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The effects of aqueous extracts from maize roots and sorghum stem on the germination and radicle growth of *Sphenosylis sternocarpa* Hochst ex. Rich. (African Yam beans)

J. M. Ayeni, and J. Kayode

Department of Plant Science, University of Ado-Ekiti, Ado-Ekiti, Nigeria
Emails (1) jayeni@yahoo.com (2) jokayode@ymail.com

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ABSTRACT: The study examined the allelopathic effects of aqueous extracts from maize roots and sorghum stem on the germination and radicle growth of *Sphenostylis sternocarpa* (African Yam beans), an important cereal in southwestern Nigeria. The extracts from the two crop residues inhibited radicle growth of this crop. The degree of inhibition was concentration dependant as the inhibition increased with the increase in the concentrations of the extracts. The aqueous extracts derived from sorghum stem had more inhibitory effects as no radicle growth was recorded in the sorghum stem-extract treated seeds until 120hrs of the experiment. Statistical analysis (t-test, at 5% level) revealed that the inhibitions in sorghum extracts were not significantly different when the radicle lengths in the extract-treated seeds were compared to those in the control experiment. In the maize root-extract treated seeds, apart from the comparison of radicle lengths of seedlings in the 10g and 15g and between 10g and 20g extract concentrations that were significantly different, there were no significantly differences in the growth length of the radicles in the varying extract concentrations as well as those of the control experiment at 5% level.

Keywords: Allelopathy, Sorghum stem, Maize root, *Sphenosylis sternocarpa*, inhibition, radicle.

Introduction

Recent initiatives had shown that residues from crops are major sources of allelochemicals that inhibit seed germination and cell division (Irshad and Cheema 2004), caused significant reduction on growth and development of crops (Turk *et al*., 2003), retard seedling growth (Kaburtji 1993 a and b) and often result in poor seedling survival (Conard, 1985)

Previous allelopathic studies had focused on the allopathic effects of some weeds on crops, some crops on weeds, (Pheng *et al*., 1999), as well as the allelopathic effects of some crops on other crops. Studies reported so far in Nigeria were concentrated on the allelopathic effects of some weeds on agricultural crops. Examples include the studies of Tijani-Eniola and Fawusi (1989), Gill *et al*. (1993) on *Chromoleana odorata* and Kayode (1998, 2004a and 2004b) on *Euphorbia heterophylla, Aspillia africana, Calotropis procera* respectively. No study had been reported so far on the allelopathic effects of crop residues in the country where crops residues such as maize roots and sorghum stems are often left uncared for in the fields after harvest.

Consequent on the above, the study being reported here aimed at examining the allelopathic potentials of aqueous extracts from residues of maize roots and sorghum stems on African yam beans (*Sphenostylis sternocarpa*).

Materials and Methods

Seeds of *Sphenostylis stercocarpa* were obtained from a local market in Ikere-Ekiti, a community situated at about 20km from the campus of the University of Ado-Ekiti, Ado-Ekiti, Nigeria. Maize roots and sorghum stems were collected after harvesting of their crops from the Research Farm of the Department of Plant Science, University of Ado-Ekiti, Ado-Ekiti, Nigeria. The maize roots and sorghum stems were cut into pieces to facilitate drying. These materials were air dried for three weeks after which they were pounded using pistil and mortal.

Portions of 5, 10, 15, 20, and 25g were measured out from the sorghum stems and maize roots residues. Each portion was soaked in 200ml of distilled water in 500ml conical flasks. The mixture were shaken intermittently and left for 24hrs after which the extracts were filtered using Whatman No 1 filter paper and the filtrates were used afresh, some portions were put inside the refrigerator for further usage. Two layers of Whatman No 1 filter papers were put in each Petri dish and five seeds of *Sphenostylis sternocarpa* were planted in each Petri dish. The Petri dishes were moistened daily with the aqueous extracts using syringe and needle. The treatments in each extract concentration were replicated ten times.

Control experiments, with the seeds moistened with distilled water, were also set up and replicated ten times. All the Petri dishes were kept in the growth chamber at room temperature. The seeds were considered germinated upon radicle emergence. The germination of radicles and their growth elongation measurements were recorded at 24hrs interval for six days. The results obtained from the extracts treated seeds were compared statistically to those obtained from the control experiments.

Result and Discussion

The allelopathic effects of the aqueous extracts from the maize root and sorghum stem residues on the germination of African yam beans (*Sternostylis sternocarpa*) are shown in Tables 1 and 2 respectively. It was obvious that the extracts of both maize root and sorghum stem inhibited the germination of this crop. The degree of inhibition was concentration dependant as the proportion of the inhibition increased with the increase in the concentration of extracts. For example, Table 1 revealed that in the 96hrs experimental time of the maize root extracts, the % germination was 12%, 10%, 0%, 0% and 0% at 5g, 10g, 15g, 20g and 25g extract concentrations respectively. Similarly at 144hrs experimental time, the % germination decreased from 36% at 5g extract concentration to 30% at 25g extract concentrations.

Results from the sorghum stem extracts (Table 2) revealed that the % germination at 96hrs experimental time reduced from 14% in the 5g extract concentrations to 0% even at 15g extract concentration. Similarly, at 144hrs experimental time, % germination reduced from 26% at 5g extract concentration to 22% at 25g extract concentration. Thus seed germination was delayed in both extracts.

The results of the effects of the two different aqueous extracts on the radicle length of African yam bean are shown in Tables 4 and 5. The results showed that radicle growth was retarded by both extracts but the degree of inhibition was more pronounced in the extract from sorghum stem. Also in both extracts, the degree of retardation increased with increase in the concentration of the extracts. In the maize root extract, radicle length at 120hrs experimental time decreased from 0.15cm in the 5g extract to 0cm in the 25g extract and at 144hrs experimental time, radicle length decreased from 0.45cm to 0.04cm at the 25g extract (Table 3). Similarly, the length decreased from 0.14cm at 5g extract to 0g at 25g extract at 120hrs experimental time and from 0.43cm at 5g extract to 0.07 at 25g extract in the 144hrs experimental time in the sorghum stem extract (Table 4). Statistical analyses at 5% of levels (t-test) revealed that apart from the comparison between 10g and 15g and between 10g and 20g that were significantly different in maize root extract treated seeds; there were no significant differences in the growth length of the radicle in the varying extracts concentration as well as those of the control in both extracts.

Table 1. Effects of aqueous extract from maize roots on the germination of *Sphenostylis sternocarpa*.

Extracts (g/200)ml	% Germination / Experimental time (Hrs.)					
	24	48	72	96	120	144
5	0	0	0	12	44	36
10	0	0	0	10	38	36
15	0	0	0	0	38	34
20	0	0	0	0	38	30
25	0	0	0	0	10	30
Control	0	0	0	16	46	38

Table 2. Effects of sorghum stem extracts on the germination of Sphenostylis sternocarpa

Exrtacts (g/200ml.)	% Germination / Experimental time (Hrs.)					
	24	48	72	96	120	144
5	0	0	0	14	48	26
10	0	0	0	12	32	40
15	0	0	0	0	40	38
20	0	0	0	0	32	24
25	0	0	0	0	20	22
Control	0	0	0	24	48	18

Nimbal *et al*. (1996) asserted that sorghum contain sorgoleone, a long chain hydroxyquinne. Also Cheema (1988) asserted that the allelochemicals in mature sorghum included benzoic acid, P-hydroxyl acid, Vallinic acid, M-comadic acid, p -coumaric acid, gallic acid, caffeic acid, ferulic acid and Chlorogenic acid. Guenzi and McCcalla (1966) had earlier asserted that the inhibitory compounds occurring in sorghum plants are mostly phenols. Phenolics derivatives, such as jugleone and lawson are among the more phytotoxic phenolic compounds. Phenolic compounds such as dihydroquine sorgoleone produced by *Sorghum bicolor* have been found to be extremely phytotoxic in hydrophonic culture (Eighllig and Souza, 1992). Allelochemical in maize roots exudates is mostly saponin which are extremely phytotoxic. Also Sanchez-Moneiras *et al*. (2004) attributed allelopathy in maize inflorescence to hydroxamic.

Table 3. Effects of maize roots extracts on the radicle length (cm) of *Sphenostylis stenocarpa*.

Extracts (g/200ml)	Radicle length (cm.) /Experimental time(Hrs.) 24	48	72	96	120	144
5	0	0	0	0	0.15	0.45
10	0	0	0	0	0.13	0.33
15	0	0	0	0	0.04	0.18
20	0	0	0	0	0.03	0.17
25	0	0	0	0	0	0.04
Control	0	0	0	0.01	0.21	0.49

Table 4. Effects of sorghum stem extracts on the radicle length (cm) of *Sphenostylis sernocarpa*.

Extracts (g/200ml)	Radicle length (cm.) /Experimental time(Hrs.) 24	48	72	96	120	144
5	0	0	0	0	0.14	0.43
10	0	0	0	0	0.14	0.38
15	0	0	0	0	0.03	0.20
20	0	0	0	0	0.02	0.10
25	0	0	0	0	0	0.07
Control	0	0	0	0.01	0.28	0.64

In conclusion, these compounds may be responsible for the inhibition of seed germination and retardation of radicle growth in *Sphenostylis sternocarpa* used in this study. Thus, the act of leaving these residues uncared for in the fields might be detrimental to the growth of subsequent crops in such field.

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