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Short Communication

Responses of Some Hausa Potato [*Solanostemon rotcardifollices* (Pair) J.K. Morton] Cultivars to the Root-knot Nematode [*Meloidogyne javanica* (Treub) Chitwood] in Nigeria

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ABSTRACT

Six cultivars (Ex-Yola$_1$, Ex-Yola$_2$, Ex-Hong$_1$, Ex-Hong$_2$, Ex-Zing$_1$ & Ex-Zing$_2$ from Taraba State) of Hausa potato [*Solenostemon rotcardifollices* (Pair) J.K. Morton], a minor small tuber crop cultivated in Northern Nigeria, were subjected to infection by 500 second stage Juveniles (J_2) of root-knot nematode [*Meloidogyne javanica* (Treub) Chitwood] in plastic buckets. The results indicated that all the six cultivars had galling index of > 3.5 and in Ex – Hong$_1$ and Ex – Hong$_2$ the root development was also affected. The lowest reproduction index of 1.9 was observed in Ex – Zing$_2$. Therefore all these cultivars should not be cultivated in *M. Javanica* infested fields or be used as rotation and/or in mixture with other root-knot nematode susceptible crops.

Key Words: *Pathogenecity; Meloidogyne javanica;* Screen house; Cultivars and hausa potato

INTRODUCTION

Hausa potato (*Solenostemon rotcardifollices* (pair) Morton), an annual plant that probably originated from tropical Africa around Ethiopia (Tindall, 1983) and is currently cultivated in Nigeria (Jos Plateau, Adamawa & Taraba States), South India and many other African and south East Asian Countries but on a small scale. In Nigeria, many farmers cultivate it to supplement their tuber requirement in family menus. The crop is cultivated in well-drained loamy or sandy loam soils on ridges like sweet potato (Grubben & Denton, 2004). A yield of 7 – 15 t ha^{-1} is normally obtained; however, if the conditions are favourable it may go up to 18 - 20 t ha^{-1} (Grubben & Denton, 2004). The tubers contain 75% water, 1.4% protein, 0.5% fat, 21% carbohydrate, 0.7% fibre, 1% ash, 17 mg 100 g^{-1} calcium, 6 mg 100 g^{-1} iron, 01.5 mg 100 g^{-1} thiamine, 0.02 mg 100 g^{-1} riboflavin, 1 mg 100 g^{-1} niacin and 1 mg 100 g^{-1} ascorbic acid (Grubben & Denton, 2004). Different root and tuber crops have been reported to be susceptible to root knot nematodes (IITA, 1985; Fawole & Evans, 1989; Nwauzor, 1998; Iwahori *et al*., 2001; Coyne *et al.,* 2003). Nwauzor (1998) reported that only 6 out of the 84 cassava cultivars screened were resistant to *M. incognita*. The root knot nematodes Meloidogyne spp have also been reported on *Colocasia* spp from Japan (Iwahori *et al.,* 2001). In Uganda, *M. hapla* was found on *Colocsia* but in low densities (Coyne *et al.,* 2003). In South Africa Hausa potato is believed to be suppressing plant parasitic nematodes, while in Ghana nematodes have been reported to attack the crop and cause large yield loss (Grubben & Denton, 2004). There is no report on nematode attack of this plant in Nigeria. Therefore this work was conducted to find out the level of susceptibility of Hausa potato cultivars to *M. javanica,* since most of its cultivation is done on marginal lands and low yields realized in Nigeria.

MATERIALS AND METHODS

Six cultivars of Hausa potato obtained form Yola and Hong in Adamawa State and Zing in Taraba State of Nigeria were used. The dark brown and Ash colour were considered as two separate cultivars and each of them were collected from the three locations. Sandy loam soil obtained from the School of Agriculture and Agricultural Technology of Federal University of Technology, Yola Taching and Research farm was used. The soil was steam sterilized and filled in to 10 L plastic buckets perforated at the bottom to improve drainage. Two tubers of each cultivar were planted in each bucket and replicated four times. The cultivars are Ex-Hong$_1$ (ash colour), Ex-Hong$_2$ (Dark brown), Ex-Yola$_1$ (ash Colour), Ex-Yola$_2$ (Dark brown), Ex-Zing$_1$ (ash colour) and Ex-Zing$_2$ (Dark brown). The plants growing in the buckets were placed on screen house bench in a completely Randomized Design.

Meloidogyae javanica juveniles were obtained from their culture, maintained on tomato (*Lycopersicom lycopersicum* (L.) H. Karst) Roma VF, in the screen house. The tomato plants were up-rooted and the egg masses were picked as described by Hartman and Sasser (1985). The

eggs were left in distilled water for 48 h to hatch into second stage juveniles (J_2). To each replicate 500 J_2 of *M. javanica* were inoculated using syringe and needle into holes around the two - weeks old Hausa potato plants. The plants were then watered regularly and 15 g of compound fertilizer (15: 15: 15) was added to the 3 weeks old plants.

After 12 weeks of planting, the following parameters were recorded; plant height was measured from the base of the plant to the tip, number of branches and leaves for each plant were counted. The plants, were up-rooted by placing the small buckets in a slanting position in to a big pan containing water, while being shaken gently until the soil was moved into the pan and roots were cleaned. The roots were examined and rated for galling responses on a scale; 1 = 1 – 2 galls; 2 = 3 – 10 galls; 3 = 11 – 20 galls; 4 = 31 – 100 galls; 5 = 101 galls and above (Taylor & Sasser, 1978).

The vegetative parts and roots of the plants were oven dried and weighed. Before up-rooting the plants 250 cm^3 of soil around each plant was collected up to a depth of 10 - 15 cm. From each of the soil samples using a modified Bearmans tray method as described by Barker (1985), J_2 were extracted. From 2 mL aliquots of each extracts J_2 were counted under a dissecting microscope and this was repeated 10 times (20 mL) to estimate the J_2 population in 250 cm^{-3} of soils.

The host efficiency (reproduction factor 'R') was calculated, where 'R' = P_f/P_i, with P_f being final population in 250 cm^3 of soil and P_i = 500 J_2 being the original inoculum. An "R-factor' of less than or equal to one (1) indicates no apparent increase in the nematode population (Nwauzor, 1998). Final assessment of the various cultivars was based on canto-saenz's host resistance designations scheme as given in Table I.

Table I. Quantitative scheme for Assignment of Canto-saenz's host suitability (resistance) Designations

Plant Damage	Host Efficiency (R-factor)	DR
≤2	≤1	Resistant
≤2	>1	Hyper-susceptible
>2	≤1	Susceptible
>2	>1	Susceptible

GL,Galliudex; DR, Degree of resistance: Source: Sasser *et al* (1984).

Table II. Effect of root-knot nematodes (*M. javanica*) on the growth of Hausa potato (*Solenostemon rotundifolius*) in screen house

Cultivar	Plant Height (cm)		No of Branches	No of Leaves	Dry weight (g)	
	1st months	2nd months			Vegetative part	Roots (g)
Ex-Hong 1	4.5	43.25	53.25	197.5	13.27	3.62
Ex-Hong 2	5.0	44.75	45.5	183.75	9.95	2.72
Ex-Yola 1	5.25	41.5	48.75	132.5	16.0	2.8
EX- Yola 2	5.25	55.0	48.5	177.5	12.1	2.95
Ex-Zing 1	4.25	37.0	49.0	191.25	6.7	3.72
Ex-Zing 2	5.0	50.25	49.73	168.75	11.6	2.45
L.S.D.	$1.89^{N.S}$	6.95*	7.67*	$84.68^{N.S}$	$11.49^{N.S}$	$2.37^{N.S}$

Note: * significant; N.S = Non significant

Table III. Host Suitability of Hausa Potato (*S. rotundifoliues*) tested for root-knot nematode, *Meloidogyne javanica*

Cultivars	Galling Index	J_2/250 cm^3 of Soil	Host efficiency (R-factor)	S D
Ex-Hong 1	4.25	1130	2.26	S
EX-Hong 2	4.00	1476	2.9	S
Ex-Yola1	4.5	1506	3.0	S
Ex-Yola2	4.45	1430	2.9	S
Ex-Zing 1	4.75	1678	3.4	S
Ex-Zing2	3.5	986	1.9	S
L.S.D	$1.7^{N.S}$	356*		

Note: SD= suitability designation; R-factor, reproductive factor; S= susceptible based on Canto-saenz[15] host suitability designations.

RESULTS AND DISCUSSION

The effect of *M. javanica* on the growth of Hausa potato indicated no significant difference ($P > 0.05$) between the plants in heights in the first month plant growth (Table II). However, a significant difference ($P < 0.05$) between the cultivars' height was observed at 3 months of growth. Ex-Yola-2 had the mean tallest plant of 55.0 cm, while Ex-zing l had the mean lowest height of 37.0 cm only. All the cultivars were attacked by *M. javanica* but their growth were the same in the first one month.

Ex-zing 1 was the worst affected recording the shortest mean height (37.0 cm) at 3 months. Similarly, Ishaq and Fademi (1998) reported stunted growth of Okra that became obvious one month after inoculating eight cultivars with *M. incognita* race 1. Coyne *et al.* (2003) reported stunted growth in root and tuber crops due to plant parasitic nematode attack. There were no significant difference ($P > 0.05$) between the cultivars in the number of leaves per plant, dry weight of vegetative parts and roots. Considering the hausa potato susceptibility to *M. javanica* (Table III) all the cultivars were susceptible using canto-saenz's host suitability (Sasser *et al.*, 1984). The galling index of all the cultivars was more than 4.0 except that of Ex-Zing 2. In Ex-Hong 1 and Ex–Yola 1 the galling index started at the base of the stem forming caller like structure around the base of the two cultivars. In the case of Ex-Hong1 and Ex-Hong 2 root development were also affected. In all the cultivars big galls were formed that encouraged rottening of the roots.

There was significant difference ($P < 0.05$) between the cultivars when number of juveniles per 250 cm^3 of soil was considered. All the cultivars had more than 1000 J_2 per 250 cm^3 of soil except Ex-zing 2 that had only 986 J_2 per 250 cm^3 of soil. The reproduction factor for all the cultivars were more than one indicating that all of them supported *M. javanica* reproduction. Adegbite *et al*. (2005), also classified five kenaf cultivars (Auba Elisuka, Ex-Giwa, G45, Ex-Funtua & a local variety) susceptible to *M. incognita* since they recorded a reproduction factor of more than one.

Nwauzor (1998) reported that about three cassava cultivars tested (73/309, 73/649 & 73/191) were although hypersensitive they did not support *M. inognita* race-1

reproduction. From the canto-saenz's host suitability designation all the cultivars of the Hausa potato tested to *M. javanica* were susceptible. This indicated that none of the cultivars should be planted in any field infested with *M. javanica* or be interplanted with other susceptible crop in an infested field.

CONCLUSION

All cultivars exhibited stunted growth due to heavily infection on roots, with Ex-Zing-1, Ex-Zing-2, and Ex-Hong 2, having big rotten root galls. However, other cultivars of Hausa potato from different parts of Nigeria should be screened in order to get resistant or tolerant cultivars to get greater yield. It is also advisable not to plant the cultivars for several years on the field. This will avoid *M. javanica* build up to cause great yield loss.

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