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Inhibitory Impact of Some Crop Plants Extracts on Germination and Growth of Wheat

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Abstract: in order to evaluate allelopathy effects of maize CVS. 301 and 704, sorghum, barley and alfalfa on some aspects of wheat plantlet such as germination and growth, a factorial experiment based on completely randomized design was carried out with three realizations. Two concentrates of 50 and 100 percent extracts based on one gram grinded aerial parts in 10 cc distilled water, were considered as 100 percent extracts. To prepare 50 and 100 percent sucrose solutions with the same osmotic potential for their relevant plant extracts, character procedure was us employed. Results showed that there were significant allelopatic differences across alfalfa, sorghum and maize cv.301 and the highest decrease in coleoptiles length was belonged to the extracts of alfalfa, sorghum and maize cv.704, while the longest seed root was achieved using alfalfa, sorghum, maize cv.301 and extracts. Decrease in the number of roots related to the extracts of alfalfa, sorghum and maize cv.704. By considering the interactions between plant extracts and sucrose solutions, it was revealed that the shortest wheat coleoptiles was obtained by applying the sorghum and alfalfa extracts and the longest seed root was achieved as a result of 100 percent alfalfa extract. The lowest seed root number was counted after maize cv.704 and alfalfa extranets, respectively. Allelopathic potentials of these plants which induces identifying and purification of allelopathic substances, may entitle them to control specific weeds especially in non-sequential crops by preparing them as natural herbicides.

Key words: Allelopathy · Alfalfa · Sorghum · Maize · Wheat and Germination

INTRODUCTION

Allelopathy has long been considered since Greek and Roman empires, when Teofrasfus could state that smell of resulted in the wilting of the grape plant. Molisch [1] issued his findings about impact of ethylene on plants in a book named allelopathy. Generally speaking, allelopathy consists of the interactions between the living creatures as a result of released chemical compounds. Scientific observations of the allelopathic impacts of plants has not been considered in Europe unstill 17th century, when the scientists issued findings on tiny drops released from the roots of the *Loliom temolentom*. They believed that plants use roots as inhibitor organs and influence subsequent plant growth by dispelling chemicals into the soil but their theory lost its importance as the Leibig's theory on the nutrient elements was suggested and interaction effect shifted to the elements and competition. In the late 19th century, precise scientific experiments done in the United States and England, illustrated that allelopathy is more important than interaction effects. Some non-woody plants were found in England which negatively influences the growth of the adjacent trees. Researches revealed that these effects are due to depletion of soil elements. In fact, drained water derived from the pots planted with these plants, influenced growth of trees same to these plants grown near by trees. In 1973, allelopathy was applied by mulish to explain any positive and negative biochemical interaction effect among plants, micro organisms and tiny living creatures, soon afterwards, studies of proved existing of the plant chemical effects and use of

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allolepathy was. Popular for the first time [2]. Shiling *et al*. [3] suggested interference as a way to explain completion and allelopathy in a theory. Ecologists have illustrated that competition and allelopatic effects in each system are considered together and allelopathic interaction effects are important in multiple cropping systems [4]. Allelopathy plays an important role in agricultural ecosystems and in a large scale, in the plant covers among the crop-crop, crop-weed and tree-crop covers. These interactions mainly are detrimental and occasionally, are useful. Soil microbes have the key role in allelopathic interaction expansion which in case of favorable management will greatly control weeds [5]. Today, allelopathy is used as a solution to weed control. Weed controlling may be performed using chemicals released from the leaves, flowers, seeds, shoots and roots ore decomposed parts of the plants. Different chemicals such as phenols, alkaloids and flavnoids are existing as natural herbicides and pesticides [6]. Allelopathic materials released from the weeds can directly inhibit germination, emergence and growth of the plants and also survival of the creatures with them. Cover plants such as wheat, barley, eat; scale, sorghum and sudan grass are effectively used to inhibit growth of the weeds. At least, part of ability of these plants and other cover plants is related to the allelopathy [7]. Alleloathic materials are released in different ways from plants. They may be resulted from the green and releasing of the matters from the decomposed plant. Even flowers, fruits and seeds may be the sources of these materials. Natural decomposition in nature or shifting of these substances to other forms by the microorganisms are of the factors causing them to be poisonous that were not poisonous before. Little is known about allelopathic effects on plants in Iran.

Allelopatic potential of the seed extracts on three rains-fed wheat CVS. In different concentrations, significantly decreased germination, length of the stem and radicle, three and seven days after treatment [8]. Wheat possesses the ability to deterrent root growth in *secale* and hence, may be wed as growth inhibitor and controlling of the weeds via its potent allelopathic activity [9]. Production of sorgoleon by sorghum has allelopathic effect on its own germination [10, 11]. Hordomin, an effective substance drivel from barley, has the same effect to the Hordomin and is negatively influenced root and shoot growth [12]. Seed extract of *Vicia* has been proved to be as interceptor in germination of some crops and weeds [13]. Alfalfa extract includes water soluble saponine which inhibits growth of aerial parts and length of the roots of the maize as a poisonous material. Allelopathic effect is evaluated in the laboratory by response of specific plant to the extract or grinded dried organs solved in the water [14]. Worshman [15] found that the reminders of alfalfa, has the significant effect on the growth of the weeds due to its soluble allelochemcal substances. Also, other substances such as sativa and media carping as inhibitors have been distinguished in alfalfa hay. Mattice *et al*. [16] reported that resulted powders from dry parts of alfalfa such as stem, leaf and root, significantly inhibit of germination in so me plants. Extract of alfalfa has censed to decrease in root dry weight, root length and plant height in *Cyprus diformis* and *Digitaria cilaris* weeds [17]. Poisonous compounds have been found in fresh leaves, stems, roots and seeds of alfalfa and their concentrations are in the order of leaf> seed> whole plant> soil> root> flower> stem [5].

MATERIALS AND METHODS

To prepare extracts of alfalfa, maize, cow grain, *Vicia*, sorghum and barley, 24 hours after soaking in distilled water, a proportion of 1:10 (1 gram substance in 10 ml distilled water) was considered as 100 percent solution and 50 percent solution was then prepared front it. Sucrose was used to make co-osmotic solutions equal to each extract. This was fallowed procedure: after preparing extracts and solutions, few colored drops of each extract was added to the sucrose solution without shaking up and down. While the color remained constant in the solution without any movement, co-osmotic solution was ready. 25 seeds of wheat cv. Sardari were placed in the Petri-dishes along with the relevant extract solution. Another experiment as factorial based on completely randomized design was laid out using sucrose solutions rather than extracts, alike with the first experiment with three replications. Plant extracts prepared as a proportion of 1:10, were considered as 100 percent primary extracts and the other extracts prepared as 50 percent from the first extract. Wheat culture in both experiments (seed extracts and co-osmotic sucrose solutions) was performed by adding 10 mol distilled water along with 1 mol benomyle fungicide to each Petri dish. 2 weeks later, measurements of the growing traits such as coleoptiles length, the longest seed root and number of roots were done.

Factors included 7 extracts along with their co-osmotic sucrose solutions. Data were subjected to analysis by SAS and comparisons of mean differences were performed using Duncan's multiple range test software's.

RESULTS AND DISCUSSION

Results presented in (Table 1) showed that impact of sucrose solutions and extracts of the plants were significant ($p<0.01$) on the measured traits. Impact of kind of plant extract was significant, as well. Interactions of different plant extracts and co-osmotic solutions were significant on the root length (p<0101) and number of roots and coleoptiles length ($p<0.05$). Furthermore, according to the Table 2, it can be said that the mentioned traits are significant ($p<0.01$) and control against the rest is significant for all is significant for all traits except for number of roots.

Results in (Table 4) showed that in 100 percent extract, the shortest coleoptiles length of 5.26 was obtained. The longest coleoptiles length of 7.68 was achieved using so percent sucrose solution. 100% sucrose solution resulted in 6.47 and 50% extract, censed 7.1 cm coleoptiles length. 100% extract showed the highest inhibitory effect on all traits. Table 3 indicates that alfalfa and maize cv.704 extracts resulted in the lowest coleoptiles lengths of 4.2 and 5.3 cm, respectively. The lowest inhibitory effect on this trait belonged to the barley extract with a coleoptiles length of 8.01 cm. Extracts of alfalfa and maize cv.301 censed the shortest root lengths of 1.8 and 2.3 cm, respectively. The lowest inhibitory impact was obtained from sorghum and cow grain extracts. Based on the Table 3, it is clear that the extracts of alfalfa, *Vicia*¡ cow grain highly decreased root number of 3.6, 4.2 and 4.05, respectively. The highest root number was achieved using barley extract of 408 roots per plant.

Table 5 showed that interactions of 100% concentration x sorghum, maize and alfalfa extracts censed the lowest coleoptiles length and 50% concentration x co-osmotic solution of barley resulted in the highest one. Interaction of 100% concentration x alfalfa extract censed the shortest and 50% concentration x co-osmotic solution of sorghum censed the longest seed root.

Table 1: ANOVA Table without control

Source	Degree of freedom	Mean of squares (MS): Coleoptile length	The longest root	Number of root
Concentration of osmotic solution and concentration of plants	3	22.52**	28.17**	0.72ns
different plants	6	21.27**	32.9*	2.3*
interaction effects	18	3.4*	10.53**	1.01*
Error	56	1.7	1.55	0.46

*, ** and ns: significant at 1%, 5% and non-significant

Table 2: ANOVA Table with control

Source	Degree of freedom	Mean of squares (MS): Coleoptile length	Longest of root	Number of root
treatment	28	10.37**	19.21**	1.26*
Control	1	3.7**	7.2*	1.1ns
error	58	1.56	1.57	0.45

*, ** and ns: significant at 1%, 5% and non-significant

Table 3: Main effects as affected by different plant extracts

Maine effect	Coleoptile length	Longest of root	Number of root
Barley	8.01a	4.2b	4.8a
Maize, cv.301	7.14ab	2.3c	4.0bc
Maize, cv. 704	5.35c	5.4a	3.47d
Sorghum	6.9ab	5.5a	4.3ab
cow grain	7.7ab	6.2a	4.2bc
Alfalfa	4.2c	1.8c	3.6dc
Vicia	6.9b	3.9b	4.05bc

Table 4: main effects as affects as affected by different plant extracts and co-osmotic solutions

Main effect of Extract with sucrose solution	Coleoptile length	Longest of root	Number of root
50% sucrose	7.68a	5.35a	4.3a
100% sucrose	6.47b	3.88b	4.09a
50% extract	7.1ab	4.9ab	4.3a
100% extract	5.26c	2.67c	3.83b

Table 5: The interaction effects (extract and sucrose solutions different concentrations) affecting measured traits

Treatments	Coleoptile length	Longest of root	Number of root
50% sucrose	9.48a	5.8c…e	5.8a
100% sucrose	8.11a…e	4.35d…f	4.6b…d
50% extract of barley	7.98a…e	3.8ef	4.58b…d
100% extract of barley	6.5d…h	3.07f…h	4.2b…f
50% sucrose	8.4a…d	4.4d…f	4.38b…e
100% sucrose	8.06a…e	2.8f…j	4.29b…e
50% extract of Maize, cv.301	6.62c…h	1.5g…k	3.88b…g
100% extract of Maize, cv.301	5.43f…k	0.64k	3.44e…h
50% sucrose	6.75b…g	7.42a…c	4.12b…g
100% sucrose	6.28f…j	6.73bc	3.49d…h
50% extract of Maize, cv. 704	4.9g…k	4.28d…f	3.36f…h
100% extract of Maize, cv. 704	3.4k	3.16fg	2.9h
50% sucrose	8.72a…c	9.1a	4.9ab
100% sucrose	8.1a…e	7.9ab	4.85ab
50% extract of Sorghum	7.6a…e	4.02ef	4.57b…d
100% extract of Sorghum	3.3k	1.1h…k	3.05gh
50% sucrose	8.8ab	7.5a…c	4.43b…e
100% sucrose	7.8a…e	7.27a…c	4.22b…e
50% extract of cow grain	7.8a…e	6.12b…d	4.13b…g
100% extract of cow grain	6.3d…i	4.18d…f	4.05b…g
50% sucrose	4.57h…k	3.00f…i	4.1b…g
100% sucrose	4.31i…k	2.6f…k	3.7c…h
50% extract of Alfalfa	4.17jk	1.00i…k	3.7c…h
100% extract of Alfalfa	4.10k	0.86jk	3.00g
50% sucrose	7.93a…e	7.11a..c	4.6bc
100% sucrose	7.63b…f	3.6f	4.4b…e
50% extract of *Vicia*	7.19b…f	3.23fg	3.80c…h
100% extract of *Vicia*	4.91g…k	1.5g…k	3.36f…h

Data with the same letter have not significant differences.

Also, 100% concentration x maize cv. 704 extract, caused the lowest and 50% concentration x lo-osmotic solution of barley used the highest root number. To tally speaking, extracts of alfalfa, maize and sorghum have allelopathic effects but it is more remarkable in alfalfa. So, if wheat is grown after these plants, would not be of favorable growth. As with the experiments of osmotic effects done besides the plant extracts, it can be separate allelopathic effects from other growth limiting factors. Comparisons of plant extracts with osmotic solutions revealed high difference for traits showing inhibitory effects of all 7 plants extracts.

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