Indian J. Applied & Pure Bio. Vol. 32(2), 141-146 (2017).

Allelopathic effect of aqueous extract and hot water extract of different parts of *Eclipta alba* (L.) Hassk. on *Malva sylvestris* L. germination and growth

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Abstract

The allelopathic potential of *Eclipta alba* using *Malva sylvestris* L. as model plant. The different concentrations (0.5%, 1%, 2%, 4%) of cold and hot aqueous extract of different parts of *Eclipta alba* were applied to determine their effect on emergence percentage, radicle and plumule length of test plant. The seeds of test plant were soaked on filter paper of Petri dishes (4" diameter) moistened with respective extracts. The treatments were arranged in completely randomized design with three replicates of each concentration. A control was set up having the filter paper saturated with water only. Both the cold and hot water extract have no effect on emergence percentage. Aqueous extracts from all parts (root, stem, leaf) reduced plumule and radicle length of the test plant. It was observed that hot water extract of leaves, stem and root shown more inhibitory effect than cold water extract. The reduction in both cases were in this order; leaves.>root>stem.

Allelopathy refers to the production and exudation of chemical compounds, including secondary metabolites, harmful to other species or their functions and influencing the growth and development of agricultural and biological systems[5,23]. These chemicals are largely classified as secondary metabolites (such as alkaloids, isoprenoids, phenolics, flavonoids, terpenoids and gluconolates etc.[16]. These chemicals with allelopathic potential exist in almost in all plants and most of the tissues. These chemicals are released directly from living plants into the environment through root exudation, leaching, volatilization and passively liberated through the decomposition of plant residues[23]. Allelopathic substances released by the plants accumulate in soil to physiologically active leve[17,24]. These allelochemicals are found to accumulate and persist for considerable time, thus, significantly interfering with the growth of neigbouring plants and weeds[17,18]. Integrated weed management is one of such approaches where allelopathy can play its eco-friendly role in weed management[9]. The allelopathic properties of plants can be exploited successfully as tool

for pathogens and weed reduction[31]. Recent research work identified a number of species including *Cardaria draba* and *Salvia syriaca*[20], *Eucalyptus micrantha*[6], *Ginkgo biloba*[14], *Tamarindus indica*[17], *Azadirachta indica*[30], and *Broussonetia papyrifera*[8] as allelopathic against other plants. Tehmina and Bajwa[29] and Kamal and Bano[12] worked on the allelopathy of *Helianthus annuus*. Marwat and Khan[15] demonstrated that leaves of *Prosopis juliflora, Eucalyptus camaldulensis* and *Acacia nilotica* had strong inhibitory efficacy. Hussain *et al*.,[9] investigated *Cassia angustifolia* for its allelopathic potential. Elizabeth *et al*.,[4] tested the phytotoxcity of *Brachiaria decumbens*. Samreen *et al.*, studied the allelopathy of *Calotropis procera*. Hussain and Ilahi[7] reported that *Cenchrus ciliaris* and *Bothriochloa pertusa* exhibit allelopathy. The review reveals that very less study was conducted on *Eclipta alba* which is a prostrate, annual and perrenial herb with wide geographical and ecological distribution and its certain parts are used as medicinal material. *Eclipta alba* are drought evergreen plants of the family Asteraceae. This plant grows as a common weed throughout India ascending to 1800m in the Himalayas and Orissa, Punjab, Western India and south India[25].

Extract preparation: Fresh leaves, stem and root of *Eclipta alba* that were gathered from Aligarh Muslim University campus, washed with distilled water, dried in shade at room temperature and then ground separately with the help of electric grinder, made fine powder and stored in paper bags. Four grams powder of root, stem and leaves of *Eclipta alba* were soaked in 100ml of distilled water and filtered through whatman no.1 filterpaper to obtain aqueous stock solution (4%). After 24 hours of soaking at room temperature and then further diluted to get 2% to 0.5% aqueous extract.

Hot water extract: 4, 2, 1, 0.5 grams of dried plant parts were separately boiled in 100ml of distilled water for 5 minutes and filtered.

Petri dish assays: The seeds of test pant were purchased from agro service stores, Aligarh. Seeds were sterilized before soaking in distilled water for 24 hours. About 10 seed were evenly distributed on single layer of whatman no. 1 filterpaper in disposable petridishes of 9cm diameter and 1.7cm deep (Iwaki-pyrex co.Ltd). The seeds were moistened with respective hot and cold extracts. Distilled water was added to untreated control .For each of the treatment, no of germinated seeds was recorded for a period of 15 days. On 15th day, the radical and plumule length were measured. Each experiment was performed in randomly completely random design block and results were mean of three replicates. All results were statistically analyzed through LSD.

The results show that as compared to control, Malva emergence and seedling growth was reduced by both hot water extract and cold water extract. Both hot water and cold water extract inhibited the germination percentage by (90% and 77%) at 4% concentration and by (42% and 32%) at 0.5% concentration respectively. This means that there was a decrease in germination percentage as concentration of extract increases (Tables

1 and 3). The germination results are in line with the findings of Parvis *et al.*,[19], Cheema,[3] and Randhawa *et al.*,[22]. Similarly the *Malva* seedling growth was reduced by both hot water extract and cold water extract from different parts of *Eclipta alba*. The only difference between these two extracts is that hot water extract causes maximum inhibitory effect than cold water extract. This is because hot water extract reduces the time for the extraction of allelochemicals. The maximum reduction in radicle and plumule length obtained is (±1.05 cm and ±2.00 cm) at 4% concentration of hot water extract (Table 4).

Hussain *et al.*,[4] also reported hot water extract to be allelopathic against test species. In case of cold water extract, maximum inhibitory effect in radicle and plumule length was observed at 4% concentration (±1.29 cm and ±2.19 cm) and minimum at 0.5% concentration (±2.66 cm and ±3.76 cm) (Table 2).

Some recent findings indicating the allelopathic effect of aqueous extract of species include *Mikania micrantha*[11], *Cyperus rotunda*[21], *Cardaria draba*[13], *Parthenium hysterophorus*[2,26], *Ageratium conyzoids*[2], *Jatropa curcas*[10], *Helianthus annuus*[1] supports our finding. It also indicates that inhibition effect was found to increase with concentration of extract from different parts. This is supported by the findings of [27,28]. In both cases the leaves are more phytotoxic than roots and stem. Some recent findings of Xaun *et al.*,[30], Marwat and Khan[15] supports the point. The results are also shown in Graphs (fig.1 for aqueous extract & fig. 2 for hot extract).

From this we conclude that *Eclipta alba* is an allelopathic plant due the presence of various allelochemicals in its different parts which are capable of inhibiting the germination and growth of test species.The *Eclipta alba* contains ecliptol (a tertienyl aldehyde), 2-angeloyloxy methylene-5'- (but-3-en-1-ynyl) dithiophene, 5-isovaleryloxy methlene-2- (4-isovaleryloxy-but-3-ynyl) diothephene, isoflavinoids, widelolactone, dimethylewe-delolactone, 7-0glucoside, nicotine, alkaloid and stigmasterol.These substances might be

Table-1: Effect of different concentrations of aqueous extract of *E. alba* on Germination percentage reduction of *Malva sylvestris*

Treatment	Germination percentage reduction			
	4%	2%	1%	0.5%
Leaves	77%	66%	63%	52%
Stem	42%	41%	38%	32%
Root	54%	52%	45%	38%
Control	20%	20%	20%	20%
LSD at 5%	parts = 1.434	conc. = 1.434	interaction = 2.867	
LSD at1%	parts = 1.931	conc. = 1.931	interaction = 3.861	

The result is a mean of three replicates

Table-2: Effect of different concentration of aqueous extract of *E. alba* on Shoot length and Root length of *Malva sylvestris*

Treatment	Root length				Shoot length			
	4%	2%	1%	0.5%	4%	2%	1%	0.5%
Leaves	±1.29	±1.29	±1.33	±1.36	±2.19	±2.29	±2.35	±2.32
Stem	±1.48	±1.57	±1.62	±1.69	±2.62	±2.65	±2.67	±2.72
Root	±1.31	±1.38	±1.41	±1.43	±2.43	±2.46	±2.56	±2.59
Control	±2.66	±2.66	±2.66	±2.66	±3.76	±3.76	±3.76	±3.76

The result is a mean of three replicates

Table-3: Effect of different concentrations of hot water extract on Germination percentage reduction of *Malva sylvestris*

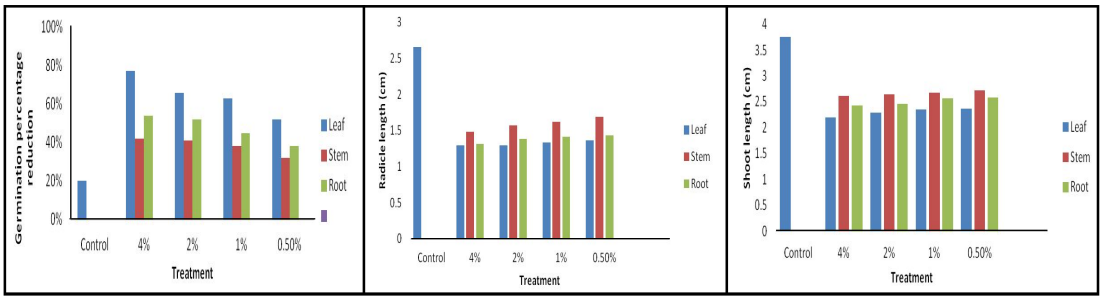
Treatment	Germination percentage reduction			
	4%	2%	1%	0.5%
Leaves	90%	80%	70%	65%
Stem	65%	56%	52%	50%
Root	79%	65%	52%	42%
Control	20%	20%	20%	20%
LSD at 5%	parts = 1.15		conc. = 1.15	interaction = 2.30
LSD at1%	parts = 1.55		conc. = 1.55	interaction = 3.10

The result is a mean of three replicates

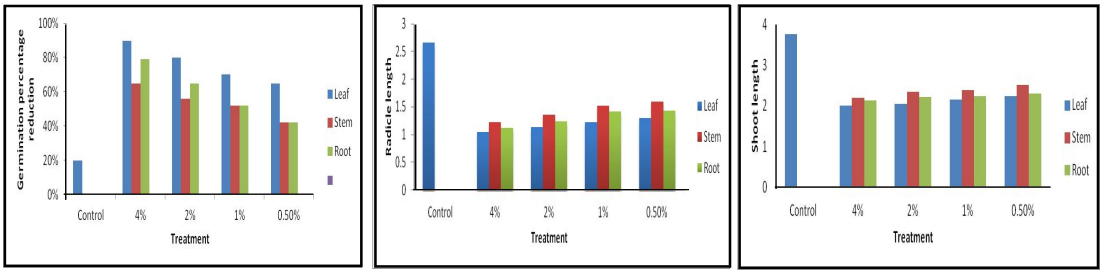
Table-4: Effect of different concentration of hot water extract of *E. alba* on Shoot length and Root length of *Malva sylvestris*

Treatment	Root length				Shoot length			
	4%	2%	1%	0.5%	4%	2%	1%	0.5%
Leaves	±1.05	±1.13	±1.23	±1.29	±2.00	±2.04	±2.15	±2.23
Stem	±1.22	±1.36	±1.52	±1.62	±2.19	±2.34	±2.39	±2.52
Root	±1.12	±1.24	±1.42	±1.43	±2.13	±2.22	±2.25	±2.31
Control	±2.66	±2.66	±2.66	±2.66	±3.76	±3.76	±3.76	±3.76

The result is a mean of three replicates



Graph 1: Effect of different concentration of aqueous extract of stem on (a) root length (b) shoot length and (c) dry weight of test plants.



Graph 2: Effect of different concentration of hot extract of stem on (a) root length (b) shoot length and (c) dry weight of test plants.

responsible for its allelopathy. It can also be used to test its efficacy as a weed, pests and disease control agent.

The author is thankful to the authorities of G. F. College, Shahjahanpur, UP, India for providing necessary facilities and encouragement to carry out this study.

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