SEARCH FOR *SCUTELLONEMA BRADYS* RESISTANCE IN YAMS (*DIOSCOREA* SPP.)

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ABSTRACT
A study to examine variability in susceptibility of yams to Scutellonema bradys and to identify possible sources of resistance in Ghanaian yam germplasm (Dioscorea spp.) for use in yam improvement programmes, particularly, in West Africa was undertaken. Pot and field screening methodologies were used. In general, S. bradys and dry rot of tuber symptoms as well as tuber cracking increased during the storage period. The study showed a positive correlation between visual nematode damage and population densities in yam tubers. There was also a linear relationship between dry rot disease and tuber cracking at harvest and during storage. This confirms that S. bradys causes dry rot of tubers resulting in external cracking of yam tubers. Positive linear relationship was also observed between yam tuber weight loss and dry rot disease indicating that dry rot disease may have contributed to the tuber weight loss. Therefore, tuber dry rot symptoms caused by S. bradys of yams could be used to discard susceptible yams at harvest and after a period of storage. However, there was no linear relationship between nematode population densities in yam tubers and roots, therefore, a root protocol cannot be used for assessing resistance in yams as it could lead to misclassification. The yam germplasm screened, reaffirmed resistance to S. bradys in Dioscorea dumetorum var. Nkanfo and D. cayenensis var. Afun.

Keywords: *Scutellonema bradys*, Nematode, *Dioscorea*, Yam, Resistance

INTRODUCTION

The yam nematode, *Scutellonema bradys* is a major nematode pest of yams, particularly, in West Africa causing severe damage to yam tubers (Adesiyan *et al*., 1990; Jatala and Bridge, 1990; Emehute *et al*., 1998). It is the most important and prevalent nematode on yam in Ghana (Plowright and Kwoseh, 1998), largely determining yam tuber quality and storability. They can cause a reduction of 20-30% in tuber weight at harvest (Smit, 1967). According to Coursey (1967), nematode infection contributes to long term storage losses and has been estimated as 50%. In severe cases, loss may be total.

S. bradys also acts as wounding agents and creates infection courts in tuber for fungi and bacteria to gain entry easily and cause wet rot (Bridge, 1982).

Yams, when grown as a subsistence crop, are generally not treated with pesticides and chemical treatments are not widely used for nematode control. Farmers have therefore relied on natural variation for their selection of suitable varieties of yam to cope with the damage caused by plant parasitic nematodes. Nematode resistant yam cultivars can be one of the most useful, economical and effective means of managing nematodes for resource-poor farmers. New and more productive varieties with resistance to nematodes are therefore, needed to increase and sustain productivity of yam cultivation.

Asiedu *et al*. (1998) showed that there is hope for the existence and management of genetic resistance in *Dioscorea* spp. According to Degras (1993) and Akoroda and Hahn (1995), substantial research investment has been made in the control of diseases and pests of yams and these efforts are continuing. However, the breeding for resistance against yam nematodes has been one of the most neglected research areas. This may be because of the genetically complex nature of the crop (Akoroda and Hahn, 1995) and few trained nematologists pursuing this goal. To breed such genotypes, sources of resistance in yams need to be identified. Also, reliable and reproducible screening methods are essential since escapes or misclassifications waste breeding effort and these have been developed and refined (Kwoseh *et al*. 2002). The objectives of this research were therefore to examine the variations in susceptibility of *Dioscorea* spp. to *Scutellonema bradys*, and identify sources of resistance for use in yam improvement programmes. The term 'resistance' in the context of this study refers to the degree of difficulty of multiplication of the nematode in either yam roots or tuber tissues (Cook and Evans, 1987).

MATERIALS AND METHODS

Juvenile and adult stages of *Scutelonema bradys* obtained from *S. bradys*-infected yam peelings was used for inoculation. The *S. bradys* populations were collected from various farmers' fields in the major yam growing zones in Ghana and the Kumasi Central market.

The yams used for the studies were obtained during a farmer-pest appraisal in the major yam agroecological zones in Ghana. Local and traditional yam varieties or landraces were collected from almost all the towns and villages visited in the districts. Selected yam varieties were screened for *S. bradys* resistance in pot and field experiments.

Yam plants were raised using the yam minisetts technique (Otoo *et al*., 1987). In this technique, the head region of the yam tuber was cut off and then the other portions sectioned horizontally into discs. Each disc was cut into parts with peel of the tuber. Setts weighing about 40 g were used for pot trials and 100g for field trials. The cut surfaces of the setts were treated with Benlate-wood ash mix. The treated setts were then pre-sprouted in a quantity of sterilised moist coco-peat (shredded coconut husk) in plastic boxes in the screenhouse. The coco-peat was moistened with Benlate, a systemic fungicide (25 g/11 litre water). The treated setts were spread on top of the coco-peat in a plastic box and then covered with another layer of moist coco-peat. This method was used to obtain more uniform plant establishment, tuber size and tuber maturity. Uniform plants of about 4 weeks old were used for the experiments.

Assessment of yam varieties for nematode resistance

Three sets of experiments were conducted to evaluate the reaction of test yam varieties of *D. rotundata, D. alata, D. cayenesis, D. bulbifera, D. esculenta* and *D. dumetorum* to *S. bradys*

Experiment 1: Field evaluation of 40 Ghanaian yam varieties for S. *bradys resistance*

A total of 40 Ghanaian yam varieties (26 *D. rotundata,* two *D. cayenensis,* 11 *D. alata* and one *D. dumetorum*) were screened for their reaction to *S. bradys* in a field experiment at the Crops Research Institute (CRI), Kumasi, Ghana (Table 1). Uniform plants from 100 g minisetts obtained as explained above were transplanted in mounds four weeks after sprouting at 1 m x 1 m planting spacing.

Two weeks after planting, each plant in the mound was infested with about 6,000 juvenile and adult stages of *S. bradys* (50 g *S. bradys*-infected yam peelings). A trench of about 5cm from the stem of each plant was made around the plants in the mound and at a depth that exposed some of the roots. The chopped infected tuber peelings were then spread around the roots and covered again with the soil. A randomised complete block design (RCBD) with four replicates was used. The entries were harvested 36 weeks after transplanting and stored in baskets kept in an open-air yam barn. Visual nematode damage symptoms score (Kwoseh *et al*., 2002) and weight of tubers were recorded at harvest and at four and 11 weeks after harvest.

Each of the tubers in the screen was washed and peeled from the proximal to the distal end at two places and opposite to one another at four and 11 weeks after harvest for nematode extraction and counting. The yam tuber peelings were then chopped into 3 to 4 mm wide and about 1cm long pieces for nematode extraction. Nematodes were extracted by the modified Baermann tray method (Whitehead and Hemming, 1965).

Experiment 2:

Confirmation test of 10 selected Ghanaian yam varieties of *D. rotundata, D. cayenensis, D. alata and D. dumetorum for S. bradys resistance*

Based on the results of Experiment 1 above, 10 different varieties and species of *D. rotundata*, *D. cayenensis*, *D. alata* and *D. dumetorum* namely Lili (*D. rotundata*), Chenchito (*D. rotundata*), Agyaasi (*D. alata*), Afun (*D. cayenensis*), Yeremma (*D. alata*), Adi-amaaba (*D. alata*), Sante (*D. rotundata*), Matches (*D. alata*), Saabiri (*D. alata*) and Nkanfo (*D. dumetorum*) were used for a confirmation test in a field experiment. The study was done at the Crops Research Institute, Kumasi, Ghana. Plants from 100g minisetts were pre-sprouted and planted in mounds. A randomised complete block design with five replicates was used.

The plants were infested with about 1,700 juvenile and adult stages of *S. bradys* (50g *S. bradys*-infected yam peelings) two weeks after transplanting as in Experiment 1. The experiments were conducted at different seasons or times therefore peelings from the *S. bradys*-infested yam tubers used as sources of inoculum were different from Experiments 1 and 3. The entries were harvested 28 weeks after transplanting and then stored. Visual nematode injury score and tuber weight were recorded at harvest and eight weeks after storage. Each tuber was peeled and chopped eight weeks after storage and *S. bradys* was extracted and counted as described in Experiment 1.

Experiment 3:

Pot screening of seven selected Ghanaian yam varieties of *D. rotundata, D. cayenensis, D. alata, D. dumetorum, D. bulbifera and D. esculenta* for *S. bradys* resistance

Seven different yam varieties (*D. rotundata* var. Kyire-Kumasi, *D. rotundata* var. Chenchito *D. rotundata* var. Lili, *D. cayenensis* var. Afun, *D. dumetorum* var. Nkanfo and unknown variety of *D. bulbifera* plus an unknown variety of *D. esculenta* were evaluated in a pot experiment at the Department of Crop and Soil Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Minisetts of 40 g of the yams were treated and pre-sprouted in sterilised cocopeat as described above. About four-week old plants of these yams were each potted into two-litre size pots containing about 1.5 litres of heat sterilised 2:1 soil-cocopeat mix. A simple line screening design with five replicates was used.

The potted plants were allowed three weeks in the screenhouse to establish and then were each inoculated with about 800 active juvenile and adult stages of *S. bradys* (50 g chopped *S. bradys*-infected tuber peelings) in a similar way as described in Experiment 1. The inoculated plants were harvested nine weeks after inoculation. Roots and tubers of all test plants were washed and fresh weights taken separately and symptoms of nematode injury were scored (Kwoseh *et al*., 2002). Nematodes were extracted from washed roots or tuber peelings and the number of *S. bradys* counted. Each tuber was completely peeled. The roots or tuber peelings for each entry were chopped separately with a pair of scissors and then 5 g tissue of each was placed on to a two-ply facial tissue supported on a sieve placed in a plate. The set-up was left for 48h under ambient conditions in the laboratory to collect the nematodes in a water suspension.

Data were transformed using square root for nematode counts and arcsin for percentages. Analyses of data were made using SAS Software Release 6.12 (1996).

RESULTS AND DISCUSSION

Experiment 1: Field evaluation of Ghanaian yam varieties for *S. bradys* resistance

Analysis of variance revealed highly significant differences (P>0.001) between the yam varieties screened for *S. bradys* reaction. Mean *S. bradys* counts at four weeks ranged from 0 to 1073/5 g and from 0 to 1050/5 g at 11 weeks after storage (Table 1).

In general, the number of *S. bradys* and dry rot of tuber as well as tuber cracking increased during the storage period (Table 1). Dry rot and tuber cracking at harvest and after 11 weeks of tuber storage showed significant differences (P > 0.01) between varieties. The coefficients of variation (CV) for the variables were high (Table 1). This may be because of the high variation in susceptibility between varieties.

It was observed that severely infected yam tubers with severe rot and cracking had large nematode populations. However, some infected tubers with symptoms recorded low nematodes counts (Table 1, e.g. TDr Labarko) probably because these tubers were either dried out or completely destroyed by dry rot disease with very little or no living tissue remaining.

Strong correlation (r = 0.9, r = 0.5 and r = 0.7) occurred between internal dry rot and tuber cracking at harvest and at four and 11 weeks after storage respectively. Dry rot of tubers also correlated positively (r = 0.6) with *S. bradys* populations in the yam tubers. This relationship confirms that (Bridge *et al*., 2005) *S. bradys* causes internal dry rot of tubers resulting in external cracking of yam tubers. Following these results, dry rot symptoms could be effectively used to select for resistance to *S. bradys* in yam tubers either at harvest or after about four weeks of storage.

Based on *S. bradys* populations, all the Ghanaian yam varieties of *D. rotundata* and *D. alata* screened were susceptible. This agrees with Adesiyan (1977) and Bridge (1982) who examined yam cultivars from West Africa. *D. dumetorum* var. Nkanfo and *D. cayenesis* var. Afun were found to be resistant. *D. dumetorum* var. Nkanfo did not support reproduction and was not damaged by the nematode. According to Bridge *et al*. (2005), *D. dumetorum* is generally considered to be less susceptible to nematodes. In this study, these yams are considered resistant because they had zero or relatively low dry rot indices and supported very small nematode populations (Table 1).

Experiment 2:
Confirmation test of selected Ghanaian yam varieties of *D. rotundata*, *D. cayenensis*, *D. alata* and *D. dumetorum* for *S. bradys* resistance

The yam varieties generally produced large numbers of *S. bradys* in the tubers except on *D. dumetorum* var. Nkanfo and *D. cayenensis* var. Afun that recorded significantly smaller numbers

Table 1: Reaction of Ghanaian yam varieties of *D. rotundata* (TDr), *D. alata* (TDa), *D. cayenensis* (TDc) and *D. dumetorum* (TDd) to *S. bradys* infection and populations in tubers after four and eleven weeks storage

	[a]Mean dry rot index			Mean tuber cracking			*Mean no. *S. bradys*/5 g tuber peelings Transformed			
Yam variety	Harvest	4wk	11wk	Harvest	4 wk	11 wk	4 wk	11 wk		[b]Reaction
TDa Yeremma	1.5	1.5	2.3	1.5	1.3	2.0	31.9 (8.8)	29.5 (15.4)	a	S
TDa Saabiri	0.5	1.3	1.8	1.0	1.3	1.8	18.5 (9.3)	28.1 (16.4)	ab	S
TDr Afi	0.7	2.0	2.3	1.3	1.3	2.0	25.1 (4.9)	27.9(11.2)	ab	S
TDr Sante	0.5	1.3	2.0	1.3	1.0	1.5	27.2 (13.3)	27.8 (11.5)	abc	S
TDa Matches	1.5	2.0	2.3	1.5	1.0	1.8	21.4 (8.9)	27.2 (13.2)	a-d	S
TDa Mmrefi	0.5	0.8	1.3	1.0	1.0	1.0	15.1 (16.4)	25.8 (14.3)	a-d	S
TDr Nigeria	1.0	1.5	2.0	1.0	1.3	1.8	29.9 (12.2)	25.7 (14.0)	a-d	S
TDa Afasie Kwandwo	0.5	1.0	2.0	1.0	1.3	1.8	19.1 (12.2)	25.7 (10.8)	a-d	S
TDa Datordi	1.8	2.0	2.5	1.8	2.0	1.8	29.5 (9.3)	24.9 (11.1)	a-e	S
TDr Accra	2.0	2.0	2.3	2.0	1.5	2.0	29.0 (5.7)	21.5 (7.8)	a-e	S
TDr Tempe	1.3	1.8	2.0	1.5	1.3	1.5	21.2 (5.2)	20.5 (7.9)	a-e	S
TDa Nsoadansi	1.0	1.5	2.0	1.0	1.0	2.0	21.2 (5.3)	20.4 (2.5)	a-e	S
TDr Puna	2.3	2.3	2.5	2.3	2.3	2.0	18.2 (7.5)	19.1 (12.9)	a-f	S
TDa Kyemogo	0.8	1.0	1.3	1.3	1.3	1.3	16.8 (7.9)	18.8 (6.0)	a-f	S
TDc Abrewa nwo	1.5	2.3	2.5	1.3	1.3	1.8	22.9 (10.0)	18.7 (8.0)	a-f	S
TDr Kpirindwo	2.3	1.7	2.3	2.3	1.3	2.0	21.8 (3.4)	17.1 (6.6)	a-f	S
TDr Sanyata	2.3	2.3	2.8	2.0	1.8	2.0	22.3 (7.6)	16.9 (7.8)	a-f	S
TDa Akaba	1.8	2.5	2.5	1.5	1.5	1.8	27.7 (4.9)	16.8 (7.1)	a-f	S
TDr.Zong	1.5	2.0	2.8	1.5	1.8	2.3	25.4 (12.7)	15.9 (8.5)	a-g	S
TDr Ziglanbgo	0.8	1.8	1.5	1.3	1.5	1.5	21.5 (10.8)	15.2 (7.6)	a-h	S
TDr Serwaah	2.3	2.3	3.0	2.3	2.0	2.3	22.8 (2.5)	15.2 (1.7)	a-h	S
TDa Kwaa-Asamoah	1.3	2.0	2.0	1.3	1.3	1.5	35.0 (11.4)	14.6 (4.6)	b-h	S
TDr Denteh	1.3	1.5	2.0	1.5	1.3	1.5	15.3 (3.5)	13.7 (3.7).	b-h	S
TDr Dakpam	1.3	1.0	1.5	1.5	1.3	1.5	11.6 (8.9)	13.1 (8.8)	c-h	S
TDr Limor	2.3	2.5	2.8	2.3	2.0	2.3	21.5 (4.6)	12.9 (2.5)	c-h	S
TDr Sono bayere	1.8	2.0	2.5	1.8	1.5	2.0	25.3 (11.2)	12.9 (1.8)	c-h	S
TDr Moninyoli	2.0	1.8	2.5	2.0	2.0	2.3	23.6 (10.9)	12.0 (3.6)	d-h	S
TDr Muchumudu	2.0	1.8	2.8	2.0	2.0	2.5	20.8 (10.6)	10.8 (3.5)	e-h	S
TDr Dakorba	2.0	2.0	2.5	2.0	1.8	2.5	17.7 (2.2)	10.0 (7.0)	e-h	S
TDr Kyire-Kumasi	1.3	1.7	2.0	1.7	1.0	1.7	18.8 (4.9)	9.5 (2.7)	e-h	S
TDr Agyaasi	1.3	1.5	2.3	1.0	1.3	1.8	15.4 (4.1)	9.2 (1.0)	e-h	S
TDr Kpiringa	2.0	2.3	3.0	2.0	1.8	2.0	21.0 (6.1)	8.9 (4.3)	e-h	S
TDr Chenchito	2.5	2.5	3.0	2.0	2.0	2.5	27.7 (4.9)	8.9 (4.0)	e-h	S
TDr Lili	1.0	1.5	2.3	1.3	1.3	1.8	18.9 (13.4)	8.2 (8.9)	e-h	S
TDr Labarko	2.0	2.0	2.7	2.3	2.7	2.7	7.7 (4.3)	7.2 (4.9)	e-h	S
TDr Fugla	1.5	1.5	2.8	1.8	1.5	2.0	12.8 (9.2)	5.6 (3.0)	fgh	S
TDr Tela	0.8	1.3	1.3	1.3	1.0	1.5	16.9 (11.3)	5.0 (2.0)	fgh	S
TDa Adi-amaaba	0.5	1.0	0.8	0.8	1.0	1.0	8.3 (4.6)	4.7 (5.7)	fgh	S
TDc Afun	0.3	0.3	0.3	0.8	1.0	1.0	1.6 (1.2)	1.8 (1.5)	gh	R
TDd Nkanfo	0 0	0 0	0 0	0.5	0.5	1.0	0.7 (0.0)	0.7 (0.0)	h	R
CV (%)	58.4	35.9	31.3	39.1	34.9	25.3	42.9	50.3		

**Square root (Mean + 0.5) and SAS adjusted for missing data. [a]Average of 4 replicates. Standard deviation in parentheses. Varieties followed by the same letter do not differ significantly according to Duncan's Multiple Range Test. [b]S = susceptible, R = resistant*

(Figure 1). *D. alata* var. Yeremma and *D. rotundata* var. Lili recorded the largest nematode counts (Figure 1). Dry rot and tuber cracking also differed significantly (P > 0.01) between yam varieties in storage with *D. rotundata* var. Lili *and D. alata* var. Yeremma registering comparatively high dry rot disease scores (Table 2). This indicates that these visual disease symptoms are useful parameters for rating host resistance or susceptibility in yams.

In most cases, high dry rot symptoms were associated with high nematode numbers. There was strong correlation (r = 0.7) between internal dry rot in tubers and *S. bradys* populations in tubers. Tuber cracking also strongly correlated (r = 0.8) with internal dry rot symptoms.

Tuber weight loss of 16.0 to 74.5% was recorded over the eight-week storage period with *D. rotundata* var. Sante recording the largest weight loss while *D. dumetorum* var Nkanfo was the least affected (Table 2). Tuber weight reduction among the yam varieties was substantial and highly significant differences (P<0.01) were observed between them.

There was correlation (r = 0.4) between tuber weight loss and dry rot disease. These results indicate that dry rot disease may have contributed to the tuber weight loss. According to Smit (1967), *S. bradys* caused a reduction of 20-30% in tuber weight. This study followed a similar trend as reported in the previous field trial (Experiment 1) and confirmed low multiplication of *S. bradys* in *D. dumetorum* var Nkanfo and *D. cayenensis* var. Afun (Figure 1).

S. bradys multiplied in the roots of all the yams in the screen with *D. dumetorum* recording the smallest numbers while, *D. esculenta* had the largest (Figure 2) although numbers in roots did not differ. It is interesting to have susceptible roots because this is likely to reduce pressure on the tuber.

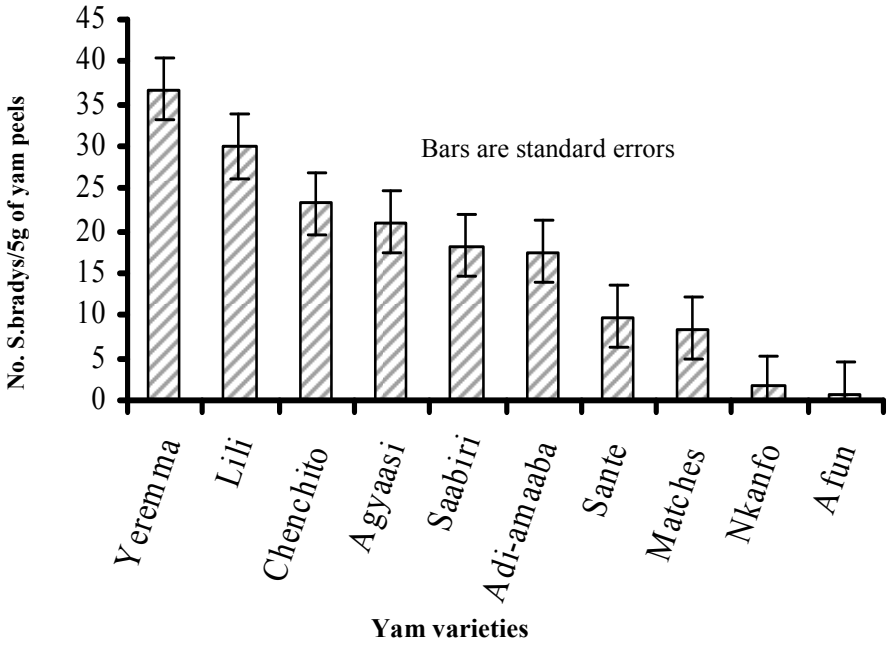

Fig. 1. Square root transformed populations of *S. bradys* in yams after eight weeks storage

S. bradys numbers were generally larger in roots than in tubers with the resistors recording the smallest numbers (Figure 2). There were highly significant differences (P>0.01) between the yam varieties regarding *S. bradys* populations in the tubers.

Experiment 3: Pot screening of selected Ghanaian yam varieties for *S. bradys* resistance

Dry rot symptoms and tuber cracking ranged between 0 and 2.4 and *D. dumetorum* var. Nkanfo was apparently symptomless (Table 3). Significant differences (P > 0.05) were also observed between the yams for dry rot disease and tuber cracking.

There were strong correlations (r = 0.7, r = 0.8) between dry rot disease and tuber cracking and number of nematodes in tubers respectively. The pot trial showed that visual damage caused by the yam nematode is useful for evaluation of resistance or susceptibility in *Dioscorea*.

Although roots supported *S. bradys* reproduction, there was no correlation between susceptibility in roots and tubers. This means that susceptibility in roots cannot be used to select for *S. bradys* resistance in yams. This is probably because the roots responded to stimulatory substances released by the nematode (Reddy, 1987) hence, created a favourable condition for their reproduction and multiplication. Also, it may be that there are nutrients or chemicals in the roots, which nematodes prefer. Developing roots are more tender than tubers so, this might have made it easier for *S. bradys* to penetrate and reproduce. The formation of roots and tubers and functions of these organs could also have played a role, and, probably there was a better *S. bradys* interaction in roots than in tubers.

Figure 2 illustrates the variation in resistance to *S. bradys* in Ghanaian yam varieties. This confirms the resistance of *D. dumetorum* var. Nkanfo and *D. cayenensis* var.Afun to *S. bradys*. The resistance exhibited by these varieties may be due to different physiological processes in them that make it impossible to meet the nutrient requirements of the nematode. This is not likely to be a species difference because *D. cayenensis* var. Abrewa-nwo is susceptible (Table 1). The resistance of *D. cayenensis* is very appreciable because it is easily compatible for hybridisation with *D. rotundata* (Kwoseh, 2000), the preferred

Table 2: Reaction of 10 selected Ghanaian yam varieties of *D. rotundata* (TDr), *D.* alata (TDa), *D. c ayenensis* (TDc) and *D. dumetorum* (TDd) to *S. bradys* resistance at harvest and after eight weeks of storage

	[a]Mean tuber weight (g)		Tuber weight loss		Mean dry rot index		Mean tuber Cracking	
Yam variety	Harvest	8 wk	%Loss	*Transformed	Harvest	8 wk	Harvest	8 wk
TDr Lili	265.1	212.3	22.1	27.9	1.3	3.0	1.0	2.3
TDa Adi-amaaba	196.3	130.8	32.0	34.4	1.0	3.0	1.0	2.3
TDa Yeremma	447.7	326.1	24.0	28.9	0.8	2.8	0.8	1.8
TDa Agyaasi	97.2	54.7	49.6	44.7	0.6	2.6	0.8	1.8
TDr Chenchito	55.3	35.5	36.6	36.9	0.8	2.4	0.8	2.0
TDa Sabiri	162.1	134.6	31.0	33.2	1.0	2.2	1.0	1.6
TDa Matches	55.6	28.3	42.8	40.5	0.7	1.3	0.7	1.3
TDr Sante	64.9	12.1	74.5	60.1	1.0	1.0	1.0	1.0
TDc Afun	194.4	151.0	23.1	28.6	0.2	0.2	0.2	1.0
TDd Nkanfo	136.9	115.7	16.0	23.5	0 0	0.0	0.0	0.2
CV (%)	80.7	78.5	43.1	25.5	69.1	47.1	64.6	40.9

** Sin^{-1} (% weight tuber loss/100). [a]Average of five replicates*

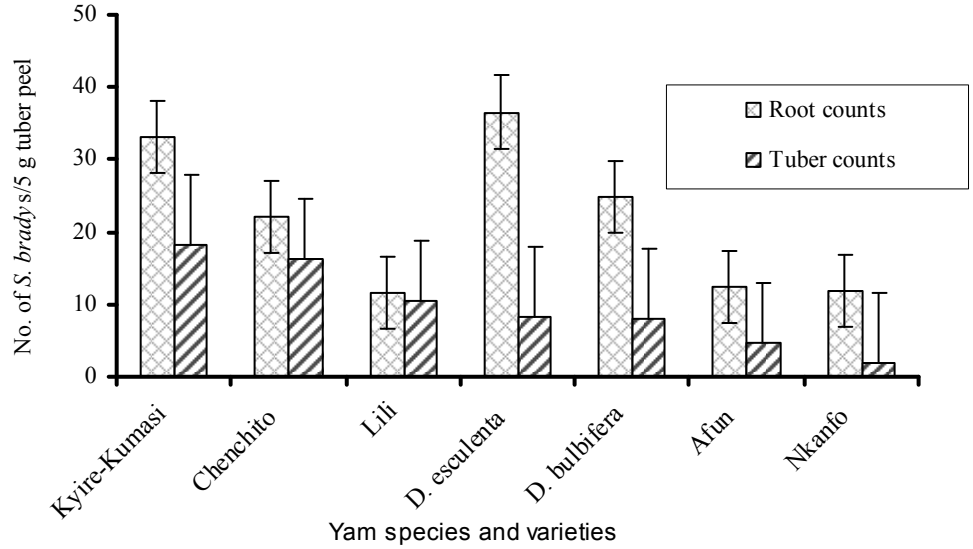

Fig. 2. Square root transformed populations of *S. bradys* in roots and tubers of yams

Table 3: Dry rot symptom scores in selected Ghanaian yam varieties of five *Dioscorea* species to *S. bradys* in pots nine weeks after inoculation

Yam varieties & species	Mean* tuber cracking	Mean dry rot index
TDr Chenchito	2.4	2.4
TDr Kyire-Kumasi	2.0	2.0
TDr Lili	1.8	1.8
TDc Afun	0.8	1.0
D. bulbifera	0.5	0.7
TDd Nkanfo	0.5	0.0
D. esculenta	0.5	0.0
CV (%)	54.0	61.8

**Average of five replicates. Yam species: TDr: D. rotundata, TDc: D. cayenensis, TDd: D. dumetorum*

food or edible species. According to Asiedu *et al.* (1998), *D. rotundata*, *D. praehensilis*, *D. cayenensis*, *D. dumentorum* and *D. burklilliana* have been used in inter specific crosses and there are efforts in advanced laboratories aimed at somatic embryogenesis, somatic hybridisation and generic transformation.

In general, the benefit-to-cost ratio of breeding nematode resistant varieties is economically beneficial (Starr *et al*., 2002), particularly, to the resource-poor farmers. The identification of the resistant genotypes or sources of resistance would constitute the beginning of more focused effort in breeding for host plant resistance. Therefore, the

information developed in this study should greatly help in yam breeding programmes for the continued search of nematode resistance in *Dioscorea*.

CONCLUSIONS

The conclusions derived from the study are as follows:

- In general, *S. bradys* population density and dry rot disease of yam tuber as well as tuber cracking increased with storage. This shows that the yam nematode is a serious storage pest.
- An efficient, positive pot and field screening methodologies with improved precision have been developed to make meaningful selections from yam germplasm.
- Results demonstrated a linear relationship between nematode damage and population densities in yam tubers, implying visual disease symptoms are useful parameters for rating host resistance in yams. Dry rot symptoms of yams could therefore be used to discard susceptible yam varieties at harvest and after a period of storage.
- There was no correlation between *S. bradys* susceptibility in roots and tubers, therefore, within the limits of this study a root protocol cannot be used for assessing resistance in yams as it could give misleading classification.
- Based on *S. bradys* populations, all the yam varieties of *D. rotundata* and *D. alata* in the screen were susceptible however, there was a high variation in susceptibility between the yam varieties.
- Tuber weight reduction among the yams was substantial after a period of storage. There was also a positive correlation between tuber weight loss and dry rot disease indicating that dry rot disease may have contributed to the tuber weight loss.
- *D. dumetorum* var. Nkanfo and *D. cayenensis* var. Afun were resistant to *S. bradys*. These yams are considered resistant because they did not support multiplication of *S. bradys* or had relatively smaller dry rot damage and supported very small nematode populations.
- Mass screening of yam germplasm using the yam minisett both in field and pot trials is practical and convenient considering the cost of tissue culture material. Mounds and ridges should be infested with infected yam peelings to avoid escapes.

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