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Effects of *Haloxylon Aphyllum* (Minkw.) Lljin Extract on Seeds Germination and Seedlings Growth of *Agropyron Elongatum* (Host.) And *Agropyron Desertorum* (Fisch.)

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ABSTRACT

Allelopathy means any process involving secondary metabolites produced by plants, microorganisms, viruses, fungi that influence the growth and development of agricultural and biological systems. In this study allelopathic effects of *Haloxylon aphyllum* (Minkw.) lljin aerial parts and root extracts, in a compeletly randomized design (CRD) were studied. Germination velocity and percentage root and shoot length, wet and dry weight of *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.) seedlings were tested. ANOVA showed that the different levels of *Haloxylon aphyllum* (Minkw.) lljin extracts had inhibitory effect on seeds germination and seedlings growth of two target species. The results of study showed that *Haloxylon aphyllum* (Minkw.) lljin aerial parts extracts in all concentrations in comparison to root extracts had more effect on the inhibition of seeds germination and seedlings growth. It is likely due to allelochemical compounds such Ascaridol essence in aerial parts of sacsaoul, particularly leaf. Also, the degree of inhibition was largely depended on the concentration of the extracts being tested. The maximum reduction in germination was at the highest concentration comming from sacsaoul extract. In addition, root length was relatively more sensitive to phytotoxic allelochemicals than shoot length. In general, the results showed that *Agropyron desertorum* (Fisch.) was affected less than *Agropyron elongatum* (Host.) under allelopathic effects of *Haloxylon aphyllum* (Minkw.) lljin. Therefore, in sacsaoul habitats in other to improvement of rangelands vegetation and forage production for animals, *Agropyron desertrum* (Fisch.) cultivation associated with *Haloxylon aphyllum* (Minkw.) lljin is not recommended.

Key words: *Agropyron* sp. allelopathic effect, *Haloxylon aphyllum* (Minkw.) lljin, seed germination, seedling growth

INTRODUCTION

Allelopathy refers to the beneficial or harmful effects on one plant, both crop and weeds species through the release from plant parts by leaching, root exudation, volatilization, residue decomposition and other processes in both natural and artificial systems (Ferguson and Rathinasabapathi, 2009). Allelopathy is believed to be involved in many natural and manipulated ecosystems and plays a role in the evolution of plant communities, exotic plant invasion and replant failure (Inderjit, 2003). Allelopathy is partial of chemical ecology, and it includes inhibition effects or stimulation of a donor plant on growth of target plant. In addition, allelopathy defines as a strategy of decreasing the environment pollutions and increasing of productions for sustainable agriculture (Mighany, 2003).

Allelopathic plants interfere with nearby plants by dispersing chemicals into the soil that may inhibit neighboring plant growth, nutrient uptake, or germination (Abhilasha *et al.*, 2008). Typical allelopathic inhibitory effects result from the action of groups of allelochemicals that collectively interfere in various physiological processes altering the growth patterns of plants (Kil and Shim, 2006). The action of allelochemicals can affect the respiration, photosynthesis, enzyme activity, water relations, stomatal opening, hormone levels, mineral availability, cell division and elongation, and structure and permeability of cell membranes and walls (Chou, 1999; Reigosa *et al.*, 1999). Through these actions, allelopathic substances may play a role in shaping plant community structure in semi-arid and arid environments (Jefferson and Pennacchio, 2003).

All plants utilize from primary metabolites in other to growth and creating of seed for next lineage. But they are different as regards secondary metabolites. Therefore from the viewpoint of creating allelochemicals are different too. Allelochemicals defines as second plant metabolites, that haven't direct effect on growth of target plant, but act as defensive work (Mizutani, 1999). Most plant species, including crops, are capable of producing and releasing biologically active compounds (allelochemicals) into the environment to suppress the growth of other plants (Abu-Romman *et al.*, 2010). Generally, different plant parts, including flowers, leaves, leaf litter and leaf mulch, stems, bark, roots, soil and soil leachates and their derived compounds, can have allelopathic activity that varies over a growing season (Ferguson and Rathinasabapathi, 2009).

Allelochemicals fall to the ground through leaching, root exudation, volatilization, residue decomposition and other processes in both natural and agricultural systems (Ferguson and Rathinasabapathi, 2009). Allelochemicals are considered to be secondary metabolites or waste products of the main metabolic pathways in plants and they do not appear to play a role in the primary metabolism essential for plant survival (Chon and Kim, 2002). The presence of allelopathic substances in soil depends on the amount of residue, degree of residue decomposition, distance from other plants and average precipitation (Safarnejad, 2005).

Allelochemicals commonly found in plants are toxic amino acids, protease inhibitors, alkaloids, cyanogenic glycosides, phenols, tannins, lignins, flvonoids, toxic lipids, glucosinolates, terpenoids, saponins and -phyto haemagglutinins (Reigosa *et al.*, 2006).

Siddiqui *et al.* (2009) reported that the *Prosopsis juliflora* leaf aqueous extract contain water-soluble allelochemicals. Which could inhibit the seed germination and reduce radicle length of wheat. They suggested that wheat should not be planted close to *Prosopsis juliflora* due to adverse effects on its growth. Abu-Romman *et al.* (2010) related that the aqueous leaf leachate of *Euphorbia hierosolymitana* was found to inhibit significantly the growth of wheat seedlings. Which allelochemicals caused significant reduction in decreased root and shoot length, fresh, dry weights and decreased the amount of total chlorophyll and protein contents. Gatti *et al.* (2010) expressed that leaf and shoot extracts of *Artistolochia esperanzae* at concentrations of 1.5 and 3% caused marked changes in germination and seedling growth with greatest inhibition produced by root extracts. Morphological changes and decreased growth and development of seedlings were also occurred. The extracts of *Artistolochia esperanzae* caused a reduction of 50% in the size of root xylem cells and marked changes in the primary root and in the number of secondary roots. Thelen *et al.* (2005) reported that Allelopathy can affect many aspects of plant ecology including occurrence, growth succession, the structure of plant communities, dominance, diversity and plant productivity. Bagavathy and Xavier (2007) showed that the application of leaf extracts of Eucalyptus globulus decreased the seed germination of sorghum with increase in the leaf extracts concentration. The extracts also inhibited the shoot and root length of sorghum seedlings with increase in Eucalyptus extracts concentration. Safari *et al.* (2010) investigated allelopathic effects of *Thymus kotschyanus* on seed germination and initial growth of *Bromus tomentellus* and *Trifolium repens*. They resulted that, *B. tomentellus* showed a higher sensitivity against *T. kotschyanus* in allelopathic effects compared to *T. repens*, which indicates that *B. tomentellus* planted in rangelands with leaf litter of *T. kotschyanus* will be adversely affected in terms of its germination, growth, and ultimately low forage production. Samedani and Baghestani-Meybodi (2005) mention that, the decline of germination wild oat (*Avena fatua*) under extract of Sagebrush species is due to allelopathic substance of Artemisinin that exist in its leaves. Turk and Tawaha (2003) expressed that Black mustard (*Brassica nigra* L.) contains water-soluble substances that inhibited the germination and seedling growth of wild oat (*Avena fatua* L.). Therefore, in this study we evaluated allelopathic effects of Sacsaoul (*Haloxylon aphyllum* (Minkw.) lljin) aqueous extract on germination and seedling growth of *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.). Because, sacsaoul (*Haloxylon aphyllum* (Minkw.) lljin) is one of the important plants introducer in arid and shallow regions that is compatible with loam silty and very saline soils. It cultivated for rangelands reclamation and sand dunes fixation in cold ultra arid, cold desert arid and warm desert arid climates in Iran. Sacsaoul stands in Iranian as regards soil conservation, fixation of running sands, grazing of animals; air infiltration etc. is very important (Mirhosseini *et al.*, 2007). *Agropyron* grows at the most of the rangelands of Iran. It is important from the view point of soil conservation and preparation of forage for livestock. The evaluation of different researches showed that among wheat grass (*Agropyron*) species, standard crested wheat grass (*Agropyron desertorum* (Fisch.)) and tall wheat grass (*Agropyron elongatum* (Host.)) from the view point of resistance to aridity, growth on deep, heavy and saline-sodic soils at arid and semi-arid regions are important (Farshadfar and Mohammadi, 2003; Moghimi, 2005). Therefore in other to improvement of vegetation in regions that sacsaoul is cultivated, can be used of standard crested wheat grass and tall wheat grass. But it is necessary that in primary compatible of those with sacsaoul, and allelopathic effects of sacsaoul be considered. Unless allelopathic effects of sacsaoul inhibit from germination and establishment said species, they not cultivate with together. Since autotoxicity and the release of autotoxins may decrease plant population, species diversity, canopy cover, regeneration and enhance competition and also reduce plant yield. Blanco (2007) reported that allelopathic species can affect whole ecosystems in ways that reduce both ecosystem productivity and biodiversity. Thus, in this research the allelopathic effects of aqueous extract, both from aerial parts and roots of the sacsaoul on seeds germination and seedlings growth of standard crested wheat grass and tall wheat grass was studied.

MATERIALS AND METHODS

This research project was conducted from 25 August to 20 November 2009.

Materials: Seeds of the standard crested wheat grass and tall wheat grass were collected from their habitats in Eshtehard-e-Karaj rangelands in Iran. Samples of aerial parts and roots of sacsaoul were taken in July 2008 from Eshtehard-e-Karaj rangelands. Both samples were oven dried at 60°C for 72 h and then were powdered by mill.

Preparation of aqueous extracts: The aerial parts and roots extracts of sacsaoul (*Haloxylon aphyllum* (Minkw.) Iljin) were prepared by soaking the powders in distilled water (1:10 weight to volume) for 24 h at room temperature (23±2°C). Afterwards, at first day the above-mentioned mixtures were stirred for 1 h by shaker and kept in 4°C for 24 h in the refrigerator. Then in day 2 mixtures were stirred by shaker and kept in 4°C for 24 h in the refrigerator again. In day 3 mixtures were placed at shaker for 2 h.

To separate allelochemicals, mixtures were placed in centrifuge with 2500 r^{-1} min for 5 min. Then were filtered through Whatman paper No.1. The extracts were diluted to obtain the concentrations of 10, 15, 25, 50, 75 and 100% while the distilled water was used as the control treatment.

Petri dishes (15 cm in diameter) and Whatman papers No.1 (as culture bed) were used. Beforehand Petri dishes were sterilized by soaking in a 5% (v/v) sodium hypochlorite solution for 1 h, and filter papers were placed in oven with 50°C for 40 min to reduce fungal infection. Seeds of standard crested wheat grass and tall wheat grass were sterilized by soaking in a 0.5% (v/v) Benomyl solution for 5 min and allowed to air-dry before planting. Then twenty five selected seeds were placed on filter papers inside a Petri-dish and 15-20 mL of the extracts or distilled water for control treatment was added. All the experiments were conducted at seed technology laboratory of Faculty of Natural Resources, University of Tehran, Iran.

Methods: The seeds germination was recorded each day for a period of 21 days. Germination percentage was calculated using the following equation:

$$\text{Final germination percentage} = \frac{\text{No. of germinated seeds}}{\text{Total number of seeds planted}} \times 100$$

Also, germination velocity was calculated using the following equation:

$$\text{Germination velocity} = \sum \frac{\text{No. of germinated seeds}}{\text{Day of count}}$$

At the end of the study period, length of the radicle and the plumule and wet and dry weight of *Agropyron elongatum* (Host.) and *Agropyron desertrum* (Fisch.) seedlings was recorded.

Experimental design and statistical analysis: This study was conducted in a Completely Randomized Design (CRD) with five replications. Totally, 13 treatments (6 treatments for aerial parts extracts and 6 treatments for root extracts and 1 control treatment) were implemented. We were used of SPSS 15.0 in other to statistical analysis of data. The normality and homogeneous of data were assessed by Kolmogorov-Smirnov's and Levene's test, respectively. ANOVA for assessing of the significantly different of treatments was used. Means were compared by Duncan's multiple range tests at p = 0.05.

RESULTS

Effects of aerial parts extract on seeds germination: The results revealed that germination of *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.) seeds under aerial parts extract had significant different with other treatments. There were significant differences in seeds

Table 1: Effects of aerial parts extract of *Haloxylon aphyllum* on germination and seedling growth of *Agropyron elongatum* and *Agropyron desertrum* than control treatment

	Germination and seedling growth					
Extract Conc (%)	Germination velocity (seed/day)	Germination percentage (%)	Root length (cm)	Shoot length (cm)	Wet weight (gr)	Dry weight (gr)
Agropyron elongatum						
0	10.58±0.17Aa	97.6±0.98 Aa	7.5±0.05 Aa	6.21±1.5 Aa	0.76±0.02Aa	0.16±0.0 Aa
10	4.24±2.01Abc	72.58±7.03Ab	1.31±0.17Ab	4.11± 0.06 Ab	0.49±0.16Ab	0.1± 0.04 Abc
15	2.23±0.42 Ac	45.6±7.43 Ac	1.03±0.08Ab	3.7±0.26 Ab	0.31±0.05Ac	0.08±0.02Ac
25	0.03±0.02 Ad	0. 8±0.8 Ad	0±0 Ac	0±0 Ac	0±0 Ad	0±0 Ad
50	0±0 Ae	0±0 Ae	0±0 Ac	0±0 Ac	0±0 Ad	0±0 Ad
75	0±0 Ae	0±0 Ae	0±0 Ac	0±0 Ac	0±0 Ad	0±0 Ad
100	0±0 Ae	0±0 Ae	0±0 Ac	0±0 Ac	0±0 Ad	0±0 Ad
p<0.05						
Agropyron desertorum						
0	3.84±0.01 Ba	68.8±2.33 Ba	7.05±0.14Ba	7. 5±0.25 Ba	0. 23 ±0.01Ba	0.05±0 Ba
10	0.01±0 Bbc	4.23±1.49 Bb	1.2±0.15 Bb	4.7±0.26 Bb	0. 01±0 Bb	0±0 Bc
15	0±0 Bc	2.4±0.98 Bc	1.03±0.15Bc	3.7±0.26 Bb	0±0 Bb	0±0 Bc
25	0±0 Bc	0±0 Bd	0±0 Bd	0.2±0.2 Bc	0±0 Bb	0±0 Bc
50	0±0 Bc	0±0 Bd	0±0 Bd	0±0 Bc	0±0 Bb	0±0 Bc
75	0±0 Bc	0±0 Bd	0±0 Bd	0±0 Bc	0±0 Bb	0±0 Bc
100	0±0 Bc	0±0 Bd	0±0 Bd	0±0 Bc	0±0 Bb	0±0 Bc
p<0.05						

Values are means±SD. Means followed by different capital letters (A, B) in each column are significantly different at 5% probability level-using Duncan's Multiple Range. Test ($p<0.05$). Means followed by different small letters (a, b, c. . .) in each column are significantly different at 5% probability level-using Duncan's Multiple Range Test ($p<0.05$)

germination of target species among all treatments at 10, 15, 25, 50, 75 and 100 % concentrations with control treatment. No significant difference was observant among 50, 75 and 100% extracts in *Agropyron elongatum* (Host.), seed germination. The germination velocity for *Agropyron desertorum* (Fisch.) among treatments of 15, 25, 50, 75 and 100%, had not significantly different. Also, the germination percentage at 25, 50, 75 and 100% concentrations had not significantly different ($p<0.05$). In these treatments allelochemical compounds were completely inhibited of seeds germination in two target plants (Table 1).

Effects of aerial parts extract on seedling growth: The results showed that seedlings growth including: root and shoot length and wet and dry weight in target species of *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.) under aerial parts extract had significant difference with other treatments ($p<0.05$). The higher concentration of the extracts had the stronger the inhibitory effects on seedlings growth (Table 2). Wet and dry weight of seedlings in all treatments had significantly different with control treatment, but 25, 50, 75 and 100% treatments had not significantly different with each other, for *Agropyron elongatum* (Host.). In *Agropyron desertorum* (Fisch.) wet and dry weight of seedlings in all treatments had significantly different with control treatment. 10, 15, 25, 50, 75 and 100% concentrations had not significantly different with another ($p<0.05$) (Table 2). This indicated that the aqueous aerial parts extracts of sacsaoul decreased the growth of *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.) seedlings in terms of root and shoot length and wet and dry weight (Table 1).

Table 2: Effects of root extract of *Haloxylon aphyllum* on germination and seedling growth of *Agropyron elongatum* and *Agropyron desertrum* than control treatment

	Germination and seedling growth					
Extract (%)	Germination velocity (seed/day)	Germination percentage (%)	Root length (cm)	Shoot length (cm)	Wet weight (gr)	Dry weight Conc (gr)
Agropyron elongatum						
0	10.58±0.17Aa	97.6±0.98 Aa	7. 5± 0.14 Aa	6.21±1.49Ab	0.76±0.02Aa	0.16±0 Aa
10	8.65±0.17 Ab	94.4±0.17 Ab	7.29±0.5Aab	9.54±0.25Aa	0.86±0.04Aa	0.15± 0 Ab
15	7.11±0.69 Ac	92.8±1.5Abc	7.18±0.31Ab	9.21±0.3 Aa	0.98±0.05Aa	0.15±0Ab
25	8.09±0.7 Abc	89.6±1.6 Ac	7.09±0.31Ac	10.68±0.3Aa	0.58±0 Aa	0.15±0Ab
50	6.83±0.4 Abc	88±3.32 Ac	6.29±0.27Ac	10.56±0.3Aa	0.51±0.15Aa	0.16±0.0 Aa
75	8.52±2.42Abc	85.6±3.91 Ad	2.44±0.38Ad	5.33±0.32Ac	0.46±0.05Ab	0.14±0.0Abc
100	3.12±0.5 Acd	57.6±7.1 Ae	0.68±0.38Ae	5.25±0.42Ac	0.25±0.04Ac	0.09±0 Acd
$p<0.05$						
Agropyron desertorum						
0	3.84±0.31 Ba	68.8±2.33Ba	7.05±0.14Ba	7. 5±0.25 Bb	0.23±0.01Ba	0.05±0 Ba
10	2.67±0.16 Bb	50.4±4.66 Bb	5.4±0.19Bab	7.35±0.37Ba	0.17±0.01Ba	0.04±0 Bb
15	2.35±0.15 Bc	40.8±3.2 Bbc	5.16±0.37Bb	6.95±0.21Ba	0.13±0.01Ba	0.03±0 Bb
25	1.48±0.24 Bbc	28.8±4.07 Bc	3.19±0.25 Bc	6.57±0.3 Ba	0.09±0.01Ba	0.03±0 Bb
50	1.04±0.31 Bbc	20±5. 2 Bc	2.31±0.2 Bc	5.37±0.44Ba	0.07±0.02Ba	0.06±0 Ba
75	0.18±0.11 Bbc	4±2.53 Bd	0.4±0.16 Bd	1.87±0.16Bc	0.01±0 Bb	0±0 Bc
100	0.37±0.16 Bcd	8±3.09 Be	0.25±0.19 Be	3.23±0.99Bc	0.02±0 Bc	0±0 Bc
$p<0.05$						

Values are Means±SD. * Means followed by different capital letters (A, B) in each column are significantly different at 5% probability level-using Duncan's Multiple Range. Test ($p<0.05$). * Means followed by different small letters (a, b, c. . .) in each column are significantly different at 5% probability level-using Duncan's Multiple Range Test ($p<0.05$)

Effects of root extract on seed germination: The germination percentage and velocity of target species under root extracts in all treatment had significant difference with control treatment ($p<0.05$). In *Agropyron elongatum* (Host.) among 25, 50 and 75% treatments for the germination velocity and the germination percentage between 25 and 50% treatments there were no significant differences. In *Agropyron desertorumb* (Fisch.) between 25 and 50% treatments for the germination percentage and 25, 50 and 75% treatment the germination velocity were not significant differences (Table 2).

Effects of root extract on seedling growth: The root and shoot length of seedlings (in target plants) in all treatments were significantly different with control. The root length in treatments 25 and 50% concentrations had not significant difference with each other. In addition, shoot length in treatments 10, 15, 25 and 50% concentrations had no significant difference with each other, in each of two target plants ($p<0.05$) (Table 2). Wet weight of seedlings in 10, 15, 25 and 50% treatments did not show significant difference with each other and control treatment, but 75 and 100% treatments had significant difference with control treatment and each other. Dry weight of seedlings in all treatments had significantly different with control, except 50% treatment, for *Agropyron elongatum* (Host.) and *Agropyron desertorum* (Fisch.) ($p<0.05$) (Table 2).

DISCUSSION

The results of this study showed that aerial parts extract of *Haloxylon aphyllum* (Minkw.) lljin in all concentrations had significant effects on seeds germination and seedlings growth of

Agropyron elongatum (Host.) and *Agropyron desertorum* (Fisch.) ($p<0.05$). In each of two target species, maximum germination velocity and percentage, root and shoot length and wet and dry weight were related to control treatment (like for *Agropyron elongatum* (Host.) 10.58 seed/day, 97.6%, 7.05, 6.21 cm, 0.76 and 0.16 g, respectively).

The effects of aerial parts extract of *Haloxylon aphyllum* (Minkw.) lljin on target plants were more than root extracts. As aerial parts extracts in 50, 75 and 100% concentrations were completely inhibited seeds germination and seedlings growth. But under root extracts even in 100% concentration seeds were germinated and seedlings growth was observed. This indicates that aerial parts extract of sacsaoul have more inhibitory effects than root extract. May be this is due to presence of higher concentrations of allelopathic substance like Ascaridol in leaves of sacsaoul. This is consistent with reports of Zhu *et al.* (2009), Ramzjuie *et al.* (2008), Hakimi-Meibodi *et al.* (2004), Mohsenzadeh (2000). Turk and Tawaha (2003) found that aqueous extracts of black mustard (*Brassica nigra*) caused the reduction in germination, hypocotyl and radicle length of *Avena fatua*. They reported that the inhibitoriest effect of allelopathic plants was produced by leaf extracts, and all of these extracts had more pronounced effects on radicle growth than on hypocotyl growth. In addition, Jefferson and Pennacchio (2003) pointed out that allelochemicals are produced in the leaves of chenopods. Allelochemicals may directly prevent or promote germination when environmental conditions are conducive to growth and establishment therefore, influencing the number of plants of each species in a community. Indirectly, allelopathic effects on germination and growth determine whether or not plants of other species have a competitive advantage.

Inhibition of seed germination in *Haloxylon aphyllum* (Minkw.) lljin indicated the presence of allelopathic substances. Inhibition of root and shoot growth was also observed. It is due to allelochemicals compounds such Ascaridol essence in sacsaoul aerial parts particularly leaf. This agrees with those reports for other species in a variety of plant families (Al-Zahrani and Al-Robani, 2007; Djurdjevic *et al.*, 2004; Escudero *et al.*, 2000; Macias *et al.*, 2000). The inhibition germination of target plants is likely because of the reduction of enzymes activity like Amylase. In addition, the decline of mitosis divisions on meristem root, the reduction of catalyzer enzymes activity, the disorder of ion absorbent and chlorophyll demolition were cause the reduction of seedlings growth. Kaur *et al.* (2005) demonstrated that benzoic acid produces irregularities in mustard root cells, which were disorganized, inhibiting root growth. Alterations in the cell membranes can be considered one of the first effects caused by allelochemicals, and these effects may then trigger secondary effects (Barkosky *et al.*, 2000). Allelochemicals are toxic (e.g., phenolics, terpenoids and alkaloids and their derivatives) and may inhibit shoot/root growth, nutrient uptake, or may attack a naturally occurring symbiotic relationship thereby destroying the plant's usable source of a nutrient (Abu-Romman *et al.*, 2010). These results agree with Rice (1974) that pointed out the effects of some allelochemicals compounds on germination and growth of plants may occur through a variety of mechanisms including reduced mitotic activity in roots and hypocotyls, suppressed hormone activity, alter cell division, elongation and ultrastructure, reduced rate of ion uptake, inhibited photosynthesis and respiration, inhibited protein formation and nucleic acid, influence of membrane permeability or chlorophyll content, decreased permeability of cell membranes and/or inhibition of enzyme action. Other researchers reported that ferulic acid, caffeic acid, and vanillin were capable of inhibiting the growth of the seedlings by decreasing the net photosynthetic rate, chlorophyll content, and the ratio of chlorophyll a/b, as well as stomatal conductance (Jia *et al.*, 2003; Einhellig and Rasmussen, 1979).

Likewise, the results in this study showed that root length was relatively more sensitive to autotoxic allelochemicals than shoot length. It means the reduction of root growth was more than shoot in the each two target plants to higher concentrations of sacsaoul extracts. That allelochemicals had negative inhibition on root growth. An especially high degree of inhibition occurred with leaf extracts at the highest concentrations in each two tested species. This is likely because of those roots are in directly contact with allelochemical substances and the first to absorb the allelochemicals from the environment. These results agree with other studies reporting that extracts of allelopathic plants had more pronounced effects on radicle growth than on plumule growth (Haddadchi and Gerivani, 2009; Rahman, 2006; Punjani *et al.*, 2006; Ercoli *et al.*, 2007; Turk and Tawaha, 2003; Munir Turk *et al.*, 2002; Chung and Miller, 1995). These findings agree also with what was found by Oudhia (1999) where he found inhibition at growth in radicle and plumule of *Lathyrus sativus* by extracts from *C. gigantea*. El-Darier and Youssef (2000) found a negative relationship among the different concentrations of alfalfa on plumule and radicle elongations of *Lepidium sativum*.

Moreover, the results in this study were showed that wet and dry weight of seedlings of target species under the sacsaoul aerial parts extracts were reduced. The root extracts had lower effects on wet and dry weight of seedlings than aerial parts extract. This is agree with reports of (Haddadchi and Gerivani, 2009; Zhu *et al.*, 2009; Ramzjuie *et al.*, 2008; Travlos *et al.*, 2008; Hakimi-Meibodi *et al.*, 2004; Mohsenzadeh, 2000; Turk and Tawaha, 2003). Ng *et al.* (2003) has demonstrated that cinnamic (CIN), caffeic (CAF), p- coumaric (p-CA), benzoic (BEN) and p-hydroxybenzoic acid (p-HB) reduced seedling fresh weight and seedling length and root length.

The degree of inhibition largely depended on the concentration of the extracts being tested. It reduced severely with increasing of the extracts concentration. The maximum reduction in germination was at the highest concentration coming from sacsaoul extract. The seeds germinate only at the lower concentrations (10 and 15%), that it was very little than control treatment. *Agropyron desertorum* (Fisch.) had the more reduction than *Agropyron elongatum* (Host.). The results agree with most of the previous results obtained by many other researchers, which emphasized that extracts of many plants inhibit germination of many other plants (Nadjafi-Ashtiani *et al.*, 2008; Chon *et al.*, 2005; Soltanipour *et al.*, 2005; Noor *et al.*, 1995). Hakimi-Meibodi *et al.* (2004) reported that maximum the inhibition seeds germination effects occurred at 100% concentration and the lower concentrations (25 and 50%) the inhibition extract effects were lower, respectively.

CONCLUSION

In general, the results in this study showed that the inhibitory effects of sacsaoul allelochemicals on germination velocity and percentage, root and shoot length and wet and dry weight of *Agropyron dsertorum* (Fisch.) seedlings were more than *Agropyron elongatum* (Fisch.). Therefore, in sacsaoul habitats for improvement of rangelands vegetation and forage production for animals, it recommends that *Agropyron elongatum* (Host.) cultivate with sacsaoul.

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