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Full Length Research Paper

Allelopathic potential of *Desmostachya bipinnata* (L.) P. Beauv. on wheat varieties (Ghaznavi and Tatara)

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Desmostachya bipinnata **has naturalized as halophytic grass in various saline soils of Pakistan. Allelopathic studies were carried out from aqueous extracts for 24 and 48 h soaking in various experiments using two wheat varieties namely; Ghaznavi and Tatara varieties of wheat as test species. The results suggested that the germination and plumule and radicle growth of test species were significantly reduced. The extracts after 48 h were inhibitory than those obtained after 24 h. Roots of *D. bipinnata* were more allelopathic followed by stem, leaves and inflorescence. Ghaznavi was susceptible to all the extracts than Tatara.**

Key words: Allelopathy, *Desmostachya bipennata,* wheat varieties (Ghaznavi and Tatara) plumule and radicle growth reduction.

INTRODUCTION

Allelopathy is defined as the direct or indirect harmful or beneficial effects of one plant on the other through the release of chemical compounds into the environment. It not only governs various ecological processes such as productivity and vegetation patterning but is an important potential source for alternative agrochemicals, pharmaceuticals and biological control agents (Cheema et al., 2004; Norton et al., 2008; Samreen et al., 2009).

Many weeds hamper the growth of crops and natural vegetation as allelopathic plants (Hussain et al., 2004; Kato-Noguchi and Tanaka, 2006). *Desmostachya bipennata* is a tough and vigorously growing grass on dry lands especially on saline soils. Therefore, the present study was conducted to explore the allelopathic potential of it.

MATERIALS AND METHODS

Roots, stems, leaves and inflorescence of mature plants of *D. bipennata* growing wildly in Botanical Garden-Azakhel, University of Peshawar were collected during summer 2010 and dried at 25°C. To check the effect of soaking duration, 5 g each of crushed roots, stems, leaves and inflorescence were separately soaked in 100 ml distilled water for 24 and 48 h respectively at 25°C. Then, the extract were filtered and tested against germination and seedling growth of two varieties of wheat namely, Tatara and Ghaznavi separately.

Ten seeds of each test species were placed on two folds of filter paper in Petri dishes and moistured with the respective extracts to make the test. Distilled water was used as a control. For each treatment there were five (5) replicates. The germination (%), growth of plumule (mm) and radicle (mm) were measured. All the results were statistically analyzed by using MSTATC tests.

RESULTS

In nature, many ecological routs are involved for the release of allelochemicals from allelopathic plants. The rainwater, irrigation or even moist soil releases water soluble substances from living or dead plant parts that might have phytotoxins.

The present study demonstrated the presence of allelochemicals in roots, stem, leaves and inflorescence of *D. bipinnata* that inhibited the germination and seedling

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Table 1. Effect of soaking duration (h) and extracts of *D. bipinnata* on germination of two varieties (Ghaznavi and Tatara) of wheat.

Extract	Soaking duration (h)				Means
	24 h		48 h		
	Ghaznavi	Tatara	Ghaznavi	Tatara	
Control	82	88	82	76	82
Inflorescence	76	78	72	72	74.5
Leaves	74	66	56	60	64
Stem	40	46	42	34	40.5
roots	32	34	30	42	34.5
Means	60.8	62.4	56.4	56.8	
Means	61.6		56.6		

ANOVA

SOV	Df	S.S	M.S.	F-value	P-value
Replication	4	364	91	1.0000	
Extracts (A)	4	34	8683	95.4231	0.0000
Soaking duration (B)	1	625	625	6.8681	0.0106
AB	4	570	142	1.5659	0.1920
Variety (C)	1	25	25	0.2747	
AC	4	250	62	0.6868	
BC	1	9	9	0.0989	
ABC	4	726	181	1.9945	0.1038
Error	76	6916	91		
Total	99	44219			

Each value is a mean of 5 replicates, each with 10 seeds.

Table 2. Effect of soaking duration (h) and extracts of *D. bipinnata* on plumule growth (mm) of two varieties (Ghaznavi and Tatara) of wheat.

Extracts	Soaking duration (h)				Means
	24 h		48 h		
	Ghaznavi	Tatara	Ghaznavi	Tatara	
Control	40.6	42.2	40.4	33.8	39.25
Inflorescence	35	35.2	26.2	32	32.1
Leaves	24.4	31.2	25.6	27	27.05
Stem	22.4	26.8	28.4	29.6	26.8
roots	16.4	21.8	14.6	25.6	19.6
Means	27.76	31.44	27.04	29.6	
Means	29.6		28.32		

ANOVA

SOV	Df	SS	MS	F-value	P-value
Replication	4	492.34	123.085	1.1271	0.3501
Extracts (A)	4	4233.34	1058.335	9.6916	0.0000
Soaking duration (B)	1	40.96	40.96	0.3751	
AB	4	344.54	86.135	0.7888	
Variety (C)	1	243.36	243.36	2.2286	0.1396
AC	4	292.34	73.085	0.6693	
BC	1	7.84	7.83	0.0718	
ABC	4	203.86	50.965	0.4667	
Error	76	8299.26	109.201		
Total	99	14157.840			

Each value is a mean of 5 replicates, each with 10 seeds.

Table 3. Effect of soaking duration (h) and extracts of *D. bipinnata* on radicle growth (mm) of two varieties (Ghaznavi and Tatara) of wheat.

Extracts	Soaking duration (h)				Means
	24 h		48 h		
	Ghaznavi	Tatara	Ghaznavi	Tatara	
Control	77.2	62.4	62.8	68.4	67.7
Inflorescence	59	60.6	47.6	58	56.3
Leaves	53.2	48.8	29	47.4	44.6
Stem	37	39.8	30.6	46.2	38.4
roots	32.4	35	24.2	36.2	31.95
Means	51.76	49.23	38.84	51.24	
Means	50.54		45.04		

ANOVA

SOV	Df	SS	MS	F-value	P-value
Replication	4	1000.34	250.085	1.8243	0.1328
Extracts (A)	4	16361.64	4090.41	29.8385	0.0000
Soaking duration (B)	1	756.25	756.25	2.5167	0.0214
AB	4	457.4	114.35	0.8342	-
Variety (C)	1	620.01	620.01	4.5228	0.0367
AC	4	600.44	150.11	1.0950	0.3652
BC	1	1376.41	1376.41	10.0406	0.0022
ABC	4	205.64	51.41	0.3750	-
Error	76	10418.46	137.085		-
Total	99	31796.590			-

Each value is a mean of 5 replicates, each with 10 seeds.

growth of wheat varieties. It was observed that soaking the plant material for 24 and 48 h durations significantly inhibited the germination of both test varieties of wheat. The extracts from roots have greatly reduced the germination in both test varieties especially in Ghaznavi. At 48 h soaking, the germination reduced as compared to 24 h for Ghaznavi but in Tatara, the germination increased with increase in soaking duration (Table 1). The extracts from the stem also reduced the germination up to half in both test varieties as compared to control. The extracts from leaves had more allelopathic effect on Tatara at 24 h soaking, but at 48 h soaking, the effect was more on Ghaznavi. The extracts from inflorescence had a little effect on both varieties (Table 1).

Similarly, the extracts of roots also significantly reduced the plumule growth in both test varieties especially in Ghaznavi. At 48 h soaking, the plumule length reduced in Ghaznavi but increased in Tatara as compared to 24 h. The extracts from leaves reduced the plumule growth of both varieties (Table 2). The extracts from stem at 24 h were more allelopathic than at 48 soaking h on both varieties. The extracts from inflorescence had same effect on both varieties (Table 2).

The extracts obtained after 48 h soaking reduced the radicle length in Ghaznavi but increased in Tatara as compare to 24 h (Table 3). The extracts of stem at 48 h were more allelopathic than at 24 soaking h for Ghaznavi but the reverse for Tatara. The extracts at 48 h of leaves reduced the radicle length to half in Ghaznavi but had no significant effect in Tatara. The extracts from inflorescence had same reduction effect of radicle in both varieties (Table 3).

DISCUSSION

The plumule and radicle growth in both Ghaznavi and Tatara varieties significantly reduced in all the treatments, especially by extracts from roots and stem obtained after 48 h. This suggests that inhibitory effect was enhanced with increasing soaking time. This agrees with those of Pereira et al. (2008) and Ullah et al. (2010).

The results suggested the presence of water leachable allelochemicals in fresh and dried roots, stems, leaves and inflorescence. The allelopathic effects depended upon the part assayed, freshness and dryness of the material, duration and amount of material soaked. It was obvious that extract from roots and stems were inhibitory than leaves and inflorescence and that extracts from dried parts were more toxic than fresh parts. Our findings agree with many other similar studies that have also shown differential toxicity of aqueous extracts from other plants (Hussain et al., 2004; Hamayun et al., 2005; Carmo et al., 2007; Pereira et al., 2008).

The present study suggests that *D. bipinnata* has strong allelopathic potential especially against the tested species. Furthermore, root extracts were more allelopathic followed by stems, leaves and inflorescence. The observed inhibition might be due to the presence of some toxic allelochemicals in assayed plant parts that need to be identified and quantified for proper understanding of allelopathy.

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