Allelopathic potentials of Populus nigra (L.) and Persicaria hydropiper (L.) against pennisetum glaucum (L.) and Zea mays (L.)

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ABSTRACT

Allelopathic effects of *Populus nigra* and *Persicaria hydropiper* aqueous leaf extracts were studied on the germination, radicle and plumule length of *Pennisetum glaucum* and *Zea mays*. Both of the plant leaf extracts were tested on each targeted species. Three concentrations of extract (5g, 10g and 15g) were used and each concentration was further based on three soaking duration (24, 48 and 72 hours). The extracts were applied to five replicates each having ten seeds of test specie and water was used as control. The allelopathic effect was mostly concentration dependent followed by soaking duration. As the concentration of extract is increased there is a significant decrease in the germination and growth parameters observed. After the concentration the inhibitory activity of soaking duration existed in which the extract soaked for 72 hours was more potent in allelopathic effect as compared to the extract of 48 hours and 24 hours. The extracts from P.hydropiper was more phytotoxic than P.nigra leaf extract. From this study it was concluded that *P. nigra* and *P.hydropiper* could be useful for weed management in the variety of agricultural settings to develop sustainable agriculture options and control the unwanted weeds by natural remedies.

Keywords: Allelopathic effects, *P.hydropiper*, *P. nigra*, Germination, *P. glaucum*, *Zea mays*, Sustainable agriculture.

1. INTRODUCTION

Allelopathy is the harmful effect of one plant upon another. The term signifies that the scientific knowledge which concerns the production of biomolecules by one plant, generally secondary metabolites, that can persuade suffering in, or give advantage to another plant. It is firmly attached with struggle for resources and stress from illness, high temperature, humidity shortage, andherbicides. [1]

Allelopathic crops are favorable for integrated weed management with considerably cheap herbicide. Researchers have identified several crop species having strong allelopathic interference mediated by root exudation of allelochemicals. Rice, wheat, barley and sorghum have paying attention mostly [2]. Previous studies focused on germplasm screening for elite allelopathic cultivars and the identification of the allelochemicals involved. Based on this, old breeding efforts were introduced in rice and wheat to breed agriculturally acceptable, weed-suppressive crops with better allelophathic interference [3].

Allelopathy happens by chemicals which affect other species this process has been observed for few decades ago that many crop plants (eg. chick pea, barley, bitter vetch) damaged weeds and prevented the growth of other crop plants. The phenomenon of plants affecting adjacent plants by the release of chemicals in the atmosphere has been identified as early as c. 370 BC. Greeks and Romans have used this information in cultivation since c. 64 AD. However, it was not until 1937 when Hans Molisch gaveit a formal name, allelopathy [4].

Theophrastus (372–285) observed this phenomena in farming practises before stating that pigweed had a suppressive effect on lucerne. De Candolle suggested in 1832 that crop plant secretion could be the cause of the agricultural problem associated with soil sickness. Since then, numerous specialists have attested to the detrimental impacts of plant residues decomposing in soil, which lower crop yield [5]. Following a continuous monoculture, the yield of numerous crops (Sorghum bicolor, Medicago sativa, Oryza sativa, Asparagus officinalis, Phaseolus radiatus, and Saccharum sinensi) was significantly decreased.

Gella *et al.* (2013) conducted an experiment to know the effect in aqueous form of allélopathie (*Amaranthus hybridus, Datura stramonium, Argemone mexicana and Parthenium hysterophoru) on* biomass production of wheat , seedlings growth and seed germination form *parts of* root, leaves, and shoot. For every type of weed, extracts in aqueous form with concentrations of 1 g/ml were made uniformly for the plant sections and administered sparingly to seeds planted in petri dishes [6]. P. hysterophorus leaf extract caused the greatest reduction in wheat seed germination (22%). The test weed species' leaf extracts showed a uniformly greater inhibition on wheat seedlings' radicle length than did the extracts from the other plant parts. The wheat seedlings' plumule length was shortened by 60% and 40% as a result of P. hysterophorus and A. hybridus leaf extracts. Overall, the study demonstrated that extracts from P. hysterophorus and A. hybridus plant leaves and shoots regularly result in a significant decrease in the percentage of seed germination [7].

In the current study the Allelopathic effects of *P. nigra* and *P. hydropiper* aqueous leaf extracts were studied on the germination, radicle and plumule length of *P. glaucum* and *Zea mays*. Both of the plant leaf extracts were tested on each target specie. The extract was based on three concentration (5g, 10g and 15g) each concentration was further based on three soaking duration (24, 48 and 72 hours). The extracts were applied to five replicates each having ten seeds of test species and distal water was used as control.

2. MATERIAL AND METHODS

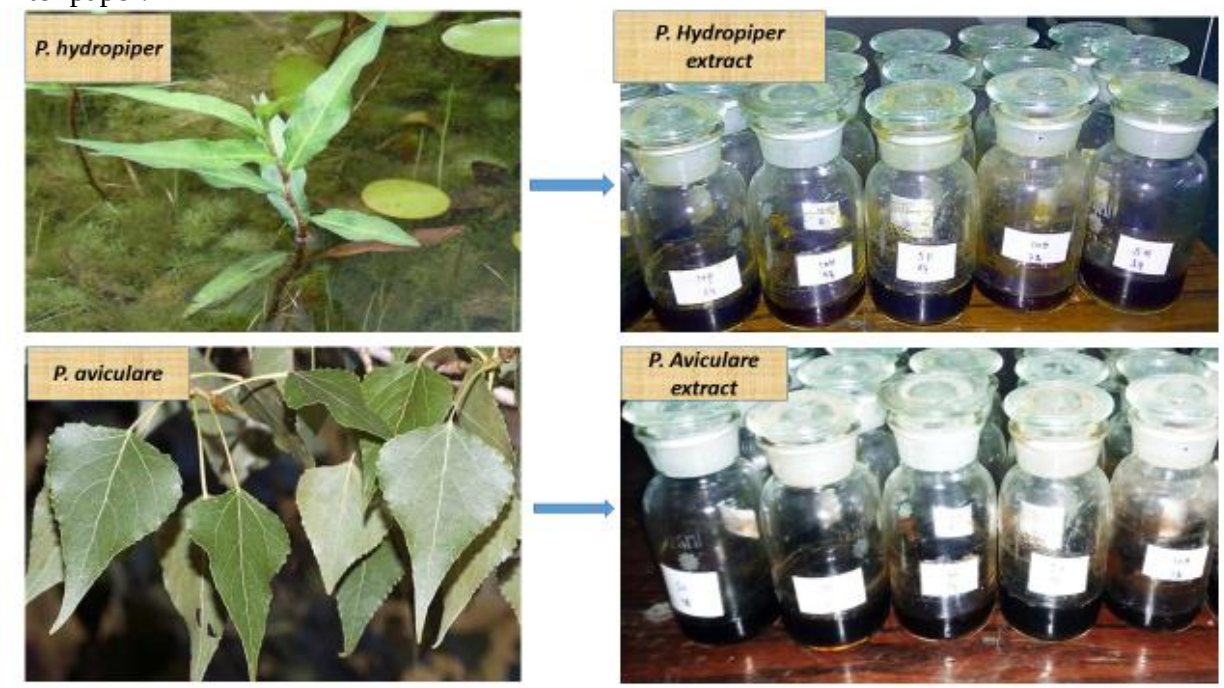
2.1.Collection of plant materials:

Plants leaves were collected from Dagi Ghulam Qadir, District Charsadda. Fresh leaves of *Populus nigra* were collected from the field and dried it in the shade. The leaves of *Persicaria*

hydropiper were collected from the agriculture field and also dried it. These two plants were used to identify their allelopathic potential. Two test species *Zea mays* (maize) *Pennisetum glaucum* (bajra) were collected from commercial suppliers in sufficient amount. Leaves of *P.nigra* and *P.hydropiper* were first dried and made its powder with the help of blender. The powder was stored in jars in sufficient amount and used for the activity.

2.2.Preparation of leaf extracts:

The leaf powder of *P.nigra* and *P.hydropiper* was mixed in different amounts (5, 10, 15 g) in 100 ml of Distal water. In order to prepare different aqueous extracts, three replicates of each mixture were stored for different duration i.e (24, 48, 72 hours) to obtain different extracts based on soaking duration. Three soaking durations of each extract is studied in the experiment for example 5g powder were stored for 24, 48 and 72 hours. The same procedure is applied for 10g and 15g mixtures. The filtration of was done with the help of whatman no.1 filter paper.



2.3.Seeds Viability test

To find the seeds viability of target species, an experiment was conducted. The viability of test species including (*Zea maize* and *Pennisetum glaucum*) was studied [8]. First took five petriplates, filter paper were placed in it, and added amount of water equal to field capacity and then we put 50 seeds from all target specie.

2.4.Application of aqueous extracts

To examine how leaf extracts affected the fresh weight and dry weight of two target plant seeds, as well as the germination and growth of seedlings [9]. Separate investigations were performed to evaluate the target species' radicle development and germination. Ten target species seeds, each containing five millilitres of the appropriate extract doses or controls, were arranged on paper germination discs on Petri dishes. For every extract, five duplicates were obtained, along with a control group. As a control, distilled water was utilised. For

seventy-two hours, the Petri plates were arranged at random in a germination incubator set at thirty degrees Celsius. The matching solution and seeds were appropriately marked on the Petri plates. We counted the seeds every day that germinated. Plumule and radical lengths were measured in (cm) and translated to (mm) for each replicate as the storage duration approached the germination (%). Numerous factors were looked into. All the results were statistically analyzed
Parameters examined:

(1). Germination (%) (2). Radicle and plumule length.

2.5. **Radicle and Plumule growth:**
After 72 hours the seeds which showed good germination and growth the size of their radicle and plumule was notified with the help of ruler [10]. The data is collected and properly noted, the growth of seedlings were examined and the comparison all aqueous plant solution were studied with control. Distal water is used as control. The size (mm) of radicle and plumule was measure with the help of length measuring ruler.
Satistical analysis
SPSS and one way ANOVA were used to analyze the data.

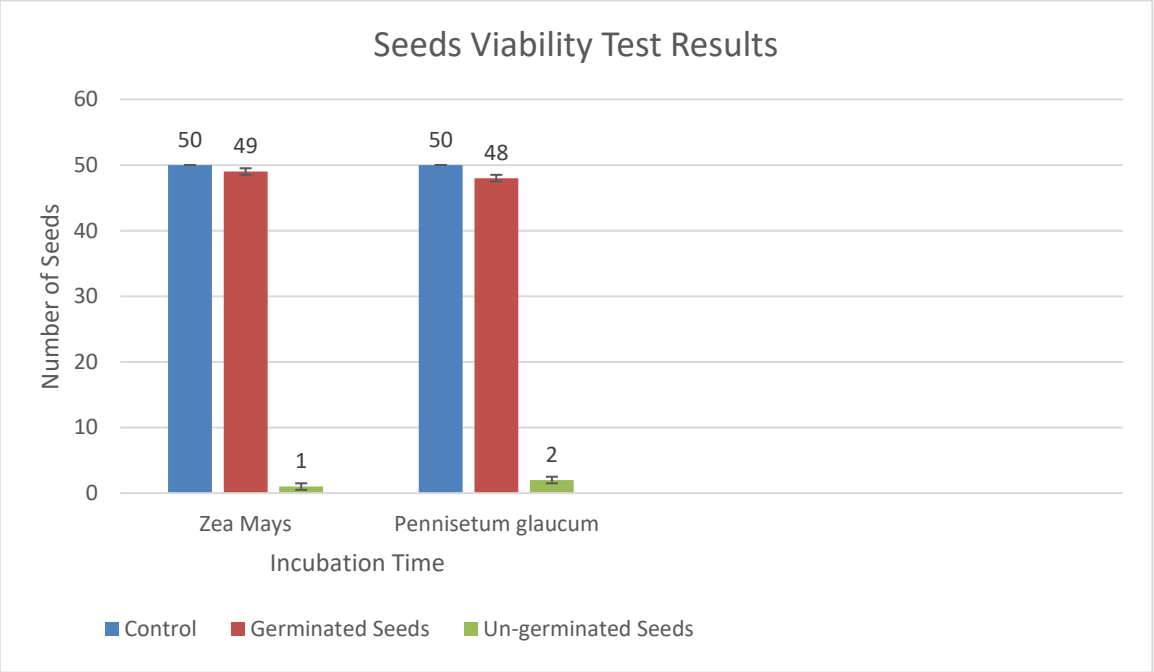
2.5.Germination percentage:

Germination percentage is obtained by the formula, "the number of germinated seeds, divided by total number of seeds multiply by hundred. The germination percentage of the seeds were compared with control.

Germination percentage = NO of germinate seeds.

3. RESULTS

After placing petriplate inside incubator for three days at a temperature of 35°C. *Pennisetum* showed high germination rate upto 96% while *Zea mays* showed 98%.



Germination percentage

The allelopathic effect of leaf extract of *Populus nigra* and *Persicaria hydropiper* on the germination of *Pennisetum glaucum* (bajra) and *Zea mays* (maize) were investigated under laboratory conditions. Three extracts obtained (5, 10, and 15g) from powder of *P. nigra* and *P.hydropiper*, significantly inhibited the germination.

It was noted that maximum germination of *P.glaucum* was (100%) and maize showed germination percentage of (98%) in control. The percentage of seed germination decreased with increase in concentration as well as soaking duration of leaf extract. Leaf extract of *P.nigra* decreased germination of *P.glaucum* to (40%) and of maize (36%) on the other hand the extracts *P.hydropiper* affected the germination of *P.glaucum* (38%) and in the same extract maize showed (32%) germination.

The germination percentage also dependent on the soaking duration of extracts. Three soaking durations of each extract were taken (24, 48 and 72 hours) When the soaking duration of *P.nigra* extract was changed from 24hours to 72 hours, the germination percentage decreased from 74 to 62% (table1).

The results clearly showed that the effect is more concentration dependent than soaking duration. When the soaking duration of extract was increased from 24hours to 72hours, it decreased the germination percentage of test species but when the concentration is increased from 5g to 15g the inhibitory effect was more as compared to soaking duration.

Radicle length (mm)

The radicle length of germinated seeds were measured and compared with control. Theextract from both of the plants significantly inhibited the growth of the radicle of all these test plants with extract. Maximum radicle length of *P.glaucum* was observed (70 mm) and *Zea mays* showed (50.5mm) in control. The effects of the extracts was concentration and soaking duration dependent.

When the soaking duration 5g extract of *P.nigra* increased from (24 to 72 hours) Pennisetum showed average length of radicle as 24hours(45mm) 48hours(34mm) 72hours (25mm) while maize showed effect in the same extracts as 24 hours(23.10mm) 48hours (17mm) 72hours(11mm). On the other side the 5g extract of Persicaria hydropiper leaf extract affected the radicle of Pennisetum as 24hours (40.60mm) 48hours (42.90mm) 72hours (30mm) in the same extract maize showed radicle length as 24 hours (18.10mm) 48hours (13.30mm) 72hours (9.90mm).

The result was also concentration dependent and when it is increased the radicle growth was significantly decreased. Maximum radicle length of *P.glaucum* in extract of *P.nigra* noted as (5g) 45mm, (10g) 35.74mm and (15g) 16mm. The radicle length of maize in the same extract noted as (5g) 23.10mm (10g) 18.5mm and (15g) 12.10mm. Maximum radicle length of Pennisetum in extract of *P.hydropiper* noted as (5g) 44.60mm (10 g) 35.80mm and (15g) 17mm. On the other side the highest radicle lengthof Pennisetum was noted as (5g) 18.10mm (10g) 13.20mm (15g) 10.20mm.

Plumule length (mm)

The plumule length of test seeds were also measured and compared with control. The extract from both of the plants significantly inhibited the growth of the plumule of all these test species. The maximum plumule length of *P.glaucum* was observed (62 mm) and *Z.mays* showed (45mm) in control. The effect of extracts on the plumule were concentration and soaking duration dependent.

When the soaking duration of 5g extract of *P.nigra* increased from (24 to 72 hours) That affected the average plumule length of *Pennisetum* the average plumule lengths were recorded as 24hours (29.5mm) 48hours (28.6mm) 72hours (20.4mm), while Maize seeds

get effected in the same extract of *P.nigra* as 24 hours (22.84mm) 48hours(16.76mm) 72hours (11.80mm). On the other hand the 5g extract of *P.hydropiper* affected the plumule of *P.glaucum* as 24hours (40.60mm) 48hours (42.90mm) 72hours(30mm) in the same extract maize showed plumule lengths as 24hours (18.10mm) 48hours (13.30mm) 72hours (9.90mm).

The extracts concentration affected the plumule length of test species and when the concentration increased the plumule growth significantly decreased. Maximum plumule length of *P.glaucum* in extract of *P.nigra* noted as (5g) 29.5mm (10g) 22.84mm and (15g) 15.10mm. The plumule length of Maize in the same extracts recorded as (5g) 10.60mm (10g) 7.86mm and (15g) 4.50mm. Maximum plumule lengthof *P.glaucum* in extracts of *P.hydropiper* noted as (5g) 28.62mm (10 g) 23.80mm (15g) 17.96mm. The highest plumule length of maize noted as (5g) 25mm, (10g) 6.50mm,(15g) 4.60mm.

Table 4.1 Effect of 5g aqueous extracts of *Populus nigra* leaf on germination andradicle length of *Pennisetum glaucum.*

Parameter studied	Extract Soaking duration	Mean±Standard Deviation	Standard Error	GERMINATION %
Radicle length	Control	55 ± 6.2	2.73861	94
	24hrs	45 ± 10 ^{NS}	4.47214	74
	48hrs	34 ± 12.9 *	5.75977	68
	72hrs	25 ± 11.1 *	4.94722	62

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.2 Effect of 5g aqueous extracts of *Populus nigra* leaf on plumule length of *Pennisetum glaucum.*

Parameter studied	Extract Soaking duration	Mean±Standard Deviation	standardError
Plumule length	Control	38.2 ± 9.1	4.02989
	24hrs	29.5 ± 2.9 ^{NS}	1.30384
	48hrs	28.6 ± 3.5^{NS}	1.56045
	72hrs	20.4 ± 6.4*	2.86094

Parameter studied.	Extract Soaking duration.	Mean ± Std. Deviation.	Standard Error.	GERMINATION. %
Radicle length	Control	48.50±9.94	4.44410	90
	24hrs	35.74±11.37*	5.08287	62
	48hrs	25.70±6.90*	3.08464	48
	72hrs	18.24±5.34*	2.38801	40

KEY; *= significant at α < < 0.05, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.
Table 4.3 Effect of 10g aqueous extracts of *Populus nigra* leaf on germination andradicle length of *Penisitum* glaucum.

KEY; *= significant at α < 0.05, Ns= non significant. Each value is the mean ofradicle length of five replicates, each having 10 seeds.

Table 4.4 Effect of 10g aqueous extracts of *Populus nigra* leaf on plumule length of *Penisitum glaucum.*

Parameter studied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	control	25.10±4.07	1.81934
	24hrs	22.84±2.38 ^{NS}	1.06330
	48hrs	16.76±4.77*	2.13134
	72hrs	11.80±4.86*	2.17141

KEY; *= significant at α < 0.05, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.5 Effect of 15g aqueous extracts of *Populus nigra* leaf on germination andradicle length of *Penisitum glaucum.*

Parameter studied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radicle length	control	53.00±14.83	6.63325	94
	24hrs	16.00±4.14*	1.85068	60
	48hrs	11.60±3.36*	1.50333	52
	72hrs	6.70±4.18*	1.86815	42

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

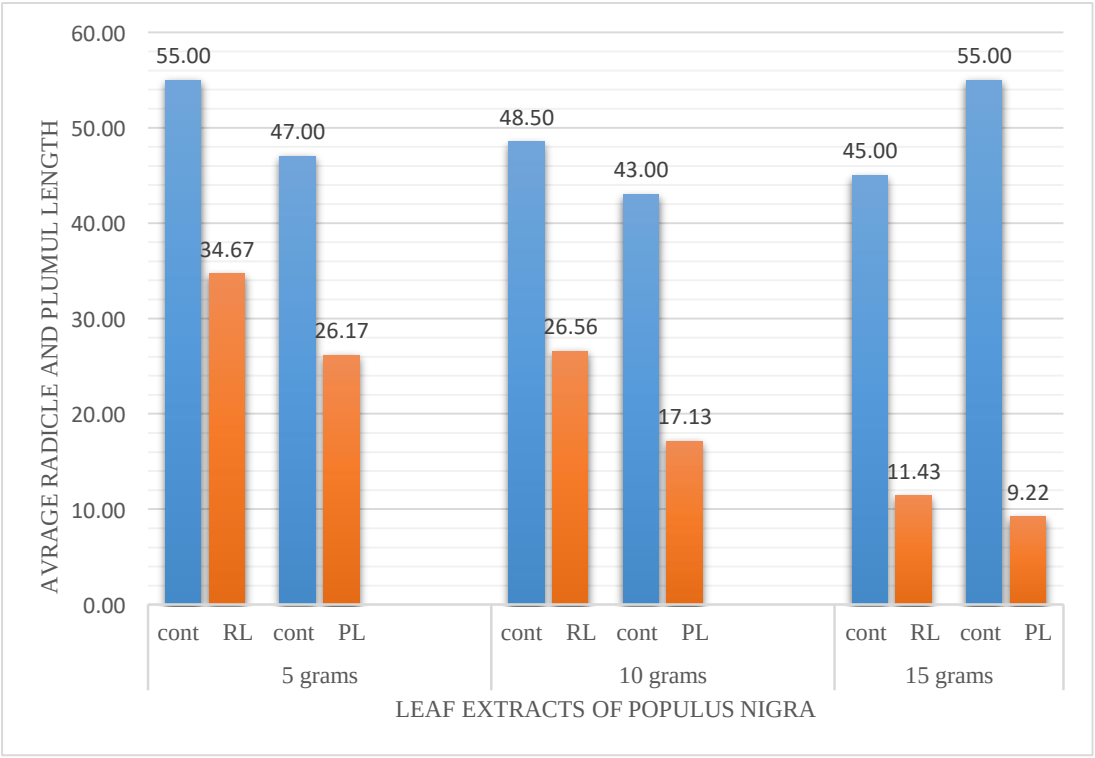


Figure 4.1 Effect of aqueous extracts of *populus nigra* leaf on radicle and plumulelength (mm) of *Penisitum glaucum*

Table 4.7 Effect of 5g aqueous extracts of *Persicaria hydropiper* leaf on germination and radicle length of *Penisitum* glaucum.

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	50.80±10.03	4.48776	96
	24hrs	44.60±8.45 ^{NS}	3.77955	74
	48hrs	41.90±8.73 ^{NS}	3.90640	68
	72hrs	33.00±6.71*	3.00000	52

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.8 Effect of 5g aqueous extracts of *Persicaria hydropiper* leaf on plumulelength of *Penisitum* glaucum.

Parameter studied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
plumule length	Control	37.60±4.67	2.08806
	24hrs	28.62±9.30 ^{NS}	4.16046
	48hrs	22.40±7.10*	3.17569
	72hrs	15.40±8.38*	3.74967

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.9 Effect of 10g aqueous extracts of *Persicaria hydropiper* leaf on germination and radicle length of *Penisitum* glaucum.

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	51.60±13.70	6.12862	100
	24hrs	35.80±3.63*	1.62481	64
	48hrs	23.50±4.94*	2.20794	56
	72hrs	15.80±4.01*	1.79304	50

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.10 Effect of 10g aqueous extracts of *Persicaria hydropiper* leaf onplumule length of *Penisitum* glaucum.

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	Control	29.20±5.63	2.51794
	24hrs	23.80±5.25 ^{NS}	2.34840
	48hrs	14.90±3.36*	1.50333
	72hrs	7.20±3.19*	1.42829

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.11 Effect of 15g aqueous extracts of *Persicaria hydropiper* leaf on germination and radicle length of *Pennisetum glaucum.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	52.80±13.52	6.04483	90
	24hrs	29.00±5.95*	2.65989	64
	48hrs	15.54±4.57*	2.04245	56
	72hrs	4.40±3.71*	1.66132	38

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.12 Effect of 15g aqueous extracts of *Persicari hydropiper* leaf on plumule length of *Pennisetum glaucum.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	Control	38.00±8.37	3.74166
	24hrs	17.96±6.48*	2.89769
	48hrs	8.40±4.28*	1.91311
	72hrs	2.60±1.98*	0.88600

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

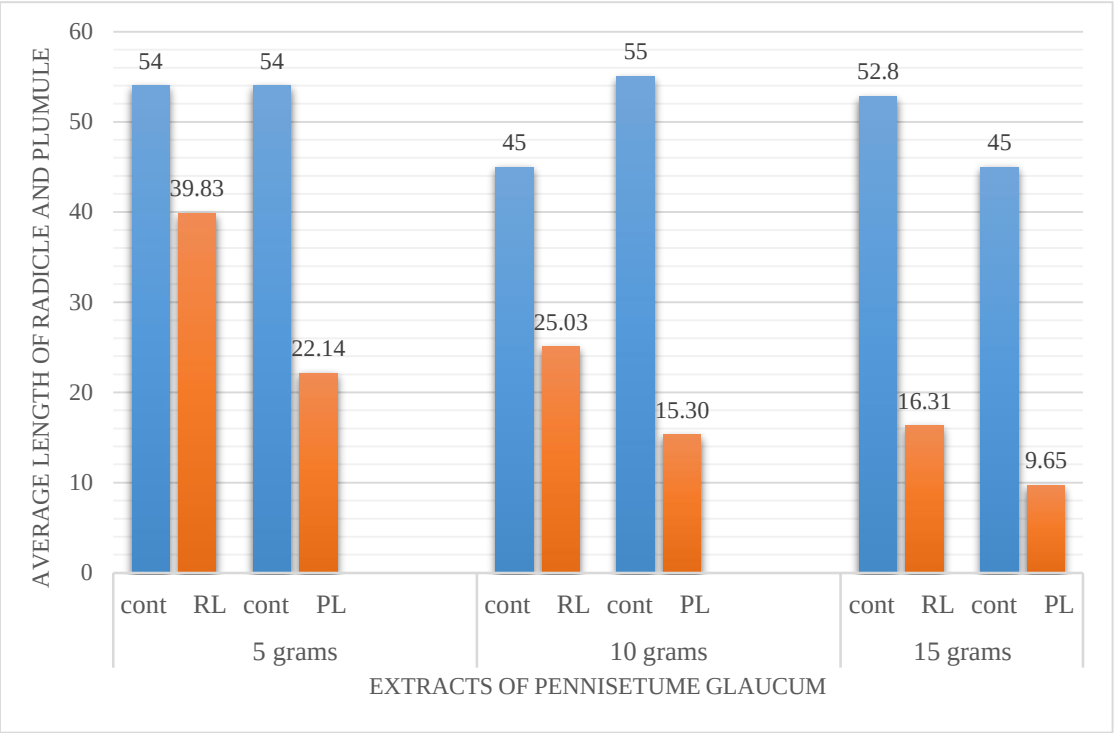


Figure 4.2 Effect of aqueous extracts of *Persicari hydropiper* leaf on radicle andplumule length of *Pennisetum glaucum.*

Table 4.13 Effect of 5g aqueous extracts of *Populus nigra* leaf on germination andradicle length of *Zea mays.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	44.30±15.85	7.08802	98
	24hrs	23.10±6.00*	2.68514	82
	48hrs	17.00±4.40*	1.96850	72
	72hrs	11.40±5.12*	2.28801	66

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.14 Effect of 5g aqueous extracts of *Populus nigra* leaf on plumule length of *Zea mays.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	Control	23.50±11.40	5.09902
	24hrs	10.60±5.28*	2.36326
	48hrs	9.80±5.42*	2.42178
	72hrs	6.50±2.74*	1.22474

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.15 Effect of 10g aqueous extracts of *Populus nigra* leaf on germination and radicle length of *Zea mays.*

Parameter studied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radicle length	control	49.80±15.50	6.93109	96
	24hrs	18.70±3.03*	1.35647	68
	48hrs	13.30±3.03*	1.35647	60
	72hrs	11.20±2.71*	1.21037	50

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.16 Effect of 10g aqueous extracts of *Populus nigra* leaf on plumule length of *Zea mays.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	Control	24.00±11.38	5.08920
	24hrs	7.86±3.32*	1.48310
	48hrs	5.66±3.63*	1.62499
	72hrs	3.40±1.64*	0.73144

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.17 Effect of 15g aqueous extracts of *Populus nigra* leaf on germination and radicle length of *Zea mays.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	57.80±15.71	7.02424	96
	24hrs	12.10±3.21*	1.43527	56
	48hrs	7.60±1.78*	0.79687	46
	72hrs	4.30±3.21*	1.43701	36

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.18 Effect of 15g aqueous extracts of *Populus nigra* leaf on plumule length of *Zea mays.*

Parameterstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	Control	31.40±8.02	3.58608
	24hrs	4.50±3.69*	1.65076
	48hrs	2.30±1.79*	0.80000
	72hrs	0.60±0.55*	0.24495

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

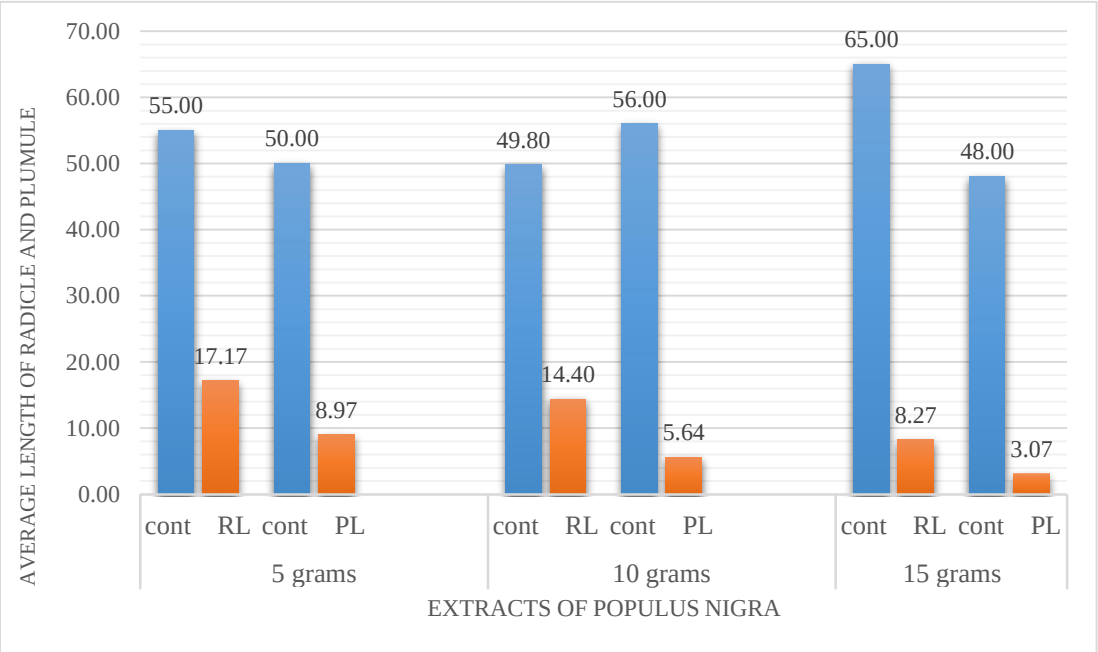


Figure 4.3 Effect of aqueous extracts of *Populus nigra* leaf on radicle andplumule length of *Zea mays*

Table 4.19 Effect of 5g aqueous extracts of *Persicaria hydropiper* leaf on germination and radicle length of *Zea mays.*

Parameters studied	**Extract Soaking duration**	**Mean±Std. Deviation**	**Standard Error**	**GERMINATION %**
Radicle length	control	45.40±13.74	6.14492	98
	24hrs	18.10±4.45 ^{NS}	1.98997	56
	48hrs	13.30±4.12 ^{NS}	1.84120	54
	72hrs	9.90±2.53*	1.13358	44

KEY; *= significant at $\alpha < 0.05$,Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.20 Effect of 5g aqueous extracts of *persicaria hydropiper* leaf on plumulelength of *Zea mays.*

Parametersstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	control	25.00±13.21	5.90762
	24hrs	10.00±4.53*	2.02485
	48hrs	5.00±2.03 ^{NS}	0.90830
	72hrs	2.90±1.24 ^{NS}	0.55678

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.21 Effect of 10g aqueous extracts of *Persicaria hydropiper* leaf ongermination and radicle growth of *Zea mays.*

Parametersstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	46.20±8.47	3.78682	90
	24hrs	13.20±7.24*	3.23883	58
	48hrs	6.60±3.91*	1.74929	48
	72hrs	2.10±3.07*	1.37295	42

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.22 Effect of 10g aqueous extracts of *persicaria hydropiper* leaf on plumule length of Zea mays.

Parameters studied	Extract Soaking duration	Mean±Std. Deviation	Standard Error
Plumule length	control	18.00±4.18	1.87083
	24hrs	6.50±2.00*	0.89443
	48hrs	2.14±0.67*	0.29933
	72hrs	0.70±1.30*	0.58310

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

Table 4.23 Effect of 15g aqueous extracts of *persicaria hydropiper* leaf on germination and radicle length of Zea mays.

Parametersstudied	Extract Soaking duration	Mean±Std. Deviation	Standard Error	GERMINATION %
Radiclelength	control	56.00±8.51*	3.80789	92
	24hrs	10.20±3.44*	1.53786	50
	48hrs	7.60±3.29*	1.46969	46
	72hrs	2.80±2.77*	1.24097	32

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of radicle length of 5 Duplicates, having 10 amount of seeds each.

Table 4.24 Effect of 15g aqueous extracts of *persicaria hydropiper* leaf on plumule length of *Zea mays.*

Parameters studied	**Extract Soaking duration**	**Mean±Std. Deviation**	**Standard Error**
Plumule length	control	27.40±4.72*	2.11187
	24hrs	4.60±2.63*	1.17686
	48hrs	1.50±1.12*	0.50000
	72hrs	2.80±4.02*	1.80000

KEY; *= significant at $\alpha < 0.05$, Ns= (Non-Significant). Each mentioned figure is the (Grand Mean Value) of plumule length of 5 Duplicates, having 10 amount of seeds each.

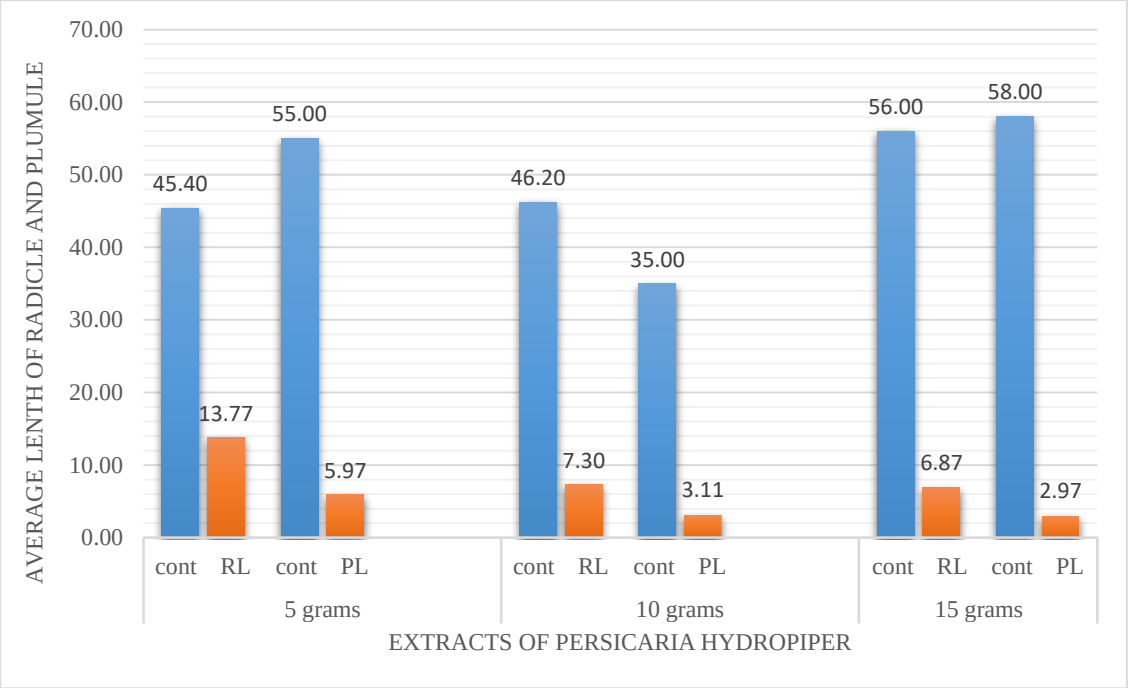


Figure 4.4 Effect of aqueous extracts of *Persicaria hydropiper* on radicle andplumule length of *Zea maize*

4. Discussion

Allelopathy is a significant process of plant interference mediated by the addition of plant-produced secondary metabolites to the ground. Allelochemicals are existing in all types of plants and tissues and are released into the earth by a range of methods, including rottenness of remains, volatilization and root exudation[11]. Allelochemical structures and modes of action are varied, and may offer potential for making of upcoming herbicides. Allelopathy was described by the Romans as a process resultingin the "sickening" of the soil; in particular, chickpea (*Cicer arietinum*) was determined as problematic when sequentially cropped with other species.

Raoof (2012). conducted a laboratory experiment to determine the effect of aqueous leaves extracts of *Jatropha curcas* was undertaken that showed negative effects on seed germination, shoot length and root length in *Capsicum annum L.*(greenchilli)[12].

The negative effect of the plant is closely related with concentration (5%, 10%, 15%, 20%) of aqueous leaves extracts of *Jatropha curcas.* The extract showed positive effects on seed germination and shoot length in *Sesamum indicum* L. (sesame)[13]. The positive effect is directly proportional to the increase in concentration (5%, 10%, 15%, 20%), but the root growth was decreased in all treatment when compared with the control. The result of showed that the negative and positive effect may be due to the presence of water soluble allelochemicals like phenols and tannins etc[14].

The present study demonstrated that aqueous extracts from leaves *Populus nigra* and *Persicaria hydropiper* reduced germination and seedling growth. A gradual decrease in germination percentage and seedling growth was recorded with increasing soaking duration as well as concentration. The retorted germination and seedling growth of *P.glaucum* and *Z.mays*

at high extract concentrations might be due to excess ofinhibitory allelochemicals. The effect of leaf extracts was more adverse in higher concentration as compared to soaking durations. The allelopathic effect of leaf extract of *Populus nigra* and *Persicaria hydropiper* on the germination of *Pennisetum glaucum* (bajra) and *Zea mays* (maize) were investigated under laboratory conditions. Three extracts obtained (5, 10, and 15g) from powder of *P. nigra* and *P.hydropiper*, significantly inhibited the germination. It was noted that maximum germination of *P.glaucum* was (100%) and maize showedgermination percentage of (98%) in control. The percentage of seed germination decreased with increase in concentration as well as soaking duration of leaf extract. Leaf extract of *P.nigra* decreased germination of *P.glaucum* to (40%) and of maize (36%) on the other hand the extracts *P.hydropiper* affected the germination of *P.glaucum* (38%) and in the same extract maize showed (32%) germination.

The germination percentage also dependent on the soaking duration of extracts. Three soaking durations of each extract were taken (24, 48 and 72 hours) When the soaking duration of *P.nigra* extract was changed from 24hours to 72 hours, the germination percentage decreased from 74 to 62% (table1). The results clearly showed that the effect is more concentration dependent than soaking duration. When the soaking duration of extract was increased from 24hours to 72hours, it decreased the germination percentage of test species but when the concentration is increased from 5g to 15g the inhibitory effect was more as compared to soaking duration.

The radicle length of germinated seeds were measured and compared with control. The extract from both of the plants significantly inhibited the growth of the radicle of all these test plants with extract. Maximum radicle length of *P.glaucum* was observed (70 mm) and *Zea mays* showed (50.5mm) in control. The effects of the extracts was concentration and soaking duration dependent. When the soaking duration 5g extract of *P.nigra* increased from (24 to 72 hours) Pennisetum showed average length of radicle as 24hours(45mm) 48hours(34mm) 72hours (25mm) while maize showed effect in the same extracts as 24 hours(23.10mm) .These results are Similar with previous literature [15].

48hours (17mm) 72hours (11mm). On the other side the 5g extract of *Persicaria hydropiper* leaf extract affected the radicle of Pennisetum as 24hours (40.60mm) 48hours (42.90mm) 72hours (30mm) in the same extract maize showed radicle length as 24 hours (18.10mm) 48hours (13.30mm) 72hours (9.90mm). The result was also concentration dependent and when it is increased the radicle growth was significantly decreased. Maximum radicle length of *P.glaucum* in extract of *P.nigra* noted as (5g) 45mm, (10g) 35.74mm and (15g) 16mm. The radicle length of maize in the same extract noted as (5g) 23.10mm (10g) 18.5mm and (15g) 12.10mm. Maximum radicle length of Pennisetum in extract of *P.hydropiper* noted as (5g) 44.60mm (10 g) 35.80mm and (15g) 17mm. On the other side the highest radicle length of Pennisetum was noted as (5g) 18.10mm (10g) 13.20mm (15g) 10.20mm.

The plumule length of test seeds were also measured and compared with control. The extract from both of the plants significantly inhibited the growth of the plumule of all these test species. The maximum plumule length of *P.glaucum* was observed (62 mm) and *Z.mays* showed (45mm) in control. The effect of extracts on the plumule were concentration and soaking duration dependent. When the soaking duration of 5g extract of *P.nigra* increased from (24 to 72 hours) That affected the average plumule length of *Pennisetum* the average plumule lengths were recorded as 24hours (29.5mm) 48hours (28.6mm) 72hours (20.4mm), while Maize seeds get effected in the same extract of *P.nigra* as 24 hours (22.84mm) 48hours(16.76mm) 72hours (11.80mm). On the other hand the 5g extract of *P.hydropiper* affected the plumule of *P.glaucum* as 24hours (40.60mm) 48hours (42.90mm) 72hours(30mm) in the same extract maize showed plumule lengths as 24hours (18.10mm) 48hours (13.30mm) 72hours (9.90mm). The extracts concentration affected the plumule length of test species and when the concentration increased the plumule growth significantly

decreased. Maximum plumule length of *P.glaucum* in extract of *P.nigra* noted as (5g) 29.5mm (10g) 22.84mm and (15g) 15.10mm. The plumule length of Maize in the same extracts recorded as (5g) 10.60mm (10g) 7.86mm and (15g) 4.50mm. Maximum plumule lengthof *P.glaucum* in extracts of *P.hydropiper* noted as (5g) 28.62mm (10 g) 23.80mm (15g) 17.96mm. The highest plumule length of maize noted as (5g) 25mm, (10g) 6.50mm,(15g) 4.60mm.

Similar research activity on allelopathic potential of *P.nigra* and *P.hydropiper*, have done by several researchers s-and their results similar with our work.

Khan *et al.* (2016) conducted an experiment to explore the allelopathic effect of *Populus nigra* bark on *Zea mays* under laboratory condition [16]. Aqueous extracts of P. nigra bark have been found to have an allelopathic effect on Zea mays germination, seedling growth, fresh weight, and dry weight. In this activity the radicle and plumule length was significantly affected by the bark of *P.nigra* similarly Hachani *et al.* (2019) in which The allelopathic effects were evaluated using several parameters including seed germination, total dry mass, root and shoot length, chlorophyll and protein concentrations in *T. durum* seedlings along with phenolic compounds in different parts(leaves, roots and litter) of the two allelopathic species [17]. Exposure to the different extracts of *C. glauca* and *P. nigra* significantly reduced germination kinetics, dry massproduction, root and shoot length, and chlorophyll and protein concentrations in *T. durum* seedlings. Another research work was carried out by Woo *et al.* (1987) Water extracts of *Polygonum hydropiper* and *Polygonum aviculare* completely inhibited the germination of lettuce seeds. Methanol extracts from these two species also inhibited the seed germination of lettuce (*Lactuca sativa*) and *Oenothera odorata*. Fifteen phenolic acids in total were identified by GLC from P. hydropiper and eighteen from *P. aviculare* [18].

CONCLUSION

The inhibitory effect of two species *Populus nigra* and *Persicaria hydropiper* was studied upon two test species *Pennisetum glaucum* and *Zea mays*. The study reveals the evidence that both of the plants have allelopathic potential on both of target species. Germination and seedling growth were significantly suppressed by leaf extracts. *P.hydropiper* was recorded as more potent than *P.nigra* in allelopathy. The effect was more concentration dependent followed by soaking duration.

Conflict of Interest:

Authors declare no conflict of interest regarding the data presented in the manuscript.

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