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Allelopathic Effect of Nutgrass (C*yperus tuberosus*) Seed and Leaf Extract on The Germination Of Groundnut (*Arachis hypogea* L.)

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ABSTRACT

The effects of leaf and root extracts of Cyperus tuberosus on the germination of groundnut (Arachis hypogea) was investigated using six (6) aqueous extract levels (0.0 g/cm^3, 0.5 g/cm^3, 1.5 g/cm^3, 2.0 g/cm^3, 2.5 g/cm^3 and 3.0 g/cm^3).There were 6 treatments with 3 replicates fitted into completely randomized design (CRD) at the Micro-biology Laboratory of the Science Laboratory Technology Department of Federal Polytechnic Mubi, Adamawa State, Nigeria. It was observed from the results that the aqueous extract concentration of 0.5g/cm3 and 1.0g/cm3 had significant ($P<0.05$) effect on the germination of groundnut and that the toxic chemical released by C. tuberosus aqueous extract affected the germination of groundnut at the beginning of the experiment for all the treatments. The results also revealed that different concentrations of leaf extract caused significant inhibitory effect on germination of the test crop. Bioassays also indicated that the inhibitory effect was proportional to the concentrations of the extracts and higher concentrations had the stronger inhibitory effect, whereas, the lower concentrations showed stimulatory effect in some cases. This investigation also shows that the leaf extract of C. tuberosus have more allelopathic effect than seed extract.

KEYWORDS: *Cyperus tuberosus,* Groundnut, Leaf, Seed, Germination,

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INTRODUCTION

Some common weed species, such as giant foxtail (*Setaria faberii* Herrm.) (Bell & Koeppe 1972), yellow nutsedge (*Cyperus esculentus* L.) (Drost & Doll, 1980) and *Amaranthus spp*. (Keilo *et al*., 2004), that grows along side our cultivated crop causes a lot of damage to the establishment and subsequent emergence of such cultivated crop plants. Nutsedge (*Cyperus tuberosus*) is considered one of the worst weeds of the world; with wide spread distribution in 52 different crops and 92 countries covering tropics as well as sub-tropics on the globe (Rao, 2000). Many crop and root residues have been reported to have allelophatic effect on agricultural plants (Whitaker and Feeny, 1971). A lot of study has been carried out on the effects of chemicals released by roots, leaves, fruits and other parts of intact growing plant of one species on the growth of another species (Rice and El Roy, 1984). Plants may influence the growth of each other by means of exudates from decomposing residues, and residues incorporated into growing medium.

Allelophaty is also a biological phenomenon in which one or more biochemicals produced influences the growth, survival and reproduction of other organism. These biochemicals are known as allelochemicals and can have beneficial (Positive allelophaty) or detrimental (negative allelophaty) effect on the target organisms. Willis and Rick (2007) explained that allelochemicals are a subset of secondary metabolites, which are not required for metabolism (i.e growth, development and reproduction) of the allelophatic organism and the allelochemicals with negative allelophatic effect are an important part of the plant.

The groundnut or peanut (*Arachis hypogea* L.*)* is a specie in the legume family Fabaceae. The cultivated groundnut was probably first domesticated in the valley of Paraguay and Parana rivers in the Chaco region of Paraguay and Bolivia. It is an annual herbaceous plant growing 30-50 cm tall. Groundnuts are widely used in Southeast Asian cuisine, particularly in Indonesia, where it is typically made into a spicy sauce. Peanuts are used in making candies, cakes, cookies, and other sweets. They are also enjoyed roasted and salted.

Groundnut is rich in nutrients, providing over 30 essential nutrients and phytonutrients. Peanuts are good source of niacin, folates, fiber, magnesium, vitamin E, manganese, and phosphorus. They contain 11.5 g unsaturated fats and 2 g of saturated fats. Peanuts are good sources of niacin and thus contribute to brain health and blood flow (Okumura et al., 1999)

Many factors have been known to affect the germination of groundnut. These factors include among others pest, diseases, weeds, and

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allelophatic effects of plant. *Cyperus tuberosus* is a noxious weed that is common and prevalent in the agricultural fields of Adamawa state and affect the germination of groundnuts, thus bringing economic loss to farmers. There is no enough work in literature on the effect of *Cyperus tuberosus* on the germination of groundnut in the study area. This research work was set out to determine the allelophatic effect of leaf and seed extract of *Cyperus tuberosus* on germination of groundnut.

MATERIALS AND METHODS

Study area:

The study was conducted in Federal Polytechnic , Mubi. Mubi is the headquarters of Mubi-North local Government which is located on Latitude 10^0 15'N and Longitude 13^0 16' E at an altitude of 696 m above sea level. The major ethnic groups include Fulani, Gude, and Fali and the minorities are Marghi and Kilba. The climate is characterized by alternating dry and wet season. The rains last from April to October with a mean annual rainfall from 700mm to 1050 mm (Udo, 1970; Adebayo, 2004).

Preparation of extract: The fresh samples of the weed plant (*Cyperus tuberosus)* were collected from agricultural fields in Federal Polytechnic Mubi. Both leaves and roots of *Cyperus tuberosus* were collected and the seeds were removed from the roots of the plant and washed several times with running tap water, then rinse with distilled water .

The plant (sample) that was collected was placed into the hot air oven at 80^oC for 24 hours for drying and sterilization. This was then transferred into a sterilized mortar and using a sterilized pestle, it was pounded into a fine powder each (leaves and seed powders). These were sieved through 8.0 mm size wire mesh net screen and the larger particles were removed. The fine particles were weighed into different grams of 50g, 100g, 150g and 300g by using a weighing scale. Each of them was then dissolved into $100cm^3$ of distilled water to make up the various concentrations. They are left for 24 hours. The concentrations were filtered using funnel and muslin cloth into various conical flasks. The concentration of $0.5g/cm^3$, $1.0g/cm^3$, 1.5g/cm3, $2.0g/cm^3$, and $3.0g/cm^3$ were obtained after filtration, and then used for germination tests. The powder was reconstituted at various in nairds to keep the seeds moist in the Petri dishes until the development of the first two leaves.

Treatments: Five concentrations of 0.5 g/cm3, 1.0 g/cm^3, 1.5 g/cm^3, 2.0 g/cm^3 and 3.0 g/cm^3 of *Cyperus tuberosus* water extracts of both leaves and seeds were prepared by dissolving 50g, 100g, 150g, 200g and 300g in

100cm^3 of distilled water each . Sixty four (64) petri dishes were used with five (5) seeds each of groundnut, soaked in sterilized cotton wool., while four (4) of the Petri dishes were used as control (Two were distilled water and two were tap water). The leaves and seeds extracts were used in moistening the cotton wool that contained the seeds of groundnut. in the Petri dishes. The treatment of each water level was replicated 3 times. The germination of each replicate was recorded on daily basis. The experiment was terminated after thirteen (13) days. The germinated seed were counted. The result were expressed in terms of the mean values of the three (3) replicates.

Statistical analysis: The data obtained from the experiment were analyzed statistically by subjecting them to analysis of variance (ANOVA) using SAS system for windows (SAS, V8, 2000). Significant differences among means were separated using Least Significant Difference (LSD) procedure (Little and Hills, 1986)

RESULTS AND DISCUSSION

The allelophatic effect of *Cyperus tuberosus* seed extract on the germination of groundnut is presented in Table 1. There was a significant ($P \leq 0.05$) difference between the various extract concentrations at day 1 to day 13 of the experiment. At day 8, the inhibitory effect of the aqueous extract stabilized (99.66) for concentration of 0.5g/cm3, while the stability was noticed at day 6 for the 3.0g/cm^3 (12.90) concentration. The least value in germination was recorded on aqueous extract concentration of 3.0g/cm^3 which had no germination at the 1st and 2nd days. The highest germination was recorded on concentration of 0.5g/cm3 with 99.66 from days 9-13, and on the control from days 8- 13 of the experiment. Interestingly, the concentration of 0.5g/cm3 started well with 22.66% germination.

The allelophatic effect of *Cyperus tuberosus* leaf extract on the germination of groundnuts is also presented in Table 2. There was no significant ($P \leq 0.05$) variation amongst the treatments in the 1$^{st\ day}$ of germination except for the aqueous concentration of 1.5g/cm3 which recorded a significant ($P \leq 0.05$) with mean germination of 8.60 in the 1st day of the experiment. There was also a significant ($P \leq 0.05$) variation amongst the treatment from day 2 of the experiment to the last 13th day. Similarly, all the treatments seem to exhibit some level of allelophaty and inhibition effect on the germination of groundnut. The highest mean germination was recorded on aqueous extract concentration of 0.5g/cm3 with 86.53 on the 12th and 13th day as against the 99.66 recorded in the control on the 7th to 13th day. The mean least germination on the 13th day was recorded for aqueous concentration of 3.0g/cm^3 (26.86).

Table 1: Effect of Cyperus tuberosus seed extract on the germination of Groundnuts

Treatment	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10	Day11	Day12	Day13
0.0	20.33b	70.00a	70.00a	90.00a	90.33b	96.33b	99.33a	99.66a	99.66a	99.66a	99.66a	99.66a	99.66a
0.5	26.66a	40.13c	60.26b	74.30b	99.66a	99.60a	99.00a	99.93a	99.66a	99.66a	99.66a	99.66a	99.66a
1.0	13.16c	53.16b	52.83c	59.66c	66.53c	66.20b	66.20b	70.40b	73.40b	86.43b	86.43b	86.53b	86.53b
1.5	13.10c	26.40d	40.00d	46.50d	61.20c	65.00b	66.20b	66.20c	66.50c	72.40c	72.73c	73.40c	73.40c
2.0	6.40d	25.73d	33.13e	40.40e	51.73d	57.13c	57.80c	62.33c	62.33d	65.33c	65.33c	66.00c	66.00c
3.0	0.00e	0.00e	4.40f	8.60f	12.80e	12.90d	12.90d	12.90d	12.90e	12.90d	12.90d	12.90d	12.90d
LSD (0.05)	1.08	1.07	2.57	2.62	7.12	6.44	6.57	3.92	3.50	7.63	7.76	8.60	8.60

Means with the same letter are not significantly different

Table 2: Effect of Cyperus tuberosus seed extract on the germination of Groundnuts

Treatment	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10	Day11	Day12	Day13
0.0	20.66a	69.66a	69.66a	83.00a	89.66a	99.33a	99.66a	99.66a	99.66a	99.66a	99.66a	99.66a	99.66a
0.5	0.00c	26.13b	30.53b	53.33b	66.43b	73.30b	80.06b	80.33b	86.43b	86.43b	86.50b	86.53b	86.53b
1.0	0.03c	20.33c	26.53b	33.40c	53.46c	60.33c	60.66c	60.33c	66.20c	72.96c	73.50c	73.33c	73.66c
1.5	8.60b	13.26d	25.66b	40.00c	46.43d	53.36d	53.46d	53.46d	60.00d	66.46d	66.53d	66.53d	66.63d
2.0	0.00c	6.60e	24.46b	33.56c	40.00e	46.10e	46.30e	46.30e	46.40e	46.40e	46.43e	46.43e	46.53e
3.0	0.00c	0.03f	6.60c	6.63d	13.43f	20.53f	20.53f	20.53f	26.20f	26.20f	26.20f	26.53f	26.86f
LSD(0.05)	0.83	0.77	12.50	8.67	0.60	4.36	0.90	0.82	0.64	0.50	0.57	0.94	1.51

Means with the same letter are not significantly different.

The introduction of *Cyperus tuberosus* leaf and seed aqueous extract residues showed no significant little effect on the seed germination of groundnut at the high water level extract. The result from the introduction of *Cyperus tuberosus* seed aqueous extract on the germination of groundnuts seed to test its allelophatic effect was further verified on a similar experiment using *Acacia auriculiformis* on seed germination of some agricultural crops. This also confirms the findings of Mousari and Al Naib (1975) on the inhibition of seed germination of some herbaceous plants by leaf extract of Eucalyptus. It was also observed that the leaf extract of *Acacia auriculiformis* delayed as well as hindered the germination in plants (Rafiqul hoque *et,al*, 2003). Allelopathic effects of *Lantana camara* on germination and growth behavior of someagricultural crops was also reported (Ahmed *et al.,* 2007). The growth inhibition cause resulted from allelochemicals from *Cyperus tuberosus* residue to interfere with many processes. Evanari (1994) noted that the presence of germination inhibitors is a wide spread phenomenon, while the detrimental effect of chemical exudates from growing plant can be directly related to their environmental product of decay or dead plant tissue are only part of the inert , non living component of the ecosystem. The inhibitory effect increases with the increase in extract concentration (Rafiqul hoque *et al*., 2003). It has also been reported that a decrease in phyto toxicity was observed with increasing age of residue (Batish *et al*., 2005). Allelo-chemicals are subject to various biotic and abiotic processes that reduce their persistence, concentrations, availability and biological activities after they are released into the soil. Such processes embody utilization by soil microorganisms (Blum *et al*., 1999), chemical transformation (Okumura *et al*., 1999) and polymerization (Wang *et al*., 1986) among others. Allelophatic potential vary from plant to plant (Hong *et al*., 2003; Brennan andSmith, 2005; Reeves *et al.*, 2005; Batish *et al.*, 2006;Stoll *et al*., 2006; Adler and Chase, 2007; Price *et al*., 2008). Rice (1984) inferred that chemicals that inhibit the growth of some species at certain concentration could stimulate the growth of the same or different specie at lower concentration. This study has also shown that *Cyperus tuberosus* have little allelophatic effect and more inhibitory effect on the germination of groundnut seed.

CONCLUSION

Based on the result obtain from this research on the allelophatic effect of *Cyperus tuberosus* leaf and seed water extract on groundnut germination, it can be concluded that the allelochemicals released by *Cyperus tuberosus* water extract of both leaf and seeds have an adverse

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effect on the germination of groundnut. Also the toxic chemical has both inhibitory and stimulatory effect on groundnut germination depending on the level of concentration.

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