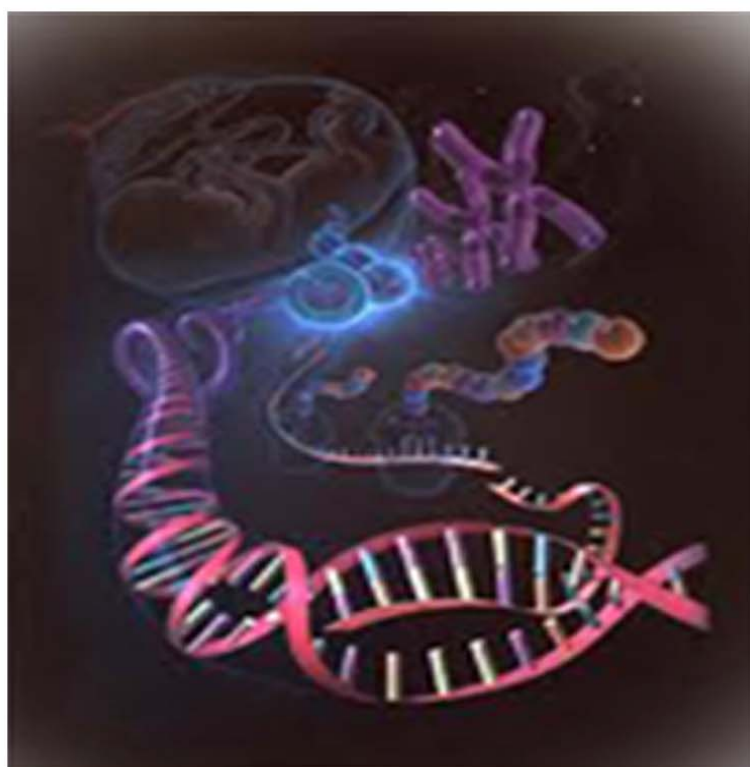




# International Journal of Life Sciences Biotechnology and Pharma Research





Research Paper

## ALLELOPATHIC EFFECTS OF *CELOSIA ARGENTEA* L. LEAF EXTRACTS ON CROP PLANT SEED GERMINATION

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Cocks comb (*Celosia argentea* L.) is one of the most famous allelopathic plants. The present study was conducted to investigate the allelopathic effects of different concentrations of *Celosia argentea* L weed on seed germination and seedling growth of surrounding crop plants *Sorghum bicolor*, *Phaseolous aureus*, *Arachis hypogaea*, *Dolichos lab lab* and *Vigna unguiculata*. The average growths of plumule and radicle was measured and compared. 1%, 2%, 3% and 5% aqueous extracts of leaf inhibited seed germination and seedling growth of crop plant seeds. The percentage seed germination and seedling growth of crop plant seeds decreased with concentration of leaf extracts used. The reduction of germination percentage may be due to the presence of allelochemicals of *Celosia argentea* L. which is reported to contain hyaluronic acid, celosianin, betanin and isocelosianin. Among the five crop plant seeds, *C. argentea* leaf extract showed more inhibitory effect on growth of seedlings of groundnut (8.96%).

**Keywords:** *Celosia argentea* L., Weed, Allelopathy, Allelochemicals, Aqueous leaf extract

### INTRODUCTION

Jethro Tull (1731) was the first man who used the word 'weed' in literature in his famous writing on 'Horse Hoeing Husbandry'. Knowledge of weed biology is essential for the development of economic and environmentally acceptable weed management systems (Bhowmik, 1997). Thus, weeds grow as an integral component with crop plants and enjoy the benefits which crop plants receive and at the same time release some organic compounds which interfere with the

metabolism of crop plants thereby reducing their yield. *Celosia argentea* L. is one of the most dominating herbaceous annual weed found in all semiarid land crops such as Groundnut (*Arachis hypogaea* L.), Finger Millet (*Eleusine coracana* L.) Maize (*Zea mays* L.) Radish (*Raphanus sativus*), jowar (*Sorghum bicolor*), hyacinth bean (*Dolichos lablab*), cowpea (*Vigna unguiculata*), red gram (*Cajanus cajan*), green gram (*Phaseolous aureus*). The economic importances of these plants have been documented (Ayensu, 1978; and Nwalozie, 1984). *Celosia argentea* L.

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is an erect plant and grows to a height of 1.0 to 1.6 m under favorable condition (Gogga M Ravindra, 2008). Weeds have enormous reproductive capacity, huge seed banks in the soil, viability and dormancy of seeds, synchronizing the biological clock with that of the crop, sociability with crops, ecological races within the weed populations, etc. (Robert Zimdhal, 2008). In addition to the above, this weed species have allelopathic effects.

This particular study looks at the physiological effects of *Celosia argentea* L. leaf extracts on seed germination, seedling growth of surrounding crop plant seeds.

## MATERIALS AND METHODS

Actively growing *Celosia argentea* plants were collected from the fields and aqueous extracts of leaves were prepared by taking 10 g of leaves each time over the water bath for 2 h. Later the extracts were filtered to remove plant debris using what man filter paper. From this extract (10%) further dilutions were prepared to get 1.0%, 2.0%, 3.0% 4.0% and 5.0% with deionized water. Each time 100 seeds of jowar, groundnut, green gram, hyacinth bean and cowpea were soaked separately in various concentrations of leaf extracts for 48 h in sterile petri plates (9" size) with moistured filter paper for seed germination and seedling growth. For each of experiment three replicates maintained. Seeds treated with deionized water were plated in the same way and were kept as controls for every set of experiment. The filter paper pads in the petri plates were kept with moist with distilled water. All the experiments were conducted at room temperature (28±2 °C). The percentage germination was calculated after 48 h and the average growth of plumule and radicle was measured and compared with the

corresponding controls and data were statistically analyzed.

## Methodology for Statistical Analysis

Analysis of variance (ANOVA) was used as a statistical tool to get findings from sample data tables. The findings have been calculated by using SPSS package/MS-Excel for to find out the effect of root extract on seed germination. Duncan's multiple range test was also used.

## RESULTS AND DISCUSSION

Allelopathic effects of *Celosia argentea* L. weed against other crop plant seed germination and growth was studied. Allelopathy can be defined as chemical interactions between and among both plants and microorganisms via releases of biologically active compounds into the environment (Jayakumar and Jagannathan, 2003). The compounds involved on Allelopathic interference are often termed as Allelopathic compounds, allelochemicals or phytotoxins.

Allelopathic effects of many weeds on crops have been reported (Oudhia P Kohla and Tripathi, 1977a and 1977b; Ashraf and Sen, 1978; Bhowmik and Doll, 1979; Tripathi *et al.*, 1981; Wadhvani and Bhardwaja, 1987, Murthy *et al.*, 1995; Dhawan *et al.*, 1996; Prakasa Rao *et al.*, 1996; Oudhia and Tripathi 1997; and Rao *et al.*, 1997). Allelopathy can be stimulatory or inhibitory depending on the identity of the compound. These allelochemicals (Metabolites) under suitable conditions may be released into the environment either by withering, leaching, exudation and volatilization. Allelopathy is an interference mechanism, in which live or dead plant materials release chemical substances, which inhibit or stimulate the associated plant growth (Harper, 1977; and May and Ash, 1990).

The aqueous leaf extracts of *Celosia argentea* had inhibitory effects on radicle and plumule growths of Jowar, groundnut, green gram hyacinth bean and cow pea. When these seeds were put for germination in laboratory conditions, this showed that the weed *Celosia argentea* in field conditions with adverse effects on crop plants. Allelopathic effects of *Celosia argentea*, L. on seed germination and seedling growth of *Pennisetum typhoides*, Burm have been recorded (Inamdar Archana, Kamble, 2010) and the allelopathic effects of *Cassia alata* leaf extracts on the germination, growth and flowering of *Vigna unguiculata*, *Arachis hypogea* and *Sorghum bicolor* was carried out by Nwalozie (1984). Allelopathic Effects of the plant *Celosia argentea* L. on Seed Germination and Seedling Growth of *Vigna mungo* L. by (Archana Inamdar and Kamble, 2009). Pandya (1975) recorded similar results on the effect of *Celosia argentea* extract on root and shoot growth of *Sorghum vulgare* seedling. Germination percentage of groundnut, Jowar, cowpea, green gram and hyacinth bean decreases as the concentration of *Celosia argentea* L. leaf extract increases. Thus as compared to other treatments, in 5% concentrations of leaf extract showed significantly low

germination rate. The highest germination percentage was recorded in control in all crops (100%).

Leaf extract showed more inhibitory effect on seedling growth of crop plant seeds. Mostly, groundnut radicle growth was decreased to 8.96% in 5% concentration of leaf extract (Table 1 and Figure 1). It is followed by Jowar radicle growth i.e., 9.29% and plumule growth 9.82% in 5% concentration of leaf extract of *Celosia argentea* L. (Table 2 and Figure 2). In cowpea 31.98% (Table 3 and Figure 3). green gram 34.38% (Table 4 and Figure 4), and hyacinth bean 36.30% (Table 5 and Figure 5) of seedling growth was recorded.

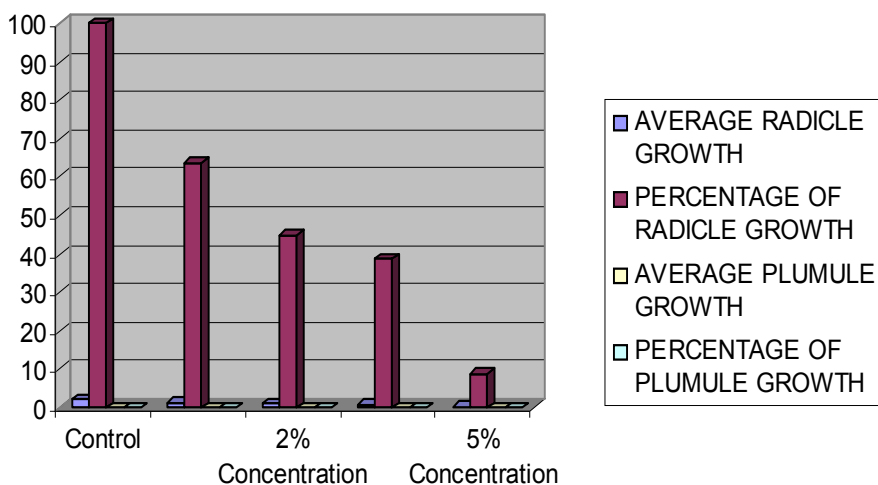
The reduction of germination percentage may be due to the presence of allelochemicals. The plant *Celosia argentea* L. is reported to contain hyaluronic acid, celosianin, betanin and isocelosianin (Joshi, 2001). However, McCalla and Haskins (1964) suggest that allelochemicals or toxins are released from the weed by the action of micro-organisms during decomposition. In the present study, the growth inhibition caused by allelochemicals released from *C. argentea* may be due to its interference with the plant growth

**Table 1: The Effect of Leaf Extract of *C. argentea* on Ground nut**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of of Plumule Growth	Mean	Duncan Grouping
Control	2.12	100	2.1200	A	0	0	0	A
1% RootExtract	1.35	63.67	1.3500	B	0	0	0	A
2% Root Extract	0.95	44.81	0.9500	C	0	0	0	A
3% Root Extract	0.82	38.67	0.8200	C	0	0	0	A
5% Root Extract	0.19	8.96	0.1900	D	0	0	0	A

Note: \*\* p<0.01 (significant at 1% level).

**Figure 1: The Effect of Leaf Extract of *C. argentea* on Groundnut Seed Germination**

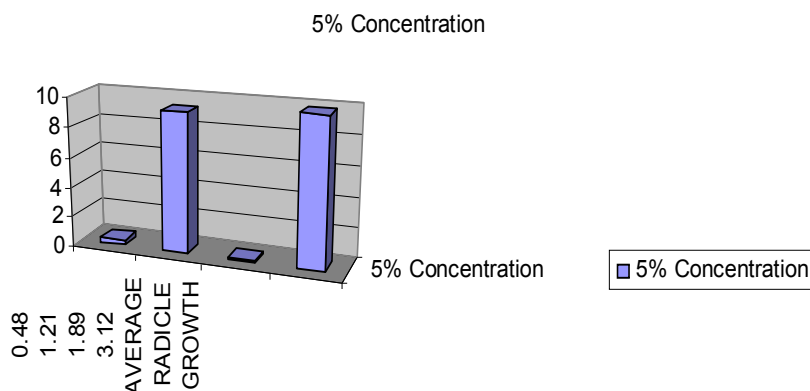


**Table 2: The Effect of Leaf Extract of *C. argentea* on Jowar Seed Germination**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of Plumule Growth	Mean	Duncan Grouping
Control	3.12	100	3.1200	A	1.12	100	1.1200	A
1%RootExtract	1.89	60.57	1.8900	B	0.31	27.67	0.3100	B
2%Root Extract	1.21	38.78	1.2100	C	0.26	23.21	0.2600	B
3% Root Extract	0.48	15.38	0.4800	D	0.24	21.42	0.2400	B
5% Root Extract	0.29	9.29	0.2900	D	0.11	9.82	0.1100	B

Note: \*\* p<0.01 (significant at 1% level).

**Figure 2: The Effect of Leaf Extract of *C. argentea* on Jowar Seed Germination**

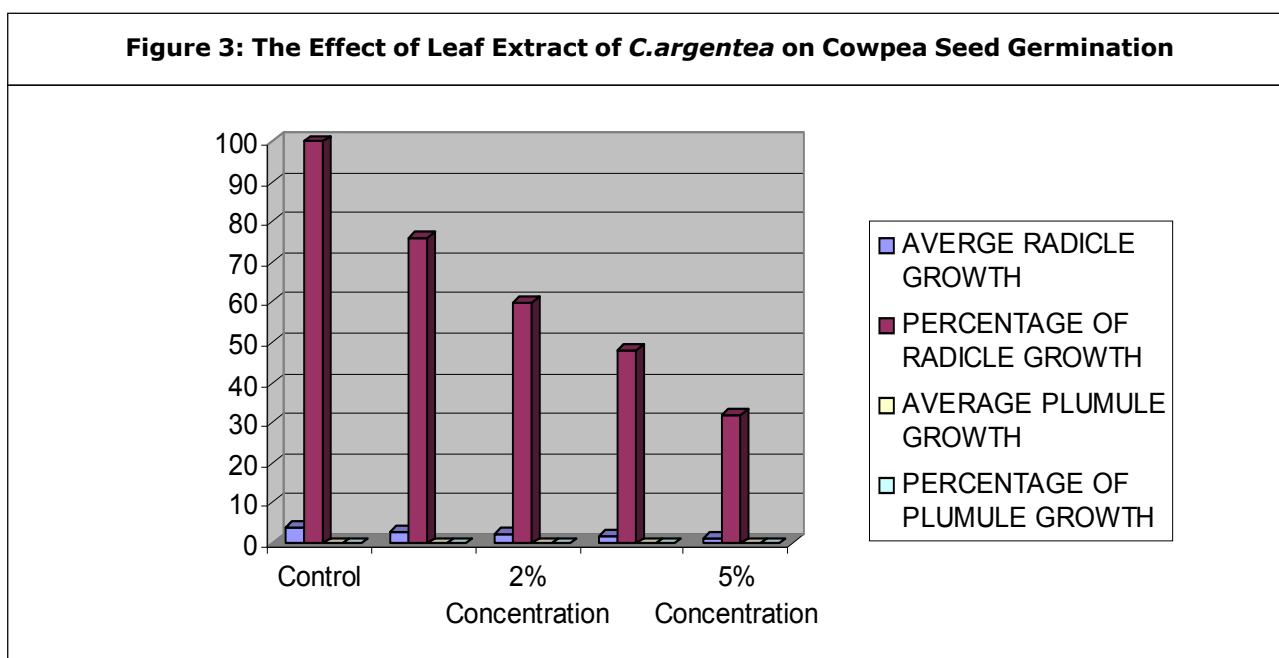


**Table 3: The Effect of Leaf Extract of *C. argentea* on Cow Pea**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of Plumule Growth	Mean	Duncan Grouping
Control	3.97	100	3.9700	A	0	0	0	A
1%RootExtract	3.02	76.07	3.0200	B	0	0	0	A
2%Root Extract	2.38	59.94	2.3800	B	0	0	0	A
3% Root Extract	1.91	48.11	1.9100	B	0	0	0	A
5% Root Extract	1.27	31.98	1.2700	C	0	0	0	A

Note: \*\*p<0.01 (significant at 1% level).

**Figure 3: The Effect of Leaf Extract of *C. argentea* on Cowpea Seed Germination**

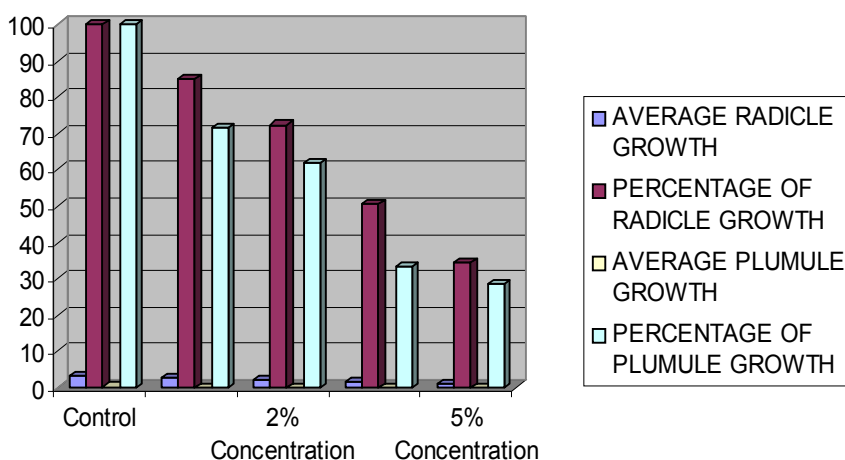


**Table 4: The Effect of Leaf Extract of *C. argentea* on Green Gram**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of Plumule Growth	Mean	Duncan Grouping
Control	3.19	100	3.1900	A	0.21	100	0.21000	A
1% RootExtract	2.71	84.95	2.7100	B	0.15	71.42	0.15000	A
2% Root Extract	2.31	72.41	2.3100	B	0.13	61.90	0.13000	A
3% Root Extract	1.61	50.47	1.6100	C	0.07	33.33	0.07000	B
5% Root Extract	1.1	34.48	1.1000	D	0.06	28.57	0.0600	B

Note: \*\* p<0.01 (significant at 1% level); \*\* p<0.03 (significant at 1% level)

**Figure 4: The Effect of Leaf Extract of *C.argentea* on Greengram Seed Germination**

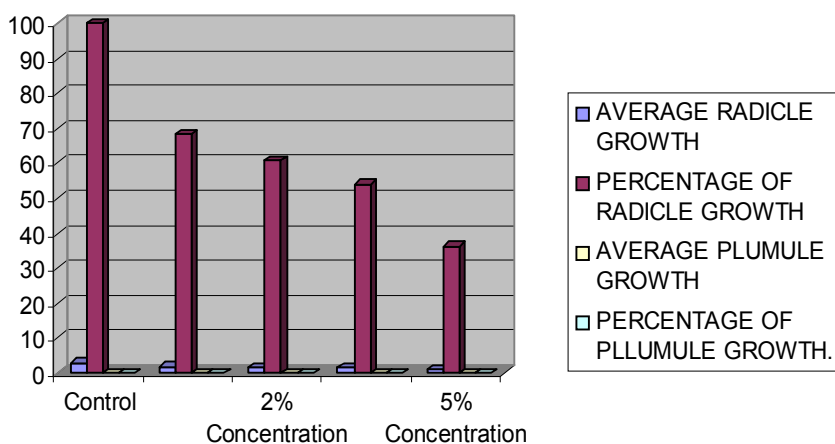


**Table 5: The Effect of Leaf Extract of *C.argentea* on Hyacinth Bean**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of Plumule Growth	Mean	Duncan Grouping
Control	2.92	100	2.9200	A	0	0	0	A
1%RootExtract	1.99	68.15	1.9900	B	0	0	0	A
2%Root Extract	1.77	60.61	1.7700	B	0	0	0	A
3% Root Extract	1.58	54.1	1.5800	B	0	0	0	A
5% Root Extract	1.06	36.3	1.0600	C	0	0	0	A

Note: \*\*p<0.01(significant at 1% level).

**Figure 5: The Effect of Leaf Extract of *C.argentea* on Hyacinthbean Seed Germination**



processes. Or the allelochemicals may be reducing cell division.

There was a significant difference between concentration levels with respective Jowar seed radicle growth. There is a significant difference from control to 1%, 1% to 2% and 2% to 3% concentration. But no significant difference was found from 3% to 5% concentration.

Whereas in plumule growth no significant difference was found from 1% to 2%, 2% to 3% and 3% to 5% concentrations.

There was a significant difference between concentration levels with respective green gram seed radicle growth. There is a significant difference from the control to 1%, 2% to 3% and 3% to 5% concentration. But there is no significant difference from 1% to 2% concentration. Whereas in plumule no significant difference was found from 1% to 2% and 3% to 5% concentrations. So same Duncan group was given to both concentrations.

There was a significant difference between concentration levels with respective groundnut seed radicle growth. There was a significant difference from the control to 1% concentration, 1% to 2% and 3% to 5% concentration. But there was no significant difference from 2% to 3% concentration. According to Duncan grouping, there was no significant difference between concentration levels with respective groundnut seed plumule growth.

There was a significant difference between concentration levels with respective hyacinth bean radicle growth. There is a significant difference from the control to 1% concentration and 3% to 5% concentration. But there was no significant difference was recorded from 1% to 2% and from 2% to 3% concentration. According to Duncan

grouping, there was no significant difference between concentration levels with respective hyacinth bean seed plumule growth.

There is a significant difference between concentration levels with respective Cowpea seed radicle growth. There was a significant difference from the control to 1% concentration and 1% to 2% concentration and 3% to 5% concentration levels. But no significant difference was recorded from 2% to 3% concentration. So same Duncan group was given to both concentrations. According to Duncan grouping, there was no significant difference between concentration levels with respective cowpea seed plumule growth.

## CONCLUSION

The present study concludes allelopathic effects of *Celosia argentea* L. has succeeded in suppressing the yields of cereal crops. So it is recommended that the weed *Celosia argentea* L. should be physically removed from crop plant fields before the allelochemicals wash down with the rains.

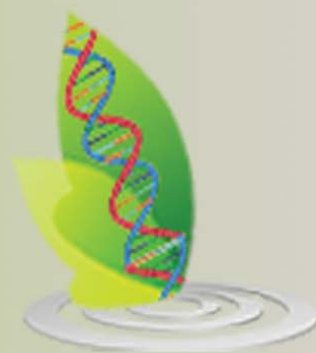
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