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Research Paper

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

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One of the most famous allelopathic plants is cocks comb (*Celosia argentea* L.) The effects of different concentrations of *Celosia argentea* L. root extracts on seed germination and seedling growth of jowar (*Sorghum bicolor*), green gram (*Phaseolous aureus*), groundnut (*Arachis hypogaea*), hyacinth bean (*Dolichos lab lab*) and cowpea (*Vigna unguiculata*) was studied. The average growths of radicle and plumule was measured and compared. 1%, 2%, 3% & 5% aqueous extracts of root inhibited seed germination and seedling growth of crop plant seeds. The percentage of seed germination and seedling growth of crop plant seeds decreased with concentration of root 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* root extract showed more inhibitory effect on growth of seedlings of green gram (0%).

**Keywords:** *Celosia argentea* L. weed, Allelopathy, Allelochemicals

### INTRODUCTION

*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;

Nwalozie, 1984). *Celosia argentea* L. is an erect plant and grows to a height of 1.0 to 1.6 m under favourable conditions (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

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effects of *Celosia argentea* L root extracts on seed germination, seedling growth of surrounding crop plant seeds.

## MATERIALS AND METHODS

### Allelopathic Effects of *Celosia argentea* L. Root Extract on Crop Plant Seed Germination

Actively growing *Celosia argentea* plants were collected from the fields and aqueous extracts of roots were prepared by taking 10 g of roots each time over the water bath for 2 hours. Later the extracts were filtered to remove plant debris using whatman filter paper. From this extract (10%) further dilutions were prepared to get 1.0%, 2.0%, 3.0% 4.0% and 5.0% with de ionized water. Each time 100 seeds of groundnut, hyacinth bean, green gram, jowar and cowpea were soaked separately in various concentrations of root extracts for 48 hours in sterile petri plates (9" size) with moistured filter paper for seed germination and seedling growth. For each experiment three replicates were maintained. Seeds were treated with de ionized water and placed 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±2c). 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 the 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

### Allelopathiceffects of *Celosia argentea* L Root Extract on Various Crop Plant Seeds Germination and Seedling Growth

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). Many plants may excrete something from their roots which is injurious to other plants DeCandolle (1832). Kanchan and Jayachandran (1979) reported that maximum release of allelopathic compounds from roots of Parthenium. 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 *et al.*, 1977a and 1977b; Oudhia and Tripathi 1997; Rao *et al.*, 1997; Ashraf and Sen 1978; Bhowmik and Doll, 1979; Tripathi *et al.*, 1981; Wadhvani and Bhardwaja, 1987; Murthy *et al.*, 1995; Dhawan *et al.*, 1996; and Prakasa Rao *et al.*, 1996). 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; May and Ash, 1990).

The aqueous root extracts of *Celosia argentea* had inhibitory effects on radicle and plumule growths of Jowar, groundnut, green gram and hyacinth bean. 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 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.

The percent of germination and seedling growth of Jowar, groundnut, green gram and hyacinth bean seed varies considerably under the influence of root extract of *Celosia argentea* L. Root extract expressed more inhibitory effect on

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



Control (24 hours)



Control (48 hours)



2% Root Extract of *C. argentea*

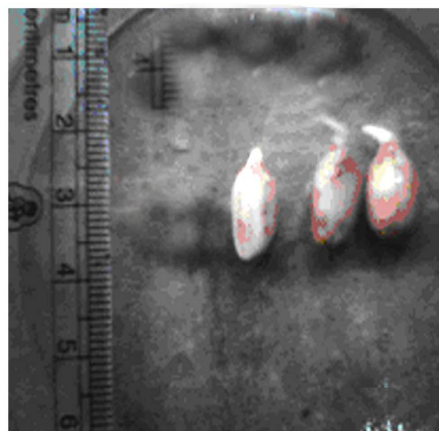


3% Root Extract of *C. argentea*

**Figure 3: The Effect of Root Extract of *C. argentea* on Groundnut Seed Germination**



Control



2% Root Extract of *C. argentea*



3% Root Extract of *C. argentea*



5% Root Extract of *C. argentea*

radicle and plumule growth of seedlings of green gram (0%), (Table 1, Figure 2 and Graph 1) it is followed by Jowar seeds (8.5% and 7.8%), (Table 2, Figure 2 and Graph 2), groundnut (29.24% and 0%) (Table 3, Figure 3 and Graph 3) and hyacinth bean (31.03% and 0%) (Table 4, Figure 4 and Graph 4), cowpea (25.86% and 40.12%) (Table 5, Figure 5 and Graph 5) respectively in 5 percent concentration of *Celosia argentea* L. Germination percentage was recorded in control in all the crop plant seeds. Growth of radicle and plumule of

crop plants decreases as the concentration of *Celosia argentea* root extract increases. Among the five crop plant seeds, *C. argentea* root extract showed more inhibitory effect on growth of seedlings of green gram (0%) (Table 1, Graph 1 and Figure 1).

The reduction of germination percentage may be due to the presence of allelochemicals. The plant *Celosia argentea* L. was reported to contain hyaluronic acid, celosianin, betanin and isocelosianin (Joshi, 2001). However, McCalla and



**Figure 4: The Effect of Root Extract of *C. argentea* on Green Gram Seed Germination**



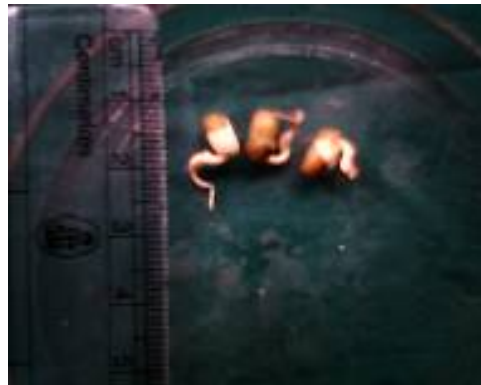
Control (24 hours)



Control (48 hours)



2% Root Extract of *C. argentea*



3% Root Extract of *C. argentea*



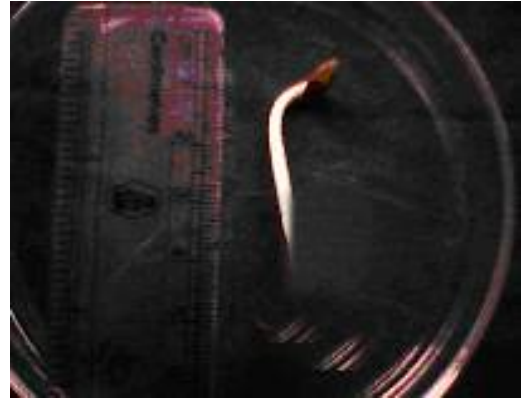
5% Root Extract of *C. argentea*

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 processes or the allelochemicals may be reducing cell division.

**Figure 5: The Effect of Root Extract of *C. argentea* on Hyacinth Bean Seed Germination**

Control (48 hours)

2% Root Extract of *C. argentea*3% Root Extract of *C. argentea*5% Root Extract of *C. argentea*

There was a significant difference between concentration levels with respective Jowar radicle growth. There was significant difference from Control to 1%, 1% to 2%, 2% to 3% and 3% to 5% concentrations. In plumule growth, there was a significant difference from 1% to 2% and 2% to 3%. But no significant difference was found from Control to 1%, and 3% to 5% concentration level. So different Duncan groups was given to different concentrations.

There was a significant difference between concentration levels with respective green gram

radicle growth. There was a significant difference between 2% to 3%. But no significant difference was found from Control to 1%, and 1% to 2% concentration level. So different Duncan groups was given to different concentrations. According to Duncan grouping, there is no significant difference between concentration levels with respective groundnut plumule growth.

There was a significant difference between concentration levels with respective Groundnut radicle growth. There was significant difference from Control to 1%, and 3% to 5% concentrations.

**Figure 5: The Effect of Root Extract Of *C.argentea* on Cowpea Seed Germination**

Control (48 hours)

2% Root Extract of *C.argentea*3% Root Extract of *C.argentea*5% Root Extract of *C.argentea*

But no significant difference was found from 1% to 2% and 2% to 3% concentration level.

According to Duncan grouping, there was no significant difference between concentration levels with respective groundnut plumule growth.

There was a significant difference between concentration levels with respective hyacinth bean radicle growth. There was significant difference from Control to 1%, 1% to 2% and 3% to 5% concentrations. But no significant difference was found from 2% to 3% concentration level. According to Duncan grouping, there is no

significant difference between concentration levels with respective hyacinth bean plumule growth.

There was a significant difference between concentration levels with respective cowpea radicle growth. There was significant difference from Control to 1%, 1% to 2% and 3% to 5% concentrations. But no significant difference was found from 2% to 3% concentration level.

There was a significant difference between concentration levels with respective green gram plumule growth. There was significant difference

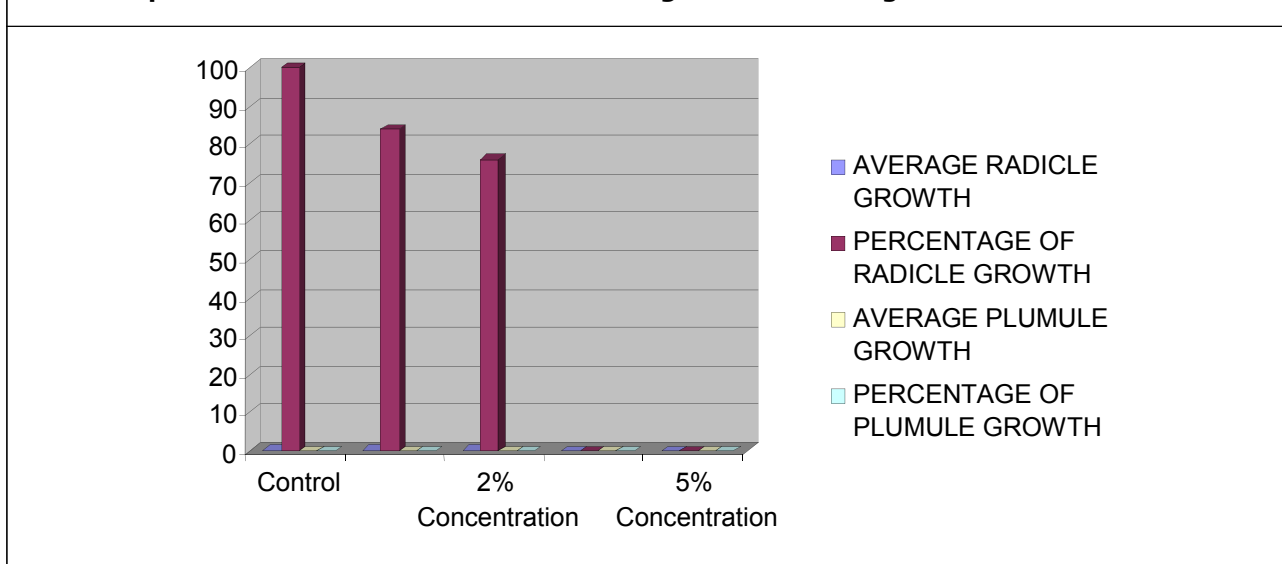


**Table 1: The Effect of Root Extract of *C.argentea* on Greengram Seed Germination**

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	0.25	100	0.25000	A	0	0	0	A
1% Root Extract	0.21	84	0.21000	A	0	0	0	A
2% Root Extract	0.19	76	0.19000	A	0	0	0	A
3% Root Extract	0	0	0.00000	B	0	0	0	A
5% Root Extract	0	0	0.00000	B	0	0	0	A

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

**Graph 1: The Effect of Root Extract of *C.argentea* on Greengram Seed Germination**

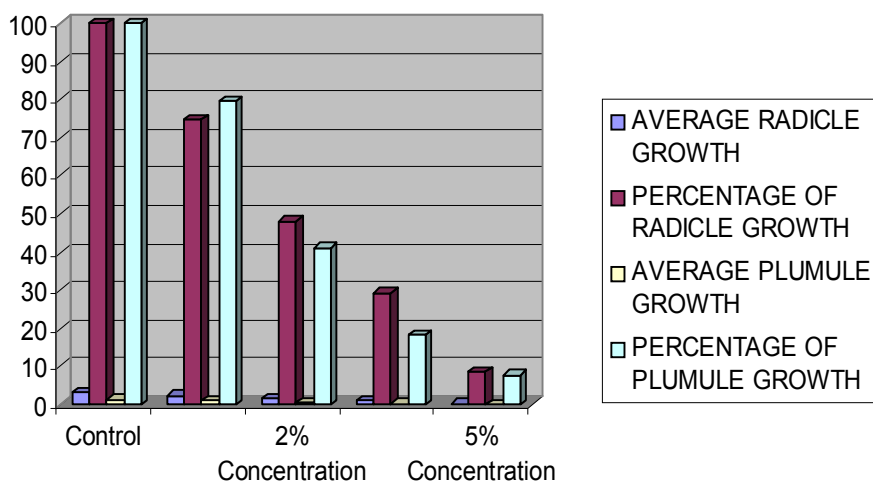


**Table 2: The Effect of Root Extract of *C.argentea* on Jowar Seed Germination**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of of Plumule Growth	Mean	Duncan Grouping
Control	3.14	100	3.1200	A	1.41	100	1.3100	A
1%RootExtract	2.35	74.84	2.3500	B	1.12	79.43	1.0200	A
2%Root Extract	1.51	48.08	1.5100	C	0.58	41.13	0.6500	B
3% Root Extract	0.92	29.29	0.9200	D	0.26	18.43	0.2100	C
5% Root Extract	0.27	8.59	0.2700	E	0.11	7.80	0.1000	C

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

**Graph 2: The Effect of Root Extract of *C. argentea* on Jowar Seed Germination**

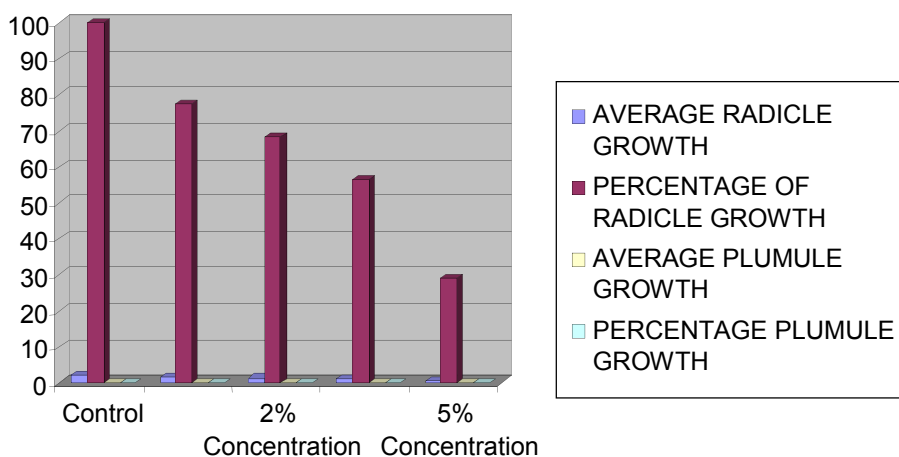


**Table 3: The Effect of Root Extract of *C. argentea* on Groundnut Seed Germination**

Treatment/ concentration (Percentage)	Average Radicle Growth	Percentage of Radicle Growth	Mean	Duncan grouping	Average Plumule Growth	Percentage of Plumule Growth	Mean	Duncan Grouping
Control	2.12	100	2.1200	A	0	0	0	A
1% Root Extract	1.64	77.35	1.6400	B	0	0	0	A
2% Root Extract	1.45	68.39	1.4500	B	0	0	0	A
3% Root Extract	1.2	56.6	1.200	B	0	0	0	A
5% Root Extract	0.62	29.24	0.6200	C	0	0	0	A

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

**Graph 3: The Effect of Root Extract of *C. argentea* on Groundnut Seed Germination**

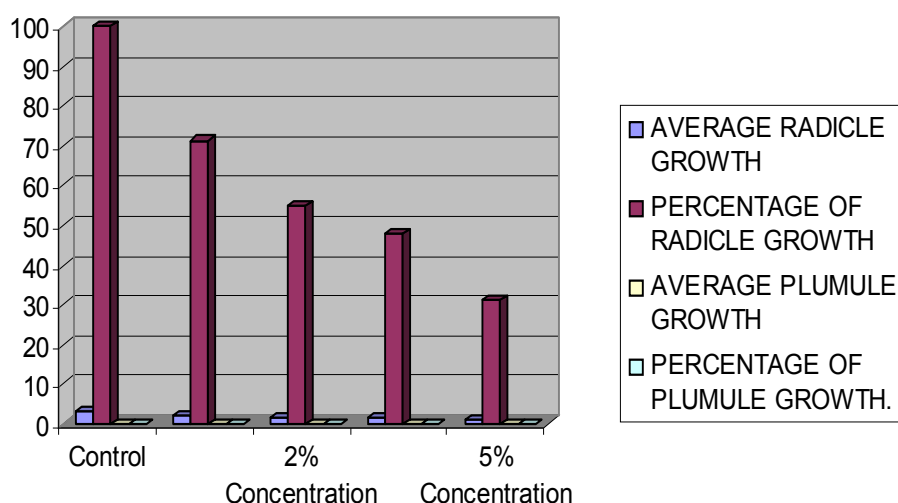


**Table 4: The Effect of Root Extract of *C. argentea* on Hyacinth Bean Seed Germination**

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	3.19	100	2.9200	A	0	0	0	A
1% Root Extract	2.27	71.15	2.2700	B	0	0	0	A
2% Root Extract	1.75	54.85	1.7500	C	0	0	0	A
3% Root Extract	1.53	47.96	1.5300	C	0	0	0	A
5% Root Extract	0.99	31.03	0.9900	D	0	0	0	A

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

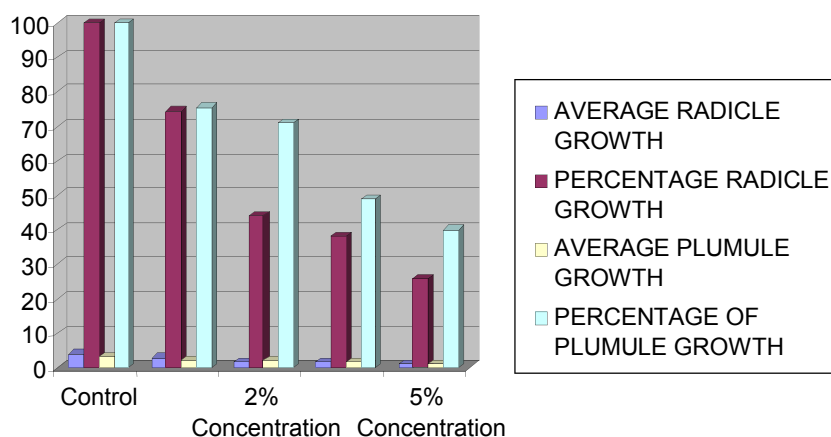
**Graph 4: The Effect of Root Extract of *C. argentea* on Hyacinth Bean Seed Germination**



**Table 5: The Effect of Root Extract of *C. argentea* on Cowpea Bean Seed Germination**

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	4.06	100	2.9200	A	3.19	100	3.1900	A
1% Root Extract	3.02	74.38/	2.2700	B	2.41	75.54	2.4100	B
2% Root Extract	1.79	44.08	1.7500	C	2.26	70.84	2.2600	B
3% Root Extract	1.55	38.17	1.5300	C	1.56	48.90	1.5600	C
5% Root Extract	1.05	25.86	0.9900	D	1.28	40.12	1.2800	C

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

**Graph 5: The Effect of Root Extract of *C. argentea* on Cowpea Bean Seed Germination**

from Control to 1%, 2% to 3% concentrations. But no significant difference was found from 1% to 2% and 3% to 5% concentration level. So different Duncan groups were given to different concentrations.

## CONCLUSION

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

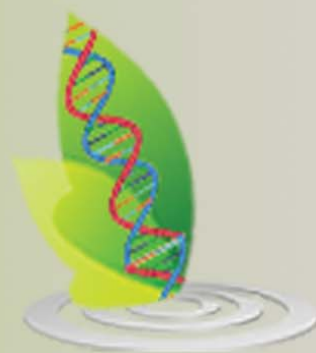
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