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## Research Article

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## Effect of Aqueous Leaf Extract of *Eucalyptus globulus* Labill. on Seed Germination of Chickpea

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### ABSTRACT

The present study has been done to investigate the effect of aqueous leaf extract of *Eucalyptus globulus* on seed germination and rate of radicle growth of Chickpea under laboratory conditions. The study found complete inhibition of seed germination under the treatment of concentrated raw extract (14.28gm/100 ml) and its different dilutions (viz-90%, 70%, 50%, 30% & 10%). Later, a much-diluted raw extract (5.26gm/100ml) was made with its different dilutions as above to study germinations. Later case showed a gradual inhibition in radicle growth with the increasing concentration with a correlation coefficient ( $r=0.72$ ).

**Keywords:** Chickpea, *Eucalyptus globulus*, Leaf extract, Germination.

### INTRODUCTION

It has been investigated that living or dead plant tissue releases chemicals to inhibit growth of nearby plants. The growth inhibition takes place in terms of decreasing radical growth<sup>[1]</sup>, suppression of seed germination vegetative propagules and early seedling growth<sup>[2, 3]</sup>. This process is known as allelopathy. The chemicals that are released during this process are known as allelochemicals. These are a subset of secondary metabolites<sup>[4]</sup>, and can have beneficial or detrimental effects on the target organisms. *Eucalyptus globulus* is such a species that can cause understorey suppression especially in drier climates<sup>[5]</sup>. Aqueous leachate of fresh leaves of *Eucalyptus* significantly suppressed the establishment of seedling growth of target plants<sup>[2]</sup>. Several volatile and water-soluble terpenes like Cineole and  $\alpha$ -pinene are found in *Eucalyptus globulus* leaf those toxic to germinating seeds and seedlings<sup>[6]</sup>. Extracts from different parts of *Eucalyptus globulus* have been found to inhibit the seed germination and seedling growth of wheat maize sorghum chickpea and pigeon pea<sup>[7]</sup>. Different species of *Eucalyptus* release phenolics coumaric gallic gentilic hydroxybenzoic syringic and vanillic acids and catechol was found to inhibit seed germination<sup>[8]</sup>. Phenolics adversely affects membrane permeability cell division, photosynthesis respiration enzyme function hormone and protein synthesis<sup>[9]</sup>. Study of allelochemical pot entities of *Eucalyptus citriodora* (L.), on chickpea found adverse effects on parameters like seed germination vigour index shoot length root length fresh weight and dry weight<sup>[10]</sup>. Chickpea (*Cicer arietinum* L.), is a legume belonging to Leguminosae with high nutritive values. It is cultivated in Africa Asia Middle East Europe Australia Central America and South America<sup>[11]</sup>. The seeds were used traditionally as aphrodisiac for bronchitis catarrh cholera constipation diarrhoea dyspepsia flatulence snakebite sunstroke and warts. Acids (malic and oxalic acids), are supposed to lower the blood cholesterol levels<sup>[11]</sup>. The objective of the present study is to investigate the effect of aqueous leaf extract of *Eucalyptus globulus* on seed germination and rate of radicle growth under laboratory conditions.

### MATERIALS AND METHODS

The dry leaf litter of *Eucalyptus globulus* was collected from Jhargram Raj College Campus, Jhargram, West Bengal, on 2nd January, 2019. After collection, dry leaves were washed thoroughly in tap water to surface impurities. Then the leaves were sun dried and cut into small pieces of about 5cm<sup>2</sup>. Dried leaves were crushed using a mixer grinder to make fine powder. Two stock solutions were made using distilled water and two separate experiment sets were constructed. Experiment Set -A) Stock solution was made using 350 ml of distilled water with 50 gm of leaf powder. Experiment Set -B) Stock solution was very much less concentrated. the earlier. It was made using 190 ml of distilled water with 10 gm of leaf powder. Both the stock solution was mixed overnight using a rotary shaker at room temperature. The solutions were filtered 3 times using filter paper. From the filtered solution of both stock A and B, different dilutions (viz-90%, 70%, 50%, 30% & 10%) were made using distilled water. Only distilled water was used as control and raw filtrate was marked as 100% concentration. Healthy and uniform chickpea (*Cicer arietinum* L.) seed lots were tested for viability using 2,3,5-triphenyl tetrazolium chloride (TTC). Ten seeds were selected randomly for each test solution including control and found

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100% viable seed. Seeds were then soaked in respective test solutions overnight. After overnight soaking, seeds were placed on filter papers inside sterile Petri plates (ten seeds in each Petri plate in randomized fashion) to test seed germination and radicle growth. Petri plates were kept at room temperature for 24 hr. after 24hr. Data were collected in a one-day interval. The results of experimental seedling were determined by counting the number of germinated seeds measuring the length on the radicle in centimetres. The data were analysed statistically. Correlation coefficient was determined by putting data of radical growth parameters against different concentrations of leaf extracts.

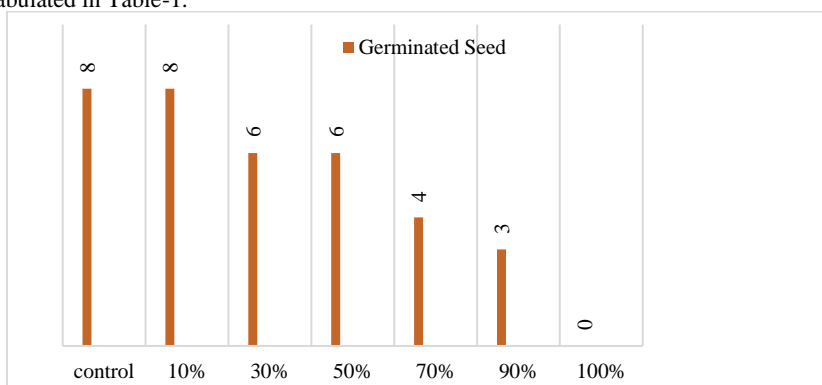
**RESULTS AND DISCUSSIONS**

Data obtained from Experiment Set –A regarding seed germination showed complete inhibition of germination in all the treated concentration except the control one. So, rest the experiment was carried out on Set-B. Germination percentage was calculated after 24 hr. from Experiment Set -B) for all the treated concentration along with distilled water as control is given by the following Figure-1.

After 24 hrs. there was no seed germination in higher concentration (100%), although after 36 hr. all the seeds from all the treated concentrations get germinated. So, from this result it is clear that the aqueous extract has delayed the germination process in higher concentration. Such delayed germination under the effect was found by [12]. Data obtained from the average rate of radical growth for 36 hr. of observation has been tabulated in Table-1.

From the data of Table-2, it is found that the radicle growth after 36 hr was maximum in case of control followed by 30%, 50%, 10%, 70% and 100% with lowest radicle growth in 90%. It has been also found that radicle growth was stopped in 70%, 90% and 100% which indicates suppression of radicle growth and seedling development. Such suppressive effect on root growth by leaf extract of Eucalyptus species on *Arachis hypogea* was found by [13]. Correlation coefficient was determined by putting data from all treatments and the relation amongst radical growth parameters. The result is given by following Figure-2.

The value of Correlation coefficient  $r = 0.72$ , that represents a positive correlation between concentration of leaf extract and length of radicle. That indicates a strong suppressive effect on radicle growth. Almost same the result ( $r = 0.5$ ) was obtained by Lawan *et al.* in the year 2011 while working on the study of germination and root growth of *Arachis hypogea* under the influence of leaf extract of different *Eucalyptus* species. The maximum average radicle length after 48 hr of treatment was found in control (16.6 mm) and the lowest average length was found in cases of 90% and 100% i.e. 8.7 and 12.3 respectively. Whereas maximum average radicle length after 72 hr of treatment in control (29.5 mm) with the lowest average length was found in cases of 90% and 100% i.e. 13.2 and 14.4 respectively. These differences again indicate inhibition of radicle growth. Such variation in lengths again indicates inhibition of radicle growth. The average increase of radicle length from 48 h. to 72 h. is tabulated in Table-2.



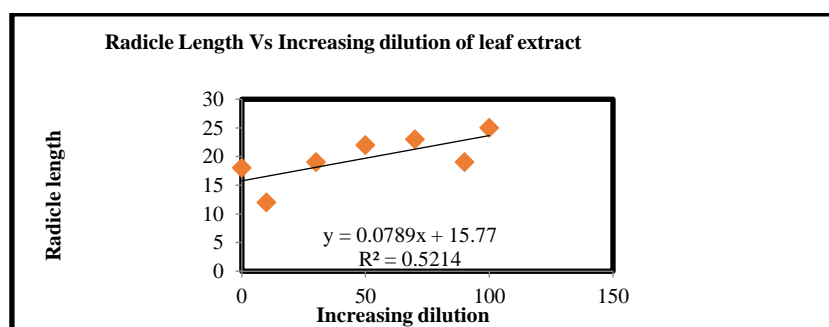
**Figure 1:** Seed germination percentage

**Table 1:** Table showing increase of radicle length in different concentration of leaf extract

Experimental treatments (Set-B)	Radicle growth of a single seed (Randomly selected)				
	12 hr.	24 hr.	Radicle increase	36 hr.	Radicle increase
Control	10 mm	24 mm	14 mm	25 mm	1 mm
10%	7 mm	18 mm	11 mm	19 mm	1 mm
30%	5mm	23 mm	18 mm	23 mm	0 mm
50%	4 mm	21 mm	17 mm	22 mm	1 mm
70%	5 mm	19 mm	14 mm	19 mm	0 mm
90%	2 mm	12 mm	10 mm	12 mm	0 mm
100%	0 mm	18 mm	18 mm	18 mm	0 mm

**Table 2:** Table showing average increase of radicle length from 48 hr to 72 hr

Duration of Treatment	Control	10%	30%	50%	70%	90%	100%
After 48	16.6	14.9	17.9	12.7	15.2	8.7	12.3
After 72	29.5	20	22.6	23.7	30.2	13.2	14.4
Increase in length	12.9	6.9	4.7	11	15	4.5	2.1



**Figure 2:** Correlation between Radicle length and Increasing dilution of leaf extract

## CONCLUSION

The present study showed that aqueous extract of *Eucalyptus globulus* leaf definitely has some inhibitory effect on chickpea in terms of germination as well as radicle growth. In concentrated extract, the germination was totally inhibited and germination took place with varying degree of radicle growth in diluted treatments. That also indicated that Chickpea seeds also possess some sort of resistance from the allelopathic effects of *Eucalyptus globulus* species. From these observations it could be suggested that chickpea cultivation must be avoided from plantation areas of *Eucalyptus globulus* or chickpea cultivation fields must be free from any leaf litter or any other part of *Eucalyptus globulus*.

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## Conflict of Interest

None declared.

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## HOW TO CITE THIS ARTICLE

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