ALLELOPATHIC POTENTIAL OF INDIAN PLUM (*Ziziphus mauritiana* L.) CONTRARY TO WHEAT (*Triticum aestivum* L.), MAIZE (*Zea mays* L.) AND CHICKPEA (*Cicer arietinum* L.)

Barkatullah[1], Sumayya Noreen[1].Khushnood Ur Rehman[1], Zahid Ali Butt[2], Tabassum Yaseen[3], Kamran Akbar[3], and Salma Noreen[3]

DOI: https://doi.org/10.28941/pjwsr.v27i1.870

ABSTRACT

Allelopathic chemicals have an important role in reproduction, growth, and survival in an ecosystem. To determine the allelopathic effect of Indian plum (*Ziziphus mauritiana*) contrary to three selected crops i.e. wheat (*Triticum aestivum* L.), maize (*Zea mays* L.), and chickpea (*Cicer arietinum* L.). The collection of Indian plum was made from Ahmad Abad District Karak and was dried at room temperature under the shade. The aqueous extract was used from different parts of the plants, which include bark, fruit, leaves, mulching, and rainwater. In all applications the growth of plumules and radicles of three test species was retarded. It was determined that the allelopathic effect of extracts is directly related to the duration of soaking i.e. 48 h extracts were more effective than 24 h. among all parts the highest activity was shown by leaves followed by fruit, bark, Rainwater, and then mulching. From the above experiment, it is strongly suggested that the tested portions of *Z. mauritania* have significant negative allelopathic effects on the tested plant species. Additional study is mandatory to understand its allelopathic performance in field conditions contrary to its related types and to recognize the noxious value**.**

Key Words: Allelopathy, *Ziziphus mauritiana, Triticum aestivum, Zea mays, Cicer arietinum.*

Citation: Barkatullah, S. Noreen, Khushnood Ur Rehman, Z. A. Butt, T. Yaseen, K. Akbar, and S. Noreen. 2021. Allelopathic potential of Indian plum (*Ziziphus mauritiana* L.) Contrary to wheat (*Triticum aestivum* L.), maize (*Zea mays* l.) And chickpea (*Cicer arietinum* L.,). Pak. J. Weed Sci. Res., 27 (1):23-34.

[1]Department of Botany, Islamia College, Peshawar-Pakistan
[2]Department of Botany, GC Women University, Sialkot-Pakistan
[3]Department of Botany, Bacha Khan University, Charsadda-Pakistan
Corresponding email address: tabassumyaseen@bkuc.edu.pk

INTRODUCTION

According to the "novel weapons hypothesis," the weeds inhibit an environment by applying new chemicals, that are allelopathic chemicals or weapons, to that the native plants are not so far adopted, that inhibit the growth of seedlings of beneficial plants. In an ecosystem, no organism can live aloof, neither the plants can do so, that they have a positive or negative impact on each other. This direct or indirect influence is due to the chemicals released by plants near one another (Weidenhamer and Callaway, 2010). These chemicals have an important role in reproduction, growth, and at large in survival in particular environmental conditions (Duke, 2003). The decomposition of residues causes the release of allelochemicals by exudation or volatilization, which causes a positive or negative allelopathic impact on plants in proximity (Bajwa *et al*., 2016). The adaptation of allelopathy is a natural defense against herbivores (Latif *et al*., 2017). These, on one hand, decrease and interrupt seed germination and on another hand reduce root and shoot growth (Fernandez *et al*., 2016). Almost all physiological processes i.e photosynthesis, enzymes, and membrane functions, uptake of water, and nutrients, and seedling germination are affected by allelochemicals (Ghimire *et al*., 2020; Mushtaq *et al*., 2020). The role of soil microorganisms can not be neglected as they alter the already toxic allelochemical to more toxic ones and affect plant age and vigor (Aslam *et al*., 2017). *Ziziphus mauritiana* is also known as Indian plum or Chines berry and a native plant of central Asia (Shahrajabian *et al*., 2019). The plant has the endurance to drought and heat and has some medicinal values like Anti-inflammatory, antimicrobial, antioxidant, anti-tumor, hypoglycemic, hypotensive, immune-system stimulant, and Liver-protective agent (Koley *et al*., 2016). *Ziziphu*s is drought tolerant and heat resistant (Perveen *et al*., 2019). In central Sudan, the plant is used to treat diarrhea and malaria, as well as to treat the scorpion sting (Perveen *et al*., 2019). Wheat *(Triticum aestivum L.*) is the number one need for the widely held of the realm's inhabitants, make available nearly 65% of the starches and sugars, and 25% of the nutrition consumed worldwide (Enyiukwu *et al*., 2020; Head and Atchison, 2016). Maiz stands third regarding food necessity in Pakistan and the world only after Wheat and rice (Ramankutty *et al*., 2018; Sher *et al*., 2017). Chickpea (*Cicer arietinum* L.,) leguminous plant harvest grown in some countries is a rich basis of protein, carbohydrates, and minerals, particularly for the vegan inhabitants. Apart from that, it is a source of Nitrogen-fixing bacteria like Rhizobium (Abd-Alla *et al*., 2019). The cultivation of it increases the soil fertility and can fix atmospheric nitrogen through its symbiotic association with Rhizobium species, enhancing the soil quality for subsequent cereal crop cultivation (Egamberdieva *et al*., 2017).

MATERIALS AND METHODS

Different parts of the *Ziziphus mauritiana* plant (leaves, fruit, and bark) were collected separately, shade and sun-dried, crushed, and stored in polythene bags for further use in different treatments. The aqueous extracts were prepared by soaking 5gm and 10gm dried leaves, bark, and fruit in 100ml of distilled water for 24 and 48 hours at room temperature. These extracts were applied on wheat *(Triticum aestivum* L.) maize *(Zea mays) Cicer* (*Cicer arietinum*) of test plant seeds to identify the allelopathic effect of *Ziziphus mauritiana*. Sterilized Petri dishes lined with filter paper. In each Petri dish, 10 seeds of each tested plant were placed at an equal distance on filter paper and moistened with drops of plant extract of the desired concentration of a plant part in treatment or distilled water in case of control. These Petri dishes were placed at room temperature for 72 hours. Each treatment and control had 10 replicates. Readings were taken from all the Petri dishes containing test seeds after

72 hours to count the number of plumules and radicles.

The emergence of plumules and radicles

Different sizes of plumules and radicles emerge from the tested plant seeds readings taken after 72 hours in millimeters and comparing the plumule length, radicle length of all the test plant,s seeds. This process was performed with the help of distilled water. This process is the same as the process of extracts of leaves, fruit, and bark of *Ziziphus mauritiana*. 10 seeds of wheat, maize, and chickpea were placed in three Petri dishes respectively. Few drops of distilled water were placed on the filter paper to moisten it. These Petri dishes were placed at room temperature for 72 hours. The readings were taken after 72 hours. The weight of dried seeds was identified to obtain accurate readings the leaves, bark, and fruit extracts were applied to the tested plants to identify the positive and negative effects on the length of plumules and radical.

1: Effect of Mulching

Five (5) grams of dried leaves, bark, and fruit were separately placed in plastic pots containing sterilized sand. For each treatment and control, ten replicates, with 10 seeds each. The control consisted of fine pieces of filter paper. The plastic pots were incubated at 25°C. Germination, plumule, and radical growth were measured. Ten seedlings were randomly taken out for the determination of fresh, dry weight, and moisture contents.

Effect of Rain Water

Instead of using extract rainwater was used as an extract on the tested seed. Sterilized Petri dishes were lined with 2 round shape filter paper. In each Petri dish, 10 seeds of each tested plant were placed at an equal distance on the filter paper. The seedbed i-e filter paper was moistened with some drops of plant extract of the desired concentration of a plant part in treatment or distilled water in case of control and placed at room temperature for 72 hours.

RESULTS AND DISCUSSION

The allelopathic activity of *Ziziphus mauritiana* was determined on different parts of *Zea mays* that are plumule and radicle in this activity the germination of plumule length and radical length of *Zea mays* was noted as compared to control (distilled water). In the present work, the effect of (Leaf, bark, and fruit) of *Ziziphus mauritiana* was exterminated on *Zea mays* seed germination. The control group showed 100% germination followed the fruit and bark of *Ziziphus mauritiana* which showed 100% germination on 5g concentration while the leaf showed 96% germination on a concentration of 5g. Similarly, the bark, leaf, and fruit of *Ziziphus mauritiana* were investigated on a concentration of 10g against the germination of *Zea mays*. In which the leaf, bark extract showed 100% germination while leaf and fruit extract showed 83% and 63% inhibition respectively Table(1).

Table.1. Allelopathic effect of *Ziziphus mauritiana* on germination percentages of test species.

S.NO	Treatments	Germination Percentage	
		5 grams	10 grams
1	Control	100%	100%
2	Leaf	96%	83%

3	Bark	100%	100%
4	Fruit	100%	63%

*Ziziphus Mauritiana*leaf, Allelopathic effect on Bark, and Fruit on the Plumule Size Of *Zea mays*.

The outcome of aqueous extracts of *Ziziphus Mauritania* leaves, bark, and fruits on the plumule size of *Zea mays* recorded in comparison to the control group (distilled water) after 24hrs, 48hrs at a concentration of 5gm and 10gm and then the difference between fresh and dry weight of the above-mentioned parts was recorded (Table 2). After 24hrs and 48hrs, plumule lengths were 25.37±1.21mm and 27.33±3.07mm respectively at a concentration of 5gm while the leaf extract of *Ziziphus mauritania* showed 5.40±0.0mm and 00.± 1.92 lengths after 24hrs and 48hrs the leaf extract showed the more significant result as compared to control. Similarly, a significant result was shown by bark extract which is 0.733±0.26mm. On 10gm concentration, the more significant result was shown by leaf extract and fruit extract after 24hrs and 48hrs. The differences between fresh and dry weight of leaf, bark, and fruit extract were compared to control, similar results were shown in vitro allelopathic effect of aqueous extracts of sugarcane on germination parameters of wheat (Majeed *et al*., 2017). And the allelopathic Effects of Aqueous Extracts of *Ricinus communis* L. on the germination of six cultivated species (Saadaoui *et al*., 2015).

Table 2. Effect of aqueous extracts of *Ziziphus mauritiana* leaves, bark, and fruits on the plumule length of *Zea mays*.

S.N	Treatment	5g/24hrs (mm)	5g/48hrs (mm)	10g/24hrs (mm)	10g/48hrs (mm)	Fresh weight (g)	Dry weight (g)
1	Control	25.37±1.21	27.33±3.07	24.22±1.07	26.22±0.07	6.45±2.45	3.98±0.02
2	Leaf	5.40±0.0**	00±1.92**	6.66±0.16**	0.166±0.16**	5.34±2.15*	2.99±0.04*
3	Bark	0.733±0.267**	21.29±2.84	14.46±0.120*	5.54±3.38**	3.99±0.09	1.99±0.01**
4	Fruit	10.43±0.48*	11.06±0.417*	3.83±0.98**	7.23±0.120**	6.08±2.33*	2.99±2.1*

Data are presented as mean ± S.E.M.; at *(p<0.05) = Significant, ** (p<0.01) = Highly Significant, compared to control (one-way ANOVA followed by Dunnett's posthoc test) effect Of Aqueous Extracts Of *Ziziphus mauritiana* Leaf, bark and fruit on the plumule length of *Triticum aestivum.*

In Table (3) the plumule length of wheat was noted against leaf, bark, and fruit and compared to the control group. After 24hrs and 48hrs, the length of the plumule was 26.90±0.45mm and 27.77± 5.89mm respectively at 5gm concentration while the leaf extract of *Ziziphus mauritiana* showed 2.60± 1.23mm plumule length after 48hrs the leaf extract showed the more significant result. On 10gm concentration the more significant result was shown by leaf extract and bark extract after 24hrs and 48hrs., and the differences between fresh and dry weight of leaf, bark, and fruit extract compared to control were noted

(Safdar, 2015). Allelopathic effects of medicinal plants of lemon balm, lemon verbena, and bitter apple on seed germination and early seedling growth characteristics of wild mustard weed were also studied by Geimadil *et al*., (2015). Results showed that the essential oil of lemon verbena at 600 mg/L concentration had a more meaningful effect on germination percentage and germination rate of wild mustard. Our results also indicated the aqueous extract of these plants had a stimulating effect on weed seed development (Kaliyadasa and Jayasinghe, 2018). *Phragmites karka* (Retz.) is growing as tough weed grass almost everywhere in Pakistan. The experiment was conducted in laboratory conditions to analyze the allelopathic impact of *Phragmites karka* on the wheat variety (Behera *et al*., 2018). The Collected data indicated that root extracts significantly affected the percentage of seedling germination and growth of plumule and radical of test species. The roots were more allelopathic followed by inflorescence, stem, and leaves.

Table3. The outcome of aqueous extracts of *Ziziphus mauritiana* on fruits, bark, and leaves on the plumule size of *Triticum aestivum*.

S.N		5g/24hrs (mm)	5g/48hrs (mm)	10g/24hrs (mm)	10g/48hrs (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	26.90±0.45	27.77±5.89	21.00±4.6	23.33±5.99	8.22±2.11	4.77±1.43
2	Leaf	22.20±0.00	2.60±1.23**	17.33±2.16*	3.30±1.90**	5.88±1.09**	2.34±0.09**
3	Bark	27.20±1.70	29.59±2.66	23.53±1.03*	53.16±4.38	8.22±0.65	5.22±2.23
4	Fruit	41.70±4.47	57.64±2.46	45.83±1.01	26.90±0.45	7.22±1.08**	2.99±0.09**

Data presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, ***(p<0.001)= Very Highly Significant compared to control (one-way effect of aqueous extracts of *Ziziphus Mauritiana* Leaf, Bark And fruit on the plumule length of *Cicer arietinum.* ANOVA followed by Dunnett's posthoc test).

In Table (4) leaf, bark, and fruit extract showed negligible results after 24hrs and 48hrs on 5gm and 10gm concentration against *Cicer spp*. The differences in fresh and dry weight of leaf, bark, and fruit extract were compared to control presented a good response. The result obtained was in contrast with the findings of Begum *et al*. (2020) and Grisi *et al*. (2015), who worked on the Allelopathic potential of *Sapindus saponaria* L. leaves in the control of weeds. They observed extracts of *Sapindus saponaria* leaves significantly inhibited the germination of barnyard grass and morning glory diaspores.). As a result, there was a linear decrease in the mean germination rate. Similar results were examined that *Psychotria leiocarpa* is an understory wood shrub, which occurs in groups of relatively high-density Grisi *et al*. (2015). Leaves of field-grown plants contain approximately 2.5% of their dry weight as the N-glycosylated indolic alkaloid N, B-d- glycol pyranosyl lincosamide (GPV) The data suggested that polar phenolic compounds or iridoids are responsible for the Phytotoxic effect observed.

Table.4. Effect of aqueous extracts of *Ziziphus mauritiana* leaves, bark, and fruits on the plumule length of *Cicer arietinum*.

S.No		5g/24hrs (mm)	5g/48hrs (mm)	10gm/24hrs (mm)	10g/48hrs (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	3.6±0.45	4.22±0.7	2.88±0.09	4.55±0.98	5.00±1.07	3.01± 0.13
2	Leaf	0±0.00	0±0.00	0±0.00	0±0.00	4.03± 1.23*	2.31±2.05**
3	Bark	0±0.00	0±0.00	6.6 ±1.03	8.16±4.38	3.13± 1.45*	2.0±0.15**
4	Fruit	5.033 ±0.47	4.64±2.46	2.46±0.01	3.90±0.45	4.4± 0.23	2.11± 1.01**

Data are presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, ***(p<0.001)= Very Highly Significant compared to control (one-way ANOVA followed by Dunnett's posthoc test effect Of Aqueous Extracts Of *Ziziphus Mauritiana* Leaf, Bark And Fruit On The Radical Length Of *Zea Mays*.

From the data presented in Table (5) the leaf extract of *Ziziphus mauritiana* showed 16.56± 2.95mm and12.00± 1.33 length of radical after 24hrs and 48hrs was a more significant result as compared to control. Similarly, the significant result was shown by fruit extract 23.64± 1.46 as a more significant result was shown by leaf and fruit extract. The difference between fresh and dry weight of leaf bark and fruit extract compared to control showed satisfactory results. These findings were in line with the result for *(Quercus)* allelopathic influence contrary to inspective species maize and brassicas., *Euphorbia helioscopia L. against wheat (Triticum aestivum L.),* chickpea *(Cicer arietinum L.*), and lentil (*Lens culinaris* Medic.) (Bonifacio *et al*., 2015; Pratap *et al*., 2020).

Table 5.Effect of aqueous extracts of *Ziziphus mauritiana* leaves, bark, and fruits on the plumule length of *Zea mays*.

S.No		5gm/24hrs (mm)	5gm/48hrs (mm)	10gm/24hrs (mm)	10gm/48hrs (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	34.26±3.40	33.33±2.66	24.55±1.77	30.33±2.00	6.23±2.45	3.33±2.01

2	Leaf	16.56±2.9 5.00*	12.00±1, 73**	20.33±0. 66**	8.80±1.0 9**	4.18±1.04*	2.14±0. 33**
3	Bark	43.23±2.9 3	47.00±4. 09	45.93 ±0.31	26.93±- 0.38*	6.33±3.01	2.13±0. 46
4	Fruit	31.03 ±5.13	23.64±1. 46*	21.56±3. 52**	26.90±0. 45**	5.34±1.09	3.45±1. 44**

Data are presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, ***(p<0.001)= Very Highly Significant compared to control (one-way ANOVA followed by Dunnett's posthoc test effect Of Aqueous Extracts Of *Ziziphus mauritiana* Leaf, Bark And Fruit On The Radical Length Of *Triticum aestivum*.

After 24 hrs and 48hrs, the length of the radicle was 77.34±8.33 mm and 76.22±3.55 mm respectively at a 5 gm concentration while the leaf extract of *Ziziphus mauritiana* showed 16.96± 2.16mm and 25.70± 5.57mm as the leaf extract revealed more significant result as compared to the control. These findings are in favor of our result, *Diospyros kaki* L. against L., *Brassica* L *Triticum aestivum compestris,* and *Trifolium alexandrinum* L (Cheon *et al*., 2004). *Aristolochia esperanza* O.Kuntze on the development of *Sesamum indicum* L. seedlings (Husain *et al*., 2018).

Table 6. Effect of aqueous extracts of *Ziziphus mauritiana* leaves, bark, and fruits on the plumule length of *Triticum aestivum*.

S.N		5gm/24hrs (mm)	5gm/48hrs (mm)	10gm/24hrs (mm)	10gm/48hrs (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	77.34±8 .33	76.22±3 ,55	72.22±2.9 9	70.77±1. 66	6.28±2. 56	4.45±1. 34
2	Leaf	16.96±2 .16*	25.70±5 .57*	18.33±8.0 8**	6.33±2.4 0**	5.25±1. 34	4.24±3. 13
3	Bark	73.23±2 .93	83.40±1 .09	62.63 ±3.31	82.93±- 5.38	7.23±0. 25**	3.13±0. 24**
4	Fruit	92.83 ±7.13	55.2±3. 26	66..56±10 .52*	33.90±2. 45**	6.09±1. 29*	3.67±1. 03**

Data are presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, ***(p<0.001)= Very Highly Significant compared to control (one-way ANOVA followed by Dunnett's posthoc test)Effect Of Aqueous Extracts Of *Ziziphus Mauritiana* Leaf, Bark And Fruit On The Radical Length Of *Cicer arietinum*.

The radicle length of chickpea was noted against a leaf, bark, and fruit compared to the control group. After 24hrs and 48hrs, the length of the radicle was 29.10± 6.40mm and 30.22± 5.44mm respectively at a 5gm concentration, while leaf, bark, and fruit extract of *Ziziphus mauritiana* showed negligible result after 24hrs and 48hrs at a 5gm concentration. While 10gm concentration presented more significant results by leaf and fruit extract after 24hrs and 48hrs. These results were similar to the findings of (Tyagi and Agarwal, 2011).

Table 7. Effect of aqueous extracts of *Ziziphus mauritiana* leaves, bark, and fruits on the plumule length of *Cicer arietinum*.

S.No		5gm/24 hrs (mm)	5gm/48 hrs (mm)	10gm/24 hrs (mm)	10gm/48 hrs (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	29.10±6.40	30.22±5.44	22.66±0.59	24.55±1.99	5.25±2.122	3.45±0.34
2	Leaf	10.56±0.80	11.30±3.73	4.33±0.77*	8.96±0.91**	4.34±0.12*	2.02±0.07*
3	Bark	23.86±6.23	31.20±1.67	44.93 ±0.47	83.36±-6.44	5.23±2.17**	2.23±0.09
4	Fruit	35.03±3.13	80.60±8.46	35.56±0.52*	31.90±1.60*	6.23±3.14**	2.99±2.14**

Data is presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, compared to control (one-way ANOVA followed by Dunnett's posthoc test).

2: Mulching Experiment

The added plant materials significantly reduced the germination in all the test species except the germination of *Cicer arietinum* by fruit (Table 8). Plumule and radicle growth are significantly declined. The fresh and dry weight, of all the test species, decreased in all the treatments (Table 8). This aspect when tested by using *Ziziphus mauritiana* mulch in experiments significantly inhibited test species. These findings agree with those of Muturi *et al*., (2012); Saroj *et al*., (2002), who observed similar phytotoxicity on other plants.

Table 8. Allelopathic effect of *Ziziphus mauritiana* on growth parameters of crops in mulching Experiment.

	Control		Leaf		Bark		Fruit	
	Radicle length (mm)	Plumule length (mm)	Radicle length (mm)	Plumule length (mm)	Radicle length (mm)	Plumule length (mm)	Radicle length (mm)	Plumule length (mm)
T.aestivum	22.73±1.33	10.66±0.33	22.733±2.44	1.90±0.05**	10.06±0.33**	0.00±0.00**	2.16±0.06**	7.73±2.03*
Germination %	*46*		*33*		*13*		*3*	
Fresh weight	*1.31±0.06*		*1.52±0.11***		*0.99±0.01**		*0.75±0.77**	
Dry weight	*0.6±0.02*		*0.45.0.001***		*0.41±0.01***		*0.58±0.01***	
Zea maize	*11.66±0.44*	*6.33±3.13*	*0.00±0.00***	*7.43±6.4*	*0.00±0.00***	*9.66±6.45*	*2.72±0.02**	*3.9±2.44***

Germination %	*6.6*		*13.3*		*30*		*10*	
Fresh weight	*2.43±1.77*		*2.36±0.01**		*3.58±1.71*		*4.28±1.81**	
Dry weight	*1.66±1.01*		*1.66±1.00***		*1.77±0.012***		*1.81±0.02**	
Germination	*16.6 %*		*23 %*		*3.33 %*		*10 %*	
C. arietinum	*5.44±1.83*	*6.33±0.33*	*11.06±4.09*	*15.16±5.31***	*6.00±3.00*	*0.744±0.03***	*6.46±4.22*	*8.00±4.00*
Fresh weight	*3.31±1.09*		*4.61±0.01*		*3.1±2.4*		*3.87±3.09*	
Dry weight	*1.78±0.01*		*2.47±0.15*		*2.31±0.99*		*2.30±0.98*	

Data is presented as mean ± S.E.M.; at *(p<0.05) = Significant, **(p<0.01) = Highly Significant, ***(p<0.001)= Very Highly Significant Compared To Control (One-Way ANOVA Followed By Dunnett's Post-Hoc Test)

3: Rain Water Effect

The rainwater showed a non-significant result shown in Table (9) as the plumule and radicle length were not affected compared to control. The result was obtained in contrast to Pawar and Rawal (2016) on *Cosmos bipinnatus* Huang and Chou's (2005) report focuses only on the control of target pathogens by biocontrol agent(s) or allelopathic substance without investigating their impacts on the agroecosystem and the environment.

Table 10. Effect of rainwater on the growth of selected crops.

S. N		Germination %	Plumule length (mm)	Radicle length (mm)	Fresh weight (gm)	Dry weight (gm)
1	Control	33	17.33±0.33	14.46±1.33	1.47±0.12	0.47±1.67
2	*T. aestivum*	36	13.56±1.44	11.33±0.05	0.43±1.00	0,42±0.12
3	Control	40	21.23±3.88	16.7 ±177	4.56±3.33	2.29±1.55
4	*Zea maize*	23	5.44±1.83	6.33±0.33	3.94±1.77	2.17±0.77
6	Control	23	2.33±0.33	5.46±1.33	6.82±2.11	2.58±0.55
7	Cicer aretinum	6.6	3.73 ± 0.33	5.50±1.44	5.16±3.44	1.77±0.99

RECOMMENDATIONS

It is recommended that *Ziziphus mauritiana* should not be cultivated around or near those crops whose production can be affected. The presence of allelochemicals negatively affects neighboring plants. There is a need to provide information to farmers about the plantation of *Ziziphus mauritiana* and their allelopathic effects.

CONCLUSIONS

The current work was conducted to evaluate the allelopathic prospective of *Ziziphus mauritiana* contrary to the test varieties ie., *Cicer arietinum*, *Zea mays,* and *Triticum aestivum*. It was examined that the noxious influence of allelochemicals on the restraint of seed development and sprout growth was at the mercy of the application and period of soaking. The consequence disclosed that the leaves extract withdrawn additional the sprouting of trial species as likened to bark and fruit at diverse concentrations i. e 10g treatment extract produced the thoroughgoing restraint while 5g originated the lowest restraint. As an outcome, the general development of sprouts was abridged nearly with all the treatment related to control.

REFERENCES CITED

Abd-Alla, M.H., N.A. Nafady, S.R. Bashandy, A.A. Hassan. 2019. Mitigation of effect of salt stress on the nodulation, nitrogen fixation and growth of chickpea (*Cicer arietinum* L.) by triple microbial inoculation. Rhizosphere 10:100148

Aslam, F., A. Khaliq, A. Matloob, A. Tanveer, S. Hussain, Z.A. Zahir. 2017. Allelopathy in agro-ecosystems: a critical review of wheat allelopathy-concepts and implications. Chemoecology 27:1-24

Bajwa, A.A., B.S. Chauhan, M. Farooq, A. Shabbir, S.W. Adkins. 2016. What do we really know about alien plant invasion? A review of the invasion mechanism of one of the world's worst weeds. Planta 244:39-57

Begum, K., M. Shammi, N. Hasan, K.S. Appiah, Y. Fujii. 2020. Evaluation of Potential Volatile Allelopathic Plants from Bangladesh, with Sapindus mukorossi as a Candidate Species. Agronomy 10:49

Behera, P., M. Mohapatra, T.K. Adhya, M. Suar, A.K. Pattnaik, G. Rastogi. 2018. Structural and metabolic diversity of rhizosphere microbial communities of Phragmites karka in a tropical coastal lagoon. Applied Soil Ecol. 125:202-212

Bonifacio, E., M. Petrillo, F. Petrella, F. Tambone, L. Celi. 2015. Alien red oak affects soil organic matter cycling and nutrient availability in low-fertility well-developed soils. Plant and Soil 395:215-229

Cheon, S.U., J.S. Yoon, H.O. Boo. 2004. Allelopathic and antioxidant activities of extracts and residues from persimmon (*Diospyros kaki* Thunb.) leaves. Korean J. Weed Sci. 24:21-29

Duke, S.O. 2003. Ecophysiological aspects of allelopathy. Planta 217:529-539

Egamberdieva, D., S.J. Wirth, V.V. Shurigin, A. Hashem, F.F. AbdulAllah. 2017. Endophytic bacteria improve plant growth, symbiotic performance of chickpea (*Cicer arietinum* L.) and induce suppression of root rot caused by Fusarium solani under salt stress. Frontiers in Microbio. 8:1887

Enyiukwu, D., G. Nwaogu, I. Bassey, J. Maranzu, L. Chukwu. 2020. Imperativeness of Agricultural Technology for Sustainable Crop Production, Food Security and Public Health in Sub-Saharan Africa. 10(1), 01-24, 2020

Fernandez, C., Y. Monnier, M. Santonja, C. Gallet, L.A. Weston, B. Prévosto, A. Saunier, V. Baldy, A. Bousquet-Mélou. 2016. The impact of competition and allelopathy on the trade-off between plant defense and growth in two contrasting tree species. Frontiers in Plant Sci. 7:594

Geimadil, R., B. Shokati, H. Shahgholi. 2015. Allelopathic effects of medicinal plants of lemon balm, lemon verbena and bitter apple on seed germination and early seedling growth characteristics of wild mustard weed. 49-254

Ghimire, B.K., M.H. Hwang, E.J. Sacks, C.Y. Yu, S.H. Ki, I.M. Chung. 2020. Screening of Allelochemicals in Miscanthus sacchariflorus Extracts and Assessment of Their effects on germination and seedling growth of common weeds. Plants 9:1313

Grisi, P.U., M.R. Forim, E.S. Costa, S. Anese, M.F. Franco, M.N. Eberlin and S.C.J. Gualtieri. 2015. Phytotoxicity and identification of secondary metabolites of Sapindus saponaria L. leaf extract. J. Plant Growth Reg. 34:339-349

Head, L. and J. Atchison. 2016. Ingrained: a human bio-geography of wheat: Routledge

Huang, H.C. and C.H. Chou. 2005. Impact of plant disease biocontrol and allelopathy on biodiversity and agricultural sustainability. Plant Pathol. Bull. 14:1-12

Husain, W.S., J.A. Saeed and A.M. Al-Mathedy. 2018. The effect of some crop residues in phenotypic and anatomic features of four weed species (*Silybum marianum* L. *Lolium rigidum* L., *Sonchus oleraceus* L., *Panicum* Spp.). Mesopotamia J. Agri. 46:393-406

Kaliyadasa, E. and S.L. Jayasinghe. 2018. Screening of allelopathic activity of common weed species occurring in agricultural fields. African J. Agri. Re. 13:2708-2715

Koley, T.K., C.Kaur, S. Nagal, S. Walia and S. Jaggi. 2016. Antioxidant activity and phenolic content in genotypes of Indian jujube (*Zizyphus mauritiana* Lamk.). Arabian J. Chem. 9:S1044-S1052

Latif, S., G. Chiapusio and L. Weston. 2017. Allelopathy and the role of allelochemicals in plant defence. Advan. Bot Res. 82:19-54

Majeed, A., Z. Muhammad, M. Hussain and H. Ahmad. 2017. In vitro allelopathic effect of aqueous extracts of sugarcane on germination parameters of wheat. Acta Agri. Slovenica 109:349-356

Mushtaq, W., M.B. Siddiqu and K.R. Hakeem. 2020. Mechanism of action of allelochemicals. Allelopathy: Springer. 61-66.

Muturi, G.M., L. Poorter, G.M. Mohren and P. Bala. 2012. Prosopis litter allelopathy decreases occurrence of Acacia tortilis in Turkwel riverine forest, in Northern Kenya. Conference: IUFRO-Fornessa Regional Congress 25-29 June 2012 at: Nairobi.

Pawar, K.B., A.V. Rawal. 2016. Allelopathic Potential of Bract Leachates of Bougainvillea spectabilis against Cosmos bipinnatus and Ipomoea marginata. J. Plant Prot. 11:13-23

Perveen, S., M. Yousaf, M.N. Mushtaq, N. Sarwar, M.Y. Khan and S. Mahmood. 2019. Bioherbicidal potential of some allelopathic agroforestry and fruit plant species against Lepidium sativum. Soil & Env. 38:11-18

Pratap, U.B., A. Kukreti, B. Singh and V. Khanduri. 2020. Allelopathic Influence of Quercus Species on Performance of Traditional Food Crops of the Western Himalayan Region. Indian Forester 146:688-696

Ramankutty, N., Z. Mehrabi, K. Waha, L. Jarvis, C. Kremen, M. Herrero and L.H. Rieseberg. 2018. Trends in global agricultural land use: implications for environmental health and food security. Annual Review Plant Bio 69:789-815

Saadaoui, E., J.J.M. Gómez, N. Ghazel, C.B. Romdhane, N. Massoud and E. Cervantes. 2015. Allelopathic effects of aqueous extracts of *Ricinus communis* L. on the germination of six cultivated species. International Journal of Plant & Soil Science 7(4): 220-227.

Safdar, M.E. 2015. Interference and management studies of Parthenium hysterophorus L. in maize: Ph. D. Thesis, University of Agriculture, Faisalabad, Pakistan

Saroj, P., B. Sharma, R. Bhargava and C. Purohit. 2002. Allelopathic influence of aqueous leaf extracts of ber (*Ziziphus mauritiana* L.) on germination, seedling growth and phytomass of groundstorey crops.

Shahrajabian, M.H., M. Khoshkharam, P. Zandi, W. Sun and Q. Chen. 2019. Jujube, a super-fruit in traditional Chinese medicine, heading for modern pharmacological science. J. Medic. Plant Stud. 7:173-178

Sher, A., A. Khan, L.J. Cai, M. Ahmad, U. Asharf and S.A. Jamoro. 2017. Response of maize grown under high plant density; performance, issues and management-a critical review. Adv. Crop. Sci. Tech. 5

Tyagi, S.R. and R. Agarwal. 2011. Analysis of *Zizyphus mauritiana* Lam. from Allelopathic Viewpoint. J. Func. Env. Bot. 1:133-138

Weidenhamer, J.D. and R.M. Callaway. 2010. Direct and indirect effects of invasive plants on soil chemistry and ecosystem function. J. Chem. Ecol. 36:59-69