Response of Wheat To Allelopathic Effects of Argemone Mexicana L.

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Abstract- *The present study was conducted to determine the allelopathic effect of Argemone mexicana L. on seed germination, seedling growth, photosynthetic pigments and protein content of wheat. The leachate treatment concentrations 5, 10, 15, 20% were made by using healthy root, stem and leaves of A. mexicana. The seed germination percentage was counted after 24 hours of seed germination. All root, stem and leaves leachates showed remarkable response to seed germination and lower concentration (5%) of all treatments reported 100% seed germination. The root and shoot length was measured upto 96 hours and root-shoot length was also enhanced favourably. 10% stem leachates caused maximum root length (5.6cm) next to 15% root leachates (4.9cm) and 20% leaves leachates (4.6cm). The maximum shoot growth was recorded in 15% root and 5% leaves leachates (6.2cm). The biomass of fresh seedlings were measured from 144 hours old seedlings and it was decreased at higher concentrations (20%) of stem and leaves leachate treatments. On the contrary 20% root and 5% of leaves leachates significantly increased the biomass compared to control. Chlorophyll contents were estimated from 144 hours old seedlings. The chl.a, chl.b and total chlorophylls were stimulated at lower concentrations of all leachate treatments and inhibited at higher concentrations of root and stem leachates. The higher concentration of leaves leachates promisingly increases the chlorophyll pigments. Protein was estimated from 192 hours old wheat seedlings. The all leachate concentrations visibly increased protein content compared to control and highest protein content was reported from 20% concentration of root leachates.*

Keywords- Argemone mexicana L., Triticum aestivum L., germination, biomass, root-shoot length, chlorophyll, protein.

I. INTRODUCTION

Allelopathy is a biological phenomenon in which plant synthesizes one or more allelochemicals that influence the germination, growth, metabolism, development, survival and reproduction of other organisms (Hossain *et al.,* 2012). Allelochemicals have beneficial or harmful effects on the target organisms and community (Mali and Kanade, 2014). Weeds can also affect a crop's growth by releasing allelochemicals into the growing environment (Edrisi and Farahbakhsh, 2011). Many workers reported beneficial as well as harmful allelopathic effects of weeds and plants on seed germination (Khan *et al*., 2008 and Ghodake *et al*., 2012), root-shoot growth (Dessalegne *et al*., 2013; Mali and Kanade, 2014), fresh and dry weight of seedlings (Hossain *et al*., 2012 and Mujawar *et al*., 2016), photosynthetic pigments (Sarkar *et al*., 2012 and Salgude *et al*., 2015), total proteins (Verma and Rao, 2006), enzyme activities (Muhammad *et al*., 2013), carbohydrates (Gulzar and Siddiqui, 2014), phenolic compounds (Iannucci *et al*., 2012), mineral contents, phytohormones, anthocyanin and amino acids (Balah and Latif, 2013), yield (Hossain *et al*., 2012), herbicidal potential (Marzieh *et al*., 2013), antibacterial and antioxidant properties (Milena *et al*., 2012), seed-borne mycoflora (Shafique *et al*., 2007), soil microbial populations (Souto *et al*., 2001) and soil pH (Wang *et al*., 2009).

Wheat is important winter crop in Baramati area of Pune district of Maharashtra and *Argemone mexicana* L. is found as a common weed in wheat fields. The objectives of this study is to determine the allelopathic effect of root, stem and leaves leachates of *A. mexicana* on seed germination, root-shoot length, biomass, chlorophyll and protein content in wheat (*Triticum aestivum* L.) seedlings.

II. MATERIALS AND METHODS

The experiments were conducted under laboratory conditions in Botany Department of Tuljaram Chaturchand College, Baramati, Dist. Pune, Maharashtra, India. The healthy weed *Argemone mexicana* L. was collected from agricultural fields from Baramati. The plant parts were separated into leaves, stems and roots. Leachates were prepared by soaking 10gm fresh plant material pieces into 100ml distilled water for 24 hrs. Then it was filtered through Whatman No.1 filter paper. These solutions were treated as stock solutions and 5, 10, 15, 20% concentrations of all stock solutions were prepared for treatments. 15 wheat seeds were kept in sterile petriplates over filter paper at room temperature and treated with 5, 10, 15, 20% concentrations of all leachates

separately and control were made by using distilled water. The treatment solutions were supplied to the seedlings as and when required. The seed germination was observed after 24 hours of seed germination, root-shoot length was measured upto 96 hours, chlorophyll contents were measured from 144 hours old seedlings by the method of Arnon (1949) and protein was estimated from 192 hours old seedlings (Lowry *et al*., 1951).

III. RESULTS AND DISCUSSION

Effect of *A. mexicana* root, stem and leaves leachates showed favourable response to seed germination of wheat. It is interesting to note that lower concentration (5%) of all treatments noticed 100% seed germination. Along with seed germination, the root and shoot length also increased favourably. Maximum root length (5.6cm) observed in 10% stem leachates next to 15% root leachates (4.9cm) and 20% leaves leachates (4.6cm). The shoot length was highest in 15% root and 5% leaves leachates (6.2cm) then 5% stem leachates i.e. 5.3cm. General observation found that highest concentration (20%) of root, stem and leaves leachates recorded decreased trend of shoot length. The fresh biomass was reduced at higher concentrations (20%) of stem and leaves leachate treatments on the other hand 20% root and 5% of leaves leachates appreciably stimulated the biomass of seedlings compared to control. Stem leachates could not respond for weight gaining of seedlings (Table-1).

The photosynthetic pigments chl.a, chl.b and total chlorophylls were studied after 144 hours old seedlings. Usually photosynthetic pigments were stimulated in lower concentration of treatments i.e. 5 and 10% of all leachates. On the contrary they were inhibited at higher concentrations (15 and 20%) of root and stem leachates. It is interesting to note that higher concentration of leaves leachates promisingly enhance the chlorophyll contents (Table-2). Allelopathic impact of all leachate concentrations noticeably raised protein content of wheat seedlings compared to control. The maximum amount of protein was reported from 20% concentration of root leachates (Table-2).

Effect of aqueous extract and powder of lemon balm (*Melissa officinalis*) on the germination and seedlings growth of wheat, pea and safflower were investigated by Pour and Farahbakhsh (2012) and they reported inhibition in wheat and pea seed germination noticeably and found stimulatory effect on safflower germination. Mali and Kanade (2014) studied effect of *Alternanthera sessilis.* [L] R.Br. and *Cynadon dactylon* [L]. Pers. on seed germination of jowar and found stimulatory effect on seed germination as compared to control. According to Ghodake *et al*. (2012) aqueous extracts of *Euphorbia geniculata* Ort., *E. hirta* L. and *E. microphylla* Heyne exhibited inhibition in wheat seed germination in initial stage and later on it was stimulatory. Khan *et al*. (2008) noticed that aqueous extracts of *Eucalyptus camaldulensis* L. at a concentration of 10, 15 and 20% had inhibitory effect on wheat seed germination and effect was found significantly higher than control treatment. Effect of aqueous extracts of *Ammi majas* (Khella), *Guiera senegalensis* (Globefish) and *Salix* spp. (Safsaf) reduce total germination percentage of *Sorghum bicolor* L. and botanical extracts exhibited extra inhibitory effects on radicle emergence than on plumule growth were studied by Hassan *et al*., (2012). Seyed *et al*. (2011) investigated effect of *Artemisia annua* aqueous extracts on germination of *Plantago ovate* (Isabgol) and noticed a significant decreasing effect on germination percentage. *Parthenium hysterophorus* and *Amaranthus hybridus* leaf and stem extracts consistently causes reduction in seed germination percent of wheat and highest negative effect on radicle and plumule elongation of seedlings were reported by Dessalegne *et al.* (2013). Dhole *et al.* (2013) worked on effect of aqueous and ethanolic extract of some common 10 weeds *viz. Alternanthera sessilis* (L.) R.Br.ex Dc, *Amaranthus tricolor* L., *Cardiospermum helicacabum* L., *Corchorus olitorus* L., *Euphorbia hirta* L., *Phyllanthus amerus* Schumach. and Thann, *Portulaca oleraceae* L., *Vicoaindica* L. (Dc.) on seed germination and seedling growth of maize and noticed stimulatory effect on seed germination, seedling emergence and root and shoot length. Effect of *Moringa oleifera* on growth and productivity of mung bean investigated by Hossain *et al.* (2012) and reported that the different concentrations of root extracts have negative effect on the biomass performance.

Muhammad *et al.* (2013) investigated that, genetically modified maize aqueous extracts decreased chlorophyll-a, increased chlorophyll-b and significantly increase in protein and sugar content in wheat. Effect of powders of *Crocus sativus, Ricinus communis, Nicotiana tobaccum, Datura inoxia* and *Nerium* influenced on the dry weight, height, leaf area as well as chlorophyll and carotenoid contents of *Sorghum vulgare* (Marzieh *et al*., 2013). Sarkar *et al*. (2012) studied effect of *Cassia tora* aqueous extracts on the chlorophyll content of mustard and determined extracts causes reduction in the chlorophyll content. The effect of aqueous leaf leachates and organic fractions of *Eclipta alba* (L.) Hassk reduced chlorophyll and protein content of *Amaranthus spinosus* L., *Cassia tora* L. and *Cassia sophera* L. were studied by Gulzar and Siddiqui (2014). Verma and Rao (2006) investigated that effect of *Ageratum conzoides* L., *Cynadon dactylon* (L.) Pers., *Parthenium hysterophorous* L., and *Solanum nigrum* L. aqueous extracts increased growth and protein content of *Glycine max* (L.) Merrill. In the present work we also found favourable response of *A. mexicana* root,

stem and leaf leachates on seed germination, root-shoot length, biomass, photosynthetic pigment and protein content of wheat at lower concentrations. This may be happened due to potential of allelochemicals present in *A. mexicana*.

Table -1: Effect of *Argemone mexicana* L. root, stem and leaves leachates on seed germination, root-shoot length and biomass of fresh wheat seedlings

Time (after germination)	Part used	Treatments				
		Control	5%	10%	15%	20%
Germination percentage (%)						
24hrs	Root	99	100	100	100	100
	Stem	99	100	99	99	99
	Leaf	99	100	100	100	99
Root length (cm)						
72hrs	Root	3.64	3.9	4.0	4.0	4.3
	Stem	3.6	4.4	3.6	3.5	3.0
	Leaf	3.6	4.2	3.9	3.8	4.1
96hrs	Root	4.1	4.4	4.6	4.9	4.5
	Stem	4.0	4.5	5.6	5.5	4.6
	Leaf	4.0	4.4	4.4	4.5	4.6
Shoot length (cm)						
72hrs	Root	3.82	4.0	4.5	4.8	4.4
	Stem	4.2	3.8	3.6	3.5	3.0
	Leaf	3.5	3.8	3.8	3.8	3.6
96hrs	Root	5.4	6.1	6.1	6.2	5.7
	Stem	5.0	5.3	4.3	4.2	3.2
	Leaf	4.9	6.2	5.8	5.5	5.5
Biomass of fresh seedlings (gm)						
144hrs	Root	1.22	1.10	1.12	1.35	1.39
	Stem	1.22	1.22	1.17	1.10	1.10
	Leaf	1.22	1.42	1.34	1.11	1.10

Table -2 : Effect of *Argemone mexicana* L. root, stem and leaves leachates on chlorophy and protein content of wheat seedlings

Parts used	Chlorophyll content from 144hrs old seedlings of wheat (mg chl./g of fresh weight)					
	Parameter	Control	5%	10%	15%	20%
Root	Chl.a	3.1	3.7	4.7	3.3	3.0
	Chl.b	3.4	3.5	3.9	3.0	2.4
	Total Chl.	6.6	6.8	8.8	6.6	5.4
Stem	Chl.a	2.9	3.2	4.2	2.9	2.7
	Chl.b	3.8	4.0	4.8	3.3	3.0
	Total Chl.	6.7	7.2	9.8	6.2	5.7
Leaves	Chl.a	3.7	4.5	4.8	4.7	4.5
	Chl.b	3.8	4.1	4.1	4.1	3.8
	Total Chl.	7.5	8.5	8.8	8.8	8.4
Protein content from 192hrs old seedlings of wheat (mg protein/g fresh tissue)						
Root		26.0	26.2	34.0	42.3	54.1
Stem		32.1	34.4	38.0	40.3	40.0
Leaves		20.2	38.3	42.0	38.7	34.2

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