

Allelopathic Impact Of *Commelina Benghalensis* Leaves And Stem Leachate On Seed Germination, Radicle Length And Plumule Length Of Wheat (*Triticum Aestivum*) Plant

Dr. Awanish Kumar Singh
Assistant Professor

Department of Botany, SGN Govt.P.G.College Muhammadabad, Gohna, Mau-276403 UP, INDIA.

ABSTRACT

The present investigation was carried out to study the allelopathic effect of different concentrations of leaf and stem leachates of *Commelina benghalensis* on seed germination and seedling growth. Leachates of leaves and stems were prepared in varying concentrations (20%, 40%, 60% and 80%) and their effects were studied on percentage seed germination, radicle length and plumule length. Distilled water was used as control. The results revealed a concentration-dependent inhibitory effect of both leaf and stem leachates on seed germination and seedling growth. Maximum inhibition was observed at higher concentrations, especially at 80%. Leaf leachate exhibited a stronger inhibitory effect compared to stem leachate in all parameters studied. The study indicates that *Commelina benghalensis* possesses allelopathic potential due to the presence of allelochemicals which adversely affect seed germination and early seedling development.

Keywords: Allelopathy; *Commelina benghalensis*; Leaf leachate; Stem leachate; Seed germination; Seedling growth; Allelochemicals.

INTRODUCTION

Allelopathy refers to the biochemical interaction between plants, in which one plant releases chemical substances called allelochemicals that influence the growth, germination and development of other plants.

Hans Molisch, an Australian physicist, coined the word "allelopathy" in 1937. Molisch is regarded as the founder of allelopathy. The terms "allelon" and "pathos," which are both Greek in origin, combine to form the phrase allelopathy. According to Molisch, "pathos" means "suffering," and "allelon" implies "mutual." Allelopathy, according to Rice (1974), is any inhibitory effect, either direct or indirect, that one plant (including microbes) exerts on another through the release of chemicals into the environment.

Numerous data indicate that certain weed species have allelopathic effects on the germination of seeds and the growth of seedlings of economically significant crop plants. (Shibu and Andrew, 1998; Delabays et al., 2004; Mulatu et al., 2009).

According to Olofsdotter (1998), allelopathy refers to the direct impact of chemical compounds emitted by one plant on the growth and development of another plant. Allelochemical-mediated direct plant-plant interference and the effect of secondary compounds generated by plants on biotic and abiotic soil

processes that affect other plants are two different categories that Inderjit and J. Weiner (2001) distinguish.

The various allelochemical kinds and their impact on the growth and productivity of Ravi crops (Wheat-Triticum species) are studied by A. K. Singh (2005). Various weed plants are the source of these allelochemicals. Allelochemicals may be present in different plant parts such as leaves, stems, roots and seeds.

Putnam (1988) states that nearly all plants and numerous tissues, including leaves, stems, flowers, fruits, seeds, and roots, contain chemicals with allelopathic potential (usually in conjugated form).

When leachates prepared from plant parts come in contact with seeds, they may either inhibit or stimulate germination and seedling growth. In the present experiment, the allelopathic effect of leaf and stem leachates of *Commelina benghalensis* is studied by observing changes in seed germination, radicle length and plumule length.

METHODS AND MATERIALS

Dessalegne Gella (2013) investigated the allelopathic effects of aqueous extracts from the leaf, stem, and root parts of *Amaranthus hybridus*, *Parthenium hysterophorus*, *Datura stramonium*, and *Argemone mexicana* on seed germination, seedling growth, and biomass production in wheat cultivars; Durum wheat and HAR-1685. It was noted that the leaf extract of *P. hysterophorus* resulted in the highest reduction in wheat seed germination (22%). the plumule length of the wheat seedlings was diminished by 60% and 40%, respectively, because of leaf extracts from *P. hysterophorus* and *A. hybridus*.

Fresh leaves and stems of *Commelina benghalensis*, healthy and uniform seeds, distilled water, beakers, measuring cylinder, Petri dishes, filter paper, mortar and pestle, dropper, ruler or scale.

Fresh leaves and stems of *Commelina benghalensis* were collected and washed thoroughly with distilled water to remove dust and impurities. The leaves and stems were crushed separately in a mortar and pestle by adding a known quantity of distilled water to prepare the stock solution. From this stock solution, different concentrations (20%, 40%, 60% and 80%) of leaf and stem leachates were prepared by dilution with distilled water.

Petri dishes were lined with filter paper and equal number of healthy seeds were placed in each Petri dish. Seeds treated with distilled water served as control. Required quantity of respective leaf and stem leachates was added to the Petri dishes. The Petri dishes were kept under suitable conditions for germination. After a fixed period, percentage seed germination was calculated. The lengths of radicle and plumule were measured using a ruler and observations were recorded carefully. Percentage inhibition was calculated by comparing treated seeds with control.

RESULT AND DISCUSSION

Effect of various concentrations of leaf and stem leachate of *Commelina benghalensis* on % seed germination of *Triticum aestivum*

According to Tefera (2002), aqueous extracts of *P. hysterophorus* leaves and flowers completely prevented teff (*Eragrostis tef*) seeds from germinating. The results showed that percentage seed

germination decreased with increase in concentration of both leaf and stem leachates. In control, 100% seed germination was observed. At 20%, 40%, 60% and 80% concentrations, a gradual reduction in seed germination percentage was recorded. Leaf leachate showed greater inhibitory effect on seed germination compared to stem leachate at all concentrations. Maximum inhibition of seed germination was observed at 80% concentration, where leaf leachate showed 55.21% inhibition and stem leachate showed 44.50% inhibition (Table 1).

Table.1 Effect of various concentrations of leaf and stem leachate of *Commelina benghalensis* on % seed germination of *Triticum aestivum*

S.N.	Concentration (%)	% seed germination (% inhibition)	
		Leaf leachate	Stem leachate
1.	Control	100 (0.00)	100 (0.00)
2.	20%	86.90 (13.10)	90.00 (10)
3.	40%	70.00 (30.30)	74.73 (25.27)
4.	60%	60.87 (39.13)	65.80 (34.20)
5.	80%	44.79 (55.21)	55.50 (44.50)

It was observed that seed germination percentage, radicle length and plumule length decreased gradually with increase in concentration of both leaf and stem leachates. Control seeds showed maximum germination and seedling growth. Leaf leachate caused greater inhibition than stem leachate at all concentrations. Maximum inhibitory effect was observed at 80% concentration.

Effect of various concentrations of leaf and stem leachate of *Commelina benghalensis* on radicle length of *Triticum aestivum*

The radicle length of *Triticum aestivum* seedlings decreased progressively with increasing concentrations of both leaf and stem leachates of *Commelina benghalensis*. In the control, the radicle length measured 5.92 cm, while treatments with leaf leachate showed a marked reduction, with values declining from 4.30 cm at 20% concentration to a minimum of 1.90 cm at 80%. This corresponded to inhibition percentages ranging from 27.36% to 67.91%. According to Femina et al. (2012), *Tridax procumbens* L. aqueous leaf extracts inhibited germination, roots, and shoots length and the leguminous material's fresh and dry weight (Table 2).

Table.2 Effect of various concentration of leaf and stem leachate of *Commelina benghalensis* on radicle length of *Triticum aestivum*

S.N.	Concentration (%)	Radicle length in cm (% inhibition)	
		Leaf leachate	Stem leachate
1.	Control	5.92 (0.00)	5.92 (0.00)
2.	20%	4.30 (27.36)	5.10 (13.85)
3.	40%	3.75 (36.66)	4.70 (20.61)
4.	60%	2.30 (61.15)	3.20 (45.95)
5.	80%	1.90 (67.91)	2.85 (51.86)

Stem leachate also caused a concentration-dependent reduction in radicle length, though the effect was comparatively lower than that of leaf leachate. Radicle length decreased from 5.10 cm at 20% concentration to 2.85 cm at 80%, with inhibition values increasing from 13.85% to 51.86%. Overall, leaf leachate exhibited a stronger allelopathic effect on radicle elongation than stem leachate, and maximum inhibition was observed at the highest concentration (80%).

Effect of various concentration of leaf and stem leachate of *Commelina benghalensis* on plumule length of *Triticum aestivum*

The allelopathic effects of *Eucalyptus camaldulensis* L. on the growth of wheat seedlings were shown by Khan et al. (2008). Ghodake et al. (2012) investigated the allelopathic impact of Euphorbia species on wheat germination and found inhibition in Root-shoot length and germination rate (Table 3).

Table.3 Effect of various concentration of leaf and stem leachate of *Commelina benghalensis* on plumule length of *Triticum aestivum*

S.N.	Concentration (%)	Plumule length in cm (% inhibition)	
		Leaf leachate	Stem leachate
1.	Control	12.50 (0.00)	12.50 (0.00)
2.	20%	8.03 (35.76)	9.10 (27.20)
3.	40%	7.39 (40.88)	8.34 (33.28)
4.	60%	5.40 (56.80)	6.42 (48.64)
5.	80%	4.43 (64.56)	5.30 (57.69)

In my work, the results revealed that plumule length decreased progressively with increase in concentration of both leaf and stem leachates. The control showed maximum plumule length (12.50 cm). At 20%, 40%, 60% and 80% concentrations, a gradual reduction in plumule length was observed. Leaf leachate caused greater inhibition of plumule growth compared to stem leachate at all concentrations. Maximum inhibition was recorded at 80% concentration, where leaf leachate showed 64.56% inhibition and stem leachate showed 57.60% inhibition.

CONCLUSION

From the present investigation, it can be concluded that leaf and stem leachates of *Commelina benghalensis* have strong allelopathic effects on seed germination and seedling growth. The inhibitory effect increased with increase in concentration of leachates. Leaf leachate was found to be more inhibitory than stem leachate, indicating that leaves contain higher concentration of allelopathic chemicals. These allelochemicals adversely affect seed germination as well as radicle and plumule growth, thereby influencing early seedling development.

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