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In vitro determination of allelopathic efficacy of some species of weeds on wheat (*Triticum aestivum* L.) seeds.

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Abstract- Weeds are unwanted problem in agriculture. In the present study allelopathic efficacy of four wild species such as *Alternanthera sessilis, Calotropis procera, Parthenium hysterophorus and Chenopodium album* were used to study their allelopathic impact on wheat. Aqueous extracts of the above weeds were prepared and their impact on percentage germination of seeds, growth of plumule, radical, total dry biomass were observed with respect to percentage germination of seeds at 5% concentration. Aqueous extract of *Parthenium hysterophorus* was more effective where only 18% seeds could germinate. This was followed by aqueous extract of *Calotropis procera* 20%, *Alternanthera sessilis* 22% and less effect was observed in case of *Chenopodium* album that was 36%. Similarly, the reduction in length of plumule was the highest in the seedlings treated with 5% aqueous extract of leaves of *Calotropis procera* that was 2.60cm, followed by *Parthenium hysterophorus* 2.40 cm, *Alternanthera sessilis* 2.7cm and 3.10 cm in case of *Chenopodium album*. This was also with root length which was 2.20cm at 5% concentration of the aqueous extract of *Calotropis procera,* followed by 2.30 cm in case of *Parthenium hysterophorus* and *2*.8cm case of *Chenopodium album*. The dry biomass of seedlings was also lower at 5% concentration in aqueous extract of leaves of *Calotropis procera* (260 mg) followed by *Parthenium hysterophorus* (280mg), *Alternanthera sessilis* (282mg) and least in case of *Chenopodium album* (320mg) chlorophyll content of the seedling was also reduced in comparison to the control. Here also aqueous extract of *Calotropis procera* affected the much which was 0/mg/g of leaf. Here also *Chenopodium* had least impact. All the parameters revealed gradual reduction in comparison to control along with the increasing concentration of the aqueous extracts of leaves of selected weeds.

Key words: Allelopathy, Aqueous extract, Weeds, dry biomass

INTRODUCTION

In the present study, efficacy of allelopathic impact of aqueous extracts of leaves of four different weeds have been studied. Because of the wide range of adaptation, the weeds mostly compete with the cultivated crops and influence seed germination, seedling growth and finally the yield. Allelopathic impact of different weeds on different crops have been studied by several workers. Some of them are being mentioned here. Inderjit and Dakshini (1998)[1] reported interference of *Stellaria media* an important weed on the seedling growth of wheat. Bora *et al.* (1999)[2] reported allelopathic effect of leaf extracts of *Accacia auriculiformis* on seed germination of some agricultural crops. Quasem (2002)[3] observed allelopathic effect of some medicinal plants on *Amaranthus retroflexus* and *Chenopodium murale*. Mohammad *et al.* (2004)[4] reported allelopathic effect of some weed species on germination and seedling growth of chickpea. Izzet *et al.*

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(2005)[5] studied allelopathic effect of some weed extracts against seed germination and seedling growth of some economically important plants. Stuphicka *et al.* (2006)[6] reported impact of selected phenolic compounds on the initial growth of some weeds. Khan *et al.* (2008)[7] studied effect of *Eucalyptus camalldulensis* L. On germination and seedling growth of wheat (*Triticum aestivum*).

Oyeainde *et al.* (2009)[8] reported allelopathic effect of *Tithonia diversifolia* on the germination, growth and chlorophyll contents of maize (*Zea mays*). Rose and Anitha (2012)[9] observed allelopathic effect of *Euphorbia hirta* L. extract on the germination seedling growth of ground nut. Gella *et al.* (2013)[10] allelopathic effect of aqueous extract of major weed species on germination and growth of wheat seeds. Pudelk *et al.* (2014)[11] reported allelopathic effect of fibre hamp (*Canabis sativa* L.) On the seed germination of some monocot and dicot plants. Sangeetha and Bhasker (2015)[12] gave a critical review on allelopathy in weed management of agricultural crops. Joshi and Joshi (2016)[13] also reported the allelopathic effect of some weed extract on germination of wheat seeds. Gulzar and Siddiqui (2017)[14] observed allelopathic effect of *Calotropis procera* on growth and antioxidant activity of *Brassica olerancea* ver. *botrytis* and reported positive impact. Asma *et al.* (2019)[15] observed effect of *Calotropis procera* L. Plant extracts on seed germination and the growth of microorganism *in vitro*. Shah *et al.* (2022)[16] allelopathic potential of summer wheats on germination seed and growth of seedlings of wheat and chickpea.

MATERIAL & METHOD

Leaves of *Calotropis procera, Parthenium hyterophorus,* whole plant of *Alternanthera sessilis* and *Chenopodium album* were collected from their natural habitats. They were brought to the laboratory and washed properly in running tap water to remove dusts etc. Then the leaves were treated with 0.1 mercuric chloride solution for two minutes. After these leaves were washed thrice in a conical flask with distilled water to remove even a trace of the chemical from the surface of the leaves. After this the leaves were dried in shade and then in hot oven at 60°C till it became completely dry. All the leaves were grind separately in grinder and the powders were collected separately. These powders were filtered through the muslin cloth to remove the debris. Finally, they were stored separately in glass jar with tight cap.

Preparation of aqueous extracts from the dried and powdered leaves of the above-mentioned weeds:

10g of each powder was taken separately to prepare 10% stock solution by dissolving it in 100ml distilled water. Then the above water was filtered through Whatman filter paper number 1. Filtrates were stored separately in well cleaned reagent bottles at low temperature till it was used. Petri plates were cleaned and dried properly. These plates were lined with double layered Whatman filter paper no-1. Wheat seeds were purchased from the registered seed trader. Seeds of uniform size were selected. Before this form the 10% stock solution of the aqueous extract, 0.5% 1.0% 2.0% 2.5% and 5% concentration were prepared by dilution method. Now, for each concentration three sets of experiment were arranged. In each plate 20 seeds were placed at proper distance. The filter paper was moisted by adding 15ml of dilute extract separately. The plates were placed in laboratory at 22±1°C for germination. To maintain the moisture of the plate few ml of dilute extract was added on an alternate day. After 7 days, observation was made for percentage germination, length of the plumule, length of roots. After 14 days, plants were dried in hot air oven at 60°C till the constant weight was obtained. The petri plates lined with filter paper and moistened with distilled water were used as control for seed germination, length of the plumule & radicle and dry biomass. All the experiments were done in triplicate.

RESULT & DISCUSSION

From the table 1 it may be noted that the percentage of seed germination in control was 98% seed germination at 0.5% concentration of aqueous extract of *Alternanthera sessilis* was reduced to 82.0%, at 1.0% to 71% at 2.5% to 46% and at 5.0% to 22% germination respectively. Similar concentration of aqueous leaf extract of *Calotropis procera* reduced the percentage of germination to 80.25%, 62.30%, 40% and 20% respectively. In case of *Parthenium hysterophorus* at 5% concentration, the percentage of germination was 80.00%, at 1.0% conc. Germination was 62%, at 2.5% conc. Germination was 38% and at 5.0% it was 18.0% respectively. In case of aqueous extract of leaves of *Chenopodium album* the percentage of germination at 0.5% was 82%, at 1.0% conc., it was 73%, at 2.5% conc. It was 52.0% and at 5.0% conc. It was 36.0% respectively. From the table-1 it is evident that aqueous extract of different weeds influenced wheat seed

Botanical name	Concentration of the extract	Percentage of germination	Shoot length	Root length	Dry weight of seedling
	Control	98.0%	12.80	6.45	1.98gm
Alternanthera	0.5	82.0%	8.50	3.70	650mg
sessilis	1.0	71.0%	5.40	3.10	580mg
	2.5	46.0%	3.16	2.70	340mg
	5.0	22.0%	2.7	2.4	282mg
	Control	98.0%	13.25	5.86	1.98gm
Calotropis	0.5	80.25%	7.50	3.60	680mg
procera	1.0	62.30%	4.85	2.85	630mg
	2.5	40.0%	3.00	2.50	460mg
	5.0	20.0%	2.00	2.20	274mg
	Control	98.0%	13.50	5.70	1.98gm
Parthenium	0.5	80.0%	7.40	3.35	640mg
hyterophorus	1.0	62.0%	4.20	2.70	620mg
	2.5	38.0%	2.8	2.50	415mg
	5.0	18.0%	2.40	2.30	260mg
	Control	98.0%	12.88	6.10	1.98gm
Chenopodium	0.5	82.0%	8.62	4.50	676mg
album	1.0	73.0%	5.78	3.82	640mg
	2.5	52.0%	3.80	3.20	430mg
	5.0	36.0%	3.10	2.80	350mg

germination to different extent in comparison to the control. At 5.0% concentration aqueous leaf extract of *Parthehium hysterophorus* showed the highest impact which was 18% only followed by *Calotropis procera* 20% *Alternanthera sessilis* 22% respectively. At this concentration leaf extract of *Chemopodium album* reduced the percentage of seed germination which was only 36%. It may further be noted that along with the increasing concentrations of aqueous leaf extract from 0.5% to 5.0% there was decrease in the percentage of seed germination in comparison to the control.

Shoot length of wheat seedling:

Shoot lengths of the treated and controlled seeds were also observed on 7th day of treatment. The length in control ranged between 12.80 cm to 13.50 cm respectively however, the length was influenced by the aqueous extract of leaves of above said weeds. Here again minimum reduction in the length of the shoots in all the leaf extract was at 0.5% concentration, which was 8.50 cm for *Alternanthera sessils,* 7.5 for *Calotropis procera* 7.40 cm for *Parthenium,* it was 8.62 cm for *Chinopodium album.* The length of shoot reduced to 2.7 cm at 5.0% conc. Of aqueous leaf extract of *Alternanthera sessils,* 2.60 cm in *Calotropis procera*, 2.40 cm in *Parthenium hysterophorus* and 3.10 cm in case of *Chenopodium album.* Here again it may be noted that along with the increasing conc. Of the aqueous leaf extract there was gradual decrease in the length of shoot. Here again the aqueous leaf extract of *Parthenium hysterophorus at* 5.0% conc. Influenced the length of the shoot which are maximum.

Length of the Roots

Root length in the control as well as in the treated seeds were also measured on 7th day of experiment. The means of the data have been tabulated in table-1. perusal of the table clearly indicated that root lengths in control ranged between 5.70 cm to 6.45 cm respectively. However, reduction in the length of the roots was noted even at 0.5% conc. of all the aqueous extracts, which ranged between 3.35cm to 3.70 cm. At 5.0% conc. The length ranged between 2.20 cm to 2.80 cm respectively. Here again reduction of growth of the roots at 5.0 conc. Of *Calotropis procera* was the maximum 2.20 cm followed 2.40 cm in case of *Parthenium hysterophorus*. The least reduction was in case of *Chenopodium album* at 5.0% conc. Which was 2.80 cm respectively.

Dry biomass of seedlings grown in control and in treated condition of the seedling was also determined and means of the data have been tabulated in table-1. From the data mentioned in the table it was found that biomass in the control condition of the seedling was 1.98gm.

However, there was considerable reduction in the biomass among the treated seedlings. Even at 0.5% concentration the biomass varied from 650mg to 676mg respectively. It was further noted that at 5.0% concentration the reduction in dry biomass was the maximum which ranged between 260mg to 320mg respectively. Here again maximum reduction in the biomass was among the seedlings treated with 5.0% of the aqueous extract of leaves of *Chenopodium album*.

DISCUSSION

In the present study allelopathic effects of four selected weeds leaf extracts at different concentration was observed. It was noted that even at the similar concentration of the different weeds had different effects on percentage germination, seedling growth with respect to radicals and plumules, day biomass etc. This may be due to presence of different secondary metabolites at different amount and ratio. Actually, the degree of allelopathic is determined by the presence of secondary anabolites in the weeds. Similar finding has been reported by Tanveer *et al*. (2010)[17]; Famina *et al.* (2012)[18]; Ghodake *et al*. (2012)[19]; Seth *et al.* (2016)[20]; Cheng and Cheng (2015)[21]; Aslam *et al.* (2016)[22]; Chouhan *et al*. (2017)[23]; Asma *et al.* (2019)[15]; Shah *et al.* (2022); Patane *et al.* (2023)[25] respectively.

CONFLICT

There is no conflict with respect to publication of this paper.

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