INHIBITORY IMPACT OF WHITE CEDAR (*Melia azedarache*)LEAVES LITTER ON WHEAT (*Triticum aestivum*) SEEDLINGS

Iqtidar Hussain[1], Ejaz Ahmed Khan[1], Jawad Nazir and Ehtesham-ul-Haq[1]

DOI: https://doi.org/10.28941/pjwsr.v27i2.876

Abstract

A biological phenomenon by which one plant releases some chemicals in the environment that affect the rate of germination, seedling emergence, physiology and overall growth of neighbouring plants is called allelopathy. The significance of study was checked allelopathic phytochemical potential of white cedar vern. Bakain (*Melia azedarach*L.) leaves on wheat.Leaveslitter was used to examine the allelopathic effects of *M.azedarach* at five concentrations (100, 200, 300, 400 g, control). The studied parameters were germination percentage (%), Speed of germination, plant height (cm), root length (cm), Shoot length (cm), coleoptile length (cm), fresh weight (g), dry weight (g), tiller (plant^{-1}) and chlorophyll content (µg cm^{-2}) of *Triticum aestivum.*All concentration of Leaves litterof *M. azedarach*showed pronounced inhibitory effect on all parameters of *T. aestivum. M. azedarach* exerted phytotoxic influence on *T. aestivum* at initial growth stages. *M.azedarach*exhibited a significant negative impact on germination of *T. aestivum*at100, 200, 300, 400 glitterof leaves than control (sterilized soil).*M. azedarach*halted the coleoptilelength of *T. aestivum*@ 400 gleaves litter^{-1} (T4). Powdered leavesof *M. azedarach*in clay loam soil appeared to have strong allelopathic inhibition under maximum concentrations on growth and germination of*T. aestivum.*Hence, *M.azedarach* proved to be a strong allelopathic plant that should be planted aside from field to avoid harmful impacts during early growth stages of *T. aestivum*.

Keywords: Allelopathy, inhibitory impact *, Melia azedarach*, , wheat.

Citation: Hussain, I.,E.A. Khan, J. Nazir, E.U. Haq. 2021. Inhibitory Impact Of White Cedar (Melia Azedarache) Leaves Litter On Wheat (Triticum Aestivum) Seedlingspak. J. Weed Sci. Res., 27 (2):191-200.

[1] Department of Agronomy, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan.
Corresponding email: iqtidarhussain453@yahoo.com

Introduction

Allelopathy is a biologicalphenomenon that refers to impact of chemicals released by plants, microorganisms on development and growth of neighbouring plants in agriculture (Anwar *et al*., 2019).These allelochemicals when discharged by the plants into environment have adverse influence on seedling emergence, growth and development of neighbouring plants (Mushtaq *et al.*, 2020). The allelopathic effects mayhaverestrain substances that are released from the living plants directly into environment vialeaching, root exudation & volatilizationof plants andfurtherdevelopments in both agricultural &natural ecosystem (Rice, 1984; Narwal *et al*., 2011).These allelochemicals include glucosinolates, flavonoids phenols, alkaloidsand some acids like other natural compounds, these chemicals have biotic effects and can be useful for weed control inagriculture systems (Anwar *et al*., 2013).Bread wheat is the one most important cereal-grains worldwide. In Pakistan, Alley cropping of wheat is practiced in different tree plantation to obtain economic value of trees with crop like wheat crop also.In this context, wheat is growing under trees and that affect *Triticum aestivum* through their allelopathic releases. They release allelochemicals through root exudation andleaf leachates and hinder wheat germination, plant development and its growth. In short, some plants neighboring its field, interfered in its vigorous growth and development (Saleem *et al*., 2019). *Melia azedarach*family Meliaceae also known as Persian lilac, or Indianlilaclocally known as Bakain, is a deciduous tree. It is native to Indo Pak sub continent(Nandal and kumar, 2010)

It is commonly planted along the canal side in irrigated area & its foliage is used for fodder purpose also. It dropped their leaves in autumn and winter. After falling these leaves in canals, fresh and decomposed leaves entered in the cropped area. The authors are not aware of any results of the research on the allelopathic effect of this plant. It has been difficult to make an absolute connection between assumed allelochemical inhibitorsand reduction in plant growth, germination that characterizes a particular allelopathic situation. A characteristic feature of allelopathy is inhibitory effect of allelopathic compounds is concentration dependent. It is planted by farmers in our agroforestry systems either block or boundary plantations, preferred in alley cropping system of agro-forestry and ornamental purpose (Krishnan *et al*., 2009; Hanif and Bari, 2013). It helps to increase fertility of soil by some extent (Nandal and Kumar, 2010). In view of the above review it was imperative to conduct an experiment involving different concentrations of leaves of Bakain (*Melia azedarach*)on wheat germination and seedling physiology.

Materials and Methods

The present investigation was undertaken to investigate the allelopathic effect of leaves litter of white cedar (*Melia azedarach* L.) on germination, speed of germination, plant height, Root Length, Shoot Length, coleoptile length, Fresh and Dry weight, Tiller (plant^{-1}) and chlorophyll content (μ cm^{-2}) of Wheat (*Triticum aestivum*) in Post-graduate Agronomy Lab., Faculty of Agriculture, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa Province, Pakistan during 2019. The details of the experiment are as under:

1. Plant material and preparation of Leaves Litter

Leaves (mixture of young and mature leaves showing signs of senescence) of Bakain (*Melia azedarach* L.) were collected from 3 years old plantation during October-November, 2019.The dried leaves litter was stored at room temperature.Leaves litter was ground to powder form with the help of a grinder. Course grounded leaf litter of 100, 200, 300, 400 g (4, 8, 12, 16% respectively to the weight of soil) was applied per pot and was mixed in the upper soil layer in the pots with a control treatment (sterilized soil). For each treatment, three replications were considered. Pots were irrigated (2 L/ pot) with water (pH 7.71, electrical conductivity 1.752 S/m) a day prior to seed sowing and approx. one liter water was applied on subsequent days to keep the soil moist. The seed germination and seedling growth were recorded after ten days of sowing. In each pot, only 6-seeds were sown and one healthy seedling was retained 2-weeks after sowing. At 30 days after sowing, fresh and dry weight of plant and other germination physiological data were recorded. Chlorophyll contents in five leaves per plant in each treatment was measured with SPAD photometer. Coleoptile length (cm) was measured with scale.

2. Pot experiment details

Total six seeds were sown on soil filled in the plastic pots [18 cm diameter x 16 cm height (4070 cc)] containing approximately 2.5 kg normal soil (N, P and K content 84.82, 17.85 and 80.35 ppm, respectively).

3. Statistical analysis

The experimental data recorded for all the parameters in this experiment was laid out in in completely randomized design and data were subjected Ftestand the significant means were separate using Least Significant Difference as suggestedby Sheron *et al*. (1998).

Results and discussion

1. Germination %

Results revealed that T2, T3, T4 (leaves litter) of *M. azedarach* inhibited seed germination (55.5 %) respectively as compared to control (Table 1).Leaveslitter of various concentration of *M. azedarach* had significant impact on Germination percentage (%). However maximum (88.83 %) germination was observed in control treatment and minimum germination percentage (55.5%) was noted by application of leaves litter @ 200, 300, and 400 g per pot,respectively. The results revealed that allelopathic inhibitory effect was concentration dependent for *Melia azedarach*increased concentration over 100 gm, induced more pronounced reduction. The present study of allelopathic potential of *Melia azedarach*leaves litter highly inhibited seed germination of wheaton soil media. These findings are in accordance to the previous findings where it was reported that root and shoot elongation along with germination percentage of *wheat* seedling was significantly checked by *M. azedarach*aqueous extract (Wabo *et al.,* 2011). This *allelopathic potential* may be attributed to the presence of some inhibitory secondary metabolites such as chlorogenic acid, quercetin, kaempferol, caffeic acid, p-coumaric acid and protocatechuic acid reported in various parts of some forest plants(Canini *et al*., 2007). Water being highly polar can dissolved maximum allelochemicals such as phenolics from a plant parts (Miean *et al*., 2001) and may cause death of embryo in the seed by imbibition process. Hussain *et al*. (2019) also confirmed our results and they reported that indian lilac (*Melia azedarach* L.) and neem (*Azadirachta indica* L.) inhibited the germination in maize by applying their 20 % concentrated aqueous extract.

2. Speed of germination

Various leaves litter concentrations significantly affected on the speed of germination of wheat crop (Table 1). It was vivid that the concentrations had inhibited the speed of germination of *Triticum aestivum*. With the increasing concentration of leaves of *M. azedarach*then speed of germination of*Triticum aestivum* decreased. 400 g leaves litter concentration badly affected and reduced the speed of germination of *Triticum aestivum*. Control treatment had higher speed of germination (10.93).Enhanced level of parthenium concentrations posed more negative influence on the speed of germination of *Triticum aestivum*as reported by Hassan *et al*., (2008). Higher *Parthenium* aqueous extracts reduced the speed of germination significantly (Tefera, 2002).Likewise, inhibitory impact was also reported in chickpea at higher concentration of parthenium extract. Our results indicated that pots highly enriched with Indian lilac leavesproduce more allelochemicals which may prove lethal to economic crops. Khaliq *et al*. (2016) also agreed with our research and concluded that some plant extracts reduced the speed of germination.

3. **Plant height (cm)**

Data pertaining to plant height were affected significantly by various concentrations of Leaves litter of *M. azedarach* (Table-1). Mean values for various concentration of leaveslitter revealed that 400 g pot^{-1}had lower plant height (18.35 cm) than all other leaves litter (i.e. 100, 200 & 300 g) while control treatment had tallest plants (33.66 cm). Hussain *et al* (2019) also registered short plant height of maize by applying neem and indian lilac (*M. azedarach*) aqueous solution as compared to control where only water was applied. It might be due to presence of allelochemicals in indian lilac leaves which cause hindrance in water uptake and growth of plant. Similarfinding was recorded by Kasarkar and Barge (2016) in maize by application of neem (*Azadiracta indica* L.) leaves extract. Reinhardt*et al*. (2006) reported thesignificant effects of parthenium extracts on wheatin studied parameters (plant height, root length, shoot length) of the crop. If the parthenium extracts keep on increasing, plant stature might get adversely affected.Parthenin released from the leaves of parthenium has greater allelopathic potential when it gets decomposed however, it is dependant on the quantity of leaf material on soil stratum and the parthenin concentration therein.Hassan, *et al.* (2018) also suggested that Parthenium extract may cause soil toxicity and therefore inhibition of subsequent crop growth.

Root length (cm)

Statistical analysis revealed that root length was significantly influenced by different concentration of leaves litter of *M. azedarach* (Table-1). It was noted that higher concentration of leaves litter (400 g lit^{-1}) greatly reduced root length of wheat crop. Maximum reduction in root length (5.00 cm) was recorded with the application of 400 g leaves litter per pot. The study also expressed that lower concentration (100 g pot^{-1}) of leaves litter had minimum effects on root elongation while control treatment had no effect on roots of wheat crop. Phytochemicals involved in allelopathy in some plants may decrease the permeability of cell membrane which cause reduction in root length (cm). Our results are confirmed by Shinwari *et al*., (2017). Hussain and Shah (2017) also concluded from their result that allelo-chemicals disturbed the normal permeability and plant water uptake. Similar observations were also registered by Gulzar and Siddique (2014) who reported that increasing *Pennisetum glaucum* aqueous extract concentrations reduced root length. Similar inhibitory effect of leaf leachate extract of fruit tree on cereal and pulse crops have also been reported (Sale & Oyun 2013; Thakur, 2014). *Melia dubia* higher aqueous leaf extracts (over 50% concentration) inhibited the root growth of black chickpea was reported by Thakur *et al*., (2017). The alleleo-chemicals may hinder nutrient uptake or even hamper shoot/root growth, or in some cases the symbiotic relationship might get destroyed causing impairment of plant usable nutrient sources (Safdar *et al*., 2019).

4. **Shoot length (cm)**

Shoot length was significantly affected by different concentration of leaves litter of *M. azedarach* (Table-1). Data analysis showed that highest concentration (300, 400 g pot^{-1}) of *M. azedarach*leaves litter reduced shoot length (8.33cm). However, longest shoot length was recorded in control.The results of the present study show that present reducing effect of leaves litter of *M. azedarach* was more pronounced on initial shoot growth as compared to root growth. Similar organ specific effects of *M.azedarach* leaf aqueous extracts have been reported by Phuwiwat *et al.,* (2012) on *Echinochloa crus-galli*and Akacha *et al.,* (2013) on radish against leaf leachates of *M.azedarach*, in laboratory bioassays. Shapla *et al.,* (2011) have reported inhibitory effect of *M. azedarach*on shoot length, initial growth in pot culture experiments. The roots first come in contact with allelochemicals (Rezaeinodehi *et al.,* 2006) and are the first to absorb them from the environment in which they are growing (Kimber, 1973). This may also be attributed to the fact that, cell death and tissue browning frequently occur in the root apical zone, an area with active cell division, when roots are exposed to allelopathic agents (Ding *et al.,* 2007). Similar to present findings, several studies have shown that young seedlings, especially the roots, are more sensitive to allelopathic agents than adult plants or other plant organs (Zhang *et al.,* 2010). The leaf leachates hamper the physiological processes of the seedlings growing in such environment. Gulzar and Siddiqui (2014) reported that higher concentration of aqueous extract was more effective in controlling weed growth in early seedling stages.

5. Coleoptile length (cm)

Coleoptile is a vital organ for success emergence in drought conditions.Coleoptile is the protective sheat surrounding the emergence shoot, apical meristem and leaf primordial (Plumule) of the grass embryo; often considered as vigour of the seedling. It is mostly genetic character and less influenced by exogenous factors in wheat. It helps the plant to reach the soil surface in case of deep sowing (Zhang and Wang, 2012). Coleoptile length was significantly affected by variable concentration of *M. azedarach*Leaves litter (Table-2). Analysis data revealed that highest concentration (400 g) of Leaves litter of *M. azedarach* reduced shoot length (1.32 cm) as compared to lower concentration (100 g) of Leaves litter of *M. azedarach*, while control treatment had more the coleoptile length (2.00 cm).Conflicted results were found by Malik *et al*., (2019) who reported that coleoptile Length increases with increase the Leaves litter of millet upto some extent. A significant interaction was noticed between allelopathic potential of leaf aqueous extracts of donor species and coleoptile length of test plants, as *Flacourtia indica*indicated strongest allelopathic potential on coleoptile growth of *Trifolium* spp., whereas *Mangifera indica*displayed lowest allelopathic effects on coleoptile length of *Trigonella foenum-graecum* (Mustafa *et al*., 2019). Rebetzke *et al*. (2005) revealed that more stubble or plant residues in the field showed negative impact on seedling attributes of wheat specially delay in seedling emergence & shorter coleoptile length. Lassi *et al*. (2015) having the view that coleoptile growth of wheat is sensitive to abiotic stress specially drought and alleleo-chemicals present in the soil from neighboring plants.

6. **Fresh weight (g)**

The data indicated that fresh weight of the wheat decreased with increasing concentration of Leaves litter of *M. azedarach*(Table-2). The concentration means show that 300and 400 g Leaves litter had the lowerfresh weightrespectivelythan other concentrations of leaves (100, 200, g leaves litter) while control had maximum fresh weight (303.33 g) which is not treated by leaves of *M. azedarach*. All Leaves litter of *M. azedarach*markedly inhibited all parameters (fresh weight, dry weight, germination) but inhibitory effect increases with increasing concentration and time period. Leaves andseed of *M. azedarach*had more inhibitory effect than other parts of tree when compared (Blez, 2016). The chemicals which show allelopathic activity are present in different parts of plants including stem, leaves, flowers, seeds and fruits. These chemicals are released into the environment by means of leaching, root exudation, decomposition of residue and volatilization (Oyun, 2006). Our results predicated that wheat seedling is badly affected by leaves litter & its decomposition in the soil. Leaves litter of various concentrations badly affected the fresh weight of wheat. Similar results were also obtained by Khan *et al*, (2009) in wheat after treatment with Euclyptus extract.

7. **Dry weight (g)**

Statistical analysis of the data showed that different concentrations had a significant effect on dry weight of the wheat plant (Table 2). The data indicated that 400 g leaves litter concentration effectively inhibited dry weight (2.03 g) of wheat plant as compared to other concentrations (100, 200 &300 g Leaves litter concentrations) while control treatment had maximum dry weight (30.33 g) of wheat seedling. Leaves and stem of *Calatropis procera* had inhibitory effect on germination and fresh and dry weight of *Pennesitum americanum* L. Both plants showed inhibition in dry and fresh weight similarly. Higher dose of *M. azedarach*leaves extract showed more inhibition than other plants and their parts (Khan *et al*., 2011). Similar result was found by Lungu *et al*. (2011) who reported that various levels of oneplant extract had significant effect on fresh and dry weight of other plant. Neem and indian lilac extract adversely affected the growth of maize seedling and caused reductionin weight also reported by Hussain *et al*. (2019).

8. Chlorophyll contents (µg cm^{-2})

The data presented in Table-2 elucidated that leaves litter of indian lilac caused maximum adverse impact on chlorophyll contents of wheat by maximum concentration of 400 g. 100 gram leaves litter have positive influence on chlorophyll content. Chlorophyll content (15.02 µg cm^{-2}) was noted in control lower than 100 gram leaves litter (16.03 µg cm^{-2}). In lower concentration, allelochemicals may be act as Auxin, which have positive effect on growth. Yazdani and Bagheri (2011) also reported that chlorophyll contents of soybean are badly influenced by application of tobacco leaves extract. Reduction in chlorophyll content may causes reduction in photosynthesis and also found reduction in abiotic activities. Hussain *et al*. (2019) also reported that chlorophyll content of maize seedling were adversely affected by different plants extracts**.**

9. **Tillers per plant**

Tillers per plant are an important tool for economic productivity of wheat. Data in table-2 indicated the significant impact of leaves litter on tillers per plant of wheat seedling. Data showed adverse effect of leaves litter on wheat seedling growth. As the concentration of leaves litter increased, the number of tiller per plant reduced. It is a clear trend of declining in the growth habit of wheat seedlings. Maximum tillers per plant (4.15) obtained where only water was applied in soil (control). Minimum count was registered in maximum concentration (0.62). It means allelochemicals present in leaves litter released after decomposition in soil and badly affected the growth of wheat seedling. Similar result was found by Khan *et al*., (2011). When higher concentrated extracts (50 and 75%) of *Chenopodium album* L. were applied which had detrimental effects on number of tiller per plantofwheat.

Table1. Allelopathic effect of *Melia azedarach* on Germination (%), Speed of germination (days), Plant height (cm), Root length (cm), Shoot length (cm) of Wheat.

Treatments	Germination (%)	Speed of germination (days)	Plant height (cm)	Root length (cm)	Shoot length (cm)
T1:Leaves litter @ 100 g L^{-1}	72.16 ab	10.46 a	26.66 b	10.33 bc	15.00 bc
T2: Leaves litter @ 200 g L^{-1}	55.5 b	10.24 a	22.66 bc	10.00 bc	12.66 bc
T3: Leaves litter @ 300 g L^{-1}	55.5 b	9.81 b	19.00 c	7.66 c	8.33 c
T4: Leaves litter @ 400 g L^{-1}	55.5 b	9.28 b	18.35 c	05.00 c	8.33 c

T5: Control	88.83 a	10.93 a	33.66 a	27.66 a	22.66 a
$LSD_{0.05}$	**14.48**	**0.54**	**5.58**	**6.45**	**6.8**

Table 2. Allelopathic effect of *Melia azedarach* on Tiller plant^{-1}, Chlorophyll content (µg cm ^{2}), Coleoptile length (cm), Fresh weight (g), Dry weight (g) of wheat.

Treatments	Tiller plant^{-1}	Chlorophyll content(µg cm^{-2})	Coleoptile length (cm)	Fresh weight (g)	Dry weight(g)
T1:Leaves litter @ 100 g L^{-1}	3.61 ab	16.03 a	2.66 a	146.67 b	12.66 b
T2: Leaves litter @ 200 g L^{-1}	2.45 b	13.25 b	3.00 a	100.00 b	11.00 b
T3: Leaves litter @ 300 g L^{-1}	1.51 bc	10.02 c	2.00 b	50.00 c	3.00 c
T4: Leaves litter @ 400 g L^{-1}	0.62 c	6.35 d	1.32 c	50.33 c	2.03 c
T5: Control	4.15 a	15.02 a	2.00 b	303.33 a	21.33 a
$LSD_{0.05}$	**1.92**	**2.06**	**0.6**	**109.12**	**8.94**

Conclusion

It is concluded that the Leaves litter of *M. azedarach* did influence the studied parameters in wheat seedlings which confirms the presence of allelochemicals in Bakain leaf extracts. Therefore, it is recommended not to plant Bakain near the wheat fields. Because it badly affects germination and growth of wheat. It is suggested from these results that growing of plant Bakain (*M. azedarach*) in agro-forestry may not be encouraged so that growth inhibition of field crops could be avoided. However, in barren and marginal lands, their cultivation may be encouraged due to the ability of these plants to change micro climate of that area.

References

Akacha M, Boughanmi NG, Haouala R. 2013. Effects of *Melia azedarach* leaves extracts on radish growth and oxidative status. Int. J. Bot. Res., 3: 29-42.

Anwar, T. A. U. S. E. E. F., Ilyas, N., Qureshi, R., and Malik, M. A. 2019. Allelopathic potential of *Carica papaya* against selected weeds of wheat crop. Pak. J. Bot., 51(1), 1-37.

Anwar, T., Khalid, S., Arafat, Y. Sadia, S. and Riaz, S.. 2013. Allelopathic suppression of *Avena fatua* and *Rumex dentatus* in associated crops. Pak. J. Weed Sci. Res., 19: 31-43.

Belz R.G. Investigating a potential Auxin-Related Mode of Hormetic/Inhibitory Action of the Phytotoxin Parthenin. J Chem Ecol. 2016;42:71-83.

Canini, A., Alesiani, D. Arcangelo, G. and Tagliatesta, P. 2007. Gas Chromatography-Mass Spectrometry analysis of phenolic compounds from *Carica papaya* L. leaf. J. Food Compos. Anal., 20: 584-590.

Ding, J., Sun, Y., Xiao, C.L., Shi, K., Zhou, Y.H. and Yu, J.Q. 2007. Physiological basis of different allelopathic reactions of cucumber and figleaf gourd plants to cinnamic acid. J. Exp. Bot., 58:3765-3773.

Gulzar, A. and M.B. Siddiqui. 2014. Allelopathic effect of aqueous extracts of different part of *Eclipta alba* [L.] Hassk. on some crop and weed plants. J. Agric. Ext. Rural Dev., 6 (1):55-60.

Hanif, M.A., and Bari, M.S. 2013. Potentiality of potato based agrisilvicultural land use system in the northern part of Bangladesh. Sci. Sec. J. Biotechnol., 2 (2): 61-65.

Hassan G. et al. 2008. Efficacy of some forest species extracts on wheat and two major weeds of Arid Zone of NWFP. Jap. J. Plant Sci.2(2):39-42.

Hassan, G., Rashid, H. U., Amin, A., Khan, I. A., and Shehzad, N. 2018. allelopathic effect of *Parthenium hysterophorus* on germination and growth of some important crops and weeds of economic importance. Planta Daninha, 36.

Hussain, 1., M. S. Baloch, E. A. Khan and A. A. Khan 2019. Morphological and physiological response of maize to some allelopathic plant extracts Pak. J. Weed Sci. Res., 25(2): 137-145.

Hussain, I. and Shah, A.N. 2017. Allelopathic potential of *Eucalyptus camaldulensis* L. as an organic herbicide. Pak. J. For., 67 (1&2): 36-44.

Kasarkar, A. R. and A. N. Barge. 2016. Effect of aqueous extract of neem (Azadiraciata indica A. Juss.) leaves on germination and growth of some agricultural crops. J. Medicinal plants stud., 4: 11-13.

Khaliq, A., Aslam, F., Matloob, A., Javaid, A., Tanveer, A., Hussain, S., & Ihsan, M. Z. (2016). Phytotoxic activity of parthenium against wheat and canola differ with plant parts and bioassays techniques. *Planta Daninha*, *34*(1), 11-24.

Khan, M., Hussain, F. and Musharaf, S. 2011. Allelopathic potential of *Rhazya stricta* Decne on germination of *Pennisetum typhoides*. Int. J.Biosci., 1(4): 80-85.

Khan, M.A., R.E. Blackshaw and K.B. Marwat. 2009. Biology of milk thistle and management options for growers in northwest Pakistan. Weed Biol. Manag., 9:99-105

Kimber, R.W.L, 1973. Phytotoxicity from plant residues. III.The relative effect of toxins and nitrogen immobilization on the germination and growth of wheat. Plant Soil, 38: 543-555.

Krishnan, K.M., Neeraja, G., Subrahmanyam, M.V.R. and Bheemaiah, G. 2009. Production potential of sunflower alley cropped with neem and melia under dry land condition. Ann. Agric. Res., 30:14-18.

lassi, 1., Y. S. Liti, S. Elbok and M. Elgazzah. 2015. Characteristics of seed, Roots and Coleoptile growth affected by the salt stress and high temperature of two tunisian landrace varieties of Durum wheat (Triticum durum). Journal of Agriculture and Food technology, 5(4): 1-7.

Lungu, L., C.L, Popa, J. Morris J. and Savoiu, M. 2011. Evaluation of phytotoxic activity of *Melia azedarach* L. extracts on *Lactuca sativa* L. Rom. Biotechnol. Letters, 16:(2);6089-6095.

Malik, M. W. I., I. Hussain, M. S. Baloch, M. A. Nadim, A. U. Sayal and A. U. Khan. 2019. Pennisetum glaucum suppresses growth of some weed species. Pak. J. Weed Ci. Res. 25 (4):337-347

Miean, K., H. Mohamed and S. Flavanoid. 2001. Myricetin, Quercetin, Kaempferol, Luteolin, and Apigenin: content of edible tropical plants. J. Agric. Food Chem., 49:3106-3112.

Mushtaq, W., M. Mehdizade, M. B. Z. Siqqiqui, M. Ozturk, K. Jabran and V. Altay. 2020. Phototoxicity of above ground weed residue against some crops and weeds. Pak. J. Bot., 52(3): 851-860.

Mustafa, G., Ali, A., Ali, S., Barbanti, L. and Ahmad, M. 2019. Evaluation of dominant allelopathic weed through examining the allelopathic effects of four weeds on germination and seedling growth of six crops. Pak. J. Bot., 51(1), 269-278

Nandal, D.P.S., and Kumar, R. 2010. Influence of Melia azedarach based land use system on economics and reclamation of salt affected soil. Ind. J. Agrofor., 12:23-26.

Narwal, S.S., Pavlovic P. and John, J. 2011. Forestry and Agroforestry- Research Methods in Plant

Science, Vol 2. Studium Press Houstan Taxas USA, Pp. 249.

Oyun, M.B. 2006. Allelopathic potentialities of Gliricidia sepium and Acacia auriculiformis on the germination and seedling Vigour of Maize (Zea mays L.) Amer. J. Agr. Biol. Sci. 1 (3): 44-4.

Phuwiwat W, Wichittrakarn W, Laosinwattana C, Teerarak M (2012) Inhibitory effects of Melia azedarach leaf extracts on seed germination and seedling growth of two weed species. Pak. J. Weed Sci. Res., 18: 485-492.

Rebetzke, G. J.,Bruce, S. E., and Kikegaard, J. A. 2005. Longer coleoptile improve emergence through crop residues to increase seedling number and biomass in wheat (Triticum aestivum L.) plant and soil, 272(1): 87-100.

Reinhardt C. *et al*. 2006. Production dynamics of the allelochemical parthenin in leaves of *Parthenium hysterophorus* L. J Plant Dis Prot.20:427-33.

Rezaeinodehi A., Khangholi S., Aminidehaghi, M. and Kazemi, H. 2006. Allelopathic potential of tea (*Camellia sinensis* (L.) Kuntze) on germination and growth of *Amaranthus retroflexus* L and *Setaria glauca* (L) P Beauv. J. Plant Dis.Prot., 20: 447-454.

Rice E L. 1984. Allelopathy. 2nd Edn. Orlando, Florida, USA: Academic Press.

Safdar, M. E., A. Aziz, U. Farooq, M.S. Hayat, A. Rehmab, R. Qamar, A. Ali and T. H. Awan. 2019. Germination and growth of some summer crops as affected by allelopathicity of different waste_land weeds. J. Res. Weed Sci., 2(4): 358_371.

Sale, F.A. and Oyun, M.B. 2013. Inhibitory effect of leaf extract and leaf mulch from selected tree species on physiology of millet under nursery condition. J. Biol. Agric.Health Care, 3:80-85.

Saleem, M. M., S. A. Masood, S. B. Din, M. Yasin, S. Ahmad, S. Salman and Q. Ali. 2019. Relative study of efficiency of weedicide to curb the impacts of phalaris minor on hexaploid (6x) wheat yeild. Int. J. of B. Studies. 4(3): 133-137.

Shapla, T.L., Parvin, R., Amin M.H.A. and Rayhan, S.M. 2011. Allelopathic effects of multipurpose tree species Melia azedarach with emphasis on agricultural crops. J. Innov. Dev. Strat., 5: 70-77.

Sheron, O.P., Tonk, D.S., Kaushik, L.S., Hasija, R.C. and Pannu, R.S. 1998. Statistical Software Package for Agricultural Research Workers. Department of Mathematics and Statistics, CCS HAU, Hisar, India.

Shinwari, M. I., Osama, Shinwari and Y. Fuji. 2017. Evaluation of phytodivetsity for allelopathic activity and application to minimize climate impact. Pak. J. Bot., 49(51): 139_144.

Tefera, T. 2002. Allelopathic effects of *Parthenium hysterophorus* extracts on seed germination and seedling growth of *Eragrostis tef.* J Agron Crop Sci.,188:306-10.

Thakur, M.K. 2014. Studies on allelopathic effects of some agroforestry tree species on soybean. Int. J. Farm. Sci., 4:107-113.

Thakur, N. S., Kumar, D. and Gunaga, R. P. 2017. Allelopathic influence of leaf aqueous extract and leaf litter of Indian lilac (*Melia azedarach* L.) on germination, growth, biomass and grain yield of green gram *(Vigna radiata* L*.)* and black Chickpea *(Cicer arietinum* L*.)*. Int J Curr Microbiol Appl. Sci., 6(10), 2669-2683.

Wabo, P.J., N.J.D. Ngankam, B.C.F. Bilong and M. Mpoame. 2011. A comparative study of the ovicidal and larvicidal activities of aqueous and ethanolic extracts of pawpaw seeds *Carica papaya* (caricaceae) on Heligmosomoides bakeri. Asian Pac. J. Trop. Med., 24: 447-450.

Yazdani, M. and H. Begheri. 2011. Allelopathic effect of tabacco (Nicotiana tobaccum L.) on germination and early growth of soybean (Glycine max L.). Aus. J. Basic Appl. Sci., 5: 1178-1181.

Zhang, H., and H. Wang: 2012. Evaluation of drought tolerance from a wheat recombination inbred line population at the early seedling growth stage. African Journal of agriculture research. 7(46): 6167-6172.

Zhang, Y., Gu, M., Shi, K., Zhou, Y.H. and Yu J.Q. 2010. Effects of aqueous root extracts and hydrophonc root exudates of cucumber (C*ucumis sativus* L.) on nuclei DNA content and expression of cell cycle-related genes in cucumber radicles. Plant Soil, 327:455-463.