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Survey of Plant-Parasitic Nematodes in the Benue Valley of Adamawa State, Nigeria

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Abstract: A field survey was carried out between 2005 and 2007 at the Benue valley for plant –parasitic nematodes. The area lies between latitude 7 and 11^0 N and longitude 11 and 14^0E. It is also within the northern Guinea savanna zone of Nigeria with annual rainfall between 700-1600 mm. The area is mostly cultivated for vegetables such as onion, pepper, cabbage and cerals such sorghum. Soil and plants were analysed for nematodes. The results from soil analysis and perineal patterns reveals the presence of six genera namely-*Meloidogyne* sp. (*M. javanica* and *M. incognita*), *Pratylenchus* sp., *Helicotylenchus* sp., *Longidorus* sp. and *Scutellonema* sp. Weeds such as Vernona and Polygonum were also found to be infected by these nematodes. The result also indicated that *Meloidogyne* sp. were the most widespread. The heavy population of nematodes affects vegetable production in the area and hence there is need to step up control measures.

Key words: Plant-parasitic, nematodes, Benue valley, soil and plants, Adamawa state

INTRODUCTION

Adamawa state is located in the north eastern part of Nigeria. It lays between latitude 7 and 11^0N and longitude 11 and 14^0E. It is also within the northern Guinea savanna zone of Nigeria with annual rainfall between 700-1600 mm (Adebayo, 1997). The Benue valley is utilized by farmers for the cultivation of crops under rain fed, irrigation and residual moisture during the dry season. The floodplains (fadama) are under serious pressure as land available for irrigation and residual moisture is becoming scarce as a result of other human activity such as building of structures.

The continuous cultivation of this area in both wet and dry season led to the build-up of pests and diseases which affected crop productivity. Nematodes are one of the major root pests that affect crop production and yields may be affected (Sasser, 1980). Nematodes survey in the area has not been carried out over two decades. The last survey in the area was carried out by Idowu (1981a, b). Although, earlier surveys were carried out by Bridge (1972) and Smith (1975), it did not cover the whole valley where vegetables crops are presently grown. The farmers living in this area produce vegetable crops like tomato and cereal crops such *Sorghum bicolar* sp. *masakwa* (a type of *Sorghum* grown under residual moisture) which generate a lot of income to them. An average of 4000 ha is put under cultivation in this area every year (AADP, 1992). The continuous cultivation of this area with vegetables and some cereals which are susceptible to nematodes form the basis of this research.

MATERIALS AND METHODS

Survey area: The area surveyed were the flood plains of the Benue valley of Adamawa state, Nigeria between 2005 and 2007. The areas surveyed were Dasin, Gyawana, Lamurde and Geriyo flood plains. The survey was conducted using the methods described by Idowu (1981a). Soil from each survey site was collected at a depth of 0-15 cm and analysed for chemical and physical properties in the soil science laboratory, Federal University of Technology, Yola. Plots of size 2×2 m^2 at the survey area were planted to pepper tomato and egg plant to observe the level of infection by nematodes. Plots were arranged in a completely randomized block design and replicated three times. Each crop was allocated three plots in each survey area. Thus given a total of nine plots/surveyed area. Plots were planted with local varieties of these crops obtained from the local farmers and irrigated twice weekly up to termination of the experiment at end of 90 days. Soils from various farmers' plots in the survey area were sampled for nematodes every year. Five hundred cubic centimeter of soil were

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sampled at depth of 0-15 cm. Soil samples from same plots were pooled, thoroughly mixed before taken 500 cm^3 of the representative sample for nematode extraction using Cobbs sieving and decanting method with Bearmann techniques (Southey, 1986). The nematode suspensions were collected from the funnels. Separate water suspensions of the nematodes were gently stirred to make a homogeneous suspension and then 5 mL were transferred to the counting dish and nematodes were identified using Siddiqui (1986) methods and counted under the microscope. On the average five counts were made in each case. Four crop plants and weeds from the experimental plots were gently uprooted, washed with water in a bucket and roots were stained with 0.5% acid fuchsine in lacto-glycerol (Bridge, 1972) before galls were rated using the rating scheme described by Sasser *et al.* (1984). Sterilised screen house experimental soil from each of the survey areas was assayed with susceptible tomato (Samtom 7) and pepper plants using 20 cm diameter perforated plastic pots. Potted plants were gently uprooted and washed with water in a plastic bucket. Females of *Meloidogyne* sp. extracted from the roots were used for perennial pattern. All data collected were subjected to analysis of variance and Duncan's multiple range test was used to separate means at 5%.

RESULTS AND DISCUSSION

The results of the survey of nematodes in the Benue valley in Adamawa state Nigeria between 2005 and 2007 are presented in Table 1-5. The results of the physico-chemical characteristics of the soil of the survey area showed that Dasin, Geriyo, Gyawana and Lamurde are clayey-loam, while Ngurore site is sandy-loam (Table 1). The soil also had similar temperature regimes ranging between 31-32°C. The high temperature regimes tend to favour the increased in population of nematodes recorded in all the survey sites especially root-knot nematodes (*Meloidogyne* sp.). Adesiyan *et al.* (1990) reported that temperature regimes of 25°C and above favours the generation time, egg hatch, nematode mobility, penetration, growth, reproduction and survival of root-knot nematodes especially *Meloidogyne javanica*.

The crop plants sampled from all the survey sites indicated heavy galling of vegetable crops grown in the area especially tomato plants. The result also indicated that pepper and okra were heavily galled at Dasin site as compared with other sites (Table 2). The result indicated that these vegetable crops are suitable host to the nematodes and this resulted in the heavy galling of roots. The result of the study also indicated that the cereal crops (*Sorghum* and maize) grown in all the sites were poorly galled and this shows low level of infection by nematodes (Table 3). The result also suggests that the cereal crops grown in the study area were poor host to these nematodes. All the weeds sampled showed various degree of galling. Weeds sampled from Dasin site showed heavy galling as compared with other sites (Table 4). The result tend to suggest that the weeds sampled serve as alternative host to the nematodes in the absence of suitable host such as tomato crops.

The population of nematodes recorded from the various survey sites and perennial patterns indicated six nematode genera were identified. They include *Meloidogyne* (M. javanica and M. incognita), Pratylenchus, Helicotylenchus, Longidorus, Xiphinema and Scutellonema (Table 5). These nematodes were found to be associated with tomato, pepper, onion, garden egg, okra, maize, sorghum and some weeds (Table 4 and 5). There were significant difference between *Meloidogyne* sp. and the other species of nematodes in all the survey sites (Table 5). Dasin site recorded the highest population of *Meloidogyne* sp., followed by *Pratylenchus* sp. and *Scutellonema* sp. as compared with other sites (Table 5). As with most survey of nematodes in northern Nigeria (Bos, 1978; Bridge, 1972; Omiyi, 1976; Wilson, 1962) *Meloidogyne* sp. have been found to be most widespread especially in irrigated Benue valley because of their wide host ranges. The result also indicated that the presence of a variety of host plants at the survey site tend to favour the increased in the population of *Meloidogyne* sp. throughout the study period 2005 to 2007. The result is similar to those obtained by Idowu (1981a,b), Bos (1976), when they survey the irrigated plants of northern Nigeria. The presence of these nematodes means that there is the need to step up nematode control measures. Farmers are currently experiencing low yields as a result of heavy

Table 1: Physico- Chemical characteristics of the survey area in the Benue valley Adamawa state-Nigeria

Area moisture	Temp. °C	Field texture	P^H	Carbon %	Organic (%) meq $100g^{-1}$	EC level
Dasin	32	Clay-loam	6.2	1.74	3.01	0.20
Geriyo	32	Clay-loam	6.1	1.50	3.51	0.27
Ngurore	31	Sandy-loam	6.8	1.77	2.61	0.22
Gyawana	32	Clay-loam	6.2	1.69	3.57	0.29
Lamurde	32	Clay-loam	6.3	1.65	3.06	0.20

Table 2: Means of galling index of vegetables in the Benue valley of Adamawa state-Nigeria between 2005 and 2007

Infected plants	Location	Galling index
Tomato (*Lycopersicon esculentum*)	Dasin	5.0[a]
	Geriyo	5.0[a]
	Ngurore	4.0[a]
	Gyawana	4.0[a]
	Lamurde	4.0[a]
Pepper (*Capsicum annum*)	Dasin	5.0[a]
	Geriyo	3.0[b]
	Ngurore	3.0[b]
	Gyawana	4.0[a]
	Lamurde	4.0[a]
Onion (*Allium cepa*)	Dasin	4.0[a]
	Geriyo	1.0[c]
	Ngurore	1.0[c]
	Gyawana	1.0[c]
	Lamurde	1.0[c]
Okra (Hibiscus esculentus)	Dasin	4.0[a]
	Geriyo	1.0[c]
	Ngurore	1.0[c]
	Gyawana	1.0[c]
	Lamurde	1.0[c]
Egg plant (Solanum mlongena)	Dasin	4.0[a]
	Geriyo	4.0[a]
	Ngurore	3.0b
	Gyawana	1.0[c]
	Lamurde	1.0[c]

Means in the same column with same letters are not significantly different according to Duncans multiple range test at 5%

Table 3: Means of galling index of cereal crops in the Benue valley of Adamawa state-Nigeria between 2005 and 2007

Infected plants	Location	Galling index
Sorghum (*Sorghum bicolar*)	Dasin	1.0[a]
	Geriyo	1.0[a]
	Ngurore	1.0[a]
	Gyawana	1.0[a]
	Lamurde	1.0[a]
Maize (*Zea mays*)	Dasin	2.0[b]
	Geriyo	2.0[b]
	Ngurore	2.0[b]
	Gyawana	1.0[a]
	Lamurde	1.0[a]

Means in the same column with same letters are not significantly different according to Duncans multiple range test at 5%

Table 4: Means of galling index of weed plants in the Benue valley of Adamawa state-Nigeria between 2005 and 2007

Infected plants	Location	Galling index
Vernona nesta	Dasin	3.0[a]
	Geriyo	3.0[a]
	Ngurore	1.0[b]
	Gyawana	1.0[b]
	Lamurde	1.0[b]
Vernonia pauciflora	Dasin	4.0[a]
	Geriyo	4.0[a]
	Ngurore	1.0[b]
	Gyawana	1.0[b]
	Lamurde	4.0[a]
Polygonim laigarum	Dasin	2.0c
	Geriyo	2.0[c]
	Ngurore	2.0[c]
	Gyawana	1.0[b]
	Lamurde	2.0[c]
Leucas martinicensis	Dasin	4.0[a]
	Geriyo	3.0[a]
	Ngurore	3.0[a]
	Gyawana	2.0[c]
	Lamurde	2.0[c]

Means in the same column with same letters are not significantly different according to Duncans multiple range test at 5%

Table 5: Means of plant parasitic nematodes population recovered from area surveyed soil (500cm ^{3}) at the Benue valley of Adamawa state-Nigeria during 2005 and 2006 surveys

	DS			LG		
Nematode Sp.	2005	2006	2007	2005	2006	2007
Meloidogyne	2311[a]	2672[a]	3451[a]	2111[a]	2320[a]	2989[a]
Pratylenchus	1060[b]	1120[b]	1170[b]	2087[a]	2225[a]	2611[b]
Helicotylenchus	276[c]	315[c]	521[c]	262[b]	285[b]	360[c]
Longidorus	213[d]	226[d]	371[d]	311[c]	335[c]	415[d]
Xiphinema	115[e]	201[d]	231[e]	122[d]	130[d]	170[e]
Scutellonema	109[e]	225[d]	265[e]	179[d]	198[e]	205[f]
	NGU			GY		
Nematode Sp.	2005	2006	2007	2005	2006	2007
Meloidogyne	2065[a]	2370[a]	2678[a]	1172[a]	1830[a]	2116[a]
Pratylenchus	3051[b]	3371[b]	3621[b]	2651[b]	2981[b]	3191[b]
Helicotylenchus	475[c]	522[c]	781[c]	201[c]	251[c]	203[c]
Longidorus	621[d]	675[d]	915[c]	223[c]	201[d]	237[c]
Xiphinema	119[e]	213[e]	220[d]	106[d]	115[d]	98[d]
Scutellonema	79[f]	106[e]	115[e]	117[d]	223[d]	162[e]

	LD		
Nematode Sp.	2005	2006	2007
Meloidogyne	2365[a]	2411[a]	2671[a]
Pratylenchus	3615[b]	3320[b]	3311[b]
Helicotylenchus	211[c]	251[c]	247[c]
Longidorus	115[d]	203[d]	221[c]
Xiphinema	106[d]	115[d]	102[d]
Scutellonema	86[d]	98[c]	76[e]

Means in the same column with same letters are not significantly different according to Duncans multiple range test at 5%

infestation of these soils by nematodes. Cultural and chemical control measures should be step up in these areas to avoid crop failures by farmers. There is also the need to enlighten the farmers in these areas about the threat the nematodes pose their crops.

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