Global Journal of Science Frontier Research
Biological Science
Volume 13 Issue 7 Version 1.0 Year 2013
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

# Allelopathic Efeects of Aqueous Extracts of Plant Residues on Two Tropical Weeds of South Western Nigeria

By Modupe Janet Ayeni & Joshua Kayode
*Ekiti State University, Nigeria*

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*Keywords: allelopathy, cajanus cajan, euphorbia heterophylla, bidens pilosa.*

*GJSFR-C Classification : FOR Code: 060799*

ALLELOPATHIC EFEECTS OF AQUEOUS EXTRACTS OF PLANT RESIDUES ON TWO TROPICAL WEEDS OF SOUTH WESTERN NIGERIA

# Allelopathic Efeects of Aqueous Extracts of Plant Residues on Two Tropical Weeds of South Western Nigeria

Modupe Janet Ayeni [α] & Joshua Kayode [σ]

*Abstract-* The allelopathic effects of aqueous extracts of plant residues from *Zea mays* (root and tassel) and *Cajanus cajan* (leaves and stem) were examined on the two weeds, *Euphorbia heteropyhlla* L. and *Bidens pilosa* L. The results obtained showed that the aqueous extracts retarded the germination and the initial growth of both weeds. The effects were concentration dependent as the degree of retardation increased with increase in the concentrations of the extracts. The retardation of germination of *E. heterophylla* seeds was more pronounced in seeds treated with extracts from *C.* cajan leaf. The % germination decreased from 18% in the 5g concentration to 10% in 25g/200mL concentration at 144hrs experimental time. Similarly, the retardation of germination of *B. pilosa* seeds was more pronounced in *C. cajan* stem extract treated seeds.

The % germination decreased from 52% in the 5g concentration to 20% in 25g/200mL concentration at 144hrs experimental time. The radicles of the two weeds were also retarded by the extracts. The retardation of radical lengths of *E. heterophylla* and *B. pilosa* seedlings were more pronounced in *Cajanus cajan* stem extract treated seeds as no radicle emerged until 72hrs experiment time. The radicle length of *E. heterophylla* seedling at 144hrs experiment was 0.93cm in the 5g concentration which reduced to 0.29cm in 25g/ 200mL extract concentration. The radicle length of *B. pilosa* seedling at 144hrs experimental time was 1.25cm in 5g concentration which decreased to 0.59cm in 25g/ 200mL concentration. The plumule lengths of the two weeds were also retarded by the extracts. The plumule length of *E. heterophylla* seeds were mostly retarded by extract from *C. cajan* stems. Plumule length in the 5g concentration was 0.53cm which decreased to 0.06cm in the 25g extract concentration. *B. pilosa* seedlings were retarded mostly by extracts from *C. cajan* leaves. Plumule length was 1.20cm in the 5g extract concentration which decreased to 1.03cm in 25g/200mL extract concentration.

Statistical analyses ($P < 0.05$) revealed that there were significant differences in the germination, radicle and plumule lengths obtained in the extract treated seeds when compared to the control especially at between 120 and 144hrs experimental time.

*Keywords: allelopathy, cajanus cajan, euphorbia heterophylla, bidens pilosa.*

*Authors α σ : Department of Plant Science, Ekiti State University, Ado-Ekiti, Nigeria. e-mails: jayeni@yahoo.com, jokayode@gmail.com*

## I. Introduction

The presence of weeds in agricultural fields greatly reduces crop yields. This has forced farmers to use herbicides as possible control measure. At present, these herbicides are highly expensive beyond the reach of resource-poor farmers. Quite often they are not available in the rural areas where majority of the farmers reside. Situations abounds where farmers procured resources from diverse sources and yet the herbicides were unavailable to purchase and when available, they could be adulterated and useless. Also the herbicides are environmentally unfriendly.

Consequent on the above, there has been a resurgent of interest in the search for sustainable weed control strategies that would address the problems stated above. Attempts made elsewhere included the use of allelopathy. In Nigeria, there abounds a gross dearth of studies on the allelopathic effects of crop residues until recently when allelopathic effects of some crop residues were considered on some agricultural crops and weeds by Ayeni *et al.,* 2010, Ayeni and Kayode (2012), Ayeni and Kayode (2013). The study being presented here examined the allelopathic effects of two common plant residues on two common weeds in Ekiti State, Nigeria.

## II. Materials and Methods

Laboratory experiment was conducted in the Department of Plant Science, Ekiti State University, Ado-Ekiti, Nigeria, in September 2010 to determine the effects of different concentrations of aqueous extracts from residues of maize tassels and roots as well as *Cajanus cajan* leaves and stems on the germination and growth of two tropical weeds (*E. heterophylla* and *B. pilosa).*

*Z. mays*' tassels and roots were obtained from the experimental farm of the Faculty of Agricultural Sciences of the Ekiti State University, Ado-Ekiti, Nigeria, after the corns had been harvested. *Cajanus cajan's* leaves and stems were obtained from a farmland in Ikere-Ekiti, a town located at about 15km from the campus of the University.

These materials were chopped into pieces and were air-dried for three weeks after which they were pounded using pestle and mortal. Seeds of *E. heterophylla* and *B. pilosa* were obtained within the University campus.

## III. Extract Preparation

Portions of 5g, 10g, 15g, 20g, and 25g of each of the grounded samples of the crop residues were measured out using G&G Electric Top Loading Digital balance, JJ300Y, China. Each portion was soaked in 200ml distilled water in 500ml conical flasks. The mixtures were shaken intermittently for 24hrs at 25$^0$C ± 1$^0$C. The extracts for each crop residue was filtered and the filtrates were stored in a refrigerator for further usage.

## IV. Allelopathy Bioassay

In each treatment, two layers of Whatman No. 1 filter papers were put in each Petri dish (with a diameter of 9cm). Five seeds, each of the weeds, were sown in the Petri dish and each replicated ten times for each extract concentration. The filter papers were moistened daily with the different extract concentrations using syringe and needle. Control experiments were set up for each extract residues and were replicated ten times. All the Petri dishes were arranged on germination tables at room temperature between 25-30$^O$C. The seeds were considered as germinated upon radicle emergence and the number that germinated was counted and recorded for six days. The radicle and plumule growth elongations were recorded at 24hrs interval. The data obtained from the experiments were compared to those obtained from the control using Analysis of Variance (ANOVA, $P < 0.05$).

## V. Results and Discussion

*a) Seed germination*

The effects of aqueous extracts from the plant residues on the germination of seeds of the two weeds are shown in Tables 1and 2. The % germination of *E. heterophylla* seeds in all the four treatments was retarded (Table 1). It was observed that germination of seeds of *E. heterophylla* were retarded mostly by the extract from the *C. cajan* stem as no germination occurred until 72hrs experimental time (Table1 D). The effects of the extracts on the % germination (Table 1 A-D) increased with increase in the concentration of the extracts. This tends to show that the effects of the extracts were concentration dependent.

In *Z. mays* root extract treated seeds of *E. heterophylla* (Table 1 A), results obtained at 144hrs experimental time revealed that while the % germination in the control was 54%, those of 5, 10, 15, 20 and 25g/ 200mL concentrations were 34%, 24%, 24%, 24% and 20% respectively. In *Z. mays* tassel extract treated seeds (Table 1 B), results obtained at 144hrs experimental time was 54% in the control, those of 5, 10, 15, 20 and 25g/mL concentration were 54%, 40%, 32%, 18% and 10% respectively. Likewise, the % germination of *E. hereophylla* seeds in the *C. cajan* leaves aqueous extracts treated seeds (Table 1 C) was 28% in the control which decreased to 10% in 25g/200mL concentration. Also, in the *C. cajan* stem aqueous extract treated seeds (Table 1 D), % germination was 36% in the control which decreased to 6% in 25g/200mL Concentration.

The germination of *B. pilosa* seeds in the aqueous extracts of the four treatments were shown in Table 2. It was also observed that the aqueous extracts also brought a considerable inhibition in the germination of *B. pilosa* seeds. In *Z. mays* root extract treated seeds (Table 2 A), the % germination of *B. pilosa* seeds was 90% in the control experiment, those of 5, 10, 15, 20 and 25g/ 200mL were 74%, 52%, 48%, 32% and 32% respectively. In the *Z. mays* tassel extract treated seeds (Table 2 B), the % germination was 72% in the control which decreased to, 30% in 25g/200mL concentration. Likewise, the *C. cajan* leaf extract treated seeds (Table 2 C) had 90% germination in the control experiment which decreased to 46% in the in 25g/200mL concentration. In *C. cajan* stem extract treated seeds (Table 2 D), control experiment had 70% which decreased to 20% in 25g/200mL concentration. It was observed that extract from the *C. cajan* stem retarded the germination of *B. pilosa* seeds more than the others.

Statistical analysis( $P<0.05$) showed that there were significant differences in the % germination of extract treated seeds between 96 and 144hrs experimental time in all the treatments except the extract from the *Z. mays* tassel in *B. pilosa* treated seeds where no significant different was observed in extract treated seeds and the control at low extract concentrations.

The study lend credence to the previous assertions of Oyun (2006) who reported that aqueous extracts from *Gliricidia sepium* caused a prolong delay of maize seeds germination. Also, Aisha *et al.* (2010) and Monica *et al.* (2011) reported the aqueous extracts of *Ascarum europaeum* L. inhibited the germination and growth of *Lycopersicum esculentum.*

## VI. Radicle Length

The effects of the aqueous extract of the plant residues on the radicle lengths of the two weeds are shown in Tables 3 and 4. The results showed that the four plant residues retarded the radicle lengths of the weeds. *E. heterophylla* seeds treated with aqueous extract of *C. cajan* stem were mostly retarded (Table 3 D). At 144hrs experimental time, the radical length in the control experiment was 2.38cm, those of 5, 10, 15, 20 and 25g/ 200mL concentrations were 0.93cm, 0,83cm, 0.72cm, 0.51cm and 0.29cm respectively. Likewise, *B. pilosa* seeds treated with extract from *C. cajan* stem resulted in more inhibition of the radicle lengths

(Table 4 D). Radicle length in the control experiment was 1.52cm, those of 5, 10, 15, 20 and 25g/200mL extract concentrations were 1.25cm, 0.99cm, 0.92cm, 0,83cm and 0.59cm respectively.

Statistical analysis (P<0.05) revealed that there were significant differences in the radical lengths of extract treated seeds between 72 and 144hrs experiment time in the three crop residues extracts except the extracts from *Z. mays* roots on radicle length on *B. pilosa* at the low extract concentrations (Table 4). The results obtained in this study corroborated the earlier assertions of Khan *et al.* (2011) who reported that litter from leaves and stem of *Rhazyastricta dence* significantly reduce the germination, radicle, plumule growth and number of roots of maize. Sisodia and Siddiqui (2010) reported that the radicle and plumule lengths of seedlings of test species were reduced significantly in response to the *C. bonplandianum* extracts.

## VII. Plumuleat Length

The effects of aqueous extracts of plant residues on the plumule growth of the two weeds were shown in Tables 5 and 6.The results also showed that the four aqueous extracts of the plant residues retarded the plumule length of the two weeds. The results revealed that the plumule length of *E. heterophylla* seeds treated with the aqueous extracts from *Z. mays* root was 2.83cm at 144hrs experimental time in the control experiment. The plumule lengths of the 5, 10, 15, 20 and 25g/200mL extract concentrations were 1.99cm, 1.40cm, 1.30cm, 0.84cm and 0.64cm respectively (Table 5 A). Also in the *Z. mays* tassel extract treated seeds, the plumule length of *E. heterophylla* in the control was 2.23cm, those of 5, 10, 15, 20 and 25g/200mL concentrations were 1.79cm.1.47cm, 0.91cm, 0.90cm and 0.81cm respectively (Table 5 B). It was observed that extracts from *C. cajan* stem retarded the plumule lengths of *E. heterophylla* mostly with 1.31cm in the control which decreased to 0.06cm in 25g/200mL concentration (Table 5 D).

The results also revealed that the plumule lengths of seedlings emerged from *B. pilosa* extract treated seeds were retarded by the aqueous extracts of the plant residues. In the *Z. mays* root extract treated seeds (Table 6 A), plumule length in the in the control experiment was 1.52cm. Those of 5, 10, 15, 20 and 25g/200mL concentrations were 1.20cm, 1.17cm, 1.06cm, 0.93cm and 0.38cm respectively. Also in the *C. cajan* stem extract treated seeds (Table 6 D) plumule length was 2.17cm in the control experiment which decreased to 1.03cm in 25g/200mL concentration.

Statistical analyses (P<0.05) revealed that significant differences abound in results obtained from *E. heterophylla* seeds treated with the aqueous extracts of the residues, most especially at higher extract concentrations, between 96 and144hrs experimental time. The results obtained from this study were in accordance with the work of Seerjana *et al.* (2007) who reported that the leaf aqueous extracts of *Parthenium hysterophorus* L. exhibited significant inhibitory effects on seed germination and seedling growth of all test species in cruciferous species. Abu-Romman (2010) also noted that allelochemicals released into the surrounding might inhibited or retarded root or radicle and shoot or coleoptile of plants. Aisha *et. al.* (2010) and Yarnia *et. al.* (2009), Kaul and Bansal (2002) also demonstrated similar results in their studies.

In conclusion, the study revealed that the root and tassel of *Z. mays* contain some allelochemicals which might be responsible for the inhibitory effects exhibited on the two weeds examined in this study. According to Sanchez- Moreiras *et. al.* (2004), *Z. mays* tassels' allelopathy was attributed to hydroxamic acid. Also, An *et al.* (2003) and Alberto *et al.* (2012) reported that *Z. mays* root allelopathy contained 2, 4- dihydroxy-7-methoxy-2*H* -1, 4- benzoxazin-3(4*H*) – one (DIMBOA). Nulifer (2006) revealed the phenolic acid in *Cajanus cajan* to include ptotocatechic, p- hydroxyl benzoic acid. All these chemicals might be responsible for the retardation in the germination and the initial growth of the two weeds examined here. It is hereby recommended that there is need for further studies on the potentials of turning these crop residues from waste materials to wealth.

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*Table 1 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) on the germination of seeds of *E. heterophylla*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A. | | | | | | |
| *Z. mays* root 0 | 0a | 8a | 42a | 54a | 54a | 54a |
| *Z. mays* root 5 | 0a | 6a | 24b | 34b | 34b | 34b |
| *Z. mays* root 10 | 0a | 4a | 16b | 24b | 24b | 24b |
| *Z. mays* root 15 | 0a | 4a | 16b | 24b | 24b | 24b |
| *Z. mays* root 20 | 0a | 2a | 14b | 24b | 24b | 24b |
| *Z. mays* root 25 | 0a | 0a | 10b | 20b | 20b | 20b |
| B | | | | | | |
| *Z. mays* tassel 0 | 0a | 14a | 30a | 52a | 54a | 54a |
| *Z. mays* tassel 5 | 0a | 10b | 30a | 38ab | 42ab | 54a |
| *Z. mays* tassel 10 | 0a | 4b | 18ab | 32abc | 36ab | 40ab |
| *Z. mays* tassel 15 | 0a | 2b | 10b | 24bc | 32ab | 32ab |
| *Z. mays* tassel 20 | 0a | 2b | 6b | 18bc | 18b | 18b |
| *Z. mays* tassel 25 | 0a | 0b | 4b | 10c | 10b | 10b |
| C | | | | | | |
| *C. cajan* leaf 0 | 0a | 12a | 14a | 18a | 28a | 28a |
| *C. cajan* leaf 5 | 0a | 6a | 12a | 14a | 18ab | 18ab |
| *C. cajan* leaf10 | 0a | 4a | 10a | 12a | 14ab | 14ab |
| *C. cajan* leaf 15 | 0a | 2a | 10a | 12a | 14ab | 14ab |
| *C. cajan* leaf 20 | 0a | 2a | 8a | 10a | 12ab | 14ab |
| *C. cajan* leaf 25 | 0a | 2a | 6a | 10a | 10b | 10b |

| | | | | | | |
|---|---|---|---|---|---|---|
| D | | | | | | |
| *C. cajan* stem 0 | 0a | 2a | 14a | 36a | 36a | 36a |
| *C. cajan* stem 5 | 0a | 0b | 10ab | 16b | 16b | 16b |
| *C. cajan* stem 10 | 0a | 0b | 8ab | 12b | 16b | 16b |
| *C. cajan* stem 15 | 0a | 0b | 8ab | 8b | 8b | 8b |
| *C. cajan* stem 20 | 0a | 0b | 4ab | 6b | 6b | 6b |
| *C. cajan* stem 25 | 0a | 0b | 0b | 6b | 6b | 6b |

Means followed by the same letter with the column for each treatment are not significantly different at (P< 0.05)

*Table 2 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) on the germination of seeds of *B. pilosa*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A. | | | | | | |
| *Z. mays* root 0 | 0a | 36a | 82a | 86a | 90a | 90a |
| *Z. mays* root 5 | 0a | 20b | 50b | 66a | 74a | 74a |
| *Z. mays* root 10 | 0a | 12b | 32bc | 40b | 48b | 52bc |
| *Z. mays* root 15 | 0a | 12b | 28c | 38b | 46b | 48c |
| *Z. mays* root 20 | 0a | 4b | 20c | 24b | 32b | 32c |
| *Z. mays* root 25 | 0a | 4b | 20c | 24b | 32b | 32c |
| B | | | | | | |
| *Z. mays* tassel 0 | 0a | 32a | 42a | 50a | 72a | 72a |
| *Z. mays* tassel 5 | 0a | 14b | 42a | 50a | 72a | 72a |
| *Z. mays* tassel 10 | 0a | 9b | 38a | 46a | 58ab | 60ab |
| *Z. mays* tassel 15 | 0a | 2b | 34a | 46a | 50ab | 58ab |
| *Z. mays* tassel 20 | 0a | 0c | 30a | 32a | 44bc | 46bc |
| *Z. mays* tassel 25 | 0a | 0c | 22a | 28a | 30c | 30c |
| C | | | | | | |
| *C. cajan* leaf 0 | 0a | 54a | 64a | 72a | 72a | 90a |
| *C. cajan* leaf 5 | 0a | 14b | 56ab | 70ab | 70ab | 78ab |
| *C. cajan* leaf10 | 0a | 10b | 48ab | 54abc | 64abc | 64abc |
| *C. cajan* leaf 15 | 0a | 4b | 32bc | 40bc | 64abc | 64abc |
| *C. cajan* leaf 20 | 0a | 2b | 20c | 40bc | 62abc | 62abc |
| *C. cajan* leaf 25 | 0a | 0c | 12c | 28c | 46c | 46c |
| D | | | | | | |
| *C. cajan* stem 0 | 0a | 34a | 14a | 56a | 64a | 70a |
| *C. cajan* stem 5 | 0a | 12b | 10ab | 36b | 50ab | 52ab |
| *C. cajan* stem 10 | 0a | 6b | 8ab | 28b | 34bc | 46b |
| *C. cajan* stem 15 | 0a | 6b | 8ab | 22b | 28bc | 34b |
| *C. cajan* stem 20 | 0a | 4b | 4ab | 20b | 20bc | 28b |
| *C. cajan* stem 25 | 0a | 0b | 0b | 14b | 16c | 20b |

Means followed by the same letter with the column for each treatment are not significantly different at (P< 0.05)

*Table 3 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) on the radicle length (cm) of *E. Heterophylla*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A. | | | | | | |
| *Z. mays* root 0 | 0.00a | 0.03a | 0.64a | 1.17a | 2.00a | 3.68a |
| *Z. mays* root 5 | 0.00a | 0.00a | 0.36b | 1.01a | 1.74ab | 2.46b |
| *Z. mays* root 10 | 0.00a | 0.00a | 0.31bc | 0.75ab | 1.72ab | 2.05bc |
| *Z. mays* root 15 | 0.00a | 0.00a | 0.19bcd | 0.72ab | 1.23c | 1.69bcd |
| *Z. mays* root 20 | 0.00a | 0.00a | 0.06cd | 0.33c | 0.72cd | 1.19cd |
| *Z. mays* root 25 | 0.00a | 0.00a | 0.00d | 0.00c | 0.41d | 0.76d |

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| | | | | | | |
|---|---|---|---|---|---|---|
| B | | | | | | |
| *Z. mays* tassel 0 | 0.00a | 0.00a | 0.33a | 0.70a | 0.89a | 2.41a |
| *Z. mays* tassel 5 | 0.00a | 0.00a | 0.06a | 0.27a | 0.89a | 1.16b |
| *Z. mays* tassel 10 | 0.00a | 0.00a | 0.06a | 0.20a | 0.77a | 1.10b |
| *Z. mays* tassel 15 | 0.00a | 0.00a | 0.02a | 0.17a | 0.35a | 0. 79b |
| *Z. mays* tassel 20 | 0.00a | 0.00a | 0.01a | 0.15a | 0.31a | 0.78b |
| *Z. mays* tassel 25 | 0.00a | 0.00a | 0.00a | 0.12a | 0.21a | 0.26b |
| C | | | | | | |
| *C. cajan* leaf 0 | 0.00a | 0.11a | 0.58a | 1.48a | 2.13a | 3.07a |
| *C. cajan* leaf 5 | 0.00a | 0.10a | 0.22ab | 0.59b | 1.16b | 1.75b |
| *C. cajan* leaf10 | 0.00a | 0.06ab | 0.18ab | 0.29b | 0.49b | 0.68bc |
| *C. cajan* leaf 15 | 0.00a | 0.03ab | 0.09b | 0.29b | 0.46b | 0.63bc |
| *C. cajan* leaf 20 | 0.00a | 0.00b | o.o2b | 0.20b | 0.29b | 0.52c |
| *C. cajan* leaf 25 | 0.00a | 0.00b | 0.01b | 0.16b | 0.28b | 0.35c |
| D | | | | | | |
| *C. cajan* stem 0 | 0.00a | 0.00a | 0.69a | 1.61a | 1.95a | 2.38a |
| *C. cajan* stem 5 | 0.00a | 0.00a | 0.17b | 0.59b | 0.88ab | 0.93b |
| *C. cajan* stem 10 | 0.00a | 0.00a | 0.08b | 0.48b | 0.75b | 0.83b |
| *C. cajan* stem 15 | 0.00a | 0.00a | 0.02b | 0.43b | 0.61b | 0.72b |
| *C. cajan* stem 20 | 0.00a | 0.00a | 0.00b | 0.28b | 0.40b | 0.51b |
| *C. cajan* stem 25 | 0.00a | 0.00a | 0.00b | 0.17b | 0.25b | 0.29b |

Means followed by the same letter with the column for each treatment are not significantly different at ($P< 0.05$)

*Table 4 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) *on the radicle length of B. pilosa*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A | | | | | | |
| *Z. mays* root 0 | 0.00a | 0.52a | 0.79a | 1.02a | 1.48a | 1.89a |
| *Z. mays* root 5 | 0.00a | 0.15b | 0.46b | 0.75ab | 1.18ab | 1.85a |
| *Z. mays* root 10 | 0.00a | 0.09bc | 0.40b | 0.69ab | 1.00b | 1.86a |
| *Z. mays* root 15 | 0.00a | 0.03c | 0.36bc | 0.50bc | 0.86b | 1.77a |
| *Z. mays* root 20 | 0.00a | 0.02c | 0.21bc | 0.43bc | 0.81bc | 0.50b |
| *Z. mays* root 25 | 0.00a | 0.01c | 0.09c | 0.22c | 0.37c | 0.47b |
| B | | | | | | |
| *Z. mays* tassel 0 | 0.00a | 0.95a | 0.32a | 0.95a | 1.42a | 2.20a |
| *Z. mays* tassel 5 | 0.00a | 0.07ab | 0.22ab | 0.56b | 1.21ab | 2.11ab |
| *Z. mays* tassel 10 | 0.00a | 0.02bc | 0.16b | 0.54b | 1.11ab | 1.77ab |
| *Z. mays* tassel 15 | 0.00a | 0.00c | 0.09bc | 0.42bc | 0.99ab | 1.70ab |
| *Z. mays* tassel 20 | 0.00a | 0.00c | 0.08bc | 0.32bc | 0.89ab | 1.59ab |
| *Z. mays* tassel 25 | 0.00a | 0.00c | 0.00c | 0.17c | 0.72b | 1.29b |
| C | | | | | | |
| *C. cajan* leaf 0 | 0.00a | 0.20a | 0.41a | 0.95a | 1.27a | 1.89a |
| *C. cajan* leaf 5 | 0.00a | 0.19a | 0.26b | 0.86ab | 1.23ab | 1.63ab |
| *C. cajan* leaf10 | 0.00a | 0.15a | 0.11c | 0.61abc | 0.99abc | 1.41ab |
| *C. cajan* leaf 15 | 0.00a | 0.10b | 0.05c | 0.54bc | 0.98abc | 1.39ab |
| *C. cajan* leaf 20 | 0.00a | 0.00b | 0.04c | 0.32c | 0.79bc | 1.32ab |
| *C. cajan* leaf 25 | 0.00a | 0.00b | 0.02c | 0.24c | 0.59c | 1.05b |
| D | | | | | | |
| *C. cajan* stem 0 | 0.00 | 0.00a | 0.42a | 0.76a | 1.05a | 1.52a |
| *C. cajan* stem 5 | 0.00a | 0.00a | 0.23ab | 0.67ab | 0.98a | 1.25ab |
| *C. cajan* stem 10 | 0.00a | 0.00a | 0.12b | 0.39bc | 0.69ab | 0.99ab |
| *C. cajan* stem 15 | 0.00a | 0.00a | 0.10b | 0.31cd | 0.64ab | 0.92ab |
| *C. cajan* stem 20 | 0.00a | 0.00a | 0.01b | 0.25cd | 0.55ab | 0.83ab |
| *C. cajan* stem 25 | 0.00a | 0.00a | 0.00b | 0.04d | 0.39b | 0.59b |

Means followed by the same letter with the column for each treatment are not significantly different at ($P< 0.05$)

*Table 5 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) on the plumule length (cm) of *E. heterophylla*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A. | | | | | | |
| *Z. mays* root 0 | 0.00a | 0.00a | 0.08a | 0.49a | 1.27a | 2.83a |
| *Z. mays* root 5 | 0.00a | 0.00a | 0.05a | 0.42a | 1.23a | 1.99ab |
| *Z. mays* root 10 | 0.00a | 0.00a | 0.04a | 0.37a | 1.01ab | 1.40bc |
| *Z. mays* root 15 | 0.00a | 0.00a | 0.02a | 0.35a | 0.78ab | 1.30bc |
| *Z. mays* root 20 | 0.00a | 0.00a | 0.00a | 0.28ab | 0.53bc | 0.84c |
| *Z. mays* root 25 | 0.00a | 0.00a | 0.00a | 0.00b | 0.36c | 0.64c |
| B | | | | | | |
| *Z. mays* tassel 0 | 0.00a | 0.00a | 0.10a | 0.80a | 1.48a | 2.23a |
| *Z. mays* tassel 5 | 0.00a | 0.00a | 0.05a | 0.60a | 0.90ab | 1.79a |
| *Z. mays* tassel 10 | 0.00a | 0.00a | 0.00a | 0.38ab | 0.74ab | 1.47a |
| *Z. mays* tassel 15 | 0.00a | 0.00a | 0.00a | 0.01b | 0.48ab | 0. 91b |
| *Z. mays* tassel 20 | 0.00a | 0.00a | 0.00a | 0.01b | 0.30b | 0.90b |
| *Z. mays* tassel 25 | 0.00a | 0.00a | 0.00a | 0.00b | 0.21b | 0.81b |
| C | | | | | | |
| *C. cajan* leaf 0 | 0.00a | 0.00a | 0.07a | 0.73a | 1.53a | 2.26a |
| *C. cajan* leaf 5 | 0.00a | 0.00a | 0.06a | 0.61a | 1.36a | 2.02b |
| *C. cajan* leaf10 | 0.00a | 0.00a | 0.05a | 0.26a | 0.90a | 1.47b |
| *C. cajan* leaf 15 | 0.00a | 0.00a | 0.00a | 0.25a | 0.90a | 1.40b |
| *C. cajan* leaf 20 | 0.00a | 0.00a | 0.00a | 0.17a | 0.58b | 0.98b |
| *C. cajan* leaf 25 | 0.00a | 0.00a | 0.00a | 0.08b | 0.48b | 0.63b |
| D | | | | | | |
| *C. cajan* stem 0 | 0.00a | 0.00a | 0.15a | 0.62a | 1.03a | 1.31a |
| *C. cajan* stem 5 | 0.00a | 0.00a | 0.01b | 0.21ab | 0.45ab | 0.53b |
| *C. cajan* stem 10 | 0.00a | 0.00a | 0.00b | 0.06b | 0.12b | 0.16b |
| *C. cajan* stem 15 | 0.00a | 0.00a | 0.00b | 0.04b | 0.08b | 0.12b |
| *C. cajan* stem 20 | 0.00a | 0.00a | 0.00b | 0.03b | 0.07b | 0.10b |
| *C. cajan* stem 25 | 0.00a | 0.00a | 0.00b | 0.03b | 0.05b | 0.06b |

Means followed by the same letter with the column for each treatment are not significantly different at (P< 0.05)

*Table 6 :* Effects of aqueous extracts of *Zea mays* (root and tassel) and *Cajanus cajan* (leaf and stem) on the plumule length of *B. pilosa*

| Extracts g/200mL | Experimental Time (Hrs) | | | | | |
|---|---|---|---|---|---|---|
| | 24 | 48 | 72 | 96 | 120 | 144 |
| A. | | | | | | |
| *Z. mays* root 0 | 0.00a | 0.45a | 0.69a | 0.91a | 1.09a | 1.52a |
| *Z. mays* root 5 | 0.00a | 0.00b | 0.28b | 0.56b | 0.88ab | 1.20ab |
| *Z. mays* root 10 | 0.00a | 0.00b | 0.12bc | 0.51bc | 0.83ab | 1.17ab |
| *Z. mays* root 15 | 0.00a | 0.00b | 0.09bc | 0.38bc | 0.67bc | 1.06ab |
| *Z. mays* root 20 | 0.00a | 0.00b | 0.03c | 0.33bc | 0.53bc | 0.93b |
| *Z. mays* root 25 | 0.00a | 0.00b | 0.00c | 0.18c | 0.27c | 0.38c |
| B | | | | | | |
| *Z. mays* tassel 0 | 0.00a | 0.00a | 0.54a | 0.87a | 1.45a | 1.96a |
| *Z. mays* tassel 5 | 0.00a | 0.00a | 0.32ab | 0.66ab | 1.04ab | 1.83a |
| *Z. mays* tassel 10 | 0.00a | 0.00a | 0.21bc | 0.45bc | 0.95ab | 1.32a |
| *Z. mays* tassel 15 | 0.00a | 0.00a | 0.02c | 0.34bc | 0.60b | 1.17ab |
| *Z. mays* tassel 20 | 0.00a | 0.00a | 0.00c | 0.23c | 0.52b | 1.01b |
| *Z. mays* tassel 25 | 0.00a | 0.00a | 0.00c | 0.06c | 0.45b | 0.87b |
| C | | | | | | |
| *C. cajan* leaf 0 | 0.00a | 0.00a | 0.49a | 0.67a | 0.89a | 1.23a |
| *C. cajan* leaf 5 | 0.00a | 0.00a | 0.21b | 0.86ab | 0.79a | 1.20a |

| | | | | | | |
|---|---|---|---|---|---|---|
| *C. cajan* leaf10 | 0.00a | 0.00a | 0.04c | 0.61abc | 0.58ab | 1.02ab |
| *C. cajan* leaf 15 | 0.00a | 0.00a | 0.01c | 0.54bc | 0.58ab | 0.91ab |
| *C. cajan* leaf 20 | 0.00a | 0.00a | 0.00c | 0.32c | 0.38b | 0.82ab |
| *C. cajan* leaf 25 | 0.00a | 0.00a | 0.00c | 0.24c | 0.02b | 0.60b |
| D | | | | | | |
| *C. cajan* stem 0 | 0.00a | 0.12a | 0.74a | 1.19a | 1.65a | 2.17a |
| *C. cajan* stem 5 | 0.00a | 0.04b | 0.31b | 1.05a | 1.55a | 1.97ab |
| *C. cajan* stem 10 | 0.00a | 0.04b | 0.28b | 0.93ab | 1.31a | 1.55ab |
| *C. cajan* stem 15 | 0.00a | 0.03b | 0.15b | 0.74ab | 1.03a | 1.37ab |
| *C. cajan* stem 20 | 0.00a | 0.00b | 0.08b | 0.39b | 0.98a | 1.31ab |
| *C. cajan* stem 25 | 0.00a | 0.00b | 0.06b | 0.37b | 0.79a | 1.03b |

Means followed by the same letter with the column for each treatment are not significantly different at ($P< 0.05$)