



INHIBITORY EFFECT OF *Ageratum houstonianum* L. ON SEED GERMINATION AND SEEDLING GROWTH OF *Vicia faba* L.

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ABSTRACT

Allelopathy is a relatively young discipline of study that is defined as a direct or indirect helpful or harmful influence of one plant on another by chemical substances emitted into the environment. An experiment was carried out to assess the allelopathic effect of leaf leachates of *Ageratum houstonianum* on germination and seedling growth of *Vicia faba* at various concentrations viz. 25, 50, 75 and 100 % in the laboratory. At the doses used, aqueous leaf extracts of *Ageratum houstonianum* L. had a negative effect on percent seed germination and seedling growth of *Vicia faba* L. The results revealed that all the germination and seedling growth of *Vicia faba* significantly inhibited by the influence of water extract at various concentrations as compared to control. Germination of *Vicia faba* was significantly higher when they were treated with 25% and shoot length and root length was reported maximum inhibition when the crops were treated with 100% concentration at 25 DAS. The results showed that allelochemical stress caused by *Ageratum houstonianum* aqueous was much pronounced in 100% concentration. The study concluded that increasing concentration of leaf leachates of *Ageratum houstonianum* has adverse effects on germination, shoot length, and root length of *Vicia faba* than the control.

KEYWORDS: Allelopathic effect, *Ageratum houstonianum*, *Vicia faba*, Seedling Growth

Allelopathy is a natural ecology process of chemical inhibition of one species by another species, where substances acting as germination or growth inhibitors are released into the environment, influencing the development and growth of nearby plants. The term Allelopathy was introduced by professor Hans Molisch in 1937, which is derived from two separate Greek words allelon which means "of each other" and pathos which means "to suffer" literally meaning 'mutual suffering'. Allelopathic chemicals can be present in any part of the plant. They can be found in leaves, flowers, roots, fruits, or stems.

According to Rice (1984), any direct or indirect, beneficial or harmful impact that one plant has on another through the release of biochemicals into the environment is known as allelopathy. Allelopathy has an impact on the growth, quantity, and value of the product and is important in agricultural environments (Oudhia, P. 2000; Singh *et al.*, 2001).

The phenomenon of allelopathy refers to chemical interactions between all sorts of plants. During this process the chemical exudates or leachates released from leaves, stems or roots of a plant will inhibit the expansion of a neighboring one (Dongre and Singh 2011). Higher concentrations of allelochemicals have been observed to have inhibitory effect (Singh 2019 and Singh 2021a), while, lower concentrations exert

stimulatory allelopathic impact on seed germination and growth of plant (Sahoo *et al.*, 2010).

Vicia faba, also known as fava bean, faba bean, or broad bean. This plant belonged to the family fabaceae. This is cultivated for human feed because the seeds are a good source of protein. The seeds are also consumed by cattle, such as horses, etc. This crop is native to North and Southwest Africa. Phyllotaxy is an alternate type, meaning only one leaf at one node. The plant body is erect, growing, and up to 1 meter in height.

Ageratum houstonianum L. belongs to the family Asteraceae. A wide range of chemical compounds is found in *A. houstonianum*, including flavonoids, alkaloids, chromenes, phenolics and essential oils (Sharma and Sharma., 1995). These allelochemicals are released either through leaching or volatilization into the soil or environment in bioactive concentrations and restarted the growth of other plants (Batish *et al.*, 2009a; Batish *et al.*, 2009b). The current study was conducted to determine the effect of aqueous leaf extracts of goat weed on broad bean seed and seedling growth.

MATERIALS AND METHODS

The present study was conducted under the Botany lab of Sant Ganinath Government P.G. College Muhammadabad Gohna Mau UP in the year 2024. The plant of *Ageratum houstonianum* was collected roadside

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of the college and the leaves were separated, cut into small pieces of approximately 1 cm² and soaked into sterilized water in a ratio of 1:1 (w/v) for 48 hours from the stems. The leachates were filtered through Whatmann filter paper No.1 and filtrate was considered to be stock solution, which were stored in glass bottles in dark and the extracts of different concentration i.e. 25, 50, 75 and 100 percent was prepared accordingly. Thus, there were five treatments including Control water as follows: C0 - Control water (Tap water), C1- leachates of 25% Concentration, C2 - leachates of 50% Concentration, C3 - leachates of 75% Concentration and C4- leachates of 100% Concentration.

Pot Culture

For the seed germination experiment Polyethylene pots (dia. 15 cm, depth 20 cm) were filled with garden soil at 2 kg soil/pot. Ten seeds of *Vicia faba* were sown per pot in moistened soil on October 2024. Thinning was done after 7 days and 5 healthy seedlings were kept/ pot. Leaf leachates of different concentrations were applied at 200 ml/pot at 5 days interval till the end of experiment. Control pots were irrigated with tap water. The treatments were replicated 5 times. Root length, shoot length, relation elongation ratio of root, shoot and inhibition or stimulation on seed germination percentage were recorded at 25 DAT (days after treatment) (Shikha

and Jha 2016). Seed vigour index (SVI) was calculated by: $SVI = (\text{length of radicle} + \text{length of plumule}) \times \text{Germination Percentage}$. These data were statistically analyzed using critical difference (CD at 5%) as a measure of significance.

RESULTS AND DISCUSSION

The data collected are presented in Table 1 and in Figure 1. Leaves leachates do inhibitory effect on seeds germination of test crop (*Vicia faba*). The per cent seed germination was 20% to 100% in different concentrations of leaf leachates of *Ageratum houstonianum*. The inhibitory effect on seed germination ranged from -5.0 to -80% in different concentrations of leaf leachates. The minimum rate of seed germination (20%) was observed for 100% treatment. The length of shoot values varied from 28.5cm to 42.2cm and minimum value 28.5cm was recorded for 100% treatment. The length of root values varied from 10.0cm to 17.5cm and minimum value 10.0cm was observed for 100% treatment. Increase in concentration of leachate was associated with drastic inhibition of germination and seedling growth of broad bean irrespective of weed species. Similar effect of leaf leachates of goat weed was reported in cereals and pulses (Dongre *et al.*, 2004; Dongre and Singh, 2007; Singh, 2021a).

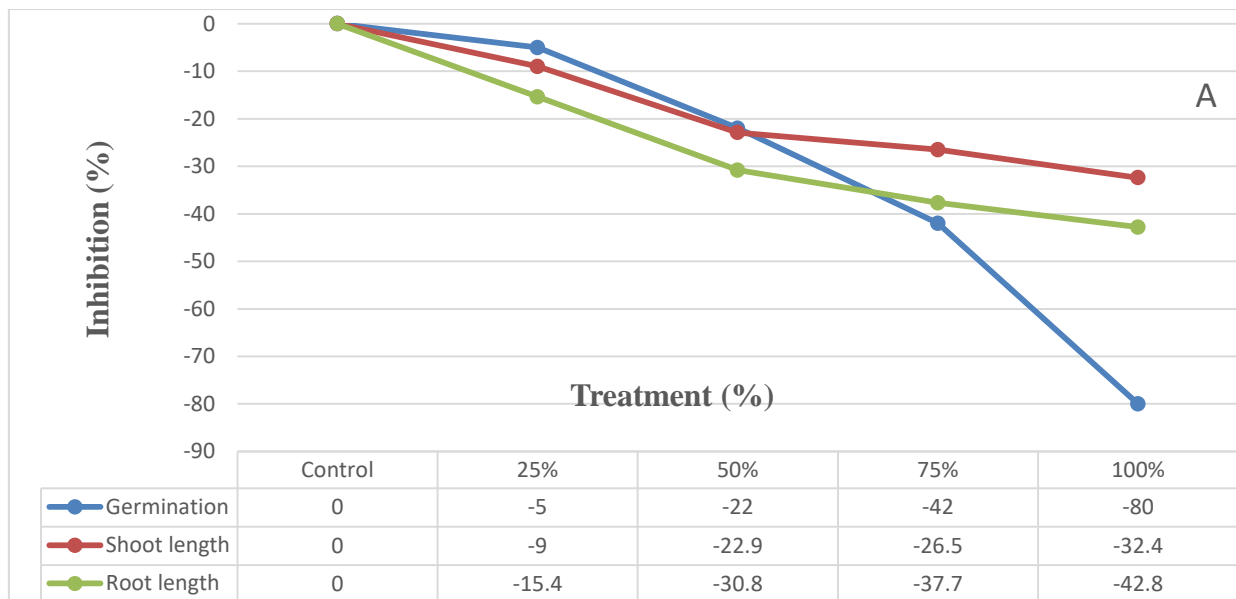
Table 1: Effect of leaf extract of *Ageratum houstonianum* on germination, seedling growth, Relative elongation of shoot, relative elongation of root and SVI values of *Vicia faba* at 25 DAS

Treatment (%)	GP (%)	SL (cm)	RL (cm)	RES (%)	RER (%)	SVI
0 (Control)	100	42.2	17.5	--	--	5970.0
25	95 (-5.0)	38.4(-9.0)	14.8 (-15.4)	90.9	84.5	5054.0
50	78.0 (-22.0)	32.5(-22.9)	12.1 (-30.8)	77.0	69.1	3478.8
75	58.0 (-42.0)	31.0(-26.5)	10.9 (-37.7)	73.4	62.2	2430.2
100	20.0 (-80.0)	28.5(-32.4)	10.0 (-42.8)	67.5	57.1	770.0
CD at 5%	2.3	0.09	0.44	-	-	-

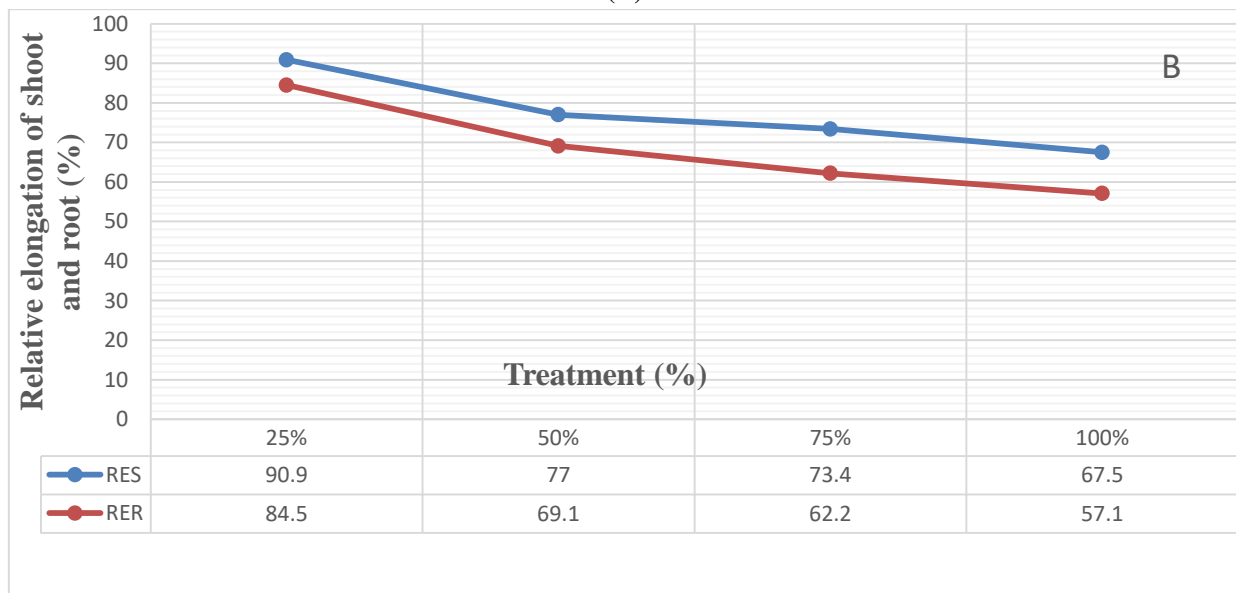
Data in parenthesis indicate percent decrease from control. GP=Germination percent, SL=Shoot length, RL= Root length, RES=Relative elongation of shoot, RER=Relative elongation of root, SVI=Seed vigour index.

The relation elongation ratios of shoot and root recorded in different concentrations of leaf extract of *Ageratum houstonianum* ranged from 67.5 to 90.9 and 57.1 to 81.5, respectively. The SVI values ranged from 770.0 to 5054.0 in 25 to 100% treatments compared to control condition (5970.0. %). The inhibition in shoot length was maximum in 100% treatment (-32.4%) to minimum in 25% treatment (- 9.0%) compared to control treatment. The inhibition in root length decreased by 15.4% to 30.8% in 25% and 50% treatments, respectively compared to control treatment whereas this value increased by 37.7 to 42.8% in 75% to 100%, respectively (Table 1). Singh (2021b) have also reported that the

Ageratum reduces root and shoot length of pea. More or less similar allelopathic impact of leaf leachates from other related weeds on seed germination and seedling growth of green gram, black gram, rice, maize and chickpea etc. have already been reported (Dongre *et al.*, 2010; Singh, 2019; Singh, 2021c; Singh, 2024). Saxena *et al* (2003) isolated gallic, vanillic and p-hydroxybenzoic acids from *A. conyzoides* extracts and also found the inhibition of germination, seedling length, seedling dry weight and uptake of labelled phosphorus and zinc (32P and 65Zn) in seedlings of three varieties of wheat with increasing concentration (5 and 10%) of its extracts.



(A)



(B)

Figure 1: Effect of *Ageratum houstonianum* leaf leachates on inhibition of germination, shoot length, root length, Relative elongation of shoot, and relative elongation of root in *Vicia faba* at 25 DAS. (A) Germination, shoot length and root length and (B) Relative elongation of shoot and root.

CONCLUSION

Leaf leachates of *Ageratum houstonianum* weed drastically inhibited the germination and seedling growth of *Vicia faba* and the inhibitory response was dose dependent. The weed leachates inhibited the different growth attributes; germination, shoot and root length, relative elongation of shoot, relative elongation of root and seed vigour index. This inhibition may be attributed to presence of various allelochemicals in them. It is recommended that *Ageratum houstonianum* should not be used as a green manure because of its harmful allelopathic properties.

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