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EFFECT OF *Alectra vogelii* (Benth) AQUEOUS EXTRACT ON THE GROWTH PARAMETERS OF COWPEA (*Vigna unguiculata* (L.) Walp) VARIETIES IN ZARIA, KADUNA STATE

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ABSTRACT
A study was conducted to evaluate the effect of Alectra vogelii (Benth) aqueous extracts on the growth parameters of cowpea (Vigna ungiucuata (L.) Walp). The experiment was carried out in the Orchard of the Department of Agronomy, Institute of Agricultural Research, Ahmadu Bello University, Samaru, Zaria, Nigeria in 2018. Qualitative and quantitative phytochemical screening of Alectra vogelii whole plant was carried out at National Research Institute and Chemical Technology (NARICT), Zaria. Alectra vogelii aqueous extract was applied on four varieties of cowpea: Sampea 7, Sampea 9, Sampea 10 and IAR-00-1074 at 0, 50, 100, 150 and 200 g/l, and the treatment were laid in complete randomized design with three replications. The growth parameters evaluated included plant height, number of leaves and root noodles at 5, 7 and 9 weeks after planting (WAP). Data obtained for growth parameters were analyzed using Analysis of Variance with Duncan's New Multiple Range Test used to separate means that were significant. The result for phytochemical composition of A. vogelii whole plant showed the presence of five active phytochemical constituents: Saponins (46.50%), flavonoids (16.04%), tannins (0.247%), cyanogenic glycoside (0.212%) and alkaloids (0.08%). Significant difference (P≤0.05) was found in the effect of the extracts on growth parameters of cowpea. There is marked reduction in the growth parameters with increase in A. vogelii aqueous extract concentration. This implies that, A. vogelii extracts inhibits growth of cowpea with 200mg/l having the highest effect. Thus, the inhibitory action of A. vogelii can probably be attributed to the active phytochemicals present in the extracts Therefore, it is recommended that, A. vogelii residues should be well removed from farms as may inhibit the growth of cowpea due to their allelochemicals content.
Key Words: Cowpea, Phytochemicals, Varieties, Witch-Weed,

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is among the most important food legumes in the world. Cowpea, known as southern pea, is cultivated in the range of agro-ecologies and cropping system in the tropics. It originated from the semi-arid areas of West Africa. It's contributed to human nutrition and generates income to farmers and food vendors (Boukar *et al*., 2016). However, despite the tremendous benefits of cowpea, it is threatened by biotic stress such as parasitic witchweeds infestation by *Alectra vogelii* that affect yield negatively. *Alectra vogelii* cause a restriction to cowpea production to farmers (Femina *et al*., 2012). Cowpea yield loss to *Alectra* has been reported to range between 85 to 100% (Awuku, 2018).

Alectra vogelii is an obligate root parasitic flowering plants of the family *Scrophulariaceae* that influence the growth of cowpea and other legumes (Mohammed *et al*., 2001; Botanga and Timko, 2005; Matusova *et al*., 2005). *A*, *vogelii* is distributed throughout Burkina Faso, Benin, Niger, Nigeria, Ghana, Mali, Togo and Cameroon with one race designated to each country (Awuku, 2018). The seed of these parasites weeds are microscopic in size measuring 0.20 mm to 0.35 mm long, weighing 4 to 7 µg (Alonge *et al*., 2005) easily dispersed by winds, water and animals and can remain dormant in the soil until a suitable host is planted. *A. vogelii* thrives well in arid and semi-arid regions. The residues left in the field exhibit allelopathic effects by releasing water soluble allelochemicals from its leaves, stems, roots, rhizomes, flowers, fruits and seeds (Agarwal *et al*., 2002; Batish *et al*., 2007; Naseem *et al*., 2009).

However, despite the parasitic nature of *A. vogelii* to cowpea in Nigeria, there is paucity of information on its phytochemical composition and studies evaluating the effect of its extracts on growth performance of cowpea. Most of the studies were centered upon *Striga* species aqueous extracts (Olorunmaiye and Ogunfolaji, 2002; Jabeen and Ahmad, 2009; Romman *et al*., 2010; Kumbhar and Dabgar, 2011; Musniyi *et al*., 2012). This study therefore aimed at evaluating the effect of *A. vogelii* aqueous extracts on the growth attributes of four varieties of cowpea.

MATERIALS AND METHODS

Preparation of Plant Extracts

The *Alectra vogelii* whole plants were obtained from infested fields at the Institute for Agricultural Research Farm, Ahmadu Bello University, Samaru-Zaria. The plants were air dried at room temperature, crushed into powder using mortar and pestle and kept in specimen bottle pending analysis. The powdered *Alectra vogelii* plant was weighed as 50, 100, 150 and 200g each and dissolved into labeled bottles containing 1000 ml of distilled water. These were placed on a shaker machine and shaken for 3 hours. The solution was then filtered using a muslin cloth to separate the aqueous extract from the residue and form four different concentrations (50, 100, 150, and 200 g/l). Distilled water was used as the control treatment. The prepared aqueous extracts were stored at room temperature of 20-22^{o}C.

Phytochemical Analysis

The qualitative phytochemical screening of the aqueous extract of *A. vogelii* was carried out according to the methods described by AOAC (2006) and Adegoke *et al*. (2010) to determine the presence of active constituents in the plant leaves and their composition. The aqueous extract was subjected to qualitative test for the presence of bioactive components that include Molisch's test for detection of Carbohydrates, Meyer's test for detection of Alkaloids, Wagner's test for detection of Alkaloids, Lead subacetate test for detection of Tannins, Keller- Killiani's test for detection of Cardiac Glycosides, Frothing/Foaming test for detection of Saponins, Libermann-Burchard's test for detection of Steroids and Alkaline test for the detection of Flavonoids and Keller-killiani test for cyanogenic glycosides.

The quantitative phytochemical analysis of the aqueous extract of *A. vogelii* was carried out according to the method described by Akujobi *et al*. (2004). A 5gportion of sample was made into paste, and the paste was dissolved into 50ml distilled water. The extract was filtered and the filtrate was used for quantitative analyses.

Pot Experiment

Pot experiment was carried out at the Department of Agronomy Orchard, Institute for Agricultural Research, Ahmadu Bello University, Samaru- Zaria (Latitude 11^{o} 11′N, Longitude 7^{o} 38′E and 686m above sea level) in the Northern guinea savannah ecological zone of Nigeria in 2018. Seeds of four cowpea varieties (SAMPEA 7, SAMPEA 9, SAMPEA 10 and IAR-00-1074) were obtained from Seeds Production Unit, Institute for Agricultural Research, Ahmadu Bello University, Samaru-Zaria. Top soil was collected from farm lands and sharp sand was collected from a stream at area BZ, Ahmadu Bello University, Samaru Zaria and mixed together in 1:1 ratio. Each pot was filled with equal volume (2 kg per pot) of soil. The physico-chemical properties of this soil were determined in the Department of Soil Science, Ahmadu Bello University, Zaria. Seeds of the four cowpea varieties were dressed with Apron Plus at the rate of 5 g per 2 kg of seeds before planting. Four seeds of each cowpea variety were sown 2 cm deep at the center of the soil in each bag. Then 10 mls of each of the prepared *A. vogelii* aqueous extract (50, 100, 150, and 200 g/l) concentrations were applied on the spot where the seeds were sown in each pot. Application of insecticides (sharp shooter) was carried out at 4 weeks after planting (WAP), and subsequently at 2 weeks' interval from commencement of flowering. Hand weeding was carried out from 4 WAP whenever any weed was noticed in the pots. The growth parameters evaluated include; plant height, root nodules and number of leaves at 5, 7 and 9 WAP.

Data Analysis

Data obtained for the effect of *A. vogelli* extracts on growth parameters of cowpea was analyzed using Analysis of Variance with Duncan's New Multiple Range Test (DNMRT) used to separate the significant means.

RESULTS AND DISCUSSION

The result for the qualitative screening of *A. vogelii* aqueous extract is presented in Table 1. The result revealed the presence of five (5) active constituents in the form of flavonoids, alkaloids, saponins, tannins and cyanogenic glycosides.

Table 1: Qualitative Phytochemical Composition of *Alectra vogelii* aqueous extract

S/N	Constituent	Result
1	Flavonoids	+
2	Phytate	-
3	Phenol	-
4	Alkaloids	+
5	Oxalate	-
6	Saponins	+
7	Tannins	+
8	Terpenoids/Steriods	-
9	Trypsin	-
10	Cyanogenic Glycosides	+
11	Cardiac glycosides	-
12	Carbohydrates	-

KEY: + = PRESENT -= ABSENT

However, the composition of such constituents varies as shown in Table 2. The result shows that, the aqueous extract of *A. vogelii* had low Alkaloids (0.08%), Tannins (0.247 %) and Cyanogenic Glycosides (0.212 %) but high in Saponins (46.50 %) and Flavonoids (16.04 %) contents (Table 2).The presence of these active bio-chemical metabolites in *A. vogelii* indicates its parasitic potency via allelopathic mechanism on growth of cowpea. This finding is in agreement with that of Saidu *et al*. (2011) who reported the potency of some plant extracts in inhibiting growth of some organisms due to the presence of phytochemical constituents of the extracts.

Table 2: Quantitative Phytochemical Composition of *Alectra vogelii* aqueous extract

Chemical Component	Quantity (%)
Alkaloids	0.08
Cyanogenic Glycosides	0.212
Flavonoids	16.04
Saponins	46.50
Tannins	0.247

The effect of *Alectra vogelii* extract on the various growth parameters of the four cowpea varieties is presented in Table 3.The result revealed significant difference (P≤0.05) in the effects of the extracts on growth parameters of cowpea. The result showed that, *Alectra* extract at different concentrations inhibits growth of cowpea. The effect is concentration dependents, increase with increase in concentration. The inhibitory action of the *A. vogelii* extracts can be attributed to the active phytochemical present in the extracts that possessed allelopaathic effects. This finding agrees with that of Lawan (2011) who reported allelopathic potency of different weeds and plants secondary metabolites leading to reduction in growth attributes of *Tithonia diversifoli* seedlings.

The *A. vogelii* extracts also reduced leaf number of cowpea plants. The lowest number of leaves was found under the influence of 200g/l in all the cowpea varieties. *Alectra* aqueous extract reduced the number of leaves in each cowpea varieties and this reduction increased with concentration of the aqueous extract. The inhibitory action of leaf production by the *A. vogelii* extracts is probably due to the ability of the allelopathic chemicals in it to interfere with growth in leaves venations thereby inhibiting leaves morphogenesis. This finding is in conformity with that of Bano *et al*. (2012) who reported inhibitory potential of Neem (*Azadirachta indica*) leaf extracts on leaves morphogenesis in *Cleane gyandra*.

Similarly, the *A. vogelii* aqueous extract reduced the number of root nodules in all the cowpea varieties and the reduction increased with the concentration of the aqueous extract increases. The reduction in noodles number signifies the negative effect on the production of Leghaemoglobin that supply oxygen to the Rhizoobium thereby reducing the rate of nodulation. This finding is in agreement with that of Rice (1974) who reported that, phytochemicals are potential inhibitors of *Rhizobium* which may lead to reduction in root nodulation.

Reduction in plant heights dueto *A. vogelii* aqueous extracts activities in all the cowpea varieties increased with increase in concentration of the aqueous extract. The extracts inhibit the cellular expansion and proliferation of the primary meristematic cells. Similar findings were reported by Sazada *et al*. (2009) that allelopathy of phenonyl group is concentration dependent phenomenon.

The result for the physico-chemical properties of the soil is presented in Table 4. The result showed that, the soil contained Calcium (6.06 meq/100 g soil) and Nitrogen (2.03 meq/100g soil), Phosphorus (3.2 ppm), Organic carbon (1.08%), Magnesium (2.50 ppm), Potassium (2.86 ppm), Nitrogen (2.03 %) and had the pH of 5.80.

Table 3: Effect of *Alectra vogelii* aqueous extract on growth parameters of Cowpea

Varieties	*Alectra* Extract (g/l)	Number of Leaves			Number of Root Nodules			Plant Height		
		5WAP	7WAP	9WAP	5 WAP	7 WAP	9 WAP	5 WAP	7 WAP	9 WAP
SAMPEA 7	0	4.33[a]	9.67a	13.33a	59.00a	95.67a	113.33a	23.33a	35.33a	41.00a
	50	4.00[ab]	8.67ab	10.33b	47.67b	70.33b	91.00b	20.00b	30.00b	37.33b
	100	3.67[ab]	7.33bc	8.33c	33.33c	60.00bc	85.33b	18.33b	27.67bc	31.67c
	150	3.33[ab]	7.00cd	7.67c	29.00c	49.33cd	61.67c	16.33c	25.67cd	29.33d
	200	3.00[b]	5.67d	6.67c	23.00d	37.67d	49.00c	14.00d	23.00d	24.33d
	Mean	**3.67**	**7.67**	**9.27**	**38.40**	**62.60**	**80.07**	**18.40**	**28.33**	**32.73**
	SE ±	**0,37**	**0.47**	**0.62**	**1.57**	**4.15**	**4.89**	**0.63**	**1.18**	**1.14**
SAMPEA 9	0	5.00a	11.67a	14.33a	5.3.33a	92.00a	111.00a	22.33a	34.00a	42.67a
	50	4.00ab	10.00b	11.00b	45.00b	74.33b	97.33b	20.33ab	29.67b	36.33b
	100	4.00ab	8.00c	8.67c	32.00c	56.33c	91.33b	18.67b	27.33b	31.00c
	150	3.67b	6.67cd	7.67c	27.33c	46.33d	57.00c	15.33c	24.67c	26.67cd
	200	3.67b	5.67d	7.67c	18.00d	33.67c	48.33c	14.33c	22.67c	24.33d
	Mean	**7.07**	**8.40**	**9.87**	**36.13**	**60.53**	**81.00**	**18.20**	**27.67**	**32.20**
	SE ±	**0.33**	**0.45**	**0.62**	**2.53**	**2.70**	**3.13**	**0.67**	**0.79**	**1.51**
SAMPEA 10	0	4.00a	10.67a	13.67a	57.00a	83.33a	122.33a	21.33a	31.00a	40.00a
	50	4.00a	8.33b	9.00b	41.00b	73.67ab	93.33b	19.33ab	29.00b	36.67a
	100	3.67a	7.33bc	9.00b	31.00c	61.00bc	85.67bc	20.00ab	26.33c	31.33b
	150	3.33a	6.00c	7.00b	26.67cd	46.33cd	72.67c	15.67bc	24.00d	25.67c
	200	3.00a	6.00c	4.00c	22.33d	34.00d	46.00d	13.00c	21.00e	24.00c
	Mean	**3.60**	**7.67**	**8.53**	**35.60**	**59.67**	**84.20**	**17.87**	**26.27**	**31.53**
	SE ±	**0.33**	**0.63**	**0.94**	**2.38**	**4.96**	**4.52**	**0.67**	**0.60**	**1.07**
IAR-00-1074	0	4.33a	12.00a	13.67a	53.00a	80,67a	125.33a	21.00a	30.33a	42.33a
	50	4.33a	7,33b	9.67b	41.00b	73.00ab	94.00b	18.67b	28.67a	37.67b
	100	3.67ab	6.67b	8.67bc	30.00c	61.67b	86.00b	16.67c	26.00b	28.67c
	150	3.33ab	6.00b	7.00c	26.33c	44.33c	80.33b	15.67cd	24.33b	26.00c
	200	3,00b	5.67b	6.33c	18.00d	36.00c	46.00c	15.33d	19.00c	21.67d
	Mean	**3.73**	**7.53**	**9.07**	**32.57**	**59.13**	**86.33**	**17.47**	**25.67**	**31.27**
	SE ±	**0.30**	**0.82**	**0.79**	**1.70**	**3.83**	**5.00**	**0.39**	**0.73**	**1.33**

N.B: Means with the same superscript(s) along each column, under each variety are not significantly different (P<0.05)
WAP: Weeks After Planting

Table 4: Physical and chemical properties of the soil used

Soil Properties	**Value**
Sand (%)	28.30
Silt (%)	55.68
Clay (%)	16.02
Textural class	Silt loam
pH 1:2:5 in water	5.80
Available Phosphorous (ppm)	3.2
Organic Carbon (%)	1.08
Exchangeable Cation (meq/100 g soil)	
Ca (ppm)	6.06
Mg (ppm)	2.50
K (ppm)	2.86
N (%)	2.03

CONCLUSION

It was concluded that, extracts obtained from *A. vogelii* exhibit allelophathic effects on the growth of cowpea. The extracts affect nodulation, leaves number and plant height. The effect is concentration dependent, increase with increase in concentration.

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