195±2	197±5	387±1	110±5	305±10	286±5	602±2	285±10	715±2	302±5	732±5
Paratrichodorus spp	102±10	186±5	198±2	411±8	158±5	451±5	382±1	983±5	398±5	1100±2	488±1	1235±6
Tylenchorhynchus spp	85±5	192±2	100±2	345±5	88±1	235±5	102±5	413±6	132±6	528±5	200±2	635±5
Aphenlenchus spp	42±15	65±5	75±10	135±2	100±6	250±10	239±5	583±2	385±8	834±2	489±3	1805±4

parasitic nematodes in kenaf fields in temperate regions have resulted in significant yield increase (Starr *et al.,* 2005).

As the intensity of kenaf cultivation increases, population of plant parasite nematodes increases. This allows an analysis of the sustainability of intensified kenaf cropping systems and a delineation of risk areas/systems for nematode increases to pest status. The probable reason for more plant parasitic nematode in both derived and Northern Guinea Savannah agro-ecologies than in the humid rain forest was due to practice of irrigation which maintained high population of plant parasitic nematodes the year round as long as suitable host crops persists. Moreover, many of the plant parasitic nematodes encountered in this work are not specific to kenaf some of them have been recorded on other crops in Nigeria (Caveness, 1967).

In moving crop yields towards an efficiency frontier, optimal pest and disease management will be essential, especially as the proportional production of some commodities steadily shifts. With this in mind, it is essential that the full spectrum of crop production limitations is considered appropriately including often over looked nematode constraints. The vision of the Agricultural Transformation Agenda (ATA) strategy is to achieve a hunger free Nigeria through an agricultural sector that will drive income growth, accelerate achievement of food and nutritional security, generate employment and transform the country into a leading player in global food markets to grow wealth for millions of farmers. The primary objective of the ATA is value adding, a much needed development in the agricultural sector. The focus is expected to be on the value chains of ten crops; cassava, rice, sorghum, kenaf, cotton, cocoa, tomato, onion, soybean and maize, as well as livestock and fisheries. Unfortunately, all the ten crops are susceptible to plant parasitic nematodes. Therefore, nematode disease management, a practice whereby phytopathogenic nematode populations are maintained a level that do not cause economic losses, is imperative for us to achieve the goal of the agricultural transformation in Nigeria.

Plant parasitic nematode management strategies are targeted at preventing nematode population multiplication and hence protect the crop from damage. In the absence of nematicides, the growing of resistant varieties is the most cost-effective and successful means of management.

Combined with knowledge of the biology life-cycle, and the effects of cultural practices like crop rotation, organic amendment, growing resistant cultivars may minimize the effect of plant parasitic nematodes.

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