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Varietal response of African yam bean, *Sphenostylis stenocarpa* (Hochst Ex. A. Rich) Harms to infection with *Meloidogyne incognita* (Kofoid & White) Chitwood under field conditions

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A pot study demonstrated that four and eight African yam bean (*Sphenostylis stenocarpa*) accessions were tolerant and susceptible to the root-knot nematode (*Meloidogyne incognita*), respectively. A study was, therefore, conducted to confirm the pot results under field conditions. Experimental design was randomized complete block design with 3 replications. A total of 750 nematode juveniles per 500 g soil sample from experimental field were recorded as the pre-planting initial nematode population. Data were collected on growth, yield and yield parameters of the different African yam bean accessions and statistically analyzed using Genstat for windows, version 3.2. Results indicated that none of the accessions was resistant to *M. incognita* infection as most of the sampled parameters were significantly (P≤0.05) reduced by *M. incognita* infection. Percentage yield losses amongst the accessions ranged from 6.2 to 71.5%. Four accessions, TSS 63, Eha-Amufu, TSS 56 and Ugbokolo were categorized as tolerant, while TSS 3, TSS 4, TSS 22, TSS 5, TSS 10, TSS 11, TSS 112 and TSS 7 were susceptible. In conclusion, results of this study confirmed those under pot conditions. The tolerant accessions are, therefore, recommended for use by farmers to minimize losses due to *M. incognita* infection.

Key words: African yam bean, *Meloidogyne incognita*, infestation, field condition.

INTRODUCTION

Root-knot nematodes (*Meloidogyne* species) are obligate, sedentary, biotrophic endoparasites of many plant species (Abad et al., 2003). They cause immense damage to a wide range of agricultural crops leading to significant yield losses mainly in the tropical and subtropical regions of the world, where environmental conditions support their survival and distribution (Sikora and Fernandez, 2005). The most important among the many species of *Meloidogyne* include *M. incognita*, *M. javanica*, *M. arenaria* and *M. hapla* (Castagnone-Sereno, 2002). This is because they have been implicated in at least 90% of all damage caused by root-knot nematodes. Leguminous crops, including African yam bean (*Sphenostylis stenocarpa*), are of tremendous importance among food crops, contributing about 12 million tons of grains annually in some countries (Khanna and Gupta, 1988). Root-knot nematodes remain a major constraint amongst other factors responsible for low production and

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uncertainty in the yield of African yam bean (Onyeke and Akueshi, 2012).

Nutritionally, *Sphenostylis stenocarpa* has a crude protein range of 18.1 to 25.8% which compares well with 16.9 to 25.4%, 21.2 to 22.5% and 24.4% to 28% for Bambara groundnut (*Voandzeia subterrenea*), pigeon pea (*Cajanus cajan*) and cowpea (*Vigna unguiculata*), respectively (Uguru and Madukaife, 2001). Agronomically, the plant has the potential of improving the fertility of a soil through the help of bradyrhizobia found in the root nodules and as such minimizes the use of nitrogenous fertilizers (Schippers, 2000).

The environmental hazards associated with chemical control measures have prompted the need for alternatives which included the use of nematode-resistant/ tolerant germplasm (Pofu et al., 2011). The identification of nematode-resistant/tolerant genotypes would definitely provide an alternative to nematicides for the management of *Meloidogyne* species in the African yam bean. In the pot experiment, four and eight African yam bean accessions were tolerant and susceptible to *M. incognita*, respectively (Onyeke and Akueshi, 2012). The present study, therefore, was undertaken to confirm the reactions and tolerance/ susceptibility status of the twelve African yam accessions to *M. incognita* under field conditions.

MATERIALS AND METHODS

Germplasm collection

A total of 12 African yam bean accessions were used for this study. Ten accessions - TSS 56; TSS 22; TSS 7; TSS 10; TSS 11; TSS 112; TSS 63; TSS 4; TSS 5 and TSS 3 were collected from the germplasm collection of the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria. The other two accessions were collected from two African yam bean producing localities. They included Ugbokolo from Benue State, Nigeria and Eha-Amufu from Enugu State, Nigeria.

Field experiment

A piece of land at the Department of Crop Science Farm, University of Nigeria, Nsukka (Latitude 06°86' 32.8" N, Longitude 007°41' 49.8" E and Altitude 440 m above sea level) with a history of root-knot nematode infestation was used for this experiment. An initial soil nematode population (Pi) was determined using the Baermann funnel method (Christie and Perry, 1951). A total of 750 nematode juveniles per 500 g soil sample were recorded as the pre-planting/initial nematode population. The physical and chemical properties of the soil were determined according to standard methods (IITA, 1989). The textural class of the soil was loamy (51% coarse sand, 25% fine sand, 16% silt, 8% clay) pH (in H_2O) 6.1, pH (in Kcl) 5.8, OM 3.88%, OC 2.21%, BS 91.1%, N 0.098%, CEC 11.2%, Na 0.17, K 0.12, Ca 6.90, Mg 2.4, exchangeable acidity 1.6 and P (in ppm) 48.25. The land was divided into two equal halves measuring 43.5 m x 15.25 m (663.4 m^2) each. One half was used for the control experiments. A standard nematicide, carbonfuran 3G (Ceiba Geigy Coy) was used to treat the field for the control experiments at the rate of 5 kg a.i./ha before planting to exclude plant parasitic nematodes. The experimental design was Randomized Complete Block Design (RCBD). The land was ploughed and harrowed, and later marked out into three blocks measuring 3.75 m x 41.5 m each. Well-dried pig manure at 4.5 tons/ha was added to the land before the ridging operation. Each block was divided into 12 plots measuring 3.75 m x 3 m. A space of 1 m was allowed between blocks, while a distance of 0.5 m was marked out between plots. Each of the twelve African yam bean accessions was randomly assigned to each of the twelve plots in each of the three blocks. Each plot had a total of 20 plants. Planting space was 70 cm within rows and 90 cm between rows. Bamboo stakes of about 2 m high were used to stake the plants 4 weeks after planting (WAP). Weeding was done manually with a hoe as the need arose. At the onset of flowering, three plants per plot and per accession were selected and used for the determination of the following parameters: number of leaves per plant, number of branches on main vine per plant, fresh shoot weight per plant, dry shoot weight per plant, fresh root weight per plant, dry root weight per plant, days to 50% flowering, number of nodules per plant and number of branches per plant. At maturity, pod length per plant, number of pods per plant, number of unfilled pods per plant, seed yield per plant, number of seeds per pod, 100-seed weight per plant, number of nematodes in roots per plant, number of *M. incognita* eggs per root system, number of *M. incognita* juveniles in 500 g rhizosphere soil per plant and number of galls per plant were determined. Data collected were subjected to statistical analysis using Genstat for windows, version 3.2. Treatment means were separated using Least Significant Difference (LSD) at P = 0.05.

Identification of root-knot nematode

The identification of the *Meloidogyne* sp. was done using 10-20 single galls containing mature females from the African yam bean plants in the field. The galls were teased to remove adult females under a dissecting microscope (Southey, 1970). The adult females were used for the preparation of the perineal patterns for the identification of the species of root-knot nematode according to the procedures described by Hartman and Sasser (1985). The identity of *M. incognita* was confirmed by comparing the perineal patterns with those described by Eisenback et al. (1981).

Extraction of nematode juveniles from rhizosphere

Soil samples (500 g each) were collected from the rhizosphere of *Meloidogyne*-infected plants with polyethylene bags. Samples were immediately taken to the laboratory for subsequent extraction and counting of *M. incognita* juveniles present. The method of extraction adopted here was the modified Baermann funnel method of Flegg and Hooper (1970). A glass funnel was placed on a retort stand and plastic mesh was shaped to fit inside the top of the funnel and held tightly with a rubber band. Rubber tubing was attached to the stem of the funnel and the tip closed with a pinch clamp. The funnel was filled with water to the level of the plastic mesh. Air bubbles were avoided by slightly opening the pinch and allowing some water to drop. Cotton wool layer was placed on the mesh and water was added to bring the level just above the cotton wool. The soil sample was placed on top of the cotton wool. The funnel was left undisturbed for 48 h. Nematode juveniles that had settled in the rubber tubing were collected by slightly opening the pinch clamp and allowing 10-30 ml of water to collect into a 100 ml beaker. The juvenile suspension was homogenized using a magnetic stirrer and the estimated number of juveniles per kg soil was made from the average of four counts.

Estimation of number of nematode eggs, juveniles and females in roots

The method of estimation used here is similar to that of Siddiqui

Table 1. The effects of M. incognita infection on growth parameters of 12 African yam bean accessions, under field conditions.

Accession	Health Condition	Fresh shoot weight	Dry root weight	Dry shoot weight	Vine length	Number of branches	Number of leaves	Fresh root weight
TSS 63	Infected	84.8	17.5	15.0	223.3	12.0	67.7	171.1
	Control	526.0	3.2	165.0	350.3	25.6	238.3	27.0
TSS 4	Infected	505.3	14.7	145.9	337.3	19.0	212.7	124.0
	Control	370.0	3.9	90.0	397.0	33.3	383.0	22.3
TSS 22	Infected	156.8	36.6	30.2	315.0	14.0	89.3	218.8
	Control	93.0	3.1	49.0	296.0	22.0	135.0	12.3
TSS 5	Infected	54.0	13.4	17.8	206.0	8.6	56.7	103.1
	Control	810.0	5.9	198.3	541.0	32.0	323.0	35.0
EHA-AMUFU	Infected	374.4	27.7	131.9	328.3	18.0	160.0	204.0
	Control	233.0	3.7	84.3	387.0	26.3	160.0	22.7
TSS 10	Infected	202.0	17.6	56.4	360.3	21.0	144.3	129.0
	Control	450.0	3.5	150.6	498.7	32.6	190.0	16.7
TSS 56	Infected	380.7	22.7	75.5	338.3	15.6	143.7	183.7
	Control	120.0	2.4	62.3	379.3	18.0	156.0	20.3
TSS 11	Infected	106.8	14.6	32.4	362.0	13.0	134.7	122.1
	Control	643.0	3.1	172.0	420.0	28.6	273.0	14.7
TSS 112	Infected	314.8	20.5	62.7	317.7	16.0	136.0	193.8
	Control	289.0	6.1	87.0	344.0	29.0	266.0	29.0
	Infected	210.9	42.5	54.2	281.7	12.0	144.0	245.5
UGBOKOLO	Control	560.0	3.1	148.3	370.0	24.0	137.0	25.3
	Infected	515.9	23.5	130.0	358.3	18.0	127.7	128.5
TSS 7	Control	277.0	3.8	75.0	490.0	23.0	181.0	19.7
	Infected	171.8	20.7	26.1	346.0	12.6	70.3	167.9
LSD(0.05) INTERACTION		109.11	4.25	10.89	16.97	4.50	14.30	34.71

et al. (2001). One gram sub-sample of galled root was macerated for 30-40 s in a Waring blender and counting was done using the suspension obtained. The total numbers of nematodes present in the roots were calculated by multiplying the number of nematodes present in 1 g of root by the total weight of root.

RESULTS

Growth parameters

Results showed that *M. incognita* infection significantly (P ≤ 0.05) reduced growth parameters in most of the accessions (Table 1). Significant differences (P ≤ 0.05) in growth parameters were also observed among the accessions. Parameters were generally higher in the control experiments than those of *M. incognita* infected accessions except for the fresh root and dry root weights. Also, fresh root (r = -0.153) and dry root (r = -0.016) weights correlated negatively with seed yield (Table 3).

Yield and yield parameters

Results showed that *M. incognita* infection produced significant differences (P ≤ 0.05) in most of the accessions across all the yield variables except in days to 50% flowering where significant difference existed only in TSS 5 (Table 2). Yield parameters were generally higher in control

Table 2. The effects of *M. incognita* infection on yield and yield parameters of 12 African yam bean accessions, under field conditions.

Accession	Health Condition	Pod length	Number of unfilled pods	Number of pods	Seed weight	Seed yield	Number of nodules	Number of seeds	Days to 50% Flowering
TSS 3	Control	25.1	2.0	13.0	27.0	60.0	24.3	17.0	91.3
	Infected	23.9	14.3	6.2	25.0	17.1	10.2	10.5	103.0
TSS 63	Control	23.5	7.5	9.0	29.6	40.0	29.0	15.3	93.3
	Infected	23.0	14.0	8.6	28.9	37.5	23.6	15.1	97.4
TSS 4	Control	27.1	4.0	22.0	35.6	133.4	52.0	17.0	93.0
	Infected	25.6	13.3	8.5	29.5	39.4	16.0	14.8	102.7
TSS 22	Control	24.4	8.0	14.6	35.3	82.5	23.0	16.0	92.7
	Infected	23.0	16.0	8.4	30.6	38.8	11.6	15.0	105.3
TSS 5	Control	26.2	7.3	26.0	37.0	163.3	70.6	17.0	89.3
	Infected	24.3	15.3	19.9	27.9	92.1	20.1	16.0	104.0
EHA-AMUFU	Control	26.5	7.6	18.9	32.0	102.9	47.0	17.0	88.0
	Infected	26.0	9.0	18.0	31.0	93.7	38.3	16.5	92.0
TSS 10	Control	26.0	4.6	21.0	27.0	96.6	49.0	17.0	86.7
	Infected	24.0	12.0	15.2	23.0	51.1	21.4	14.5	95.7
TSS 56	Control	26.7	6.6	8.6	35.9	47.5	41.0	15.5	91.3
	Infected	25.4	7.6	8.4	35.0	44.3	35.6	15.1	96.3
TSS 11	Control	26.3	4.6	25.0	27.0	101.5	50.0	15.0	92.3
	Infected	23.2	13.0	11.7	25.4	43.4	20.5	14.2	102.0
TSS 112	Control	24.3	8.0	24.0	30.0	101.0	36.3	14.0	93.3
	Infected	21.5	17.6	11.9	23.2	37.6	12.7	12.0	101.4
UGBOKOLO	Control	33.8	6.0	16.6	36.0	101.3	33.0	17.0	95.7
	Infected	32.0	7.0	16.6	34.5	88.6	29.3	15.4	99.1
TSS 7	Control	26.5	7.0	18.0	29.0	85.7	54.0	16.5	88.0
	Infected	22.0	13.6	10.1	27.0	36.3	10.9	13.3	100.9
LSD(0.05) INTERACTION		1.30	3.08	2.83	2.40	15.50	5.26	1.42	14.11

Table 3. Relationship of *M. incognita* infection on growth and yield parameters of twelve African yam bean accessions under field conditions.

Parameter	FRTWT	NUFLP	NBRCH	NLVS	NNDLS	PODLT	50%FLR	DYRTWT	DYSHWT	MNVLT	MNYD	NSD/PD	FSHWT	NPODS	SDWT	NGLS	NJ2RT	NEGSRT	NJ2S0L	MNGID
FRTWT	1.000																			
NUFLP	.394*	1.000																		
NBRCH	-.014	-.348*	1.000																	
NLVS	.044	-.083	.653**	1.000																
NNDLS	-.400*	-.713**	.637**	.553**	1.000															
NPODS	-.267	-.634**	.390*	.049	.525**	1.000														
50%FLR	.103	.446**	-.233	-.205	-.351*	-.395*	1.000													
DYRTWT	.772**	.276	-.017	.036	-.264	.007	.130	1.000												
DYSHWT	-.044	-.123	.629**	.777**	.374*	.336*	-.293	.029	1.000											
MNVLT	-.065	-.564**	.606**	.554**	.689**	.382*	-.325	.013	.469**	1.000										
MNYD	-.153	-.424**	.641**	.370*	.620**	.596**	-.335*	-.016	.561**	.547**	1.000									
NSD/PD	-.319	-.402*	.455**	.384*	.628**	.391*	-.244	-.175	.429**	.525**	.713**	1.000								
FSHWT	-.096	-.096	.457**	.520**	.222	.307	-.262	-.029	.798**	.285	.401*	.362*	1.000							
NPODS	.123	-.216	.597**	.415*	.422	.380*	-.247	.188	.566**	.490**	.897**	.499**	426**	1.000						
SDWT	-.556**	-.606**	.190	-.005	.594**	.592**	-.314	-.322	.117	.316	.408*	.527**	.067	.041	1.000					
NGLS	.698**	.465**	-.181	-.001	-.448**	-.478**	.243	.600**	-.160	-.133	-.166	-.313	-.106	.158	-.690**	1.000				
NJ2RT	.704**	.583**	-.372*	-.219	-.625**	-.533**	.342*	.562**	-.301	-.356*	-.346*	-.456**	-.192	-.004	-.760*	.903**	1.000			
NEGSRT	.740**	.412*	-.099	.128	-.365**	-.409*	.207	.636**	-.023	-.104	-.157	-.285	-.001	.176	-.672**	.904**	.907**	1.000		
NJ2SOL	.770**	.521**	-.221	.017	-.485**	-.457**	.284	.700**	-.119	-.213	-.200	-.350*	-.067	.153	-.737**	.926**	.937**	.948**	1.000	
MNGID	.589**	.512**	-.268	-.203	-.520**	-.562**	.357*	.400*	-.301	-.240	-.329	-.388*	-.282	-.075	-.621**	.756**	.757**	.653**	.678**	1.000

*Significant at 0.05 level of probability. **Significant at 0.01 level of probability. FSHWT= Fresh Shoot Weight/Plant. PODLT=Pod Length (cm)/Plant. DYRTWT=Dry Root Weight/Plant. DYSHWT=Dry Shoot Weight/Plant. NUFLP=Number of Unfilled Pod/Plant SDWT=100-Seed Weight/Plant. MNYD=Mean Seed Yield/Plant. MNVLT=Main Vine Length (cm)/Plant. NNDLS=Number of nodules/Plant. NBRCH=Number of Branches on Main Vine/Plant. NLVS=Number of Leaves/Plant. FRTWT=Fresh Root Weight/Plant.NSD/PD=Number of Seeds/pod/Plant. 50%FLR=Days to 50% Flowering. NEGST=Number of Eggs/Root/Plant.NJ2S0L=Number of Juveniles in 500g Rhizosphere Soil. NJ2RT= Number of Juveniles/Root/Plant. NGLS=Number of Galls/Root/Plant. MNGID=Mean Gall Index/Root/Plant.

plants than in those with *M. incognita* infection except in number of unfilled pods and days to 50% flowering. Most of the accessions (TSS 3, TSS 4, TSS 22, TSS 5, TSS 10, TSS 11, TSS 112 and TSS 7) recorded significant ($P \leq 0.05$) yield losses. However, the remaining accessions (TSS 63, Eha-Amufu, TSS 56 and Ugbokolo) recorded no significant ($P \geq 0.05$) yield losses. Percentage yield losses of 71.5, 6.2, 70.4, 52.9, 43.6, 8.9, 47.1, 6.7, 58.8, 62.7, 12.5, and 57.6 were recorded by TSS 3, TSS 63, TSS 4, TSS 22, TSS 5, Eha-Amufu, TSS 10, TSS 56, TSS 11, TSS 112, Ugbokolo and TSS 7, respectively. Seed yield positively correlated with pod length ($r = 0.60$, $P \leq 0.01$), number of pods ($r = 0.90$, $P \leq 0.01$), 100-seed weight ($r = 0.41$, $P \leq 0.05$), number of nodules ($r = 0.62$, $P \leq 0.01$) and number of seeds per pod ($r = 0.71$, $P \leq 0.01$). Conversely, number of unfilled pods ($r = -0.42$, $P \leq 0.01$) and days to 50% flowering ($r = -0.34$, $P \leq 0.05$) correlated negatively with seed yield (Table 3).

The host status of the accessions was determined using data on Gall Index, Reproduction Factor and Seed Yield as shown in Table 4. Four accessions, TSS 63, Eha-Amufu, TSS 56 and Ugbokolo were categorized as tolerant. This is because they did not record any significant ($P \geq 0.05$) yield loss from *M. incognita* infection. Also, eight other accessions, TSS 3, TSS 4, TSS 22, TSS 5, TSS 10, TSS 11, TSS 112 and TSS 7 were categorized as susceptible because they sustained significant ($P \leq 0.05$) losses from *M. incognita* infection. Gall Indices and Reproduction Factors for the tolerant accessions were the least while those of the susceptible accessions were highest. Eha-Amufu recorded the highest yield per

Table 4. Host status rating of twelve African yam bean accessions as influenced by *M. incognita* infection under field conditions.

Accession	Mean Seed Yield/Plant (g)					
	GI	R	Control (B)	Infested (A)	Yield Difference in g/plant (A-B)	Host Status Rating
TSS 3	3.8	10.5	60.0^{e}	17.1^{h}	-42.9*	Susceptible
TSS 63	2.8	6.1	40.0^{g}	37.5^{fg}	-2.5	Tolerant
TSS 4	4.0	15.7	133.4^{b}	39.4^{ef}	-94.0*	Susceptible
TSS 22	3.8	9.6	82.5^{de}	38.8^{ef}	-43.7*	Susceptible
TSS 5	4.0	14.0	163.3^{a}	92.1^{ab}	-71.2*	Susceptible
EHA-AMUFU	3.0	7.5	102.9^{bc}	93.7^{a}	-9.2	Tolerant
TSS 10	4.0	20.0	96.6^{c}	51.1^{c}	-45.5*	Susceptible
TSS 56	3.0	7.1	47.5^{fg}	44.3^{d}	-3.2	Tolerant
TSS 11	4.0	26.6	105.5^{bc}	43.4^{de}	-62.1*	Susceptible
TSS112	4.0	29.5	101.0^{bc}	37.6^{g}	-63.4*	Susceptible
UGBOKOLO	3.0	6.8	101.3^{bc}	88.6^{b}	-12.7	Tolerant
TSS 7	4.0	12.3	85.7^{de}	36.3^{fg}	-49.4*	Susceptible

GI = Gall Index (after Taylor & Sasser, 1978): 1 = 1 – 2 galls, 2 = 3-10 galls, 3 = 11-30 galls, 4 = 31-100 galls, 5 = > 100 galls. R = Nematode Reproduction Factor (after Oostenbrink, 1966): R = Pf/Pi, where Pf is the estimated final population of RKN in both soil and roots (juveniles & eggs in roots + juveniles in soil), Pi is the initial standard inoculum of 750 juveniles per 500 g soil).*= Statistically Significant Yield Difference (P≤0.05). - = Yield loss over control. Host status rating after Afolami(2000): **Resistant** means R ≤ 1, GI ≤ 2 (No significant yield loss);**Tolerant** means R > 1, GI > 2 (No significant yield loss);**Susceptible** means R > 1, GI > 2(Significant yield loss);**Hypersusceptible** means R≤ 1, GI ≥ 2 (Significant yield loss).LSD (0.05) for comparing accession means x health condition means interaction = 15.50.

plant in the *M. incognita*-infested field experiment while TSS 3 recorded the least yield per plant. In the control plant experiments TSS 5 recorded the highest yield per plant while TSS 63 presented the least yield per plant.

DISCUSSION

Results from this study indicated consistency with those of earlier experiments carried out in the pots with the same accessions (Onyeke and Akueshi, 2012). This is because *M. incognita* infection had similar effects generally on growth and yield parameters of all the African yam bean accessions. *M. incognita*-infection produced significant (P ≤ 0.05) reduction in almost all growth and yield parameters of the African yam bean. Yield losses are attributable to the general reduction in growth and yield parameters as shown in the results. Percentage yield losses of between 20 and 49% in cowpea (Ogaraku and Akueshi, 2005b) and between 0.21 and 74.3% in African yam bean raised in pots (Onyeke and Akueshi, 2012) due to *Meloidogyne* species infection have been reported. It was observed that there was generally higher percentage yield reduction as a result of *M. incognita* infection in the field when compared with the results from pot experiments (Onyeke and Akueshi, 2012) even with lower initial population of nematodes in the field. This phenomenon could be attributed to synergy that may exist between root-knot nematodes and other plant pathogens under field conditions as against the sterilized soil used in the pot experiments. The presence of wounds created by root-knot nematodes (primary pathogens) provide avenues for entry by other pathogens (secondary pathogens) which ultimately lead to more severe infections (Powell, 1979; Upadhyay and Dwivendi, 1987; Khan and Husain, 1989).

Higher weights in roots of nematode-infected plants when compared with those of the controls was as a result of root galls (Figure 1), which agrees with other findings (Afolami and Orisajo, 2003; Ogaraku and Chhangani, 2010). The increase in weights of infected roots could also be due to movement of nutrients from shoot to root which was also thought to be partly the cause of reduction in yield as well as the attendant biochemical and physiological changes (Ogaraku and Chhangani, 2010). It was also observed that the number of days to 50% flowering in the field control was less than that of the pot control experiments. Babatola (1988) observed similar precocious flowering in plantain treated with carbonfuran. This phenomenon is attributable to ethylene donation from the methyl group on the carbonfuran structure during hydrogenation (Stephenson, 1979).

Results on host status rating of the African yam bean accessions remained consistent with the results of Onyeke and Akueshi (2012) conducted in the screen house with the same accessions. Four accessions (TSS 63, Eha-Amufu, TSS 56 and Ugbokolo) were tolerant to *M. incognita* infection, while eight accessions (TSS 3, TSS 4, TSS 22, TSS 5, TSS 10, TSS 11, TSS 112 and TSS 7) were susceptible to *M. incognita* infection. Tolerance in this context implied that *M. incognita* reproduced freely with gall formation in the roots of host plants (R > 1, GI > 2) but could not produce any statistically significant (P ≥ 0.05) yield loss at harvest (Canto-Saenz, 1983;

Figure 1. The African yam bean root system infected with *M. incognita* showing galls.

Afolami, 2000). Adegbite (2011) conducted similar experiments using maize varieties under field conditions and recorded more or less the same results on host status rating. In conclusion, results of this study confirmed those obtained under pot conditions. The tolerant accessions are hereby recommended for farmers to minimize losses from *M. incognita* infection.

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