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ALLELOPATHIC EFFECT OF *AGERATUM CONYZOIDES* L. ON SEED GERMINATION AND GROWTH OF PEA VARIETIES

Awanish Kumar Singh
Department of Botany
S.G.N. Govt. P.G. College, Muhammadabad Gohna, Mau (U.P.), India

Corresponding author: awanish78singh@gmail.com

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Abstract: An experiment was carried out to assess the allelopathic effect of leaf extract of *Ageratum conyzoides* on germination and seedling growth in Arpan and Sapna varieties of *Pisum sativum* at various concentrations *viz*. 10, 20, 30 and 40% in the laboratory. The results revealed that all the germination and seedling growth attributes to both varieties of pea were significantly inhibited by the influence of water extract at various concentrations as compared to control. Lowest germination percentage, germination index, root and shoot length, seedling dry weight and seedling vigour index in pea varieties was observed by the effect of water extract of *Ageratum conyzoides* at 10% concentration. The seed germination, plumule and radicle length were reduced with increasing concentration of aqueous solution. The study concluded that increasing concentration of leaf extract of *Ageratum conyzoides* has adverse effects on germination, shoot length, and root length and biomass production of *Pisum sativum* than the control.

Keywords: *Ageratum*, Allelochemicals, Allelopathic effect, Leaf extract, *Pisum sativum*.

INTRODUCTION

The direct or indirect, stimulatory or inhibitory effects of plants on each other through the discharge of chemicals into the environment are named as allelopathy (Rice, 1984). The chemicals that are discharged throughout this method are termed as allelochemicals that are usually secondary metabolites (Asaduzzaman *et al*., 2010). A large number of allelochemicals have been found and identified and some are involved in plant defence system (Deepmala, 2019). These allelochemicals are classified into various groups on the basis of their chemical properties. Phenolics, alkaloids, terpenes, fatty acids and indoles are the most ordinarily occurring allelochemicals in plants (Noguchi, 2008). 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). Stimulatory and inhibitory allelopathic effect depends upon the concentration of allelochemicals (Hill *et al.*, 2006). Higher concentration of allelochemicals have been observed to have inhibitory effect (Femina *et al*., 2012; Singh, 2019), while lower concentrations exert stimulatory allelopathic impact on seed germination and growth of plant (Sahoo *et al*., 2010). Allelopathic effects in legumes and cereals are projected as a technique to suppress weeds (Conklin *et al.*, 2002), pests and diseases (Messiaen, 1994), pollution and to reduce the input of agrochemicals or artificial fertilizers to enhance the crop productivity. The allelochemicals are commonly found in living

plant exudates, volatile compounds discharged from leaves, decomposing plant residues and leaf leachates (Narwal *et al*., 2005).

The common name of *Ageratum conyzoides* L. is goat weed. It is native of Central America and North American nation. As a member of family Asteraceae, the plant is non-woody in habit, found throughout tropic and semitropical regions around the world including India (Okunade, 2002). The genus consists of concerning thirty species but a few species are phytochemically investigated (Kamboj and Ajay, 2008). Essential oil and leaf extract are shown to own allelopathic effects on variety of cultivated crops. According to Xuan *et al*. (2004), several phenolic compounds like gallic acid, coumaric acid, protocatechuic acid, p-coumaric acid, sinapic acid, and carboxylic acid are secreted by *Ageratum conyzoides* that show allelopathic impact on the other crops plants.

The present study was conducted to study the impact of various concentrations of leaf extract of genus *Ageratum* on seed germination and seedling growth of a crucial legume *Pisum sativum*. Pea is cultivated in this region on large scale and *Ageratum* is invading the crop land, grassland, wasteland etc. of Muhammadabad Gohna Dist. Mau (U.P.), India on large scale rapidly.

MATERIALS AND METHODS

The present study was carried out in the year 2020. The mature fresh leaves of *Ageratum conyzoides* (goat weed) were collected from the S. G. N. Govt. P. G. College Muhammadabad Gohna, Mau (U.P.) India Campus and brought to laboratory. The leaves were separated, cut into small pieces of approximately 1 cm^2 and soaked into sterilized water in a ratio of 1:2 (w/v) for 48 hours. The leachates were filtered through Whatmann filter paper No.1 and filtrate was considered to be 50% leachates concentration, which were stored in glass bottles in dark.

Bioassay

The seeds were treated with different concentration of leaf leachates. Different concentrations of leaf leachates of *A. conyzoides* were prepared. Ten seeds of pea (Arpan and Sapna) were placed equidistantly in petridishes fitted with two layers of filter paper. 15 ml of 10, 20, 30, and 40% leachates of *A. conyzoides* were added into the petri-dishes as per treatment. Sterilized water was used as control. Five replicates of each treatment and control were maintained. The petri-dishes were maintained under laboratory condition for 5 days. Equal volume of distilled water was added in the dishes when moisture content of the blotting paper declined. Number of seeds germinated was counted on 1, 2, 3, 4, and 5 days after sowing (DAS) and seedlings growth was measured at 5 DAS. Root: shoot ratio, relation elongation ratio of root, shoot and inhibition or stimulation on seed germination percentage were calculated by Shikha and Jha (2016). Seed vigour index (SVI) was calculated by: SVI= Germination Percentage $\times$ Mean of Seedling Length. Experimental results were statistically analyzed by using critical difference (CD at 5%) as a measure of significance.

RESULTS AND DISCUSSION

Effect of Leaves on Seed Germination

Ageratum conyzoides significantly inhibited the seed germination on pea at 20% leachates concentration in both the varieties of pea. There were maximum inhibition in seed germination of 'Arpan' variety (39.6%) and 'Sapna' variety (38.7%) at 40% leachates concentration (table1, Fig.1). The minimum inhibition of seed germination was observed in 'Sapna' variety at 10% concentration followed by 'Arpan' variety of pea.

Effect of Leaves on Seedling Growth

The 20% leachates of *A. conyzoides* weed species significantly inhibited the root length in seedlings of pea (table 1). The maximum inhibition (54.6%) of seedlings growth was observed in 'Arpan' variety at 40% concentration solution and minimum inhibition (11.2%) at 10% concentration solution. The lowest inhibition of root length was observed in 'Sapna' variety of pea (fig.1). The reduction in root length was observed with increasing concentration of extracts. Similar effect of leaf aqueous extract of goat weed was reported in cereals and pulses (Dongre *et al.,* 2004; Dongre and Singh, 2007; Kumar *et al.,* 2018; Singh, 2021).

Relative Elongation ratio of Root

The relative elongation ratio of root was recorded in different concentration of leaf leachates of *Ageratum*. The values were composed for 10% to 40% concentration. The relative elongation ratio of root was decreased with the higher concentration of *Ageratum* leaf leachates in both the varieties of pea (table 1, fig. 1).

Table 1: Effect of aqueous leaf leachates of *A. conyzoides* on germination and seedlings growth, relative elongation of root, SVI values in 2 varieties of pea at 5 DAS.

Variety	Treatment (%)	GP (%)	RL (cm)	RER (%)	SVI
ARPAN	0 (Control)	92.0	3.48	-	337.56
	10	86.4 (-6.1)	3.09 (-11.2)	88.79	266.97
	20	83.4 (-9.5)	2.69 (-22.7)	77.29	223.80
	30	67.2 (-29.6)	2.32 (-33.3)	66.66	155.90
	40	55.6 (-39.6)	1.58 (-54.6)	45.40	87.84
	CD at 5%	5.23	0.17	-	-
SAPNA	0 (Control)	90.0	2.89	-	260.10
	10	90.0 (0.0)	2.84 (-1.7)	98.26	255.60
	20	81.2 (-10.0)	2.44 (-15.6)	84.42	198.12
	30	67.6 (24.5)	1.91 (-33.9)	66.08	129.11
	40	55.2 (-38.7)	1.57 (-45.7)	54.32	86.66
	CD at 5%	4.23	0.19	-	-

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

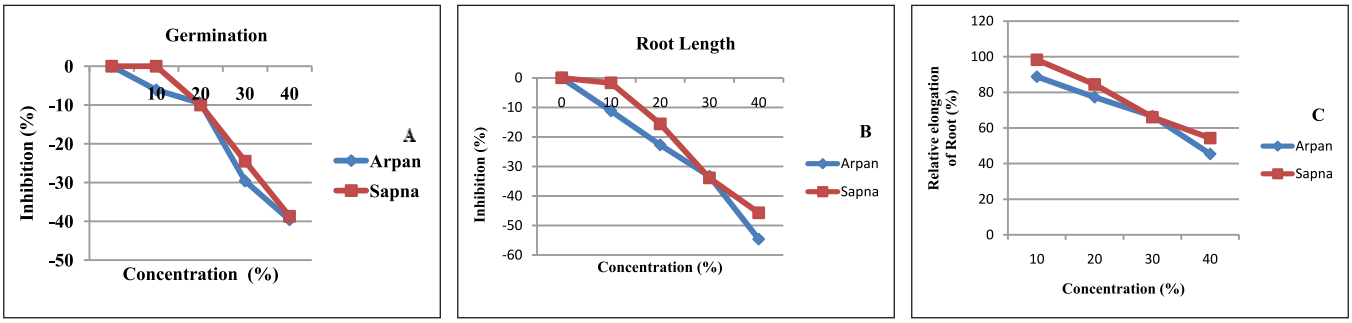

Fig. 1: Effect of *Ageratum* leaf leachates on inhibition of germination, root length and relative elongation of root in pea at 5 DAS. (A) Germination (B) Root length and (C) Relative elongation of root.

The minimum value for root elongation ratio was 45.4 recorded for 40% in variety of 'Arpan' and maximum value 98.26 for 10% concentration of leaf leachates of 'Sapna' variety. Increase in concentration of leachates was associated with drastic inhibition of germination and seedling growth. Some earlier works have also reported that the *A. conyzoides* reduces root and shoot length of rice, soybean and wheat (Singh *et al.*, 2003; Negi *et al.*, 2020).

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 sorghum, chickpea etc. have already been reported (Dongre *et al.*,

2010; Devi *et al*., 2014; Shikha and Jha, 2014; Netsere, 2015; Singh, 2019; Singh, 2021).

The nature of allelochemicals was determined as a group of heterogeneous chemicals, basically comprised of phenolic acids, coumarins, alkaloids, flavonoids and tannins etc. In *A. conyzoides,* pherolic acids, *namely*, j3-coumaric, gallic, ferulic, p-hydroxybenzoic, anisic and syringic, were identified from its different parts and all of these are known to exert allelopathic effect on the other plant species (Kong *et al*., 2002). These are very common and have been identified from a number of other weed species. Chou *et al.* (1998) identified ferulic, vanillic, caffeic and gallic acid, etc, from *Acacia confusa.*

CONCLUSION

From the study it can be concluded that aqueous leaf leachates of *Ageratum conyzoides* L. had greater inhibitory effect on germination rate, root length, relative elongation ratio of root and seed vigour index of both varieties of pea examined at 20% concentration. The leaf of *A. conyzoides* has potential to inhibit the seed germination and seedling growth of pea plants due to the presence of phenolic compound. Increase in concentration of leachates was found invariably associated with further decrease in germination of test cultivars, irrespective of weed species.

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