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Full-Length Research Paper

The Competitive Ability of *Senna occidentalis* (Coffee Senna) among some Weedy Plant Species in Sokoto, Semi-Arid Ecological Zone, Nigeria

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ABSTRACT: This research is on the competitive ability of *Senna occidentalis* (Coffee senna) among some weedy plant species effect of species in Sokoto, Semi-arid Ecological Zone, Nigeria was conducted at the Biological Sciences Garden of Usmanu Danfodiyo University, Sokoto. Sokoto is located at the extreme end of Northwest of Nigeria between latitudes 11^0 30'N and 13^0 58'N and Longitudes $4^0$8'E and $6^0$54'E. It investigated the competitive ability of *Senna occidentalis* (Coffee senna) in combination with *Sidacordifolia* and *Gynandropsis.* Thirty (30) seeds of each weed species were selected and planted different combinations. Seeds of *Senna occidentalis* in combination with seeds of *Sidacordifolia* and seeds of *Senna occidentalis* in combination with seeds of *Gynandropsis Pentaphylla*. The results indicated that*S. Occidentali s*had the stem height of 8.17cm at 2WAP and increased to 61.41 cm at 11WAP, which indicated that it grew better in other combinations. The results further showed that it had 13.22 number of leaves at 2WAP while it was 60.11 at 11WAP thereby indicating that it had more leaves in other combinations. The leaf length of 2.87cm at 2 WAP was recorded and attained 7.50 cm at 11WAP. The leaf width was 1.95cm at 2WAP and at11WAP it reached 3.79cm. It had better vegetative growth in all the three combinations thus suppressed the growth of *Sidacordifolia* and *Gynandropsis Pentaphylla* when grown in combination. This was possibly due to early seedlings growth and development of *S. occidentalis*.

Keywords: *Sidacordifolia, Senna occidentalis, Gynandropsis Pentaphylla,* Semi-arid, Ecological zone, Sokoto

INTRODUCTION

From an ecological point of view, weeds are plants that are especially successful at colonizing disturbed, but potentially productive sites and at maintaining their abundance under conditions of repeated disturbance (Liebman *et al.,* 2001). The definition of a weed is completely context-dependent, to one person, a plant may be considered a weed and to another person, that same plant may be a desirable plant. The reason some persons refer weeds as "Unwanted Plants" is because, weeds are often found growing naturally in places where they are not desired thereby competing with the desired main crops for necessary resources. Competition is the ability of an individual to acquire resources and by so doing makes the resources unavailable to other individuals (Connell, 1990). Competition occurs in different mechanisms and may occur as an indirect competition whereby individual plants inhibit the growth of neighboring plants through the release of toxic compounds (Schenk *et al.,* 1992). A mechanism referred as Allelopathy. For competition to take place within species, the resources required by individuals must be in short supply. Therefore, competition is a form of

biological interaction between two or more individuals for limited resources that is necessary for increase in growth rate, survivorship or reproduction (Birch, 2000).

The ultimate effects of competition are the reduced contribution of one generation to the next generation and the elimination of one species by the predominate species. This is so, because competition is a reciprocally negative interaction represented as -/- interaction (Jacob, 1991).A plant is often termed a weed when it has one or more of the following characteristics such as abundant seed production and thus potentially large population, Rapid population establishment and adaptation to spread (Akubundu, 1987).

Despite the negative impacts of weeds, they provide some benefits according to Akobundu (1987), which include the following: Stabilize and add organic matter to soils, Provide nectar for bees, Serve as vegetables for human consumption, Create employment opportunities during weed control, Serve as fodder for animals and medicinal values e.g. *Senna occidentalis.* Some of these weed species are known to be harmful, causing damage to plants (William and Eric, 2001).

S. occidentalis is commonly known in English as Septic weed. Other common names include coffee senna, coffee weed, Mogdad coffee, negro-coffee, senna coffee, Stephanie coffee and stinking weed. It is locally called Sangasanga in Hausa.

Taxonomy of *Senna occidentalis*

Kingdom	Plantae
Division:	Spermatophyta
Class:	Dicotyledonous
Order:	Fabales
Family:	Fabaceae
Genus:	*Senna*
Species*:*	*Senna occidentalis* L

S.occidentalis is an erect annual under shrub or sub glabrous herb, growing to 50 - 200 cm long. The stem is ribbed and branches spreading. The principle leaves alternate and are 5-12cm long. The leaflets are 3 - 5 pairs opposite to each other and are 2.5-8cm long by 2-3.5cm wide. The flowers are yellow in colour. The seeds are arranged in one row on each side about 30m across (Malviya and Sharma, 2013). This plant is widely spread in Tropical Africa. It is a common weed of field crops, wasteland, roadsides and also very common in elevation particularly coastal region (Akobundu and Agyakwa, 1987).

S.occidentalis has been in use since the ancient times in Nigeria particularly in the north as food and medicinal plants. The seeds of this weed are used as tonic and diuretic. The plant is active in the treatment of pneumonia and tuberculosis and also useful in clearing out worms and reducing menstrual pains.

MATERIALS AND METHODS

This study was carried out at the Biological garden of Usmanu Danfodiyo University, Sokoto. Sokoto State is located to the extreme northwest of Nigeria, between latitudes 11^{o} 30^{i}N and $13^{o}58^{i}$N and longitudes $4^{o}8^{i}$E and $6^{o}54^{i}$E. It shares common borders with the Republic of Niger to the north, Kebbi State to the west and southwest, and Zamfara State to east. Sokoto is on altitude of 308m above sea level and is within the Sudan Savannah ecological zone (SERC, 2001).

The climate is hot, semi-arid type and characterized by long dry season from October to May and short raining season from June to September with an annual mean of 724mm for a period of six months. The mean monthly temperature ranges between 15^{o}C in December and 40^{o}C in April.

The mean annual temperature averaged 27^{o}C (Mamman, *et al.,* 2000). Therefore, the coolest months are November and January while the hottest months are March and May

The following are the materials used for the study which include plastic germination containers, soil, seeds, buckets, cups, water, notebooks, ruler and pencil.The seeds of *G. pentaphylla* were obtained from Usmanu Danfodiyo University Biological Garden while those of *S. occidentalis* and *S. cordifolia* from Fakka in Yabo LGA of Sokoto State. The soil used was also obtained from the Biological Garden.

Twelve germination containers of equal sizes were labeled A-D in thee replicates, filled with soil and arranged accordingly.

Thirty seeds of each weed species were counted separately in three replicates. Planting was done in each container as shown below; A: Seeds of *Senna occidentalis* in combination with the seeds of *Sidacordifolia* in three replicates. B: Seeds of *Sidacordifolia* in combination with the seeds of *Gynandropsis Pentaphylla* in three replicates. C: Seeds of *Senna occidentalis* in combination with the seeds of *Gynandropsis Pentaphylla* in three replicates. D: Seeds of *Senna occidentalis* in combination with the seeds of Sida*cordifolia* and *Gynandropsis Pentaphylla* in three replicates.

Measurement of growth parameters started two weeks after planting (WAP) and continued at weekly intervals up to the end of the study. The stem height, number of leaves, leaf length and width were measured from three (3) randomly selected plants from each replicates. The Data was subjected to statistical analysis by ANOVA revealed the significant difference in the growth of the different weed species under various treatments.

Table 1: The mean stem height of *S. occidentalis* in combination with other weed species at weekly interval.

Treatment	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP
So/Sc	8.17b	15.55b	27.16a	33.03b	43.83a	47.67a	51.17a	52.20a	53.22b	61.49a
So/Gp	10.71a	18.85a	27.66a	33.96a	40.37b	47.56a	50.00a	52.85a	55.70a	61.41a
So/Sc/Gp	7.93b	15.65b	23.70b	31.94c	39.37b	42.19b	46.42b	47.77b	49.11c	55.70b
S.E (+/-)	0.89	1.03	1.25	0.58	1.35	1.81	1.43	1.60	1.92	1.92

Means in a column followed by same letter are not significant at 5% using LSD. S.E: Standard Error
Key: WAP=Week after planting So/Sc=*S. occidentalis*in combination with *S. cordifolia.* So/Gp=*S. occidentalis* in combination with *G. pentaphylla*. So/Sc/Gp= *S. occidentalis* in combination with *G. pentaphylla* and *S. cordifolia*.

Table 2: The Mean Leaf Number of *Senna occidentalis* in Combination with other Weed species at weekly interval.

Treatment	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP
So/Sc	13.22b	17.34a	29.89a	33.00a	37.11a	37.00b	37.11b	38.44b	40.44b	66.44a
So/Gp	14.00a	16.11b	24.00b	27.56c	28.67b	32.45c	35.78c	40.17a	44.56a	60.11b
So/Sc/Gp	12.78b	18.67a	24.67b	30.56b	36.89a	37.22a	39.72a	42.22a	42.33c	48.44c
S.E (+/-)	0.36	0.74	1.86	1.57	2.67	1.55	1.16	1.09	1.19	5.27

Means in a column followed by same letter are not significant at 5% using LSD. S.E: Standard Error
Key: WAP=Week after planting So/Sc=*S. occidentalis* in combination with *S. cordifolia.* So/Gp=*S. occidentalis* in combination with *G. pentaphylla.* So/Sc/Gp= *S. occidentalis* in combination with *G. pentaphylla*a nd *S. cordifolia*.

RESULTS AND DISCUSSION

The results in (Table 1) showed that *S. occidentalis* when in combination with *S. cordifolia* reached the height of 8.17cm at 2WAP and increased to 15.5cm in 3WAP. Thereafter, at 11WAP stem height recorded was 61.49cm. While the stem height of *Senna occidentalis* in combination with *G. pentaphylla* was 10.71cm 2WAP and increased to 18.85cm 3WAP. The stem height continued to increase in which at 11WAP, it recorded 61.41cm. However, the stem height of *S. occidentalis* in combination with both weeds species (*S. cordifolia* and *G. pentaphylla*) showed a reduced height when compared to *S. occidentalis* in other combinations in which at 2WAP it was 7.93cm and increased to 55.70cm at 11WAP which indicated that *S. occidentalis* grew better in other combinations. This showed that the mean stem height of *S. occidentalis* in combination with other weed species at 11 WAP ranged from 55-62 cm in all combinations which was within the range reported by Malviya and Sharma (2013).

The results in (Table 2) showed that *S. occidentalis* when in combination with *S. cordifolia* had 13.22 number of leaves at 2WAP and increased to 17.34 at 3WAP. Thereafter, at 11WAP number of leaves recorded was 66.44. While the number of leaves of *Senna occidentalis* in combination with *G. pentaphylla* was 14.00 2WAP and increased to 16.11 3WAP. The number of leaf continued to increase in which at 11WAP, it recorded 60.11. However, the leaf number of *S. occidentalis* in combination with both weeds species (*S. cordifolia* and *G. pentaphylla*) showed a reduced number when compared to *S. occidentalis* in other combinations in which at 2WAP it was 12.78 and increased to 48.44 at 11WAP which indicated that *S. occidentalis* grew better in other combinations. The leaf length of *S. occidentalis* ranged 7.3-8.2cm in all combinations which is also in agreement with Malviya and Sharma (2013) who reported that the stem height and leaf length of *S. occidentalis* ranged 50-200cm and 5-12cm respectively

The results in (Table 3) showed that *S. occidentalis* in combination with *S. cordifolia*had the leaf length to be 2.87cm at 2WAP and increased to 2.96cm at 3WAP. Thereafter, at 11WAP leaf length recorded was 8.20cm. While the leaf length of *Senna occidentalis* in combination with *G. pentaphylla* was 2.84cm 2WAP and increased to 3.04cm 3WAP. The leaf length continued to increase in which at 11WAP, it reached 7.50cm in length. However, the leaf lengths of *S. occidentalis* in combination with both weeds species (*S. cordifolia* and *G. pentaphylla*) were 2.82cm, 2.87cm, and 7.37cm at 2WAP, 3WAP and 11WAP respectively. This indicated that S*. occidentalis* in combination with *S. cordifolia* had better vegetative growth in terms of leaf length than in other combinations. The results in (Table 4) revealed that *S. occidentalis* in combination with *S. cordifolia* had the leaf width of 1.95cm at 2WAP and increased to 2.96cm at 3WAP. Thereafter, at 11WAP leaf width stood at 4.29cm. While the leaf width of *Senna occidentalis* in combination with *G. pentaphylla* was 2.09cm at 2WAP growth period and increased to 2.84cm at 3WAP. The leaf width continued to increase in which at 11WAP, it reached3.79cm. However, the leaf width of *S. occidentalis* in combination with both weeds species (*S. cordifolia* and *G. pentaphylla*) were 1.98cm, 2.87 cm and 3.91cm respectively at 2WAP, 3WAPand 11WAP.

Table 3: The Mean Leaf Length of *Senna occidentalis* in Combination with other Weed species at weekly interval

Treatment	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP
So/Sc	2.87a	2.96b	7.09a	7.58a	7.60a	7.69a	7.71a	7.80a	7.88a	8.20a
So/Gp	2.84a	3.04a	5.83c	6.22c	6.59b	6.62bc	6.62c	6.87b	7.12a	7.50b
So/Sc/Gp	2.82a	2.87c	5.10b	6.18b	6.35b	6.81ac	6.87b	6.87c	7.26b	7.37b
S.E (+/-)	0.04	0.05	0.58	0.46	0.46	0.87	0.33	0.31	0.23	0.26

Means in a column followed by same letter are not significant at 5% using LSD. S.E: Standard Error
Key: WAP=Week after planting So/Sc=*S. occidentalis* in combination with *S. cordifolia.* So/Gp=*S. occidentalis* in combination with *G. pentaphylla*. So/Sc/Gp= *S. occidentalis* in combination with *G. pentaphylla* and *S. cordifolia*.

Table 4: Mean Leaf Width of *Senna occidentalis* in Combination with other Weed species at weekly interval

Treatment	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP
So/Sc	1.95b	2.96a	3.80a	4.02a	4.03a	4.07a	4.10a	4.18a	4.19a	4.29a
So/Gp	2.09a	2.84b	3.34c	3.56b	3.57a	3.58b	3.62c	3.66b	3.76b	3.79c
So/Sc/Gp	1.98b	2.87b	3.11b	3.72b	3.79a	3.80a	3.83b	3.85a	3.91a	3.91b
S.E (+/-)	0.04	0.04	0.20	0.14	0.14	0.14	0.14	0.15	0.12	0.15

Means in a column followed by same letter are not significant at 5% using LSD. S.E: Standard Error
Key: WAP=Week after planting So/Sc=*S. occidentalis* in combination with *S. cordifolia.* So/Gp=*S. occidentalis* in combination with *G. pentaphylla*. So/Sc/Gp= *S. occidentalis* in combination with *G. pentaphylla* and *S. cordifolia*.

This indicated that *S. occidentalis* in combination with *S. cordifolia* had better vegetative growth in terms of leaf width than in other combinations. The leaf length of *S. occidentalis* ranged from 7.3-8.2cm in all combinations which was also in agreement with Malviya and Sharma (2013) who reported that the stem height and leaf length of *S. occidentalis was* within the range of 50-200cm and 5-12cm respectively.*Senna occidentalis* had better vegetative growth in all the three combinations. It was able to suppress the growth of *Sidacordifolia* and *Gynandropsis Pentaphylla* when grown in combination.

This may be as a result of early seedlings growth and development of *S. occidentalis*. Studies have also shown that *S. occidentalis* contains toxins and some phytochemicals such as alkaloids, saponins, mucilages and steroids as reported by Hussaini (2001).When released to the environment, they can be absorbed by surrounding plants thereby inhibiting their growth (Dangoggo *et al.,* 2006). From this study, it could be concluded that *Senna occidentalis* had a higher competitive ability in terms of vegetative growth and was able to suppress the growth of the other two weed species (*Gynandropsis Pentaphylla* and *Sidacordifolia*).

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