IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Allelopathic impact of *Ageratum conyzoides* L. extract on seed and seedling traits 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. At the doses used, aqueous leaf and flower extracts of *Ageratum conyzoides* L. had a negative effect on percent seed germination and seedling survival of *Vicia faba* L. In the M1 generation, there was a gradual decrease in both traits from lower to higher doses. M2 generation recovered to some extent, but not to the extent that it could be controlled.

Keywords: Allelopathy, goat weed, broad bean, seed germination, seedling survival

INTRODUCTION

The term allelopathy was first coined by Hans Molisch in 1937. It is the combination of two words Allelon which means “of each other” and pathos means “to suffer”. Allelopathy is a kind of plant-plant interaction mediated through the release of chemical substances by the plant which is detrimental to the other growing nearby [5], [8], [12], [16]. All of the plants we use, including weeds and medicinal plants contain some allelopathic activity. Simply allelopathy is the chemical inhibition of one plant species by another plant species. The inhibitory chemicals are released into the environment which affects the development as well as growth of the nearby plants. Allelopathic chemicals may be present in the leaves, flowers, fruits, roots or stems and may be affect the plant growing in vicinity. Allelopathy is a new branch of science and is defined as a direct or indirect beneficial or harmful effect of one plant on another through the production of chemical compounds released into the environment [9], [12].Many researchers have been well documented on the Allelopathy over the past few years [17].

Ageratumconyzoides L. belongs to the family Asteraceae. A wide range of chemical compounds is found in *A. conyzoides*, including flavonoids, alkaloids, chromenos, phenolics and essential oils [7], [13]. These allelochemicals are released either through leaching or volatilization into the soil or environment in bioactive concentrations and restarted the growth of other plants [15], [2],[3] .The current study was conducted to determine the effect of aqueous leaf and flower extracts of goat weed on broad bean seed and seedling traits.

METERIALS AND METHOD

Field grown goat weed plants were uprooted to make the aqueous extracts. Leaves and flowers samples weighing 250 gm were dried individually at 60°C. It was then ground and stored at ambient temperature after passing through a 1mm screen. The leaf and floral extracts were made separately using sterile distilled water in a 50:1 (v/w) water/sample ratio. It was then placed in the refrigerator for 18 hours. The suspension was then centrifuged for 15 minutes at 1000 rpm and vacuum filtered through a 0.4m polycarbonate filter to obtain the mother solution, from which different concentrations (10, 20, 30, 40, and 50 %) of both leaf and flower extracts were made separately by adding the required amount of distilled water. For 6 hours, just seed treatment was provided. The seeds were just steeped in distilled water as a control. The treated seeds were then carefully rinsed under running tap water and promptly put in equal-sized pots with homogeneous soil, along with a control, to raise M1 plants. M2 populations were created by selfing seeds from M1 populations. Germination tests were carried out at room temperature. 100 seeds were evenly distributed in two layers of filter paper at the bottom of Petri plates of sufficient size. On the fifth day after seeding, the total numbers of germinated seeds were counted. The percentage of seedling survival was calculated using the number of seedlings that survived on the 25th day after sowing. In a totally randomised design, the treatments were reproduced four times. The data were statistically analysed using Critical Difference (CD) at a significance level of 5%.

RESULTS AND DISCUSSION

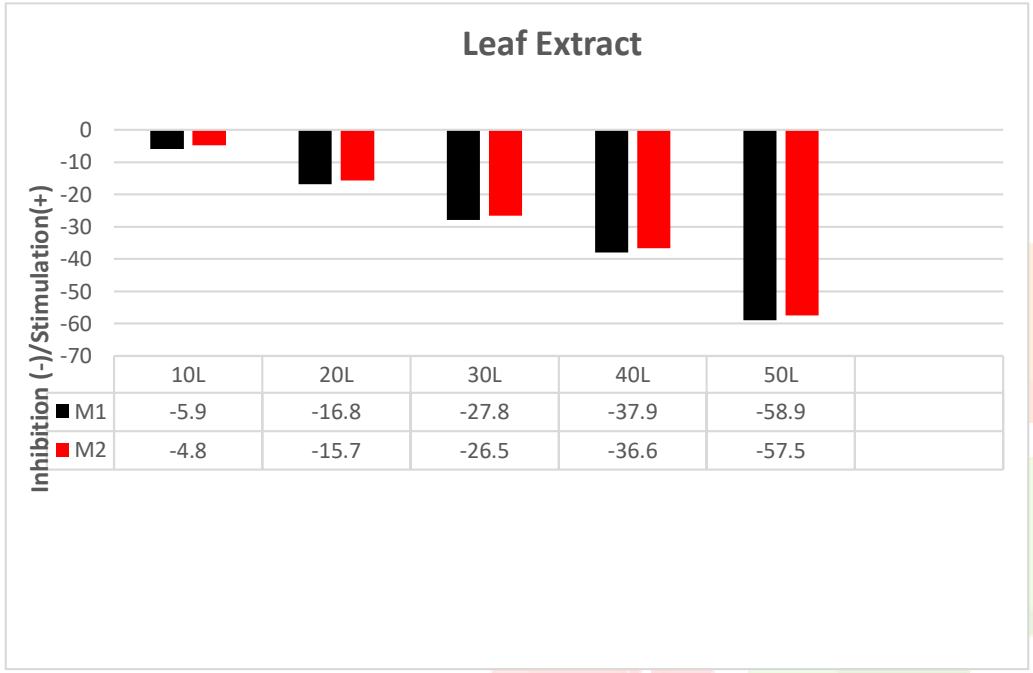
Broad bean seed germination (Table 1, Fig. 1) and seedling survival (Table 2, Fig. 2) were negatively affected by aqueous leaf and flower extracts of *Ageratum conyzoides* L. In M1 generation, these features gradually decreased from lower to higher used doses. From lower to higher used doses, the effect of floral extract treatment led a steady decrease in these features. The control showed the least inhibition in the aforesaid features, while the 50 percent concentration treatment showed the most. Surprisingly, the flower extract treatment was more harmful than the leaf extract treatment at all the used doses. M2 generation recovered to some amount at all doses, but not to the extent of control (Table 1&2; Fig 1&2).

A seed is a small plant that contains all of the physiology, biochemistry, and genetic events that occur in a fully-grown plant. It stays dormant, but it is a powerhouse of genetic traits capable of displaying all of the blueprints in the following plant generation. Seed is both a source of life and a hungry horse. It protects and preserves life. Exploration of agricultural biotechnology for the production of high-tech seeds is

currently in demand. Because it influences the embryo of the seed from which a seedling emerges to develop into an adult plant, seed germination and seedling survival are crucial metrics to measure the favourable or detrimental effects of a mutagen or allelochemical. The stimulating effect of the mutagen or allelochemical utilised has a big role in the development of a good seedling. The Ageratum genus is a fast-spreading plant that is currently posing a significant concern for environmentalists, ecologists, farmers, and animal scientists. A number of studies have been carried out on its control as a weed [1].

The word 'allelopathy,' coined by Molisch [8], refers to all stimulatory biochemical interactions between plants, including microorganisms. Allelopathic plants have complete control over their surroundings. In a natural ecosystem, allelopathy is one of the drivers for vegetation succession. The medicinal plants have strong allelopathic potential [6], [10], [11]. Theophrastus (1493-1541), regarded by many as the father of toxicology, had said “all things are poison and nothing is without poison; only the dose makes a thing poison.”

Dose (%)	Generation	1. Seed Germination (%)									
		Leaf Extracts					Flower Extracts				
		R-1	R-2	R-3	R-4	Mean	R-1	R-2	R-3	R-4	Mean
control	M1	96.6	100.0	100.0	100.0	**99.1**	100.0	100.0	96.6	100.0	**99.1**
	M2	99.6	99.6	99.6	100.0	**99.7**	99.6	99.6	100.0	99.6	**99.7**
10	M1	90.0	93.3	93.3	96.6	**93.3 (-5.9)**	86.7	90.0	86.7	83.3	**86.7 (-12.6)**
	M2	93.3	93.3	96.6	96.6	**95.0 (-4.8)**	90.0	86.7	86.7	90.0	**88.3 (-11.5)**
20	M1	83.3	80.0	80.0	86.7	**82.5 (-16.8)**	76.6	76.6	73.3	73.3	**75.0 (-24.4)**
	M2	80.0	83.3	86.7	86.7	**84.1 (-15.7)**	80.0	76.6	73.3	83.3	**78.3 (-21.5)**
30	M1	73.3	70.0	70.0	73.3	**71.6 (-27.8)**	66.6	60.0	63.3	63.3	**63.3 (-36.2)**
	M2	73.3	70.0	73.3	76.6	**73.3 (-26.5)**	63.3	63.3	66.6	66.6	**65.0 (-34.9)**
40	M1	60.0	63.3	63.3	60.0	**61.6 (-37.9)**	50.0	43.3	36.6	40.0	**42.4 (-57.3)**
	M2	66.6	60.0	63.3	63.3	**63.3 (-36.6)**	43.3	50.0	43.3	46.6	**45.8 (-54.1)**
50	M1	43.3	40.0	43.3	36.6	**40.8 (-58.9)**	33.3	30.0	26.6	36.6	**31.6 (-68.2)**
	M2	50.0	36.6	40.0	43.3	**42.4 (-57.5)**	30.0	36.6	36.6	33.3	**34.1 (-65.8)**
CD at 5% level	M1					**4.06**					**4.62**
	M2					**4.41**					**4.24**



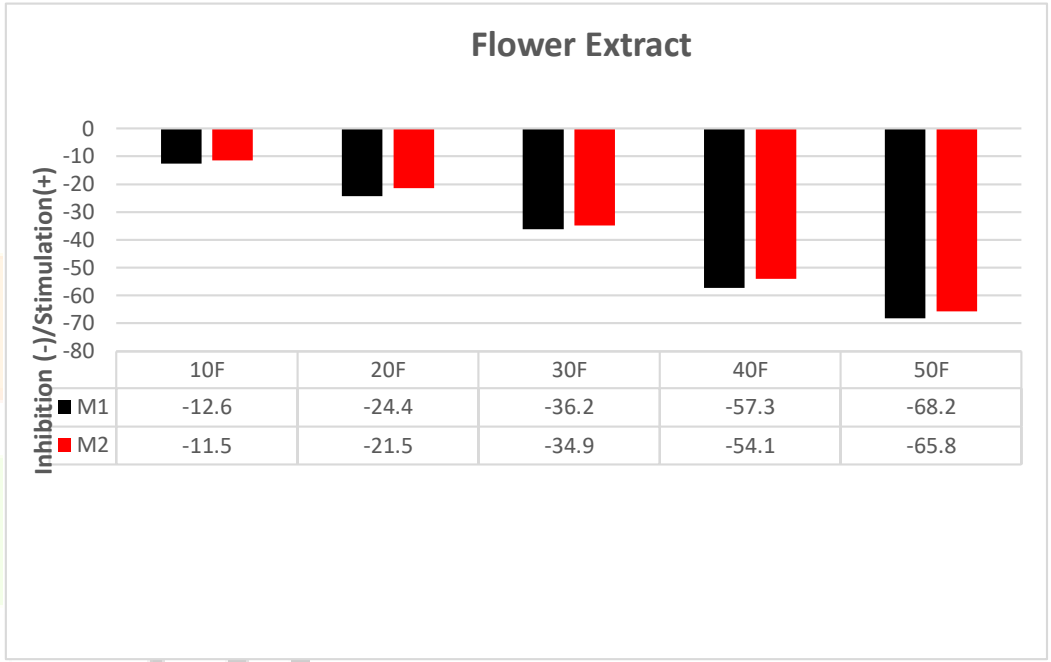
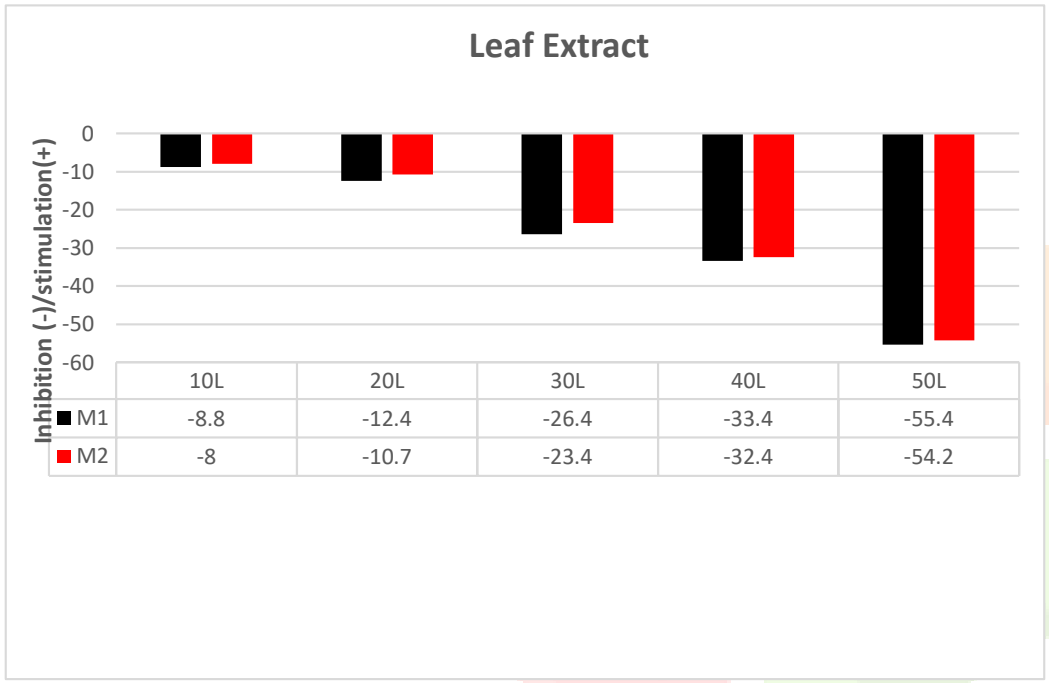


Fig 1.b. Inhibitory effect of *Ageratum conyzoides* L. extracts on seed germination of *Vicia faba* L.

Dose (%)	Generation	2. Seedling Survival (%)									
		Leaf Extracts					Flower Extracts				
		R-1	R-2	R-3	R-4	Mean	R-1	R-2	R-3	R-4	Mean
control	M1	93.3	96.6	93.3	96.6	**95.0**	96.6	93.3	96.6	93.3	**95.0**
	M2	96.4	96.7	95.9	96.5	**96.4**	96.5	96.8	96.3	95.9	**96.4**
10	M1	86.7	90.0	83.3	86.7	**86.7 (-8.8)**	83.3	80.0	76.6	80.0	**80.0 (-15.8)**
	M2	88.4	88.6	89.0	88.6	**88.7 (-8.0)**	86.9	86.8	86.7	85.8	**86.6 (-10.1)**
20	M1	80.0	83.3	86.7	83.3	**83.3 (-12.4)**	73.3	70.0	73.3	66.6	**70.8 (-25.5)**
	M2	86.5	86.7	85.4	85.3	**86.0 (-10.7)**	74.1	73.3	74.0	73.9	**73.8 (-23.4)**
30	M1	73.3	70.0	66.6	70.0	**70.0 (-26.4)**	63.3	60.0	56.6	63.3	**60.8 (-36.0)**
	M2	73.9	74.0	73.3	74.1	**73.8 (-23.4)**	64.5	63.7	63.9	63.4	**63.9 (-33.7)**
40	M1	63.3	66.6	60.0	63.3	**63.3 (-33.4)**	40.0	40.0	36.6	33.3	**37.4 (-60.6)**
	M2	65.6	64.7	65.3	64.9	**65.1 (-32.4)**	39.8	39.6	38.5	38.2	**39.0 (-59.5)**
50	M1	50.0	43.3	40.0	36.6	**42.4 (-55.4)**	33.3	23.3	26.6	30.0	**28.3 (-70.3)**
	M2	44.2	44.5	43.7	43.8	**44.1 (-54.2)**	32.8	32.6	31.5	30.6	**31.8 (-67.0)**
CD at 5% level	M1					**4.86**					**4.15**
	M2					**0.62**					**0.68**



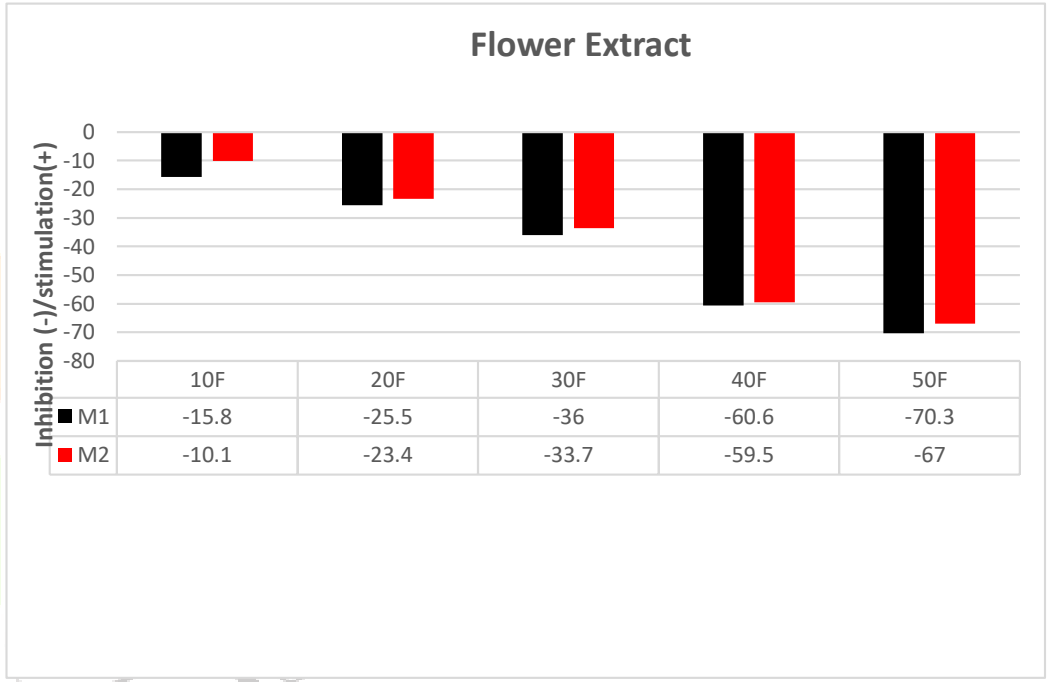


Fig 2.b. Inhibitory effect of *Ageratum conyzoides* L. extracts on seedling survival of *Vicia faba* L.

He was thinking about the apparent safety of toxicants at low dosages when he made this statement. Furthermore, while some substances are toxic at greater doses, they can be stimulating or even useful at lower doses; this is the case with compounds like medicines, which are employed for their positive effects, as well as pesticides, which are generally used as toxicants. Hormesis is the term for the stimulatory action of a low dose of a toxicant. Allelopathy has been linked to lower seed germination and seedling growth; however allelochemicals have no common method of action or physiological target location. Cell division, pollen germination, food uptake, photosynthesis, and specific enzyme functions were all recognised sites of action for various allelochemicals. Allelopathic action is complex and can involve the interaction of different classes of chemicals like phenolic compounds, flavonoids, terpenoids, alkaloids, steroids, carbohydrates and amino acids with mixtures of different compounds sometimes having a greater allelopathic effect than individual compound alone [4]. Allelopathy expertise is predicted to become increasingly important in agricultural production, agroforestry, and horticulture in both developed and developing countries in the near future. Furthermore, it has the potential to become one of the strategic sciences for reducing pollution. India's high plant diversity provides a great opportunity for future plant study. Current allelopathic research focuses primarily on ecophysiology, but future molecular level gene studies will aid in better understanding the mechanism of allelopathy, allowing for the manufacture of desired transgenic allelopathic plants.

CONCLUSION

Allelopathy plays a significant role in various plants and affects the growth, quality and quantity of the product [14]. As a result, the current research suggests that Ageratum weed has a negative impact on broad bean seed and seedling properties. The flower extract therapy had a greater retarding impact than the leaf extract treatment. At all doses utilised, however, the rate of recovery in M2 was faster in the former than the latter. When the allelochemicals found in aqueous leaf and flower extracts of Ageratum came into touch with the embryo of broad bean seed embryos during treatment, biochemical interactions occurred, which altered the survival, growth, and development of Broad bean plants. As a result, it poses a threat to productivity. Indian farmers frequently employ the plant residues/mulches of various weeds grown in their fields as green manure to improve the land's fertility. However, based on the findings of this study, it is recommended that Ageratum should not be used as a green manure because of its harmful allelopathic properties.

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