Survey and Effects of Plant Parasitic Root Nematodes of Cashew (*Anacardium occidentale*) in South-Eastern - Nigeria

C.M. Agu
Department of Crop Science and Technology, Federal University of Technology, Owerri
P.M.B. 1526, Imo State, Nigeria, cmagu2001@yahoo.com

Abstract: Plant parasitic root nematodes of cashew were surveyed in Southeastern Nigeria. Five thousand, one hundred and twenty cashew trees were sampled and nematodes in their rhizospheres extracted by modified Cobb's decanting and sieving technique. Pure cultures of the nematodes were further inoculated on 30 days old cashew seedlings. This was for pathogenicity test and effect on cashew growth. Five genera and eleven species of plant parasitic root nematodes showed association with cashew trees in Southeastern Nigeria. Based on degree of virulence, frequency of occurrence and population density; the genera *Xiphinema spp, Scutellonema spp* and *Criconemella spp* were most important. *Triphorus spp* and *Rotylenchulus spp* caused no appreciable damage. [The Journal of American Science. 2007;3(2):50-54]. (ISSN: 1545-1003).

Keywords: Cashew, nematode, genera, virulence, frequency and density.

INTRODUCTION:

Unthrifty cashew (*Anacardium occidentale*) growth due to disease and insect attacks cause poor apple and nut yields (Ohler, 1988). Such cashew trees in afforestation scheme especially in erosion prone escarpments are unuseful. Damage caused on the crop by fungi, bacteria, viruses, insects and higher animals have been variously reported (Castro, 1977; Olunloyo, 1978). Only limited information exist on nematode attack on cashew in Southeastern Nigeria. This study therefore surveyed and considered the effects of root nematodes of cashew in Southeastern Nigeria.

MATERIALS AND METHODS

Nematode Survey:

Cashew root nematodes were surveyed during the rainy seasons (April – September) of 2004 and 2005 in Uturu, Oghe, Uboloeke, Umunneochi and Ogbodoaba. These locations represented the agro-ecological zones in Southeastern Nigeria where cashew is grown as a cash crop. Four cashew plantations (two exhibiting healthy, and two exhibiting poor growth) were selected in each location and 40 trees randomly sampled in each plantation.

On 4 cardinal directions, rhizosphere samples were collected separately at 0.5 and 1.0m from each tree base and at 15-30cm depth. Three hundred and twenty (320) samples were collected from each plantation and 1280 from each location. Five hundred cubic decimeter ($500dm^3$) rhizosphere per sample were processed as recommended by Hooper (1990) and nematodes extracted by modified Cobb's decanting and sieving technique (Flegg, 1967). Nematodes recovered were identified based on their morphology, anatomy and biology (Mitchel *et al*, 1990). Nemadode populations were counted in 10ml distilled water suspension in Doncaster's counting dish (Doncaster, 1962) and a mean of 3 counts taken in each case.

Relative density (nematode number per unit volume of soil); absolute frequency (rate of occurrence); relative frequency; prominence and importance values of the different nematodes were calculated according to Norton (1978) in which:

$$\text{Relative density} = \frac{\text{no of individuals of a species in a sample}}{\text{total no of individuals in a sample}} \times 100$$

$$\text{Absolute frequency} = \text{absolute frequency of a species}$$

$$\text{Relative frequency} = \frac{\text{sum of frequency of all species}}{} \times 100$$

$$\text{Prominence value} = \frac{\text{no of samples containing a species}}{\text{no of samples collected}} \times 100$$

$$\text{Importance value} = \text{relative frequency} + \text{relative density} + \text{Density} \times \sqrt{\text{absolute frequency}}$$

relative biomass.

Pathogenicity Tests:

Pure cultures of X*iphinema spp; Criconemella spp, Scutellonema spp, Trophorus spp* and *Rotylenchulus spp* obtained from surveyed plantations were maintained on cotton, sweet potato, pearl millet, cocoa and *Cynodon dactylon* respectively for 180 days. Infested soils from these crops' rhizosphere were processed for nematodes inocula according to Barker (1985). Cashew seedlings (30 days old) each potted in 5kg steam sterilized soil mixture (2 parts fine river sand + 3 parts top-forest soil) were inoculated with 500, 1000, and 1,500 infective larvae of each nematode genera with five replications. The controls received no nematode inoculations. Seedling heights of both inoculated and controls were measured before inoculation. Sulphate of ammonia and superphosphate fertilizers at 200 and 300gm per plant respectively were applied 5-10cm deep and 15cm from seedling base (Ohler, 1988). Both inoculated and uninoculated cashew seedlings were maintained in the greenhouse at 25 ± 1^0C for 210 days.

Data collected on nematode count per pot, plant heights and oven-dry weights of tops and roots were subjected to analysis of variance (Steel and Torrie, 1981) and significant differences between means were evaluated using by Least Significant Difference Method (Fisher, 1948) at P = 0.05.

RESULTS AND DISCUSSION

Five genera and eleven species of plant parasitic root nematodes found infesting cashew trees in Nigeria were *Xiphinema attorodorum, X. index, X. elongatum, Scutellonema brachyurus, S. siamense, Criconemella axestis, C. onoensis, C. xenoplax, C. sphaerocephala, Rotylenchulus reniformis* and *Trophorus imperialis*. The geographical distribution of these nematodes in Southeastern Nigeria are as shown in table 1. Relative density and absolute frequency of *Xiphinema spp* were significantly higher than those of other genera. Next were those of *Criconemella spp* and *Scutellonema spp*. *Trophorus imperialis* gave least relative density and absolute frequency.

The prominence and importance values of *Scutellonema spp* and *Criconemella spp* were highest and differed significantly from others. This may be due to the presence of sweet potato and *Cynodon dactylon* in the plantations which respectively are good hosts to *Scutellonema spp* and *Criconemella spp* (Hollis and Joshi, 1976 Jatala; and Bridge, 1990). Pathogenicity tests showed that *Xiphinema spp; Criconemella spp* and *Scutellonema spp* caused significant reductions in cashew seedling growth at all levels of inoculation (Table 2). The population build-up of these nematodes was also quite significant. These demonstrate the importance of these three nematode genera in cashew production. An inverse relationship also occurred between inoculum levels of the nematodes and seedling growth.

T. imperialis and *R. reniformis* may not be threats to cashew production in Nigeria. This is because *T. imperilis* caused no appreciable damage to cashew seedlings and *R. reniformis* caused significant reduction in seedling growths only at it's highest inoculum level of 1,500 infective larvae per plant.

Table 1. Distribution of plant parasitic nematodes associated with Cashew in Southeastern Nigeria

Nematode Species	Location				
	Uturu	Oghe	Uboloeke	Ogbodoaba	Umunneochi
Xiphinema index	++	++	++	++	++
X. attorodorum	+++	++	+++	++	++
X. elongatum	+++	+++	++	+++	++
Criconemella axestis	+++	++	+++	++	+++
C. onoensis	++	++	++	++	+
C. xenoplax	++	++	++	++	+
C. sphaerocephala	O	++	++	+++	+
Scutellonema brachyurus	++	++	++	+++	+++
S. siamense	++	+++	++	++	++
Rotylenchulus reniformis	+	+	O	++	++
Trophorus imperilais	++	O	+	+	O

O = not recorded; + = present in survey; ++ = common; +++ = widespread.

Table 2. Effects of different plant parasitic nematode genera on seeding growths of cashew

		Mean nematode count pot^{-1} (juvenile & eggs)		Mean Seedling heights (cm)		Mean dry weights (gm)	
Nematode genus	Inoculum level (Larvae plant^{-1})	Soil	Root	Before inoculation	210 days after inoculation	Top	Root
	500	1153	0	9.94	41.72	10.6	7.4
	1000	1832	1	9.08	32.19	7.1	4.4
Xiphinema spp	1,500	2730	2	10.11	30.12	6.9	4.2
	Control	0	0	10.02	52.15	14.1	11.2
	FLSD 0.05	486	0.2	n.s	8.60	2.2	1.8
	5000	1232	0	10.14	4216	11.2	8.1
	1000	2146	1	10.03	27.21	6.1	3.8
Criconemella spp	1,500	2316	3	9.33	26.78	5.8	3.7
	Control	0	0	9.64	50.32	14.9	11.8
	FLSD0.05	424	0.3	n.s	6.72	1.6	1.4
	500	1458	28	12.14	43.26	12.1	5.6
	1000	2351	30	10.21	28.11	5.9	3.9
Scutellonema spp	1,500	2733	34	10.36	27.01	6.1	3.2
	Control	0	0	11.04	51.22	15.3	11.1
	FLSD0.05	501	5.6	n.s	6.04	1.8	2.1
	500	1012	0	11.01	48.38	13.8	10.8
	1000	1425	1	10.11	47.61	13.2	11.7
Rotylenchulus spp	1,500	1858	2	9.0	18.96	3.5	2.3
	Control	0	0	9.723	49.01	14.2	10.9
	FLSD0.05	297	0.2	n.s	5.81	2.7	1.9
	500	811	0	9.93	50.00	14.2	10.9
	1,000	1214	0	9.62	49.12	13.8	12.3
Trophorus spp	1,500	1902	1	10.02	48.60	14.0	11.7
	Control	0	0	10.01	49.30	13.4	11.5
	FLSD0.05	305	0.01	n.s.	n.s.	n.s.	n.s.

References

1. Barker, K.R. (1985). Nematode extraction and bioassays. An advanced treatise on Meloidogyne. Methodology: 2:19-38.
2. Castro, Z. B. (1977) Diplodium anacardiacearum Batista and Cavalcante, uma nova doenca do cajueiro (*Anacardium occidentale* L.) no Estado de Ceara (1), Fitossanidade (Brazil) 2, 1, p.24.
3. Doncaster, C. C. (1962). A counting dish for nematodes. Nematologica, 7: 334-336.
4. Fisher, R. A. (1948*). Statistical labels for biological, agricultural and medical research.* Oliver and Boyd, Edinburgh and London:
5. Flegg, J. J. M. (1967). Extraction of *Xiphinema* and *Longidorus* species from soil by a modified Cobb's decanting and sieving technique. Annals of Applied Biology, 60: 439 – 437.
6. Hollis, J. P. and Joshi, M. M, (1976). Weed effect on chemical control of ring nematodes of rice. Annual Proceedings of the American Phytopathological Society, pp: 44-45.

7. Hooper, D. J. (1990). Extraction and processing of plant and soil nematodes. In M. LUC, R. A, Sikora and J. Bridge (eds) Plant parasitic nematodes in aub-tropical and tropical agriculture. CAB International pp:45-64.
8. Jatala, P, and Bridge, J. (1990). Nematode parasites of root and tuber crops. In M. Luc, R. A. Sikora and J. Bridge (eds) Plant parasitic nematodes in sub– tropical and Tropical Agriculture. CAB international 1990. 137 – 180.
9. Mitchel, L., David, J. H. and Janet, E. M. (1990). Morphology, anatomy and biology of plant parasitic nematodes. In M. Luc, R. A. Sikora and J. Bridge (eds). Plant parasitic nematodes in Sub – tropical and tropical agriculture. CAB International Pp: 1-44.
10. Norton, D. C. (1978). *Ecology of plant – parasitic nematodes.* Wiley, New York.
11. Ohler, J. G. (1988) Cashew growing. Tropical Abstracts, Netherlands, 21, 9p.
12. Olunloyo, O. A. (1978). The relation of sugary exudates and insects to fungal infection of developing cashew (*Anacardium occidentale*) in the plantation. Plant Disease Reporter, 62,(5): 416 -420.
13. Steel, R. G. O, and Torrie J. H. (1981). Principles and procedures of statistics, 2nd edn. McGraw – Hill, Beak Coy, New York.