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المجلة العراقية لبحوث السوق وحماية المستهلك

EFFECT OF *Artemisia vulgaris* L. AQUEOUS EXTRACT ON SOME GERMINATION PROPERTIES AND SEEDLING GROWTH OF LINSEED

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ABSTRACT

A laboratory experiment was carried out during winter season of 2021 in the Seed Technology Laboratory- College of Agricultural Engineering Sciences/ University of Baghdad, to find out the allopathic effects of aerobic and terrestrial aqueous extracts of *Artemisia vulgaris* L. on the seed germination and seedling growth of linseed. A factorial experiment according to a completely randomized design (CRD)at three replicates was used; the first factor in clouded type of aqueous extract for two plant parts which were aerobic (stems and leaves) and terrestrial (root and rhizomes), while the second factor included five concentrations of each aqueous extract of plant part 0, 25, 50, 75 and 100%. The results showed that there was significant effect of aqueous extract types on the studied traits; the terrestrial aqueous extract gave the highest germination percentage 64.67% and germination speed 25.37%/d, whereas the aerobic aqueous extract gave a highest mean of radicle length 2.5936 cm. Regarding of aqueous extract concentrations of *Artemisia vulgaris* weed, the concentration of 25% of Artemisia aqueous extract was significantly superior and achieved the highest mean of germination speed 27.25 %/day, shoot length 3.98 cm, radicle dry weight 0.0043 g and shoot dry weight 0.0239 g, while the control treatment 0% was significantly superior in the germination percentage 100% and radicle length 2.6615 cm. The interaction between two factors had significant effect on the germination percentage and germination speed only.

Keywords: *Artemisia vulgaris*, weed, allopathic effects, phenolic compound.

تأثير المستخلص المائي للشيح المعمر في خصائص الانبات ونمو البادرة للكتان

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الخلاصة

نفذت تجربة مختبرية خلال الموسم الشتوي لعام ٢٠٢١ في مختبر تكنولوجيا البذور- كلية علوم الهندسة الزراعية- جامعة بغداد لمعرفة التأثيرات الأليلوباثية للمستخلص المائي للأجزاء الهوائية والأرضيى لدغل الشيح في انبات البذور ونمو البادرة للكتان، اذ نفذت تجربة عاملية وفق تصميم تام التعشية وبثلاثة تكرارات، إذ تضمن العامل الأول نوع المستخلص المائي للشيح بحسب الجزء النباتي الذي تضمن الاستخلاص المائي من الاجزاء الهوائية (السيقان والأوراق) والاستخلاص المائي من الأجزاء الأرضية (الجذور والرايزومات)، بينما تضمن العامل الثاني تراكيز المستخلص المائي ٠ و٢٥ و٥٠ و٧٥ و١٠٠%، وأظهرت نتائج التجربة أن المستخلص المائي للأجزاء الأرضية لدغل الشيح تفوق معنويا بأعلى نسبة انبات ٦٤.٦٧% وسرعة الانبات ٢٣.٣٧%/يوم، بينما تفوق المستخلص المائي للأجزاء الهوائية في طول الجذير ٢.٥٩٣٦ سم، أما بالنسبة لتراكيز المستخلص المائي لدغل الشيح المعمر فقد تفوق التركيز ٢٥% معنويا في سرعة الانبات ٢٧.٢٥%/ يوم وطول الرويشة ٣.٩٨ سم والوزن الجاف للجذير ٠.٠٠٤٣ غم والوزن الجاف للرويشة ٠.٠٢٣٩ غم، في حين حقق التركيز صفر% (المقارنة) أعلى نسبة انبات ١٠٠% وطول الجذير ٢.٦٦١٥ سم، وكان تأثير التداخل بين عاملي الدراسة معنويا في نسبة الانبات وسرعة الانبات.

الكلمات المفتاحية: الشيح المعمر، الأدغال، التأثيرات الأليلوباثية، المركبات الفينولي.

INTRODUCTION

The spread of different types of weeds in agricultural fields in Iraq and their competition the economic crops for growth factors is one of the most important reasons for the decline of production, in addition to the chemical compounds (allelopathic) that the weeds secrete, which will affect the crops,as these secretions are one of the factors that reduce the growth of economic crops and thus affect the yield and its quality.Also, when plant residues decompose, they secrete phytotoxins, which inhibit and decrease the seeds germination and growth of crop **(Sangeetha & Paskar, 2015)**, as the plant species produce secondary metabolites that affect germination and growth as a result of the inhibitory effect of these metabolites on physiological processes that occur in plants such as respiration, photosynthesis, water balance, membrane permeability, cell division and enzymes activity **(Onen, 2007)**. Previous studies mentioned that there are 12 families that contain allopathic compounds, 68% are weed plants, and there are 200 species of the most important weeds in the world, 16% of which belong to Compostae familysuch as Artemisia species. The perennial *Artemisia vulgaris* L. weed is considered one of the ten harmful weeds in the world for crop production **(Bradley & Hagood, 2002)**, and this weed reproduces by rhizomes and seeds **(Al-Jubouri *et al*., 2013)**.Also, artemisia weed is characterized by its ability to produce allopathic compounds that affect the germination and growth of many plants, and these compounds differ according to species, environmental conditions, and plant growth stage as well as the plant parts **(Barney & Tommaso, 2002)**. **Onen (2007)** stated that Artemisia extracts are rich in phenolic compounds, including chlorogenic derivatives, flavonoids, phenolic acid and peptides, in addition to containing mono-terpenes, including α-terpenes, ß-terpenes, limonene, caffeine and camphor as well as sesquiterpenoid. **Judzentiene & Budiene (2017)** found that the perennial Artemisia weed contains other compounds, including resins, alkaloids, glycosides and lactones. **Bradley & Hagood (2002)** observed a decrease in the germination percentage of clover seeds grown in soil containing perennial Artemisia weed. **Baloch *et al*., (2017)** reported that the phenolic compounds have cytotoxicity, as they inhibit enzyme action and affect hormonal regulation, which negatively reflect on seed germination. The aim of this study is knowledge the allopathic effects of aerobic and terrestrial aqueous extract of Artemisia on the seed germination and seedling growth of linseed.

MATERIALS AND METHODS

A laboratory experiment was carried out during winter season of 2021 in the seed technology laboratory, college of agricultural engineering sciences, university of Baghdad, to find out the allopathic effects of aerobic and terrestrial aqueous extract of artemisia on the seed germination and seedling growth of linseed (Syrian variety). A factorial experiment according to a completely randomized design (CRD)at three replicates was used; the first factor included type of aqueous extracts for two plant part which were aerobic (stems and leaves) and terrestrial (root and rhizomes), while the second factor included five concentrations for each aqueous extract of plant part 0, 25, 50, 75 and 100%.

Preparations of aqueous extract concentrations

The extraction process was carried out in a seed technology laboratory in the department of field crops, college of agricultural engineering sciences university of Baghdad. The whole plants were taken from the perennial Artemisia weed (aerobic and terrestrial parts), washed with water, and the aerobic parts (stems and leaves) were separated from the terrestrial parts (roots and rhizomes), then aerobic and terrestrial parts were cut into small pieces. Cold water extraction method (laboratory temperature) was used, as 500 mL of distilled water was placed

in a warring blender and 500 g of weed was added to it (1:1 weight:volume) and mixed by mixer for 5 min, then the mixture was transferred to a glass cylinder, after which the sediment was separated from the precipitate using a screed cloth and kept in opaque bottles. This extract is considered full strength (100%) and other concentrations were prepared from it **(Al-Husseini & Al-Jubouri, 2018).**

The petri dishes at a diameter of 15 cm were prepared, cleaned and sterilized with 70% alcohol solution, and a filter paper was placed in each petri dish. 25 randomly selected seeds of linseed were placed on filter paper, and 10 mL of different concentrations of plant extract were added to each dish at the beginning of planting, then water was added to it evenly after planting. The petri dishes were placed in the laboratory temperature for a period of three weeks.

Studied traits (Kotowski, 1996).

1. Germination percentage (%):

It was after two weeks of seeds planting according to the following equation:

$$\text{Germination percentage (\%)} = \frac{\text{No. of normal seedlings}}{\text{No. of total seeds}} \times 100$$

2. Germination speed:

It was calculated by dividing the number of germinated seeds for each day for two weeks by the total number of germinated seeds.

3. Radicle and shoot length (cm):

Ten normal seedlings were taken, then the radicle and shoot was separated from their point of contact with the seed, and then the length of the radicle and shoot was separately measured using the ruler.

4. Radicle dry weight (g):

Ten normal radicles were taken, placed in perforated paper bags and dried in an electric oven at 65°C and then 45°Cfor 3 h, and then their weight was taken using a sensitive scale and the mean of radicle dry weight was extracted.

5. Shoot dry weight (g):

Ten normal shoots were taken, placed in perforated paper bags and dried in an electric oven at 65°C and then 45°C for 3 h, and then their weight was taken using a sensitive scale and the mean of shoot dry weight was extracted.

Statistical analysis

The data were statistically analyzed for all the studied traits using Gnestat program, and the least significant difference (L.S.D) test was used to compare between means at a level of probability 0.05.

RESULTS AND DISCUSSION

Germination percentage (%)

The results in the (Table 1) show that there was significant effect of aqueous extract type on the germination percentage, the terrestrial aqueous extract gave a highest germination percentage 64.67% compared with aerobic aqueous extract which gave a lowest 58.00%. The difference of the inhibitory compounds concentrations of in terrestrial and aerobic aqueous extract of Artemisia weed may be lead to a decrease the germination percentage **(Barney & Tommaso, 2002).** Also, the control treatment 0% was significantly superior and achieved a highest germination percentage 100% compared with concentration of 100% of Artemisia aqueous extract which achieved a lowest (18.34%).The reason of decrease the germination percentage with increase the concentrations of aerobic and terrestrial aqueous extract may be

due to an increase the concentration of allopathic compounds that affect seeds germination as a result of the inhibitory effect of these compounds on the enzymes activity responsible for decomposing complex organic matter in the seed to simpler materials **(Onen, 2007)**, or the reason of decrease the germination percentage may be attributed to an increase of Abscisic acid (ABA) concentration in, which is a sesquiterpenoid compound, in linseed seeds **(Chen *et al*.,2020)**.The results show that the increasing of aqueous extract concentration led to a decrease the germination percentage of linseed seeds. The interaction between two factors had significant effect on this trait; the control treatment of aerobic and terrestrial aqueous extract recorded the highest values 100 and 100% respectively, while the concentration of 100% of terrestrial aqueous extract recorded a lowest value 16.67% with non-significant difference with concentration of 100%of aerobic aqueous extract which recorded 16.67%.

Table (1): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on germination percentage (%).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	20.00	16.67	18.34
75	26.67	43.33	35.00
50	60.00	73.33	66.67
25	83.33	90.00	86.67
0	100.00	100.00	100.00
Lsd 0.05	9.10		6.44
Mean	58.00	64.67	
Lsd 0.05	4.07		

Germination speed (%/d)

The results in the (Table 2) show that there was significant effect of aqueous extract type on the germination speed, the terrestrial aqueous extract recorded a highest germination speed 25.37%/d compared with aerobic aqueous extract which recorded a lowest 23.71%/ d. The difference in the germination speed may be due to difference the concentrations of inhibitory compounds in terrestrial and aerobic aqueous extract of Artemisia weed **(Barney & Tommaso, 2002)**. Also, the concentration of 25% of Artemisia aqueous extract was significantly superior and gave a highest germination percentage 27.25%/d with non-significant difference with control treatment 0% which gave 26.60%/d. compared with concentration of 100% which gave a lowest 22.02%/d with non-significant difference with concentration of 75% which gave 22.90%/d. The difference in the germination speed of linseed seeds may be due to difference of penetration speed of inhibitory compounds to seed membrane due to different concentrations **(Al-Issawi *et al.*, 2017)**. The interaction between two factors had significant effect on this trait; the concentration of 25% of terrestrial aqueous extract recorded a highest value 27.77%/d with non-significant difference with concentration of 25% of aerobic aqueous extract 26.73%/d and control treatment of aerobic and terrestrial aqueous extract 27.00 and 26.20%/d, whereas the concentration of 100% of aerobic aqueous extract recorded a lowest value 19.50%/d.

Table (2): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on germination speed (%/d).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	19.53	24.50	22.02
75	23.77	22.03	22.90
50	21.50	26.37	23.94
25	26.73	27.77	27.25
0	27.00	26.20	26.60
Lsd 0.05	1.67		1.18
Mean	23.71	25.37	
Lsd 0.05	0.75		

Radicle length (cm)

The results in the (Table 3) indicate that there was significant effect of aqueous extract type on the radicle length; the aerobic aqueous extract had a highest mean of this trait 2.59 cm compared with terrestrial aqueous extract which gave a lowest 2.04 cm. Regarding of aqueous extract concentrations, the results in the (Table, 3) show that the control treatment 0% was significantly superior and achieved a highest mean of this trait 2.66 cm with non-significant difference with concentrations of 25 and 50% which achieved 2.54 and 2.47 cm respectively, compared with concentration of 75% of Artemisia aqueous extract which achieved a lowest 1.96 cm with non-significant difference with concentrations of 100% which achieved 1.97 cm. It appears from the results that the high concentrations of Artemisia aqueous extract inhibited growth compared with low concentrations, which may be attributed to an increase the concentration of phenolic compounds **(Pannacci *et al.*, 2020)**. Also, the reason of decrease the radicle length at high concentrations of Artemisia aqueous extract may be attributed to the containing of aqueous extracts of terpenes that work at high concentrations as antagonists to the gibberellins action, which leads to a decrease its concentration in radicle tissues and the negative reflection of this on the elongation of cells **(Jumaa & Ibrahim, 2011)**. The interaction between two factors had non-significant effect on this trait.

Table(3): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on radicle length (cm).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	2.41	1.53	1.97
75	2.99	0.92	1.96
50	2.40	2.53	2.47
25	2.11	2.97	2.54
0	3.05	2.27	2.66
Lsd 0.05	N.S		0.28
Mean	2.59	2.04	
Lsd 0.05	0.18		

Shoot length (cm)

The results in the (Table 4) reveal that there was non-significant difference between aqueous extract types on the shoot length. Otherwise, the concentrations of Artemisia aqueous extract were significant difference in the shoot length; the concentration of 25% had a highest mean of this trait 3.98 cm compared with concentration of 100% which had a lowest 1.52 cm. It appears that the high concentrations of Artemisia aqueous extract inhibited growth compared with low concentrations. However, the reason of decrease the shoot length at high

concentrations of Artemisia aqueous extract may be attributed to the containing of aqueous extracts terpenes that work at high concentrations as antagonists to the gibberellins action, which leads to a decrease its concentration in seedling tissues and the negative reflection of this on the elongation of cells **(Jumaa & Ibrahim, 2011)**, or the reason of decrease shoot length at high concentrations of Artemisia aqueous extract may be attributed to an increase the concentration of growth-inhibiting compounds such as flavonoids, phenols, alkaloids, glycosides and resins (**Judzentiene & Budiene, 2017)**. The interaction between two factors had non-significant effect on this trait.

Table (4): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on shoot length (cm).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	1.79	1.25	1.52
75	4.34	1.14	2.74
50	4.38	3.35	3.87
25	4.46	3.49	3.98
0	3.83	2.68	3.26
Lsd 0.05	N.S		1.08
Mean	3.76	2.38	
Lsd 0.05	N.S		

Radicle dry weight (g)

The results in the (Table 5) show that there was non-significant difference between aqueous extract types on the radicle dry weight. As for concentrations of Artemisia aqueous extract, the concentration of 25% of Artemisia aqueous extract was significantly superior and achieved a highest mean of radicle dry weight 0.0043 g with non-significant difference with concentrations of 0 and 50% which achieved 0.0041 and 0.0039 respectively compared with concentration of 100% which achieved a lowest 0.0005 g. The reason of decrease the radicle dry weight linseed at high concentrations of may be due to the inhibitory effect of the allopathic compounds of the Artemisia aqueous extract weed on the physiological activities that occur in the radicle **(Onen, 2007) ,**as the perennial Artemisia weed contains phenolic compounds, monoterpene compounds,sesquiterpenoid, resins, alkaloids, glycosides and lactones which are inhibitory compounds **(Judzentiene & Budiene, 2017; Onen, 2007)**. The interaction between two factors had non-significant effect on this trait.

Table (5): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on radicle dry weight (g).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	0.0010	0.0000	0.0005
75	0.0037	0.0011	0.0024
50	0.0037	0.0041	0.0039
25	0.0054	0.0032	0.0043
0	0.0027	0.0055	0.0041
Lsd 0.05	N.S		0.0013
Mean	0.0028	0.0033	
Lsd 0.05	N.S		

Shoot dry weight (g)

The results in the (Table 6) indicate that there was non-significant difference between aqueous extract types on the shoot dry weight. Otherwise, the concentrations of Artemisia aqueous extract were significant difference in the shoot dry weight; the concentration of 25% had a highest mean of this trait 0.0239 g compared with concentrations of 75% and 100% which had a lowest 0.0036 and 0.0038 g respectively. The reason of decrease the shoot dry weight at high concentrations may be due to the inhibitory effects of allelopathy compounds the physiological processes that occur in the seedling, including respiration, photosynthesis, cell wall permeability as well as damage the chloroplasts **(Al-Jubouri *et al.*, 2011)**. Form other hand; the reason of superiority the concentration of 25%in the shoot dry weight may be attributed to the superiority of same concentration in the shoot length. The interaction between two factors had non-significant effect on this trait.

Table(6): Effects of different concentrations of aqueous extract of aerobic and terrestrial parts of Artemisia on shoot dry weight (g).

Concentration (%)	Aqueous extract type		Mean
	Aerobic parts	Terrestrial parts	
100	0.0047	0.0030	0.0038
75	0.0047	0.0025	0.0036
50	0.0133	0.0170	0.0152
25	0.0224	0.0253	0.0239
0	0.0180	0.0135	0.0158
Lsd 0.05	N.S		0.0050
Mean	0.0126	0.0123	
Lsd 0.05	N.S		

CONCLUSION

It can be concluded that the aqueous extract of the leaves and stems of *Artemisia vulgaris* weed reduced the germination percentage and germination speed of linseed seeds.Also, the high concentrations of the aqueous extract of Artemisia (50, 75 and 100%) had a negative effect on the germination properties of and seeding growth linseed.On the other hand, the concentration of 25% improved the germination speed, shoot length, seedling dry weight (radicle and shoot).

REFERENCES

1. Al-Husseini, Z. A. H. & Al-Jubouri, A. M. (2018). Comparing the effect of the aqueous extract of saffron and kinetin on the production of microtubules of two potato cultivars using tissue culture technique. *Syrian Journal Agricultural Research,* 5(3), 37-43.
2. Al-Issawi, A. Y. H., Abdel Reda, K. K. & Hussein, H. G. (2017). Effect of Allelopathic potential of aqueous extracts from *Paspalum distichum* L. and *Cyperus spp.* L. leaves on germination and growth of some accompanying weeds of rice *Oryza sativa* L. *Thi Qar Journal of Science,* 6(2), 15-24.
3. Al-Jubouri, B. K., Al-Ketbi, D. S. & Al-Jubouri, A. B. (2013). Another species of Artemisia (*Artemisia vulgaris* L.) recently entered Iraq. *Al-Furat Journal of Agriculture Science,* 5(4), 401-415.

4. Al-Jubouri, M. S., Al-Zubaidi, N. A. & Al-Omawi, E. T. (2011). Antagonistic effect of some weed plants on the growth and quality of cowpea (*Vigna unguiculata* L.). *Diyala Journal of Agriculture Science,* 7(3), 56-66.
5. Baloch, N., Faheem, M.., Khan, T., Behlil, F., Urooj, S. & Bibi, M. (2017). Allelo chemicals of *Artemisia vulgaris* and *Astragalus* Species effect on seed germination of Brassica family. *Journal Pharmaceutical Science,* 4(7), 1818-1822.
6. Barney, J. N. & Tommaso, A. D. (2002). The biology of Canadian weeds.118. *Artemisia vulgaris* L. *Canadian Journal Plant Science,* 11, 206-215.
7. Bradley, K. W. & Hagood, E. S. (2002). Evaluations of selected herbicides and rates for long-term mugwort *(Artemisia vulgaris*) Control. *Weed Technology,* 1(16), 164-170.
8. Chen, K., Li, G. J., Bressan, R. A., Song, C. P., Zhu, J. K. & Zhao, Y. (2020). Abscisic acid dynamics, signaling, and functions in Plants. *Journal of Integrative Plant Biology,* 62(1), 25-54.
9. Judzentiene, A. & Budiene, J. (2017). *Chemical Polymorphism of Essential Oils of Artemisia vulgaris L*: In: *Chemistry and Biodiversity*. Growing Wild, Lithuania. 1-13.
10. Jumaa, N. A. & Ibrahim, N. S. (2011). Effect of aqueous and alcoholic extracts of eucalyptus on germination, growth and yield of wheat (*Triticum aestivum* L. Tammuz-1 variety). *Diyala Journal Agriculture Science,* 3(2), 761-776.
11. Kotowski, F. (1996). Temperature relation to germination of vegetable seeds. *Horticultural Science,* 23, 176-184.
12. Onen. H. (2007). Autotoxic potential of Mugwort (*Artemisia vulgaris* L.). *Allelopathy Journal,* 19(2), 323-336.
13. Pannacci, E., Masi, M., Farneselli, M. & Tei, F. (2020). Evaluation of Mugwort (*Artemisia vulgaris* L.) aqueous extract as a potential bio-herbicide to control *Amaranthus retroflexus* L. in maize. *Journal of Agriculture,* 642, 1-13.
14. Sangeetha, C. & Paskar, P. (2015). Allelopathy in weed management: A critical review. *Academic Journal,* 10(9), 1004-1015.