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Assessment of the Allelopathic Effect of (*Atriplex Canescens*) "Fourwing Saltbush" on Germination of Seeds and Growth Parameters of (*Artemisia Herba-Alba Asso*)

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ABSTRACT

This work was done to evaluate allelopathic effects on seed germination of Artemisia herba-alba. Two aqueous extracts at different concentrations of leaves (LAC) and roots (RAC) of Atriplex canescens were prepared from: 2,5%; 5%; 10%;20% and 40%. They were used methodically on the seeds of Artemisia herba-alba. The results obtained showed that the bioassays had an inhibitory effect on the rate and speed of germination, shoot elongation, root development, and fresh and dry weight. The content of chlorophyll in the leaves decreased proportionally with the increase in the concentration of the Aqueous extracts of leaves (LAC) and roots (RAC) of Atriplex canescens. The higher concentration showed a significant inhibitory effect on the germination of seeds of Artemisia herba-alba.

Keywords: *Assessment, Allelopathy, Atriplex Canescens, Germination, Chlorophyll, Artemisia Herba-Alba.*

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1. INTRODUCTION

Despite the negative statements on the allelopathic phenomena for thousands of years, this science has been new, and the term Allelopathy was invented by Molisch (1937) (Nee, 1997). It is a process which results in the release of phytotoxic compounds by a plant to the environment to inhibit the growth of another plant sharing the same habitat Whittaker & Feeny (1971). It is important to know that the allelopathy is explained by the addition of the chemical compounds in the environmental medium, while the interference posed by Muller (1969) indicated the harmful influence of a plant on the others. Most allelopathic experiments have been done on the inhibiting aspects, but the stimulating effects have been probably so routine and subtle in nature that they have generally been neglected Willis (2007). Molisch (1937) expressed well that all the chemicals inhibiting substances of a plant with distinctive concentrations would probably be stimulating with lesser contractions and vice versa. So, this phenomenon usually covered the inhibitory and stimulatory effects through allelochemical substances. The majority of allelopathic compounds were secondary metabolites, including substances that are released by plants into their environment through four ecological processes including: volatilization, leaching, breakdown of vegetables residues, and root exudation (Chou, 2010). Degradation and allelopathy are among the most distinguished aspects of the handled ecosystems. The impacts of the degradation have been reflected by the erosion of biodiversity and the eradication of certain plants. The preservation and development of rangelands have been focused on defending; but recourse to the introduction of exotic species has been getting widespread. *Atriplex canescens* is among the species that have been introduced on a large scale in arid Algerian pastures. This species has been well known as a shrub, resistant to drought and salt, and it provides forage mainly to sheep and cattle during the dry season (Abderrahmane *et al*., 2014). On this subject, the opinions differed with regard to the utility from the use of this species. A field survey has shown that planting A. canescens had a negative impact on seed germination and the development of some important native forage plants in Algerian rangelands such as *Artemisia herba-alba.* Chemical exudates of some plants have been reported as agents responsible for allelopathy on the growth and development of neighboring plants and thus affecting normal growth in their natural environment (Putnam & Tang, 1986; Rice, 1984). Inhibitory allelopathic effects resulted from the action of allelochemical groups that interfered collectively in various physiological processes; modifying plant growth patterns (Kil & Shim, 2006). The purpose of the present study was to evaluate the negative impact of allelopathy of the various aqueous extracts obtained from the (FAC) and (RAC) of *Atriplex canescens* on the germination, growth and development of *Artemisia herba-alba*.

2. MATERIAL AND METHODS

2.1. Seed treatment and extract preparation

After the ripening of the seeds of Artemisia herba-alba asso, the samples were collected on 15/12/2017 from a natural population located in the area of "Taoudmout west of the city of Saïda, Algeria". The seeds were disinfected with hydrogen

peroxide titrating 10% (w / v) for 20 minutes, followed by four rinses with deionized water, and then stored dry at room temperature before the germination test.

2.2. Liquid solid extraction

The preparations of *Atriplex canesc*ens extracts were made from leaves and roots of samples taken from "Ain Skhouna south of the city of Saïda, Algeria" Dec 2017, the leaves and roots were separated and dried in a hot air dryer at 45°C. The samples were ground to a fine powder and packaged before being used for solvent extraction (Stalikas, 2007). The extractions were used to extract the active ingredients (Vermerris & Nicholson, 2006). The maceration of 80 g of the powder of each sample (roots and leaves) was diluted in a volume of one liter of distilled water , with magnetic stirring for 72 h at a temperature of (0 ± 4°C), by adding a reducing agent (ascorbic acid), to ensure the protection of phenolic compounds (Macheix & Jay, 2005). The procedure was repeated 3 times until the exhaustion of plant material. The extract of 80 g^l inhibited 100% germination of the seeds, and because of static representativeness, half of 80 g^l (40 g^l) was used, which showed that the sample was representative when a threshold was crossed 50%. The solutions were filtered through double layers of sterile wattman paper. The desired concentrations of (LAC) and (RAC); (0% distilled water, 2,5%;5%;10%;20% and 40%) were prepared by the addition of distilled water and methanol. Different concentrations were stored at 4°C until its use (Li *et al.* , 2011).

2.3. Experimental protocol

2.3.1. Germination of the seeds of Artemisia herba-alba.

Twenty tested seeds of species of *Artemisia herba-alba* were placed in boxes of Petri dishes lined with 2 layers of the absorbent paper, for conducting 4 repetitions of each concentration of (LAC) and (RAC). The experiment of 6 complete random batches, started from the 1st until the 20th day, then the control boxes were soaked daily into distilled water, and the other boxes were soaked into the solutions of concentrations. This culture was carried out in a culture chamber at 12°C and photoperiods of 12h /12h. The counting of germination was carried out everyday, the date of germination corresponded to the bursting of the radicle.

2.3.2. Measurement techniques of shoots and roots of young seedlings

After the period of germination, the lengths of shoots and roots of young plants of *Artemisia herba-alba* of each of the Petri dishes were evaluated. Ten young plants were randomly removed and placed on a graph paper, and photographed individually, and then the images were transferred to the Scion Imagej 1.48V software for determining the lengths of the roots and shoots. The measures of the fresh and dry weights were carried out by weighing young plants of different concentrations in the fresh and dry states (Figure 1; 2).

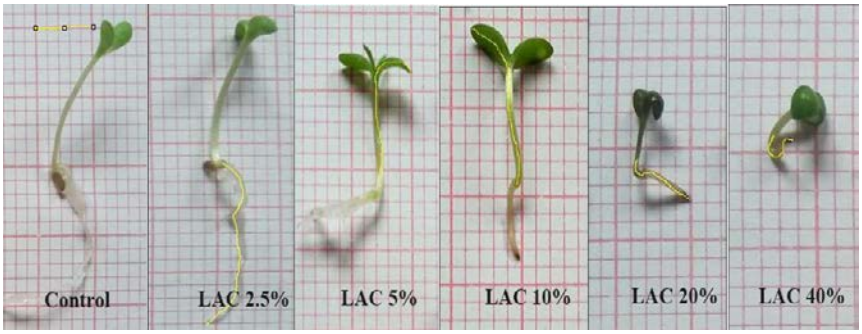

Fig. 1 . Determining the lengths of shoots and roots of *Artemisia herba-alba. asso* seedlings, by the extracts of the roots of *Atriplex canescens* (RAC).

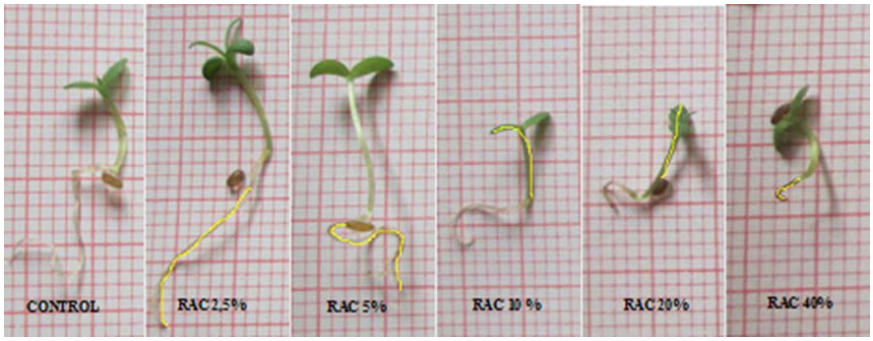

Fig. 2. Determining the lengths of shoots and roots of *Artemisia herba-alba. asso* seedlings, by the extracts from the leaves of *Atriplex canescens* (LAC).

2.3.3. Determination of the chlorophyll content of the leaves of Artemisia herb-alba.

100 mg leaf tissue of each treatment were collected, and then placed in glass vials containing 7 ml of dimethyl sulphoxide (DMSO). An incubation at 65°C for 48 hours was applied, the process was followed by the addition of 10 ml of (DMSO) in each vial. The products were stored at 4°C until the time of the analysis, this was a technique used by Elisante *et al*. (2013).

The extraction of chlorophyll from the leaves of the plant was carried out without crushing and centrifugation (Arnon, 1949). The evaluation of the chlorophyll was made by the spectrophotometer (OPTIZEN3220 UV), the values obtained were calculated using Arnon's equation:

$$Total\ chlorophyll\ \left(TCHL.\frac{mg}{L}\right) = 20{,}2D_{645} + 8{,}02D_{663}$$

2.4. statistical analysis

The data were subjected to the statistical analysis of variance (ANOVA), using software (IBM SPSS Statistic V.24). If a significant difference was found between the means, a pairwise comparison test of HSD Tukey at ($p \leq 0{,}05$) between the individual treatments were used to define the statistical significance. The parameters evaluated in this study included:

2.5. Germination rate

$$GR = ((Ni)\ /\ (Nt) \times 100)$$

where: GR: germination rate; Ni: total number of germinated seeds; NT: total number of tested seeds (Tran & Cavanagh, 1984).

2.6. Percentage of inhibition

$$I\% = ((control - Extract)\ /\ control) \times 100$$

where: I %: percentage of inhibition compared to the witness. (Dhima, Vasilakoglou, Eleftherohorinos, & Lithourgidis, 2006; Tseng, Kuo, Chen, & Chou, 2003).

Inhibition (inh) or stimulation (stim), shoot and root lengths, fresh and dry weights as well as total chlorophyll contents were accumulated in the leaves.

Kinetics of germination: It was estimated by the rate of germination according to time (days), varying by the various aqueous concentrations.

2.7. Speed of germination

$$Velocity\ coefficient = ([\sum n)\ /\ (\sum(n.Jn)] \times 100)$$

The velocity coefficient (CV) of Kotowski (1926), which was expressed by the comparison of the germination times of each tested seed, where n is the number of seeds germinated in a day, and Jn presents the number of days after seeding. When this style of the formula of the speed of germination was adopted, the calculation was done based on Harrington (1962) and Côme (1967).

$$\frac{N_1T_1 + N_2T_2 + N_3T_3 + \cdots + N_nT_n}{N_1 + N +_2 N_3 + \cdots + N_n}$$

Where N_1 is the number of seeds germinated at the time of T_1, N_{21} is the number of seeds germinated at time T_2, and N_n is the number of seeds germinated at time T_n. This formula corresponded to the reverse x100 of the "coefficient of velocity" of Kotowski (1926).

3. RESULTS

The results obtained in (Tables 1, 2 and 3), clearly showed the negative effects of the (LAC) and (RAC) extracts, on the parameters of the growth of the seedling of *Artemisia herba-alba.*

3.1. Kinetics of germination

The evolution of the percentages of germination in the function of time (20 days) has been represented in the (Figs. 3 & 4). The seeds seemed to tolerate the concentrations of 2,5% and 5% of the two aqueous solutions of (LAC) and (RAC), which were located above the witness curve, with time intervals varying between 6 to 16 days for leaves, and between 6 to 20 days for root concentrations. The germination rate started to slow down from 10%, in a way more accentuated for the first treatment, while the seeds submitted to the second treatment became sensitive than 20%. This kinetics had no particular meaning. A slowdown of the phenomenon of germination was noted when the concentrations were increased. Although the halophytes were highly developed morphologically and physiologically to tolerate salinity (Khan & Duke, 2001), they accumulated unwanted antinutrients, including salts and oxalates (Kumar, 1992), which constituted themselves by sodium or potassium oxalate and the oxalic acid. Thus, the presence of high doses of NaCl caused the osmotic potential to drop, which might delay or prevent the absorption of H_2O necessary for germination (Mirmazloum *et al.* , 2010) (Figure 3;4).

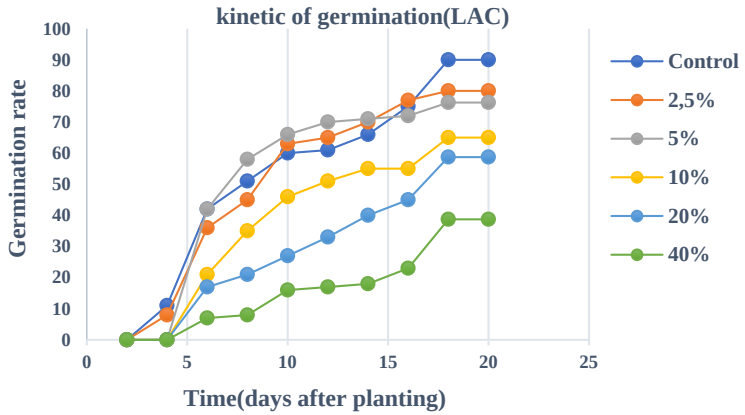

Fig. 3. The response of seed germination of *Artemisia herba-alba asso*, under the effect of changes in concentrations of (LAC), as a function of time (25 days).

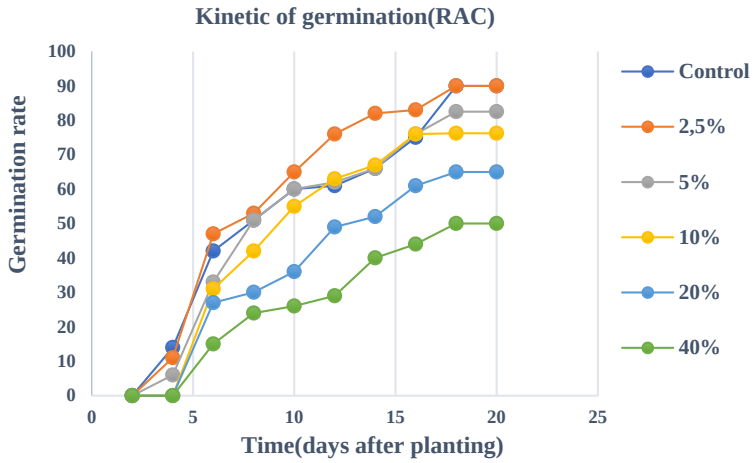

Fig. 4 . The response of seed germination of *Artemisia herba-alba asso*, under the effect of changes in concentrations of (RAC), as a function of time (25 days).

3.2. Speed of germination

For whole treatments, the coefficient of velocity (C_V) increased with concentrations, this increase was visible(10%), which corresponded to 10 days in both treatments, it had a significant effect ($p \leq 0,05$) in the control. The low concentration of 5% in both (Figures 3,4) had no significance ($p = 1$) in the control. The 2,5% concentration of (LAC) with a (C_V) of 10 days was significant ($p \leq 0,05$); on the other hand, the 2,5% concentration of (RAC) with a (C_V) of 7 days was not significant ($p = 0,192$) in the control. The results were compared with those of Nedjimi *et al.* (2013) who showed that the addition of 10g[1] of doses of $CACL_2$ to the culture medium decreased the speed of germination of *Atriplex halimus,* but did not seem to affect the speed of germination of *Atriplex Amnicola and Atriplex Lentiformis ;* only starting from 15g/1de NACL, the results could be explained by the physiological role of the toxic saline components of the halophyte as (oxalic acid) which precipitated and affected the growth target fabrics (Munns, 2002) (Figure 5 & 6).

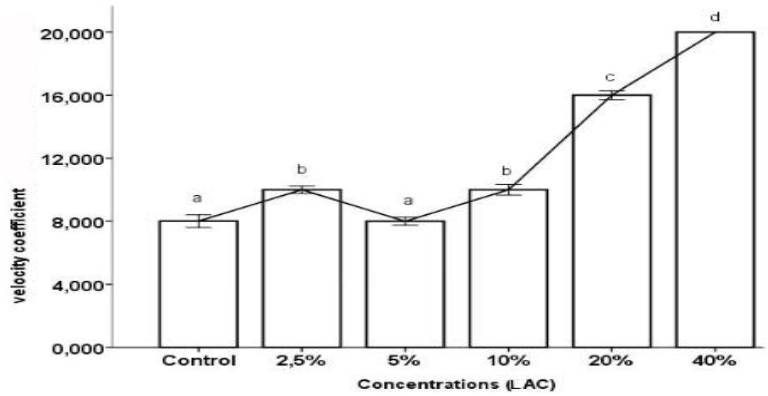

Fig. 5 . Velocity Coefficient (C_V) of *Artemisia herba-alba asso* seeds germination as a function of concentration (LAC).

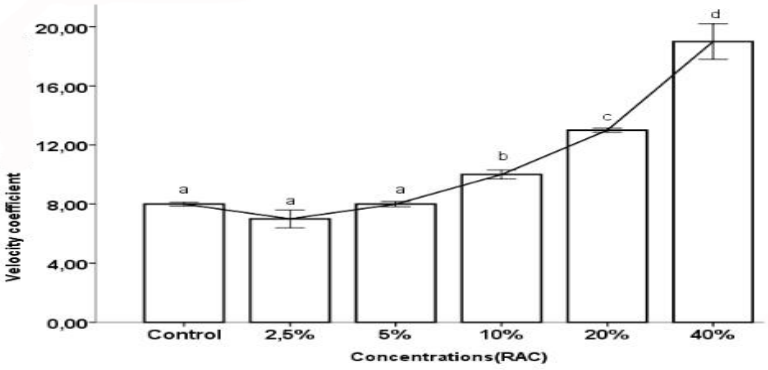

Fig. 6 . Velocity Coefficient (C_V) of *Artemisia herba-alba asso* seeds germination as a function of concentration (RAC)

3.3. Effects of (LAC) extracts on Artemisia herba-alba growth parameters

3.3.1. Effect on germination rate (GR)

The results showed that the high concentrations of extracts of (LAC) significantly affected the GR of seeds of *Artemisia herba-alba* (Table 1). Indeed, one recorded a TG of (38,75±10,30) % and 56 ,94% inhibition at a concentration of 40% ($p \leq 0,001$). By against under treatment with low concentration of 2.5% ($p = 0$,573), it was noted a GR of (80±8,16) % and 11.1% inhibition, which gave no significant difference with a GR of 90% and no inhibition (Table 1).

3.3.2. Effect on the length of the aerial parts

Table 1. The effects of *Atriplex canescens* (LAC) extracts on the growth parameters of *Artemisia herba-alba.asso*.

Aqueous extract of the leaves of Atriplex canescens						
Artemisia herba-alba.asso						
Concentrations (%)	Rate Germination (%)	Length Shoots (mm)	Length Roots (mm)	Fresh weight (mg)	Dry weight (mg)	Inh/Stim
C0=% , Control	90 ± 7,07 [a]	21,70 ± 2,04 [a]	28,86 ± 8,19 [a]	109,62 ± 21,29 [a]	4,36 ± 0,63 [a]	-
C1= 2,5%	80 ± 8,16 [ab]	19,97 ± 1,00 [a]	22,36 ± 9,71 [ab]	71,23 ±3,07 [b]	2,15 ± 0,20 [b]	11,1
C2= 05%	76,25 ± 2,5 [abc]	19,03 ± 5,01[a]	21,18 ± 2,02 [ab]	50,75 ±5,54 [bc]	1,63 ± 0,40 [bc]	15,27
C3= 10%	65 ±12,24 [bc]	16,99 ± 6,27 [ab]	15,80 ± 4,59 [bc]	50,42 ±1,76 [bc]	1,58 ± 0,28 [bc]	27,7
C4= 20%	58,75 ± 7,5 [c]	10,63 ±1,13 [bc]	4,15 ± 1,47 [cd]	41,18 ± 2,97 [cd]	1,33 ± 0,33 [bc]	34,72
C5= 40%	38,75 ±10 ,30 [d]	5,76 ± 1,21 [c]	1,67±0,36 [d]	20,92 ±3,25 [d]	1,00 ± 0,30 [c]	56,94
ANOVA ONE WAY						
F. statistic	18,14***	12,68***	14,68***	42,81***	39,82***	
	P ≤ 0,001	P ≤ 0,001	P ≤ 0,001	p<0,001	P ≤ 0,001	

Values presented are means ± std. Deviation. **, ***= significance at P < 0.01 and P < 0.001 respectively.C0, C1, C2, C3, C4, C5 are levels of concentrations. Means followed by the same letter in the same column are not significantly different for each parameter measured. According to the test (Tukey HSDa) at P ≤ 0.05.

The results recorded the effect of (LAC) extracts at (2,5%; 5% ;10%) on the means lengths of aerial parts of seedlings, did not show any significant decrease ($P = 0,979$; $P = 0,881$; $P = 0,425$) comparing to the control and it was noted for the lengths of shoots of (21,70±2,04 ;19,97±1,00 ;19,03±5,01) mm, respectively which belonged to the same group. By contrast, a significant response was recorded using a high concentration of 40%, which decreased the shoots' length to (5,76±1,21) mm with 56,94% inhibitions ($p \leq 0,001$).

3.3.3. Effect on the length of the root parts

The average lengths of the root parts were still affected significantly by (20% and 40%). Indeed, a reduction was noted in the lengths of (4,15±1,47 mm) with an inhibition of 34,72% and (1,67±0,36 mm) with an inhibition of 56,94% ($p \leq 0,001$). The lengths of the roots treated with low concentration of (2,5%) were 22,36±9,71 mm; $p = 0,586$ with an inhibition of (11,1%). At 5%, the average length was (21,18±2,02 mm; $p = 0,413$ with a rate of inhibition of 15,27%). They were thus nonsignificant compared to the control which was 28,86±8,19 mm.

3.3.4. Effect on fresh weight.

Whatever the concentrations (LAC) of extracts, they negatively affected the average biomass of young shoots of *Artemisia herba-alba*. The fresh weight of about 71,23±3,07 mg was recorded under 2,5% treatment which came down to (20,92±3,25 mg) under the concentration of 40%, whereas the fresh weight of the control was (109,62 mg; $p \leq 0,001$), and a loss of 88,7mg fresh weight was noted.

3.3.5. Effect on dry weight

Parallel to the negative effect of *Atriplex canescens* leaf extracts on fresh weight, the dry weight decreased significantly from (4,36±0,63 to 2,15±0,20) up to (1,00±0,30) mg, respectively at the concentrations of (0%; 2,5%; 40%; for $p \leq 0,001$). There was a loss of 3,36 mg in dry weight.

3.4. Effects of (RAC) extracts on Artemisia herba-alba

3.4.1. Effects on germination rate

A small concentration of 2,5% of the (RAC) extracts, and a GR of (90±7,07%; $p = 1$ and 0% of inhibition) were recorded compared to the witness which was about 90%, but at a high concentration of 40%, the reduction of GR was significant ($p \leq 0,001$), the rate decreased to 50%, and the rate of inhibition increased to 44,4% (Table 2).

Table 2. The effects of *Atriplex canescens* (RAC) extracts on the growth parameters of *Artemisia herba-alba.asso*

Aqueous extract of the roots of *Atriplex canescens*						
Artemisia herba-alba.asso						
Concentrations (%)	Rate Germination (%)	Length Shoots (mm)	Length Roots (mm)	Fresh weight (mg)	Dry weight (mg)	Inh/Stim
C0=%, Control	90 ± 7,07[a]	21,70 ± 2,04[a]	28,86 ± 8,19 [a]	109,62 ± 21,29 [a]	4,36 ± 0,63[a]	-
C1= 2,5%	90 ± 7,07 [a]	22,29 ± 4,63[a]	29,13 ± 6,55[a]	111,31 ± 20,0a[a]	4,46 ± 0,49[a]	0
C2= 05%	82,5 ± 5,00[ab]	20,34 ± 6,76[a]	26,76 ± 4,87[a]	77,03 ± 6,53[b]	2,35 ± 0,43 [b]	8,3
C3= 10%	76,25 ± 10,30[ab]	18,56 ± 2,37[a]	21,21 ± 2,98[ab]	70,01± 9,67[b]	1,84 ± 0,32[b]	15,27
C4= 20%	65 ± 7,07 [bc]	15,23 ± 3,13[ab]	11,52 ± 1,58[bc]	62,34 ± 2,34[b]	1,61± 0,28[b]	27,7
C5= 40%	50 ± 9,12 [c]	8,72 ± 2,94[b]	5,95 ± 2,72 [c]	50,30 ± 6,72 [b]	1,56 ± 0,32[b]	44,4

ANOVA ONE WAY						
F. Statistic	16,20***	6,60**	14,97***	14,57***	39,74***	
	P ≤ 0,001	P ≤ 0,01	P ≤ 0,001	P ≤ 0,001	P ≤ 0,001	

Values presented are means ± std. Deviation. **, ***= significance at P < 0,01 and P < 0,001 respectively.C0, C1, C2, C3, C4, C5 are levels of concentrations. Means followed by the same letter in the same column are not significantly different from each parameter measured. According to the test (Tukey HSDa) at P ≤ 0.05.

3.4.2. Effect on the length of the aerial parts

The length of the shoots between the witness and the various concentrations of (2,5%,5%,10%,20%) which belonged to the same homogeneous group (p =1; p = 0,996; p = 0,870; p = 0,247) respectively, did not present any significance. Except at 40% where there was a decrease in shoot length at (8,72±2,94) mm with an inhibition of 44,4% ($p \leq 0,003$) which presented an apparent significance with the control and a loss of 13,57 mm length per contribution to the 2,5% treatment.

3.4.3. Effect on the length of the root parts

The length of the roots' part was stimulated from 2,5% up to 10% (p =1; p = 0,990; p = 0,309) respectively, which to gave a significant difference with the control, and this length gradually decreased as the concentrations of the extracts increased by (20%, p = 0,001 to reach a length of 11,52 ± 1,58 mm, and an inhibition of 27,7%) and at (40%, 5,95 ± 2,72 mm in length and 44,4% of inhibition, $p \leq 0,001$), therefore a loss of length of 23,18 mm was found for the concentration of 2.5%.

3.4.4. Effects on fresh weight

In 2,5%, there was a high fresh weight of 111,31±20 mg which was included in the homogeneous group of the control (109,62±21,29 mg; p = 1). They were not statistically significant, while the other concentrations were included in the groups by pairs (C2; C3; C4; C5; p ≤ 0,05). The mean of fresh weight under the treatment of 40% was 50,30 ±6,72 mg, which revealed a decrease in the biomass of 61,01 mg and a statistical significance with the control ($P \leq 0,001$).

3.4.5. Effects on the dry weight

A greater value of (4,46±0,49 mg at 2,5%; p = 0,999) was noted, and a value of 4,36±0,36 mg for the control was not significant (p = 0,999), but the values of the dry weight >2.5% presented a significant difference with the control ($p \leq 0,001$), with a weight loss of 2.9mg.

3.4.6. Effects on the chlorophyll content

The analysis of the (Table 3) affirmed that the chlorophyll content was significantly reduced ($p \leq 0,05$) in *Artemisia herba-alba* seedlings treated respectively by the extracts of (LAC): (C0; C1; C2; C3; C4; C5), the values were respectively as follows: 6,21> 4,69> 3,66> 3,58> 2,98> 1,93. In addition, there was no significant difference between (C0; C1; C2) with a chlorophyll content 6,21±0,26 of control and (4,69 ±1.14; P = 1) and (3,66 ±0,30; P = 0,848); respectively. While for seedlings of *Artemisia herba-alba* treated respectively by the extracts of (RAC) of *Atriplex canescens* ,the chlorophyll levels of (C1; C2) were (6,27 ± 0,87; p = 1) and (5,79 ± 0,36; p = 0,848), and no statistically significant difference with the C0 control was found. Therefore, the reduction of chlorophyll content was noticed from C3; p = 0.007) in the leaves of young seedlings: (C3; C4; C5). The values were presented as follows: 4.72>4.26>3.06 (Table 3).

Table 3. The effects of *Atriplex canescens* (LAC) and (RAC) extracts on chlorophyll content accumulated in the leaves of *Artemisia herba-alba.asso*

The total chlorophyll content (mg / l)		
Atriplex canescens (LAC) extract		*Atriplex canescens* (RAC) extract
Artemisia herba-alba.asso		
Concentrations (%)		
C0=%, Control	6,21 ± 0,26 ^{a}	6,21 ± 0,26 ^{a}
C1= 2,5%	4,69 ± 1,14 ^{b}	6,27 ± 0,87 ^{a}
C2= 05%	3,66 ± 0,30 ^{bc}	5,79 ± 0,36 ^{ab}
C3= 10%	3,58 ± 0,11 ^{bc}	4,72 ± 0,30 ^{bc}
C4= 20%	2,98 ± 0,12 ^{cd}	4,26 ± 0,24 ^{c}
C5= 40%	1,93 ± 0,35 ^{d}	3,06 ± 0,67 ^{d}
ANOVA ONE WAY		
F. Statistic	31,82***	24,74***
	P ≤ 0,001	P ≤ 0,00 1

*Values presented are means ± std. Deviation. **, ***= significance at P < 0,01 and P < 0,001; respectively.C0, C1, C2, C3, C4, C5 are the levels of concentrations. Means followed by the same letter in the same column are not significantly different from each parameter measured, according to the test (Tukey HSDa) at P ≤ 0.05.*

4. DISCUSSION

The allelochemicals can inhibit the growth of the plants by modifying the distribution, elongation and the ultrastructure of the cells, or by modifying the normal physiological processes such as photosynthesis, respiration, the absorption of minerals and the enzymatic activity (Tseng *et al.* , 2003).

The present study showed the decrease in GR and the increase in the inhibition of *Artemisia herba-alba* seeds, for both extracts of the (LAC) and (RAC) from 5% with a little more emphasis on the first treatment of leaf extracts. The results corroborated with those of Hamedanian *et al.* (2010) who pointed out that the extracts of *Atriplex canescens* (fruits, leaves) had an allelopathic effect on seed germination of

Salsola rigida. Henteh *et al.* (2004) reported that *Atriplex canescens* had an allelopathic effect on the germination of *Artemisia sieberi.* The allelopathic effect of different *Atriplex* species was also reported by Davis (1981).

Moreover, the GR and the degree of inhibition were largely dependent on the concentration of the extracts of the (LAC) and (RAC). In parallel to the reduction of the GR, there was another inhibition of the length of the young shoots and roots which can be attributed to the allelochemicals present in the (RAC) and (LAC) extracts*.* The results corroborated with Hussain & Reigosa (2011) who found the inhibitory effect of allelochemicals (phenolic compounds) on the length of the roots and shoots of *Dactylis glo- Merata*, *Lolium perenne* and *Rumex acetosa*. The findings of this study suggested that the (LAC) and (RAC) concentrations significantly decreased the fresh and dry weights of the species tested, A similar observation was noticed by (Sahoo, Jeeceelee, Vanlalhriatpuia, Upadhyaya, & Lalremruati, 2010). The incapacity of the young sheets of accumulated chlorophyll which was an essential component of food, where this pigment located in the chloroplasts of plant cells, intervened in photosynthesis to intercept luminous energy was well noticed by the influence of high concentrations of extracts of the (LAC) and (RAC). The results obtained were also in conformity with those of (Elisante et al. 2013). Oyerinde *et al*. (2009) revealed the decrease in total chlorophyll at the young corn seedlings after being treated with the extracts of the aqueous fresh shoots of Mexican Sunflower. Yang *et al.* (2002) also noted that the accumulation of chlorophyll and porphyrin contained rice *Oryza sativa*, and the sowings were inhibited by the allelopathic concentrations of the increased phenolic compounds. The results in the second treatment of (RAC) extracts at the concentration of 2.5% revealed an unexpected stimulation for all the measured parameters. The results of the stimulation of low concentrations as in this study were reported by (Askham & Cornelius 1971; Jefferson & Pennacchio 2003) who also showed the existence of saponin in the plant organs of *Atriplex*, which exerted a preventive effect on the seeds' germination of the other plants. In general, one can say that *Atriplex canescens* exerted allelopathic effects on the seed germination of *Artemisia herba-alba*. Molisch (1937) expressed well that all the inhibitory chemicals of a plant at distinctive concentrations would probably be stimulating to lesser contractions and vice versa. So, this phenomenon usually covers the inhibitory and stimulatory effects in substances (Willis 2007). Consequently, in the management and the improvement of the rangelands, the allelopathic effect of the plants should be taken into account.

5. CONCLUSIONS

It was noted that this experiment was unrolled in a completely controlled environment, and the results cannot be applicable in a natural environment due to the existence of other influencing factors. Also, in order to better study the allelopathic phenomenon, it must be precisely known more about the effect of the three Amaranthaceaes (*A. canescens, A. halimus, A. nummularia*) on some species steppe native in Algeria like (*Stipa tenacissima, Lygeum spartum, Artemisia herba-alba*). Considering these results, it can be confirmed that *Atriplex canescens* had a certain Allelopathic effect, inducing a physiological and ecological mechanism which controls the germination and the growth of the young plants located around. The results obtained confirmed that the effect of *Atriplex* could harm the development of the local plant species in long run, particularly in the steppe ecosystem. To preserve the durability of the steppe ecosystems, it would be more advisable to resort, at the time of the operations of pastoral development to the local species such as the esparto, the sparte, and the armoise; and *Atriplex halimus* must nevertheless be installed on the level of its ecological facies.

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