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 [1], suppression of seed germination vegetative propagules and early seedling growth [2-3]. 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 [4], and can have beneficial or detrimental effects on the target organisms. Eucalyptus globulus is such a species that can cause understory suppression especially in drier climates [5]. Aqueous leachate of fresh leaves of Eucalyptus significantly suppressed the establishment of seedling growth of target plants [2]. Several volatile and water-soluble terpenes like Cineole and α-pinene are found in Eucalyptus globulus leaf. In one toxic to germinating seeds and seedlings [6]. 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 [7]. Different species of Eucalyptus release phenolics coumaric gallic gentilic hydroxybenzoic syringic and vanillic acids and catechol was found to inhibit seed germination [8]. Phenolics adversely affects membrane permeability cell division, photosynthesis respiration enzyme function hormone and protein synthesis [9]. 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 [10]. 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 [11]. The seeds were used traditionally as aphrodisiac for bronchitis catarh cholera constipation diarrhoea dyspepsia flatulence snakebite sunstroke and warts. Acids (malic and oxalic acids), are supposed to lower the blood cholesterol levels [11]. 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 remove surface impurities. Then the leaves were sun dried and cut into small pieces of about (5cm²). 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 (350ml) of distilled water (with 50gm), of leaf powder Experiment Set-B Stock solution was very much less concentrated the earlier. It was made using (190ml), of distilled water with (10gm), 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
(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 24 hr. Data were collected in a one-day interval. The results of experimental seedling development were determined by counting the number of germinated seeds measuring the length on the radicle in centimetres. The data were analyzed statistically. Correlation coefficient was determined by pouting 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 pouting 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 Lawana *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 (29.5mm), 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).

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

| Experimental treatments (Set-B) | 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%                            | 5 mm   | 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  |

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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