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Biological Control of some Weeds with Aqueous Extract of Wheat (*Triticum aestivum* L.)

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ABSTRACT

Allelopathic effects of wheat aqueous extract were studied on seeds germination and seedling growth of four weeds Canary grass (*Phalaris minor* L.), Mallow (*Malva rotundifolia* L.), Sweet clover (*Mililotus indica* Mill), and Wild oats (*Avena fatua*), that shown seeds germination and seedlings growth of all weed species were inhibited with in all treatment of Wheat (*Triticum aestivum* L.) residues at concentration 5, 10, 15% on germination and early seedling growth of weeds, results showed the inhibitory effect of aqueous extract of wheat was hat higher 5% of EWC (%). from results that Mallow was more sensitive for treatments, While the less sensitive was Canary.

Keywords: Biological control, weeds, Allelopathy, Wheat, aqueous extract.

INTRODUCTION

Weeds are harmful to agricultural crops production by compete on the water, nutrients, light, space and other growth factors, and may be become hosts to pests and diseases (Nichols *et al*., 2015). Wheat is Important cereal in north of Iraq (Al-Jehashy, 2021) Wheat *Triticum aestivum* L. is the third largest crop production in the world Mohammed *et al*. (2019) for that must be removed weeds grown with it, weeds cause losses in crop yield that depending to crop, strategies of weed management; composition of weed; infestation period as well as abiotic factors e.g.: climate and soil factors. Weeds are an agricultural production limiting factors because of that competition with crops on important elements of growth including water, light, spaces (Khudur *et al*., 2019).

Weed management in agricultural consider a key practice of agronomic, for that it is necessary to control weed using herbicides around the world (Aktar *et al*., 2009). Use of herbicides to control weeds in field for a long period can be formation a weed that resistance to herbicides, imbalance of ecological between "harmful and beneficial" organisms, and can be caused pollution of environmental.

In view of dangerous that resulting from the use of herbicides and development of resistance to herbicides used in the control, and ineffectiveness of traditional control methods, there was a need to find viable alternatives to herbicides, less toxic and less dangerous, cheap and effective, and not polluting the environment as much as possible (Hussain, 2020). Based on the idea of sustainable weed management is a preventing weed spread rather than controlling them until they have developed and started to cause harm (Sims *et al*., 2018). weed management comprises: crop rotation; intercropping; crop competitiveness tillage; mulching; biological control agents; and biological control as alternative to use of chemical herbicides.

Biological control refer to used Entomophagous to protect plants from (weeds, Insect, pathogenic…) by decreased that number into critical limit, and prevent these organisms from reaching the harmful level, allelopathy is one of these new techniques, that plays an important role in weeds control, the term “allelopathy” indicates to: effects exerted by one species of plant "donor" to another plant "acceptor" through release chemical substances into the environment are called "Allelochemicals", termed allelochemicals refers to all secondary compound released from organism (Carrubba *et al*., 2020). Allelochemicals most important allelochemicals includes phenols, flavonoids, terpenoids, glucosides, steroids, benzo oxaquinones, Alkanes and organic compounds, use allelochemicals for weed control as environmentally friendly by using water extracts and plant residues of a number of plants including Wheat, Barley, Sorghum, Sunflower, Rice and Maize. As far as we know, the effects plant residues on weeds control still unexplored.

This work was carried out in 2020, to evaluating the activity of wheat plant residues towards four weeds the species of weed and its effect on their germination and growth.

MATERIAL AND METHODS

Study was conducted at Biology Department/ College of Science/ University of Mosul in 2020, about the activity of wheat plant residues towards four species of weed and its effect on their germination and growth.

The wheat residues collected for testing their allelopathic activity after harvested from fields of Mosul, crushed, aqueous extracts were prepared at a concentration 5,10,15% (Abbas and Hussain, 2020), the effects of concentration 5, 10, 15% of the plant residues of Wheat (*Triticum aestivum* L.) on germination and early seedling growth of Canary grass (*Phalaris minor* L.), Mallow (*Malva rotundifolia* L.), Sweet clover (*Mililotus indica* Mill), and Wild oats (*Avena fatua*), (Table 1) were studied in a greenhouse glasshouse. For this, 10 seeds were cultured in plastic pots with diameter 20 cm, height 25 cm, at depth 0.5 cm from the surface of the soil for each of weed, then irrigated with water, and put in a glass house at a temperature of 20 ± 2C^{o}, after 8 days germination calculation, and after 60 days of germination, plants were cut off, separated shoot from roots. inhibition percentage was calculated according to the following

equation: Inhibition ratio = **(**Control - treat / Control ×100 (Chung *et al*., 2001).

Table 1: Weeds Used in study

	Weeds Name	Scientific Name	Family	Life cycle
1.	Canary grass	*Phalaris minor L.*	Gramineae (Poaceae	Annual
2.	Wild oats	*Avena fatua L.*	Gramineae (Poaceae)	Annual
3.	Mill Sweet clover	*Mililotus indica L.*	Leguminosae	Annual
4.	Mallow	*Malva rotundifolia L.*	Malvaceae	Annual

Characteristics studied.

1. Efficiency Weed Control (%) (EWC) according to the following equation:

EWC %= A-B\A×100 (Hussain, 2020)

A: dry weight for control B: dry weight of the treatment

2. Shoot length (cm).

3. Root length (cm).

4. Leaves area (cm 2): Depending:

Leaf area (cm 2) = leaf length ×max width leaf× 0.905

(Kemp *et al*., 1966).

5. Leaves Number / plant.

6. Plant dry weight (g).

Each of the following characteristics was measured according to the aforementioned source:

1. Nitrogen (N): Kjeldahl's method recorded by Jones (1991).

2. Phosphorous (P): Olsen and Sommers (1982).

3. Potassium (K): Richards (1954).

Statistical Analysis

Experiment was carried out according to Random Complete Block Design (R.C.B.D.) as a global experiment and data statistical analysis according to SAS program. Duncan multi-range test was used at a 0.05 probability of differentiation between treatments average Antar (2010).

RESULTS AND DISCUSSION

The results in (Table 2) show inhibition effect in seed germination of the four weeds (Canary grass (*Phalaris minor* L.), Mallow (*Malva rotundifolia* L.), Sweet clover (*Mililotus indica* Mill) and Wild oats (*Avena fatua*)) by effect of aqueous extract of Wheat (*Triticum aestivum* in all treatments, the inhibition was in all concentrations but was higher effect in 15%, highest percentage inhibition was (44%) observed in Canary grass treated with aqueous extract at 15% by so then wheat considers is one crops to inhibit weed growth by allelopathic interactions, effect on growth of weeds resulted released allelochemical compounds from the different parts for plants Jabran (2018).

Result showed Canary grass is more sensitive for treatment compared with other weeds, While Wild oats was less sensitive that due to differences in genotype of weeds (Hussain *et al*., 2018a).

Table 2: Effect of wheat aqueous extracts in seed germination of some weeds

Cultivar / Con	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	90b	93b	91b	96a
5%	77cd	89b	74d	96a
10%	65e	88b	73d	80c
15%	50	86bc	53f	75d
Cultivar effect	70.5cd	89a	72.75c	86.75b

Table (3) Indicated a reduction in Shoot length of the four weeds that treated with aqueous extract of Wheat (*Triticum aestivum* L.), all results shows that the highest percentage inhibition in Canary grass at concentration 15% of Wheat extract that is (78.34%), these results consistent with Refreshing (2001). that showed wheat extract prevented weed germination, results are shown reduction effect increased by concentration increased, it is apparent that Mallow was more sensitive for treatments, While the less sensitive was Canary grass may be due that to differences in genotype.

Table 3: Effect of wheat aqueous extract in Shoot length(cm) of some weeds

Cultivar / Con.	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	22.3a	3.45a	5.8a	2.69 a
5%	18.16b	3.08b	4.3 8 b	2.35 b
10%	6.42c	2.12 c	3.2 c	1.98 c
15%	4.83d	2.12 c	2.6 d	0.87d
Cultivar effect	12.92a	2.69c	3.99d	1.97e

The study demonstrated that wheat aqueous extracts of exhibited significant inhibitory effects on roots length of all test species (Table 4). Earlier works have also reported use allelopathic effect for improved food quality and increasing crop production, wheat (*Triticum aestivum* L.) is chief field crop in the north of Iraq, while weeds are reason in loss around 45–50% of yield (Ali, 2013). Hussein *et al*. (2018) reported that wheat residues reason inhibitory in germination rate of *Sochus oleraceus* L., and that inhibitory effect of wheat can be due to Salicylic acid, P-hydroxy benzoic acid they were diagnosis in wheat residues, which are known to inhibit the germination and growth of the receptor plant.

Table 4: Effect of wheat aqueous extract in Root length (cm) of some weeds

Cultivar / Con	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	5.05 a	10.35 a	7.9 a	6 a
5%	4.48 b	9.5 b	7 b	4.27 b
10%	4.12 c	5.02 c	6.9 bc	3.82 c
15%	2.55 d	4.46 d	5.68 d	3.51 cd
Cultivar Effect	4.05cd	7.33a	6.87b	4.4c

Aqueous extract of wheat was displaying various degrees from inhibit effect in dry weight of all weeds that effect depends on a concentration. the greatest inhibition was observed at the 15% w: v concentration (Table 5). Perhaps the reason for decrease in dry weight can be due to presence of allelopathic compounds such as alkaloids; Glycosides; tannins, that may be interfered with various growth mechanisms and caused inhibition in photosynthesis process, which led to low dry weight, or it is due to the plant's sensitivity for these compounds and to genetic differences between the varieties (Hussain, 2010).

Table 5: Effect of wheat aqueous extract in Plant Dry Wight (gm) of some weeds

Cultivar / Con.	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	0.145 a	0.014 a	0.445 a	0.037 a
5%	0.134b	0.010 b	0.161 b	0.011 b
10%	0.012 c	0.008 c	0.133 c	0.007 c
15%	0.007 d	0.004 d	0.123 d	0.005 cd
Cultivar effect	0.074b	0.009d	0.215a	0.015c

Results in (Table 6) showed that aqueous extracts used in this study caused inhibit at effect in leaf area at all weed the treated by aqueous extraction of Wheat, and that effect can be due to allelopathic compounds effect in cell division, elongation, and effect at IAA activity AL-Jehaishy (2017), the table show increased inhibition effect at concentration 15%. the highest inhibition observed in Canary grass by effect the aqueous extract at concentration 15% is (94.55 %)**.**

Table 6: Effect of wheat aqueous extract in Leaves area (2 cm) of some weeds

Cultivar / Con.	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	2.57a	1.20a	6.51a	1.15a
5%	0.461 b	1.08 b	2.25 b	0.270 b
10%	0.158 c	0.281 c	1.99 c	0.126 c
15%	0.140 cd	0.126 d	1.02 d	0.108 d
Cultivar Effect	0.832b	0.671c	2.942a	0.413d

The results in (Table 7) showed effect efficiency of sprayed by aqueous extracts of Wheat (*Triticum aestivum* L.), in weed control (%), saw the highest Percentage efficiency at the treatments in reducing the weeds caused by aqueous extraction of wheat at concentration 15% in Canary grass. Results show difference in weeds response to inhibitory effect of crop residues, that difference may be due to differences in genetic factors and plant nature, or may be due to activity of allelopathic compounds that releases from Wheat (*Triticum aestivum* L.) including organic acids, aldehydes and aromatic acids Aromatics, flavonoids, tannins, alkaloids or terpenoids, and steroid as well as some toxic gases Putnam and Tang (1986). Which have revealed their presence in wheat residues Hussein *et al*. (2018) this may be justify crops inhibitory effect.

Table 7: Effect of wheat aqueous extract in EWC (%) of some weeds

Cultivar / Con.	Canary grass	Wild oats	Mill Sweet clover	Mallow
Control	0	0	0	0
5%	7.5	28	63	70
10%	91	42	70	81
15%	95	71	72	86
Cultivar effect	64.5	47	68	79

Results in (Table 8) estimated that the addition of wheat aqueous extract in soil has a significant effect on the status of nitrogen, phosphorous and potassium in weeds compared with control. wheat aqueous extract at 15% gave the greatest values. these results may be due to effect of wheat aqueous extract may be increased absorption and transportation of N, P, K to plant.

Table 8: Effect of wheat aqueous extract in soil content of (N, P, K)

Treatment	N٪	P٪	K٪
Control	0.080	141	8
5%	0.008	126	6.3
10%	0.005	125	4.3
15%	0.001	115	3.6

CONCLUSIONS

Residues at concentration 5, 10, 15 % on germination and early seedling growth of weeds، results showed the inhibitory effect of aqueous extract of wheat was h at higher 5% . of EWC (%). from results that Mallow was more sensitive for treatments, While the less sensitive was Canary.

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المكافحة البيولوجية لبعض الادغال باستخدام المستخلص المائي للحنطة (*Triticum aestivum* L.)

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الملخص

تمت دراسة التأثيرات الأليلوباثية للمستخلص المائي للحنطة على إنبات البذور ونمو البادرات لأربعة انواع من الادغال: عشبة الكناري (*Phalaris minor* L.)، الخباز (*Malva rotundifolia* L)، (*Mililotus indica* Mill)، والشوفان البري (*Avena fatua*)، وأظهرت النتائج تثبيط في إنبات البذور ونمو االبادرات لجميع أنواع الادغال عند المعاملة بمستخلص الحنطة (*Triticum aestivum* L.) بتركيز 15،10،5٪ على الإنبات ونمو البادرات الادغال المدروسة، أظهرت النتائج أن التأثير المثبط للمستخلص المائي للحنطة كان عند التركيز 5٪. وأظهرت النتائج أن الخباز كان أكثر حساسية للمعاملات بينما كانت عشبة الكناري الأقل حساسية.

الكلمات الدالة: المكافحة البيولوجية، الادغال، الاليلوباثي، الحنطة، المستخلص المائي.