Agricultural Journal 7 (6): 405-407, 2012
ISSN: 1816-9155

Distribution and Effect of Plant-Parasitic Nematodes Associated with Cashew in North Central-Nigeria

Samuel B. Orisajo
Plant Pathology Section, Crop Protection Division,
Cocoa Research Institute of Nigeria, P.M.B. 5244, Ibadan, Nigeria

Abstract: Roots and soil were sampled for the presence of plant-parasitic nematodes from seven selected locations in North Central Nigeria noted for cashew production. Ten genera of plant-parasitic nematodes were found associated with cashew in North Central Nigeria. *Meloidogyne* sp., *Helicotylenchus coffeae* and *Radopholus* sp., were widespread in all the locations while *Rotylenchulus reniformis* was recorded only in Ochaja, Ayingba and Ejule. There were significant reduction in the height of cashew seedlings inoculated with root-knot nematodes, *Meloidogyne incognita*, in the nursery. Therefore, pre-planting sampling strategies should be taken to predict the impact of the nematode populations and enable preventive measures to be taken, most especially at the seedlings stage.

Key words: Cashew, plant-parasitic nematodes, *Meloidogyne incognita*, *Radopholus* sp., Nigeria

INTRODUCTION

Cashew, *Anacardium occidentale* L., is an important commodity cash crop which grows in most agroecological zone of Nigeria, right from the coast in the South to the sub-desert areas of the North (Topper *et al*., 2001). It has tremendous potential as a cash crop to generate foreign exchange, create employment to curb desertification in the Northern states while ornamental and alley trees are used to prevent soil erosion by protecting the watersheds and dams in the South (Adejumo, 2010).

Limited information on nematodes attacking cashew exists. High populations of *Criconemoides* sp., *Xiphinema* sp. and *Scutellonema* sp., have been found around unthrifty trees in Brazil and da Ponte recognized Xifinematose caused by *X. index* as one of the more common diseases of cashew in North-East Brazil, although data on its economic impact are lacking. A review of cashew diseases in Brazil concluded that nematodes supported by the plant cause no evident damage (Freire *et al*., 2002). *Rotylenchulus reniformis*, apparently in its migratory form, was reported from around cashew trees in Costa Rica but again, evidence of damage is unclear (Lopez and Salazar, 1987). *Hemicycliophora attapadii* was described from the cashew rhizosphere in India. Therefore, the study was undertaken to survey and consider the effects of plant-parasitic nematodes on cashew in selected locations of Nigeria.

MATERIALS AND METHODS

Nematode survey: Nematological surveys were carried out in selected locations in North Central-Nigeria noted for cashew production. These locations include: Ochaja, Ayingba, Ejule, Kabba, Okene (Kogi state), Ibadan (Oyo state) and Oro (Kwara state). Soil and root samples were collected from the rhizosphere region about 50-70 cm from the base of the plants and at a depth of 20 cm.

Processing of soil and root samples: Aliquots of 250 cm^3 sub-sample soil from 500 cm^3 each composite sample were assayed for nematodes by sieving and decanting (Cobb, 1918). After decanting, the sediment was assayed for nematodes using the Whitehead and Hemming (1965) tray modification of Baermann's technique as described by Coyne *et al*. (2007). The root samples were washed, pooled, chopped into approximately 1 cm pieces and thoroughly mixed. A 5 g sub-sample was put in 100 mL water in a kitchen blender. The root was macerated 3 times for 10 sec, separated by 5 sec intervals and the nematodes were extracted from the resulting homogenate using Sieve Method (Speijer *et al*., 1997). The nematode suspension was diluted with water in a graduated cylinder to 10 mL.

Prior to counting, solution containing nematodes were agitated thoroughly and nematode populations were determined in 1 mL distilled water suspension in a counting dish (Doncaster, 1962) under a stereomicroscope and expressed per 250 cm^3 soil or 5 g roots. A mean of 3 counts was taken in each case. Nematodes were transferred with an eye lash picker to a slide with a drop of water, covered (with a cover slip) and examined under a compound microscope with a 40, 60 and 100 X objective for identification using taxonomic keys (Hunt *et al*., 2005)

and counted. The identification and counting was repeated 3 times and mean population of nematodes/sample calculated.

Pathogenicity tests: Cashew seedlings collected from the locations were allowed to stabilize in the sreenhouse for 2 weeks and thereafter subjected to pathogenicity tests. The pots with the cashew seedlings were inoculated with 5,000 *Meloidogne incognita* eggs obtained from the pure culture on the roots of *Celosea argentea* using Hussey and Barker (1973)'s Sodium Hypochlorite (NaOCl) Method. Uninoculated units served as control. Normal watering of seedlings as obtains in coffee nurseries was carried out. Fortnightly, growth parameters such as plant height, stem girth and numbers of leaves were recorded. The experiment was terminated 24 weeks after inoculation. To assess infection the roots were carefully freed of soil, washed under a gentle stream of tap water, mopped and galls counted using a hand lens at 3-5 X magnification. Root galling was assessed using the 0-5 gall index (Sasser *et al*., 1984). Nematode eggs were collected from each root system using Sodium Hypochlorite Method (NaOCl) of Hussey and Barker (1973) and counted. Aliquots of 250 cm^3 soil samples from each pot were assayed for juveniles of *M. incognita* using the modified Baermann Technique (Coyne *et al*., 2007).

Data analysis: Prior to statistical analyses, data were checked for normality and homogeneity of variances and transformed where necessary. A log transformation [log10(x+1)] was applied to the data on nematodes (densities per 250 cm^3 soil, densities per gram root and gall index). The determination of disease incidence was based on the nematode population per root system and it was expressed by the number of egg masses and gall index. The numbers of egg masses were counted and Gall Index (GI) and Egg Mass Index (EMI) were determined on the following scale: 0 = 0; 1 = 1-2; 2 = 3-10; 3 = 11-30; 4 = 31-100 and 5 = >100 galls or egg masses per root system (Taylor and Sasser, 1978; Sasser *et al*., 1984). Reproduction factor of the nematode (Rf) = Final nematode population (pf) × initial nematode population $(pi)^{-1}$.

All data collected were subjected to analysis of variance and significant differences between means were evaluated using Least Significant Difference Method at $p<0.05$. All analyses were performed using GenStat (Version 7.1, VSN International Ltd., Lawes Agricultural Trust, Hempstead, UK).

RESULTS AND DISCUSSION

Ten genera of plant-parasitic nematodes were found associated with cashew in North Central-Nigeria. *Meloidogyne* sp., *Helicotylenchus coffeae* and *Radopholus* sp., were widespread in all the locations while *Rotylenchulus reniformis* was recorded only in Ochaja, Ayingba and Ejule (Table 1). An earlier survey of plant-parasitic nematodes associated with cashew in South Eastern-Nigeria revealed *Xiphinema*, *Scutellonema* and *Criconemella* sp., as the most important based on frequency of occurrence (Agu, 2007). The prominence and importance values of *Scutellonema* and *Criconemella* sp., were highest and differed significantly from others due to the presence of sweet potato and *Cynodon dactylon* in the plantations sampled which, respectively are good hosts to *Scutellonema* and *Criconemella* sp., (Jatala and Bridge, 1990). *Rotylenchulus reniformis* was reported from around cashew trees in Costa Rica, though evidence of damage is unclear (Lopez and Salazar, 1987).

There were significant reductions in the height of cashew seedlings inoculated with root-knot nematodes, *Meloidogyne incognita* (Table 2). Although, there were no significant differences in the number of leaves and stem girth of the seedlings between the inoculated and the control; yellow discoloration of the leaves was noticed in the inoculated plants. The nematode successfully reproduced on the cashew seedlings with tiny galls seen on the roots of the inoculated. It is important to emphasize that mature cashew trees has

Table 1: Distribution of plant-parasitic nematodes associated with cashew in selected locations of Nigeria

	Locations						
Nematode species	Ochaja	Ayingba	Ejule	Kabba	Okene	Ibadan	Oro
Meloidogyne sp.	+++	+++	+++	+++	+++	+++	+++
Helicotylenchus coffeae	+++	+++	+++	+++	+++	+++	+++
Xiphenema sp.	+++	++	++	++	++	+++	+++
Criconemoides xenoplax	o	+	+	+	++	+	+
Pratylenchus coffeae	+++	+++	+++	++	+++	++	+++
Scutellonema brachyurus	++	++	++	++	+	++	++
Hemicycliophora sp.	o	++	++	+	+	++	++
Radopholus sp.	+++	+++	+++	+++	+++	+++	+++
Rotylenchulus reniformis	+++	+++	+++	o	o	o	o
Trichodorus sp.	o	++	++	++	+	++	++

o = Not recorded; + = Present in survey; ++ = Common; +++ = Widespread

Table 2: Effect of root-knot nematode, *Meloidogyne incognita*, on some growth parameters of cashew seedlings at 24 weeks after inoculation

Cashew seedlings	Plant height* (cm)	No. of leaves (count)	Stem girth (cm)	GI/EMI (count)	Reproduction factor (Rf)(pf/pi)#
Oro series	32.70[b]	11.13[a]	0.81[b]	3/3	8.1
Control	38.54[a]	10.14[a]	0.80[a]	-	-
CRIN series	33.65[b]	10.54[a]	0.82[b]	3/3	7.6
Control	39.12[a]	11.14[a]	0.82[a]	-	-

*Means followed by the same letter in the same column are not significantly different ($p<0.05$); pf = Final nematode population; pi = Initial nematode population; GI = Gall Index; EMI = Egg Mass Index

been shown clearly to be highly resistant to different populations of the root-knot nematodes in West Africa and in Brazil but the seedlings are susceptible to the nematode.

CONCLUSION

From the study, pathogenicity tests showed that *Xiphinema*, *Criconemella* and *Scutellonema* sp., also caused significant reductions in cashew seedling growth at all levels of inoculation (Agu, 2007). Therefore, pre-planting sampling strategies should be taken to predict the impact of the nematode populations and enable preventive measures to be taken, most especially, at the seedlings stage.

ACKNOWLEDGEMENT

The technical assistance of Mr. Tunde Ogundeji and Mrs. Adeji of the Plant Pathology Laboratory, Cocoa Research Institute of Nigeria, Ibadan is well appreciated.

REFERENCES

Adejumo, T.O., 2010. Effect of NPK fertilization on yield and inflorescence blight of cashew (*Anacardium occidentale*). J. Agric. Biotechnol. Sust. Dev., 2: 66-70.

Agu, C.M., 2007. Survey and effects of plant parasitic root nematodes of Cashew (*Anacardium occidentale*) in South-Eastern-Nigeria. J. Am. Sci., 3: 50-54.

Cobb, N.A., 1918. Estimating the mean population of the soil. Agricultural Technical Circular Bureau of Plant Industries, United States Department of Agriculture, pp: 48.

Coyne, D.L., J.M. Nicol and B. Claudius-Cole, 2007. Practical Plant Nematology: A Field and Laboratory Guide. IITA, Cotonou, Benin, Pages: 84.

Doncaster, C.C., 1962. A counting dish for nematodes. Nematologica, 7: 334-337.

Freire, F.C.O., J.E. Cardoso, A.A. dos Santos and F.M.P. Viana, 2002. Diseases of cashew nut plants (*Anacardium occidentale* L.) in Brazil. Crop Protection, 21: 489-494.

Hunt, D.J., M. Luc and R.H. Manzanilla-Lopez, 2005. Identification, Morphology and Biology of Plant Parasitic Nematodes. In: Plant Parasitic Nematodes in Subtropical and Tropical Agriculture, 2nd Edn. Luc, M., R.A. Sikora and J. Bridge (Eds.). CAB International, ISBN-13: 9787-1-84593-056-1, pp: 11-52.

Hussey, R.S. and K.R. Barker, 1973. A comparison of methods of collecting inocula for *Meloidogyne* sp. including a new technique. Plant Dis. Rep., 57: 1025-1028.

Jatala, P. and J. Bridge, 1990. Nematode Parasites of Root and Tuber Crops. In: Plant Parasitic Nematodes in Sub-Tropical and Tropical Agriculture, Luc, M., R.A. Sikora and J. Bridge (Eds.). CAB International, UK., pp: 137-180.

Lopez, R. and L. Salazar, 1987. Observations on the spatial distribution of plant-parasitic nematodes in fruit trees. Agronomia Costarricense, 11: 141-147.

Sasser, J.N., C.C. Carter and K.M. Hartman, 1984. Standardization of Host Suitability Studies and Reporting of Resistance to Root Knot Nematodes. Dept. of Plant Pathology, North Carolina State University, Raleigh, N.C., USA., pp: 7.

Speijer, P.R., D. De Waele and R. Fogain, 1997. Screening of Musa Germplasm for Resistance and Tolerance to Nematodes. IITA, France, ISBN: 9782910810160, Pages: 47.

Taylor, A.L. and J.N. Sasser, 1978. Biology, identification and control of root knot nematode (*Meloidogyne* sp.). Cooperative Public Department Plant Pathology North Carolina State University and USAID, Raleigh NC 111.

Topper, C.P., P.D.S. Caligari, M. Camara, A. Diaoyaha and F. Coulibay *et al*., 2001. West African regional cashew survey report Guinea. Guinea-Bissau, Cote d'Ivoire, Ghana and Nigeria. Sustainable Tree Crop Programme (STCP) and Biohybrids Agrisystem Ltd. UK., pp: 110.

Whitehead, A.G. and J.R. Hemming, 1965. A comparison of some quantitative methods of extracting small vermiform nematodes from soil. Ann. Applied Biol., 55: 25-38.