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BIOLOGICAL ACTIVITY OF PHENOLIC COMPOUNDS RELEASED FROM BARLEY AND SAFFLOWER WITHIN THREE GROWTH STAGES (SEEDLINGS, ELONGATION, AND FLOWERING) ON BARLEY AND SAFFLOWER CROPS GROWTH

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ABSTRACT

Experiments were designed according to Randomized Complete Block Design (RCBD)to study the effect of barley and safflower leachate at three growth stages (seedlings, elongation, and flowering) on seed germination and growth of barley and safflower varieties. The study included conducting two experiments in the greenhouse of the Biology Department/ Science College/ Mosul University, on 20/10/2023. The results showed a variation in effect between increases and decreases depending on treatments, stages of growth, and traits studied. Several phenolic compounds were identified using HPLC techniques in the safflower plant (Ferulic acid, gallic acid, kaempferol, Rutin), while ferulic acid (gallic acid, apigenin, luteolin) was identified in barley plants. The results indicated differences in concentration of chemical compounds isolated from plant residues of barley and safflower for growth stages (seedlings, elongation, flowering). It was found that the highest concentration of Gallic acid compound was for barley and safflower in all stages of growth identified compounds gave the highest Concentrations in seedling stage of both plants, while flowering stage recorded lowest concentrations.

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INTRODUCTION

Agricultural development is required to attain economic and agricultural stability because agricultural sector faces numerous obstacles. It is crucial to use technology to allow for contemporary approaches and possibility of finding and solving (Al-Juheishy and Ghazal, 2023). Allelopathy is one of this solving. Allelopathy refers to all biochemical interactions between plants, including microorganisms, and includes negative and positive effects (Rice, 1984). This phenomenon occurs through what the allelopathic plant releases to the environment of secondary metabolic compounds (Allelochemical) in various ways, such as root exudation, volatilization, Leaching, and plant residue decomposition) by microorganisms (Kohli *et al.*, 2001). This phenomenon plays an important role in natural and agricultural ecosystems (Rizvi *et al.*, 1992). It is worth noting that allelopathic plants are not limited to weeds, but rather include crops, aquatic plants, and other species in the plant kingdom.

Identifying the presence of this phenomenon in crops led to highlighting the possibility of exploiting it in the biological control of various agricultural pests.

Efforts have focused on the possibility of using different allelopathic crops in weed management and devising strategies for this purpose to reduce reliance on chemical pesticides that are harmful to the environment and health, as well as About the possibility of developing resistance to weeds and the emergence of strains that are resistant to pesticides (Cheema *et al*., 2000).

Ben-Hammouda et.al, (2002) conducted experiments to test the Autotoxicity of barley crops. They found that the leaves caused a high inhibition of the plant, while root extracts were less inhibitory. The results also showed that the allelopathic effect of barley on the roots were greater than the rest of the plant parts. Al-Taie *et al*. (1994) also found that water extracts from soils previously planted with barley, cotton, yellow corn, and soybeans caused an inhibition in the germination and growth of two types of barley. As so the results reached by Al-Obaidi (1990) that showed water extracts of the roots of the yellow corn crop inhibited significantly the percentage of germination and growth of seedlings of two types of wheat, while Zwain (1996) indicated that aqueous extracts of wheat residues significantly inhibited the rate of seed germination and seedling length for rice and Mungbean.

Study aims to identified phenolic compounds by using HPLC techniques in safflower plant (Ferulic acid, gallic acid, kaempferol, Rutin), while ferulic acid (gallic acid, apigenin, luteolin) was identified in barley plants.

MATERIALS AND METHODS

The effect of water leachate of barley and safflower

To study the effect of barley and safflower leachate three growth stages (seedlings, elongation, and flowering) on the germination and growth of barley and safflower varieties. Petri dishes with a diameter of (13.8 cm) were used, and 15 seeds were placed in each dish between two filter papers in three replicates, and 8 ml of aqueous extract of barley and safflower at a concentration of 5%, and distilled water application was used as control treatment. The dishes were incubated at a temperature of 25±2 °C in a Gallenkhamp-type incubator. After seven days of sowing, the germination rate was measured and the number of seedlings was reduced to (5) seedlings. After 14 days of planting the shoot and root lengths of the seedlings were measured, and the dry weight of the seedlings was taken after drying them in the oven at 60°C for 72 hours (Al-Juhaishi, 2017). The percentage of germination was measured using the following equation:

$$Germination\ Percentage\ =\ No.\ natural\ seedlings/No.seeds\ sowing\ x\ 100\ (Saied,1984)$$

Leachate experiments in a greenhouse

The experiments were designed according to a randomized complete block design (R.C.B.D.) to study the effect of barley and safflower Leachate in three growth stages (seedlings, elongation, and flowering) on seed germination and growth of barley and safflower varieties in three replications. The study included conducting two experiments in the greenhouse of the Department of Biology/College of Science/University of Mosul. On 10/20/2023, at following:

First experiment

Studying the effect of barley on safflower. In this experiment, the pots were placed on a stand that included two shelves. The first shelf (the upper one) had three pots in

which barley seeds were sowed with ten seeds/pots, and the second shelf (lower) had three pots in which ten safflower seeds were sowed. The effect of barley water Leachate on safflower was studied through irrigation water falling after watering the barley plant to the point of saturation.

Second experiment

The study included the effect of safflower Leachate on barley. The experiment was designed as the first and in the same way to study the effect of safflower Leachate on barley through irrigation water falling.

Studied traits

1- Percentage of germination (%): was calculated 15 days after planting, according to the following equation:

$Germination\ Percentage\ =\ No.natural\ seedlings/No.seeds\ sowing\ x\ 100$ (*Saied,* 1984).

2- Phenotypic traits that were studied during the three growth stages (seedlings, elongation, and flowering)

- Shoot height (cm)، number of leaves, Leaf area (cm^2): Leaf area was calculated based on the following equation:

$Barley\ leaf\ area\ (cm^2)\ =\ leaf\ length\ x\ Max\ leaf\ width\ x\ 0.95$ (*Thomas,* 1975)

Safflower leaf area (cm^2) =
Whole leaf Weight × Area of small section / Weight of the small section (Shaheen, 1987)

- Estimation of chlorophyll content: Chlorophyll was estimated using a SPAD device known as chlorophyll -meter -SPAD 502 plus- made in Japan.

Traits that were studied after harvest

- Root length/cm
- Dry weight of root/g
- Dry weight of shoots (g)

Diagnosis of Phenolic Compounds in Safflower and Barley crops

Phenolic compounds were characterized using High-Performance Liquid Chromatography (HPLC) prepared alcoholic extracts of shoots according to the modified method of Al-Juhaishi (2017).

RESULTS AND DISCUSSION

Results in Table (1) Showed a variation in the effect between increases and decreases depending on the treatments, stages of growth, and traits studied. Through the results, it was noticed that the percentage of barley germination increased due to the effect of barley Leachate in the elongation and seedling stages. The reason can be due to phenolic compounds released from barley. Which were diagnosed using HPLC technology, Table (6). The results showed that the barley Leachate contains (Gallic acid, Ferulic acid, Quercetin, luteolin, and Caffeic acid), which may affect the enzymes responsible for the germination such as α-Amyles enzyme, as well as the division of cells. (Taher and Hussen, 2021). While it caused a decrease in the rest studied traits at all growth stages, the reason can be due to the presence of phenolic

compounds and alkaloids, which inhibit the activity of Auxin and the oxidase enzyme, which affects the growth and mitotic division of the shoot and root (Kamal and Bana, 2008). As for safflower, they caused a decrease in most studied traits, especially in the seedling and elongation stages. Reason can be due to the found Rutin, which was identified by HPLC technology, which plays impartment role in hindering plant growth (Kuamr *et al.*, 2011).

Table (1): Effect of Barley and Safflower Leachate on barley under laboratory conditions

Growth Stage	Treatment	Seed germination%	plumule Length (cm)	Root length(cm)	Root dry weight(gm)	Plumule dry weight(gm)
Seedling	Control	85b	6c	18.4 a	0.1812a	0.0514ab
	Safflower	93a	7.3b	9.3c	0.0525c	0.0592a
	Barley	80c	8.70 a	16.66b	0.0685b	0.0541ab
Growth Stage effect		86a	7.33c	14.73a	0.1007a	0.0549b
Elongation	Control	85c	9.68b	15.3b	0.0569b	0.0569c
	Safflower	86b	5.42b	8.00c	0.0685a	0.0600b
	Barley	100a	9.69a	16.5a	0.0525b	0.0736a
Growth Stage effect		86a	8.26b	13.26b	0.0593b	0.0635a
Flowering	Control	85b	14.18a	10.90a	0.0250 a	0.0312a
	Safflower	80c	6.37c	10.03b	0.0018b	0.0026c
	Barley	100a	9.70b	9.70c	0.0084b	0.0291b
Growth Stage effect		86a	10.08a	10.21c	0.0117a	0.0209c
Treatments effect	Control	85c	9.95a	14.86a	0.0877a	0.0465b
	Safflower	86.33b	6.36c	9.11c	0.0356c	0.0406c
	Barley	93.33a	9.36b	14.28b	0.0488b	0.0511a

*Means followed by different letters within each column are significantly different from each other under 0.05 probability based on ***** mean separation test.

Results Table (2) shows the effect of barley and safflower Leachate on safflower in the laboratory. It was shown that the safflower Leachate caused a decrease in seed germination and plumule length in the three stages and the highest percentage of inhibition (17.77) in seed germination in the flowering and elongation stages. Reason can be due to the presence of Rutin, which is known for its effect in hindering plant growth. While noticing an increase in plumule dry weight in the three stages, the reason may be due to the presence of Gallic acid in high concentration in the three stages, which is known for its role in increasing plant growth by increasing the process of photosynthesis and absorption of nutrients (Shao *et al.*, 2024). Given the effect of the growth stage, the results showed that the seedling stage gave the highest percentage of increase compared to the rest of the stages. The reason may be because the phenolic compounds identified by HPLC have a higher concentration than the rest of the stages. As for the effect of the treatments, the results show that the aqueous extracts of safflower caused an inhibition in the studied traits, except root length. The reason can be due to the effect of the released phenolic compounds identified in the table. HPLC.

Table (2): Effect of Barley and Safflower Leachate on Safflower under laboratory conditions

Growth Stage	Treatment	Seed germination %	plumule Length (cm)	Root length (cm)	Root dry weight (gm.)	Plumule dry weight (gm.)
Seedling	Control	90b	10.5 a	10.65b	0.1506 a	0.0540a
	Safflower	86c	7.16b	10.67b	0.0331b	0.0580 a
	Barley	93a	10.55 a	18.5 a	0.0129c	0.0555a
Growth Stage effect			9.40	13.27	0.0655	0.0558
Elongation	Control	90a	4.42b	7.76b	0.0583 a	0.0523b
	Safflower	83c	4.34bc	5.55c	0.0129b	0.0613 a
	Barley	90a	12.32 a	16.09 a	0.0525a	0.0555b
Growth Stage effect			7.026	9.8	0.0412	0.0563
Flowering	Control	90a	6.55b	6.76c	0.0207 a	0.0028c
	Safflower	83b	5.53c	10.07b	0.0222 a	0.0336 a
	Barley	90a	11.14 a	16.05 a	0.0182b	0.0244b
Growth Stage effect			7.74	10.96	0.0203	0.0202
Treatments effect		90b	7.15b	8.05c	0.0760 a	0.0363c
		84c	5.67c	8.76b	0.0227b	0.0509 a
		91a	11.33a	16.88 a	0.0278b	0.0451b

Table (3) shows the effect of barley Leachate on some traits of the safflower plant in three stages of growth (seedlings, elongation, flowering). Results that there was an inhibition in the germination percentage of safflower seeds growing in the soil to which the barley Leachate was added at all growth stages, the highest percentage of inhibition is 50% in the elongation and flowering stages. The reason for this can be due to the phenolic compounds released during these two stages. Seed germination is a biochemical and physiological process through which the amylase enzyme is analyzed when the seeds are stimulated with water, which decomposes the starch and provides the embryo with the energy it needs for germination (Regnault- Roger *et al.*, 2008). Results also showed a decrease in both plant height and the number of leaves under the influence of Leachate for the tested plants at all stages of growth. The reason may be due to the inhibition or obstruction of Auxin (IAA), which is responsible for the elongation of plants, which leads to shortening. Stem length or dwarfism is due to the effect of secondary metabolic compounds released from the barley (Al-Zubaie, 2019). An increase in leaf area was observed in the seedling and elongation stages, and the highest percentage of increase reached 18.70% by effect of Leachate of barley in the seedling stage increase may be due to the improvement of the plant's ability to carry out various processes (Al-Ghazal and Al-Juheishy, 2024).

Table results (4) show a significant decrease in the germination of barley seeds due to the effect of safflower Leachate in the growth stages (seedlings, elongation, and flowering). The highest percentage of inhibition (75%) in the seedling stage.

Table (3): Effect of Barley Leachate on Safflower growth i indicators under greenhouse conditions

Growth Stage	Treatment	Seed germination %	Shoot Length (cm)	Leaf area (cm2)	No. leaf Leaf/plant
Seedling	control	100 a	30.2 a	83.82 b	10.75 a
	Barley	60 b	23.6b	99.6 a	4.08 b
Elongation	control	100 a	46.16 a	71.8 a	24a
	Barley	50 b	27.94 b	58.02 b	15.7 b
Flowering	control	100 a	48.6 a	96.58 a	42a
	Barley	50 b	35 b	25.21 b	17.3 b

The reason may be due to the difference in the extract's content of phenolic compounds (Al-Snafi, 2015), and from observing the effect of safflower Leachate on barley, results showed that there was a reduction in most of the studied traits (plant height, leaf area, number of leaves) due to the effect of irrigation with safflower Leachate in the two stages (elongation and flowering), while we find an increase in (Plant height, leaf area, number of leaves) when treated with water Leachate of safflower in the seedling stage due to their varying response to environmental conditions(Al-Obady *et al.*, 2022) and genetic factors. The highest percentage of inhibition in plant height was (45.06%) in the flowering stage, while it was 13.96 and 53.45% in the leaf area and number of leaves, respectively. Under the influence of safflower Leachate in the elongation stage, the inhibitory effect on seed germination increased due to the increase in secondary metabolites identified in safflower leaves, including phenols, which may influence the effectiveness of plant hormones and enzymes that aid in germination (Muhammad, 2013)

Table (4): Effect of Safflower on some growth indicators of Barley under greenhouse conditions.

Growth Stage	Treatment	Seed germination%	Shoot Length (cm)	Leaf area (cm2)	No. leaf Leaf/plant
Seedling	control	80a	12 b	1.90b	11 a
	Safflower	20 b	18.17 a	2.53 a	3.66 b
Elongation	control	80 a	28.16 a	45.17 a	23.33 a
	Safflower	50 b	18.55 b	38.86 b	10.86 b
Flowering	control	80 a	80.33 a	10.17 a	46.66 a
	Safflower	50 b	43.8 b	10.16 a	26.33 b

Results in Figures (1) and (2) show a significant decrease in the chlorophyll content in barley and safflower leaves due to the effect of safflower and barley Leachate in the growth stages (seedlings, elongation). The highest percentage of inhibition reached (20.87, 100%), respectively, in the seedling stage. The reason can be due to It contains high concentrations of phenolic compounds, which HPLC identified in the safflower plant (Ferulic acid, Gallic acid, Kaempferol, Rutin), while (Ferulic acid, Gallic acid, Apigenin, luteolin) were identified in the barley plant Table (8), which effects on Photosynthesis by reducing the chlorophyll content and photosynthesis products (Yu *et al.*, 2003).

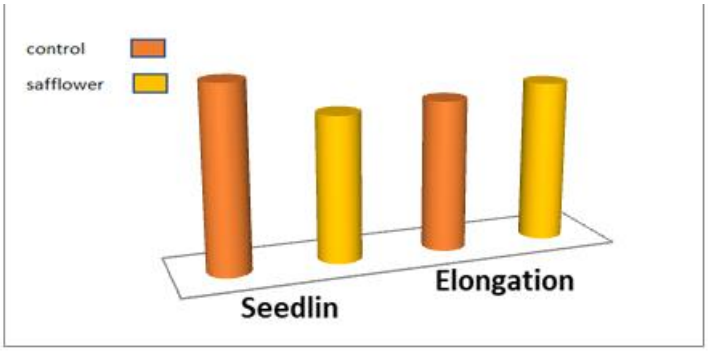


Figure (1): Effect of barley on chlorophyll content in safflower leaves under greenhouse conditions

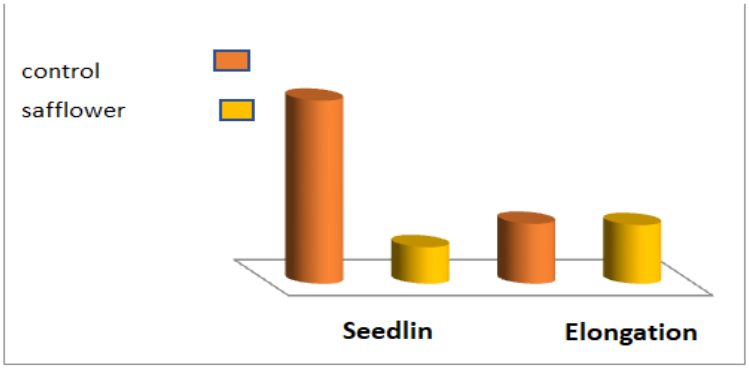


Figure (2): Effect of safflower on chlorophyll content in barley leaves under greenhouse conditions

Show the effect of safflower and barley Leachate on both barley and safflower plants in root length and shoot and root dry weight systems in Table (5). Results showed an inhibition in the studied traits of barley due to the effect of safflower leachate, and the inhibition rate of 0.93, 88.05, and 16.78% in Root length and shoot and root dry weight, respectively.

As for the effect of barley Leachate on the safflower plant, it also caused inhibition of the studied traits (root shoot length and shoot and root dry weight), and the rate of inhibition (20.22%, .51.03%, and 72.00%) respectively. The reason for this can be due to the inhibitory effect of its several phenolic compounds that were identified using HPLC techniques, or obstruction of the auxin hormone (IAA), which is responsible for elongating plants, leading to shortened stem length or dwarfism due to the effect of antibiotic compounds secreted by the plant, (Al-Zobaie, 2019). dwarfism in the lengths of plants treated with the extract is a defensive reaction against chemical compounds. These polyphenolic compounds (glycosides) released from barley and safflower plants are inhibitors of seedling growth and elongation (Ahmed, 2012) The reason can be due to effect of (Caffeic acid, Ferulic acid) identified in HPLC. Caffeic acid which affects the enzymes peroxidase, Phenyalanine, and ammonia hydrolase (Bubna *et al*., 2011), and Ferulic acid may also have affected the enzymes maltase, phospholipase, and protease, which reduces the length of the root and the weight of the plant. (Majeti and Devi, 1992). Result show increace in Shoot dry weight of barley by effect of safflower Leachate that positive effect of a low rate of applied substances could be due to enhancing dry matter forma (Abobatta *et al*., 2024).

Table (5): Effect of barley and safflower Leachate on some phenotypic traits of barley and safflower crops

Cultivars	Treatment	Seed germination %	Root length (cm)	Shoot dry weight (gm.)	Root dry weight (gm.)
Barley	Control	100 a	21.4 a	18.59 b	0.2663 a
	Safflower	50 b	21.2 a	20.22 a	0.2216
Cultivar effect		75 a	21.2 a	19.4 a	0.2439 a
Safflower	Control	100 a	17.75 a	8.72 a	2.19 a
	Safflower	50 b	14.16 b	4.27 b	0.61b
Cultivar effect		75 a	15.95 b	6.49 b	1.41 b

Diagnosing and determining the quantitative level of phenolic compounds in plant residues of barley and safflower for three growth stages (seedlings, elongation, and flowering) by HPLC technology:

High-Performance Liquid Chromatography (HPLC) separates phenolic compounds by drawing curves of the absorption peaks for each compound coupled with its retention time (RT), as shown in Table (6) of the relevant curves. (RT) values for the standard compounds were adopted to match them with the (RT) values for the compounds separated from alcoholic extracts of barley and safflower for the growth stages (seedlings, elongation, and flowering), Table (6) and Fig (3) shows (RT) values for the compounds identified in the plant residues of barley and safflower for three growth stages. The results showed the presence of some phenolic compounds known for their allelopathic ability that were diagnosed with this technology.

Table (6): Distribution of identified phenolic compounds and the retention time (RT) values diagnosed using HPLC technology for alcoholic extracts of barley and safflower for the growth stages (seedlings, elongation, and flowering).

No	Phenolic Compound	Rt	Safflower			Barley		
			Seedlings	Elongation	Flowering	Seedlings	Elongation	Flowering
1	Ferulic acid	5.89	5.86	5.86	5.86	5.88	5.87	5.85
2	Gallic acid	3.92	3.94	3.97	3.92	3.86	3.83	3.85
3	Kaempferol	7.90	7.92	7.99	7.95	-		
4	Caffeic acid	7.08	-			7.16	7.10	7.19
5	Luteolin	11.28	-			11.24	11.21	11.21
6	Rutin	6.15	6.14	6.16	6.18	-		
7	Apigenin	2.48				2.41	2.45	2.48

Based on the analysis of HPLC technology, phenolic compound concentrations were calculated and estimated quantitatively by comparing the area under the curve of the standard substance with the area under the curve of the plant residue samples. The results of Table (7) indicated that there were differences in the concentration of chemical compounds isolated from the plant residues of barley and safflower for the stages of growth (seedlings, elongation, flowering). We find that the highest concentration of the Gallic acid compound was in barley and safflower in all stages of growth. The highest concentration was in the seedling stage of the safflower

(22.14 (µg/g)) determined by HPLC technology, while the lowest concentration in safflower was of the Kaempferol and luteolin in barley. The identified compounds gave the highest concentrations in the seedling stage of the two plants, while the flowering stage recorded the lowest concentrations.

Table (7): Estimation of the amount of phenolic acids (µg/g) identified using HPLC technology for alcoholic extracts of barley and safflower for growth stages (seedlings, elongation, and flowering).

No	Phenolic Compound	Rt	Safflower			Barley		
			Seedlings	Elongation	Flowering	Seedlings	Elongation	Flowering
1	Ferulic acid	5.89	19.80	17.44	15.66	18.90	16.25	14.58
2	Gallic acid	3.92	22.14	20.45	18.99	20.6	18.98	16.58
3	Kaempferol	7.90	19.80	17.44	15.98			
4	Caffeic acid	7.08				14.59	12.89	10.98
5	Luteolin	11.28				13.66	12.66	8.77
6	Rutin	6.15	20.69	18.98	16.25			
7	Apigenin	2.48				19.11	14.00	11.58

Diagnosis and quantitative determination of phenolic compounds in plant residues of barley and safflower treated with Leachate of both barley and safflower using HPLC technology:

High-Performance Liquid Chromatography (HPLC) separates phenolic compounds by drawing curves of the absorption peaks for each compound coupled with its retention time (RT), as shown in the tables of the relevant curves. (RT) values for the standard compounds were adopted to match them with the retention values for the compounds separated from Plant extracts of barley and safflower grown under the influence of Leachate for both barley and safflower. Table (8) shows the (RT) values of the compounds identified in the plant residues of barley and safflower for three growth stages. The results showed the presence of some phenolic compounds known for their allelopathic ability that were diagnosed with this technology.

Table (8): Distribution of the identified phenolic compounds and the retention time (RT) values identified by HPLC technology for alcoholic extracts of barley and safflower treated with Leachate for both barley and safflower.

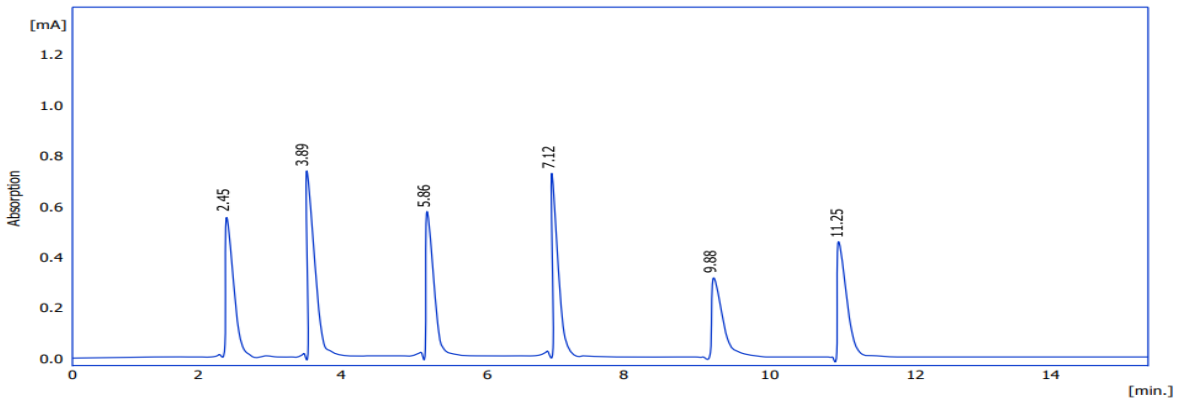
NO.	Phenolic Compound	R.T	Safflower	Barley on Safflower	Barley	Safflower on Barley
1	Ferulic acid	5.89	5.80	5.85	5.86	5.86
2	Gallic acid	3.92	3.90	3.98	3.89	3.85
3	Kaempferol	7.90	7.90	7.99	-	-
4	Caffeic acid	7.08	-	-	7.12	7.14
5	luteolin	11.28	-	-	11.25	11.26
6	Rutin	6.15	6.12	6.19	-	-
7	Apigenin	2.48			2.45	2.41
8	Qurcetine	5.40				

Based on HPLC technology analysis, the concentration of phenolic compounds was calculated and estimated quantitatively by comparing the area under the curve of the standard substance with the area under the curve of plant samples of

barley and safflower grown under the influence of Leachate for both barley and safflower. The results of Table (9) indicated differences in the concentration of phenolic compounds. Isolated from barley and safflower, that found an increase in the concentrations of the compounds in the leaves of barley and safflower due to the effect of barley and safflower Leachate, which was determined using HPLC technology. The highest concentration of the Gallic acid compound of the safflower plant reached (46.90 µg/g). This may be due to the variation in the percentages of secondary metabolite compounds in barley. and safflower to the influence of biotic and abiotic factors or environmental differences that affect the formation of these chemical compounds and their concentrations in the plant (Jan et. al, 2021).

Table (9): Estimation of the amount of phenolic acids (µg/g) identified using HPLC technology for alcoholic extracts of barley and safflower grown under the influence of Leachate for both barley and safflower.

No.	Phenolic Compound	Safflower	Barley on Safflower	Barley	Safflower on Barley
1.	Ferulic acid	33.56	39.00	24.58	26.11
2.	Gallic acid	41.25	46.90	32.56	34.12
3.	Kaempferol	22.60	28.99	-	-
4.	Caffeic acid	-	-	15.88	17.50
5.	luteolin	-	-	10.25	12.55
6.	Rutin	35.65	40.12		-
7.	Apigenin	-	-	17.89	18.45



Result chromatography Table (Uncal - F:\ sample 1)

No	Reten. Time [min]	Area [mAU.s]	Height [mAU]	Area [%]	Height [%]	W05 [min]	Compound Name
1	2.45	2562.65	580.41	15.00	15.00	0.10	
2	3.89	4512.66	710.23	25.00	25.00	0.15	
3	5.86	2844.56	592.66	15.00	15.00	0.10	
4	7.12	4785.98	715.44	25.00	25.00	0.15	
5	9.88	2541.11	320.69	10.00	10.00	0.05	
6	11.25	2985.35	400.36	10.00	10.00	0.08	
	Total	20232.15	3319.20	100.00	100.00		

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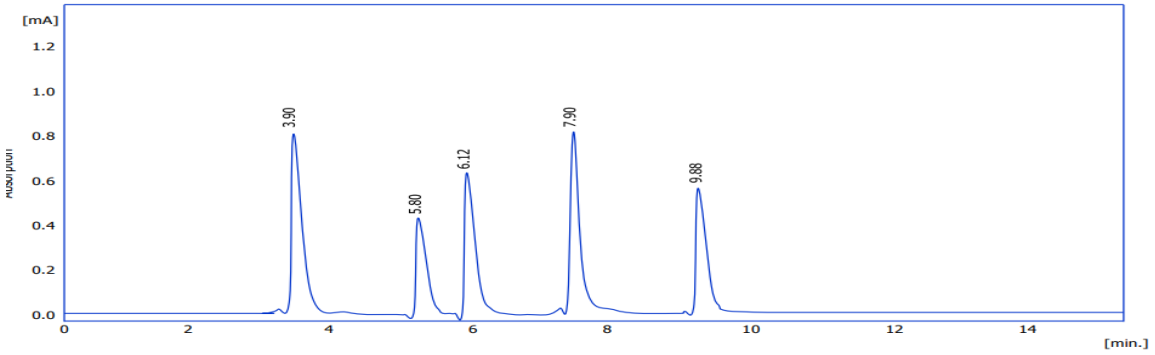
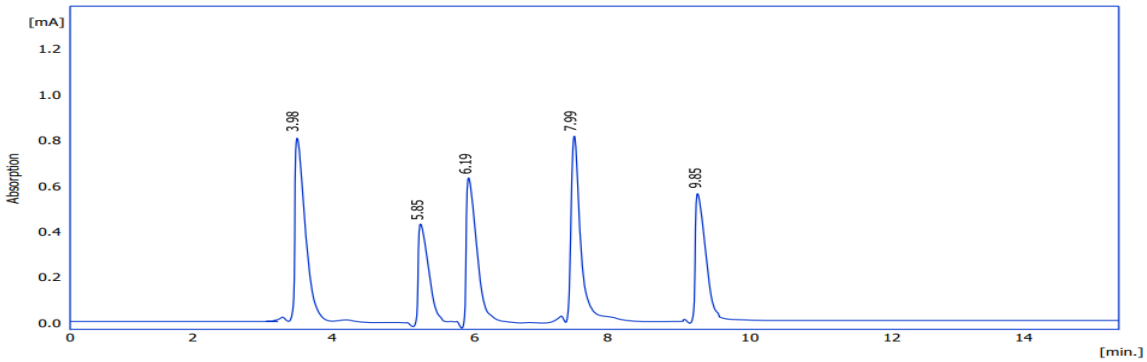


Result chromatography Table (Uncal - F:\ sample 2)

No	Reten. Time [min]	Area [mAU.s]	Height [mAU]	Area [%]	Height [%]	W05 [min]	Compound Name
1	3.90	4589.80	800.88	25.00	25.00	0.15	
2	5.80	3256.98	401.54	10.00	10.00	0.10	
3	6.12	4152.66	601.50	20.00	20.00	0.15	
4	7.90	5987.49	800.80	25.00	25.00	0.15	
5	9.88	3652.98	589.80	20.00	20.00	0.10	
	Total	21632.89	3194.11	100.00	100.00		

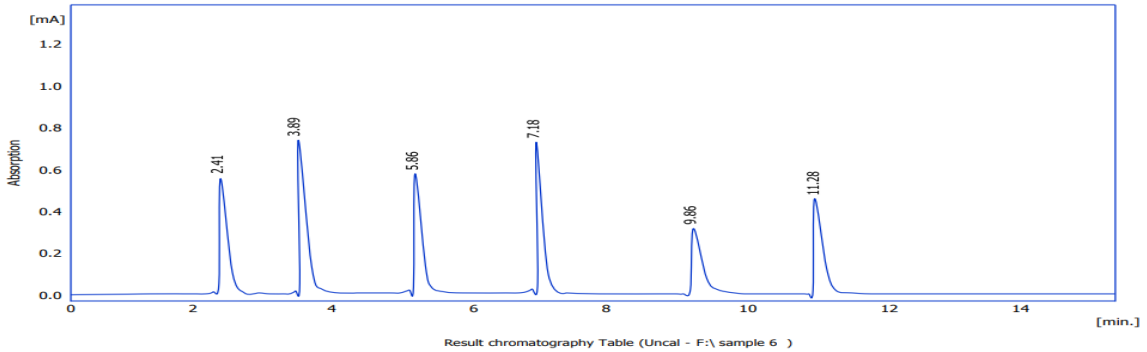
B



Result chromatography Table (Uncal - F:\ sample 4)

No	Reten. Time [min]	Area [mAU.s]	Height [mAU]	Area [%]	Height [%]	W05 [min]	Compound Name
1	3.98	5210.65	801.25	25.00	25.00	0.15	
2	5.85	4012.33	400.88	10.00	10.00	0.10	
3	6.19	4985.66	600.14	20.00	20.00	0.15	
4	7.99	6214.56	801.90	25.00	25.00	0.15	
5	9.85	4125.98	589.00	20.00	20.00	0.10	
	Total	24597.80	3196.90	100.00	100.00		

C



Result chromatography Table (Uncal - F:\ sample 6)

No	Reten. Time [min]	Area [mAU.s]	Height [mAU]	Area [%]	Height [%]	W05 [min]	Compound Name
1	2.41	3125.08	581.14	15.00	15.00	0.10	
2	3.89	5214.79	712.90	25.00	25.00	0.15	
3	5.86	3265.98	591.33	15.00	15.00	0.10	
4	7.18	5012.65	714.14	25.00	25.00	0.15	
5	9.86	3214.56	321.44	10.00	10.00	0.05	
6	11.28	3895.11	401.08	10.00	10.00	0.08	
	Total	23782.49	3320.12	100.00	100.00		

D

Figure (3): curves of the absorption peaks for each compound coupled with its retention time (RT) A: Barley, B: Safflower C: Effect of Barley Leachate on Safflower, D: Effect of Safflower Leachate on Barley.

CONCLUSIONS

It was noted from the results that there was an inhibition in the germination percentage of safflower seeds growing in soil to which barley leachate were added and at all stages of growth. Several phenolic compounds were identified using HPLC techniques in the safflower plant (Ferulic acid, gallic acid, kaempferol, Rutin), while ferulic acid (gallic acid, apigenin, luteolin) was identified in barley plants. The results showed an increase in the concentrations of compounds in barley and safflower leaves due to the effect of barley and safflower Leachate, which was determined by HPLC technology.

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CONFLICT OF INTEREST

The researcher supports this work idea and does not conflict with the interests of others.

النشاط الاحيائي لمركبات الايض الثانوي لمغسولات الشعير والعصفر على الشعير والعصفر ضمن ثلاث مراحل نمو (بادرات، استطالة، ازهار)

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مركز بحوث الزراعة الجافة والحافظة / جامعة الموصل / الموصل / العراق[3]

الخلاصة

صممت التجارب حسب تصميم القطاعات العشوائية الكاملة (R.C.B.D.) لدراسة تأثير مغسولات الشعير والعصفر وبثلاث مراحل نمو (بادرات، استطالة، ازهار) في انبات بذور ونمو اصناف الشعير والعصفر، تضمنت الدراسة اجراء تجربتين في البيت الزجاجي التابع لقسم علوم الحياة/ كلية العلوم /جامعة الموصل. اذ بينت النتائج حدوث تباين في التأثير ما بين الزيادة والنقصان باختلاف المعاملات ومراحل النمو والصفات المدروسة، حيث نجد بان مغسول العصفر في مرحلة البادرات سبب زيادة في الوزن الجاف للرويشة للعصفر في حين سببت المعاملة نفسها انخفاض في بقية الصفات، واما بالنسبة لمغسولات الشعير سببت زيادة في طول الرويشة وطول الجذير والوزن الجاف للرويشة وتثبيط في الوزن الجاف للجذير. كما لوحظ من النتائج حدوث تثبيط في نسبة البزوغ لبذور العصفر النامية في الترب المضاف اليها مغسولات الشعير وعند جميع مراحل النمو وبلغت اعلى نسبة مئوية للتثبيط 50 %في مرحلتي الاستطالة والازهار. وشخصت عدد من المركبات الفينولية بتقنيات الـ HPLC في نبات العصفر (Ferulic acid، Gallic acid، Kaempferol، Rutin) في حين شخصت (Ferulic acid، Gallic acid، Apigenin، luteolin) في نبات الشعير فقد اشارت النتائج الى

وجود اختلافات في تركيز المركبات الكيميائية المعزولة من المتبقيات النباتية للشعير والعصفر لمراحل النمو (البادرات، الاستطالة، الازهار)، ونجد ان اعلى تركيز لمركب Gallic acid للشعير والعصفر في جميع مراحل النمو و اعلى تركيز في مرحلة البادرات لنبات العصفر حيث بلغ (22.14 مايكرو غرام/غم) المشخص بتقنية ال HPLC، بينما كان اقل تركيز في العصفر لمركب Kaempferol وللشعير luteolin، اعطت المركبات المشخصة اعلى تراكيز في مرحلة البادرات للنباتين بينما سجلت مرحلة الازهار اقل التراكيز.

الكلمات المفتاحية: النشاط لاحيائي، الفينولات، الشعير، العصفر، مراحل النمو.

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