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Secondary metabolites from *Phalaris minor* responsible for the alteration of various growth parameters of the wheat crop (*Triticum aestivum*) GW -273.

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Abstract

The weeds cause the loss to the crops either due to the competition or due to the other mechanism of secreting the secondary chemicals in their vicinity that will interfere with the biochemical processes of the crop plant. *P. minor* is an associated weed plant that grows in the wheat crop fields. Aqueous extract of the weed plant was prepared and its impacts were determined under the laboratory conditions. The results were analyzed and data were subjected to the two ways ANOVA. The results convey that the germination of seeds was inhibited however, the root and shoot lengths were enhanced but root shoot ratio decreased.

Keywords: *Allelochemical, Allelopathy, Associated weed, Aqueous extract.*

Introduction

Weeds cause loss to crops, weeds are able to become invasive and according to (Auld *et al*., 1987) the agricultural production losses due to weeds are thought to be 10-20 percent and in Pakistan it was 25-30% (Nayyar *et al*., 1994). Weed competes with crop plants for different factors Anderson, (1983) and sometime interfere with crop growth by releasing toxic substance in the rhizosphere (Rice. 1984). Scientist think that these losses are due the competition or by the other mechanism called as the allelopathy, plants secret some chemicals in their vicinity and these chemicals cause the change in soil environment in that manner that the availability of the nutrients to the crop plant are becoming limited.

Some plant species produce secondary substances called allelochemicals that impacts the germination, growth, and development of other plants when they are released into the environment (Chou, 1999; Inderjit and Keating, 1999; Rizvi *et al*., 1992; Weston, 1996). This phenomenon is called allelopathy (Rice, 1984). Aqueous extracts from *Parthenium hystrophorus* leaves and inflorescence inhibit germination and seedling growth of barley, peas and wheat; root and stem extracts have less suppressive influences Srivastava *et al*. (1985). Allelochemicals may affect both germinating seeds and seedlings. Several plant species commonly used as cover crops have documented allelopathic effects and may be managed to maximize allelopathic suppression of weeds (Anaya, 1999; Chou, 1999; Weston, 1996). Later on, Le Tourneau and Heggeness (1957) suggested that water extracts of quick grass rhizomes inhibit the root growth of pea and wheat seedlings. Le Tourneau *et al*. (1956) established that aqueous extracts from 23 well-known weed and crop species reduced the germination and early growth of wheat seedlings.

Allelopathic potential of *Salvia syriaca* L. was studied in laboratory and glasshouse experiments against wheat at different temperatures. In laboratory experiment rhizome and shoot extract delayed wheat seed germination; consequently, wheat seedling growth was inhibited (Qasem and Abu-Irmaileh, 1985). Bhowmik and Doll (1979) have discovered that incorporation of lambsquarters residues in soils is extremely inhibitory to height and fresh weights of shoots of corn and soybeans. Allelochemicals are considered as either seed germination regulator or inhibitors (Murray *et al*., 1982). Seed is an ideal tool because it is a dispersal unit of life formed by three parts that are genetically different. It contains seed coat, endosperm and an embryo able to sprout out in a new plant if exposed to the right conditions (Evenari, 1980). The critical stage in the establishment of a plant is the seed germination. For the successful establishment of plant, the germination percentage should be maximal, the sensitivity of germinating seeds to the environmental factors should be low and the process of germination should be quick (Kaul and Mangal, 1985 a, b; 1987).

As there are little information regarding the effect of *Phalaris minor* on the wheat seedlings therefore the aim of present work is to confirm the impact on the germination percentage, root, shoot and coliptile length of the wheat seedling under the laboratory conditions by the aqueous leachates from *P. minor* (weed).

Materials and Methods

Plant identification and preparation of extract:

The *Phalaris minor* plant was identified in the crop field and collected, the plant was shade dried under room temperature after that the powder was made with the help of mechanical grinder. Now the powder of plant was put in to the conical flask bottles and the different concentration was made according to the w/v, the four concentration made were (1g in to 10ml, 1g in 20ml, 1g in 30ml and 1g in 40ml of distilled water respectively) and these are called as T2, T3, T4, T5 treatments and T1 that having only distilled water are called control. After that these flask bottles were put in the water both under the constant temperature 25±2℃ for the 72 hours. After that the lecheates were filtered first with the four layered muslin cloth, followed by Whatman's filter paper No. 1. Now the final extracts were ready for the ongoing experiment.

Seed germination bioassay:

The wheat seeds were surface sterilized with the help of mercuric chloride and the ten seed were put on the petriplates containing the double layer whatmans filter paper and the 10 ml of resultant aqueous extract. The temperature and the light period was maintained 10/14 hours of light and dark respectively, there are five treatments including control T1,T2 T3, T4, T5 and each treatment were having the four replicates. The number of seeds germinated after the 24 hours and contentiously counted after the period of 24 hour of gape. After the tenth day the experiment was terminated and the root shoot length and root shoot ration and coleoptile length was measured. The data were subjected to the analysis of various.

Results

The aqueous extract of *Phalaris minor* Retz. inhibits the seed germination of *Triticum aestivum* GW-273, the results showed that the maximum percentage of germination (76.66±0.43) was found in control and the minimum percentage of germination in T4 treatment (10.00±0.30). However, the values of other treatments T2, T3, T5 were 30.00±0.46, 36.66±0.49, 36.66±0.49 respectively.

On pairwise multiple comparison Bonferroni t-test between the mean values of almost all treatments showed high significant difference ($P<0.001$) except the difference between the treatments T3vsT5 were non-significant. Germination percentage was depicted in graphical form in Fig. 1 (a).

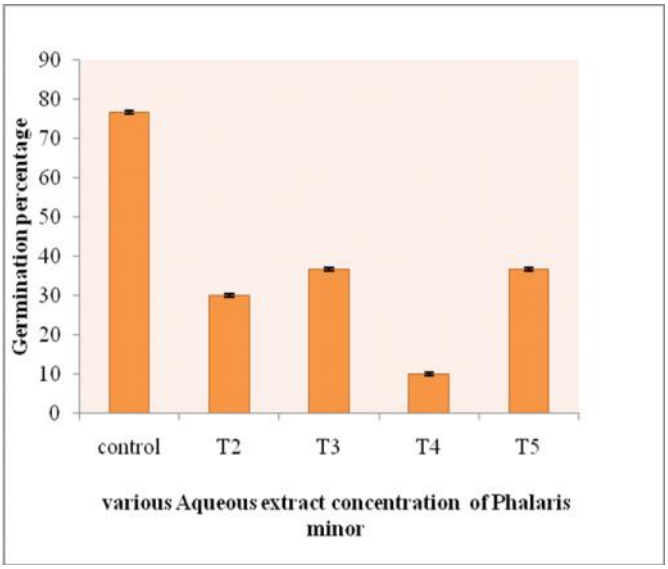

Fig. 1(a). Germination percentage of the wheat seeds in various aqueous extract of *P. minor*.

Effect on root length of seedling (cm)

The statistical analysis of the data revealed that the aqueous extract of *Phalaris minor* significantly (P<0.001) affected the root length of wheat seedlings of variety GW-273, it was evident from the data that there was increase in root length of wheat seedling, the maximum (15.19±2.67) was recorded in the T3 treatment and minimum (11.44±3.35) was recorded in the control one. However, the value of root length in other treatments T2, T4, T5 was measured (14.18±1.77, 15.16±4.25, 13.43±1.01) respectively. While on pairwise multiple comparison Bonferroni t-test between the mean values of treatments, the highest significant difference (P<0.001) was observed between T3vsT1, T4vsT1 and low significance (P<0.050) was noticed in between the T2vsT1, while non-significant difference was found between the rest of treatments when compared with each other.

Effect on shoot length of seedling (cm)

Seedlings of wheat plant showed increased shoot lengths on treatment of aqueous extracts of the *P. minor*. Statistical analysis of the data revealed that there was significant difference (P<0.001), with maximum (14.43±0.32) and minimum (5.58±2.45) in T4 and T1 treatments respectively. While the value of other treatments T2, T3, T5 were 14.26±1.71, 14.12±1.42, and 13.95±0.95 respectively. On pairwise multiple comparison Bonferroni t-test, the data revealed that there was high significant difference (P<0.001) observed in between T4vsT1, T2vsT1, T3vsT1, and T5vsT1 and non-significant difference was visualized in rest of other treatments when compared with each other.

Effect on root shoot ratio of seedling (cm)

The root shoot ratio of *Triticum aestivum* GW-273 seedlings decreased with the decrease in aqueous extract concentration of *Phalaris minor* Retz. On statistical analysis (one way ANOVA) of data revealed that there was significant (P<0.001) difference between the treatments. However, maximum ratio was recorded in the control 2.77±2.26 that were significantly higher than values of other treatments, and minimum was recorded 0.96±0.09 in the (T5) treated seedlings. While values of other treatments T2, T3, and T4 were 1.00±0.10, 1.07±0.14 and 1.04±0.28 respectively. On pairwise multiple comparison Bonferroni t-test between the mean values of treatments T1vsT5, T1vsT2, T1vsT4 and T1vsT3 showed the high significant difference (P<0.001), while the difference between the mean values of rest of all other treatments are too low, hence showed non-significant difference when compared with each other. The graphical representations of root and shoot length and root shoot ratio are graphically depicted in Fig. 1 (b).

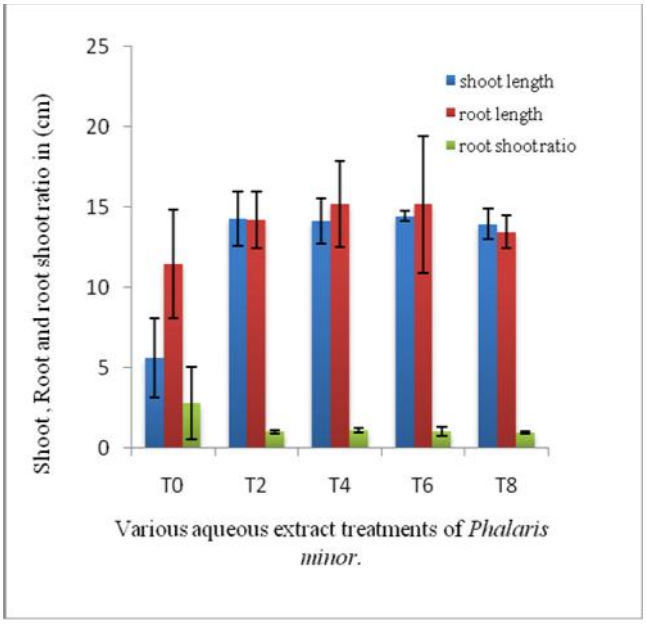

Fig. 1(b). Shoot, root length and the root shoot ratio of the wheat seedling in various aqueous extracts of *P. minor*.

Fig. 2a. Showing the germination of wheat seeds in the control.

Fig. 2b. Showing the germination of seeds in the 1:10 concentration of *Phalaris minor*.

Fig. 2c. Showing the germination of the seeds in the 1:20 concentration of *P. minor*.

Fig. 2d. Showing the germination of seeds in the 1:30 concentration of *P. minor*.

Fig. 2e. Showing the germination of seeds in the 1:40 concentration of *P. minor*

Discussion

The seed germination of the wheat seeds in the various aqueous extract was inhibited, the T4 treatment inhibits about the 90% of germination while treatments T2, T3 and T5 inhibits 70, 64, and 64 % of germination respectively. These results are supported by previous findings of Le Tourneau *et al*. 1956 who also observed in there experiment that water of common lambersquarters inhibit seed germination of wheat (cv. Mida wheat). Gella *et al.* 2013 also found that there is the inhibition of the seed germination of the wheat by the *Parthenium hysterophorus*. Gupta and Mittal 2012 they have found reduction in the seed germination percentage of wheat by the leaf extract of *Phalaris minor*.

The root, shoot length was observed to be increased by the aqueous extract of the p. minor by 8-9% these results wre supported by the Ramiah and Rao (1953) reported that the germination of rice seed was improved by soaking in juice expressed from germinating seeds of mung, a similar effect have been reported on mung bean (Bhatia *et al*., 1984). These results are supported by the fact that water extract of the weed was reported to have beneficial effect on wheat growth (Saraswat, 1987) These results are also supported by the previous finding of Bhatia *et al*. 1982, they have founded that *Phalaris minor* promotes the growth and yield of wheat. Over results are also appreciated by the finding of Kruse *et al*. 2000 they studied most frequent gross morphological effects on plants are inhibited or retarded seed germination and effects on coleoptile elongation and shoot and root development. The root shoot ratio of the wheat seedling was decreased with aqueous extract of *P. minor*.

Conclusion

The whole experiment concludes that the allelochemicals influence the various parameters of seedling differently the seed germination of the wheat variety was reduced while the root shoot length of the seedling were increased, the root soot ratio decreased.

Conflicts. There are no conflicts regarding this paper

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