ALLELOPATHIC EFFECTS OF *Selaginella uncinata* (L.) ON THE SEEDLING GROWTH OF *Zea mays* (L.)

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ABSTRACT

This research work was conducted to determine the allelopathic effect of *Selaginella uncinata*on the seedling growth of *Zea mays*. It was a completely randomized design (CRD) with three replicates and five treatments. The test treatments were extracts of *Selaginella uncinata* leaves and at different concentrations of 0%, 25%, 50%, 75% and 100% which were provided by adding distilled water. Experimental units were petri dishes in diameters of 9cm and Whatman filter paper. The plumule length and radicle length were measured using a ruler. The test result showed that the extract had both inhibitory and stimulatory effect on *Zea mays* radicle growth at different concentrations. The extract showed stimulatory effect at 25% and 50% concentrations and inhibitory effect at 75% and 100% concentrations. Radicle length decreased with increase in concentration whereas the plumule length increased when treated with 25% and 50% of the extract but decreased overtime with increase in concentrations (75% and 100%) of plant extract.

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INTRODUCTION

Allelopathy is a natural ecological phenomenon. It has been known and used in agriculture since ancient times (Zeng, 2014). The term was coined in 1937 by German plant physiologist Hans Molisch to define the harmful effect of one plant upon another. Currently, a more complete definition includes the positive and negative effects of chemical compounds produced mainly from the secondary metabolism of plants, microorganisms, viruses and fungi that have an influence upon the growth and development of agricultural and biological ecosystems (excluding mammals) (Kruse *et al.*, 2000; Olofsdotter *et al.*, 2002).

Selaginella uncinata, the blue spike moss, peacock moss, peacock spike moss, or spring blue spike moss, is a species of plant in the Selaginellaceae family. It is native to Sourthern China. It is not a true moss but rather a type of lycophyte, which are the oldest living vascular plants that date back to 410 million years ago, making them somewhat prehistoric and unlike most plants by design. It is commonly called Peacock Fern or Rainbow Moss because of the shimmery, iridescent, blue green and bronze red coloring of the unique lacy, fern like foliage. Maize also known as corn is a large grain plant first domesticated by indigenous peoples in southern Mexico, about 10,000 years ago. The leafy stalk of the plant produces separate pollen and ovuliferous inflorescences or ears, which are fruits, yielding kernels or seeds.

Recently many researchers considered the allelopathaticity of different types of plant on various plant species. But there were very few work on the allelopathic effect of *Selaginella uncinata*on plant species. Aasifa and Siddiqui (2002) conducted a study to investigate the allelopathic effects of *Eclipta alba* weed on seed germination and seedling growth of weed (*Cassia tora* L., *Cassia sophera* L.) and crop (*Phaseolus aureus* L., *Oryza sativa* L.) plants. The aqueous extracts from root, stem and leaf had no effect on seed germination of test plants. However, the aqueous extracts from leaf, root and stem inhibited root length, shoot length and dry weight. Anita and Anjana (2013) studied the allelopathic effects of aqueous extract of leaves of *Mikania micrantha* on seed germination and seedling growth of *Oryza sativa* L. and *Raphanus sativus* L. Seed germination and seedling growth were inhibited by concentrated

aqueous extract of *M. micrantha*, *R. sativus*was more sensitive to inhibitory effects of leaf aqueous extract of *M. micrantha*. The extract had strong inhibitory effect on root of seedling than in shoot. However this work considered the alleolpathic effect of *Selaginella uncinata* on the seedling growth of *Zea mays*

MATERIALS AND METHOD

Plant Material

The leaves of *Selaginellauncinata* were collected from a Dam at Ididep in IbionoIbom LGA of AkwaIbom State. The plant was identified by a taxonomist the Department of Botany and Ecological Studies University of Uyo. Specimen of the plant sample is preserved in the Departmental Herbarium.

Extraction of Plant Leaves

Aqueous extraction was carried out. The leaves were spread on a ply wood and were air-dried for three days at room temperature. The dried leaves were poured into a transparent bucket and 3 liters of distilled water was added. It was allowed to stand for 17 days so that the contents will be properly extracted. The extract was filtered through a separating funnel stuffed with enough cotton wool and hung on a retort stand to remove debris. The stock concentration was gotten by evaporating the extract using a water bath.

Determination of Allelopathic Effect of Test Plant

Experiment to determine the allelopathic effect of *Selaginella uncinata* on *Zea mays* was conducted at the Botany Green House, University of Uyo, Akwa Ibom State, Nigeria. Seeds of *Zea mays* were surface sterilized with water: bleach (10:1 v/v) solution for 5 minutes to avoid contamination and were thoroughly rinsed four times with sterile distilled water. For testing, 15 Petri-dishes (9 cm in diameter), were washed and sterilized with water: bleach (10:1 v/v) solution for 3 minutes to avoid contamination. The petri-dishes were well labeled to avoid mixing up. Whatman No.1 filter papers were kept in each Petri-dish, and ten sterilized seeds of *Zea mays* were placed on it at equal distance. Concentrations of 25%, 50%, 75% and 100% of the test plant extract were prepared from the stock solution. Thereafter 10 ml of each concentration was added to the petri-- dishes. Seeds soaked in distilled water served as control and each of the experiment was repeated two times. The treated seeds were incubated for 14 days with10 ml of the extract while10 ml of distilled water was used for control. These were applied daily on the Whatman paper to keep it moist for seedling development. Growth of seedlings was determined by measuring the radicle and plumule lengths. The radicle (root) and plumule (shoot) lengths were measured in centimeters using a ruler.

Statistical Analysis

Analysis of variance was performed using standard techniques and differences between the means were compared through Duncans multiple Significant Difference test ($P < 0.05$) using SPSS software package.

RESULTS AND DISCUSSION

The results of the allelopathic effects of *Selaginella uncinata* on the seedling growth of *Zea mays* are shown in Tables 1 & 2. The research findings have shown that *Selaginella uncinata* had both stimulatory and inhibitory effects on the radicle length of *Zea mays*. The stimulating effect was observed at 25% and 50% concentrations. Inhibitory effect was also observed at 75% and 100% concentrations. Similarly, 25% and 50% concentrations of the plant extract enhanced plumule growth remarkably. . However decrease in plumule length was observed at higher (75% and 100%) concentrations. This shows that *Selaginella uncinata* extract also exerted both inhibitory and stimulatory effect on the plumule growth *Zea mays* seedlings

Table 1: Allelopathic effect of *Selaginella uncinata* extract on the radicle length of *Zea mays* (cm)

Concentration (%)	Incubation Period (days)				
	2	4	6	8	10
0 (control)	0.5	0.36	0.60	1.0	1.50
25	0.43	0.43	1.47	1.0	0.83
50	0.40	0.53	1.80	1.80	1.50
75	0.30	0.30	1.07	0.47	0.25
100	0.33	0.30	0.57	0	0

Table 2: Allelopathic effect of *Selaginella uncinata* extract on the plumule length of *Zea mays* (cm)

Concentration (%)	Incubation Period (days)				
	2	4	6	8	10
0 (control)	0	0.20	1.90	3.13	3.20
25	0	0.1	1.73	2.47	2.63
50	0	0.47	1.90	4.13	5.10
75	0	0	1.07	1.63	1.90
100	0	0.36	1.07	2.50	2.53

Statistical analysis of data has shown that the allelopathic effect of *Selaginella uncinata* on *Zea mays* radicle growth was significant ($P<0.05$). This is in contrast with the findings of Sardoei *et al.* (2012) where the use of *Cyperus rotundus* extract reduced the seedling growth of *Lycopercicon esculentum* with significantly decrease in its density, such that at the 75% and 100% densities, germination was terminated.

Though stimulatory, the effect on the plumule length of *Zea mays* was however not significant($P>0.05$). Although the highest plumule length was also observed at 25% and 50% concentrations, there was however increase in the plumule length as the culture age and all through the experimental period. This is in agreement with the findings of Sisodia *et al*. (2009) where the extracts from stem of *Croton bonplandianum* weed had a stimulatory effect on the shoot length of crop plants (*Triticum aestivum* L., *Brassica oleracea* var. *botrytis* L. and *Brassica rapa* L.) and weed plants (*Melilotus alba* Medik., *Vicia sativa* L. and *Medicago hispida* Gaertn) at all concentration levels.

CONCLUSION AND RECOMMENDATION

The study of the allelopathic effect of *Selaginella uncinata* showed that the extract had significant effect ($P < 0.05$) on the radicle growth of *Zea mays* whereas there was no significant effect in the plumule growth. It is concluded that the extract of *Selaginella uncinata* had both inhibitory and stimulatory effects on seedling growth of *Zea mays* and may not be useful in enhancing maize productivity. However it is suggested that further research on the allelopathic effect of this extract should be done to test its effects on other cereal crops.

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