

Allelopathic Potential of *Papaver Somniferum* L. on Seed Germination Against Three Different Varieties of *Zea Mays*

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Abstract

Aims

To evaluate the allelopathic effect of *Papaver somniferum* against the 3 varieties of *Zea mays* seeds cv. Azam, Pahari and Iqbal.

Methods

Aqueous extracts were made by soaking the powder of dried leaves of *Papaver somniferum*. For the aqueous extract treatment, the extract was soaked in distilled water for 24 and 48 hours separately. For mulching treatment, the seeds were sowed in soil and sprinkled powder of leaves. For litter, the petri dishes were grounded with randomly cut pieces of filter paper wetted with extract. For hot water treatment the water was boiled for 5 minutes. The powder was then mixed in boil water.

Results

Azam got effected in 24h extract in aqueous extract treatment while Pahari in 48h treatment. In mulching all the three varieties got inhibited by extract. Azam showed resistance toward the inhibitory effect of extract in litter experiments. Iqbal was affected in hot water extract.

Conclusion

It is concluded that the extracts obtained from *Papaver somniferum* showed inhibitory effects on all the three varieties except few exceptions of maize. The plumule and radical growth got affected the most.

Introduction

Allelopathy is the favorable or unfavorable effects of a plant on another plant due to the release of biochemicals, which are known as allelochemicals. This could be from plant parts by extracts, root, evaporation, disintegration of litter, and other processes in both natural and agricultural ecosystems (Ferguson and Rathainasabapathi 2009). Allelochemicals are released from plants and crops, may have reverse effects in agricultural fields and controlled forest ecosystems that cause reduction in crop yield. These metabolites get stored and preserved for some time and put an influence on the growth and development of surrounding plants (Putnam and Duke 1974). Weeds are unwanted plants, which penetrate different crops and impose negative effect on their production. There are uncountable reports on the destructive effects of weeds on crops (Hussain et al 2004; Bhowmik and Doll 1992). Some type of allelochemicals, micro-organisms and soil conditions each play a significant role in determining the preservation of allelochemicals in soils. After extraction and verification of allelochemicals, it becomes necessary to examine their behavior in soil (Inderjit and Keating 1999). In the past, many methods were

applied for assessment of allelopathic potential. For example, aqueous extract method applied on medicinal plants exposed high allelopathic potential to some extent (Fujii et al. 1990; Fujii et al. 1991). To our knowledge, little is known about the allelopathic potential of *Papaver somniferum* tissues or extracts. Therefore, the current study aims to explore the allelopathic potential of *P. somniferum* with an emphasis on the inhibition of seed germination of maize varieties i.e., Azam, Pahari and Iqbal by different methods. We tested the following hypothesis: the root and shoot fresh aqueous extracts of *P. somniferum* would reduce seed germination of each of the 3 target varieties, and that this reduction will increase with increasing soaking time.

Material And Method

Leaves of *P. somniferum* were collected from Govt. Frontier College Peshawar and were air dried at room temperature. Powder was made from the dried leaves. Two aqueous extracts were made by soaking powder for 24 hours and 48 hours, respectively. Two Petri dishes were set for 3 varieties of maize seeds i.e., Azam, Pahari and Iqbal. Each Petri dish had 5 seeds randomly arranged.

Procedure of aqueous extracts:

1.25 gm of dried leaves powder was separately soaked in 100ml distilled water at 25°C for 24 and 48 hours and filtered to get aqueous extract. These extracts were tested against Azam, Pahari and Iqbal maize varieties. 3 filter papers were layered in Petri dishes. The filter papers were moistened with the extract. The control series were moistened with distilled water. After 72 hours germination, growth of plumule and radical were observed. Five Seedlings were taken out randomly for fresh and dry weight determination. Seedlings were dried for 72 hours.

Procedure of litter:

5 grams of randomly cut filter papers were set on the base Petri dishes. Test series were wet with aqueous extract and control series with distilled water. 5 seeds of each variety were set on litter. After 72 hours of germination, the length of plumule and radical were measured.

Procedure of mulching:

Five g of crushed dried leaf powder was layered on surface of plastic glasses containing sterilized moist sand. For each treatment, three replicates, each with 5 seeds were made. The control consisted of fine pieces of filter paper. After 72hours of germination, growth of plumule and radical were measured. 5 seedlings were randomly taken out for fresh and dry weight and moisture contents.

Procedure of hot water extract:

1.25 gram of dried plant part boiled in water for 5 mints. The extract was cooled at room temperature. The seeds were arranged in Petri dishes and set for 72 hours to germinate. Each treatment of this experiment was carried out with 3 replicates with 5 seeds in it. The data obtained were subjected to statistical analysis of variance (ANOVA) by statistix 8.1 software.

Results And Discussions

The allelopathic activity of *Papaver somniferum* was determined on different varieties of *Zea mays* and observed its plumule and radical growth. In all activities the germination of plumule length and radical length of *Zea mays* was noted as compared to control (Distilled water).

Effect of aqueous extracts:

In Germination, Azam and Iqbal variety 100% growth while Pahari showed lesser growth than them. In test series of 24h test, Azam's germination rate decreased while Pahari increased, and Iqbal showed no effect. 48h series showed growth inhibition in Iqbal while increased in Pahari and showed no effect in Azam variety. Plumule growth of Azam

is inhibited in 24h and 48h extracts as showed in table no 1. In Pahari, the growth was inhibited less by 24h extract than inhibition by 48h. Iqbal variety was inhibited by 24h extract while it was stimulated by 48h extract. Radical growth of Azam variety was inhibited by both the extracts but 24h showed more inhibitory effect than 48h. In Pahari, the growth increased by 24h while in 48h test it showed inhibition. In Iqbal, the radical was inhibited by both the extracts. Aqueous extracts from leaves soaked for 24 and 48 h significantly reduced plumule growth and radical length growth in all three varieties of maize: Azam, Pahari and Iqbal. The plumule growth in Pahari and radical growth of Iqbal was stimulated in 24h and reduced in 48h treatment. (Table no. 1) this can be concluded that phytotoxic effect depends on variety.

Treatment 24h	Azam	Pahari	Iqbal	Treatment 48h	Azam	Pahari	Iqbal
Germination							
Control	100	93.3	100	Control	100	93.3	100
Test	93.3	100	100	Test	100	100	93.3
Radical							
Control	33.66	26.73	34.83	Control	33.66	26.73	34.83
Test	20.77	30.2	17.33	Test	24.13	17.27	16.30
Plumule							
Control	5.40	2.57	0.40	Control	5.40	2.57	0.40
Test	0.00	2.46	0.00	Test	0.50	1.46	1.00
Fresh weight							
Control	3.13	2.33	1.73	Control	3.13	2.33	1.73
Test	3.40	1.73	2.33	Test	2.73	1.66	2.00
Dry weight							
Control	1.66	1.60	1.13	Control	1.66	1.60	1.13
Test	1.73	0.73	1.66	Test	1.66	1.06	1.66
Moisture content							
Control	88.40	70.88	67.40	Control	88.40	70.88	67.40
Test	99.10	141.67	39.33	Test	64.80	66.67	19.90

Table no. 1: Effect of Aqueous extract of leaves of *Papaver somniferum* on percent germination, plumule and radical growth (mm), Fresh and dry weight (mg), and percent moisture contents of *Zea mays* varieties Azam, Pahari and Iqbal. Each value is a mean of three replicates, each with 5 seeds

Effect of Mulching:

This aspect when tested by using *P. somniferum* mulch in experiments it was seen that germination was inhibited in Azam and showed no effect in Pahari while in Iqbal the germination percentage increased as compared to control. The plumule length was inhibited in all the three varieties but in Iqbal, the plumule length was reduced up to 50%. The radical length was very much reduced by the extract as compared with control series. (Table no. 2)

Treatment	Variety			
	Germination	Azam	Pahari	Iqbal
Control		100	100	86.67
Test		73.3	100	100
	Plumule			
Control		55.76	66.93	62.96
Test		52.66	64.03	31.1
	Radical			
Control		124.20	117.33	94.87
Test		98.87	93.97	51.80
	Fresh weight			
Control		2.53	2.66	3.53
Test		2.40	3.06	3.53
	Dry weight			
Control		1.40	1.40	1.51
Test		1.53	1.60	1.57
	Moisture content			
Control		84.10	90.27	103.70
Test		57.13	94.80	123.63

Table no. 2: Effect of mulch of leaves of *Papaver somniferum* on percent germination, plumule and radical growth (mm), Fresh and dry weight (mg), and percent moisture contents of *Zea mays* varieties Azam, Pahari and Iqbal. Each value is a mean of three replicates, each with 5 seeds.

Treatment	Variety			
	Germination	Azam	Pahari	Iqbal
Control		100	100	93.3
Test		100	100	100
	Plumule			
Control		3.00	5.46	2.66
Test		4.26	3.33	1.06
	Radical			
Control		26.93	32.00	29.60
Test		30.60	29.00	28.86
	Fresh weight			
Control		1.26	1.53	1.73
Test		2.46	2.20	1.40
	Dry weight			
Control		0.73	1.06	1.06
Test		1.40	1.60	1.06
	Moisture content			
Control		77.76	43.33	46.16
Test		77.76	44.50	51.12

Table no. 3: Effect of litter of leaves of *Papaver somniferum* on percent germination, plumule and radical growth (mm), Fresh and dry weight (mg), and percent moisture contents of *Zea mays* varieties Azam, Pahari and Iqbal. Each value is a mean of three replicates, each with 5 seeds.

Effect of litter:

It is observed that before decay many species release phytotoxic substances. In current study it was observed that litter of *P. somniferum* when used as growth medium the germination percentage was not affected in Azam and Pahari while increased in Iqbal. Extracts significantly reduced the plumule growth and radical length growth in Pahari and Iqbal varieties of maize. However, the plumule growth and radical growth was stimulated in Azam. (Table no. 3)

Effect of hot water extract:

The percentage of germination was not affected by the extracts in Azam and Pahari while in Iqbal it showed stimulatory effect. The plumule length was reduced by the extract in all three varieties but Pahari was more affected than other two varieties. The radical emergence was reduced in Pahari and Iqbal while stimulated in Azam. (Table no. 4).

The growth of plumule and radical was reduced by the extracts in mulching experiment in all the three varieties. Pahari was affected the most by the phytotoxic effect of extract. Whereas Iqbal was affected in mulching and hot water extract.

Treatment	Variety			
		Azam	Pahari	Iqbal
Germination	Control	100	100	93.3
	Test	100	100	100
Plumule	Control	3.26	5.20	1.06
	Test	1.26	1.00	0.60
Radical	Control	27.26	31.13	29.40
	Test	33.40	26.73	24.46
Fresh weight	Control	1.20	1.40	1.69
	Test	2.63	2.46	2.67
Dry weight	Control	0.73	0.66	1.13
	Test	1.7	1.86	2.33
Moisture content	Control	65.27	113.87	43.00
	Test	52.05	20.10	25.90

Table no. 4: Effect of hot water extract of leaves of *Papaver somniferum* on percent germination, plumule and radical growth (mm), fresh and dry weight (mg), and percent moisture contents of *Zea mays* varieties Azam, Pahari and Iqbal. Each value is a mean of three replicates, each with 5 seeds.

Discussions

The findings obtained from the aqueous extract treatment agree with (Basharat et al. 2017; Sameen et al. 2009) in which it was proven that enhancing soaking duration increased phytotoxicity of aqueous extracts. The extract inhibited the growth of both plumule and radical of the varieties.

(Inderjit and Duke 2003) Confirmed that plants release chemicals also from dead tissues, and their absorption in the soil could be accelerated by leaching thus facilitating their harmful effects in the field. Allelopathic substances which are released by the plants accumulate in the soil to physiological activity level. This aspect was proven in mulching treatment where the radical of all the three varieties were reduced to high extents.

In litter treatment the extract caused not significant inhibition in Pahari and Iqbal. Azam resisted the repressing effect and increased in length compared to control. These results were agreed with the allelopathic effects of *Ageratina adenphora* plant litter on growth of *Lantana camara* (Kaul and Bansal 2002; Rebaz et al. 2001).

(Chung et al. 2007; Peneva 2007) reported hot water extracts to be allelopathic against test species. The use of hot water extract is unnatural, but it reduces the time for extraction of allelochemicals. Similarly, it caused significant repression in plumule length of all three varieties and radical of Pahari and Iqbal.

Above mentioned results were like the inhibitory effect of the aqueous extracts from other species like *Dodonaea viscosa* (Barkatullah and Ibrar 2010), *Cenchrus ciliaris* and *Bothriochloa pertusa* (Hussain et al. 2010), *Anagallis arvensis* (Rebaz et al. 2001), *Azadirachta indica* A Juss (Xuan et al. 2004), *Tamarindus indica* L. (Pervez et al. 2003), *Broussonetia papyrifera* (Hussain et al. 2004) and *Lactuca sativa* (Chon et al. 2005), which support our findings. Other researchers like (Marwat and Khan 2006; Hussain et al. 2007; Elizabeth et al. 2008) investigated similar phytotoxicity for other plant species, which further strengthened the results.

Conclusion

Current work led us to the conclusion that the extracts obtained from powder of leaves of *Papaver somniferum* caused inhibitory effect on *Zea mays* varieties Azam, Pahari and Iqbal. Increasing soaking duration can be more inhibitory. Since the extract reduced the plumule and radical in aqueous extract treatment (24h and 48h). Also, in mulching, litter, and hot water treatments.

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Figures



Figure 1

showing germinated varieties in aqueous extract treatment.

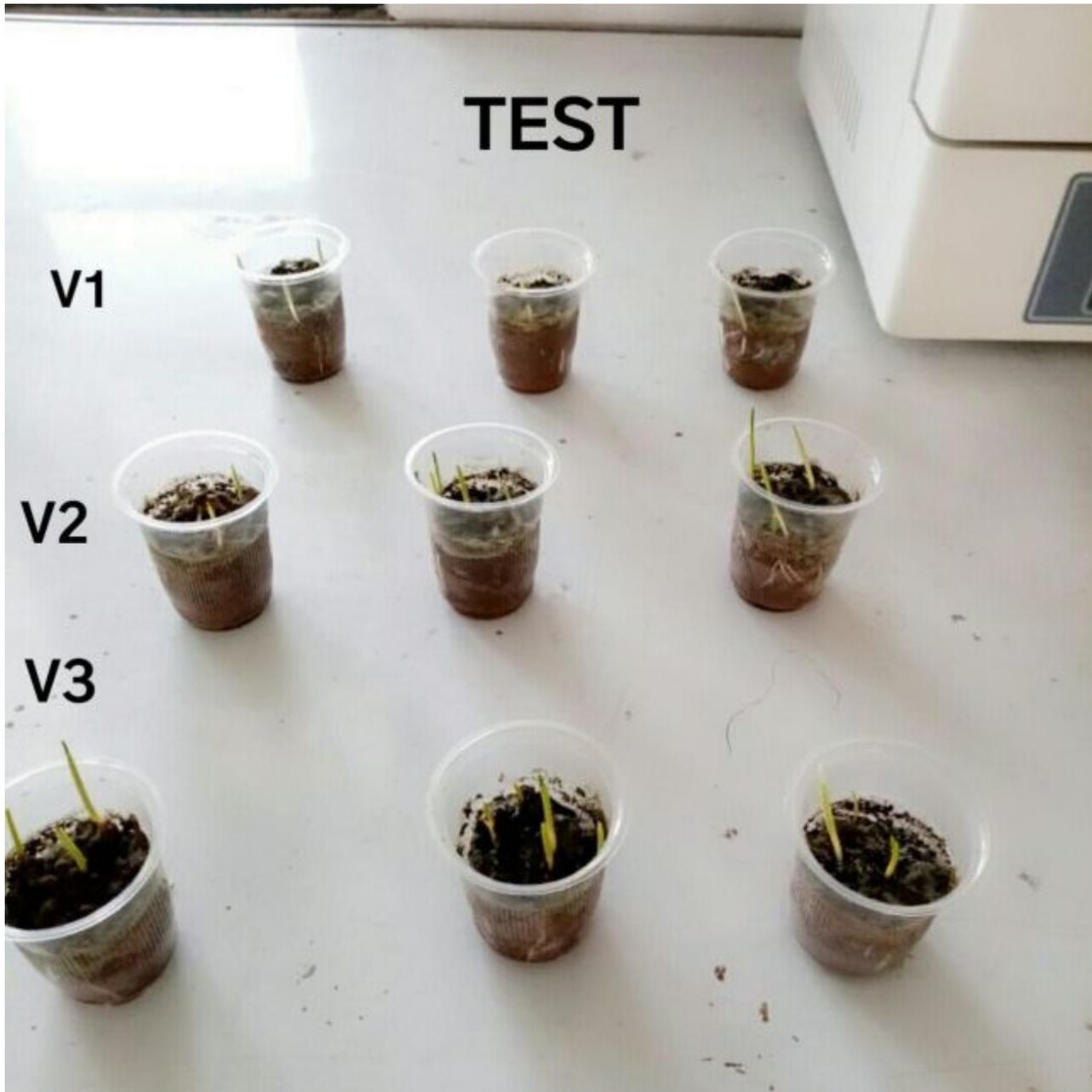


Figure 2

Showing the germinated varieties in mulch treatment. The emerging plumule can be seen clearly.