International Journal of Science, Environment and Technology, Vol. 2, No 6, 2013, 1185 – 1195
ISSN 2278-3687 (O)

STUDIES ON THE ALLELOPATHIC EFFECT OF AQUEOUS EXTRACT OF *AGERATUM CONYZOIDES* ASTERACEAE ON SEEDLING GROWTH OF *SESANUM INDICUM* L. (PEDALIACEAE)

MacDonald Idu and Ovuakporie-Uvo Oghale
Department of Plant Biology and Biotechnology, University of Benin, PMB 1154, Benin City, Nigeria
E-mail: mcdonald.idu@gmail.com

Abstract: An allelopathic study using aqueous extracts of *Ageratum conyzoides* was carried out to investigate the possible allelopathic effects of its flower, root, stem and leaf extracts on the seedling growth, percentage germination and seedling evaluation of *Sesanum indicum* at treatment concentrations - 250, 500 and 1000 ppm respectively. Distilled water was used as control experiment while sandy and loamy soils were the soil type used for this study.Results show that aqueous leaf extract particularly at 1000 ppm, showed the highest inhibitory effect on *Sesanum indicum*. This inhibition was most evident in the number of root hair recorded.
Keywords: Allelopathy, seedling evaluation, *Sesanum indicum.*

Introduction

Allelopathy is a phenomenon in which chemicals of plant or microbial origin affect the growth, development and distribution of other plants and microorganisms in natural communities or in an agricultural system (Rizvi *et al.,* 1990). Allelopathy is defined as the inhibitory or stimulatory reciprocal biochemical interactions among plants (Rice, 1984). In 1975, Newman and Rovira proposed two modes of action for allelopathy. First, the synergistic effect between competition and allelopathy may provide the producer of phytotoxins with an advantage over its competing species. The second mechanism is "self-balancing negative feed-back" whereby stressed plants produce more allelochemicals to suppress the growth of immediate vegetation, thereby providing enough reduction in competition to remain in the community. This assumes that allelochemicals are released from intact living plant materials such as roots.

Sesanumindicum commonly known as sesame seed is basically a crop of the warm climates of the tropics and sub-tropics. Sesame seeds have one dehiscent pod per leaf axial, but they show variability in seed colour days to maturity, degree of branching, number of locus per pod size (FAO, 1996). Sesame seed is used mainly to produce oil through expression (mechanical, extraction and chemical methods). Sesame seed is one of the oldest edible oil

*Received Oct 2, 2013 * Published Dec 2, 2013 * www.ijset.net*

crops and its seeds are used as food source (Ashiri, 1988). The fat of sesame seed is important in the food industry due to its flavour and stability, because it can be used to cook meals of high quality (Yermanos *et al.,*1972, Cowling *et al.,* 1998). Sesame seed oil is used for manufacture of margarine, salad oil, cooking oil, soap, paint, lubricant, and lamp fuel (Imoloame *et al.,* 2007). Sesame seed contains Sesamoline and Sesamine, which is used as a synergist for insecticides. Recent studies have shown that the oil lowers cholesterol level and hypertension in humans and reduces the incidence of certain cancers.

Ageratum is derived from the Greek "ageras", meaning non-ageing, referring to the longetivity of the flower or the whole plant.*Ageratumconyzoides*; an annual herbaceous plant with a long history of traditional medicinal used in several countries of the world have been reported to possess insecticidal and nematocidal bioactivities. Aqueous extracts of leaves or whole plants have been used to treat colic, colds and fever, diarrhea, rheumatism, spasms, or as a tonic. *Ageratumconyzoides* has a quick and effective action in burn wounds and is recommended by Brazillian drugs central as an antirheumatic. This research is aimed at investigating the possible effect(s) of *Ageratumconyzoides* extracts on *Sesanumindicum* with a focus not limited to the reactive effect of extracts and response on sesame cultivated on sandy and loamy soil, but also on adequate grain production.

Materials and Methods

Identification of plant materialsused

The medicinal plant samples used for this research were identified with the assistance of Prof. MacDonald of the Department of Plant Biology and Biotechnology, University of Benin, Benin City. Some texts were also consulted in the identification process like (Gill, 1992), (Odugbemi and Akinsulire, 2006)

Source of material

Sesanum indicum used in this research work, was obtained from the Katako grain market in Jos, Plateau state of Nigeria, while the *Ageratum conyzoides* plants was gotten from selected lawns and farmland in Ejeme-Aniogor, in Delta state, Nigeria. Seeds of sesame (*sesanum indicum*) were obtained from katako grain (commodity) market in Jos,Plateau state of Nigeria. The soil sample used in this research was obtained from Ejeme-Aniogor,in Delta state.

Preparation of test extracts

This research work was carried out using aqueous extracts from the stem, leaves, root and flowers of *Ageratum conyzoides* L. These plant parts were thoroughly washed in distilled

water and dried in the oven at 80°C for 24 hours. The dried samples were then ground to powder using pestle and mortar and sieved through an 8.0mm aperture size wire mesh net screen. Ground samples were kept in plastic bags at room temperature. Three levels (250, 500 and 1000 ppm) each of (stem, leaves, roots and flower) of *Ageratum conyzoides* L, aqueous extract was prepared for use. The extracts were filtered into 100ml beakers using whatman filter paper. Methods used by Alam and Azmi (1991) were employed for the germination and seedling growth study. The treatment at each extract level were arranged randomly and applied thrice. The germinated seeds were counted, while the plumule height, radical length and number of root hair for each germinated seed crops were recorded (i.e. Sesame seed) every day for a period of three months and the results were expressed in terms of the average of the experiment. The data were analyzed statistically using simple percentage to evaluate the treatments effects.

Viability Test

The floatation method was used whereby the seeds were steeped in a volume of water contained in a beaker; the viable seeds sank while those that floated were regarded as non-viable.

Seedling evaluation

In the evaluation of seedlings of sesame, the procedure outlined by Idu, 1989 that looks into the root and shoot system followed.

Statistical analysis

Results were expressed as mean± standard error of mean (S.E.M) and the level of significance between means were computed by Anova (F-test) using SPSS 17 computer software package. The level of significance was determined at 0.005 and data were also analyzed statistically using simple percentage to evaluate treatments.

Results

The results of this research work are presented in three (3) broad sections viz; effects of extracts on germination, percentage germination and seedling evaluation

Effect of extract

On the tables, means with same superscript are not significantly different from each other while means with different superscript are significantly different. Table 1, shows the result of the effect of flower, root, stem and leaves extract respectively on the plumule length development of *S. indicum* on sandy and loamy soil at various levels (0, 250, 500 and1000 ppm).

Table 1: Effect of *A. conyzoides* aqueous extracts on plumule length of sesame on sandy and loam soil samples

Extract sources	Parameters	Concentration in PPM	Sandy soil	Loamy soil
Flower	Plumule length	0	1.53±0.20[a]	1.31±0.19[a]
		250	1.32±0.15[a]	1.89±0.23[a]
		500	1.08±0.17[a]	1.59±0.23[a]
		1000	1.50±0.26[a]	3.76±0.28[b]
Root	Plumule length	0	1.72±0.24[a]	1.82±0.25[a]
		250	0.95±0.23[a]	2.31±0.32[b]
		500	1.89±0.20[a]	1.53±0.13[b]
		1000	1.74±0.25[a]	1.93±0.23[a]
Stem	Plumule length	0	1.92±0.17[a]	1.32±0.09[a]
		250	2.13±0.13[b]	1.21±0.16[a]
		500	2.17±0.17[b]	1.56±0.21[a]
		1000	2.49±0.17[b]	1.97±0.23[a]
Leaves	Plumule length	0	1.63±0.22[a]	1.50±0.27[a]
		250	1.58±0.24[a]	1.64±0.26[a]
		500	1.40±0.21[d]	1.35±0.24[a]
		1000	1.13±0.19[a]	1.84±0.24[a]

Table 2, shows the result of the effect of flower, root, stem and leaves extract respectively on the radical height development of *S. indicum*on sandy and loamy soil at concentrations 0, 250, 500 and1000 ppm

Table 2: Effect of *A. conyzoides* aqueous extracts on radical height of sesame cultivated on sandy and loam soil samples

Extract sources	Parameters	Concentration in PPM	Sandy soil	Loamy soil
Flower	Radicle height	0	2.39±0.43[a]	1.05±0.23[a]
		250	1.98±0.34[a]	2.79±0.27[a]
		500	1.94±0.26[a]	2.64±0.44[a]
		1000	2.08±0.29[a]	4.02±0.38[b]
Root	Radicle height	0	2.22±0.49[a]	2.12±0.32[a]
		250	1.36±0.37[a]	2.75±0.32[a]
		500	2.40±0.42[a]	2.25±0.30[a]
		1000	2.70±0.30[a]	3.47±0.45[b]
Stem	Radicle height	0	2.64±0.20[a]	1.33±0.09[a]
		250	3.41±0.26[a]	1.43±0.23[a]
		500	3.30±0.51[a]	1.88±0.22[a]
		1000	2.85±0.22[a]	2.33±0.31[b]
Leaves	Radicle height	0	2.97±0.29[a]	3.64±1.14[a]
		250	1.88±0.24[a]	4.73±0.23[a]
		500	1.80±0.41[a]	4.44±0.45[a]
		1000	1.52±0.28[a]	3.96±0.42[a]

Table 3, shows the result of the effect of flower, root, stem and leaves extract respectively on the number of root hair development of *S. indicum*cultivated on sandy and loamy soil at concentrations 0, 250, 500 and1000 ppm.

Table 3: Effect of *A. conyzoides* aqueous extracts on the number of root hairs of sesame cultivated on sandy and loam soil samples.

Extract sources	Parameters	Concentration in PPM	Sandy soil	Loam soil
Flower	Number of root hairs	0	0.80±0.33[a]	0.00±0.00[a]
		250	0.80±0.25[a]	1.80±0.29[a]
		500	0.40±0.22[a]	0.60±0.40[a]
		1000	1.00±0.56[a]	6.10±1.60[b]
Root	Number of root hairs	0	1.50±0.37[a]	0.70±0.40[a]
		250	0.70±0.40[a]	1.20±1.36[a]
		500	0.90±0.28[a]	0.10±0.10[a]
		1000	1.60±0.56[a]	1.60±0.48[a]
Stem	Number of root hairs	0	0.2±0.13[b]	4.80±1.49[b]
		250	0.6±0.34[b]	4.80±1.79[b]
		500	0.3±0.34[b]	4.00±2.57[c]
		1000	0.0±0.00[a]	0.60±0.60[a]
Leaves	Number of root hairs	0	0.70±0.34[a]	0.70±0.34[b]
		250	0.40±0.40[a]	0.40±0.31[a]
		500	0.20±0.40[a]	0.50±0.27[b]
		1000	0.10±0.35[a]	0.60±1.17[b]

Percentage germination

Table 4, shows result of the percentage germination of sesame using aqueous extract of *Ageratum conyzoides* cultivated on sandy and loam soil samples.

Table 4: Percentage germination of sesame using aqueous extract of *Ageratum conyzoides*

Extract sources	Concentration in PPM	Sandy soil	Loam soil
Flower	0	40.7±19.0[a]	64.7±16.3[a]
	250	42.3±19.2[a]	40.7±19.2[a]
	500	48.3±22.4[a]	46.3±22.1[a]
	1000	15.0±6.60[a]	15.0±6.6[a]
Root	0	44.3±24.3[a]	32.7±14.9[a]
	250	45.0±21.4[a]	40.7±17.9[a]
	500	50.3±25.6[a]	41.0±25.2[a]
	1000	52.3±25.4[a]	43.7±25.3[a]
Stem	0	50.7±26.0[a]	51.3±24.9[a]
	250	48.7±25.8[a]	34.3±16.9[a]
	500	47.7±24.2[a]	31.0±15.1[a]
	1000	44.3±23.3[a]	41.0±17.5[a]
Leaves	0	48.0±24.4[a]	27.3±12.6[a]
	250	51.7±25.3[a]	46.7±21.8[a]
	500	49.0±25.8[a]	15.3±5.7[a]
	1000	52.3±22.9[a]	12.0±4.6[a]

For all the analysis, Means with the same superscript are not significantly different, but means with different superscript are significantly different from each other. Means are not significantly different at 5%.Means for group in homogenous subset are displayed

Seedling evaluation

Seedling evaluation was done using parameters such as primary roots, hypocotyls, shoot and primary leaves evaluation. Results are shown in table 5 below.

Table 5: Seedling evaluation of effects of *A. conyzoides* extracts on the development of *S.indicum.*

Conc. (ppm)	Soil type	Primary root	Hypocotyl	Shoot Primary leaves
0	Sand	Bent over spindled	Retarded decayed	Missing bent over	Stunted retarded
	Loam	Bent over spindly	Decayed	Missing bent over	Stunted retarded
250	Sand	Spindly stubby	*	Missing decayed	*
	Loam	Missing	*	*	*
500	Sand	Missing spindly	Stunted	*	Stunted
	Loam	Missing spindly	*	*	Spindly
1000	Sand	Spindly	*	Spindly glass	*
	Loam	Bent over stunted	Missing, decayed	Bent over decay	spindly

Discussion

The effect of *Ageratum conyzoides* flower extract on germination of sesame seed on sand. Shows that plumule length decreases with increase concentration at 250 and 500 ppm, but at 1000ppm concentration the largest length was obtained (Table 1). For radicle height, at 250 and 500 ppm, radicle height was the same height and highest at 1000ppm concentration while in the number of root hair, increase in concentration lead to a decrease in the number of root hair, but at 1000ppm concentration, more number of root hair was obtainable at the concentration in comparism with control treatment. Effect of root extract on germination of sesame seed on germination on sand in comparism of treatment result with control, had a lesser effect on the plumule length at 500ppm plumule length was highest while, and least at 1000ppm treatment. For radicle height, increase in concentration (i.e 250-1000 ppm) lead to increase in the radicle height, while increase in concentration led to a decrease in the number of root hair except for 1000 ppm treatment which showed a positive response to germination

(Table 3). Effect of stem extraction germination of sesame seed on sand was observed. Increase in concentration from 250-1000 ppm led to increase in the plumule length, in comparism with the control value, extract also had a positive effect as it allowed for the elongation of radicle height, with increase in concentration from 250-1000ppm. Effect of leaves extract on germination of sesame seed on sand showed that 500ppm, had the longest plumule length, shortest plumule length was obtained at 1000ppm treatment i.e. the more the concentration the shorter the plumule length.The radicle height value was highest at control and lowest at 250ppm treatment which means that extract had a negative effect on treatment with sesame seed, but at this column it can be said that the more the concentration, the radicle height reduced. Number of root hair had the same value at both 250 and 500ppm concentration treatment, and the lowest number of root hair was obtainable at 1000ppm concentration. For the effect of*Ageratum conyzoides* flower extract on germination of sesame seed on loam,Extract (250-1000) when compared with control the values obtained where higher than the control values, meaning that the extract supports the germination of plumule.It was observed that a positive effect on radicle height germination occurred when compared with the control valuei.e. values obtained at 250-1000 ppm were higher than the control value.The same was true with the number of root hair.Root extract on germination of sesame on loam showed that the extract had positive effect on the plumule length, likewise for radicle height and the number of root hair in comparism with the control value. Effect of stem extract on germination of sesame on loam had Zero value obtained at control column, but on treatment with extract, it was observed that the more the concentration, the less the plumule length, the least value was obtained at 500ppm concentration. Value at the control column was the least compared with 250-1000ppm treatment meaning that extract has a positive value on radicle length elongation; the highest value was obtained at 1000ppm and the least value at 500ppm concentration treatment. Zero value obtained at control and at 500ppm treatment, but the highest number of root hair was obtained at 1000 ppm. Effect of leaves extract on germination of sesame seed on loam for plumule length, radicle height and number of root hair, was observed to show an increase in value. i.e the more the concentration, the more the values that were obtained. Extract had a positive effect on the column for plumule length at 1000ppm.For radicle height, it had a positive effect at 1000 ppm.Likewise at the column for root hair number it also has a negative effect at all concentration treatment (250-1000 ppm) because the value at control was higher.

The effect of *Ageratum conyzoides* root aqueous extract on % germination of sesame seed was affected, in the sense that, the more the concentration, the more the increase in germination percentage when compared with the result at the control value. On treatment with *Ageratum conyzoides* stem water extract on sandy soil, sesame seed column, showed a decrease in the percentage germination as the concentration increases i.e. for sesame seed the more the concentration, the more the decrease in the percentage germination of sesame seeds. % germination using *Ageratum conyzoides* leaves water extract on sandy soil on sesame seed at the treatment with 250 and 500 ppm. The percentage germination decrease with increase concentration up to 500 ppm, but was highest at 1000ppm treatment i.e. the effect of treatment was felt mostly at the 500ppm in that it was not up to 50%. Percentage germination using flower aqueous extract of *ageratum conyzoides* on loamy soilon sesame seed had that the more the concentration treatment from 250 – 1000 ppm the more the percentage germination except for 1000 ppm concentration which had a lesser % germination value. % germination of aqueous root extract of *Ageratum conyzoides* on loamy soil showed that the more the concentration, the more the percentage germination of sesame seed. The percentage germinate was highest at the treatment with 1000ppm concentration. *Ageratum conyzoides* stem aqueous extract on loamy soil for sesame seed; at 500 ppm concentration, there was an increase in % germination, but % germination of sesame seed had a decrease at 250 ppm and lesser at 1000ppm treatment. i.e. % germination was lowest at 1000ppm. *Ageratum conyzoides* leaves aqueous extract on loamy soil for sesame seed showed that the more the concentration, the lesser the % germination, but the percentage germination was highest at the column for concentration treatment with 1000ppm (Table 4).The seedling evaluation of the effect of *A. conyzoides* revealed that the primary root of *S. indicum* was spindly stubby and missing spindly at 250 and 500 ppm, while at 1000 ppm, it was bent over stunted, and the hypocotyls were missing decayed at 1000 ppm. The shoot was bent over decayed at 1000 ppm, the primary leaves were spindly at 1000 ppm (Table 5).It can thus be concluded that soil was not a determining factor for consideration of allelopathy of *A. conyzoides* on the seedling development of selected grain (sesame). But, could be as a result of the inhibitory effects of allelochemicals present in *A. conyzoides.* The findings from this study suggest that allelopathy plays a significant role in a root- mediated negative interference with A.*conyzoides.*

References

[1] Alam, I. and Azmi, A. R. 1991. Effect of purple nutsedge (*Cyprus rotundas*) leaf extract on germination and seeding of wheat. *Pak. J. Weed sci. Res,*(4) (1).

[2] Ashrin, A. 1988. Sesame breeding; Objectives and approach in oil crops: Sunflower, Linseed and Sesame. Proceedings of the fourth oil crops network, Njoro, Kenya. Pp 1152-1163.

[3] Cowling, R., Uzun, B., Arslan, C., Karhan, M. and Toker, C. 1998. Fats and fatty acids of White Lupin (*Lupinus albus*. L.) in comparison to Sesame (*Sesamum indicum* L.). *J. Food Chem.,*(102): 45-49.

[4] FAO, 1996. International standards for phytosanitary measures: guidelines for pest risk analysis. Publication No. 2. Rome Italy, secretariat of the international plant protection convention.

[5] Gill, L. S. 1992. Ethnomedical Uses of Plants in Nigeria. Uniben Press, Benin City. 276p.

[6] Idu, M. 1989. Germination seedling evaluation and root system of *bixa orellana* L. Msc. Thesis.University of Lagos. 134p.

[7] Imoloame, E. O., Gworgwor, N, A. and Joshua, S. D. 2007. Sesame (*Sesanumindicum*, L.) weed infestation, yield and yield components as influenced by sowing method and seed rate in Sudan Savanna agro-ecology of Nigeria. *Afr J. Agric Res.,*(2) (10): 528-533.

[8] Newman, E. I. and Rovira, A. D. 1975. Allelopathy among some British grassland species 1. *Ecol.,*(63): 727-737.

[9] Odugbemi, T. and Akinsulire, O. 2006. Medicinal plants by species names In: Odugbemi, T. (eds.). Outlines and Pictures of medicinal plants in Lagos Nigeria. University of Lagos Press, Lagos. Pp. 73-161.

[10] Rice, E. L. 1984. "Allelopathy" 2nd Ed.Academia press, New York 421p.

[11] Rizvi, S. J. H., Sinha, R, C. and Rizvi, V. 1990. Implications of mimosine allelopathy in agroforestry, pp. 22–27. *In* Proceeding of the19th World Congress on Forestry. Montreal, Canada.

[12] Yermanos, D., Hemstree,t M. J., Saleed, W. and Huszar, C. K. 1972. Oil contents and composition of seed in the world collection of Sesame (*Sesanum indicum*) introduction. J. Agric chem soc. (49) (1): 20-23.