EFFECT OF AQUEOUS EXTRACT OF ALLELOPATHIC TREES LEAF AND STEM ON THE WHEAT CROP GERMINATIONIN DERA GHAZI KHAN, PUNJAB (TEHSIL JAMPUR MOUZA MUHAMMAD PUR DEWAN) PAKISTAN

Ume Habiba[*], MuhammadAzhar Khan[*], Saima[*], Romaisa[*], Asia Siddiqui[**], Aleena fiyyaz[**]Hifza Saeed[***]

*****Botany Department Hazara UniversityMansehraKhyber PakhtunkhwaPakistan
******Botany Department Minhaj University Lahore Punjab Pakistan
[***]IT Department BahauddinZakariya University Multan Punjab, Pakistan

Abstract

Wheat (*Triticumaestivum* L.) is a significant food grain crop since it is a staple food. It is the primary source of proteins and calories for both animals and humans among cereal crops. Herbicides have an effect on the environment, the land, people, and animals.Allelopathy is an environmentally beneficial weed-control technique. *Avena sativa* L., *Brassica napus* L., *Chenopodium album* L., and *Lactuca sativa* L. seed germination was decreased by *Meliaazedarach* L. fruit extract. The major objectives of this study were to investigate how tree aqueous extract affected wheat seed germination and seedling growth through its allelopathic effects.The current study was carried out in the allelopathy Laboratory, of the Botany Department, Hazara University Mansehra, KhyberPakhtunkhwa Pakistan. The test was carried out using three varying concentrations of water extract, appropriately 5%, 10%, and 15%, using completely randomized designs. Radical and plumule lengths were determined after viewing the germination of wheat for seven days.The outcomes showed that a higher concentration of an allelopathic tree water extract boosted wheat germination. Wheat's radical and plumule lengths were dramatically lengthened at higher dosages of water extract (10% and 15%). The results of the present study are in benefit of the use of allelopathic tree extracts to control weeds in the wild and improve agricultural output.

Keywords: Allelopathic, germination, DG Khan, enhanced, Water extract

Introduction

The agricultural industry is a major contributor to Pakistan's GDP, employs more than 45% of the labor force, and provides direct or indirect support for 67% of the country's population. The performance of the nation's growth and a significant proportion of its population is likely to be impacted by any internal or external surprise that impacts agriculture (Bashir, *et al*., 2010)

Wheat (*Triticumaestivum* L.) is a significant food grain crop since it is a main component of the diet. It is the primary contributor of proteins and calories for both humans and animals among cereal crops. It includes vitamins (B-complex and vitamin E), starch (60-90%), fat (1.5-2%), protein (11.6%–16.5%), and inorganic ions (1.2–2%). It provides around 3.1% of GDP and 14.4% of the agricultural value added. It generates 3.1 percent of GDP and 14.4 percent of the value added in agriculture. 8.80 million hectares of wheat are harvested, producing 24.21 billion metric tons of wheat per year with an average yield of 2750 kg per hectare (Basit, *et al*., 2019). With the largest area under cultivation, wheat is a significant crop in Pakistan and contributes to economic stability. Several biotic and abiotic factors contribute to Pakistan's low wheat yield as compared to other developed nations(Khan, et al., 2012). Since it is a major source of food, wheat harvesting is crucial for everyone on the planet. The quantity of chromosomes detected in the vegetative cell is used to categorize different wheat species. They are separated into three series: I the diploid, or einkorn, with 14 chromosomes; (ii) the tetraploid, oremmer, with 28 chromosomes; and (iii) the hexaploid, or 42 chromosomes. There are three genomic groups in common wheat. The fundamental set of chromosomes in an organism is called its genome, and in the wheat species, this basic set has seven chromosomes (x=7). A species is classified as diploid if it has two homologous genomes (2n = 2x) and as tetraploid or polyploid if it has four or more genomes. Being a species with six genomes, or three pairs of genomes, common wheat is a hexaploid. Hence, 42 (2n = 6x = 42) chromosomes are somatically present in ordinary wheat. Common wheat may be described as AABBDD since the three genomes are identified by the letters A and Band D. The origins of the many wheat species are complicated yet fascinating. The natural species *Triticumurartu*, as well as a cultivated variety, still contain genome A, a diploid species (*Triticummonococcum*) (Ma, Y. 2005).

Approximately 71.45 million tonnes of wheat are produced in India annually, compared to a global average of 595.7 million tonnes. India thus generates around 12% of the wheat used worldwide. India produces 72 million tonnes of wheat annually, ranking second in the world only to China (97 million tonnes), with the United States (57.3), France (36.9), and Canada following (36.9). The greatest wheat-growing region in the world is in India (26.5 million hectares), which produces around 12.2% of the world's wheat (217 million ha) (Ramdas, *et al*., 2013). Sorghum, maize radicals, and wheat hypocotyls all grew faster when *M. oleifera* leaf extracts were combined with cereal seed. However, *M. oleifera* leaf extracts have adverse effects on rice radicals, sorghum hypocotyls, seedling survival, rice germination percentage, and delaying rice germination, which is likely to delay germination (Phiri, C. 2010). In addition to promoting wheat yield and yield components like days to 50% heading, plant height, tillers m-2, grain spike-1, 1000-gain weight, and biological and grain yield,allelopathic chemicals in the *Eucalyptus*, *Acacia*, *Sorghum*, Shishum, Sunflower, Poplar, *Tobacco*, and Congress grass plants' leaf water extracts significantly inhibited weed growth by reducing weed density and fresh and dry weed biomass. Even if wheat grain production is the greatest and fresh and dried weed biomass is the lowest(Khan, et al., 2015). Worldwide, post-emergence herbicides such 2, 4-D, imazamethabenz, fenoxaprop plus MCPA plus thifensulfuron plus tribenuron, bromoxynil plus MCPA, flufenacet, fenoxaprop-p-ethyl, metribuzin, and clodinafoppropargyl, and chlorotoluron + MCPA are used to manage weeds in wheat crops(Shehzad, *et al* ., 2012). In all test rice genotypes with the exception of KS-282 and IRRI-8, soil amendment with C. rotundus leaves encouraged the development of the roots and shoots. Significant genetic heterogeneity in C. rotundus competition tolerance was evident in tested rice genotypes(Javaid, *et al*., 2007).There should be an alternative to chemical herbicides. It is well known that plants may change the environment by releasing chemicals. One plant generates chemicals that have an impact on another plant's growth in the phenomenon known as allopathy(Rizvi,2012) . The term "allelopathy" (Greek: allelon, "of one another," and "to suffer") refers to the harmful effect of one plant on another and is formed from the words allelon and pathos. Allelopathy was first used in 1937 by Misch to explain the biochemical relationships between diverse crops and microbes that might be both harmful and useful (Bhadoria, 2011).Allelopathy is finally defined by the International Allelopathy Society as "any process involving secondary metabolites produced by plants, algae, bacteria, and fungi that harm the agricultural and biological system" in 1996. Chou, 2006 After Elroy L. Rice's first book on allelopathy was published in English in 1974, the idea of allelopathy implementation of sustainable development popularity. According to him, chemical chemicals released into the environment are what cause one plant's impact on other plants.

Finally, in 1996, the International Allelopathy Society defined allelopathy as "any process involving secondary metabolites generated by plants, algae, bacteria and fungus that damage the agricultural and biological system. Chou, 2006 after the release of *Elroy* L. Rice's first book on allelopathy in English in 1974, the concept of allelopathy picked renewed interest. He said that the effect of one plant on other plants is a result of chemical substances released into the environment.Allelopathy is defined as the suppression of the growth of one plant species by another plant due to the release of toxic compounds (Mallik, 2008).

The purpose of the current study was to determine whether allelopathic trees may increase wheat yield by utilizing leaf extract rather than herbicides. Due to dangerous herbicide residues in soil, water, and the food chain, the usage of herbicide has led to significant ecological and environmental problems, including herbicide resistance, weed flora changes, pollution, and health concerns.Allelopathy appears to be one alternative wheat-growing approach to consider because of the negative impacts of commercial herbicides. The goal of the study was to determine how allelopathic plants affected wheat germination in order to develop an organic fertilizer that would promote wheat crop germination and development.

Methodology

The test was performed at the Allelopathy Laboratory of the Botany Department, Hazara University Mansehra, KhyberPakhtunkhwa, Pakistan, to study further into allelopathic effects of the leaves and stem of six trees on wheat seed germination.

Collection of plant material

From a field close to Dera Ghazi Khan, the leaves and stem of the allelopathic trees *Acacia nilotica* L., *Albizialebbeck* L., *Mangiferaindica* L., *Ziziphusmauritiana*.,*Meliaazedarach* L., and *Dalbergiasissoo* L. were picked (Tehsil JampurMouza Muhammad PurDewan, Punjab). Variety was also obtained from Muhammad PurDewan's agricultural lands in order to evaluate how these trees were allelopathic to the germination of wheat.

Lab Experiment

Acacia nilotica L., *Albizialebbek* L., *Mangiferaindica* L., *Ziziphusmauritiana* L., *Meliaazedarach* L., and *Dalbergiasissoo* L. were the plants selected, and the leaves and stem were picked, dried in the shade, and crushed separately. A complete randomized design (CRD) was used to evaluate wheat germination in the lab.The stem and leaves of an allelopathic tree that had been dried and powdered were added to tap water at various concentrations (5%, 10%, and 15%) and left for 24 hours at room temperature. The extracts from the following parts were filtered using Whatman filter sheet No. 1, and the filtrate was then concentrated to a volume of 100 ml. Each bottle had a label and was kept in a separate container. The seeds were immersed in water for a day. Using two layers of Whatman filter paper and six treatments with two replications, the seven wheat seeds were germinated in Petri plates. The filter paper was then moistened with 10ml of the extract in each petri dish, while distilled water was the only liquid utilized in the control treatment. (Khan *et al*., 2016). In the allelopathy Laboratory, all Petri plates were incubated for 72 hours at 25 + 2 degrees centigrade for seed germination.Every day, check the Petri dishes and, if necessary, add additional extract. Radical and plumule lengths were measured using a tape measure, and germination percentages were noted every day for a week.

Factorial view of the experiment

Control 5% *Melia* L. 10% *Melia* L. 15% *Melia* L.

ANOVA and Statistical Software

The data analysis was performed statistically using one-way ANOVA (Computer Statistics 8.1). At the 0.05 percent probability level, the least significant difference (LSD) test was used to compare the mean values of the treatments (Wardle *et al*., 1992; Steel *et al*., 1997 Torrie, 1980).

Results and Discussion

The wheat radical length was significantly affected by water extract from allelopathic plant leaves (Table I). The data revealed that the germination of wheat was significantly ($p<0.0001$) affected by the aqueous extract of selected allelopathic trees. At the higher concentrations (15%) as well as the lower extract concentrations (5% and 10%), the radical length was significantly enhanced. The radical length increased along with the extract concentration. The allelochemical present in the leaf's aqueous extract may have important effects that lead to an increase in radical growth. The leaf aqueous extract (5%) of *Meliaazedarach* significantly increased the wheat germination and followed by the other selected trees. Theleaf aqueous extract of 10% *Meliaazedarach* and *Mangiferaindica* increase the plumule and radical length and followed by the other selected trees and 15% aqueous extract of *Meliaazedarach* and *Ziziphusmauritiana* significantly enhanced the wheat germination (Table 2).

Table 1. Analysis of variance for effects of allelopathic plants aqueous extract (Leaf) on radical and plumule length of Wheat

Factor	Parameters	DF	Sum of square	Mean of square	F ratio	P ratio	Parameters	Sum of square	Mean of square	F ratio	P ratio	Parameters	Sum of square	Mean of square	F ratio	P ratio
Allelopathic plants	5% aqueous extract effect on Plumule length (cm)	6	94.57	15.76	33.1	0.000	10% aqueous extract effect on Plumule length (cm)	94.57	15.76	33.1	0.000	15% aqueous extract effect on Plumule length (cm)	96.57	16.09	33.8	0.000
			6.66	0.47				6.66	0.476				6.667	0.47		
			101.2					101.2					103.2			
	5% aqueous extract effect on Radical length (cm)	6	73.80	12.30	28.7	0.000	10% aqueous extract effect on Radica length (cm)	73.80	12.30	28.7	0.000	15% aqueous extract effect on Radical length (cm)	188.0	31.33	94.0	0.000
			6.00	0.42				6.000	0.428				4.66	0.333		
			79.80					79.80					192.6			

Table 2. LSD for effects of allelopathic plants aqueous extract (leaf) on radical and plumule length of Wheat

Treatments	5% Plumule length (cm)	5% Radical length (cm)	10% Plumule length (cm)	10% Radical length (cm)	15%Plumule length (cm)	15%Radical length (cm)
Control(T0)	15.6 A	13. A	15.6 A	13 B	15.6 A	13.3 C
***Albizialebbeck*(T1)**	13. B	14. A	9.6 D	10.6CD	11.3 E	10.3 D
***Ziziphusmauritiana*(T2)**	12.3 B	11 B	13.3 B	11.6 C	13.3 CD	15.6 AB
***Acacia nilotica*(T3)**	10.6 C	10.3 B	11.6 C	14.6 A	13.6 BC	9.6 D
***Mangiferaindica*(T4)**	11.6 BC	13.3 A	15.6 A	10.0 DE	12.3 DE	8.3 E
***Dalbergiasissoo*(T5)**	15.6 A	14.6 A	11.6 C	9.3 E	8.6 F	14.6 B
***Meliaazedarach*(T6)**	16.6 A	14.6 A	14.6 A	13.6 AB	14.6 AB	16 A

Wheat plumule length was significantly increased by an aqueous extract of allelopathic tree stem as well (Table 3). All the selected trees increased the germination of wheat significantly (p=0.006). The data demonstrated that the higher concentrations (10%) of *Mangiferaindica* and *Acacia nilotica*promote plumule growth and followed by all the stems of selected allelopathic trees, with the 15% stem aqueous extract of allelopathic trees showing a positive effect on wheat mentioned above as in table 4. The stem aqueous extract of *Albizialebbeck*and *Ziziphusmauritiana*increased the wheat plumule and radical length and followed by all other selected trees lower concentrations (5%) of stem aqueous extract of *Mangiferaindica* increased the wheat plumule and radical length significantly. These findings are consistent with the findings of (Phiri, C. 2010).

Table 3. Analysis of variance for effects of allelopathic plants aqueous extract (Stem) on radical and plumule length of Wheat

Factor	Parameters	DF	Sum of square	Mean of square	F ratio	P ratio	Parameters	Sum of square	Mean of square	F ratio	P ratio	Parameters	Sum of square	Mean of square	F ratio	P ratio
Allelopathic plants	5% aqueous extract effect on Plumule length (cm)	6	41.80	6.96	2.57	0.06	10% aqueous extract effect on Plumule length (cm)	27.90	4.6	0.63	0.70	15% aqueous extract effect on Plumule length (cm)	31.80	5.30	1.71	0.19
			38.00	2.71				102.6	7.3				43.33	3.09		
			79.80					130.5					75.14			
	5% aqueous extract effect on Radical length (cm)	6	10.47	1.74	0.67	0.67	10% aqueous extract effect on Radical length (cm)	34.66	5.77	2.38	0.08	15% aqueous extract effect on Radical length (cm)	20.00	3.33	0.62	0.70
			36.66	2.61				34.00	2.42				74.6	5.33		
			47.14					68.6					94.6			

Table 4. LSD for effects of allelopathic plants aqueous extract (Stem) on radical and plumule length of Wheat

Treatments	5% Plumule length (cm)	5% Radical length (cm)	10% Plumule length (cm)	10% Radical length (cm)	15% Plumule length (cm)	15% Radical length (cm)
Control(T0)	15.6 AB	13.3 A	15.6 A	13.3 AB	15.6 AB	13.3 A
***Albizialebbeck*(T1)**	15.0 B	13.6 A	15.6 A	12.0 ABC	18.0 A	14.6 A
***Ziziphusmauritiana*(T2)**	15.0 B	11.6 A	14.0 A	10.3 C	16.0 AB	15.0 A
***Acacia nilotica*(T3)**	13.0 B	12.6 A	16.0 A	12.3 ABC	14.6 B	12.3A
***Mangiferaindica*(T4)**	18.0 A	12.6 A	16.0 A	14.6 A	15.3 AB	14.0 A
***Dalbergiasissoo*(T5)**	14.3 B	12.3 A	13.3 A	11.3 BC	13.6 B	14.0 A
***Meliaazedarach*(T6)**	14.6 B	11.6 A	13.3 A	12.3 ABC	15.6 AB	12.3 A

The length of the wheat radical was extended by the stem aqueous extract of allelopathic trees. The control was successful in attaining a maximum radical length. A highly significant effect on radicals was shown at 5%, 10%, and 15% concentrations of stem aqueous extract. The wheat plumule length is increased by the stem aqueous extract of allelopathic plants. The control showed the maximum plumule length. At a 15% concentration of stem aqueous extract, radical length was significantly impacted.

Distinct leaf and stem concentrations of different allelopathic plants (*Acacia nilotica*, *Albizialebbek*, *Mangiferaindica*, *Ziziphusmauritiana*, *Meliaazedarach*, and *Dalbergiasissoo*) had different effects on the germination of wheat. The germination was significantly increased by allelopathic plants with the highest concentration of leaf and stem aqueous extract (15%). Distinct leaf and stem concentrations of selected plants affected the germination of wheat in different ways. Even while all treatments started germination on the same day, it resembled the control and stayed there until day 7. *Albizialebbeck* revealed a minimal allelopathic impact, but *Meliaazedarach* leaf concentrations of 5%, 10%, and 15% had a considerable allelopathic impact. Germination increased as the concentration increased (Khan *et al*.2015)and found similar results. The stem of *Mangiferaindica* demonstrated a considerable positive allelopathic effect on plumule length, whereas *Dalbergiasissoo* had the least. While *Ziziphusmauritiana* and *Albizialebbeck* stems had a positive impact on wheat seed germination, The *Acacia nilotica* stem had a less significant impact on radical length.

Conclusion and recommendation

Allelochemicals included in the allelopathic plant enabled it for larger quantities of water extract from allelopathic trees to boost wheat germination, radical, and plumule growth. Separate the allelochemicals from the organic herbicides. Allelochemicals contained in allelopathic plants can be separated using organic herbicides that can be manufactured. Even though it was only a preliminary laboratory study, the findings were positive and served as a foundation for further investigation.

Reference

Bashir, M. K., Mehmood, Y., and Hassan, S.(2010) Impact of agricultural credit on productivity of wheat crop: Evidence from Lahore, Punjab, Pakistan. *Pakistan Journal of Agricultural Science*, *47*(4), 405-409.

Basit, A., Irshad, M., Salman, M., Abbas, M., and Hanan, A. (2019) Population dynamics of weeds (canary grass, broad leave, and wild oats), Aphid and Abiotic factors in association with wheat production in Southern Punjab: Pakistan. *J ApplMicrob Res*, *2*, 17-23.

Khan, A. M., A. A. Khan, M. Afzal and M. S. Iqbal. (2012) Wheat crop yield losses caused by the aphids infestation. *Journal of BiofertilBiopestici*, *3*(4); 2-7.

Ma, Y. (2005). Allelopathic studies of common wheat (*Triticumaestivum* L.). *Weed Biology and Management*, *5*(3), 93-104.

Ramdas, S., R. Singh and I. Sharma. (2013) Exploring the performance of wheat production in India. *Journal of Cereal Research*, *4*(2); 37-44.

Phiri, C. (2010) Influence of *Moringaoleifera* leaf extracts on germination and early seedling development of major cereals. *Agriculture and Biology Journal of North America*, *1*(5), 774-777.

Khan, E. A., Khakwani, A. A., and Munir, M. (2015) Effects of allelopathic chemicals extracted from various plant leaves on weed control and wheat crop productivity. *Pakistan Journal of Botany*, *47*(2), 735-740.

Shehzad, M. A., Nadeem, M. A., and Iqbal, M. (2012) Weed control and yield attributes against post-emergence herbicides application in wheat crop, Punjab, Pakistan. *Global Advanced Research Journal of Agricultural Science*, *1*(1), 7-16.

Javaid, A., Bajwa, R., Rabbani, N., and Anjum, T. (2007) Comparative tolerance of rice (*Oryza sativa* L.) genotypes to purple nutsedge (Cyperusrotundus L.) allelopathy. *Allelopathy Journal*, *20*(1), 157.

Rizvi, S. J. (Ed.). (2012) *Allelopathy: basic and applied aspects*. Springer Science and Business Media.

Bhadoria, P. B. S. 2011. Allelopathy: a natural way towards weed management. *Journal of Experimental Agriculture International*, 7-20.

Mallik, A. U. (2008) Allelopathy: advances, challenges and opportunities. In *Allelopathy in sustainable agriculture and forestry* (pp. 25-38). Springer, New York, NY.

Khan, M. A., Z. Iqbal, M. Hussain and I. U. Rahman. (2016)Allelopathic effect of some tree fruits on wheat (*Triticumaestivum* L.)," *International Journal of Biosciences,* vol. 9, pp. 120-125.

Wardle, D. A., K. S. Nicholson. (1992)Comparison of osmotic and allelopathic effects of grass leaf extracts on grass seed germination and radicle elongation.*Plant Soil*, *140*(2); 315-319.

Steel, R. G. D and J. H. Torrie. (1980)Analysis of covariance." Principles and procedures of statistics: *A Biometrical Approach*, 401-437.