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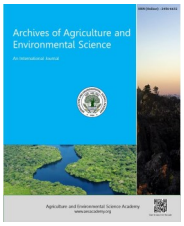

ORIGINAL RESEARCH ARTICLE

Allelopathic effect of peanut, sunflower and corn crops on germination and growth of some winter weeds

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ABSTRACT

The present study was carried out to study the effects of three summer crops water extracts (peanut, sunflower, maize) on germination and seedling growth of six winter weeds (*Medicago polymorpha,* L., *Sonchus oleraceus,* L., *Lathyrus hirsutus,* L., *Phalaris minor*, *Anagallis arvensis,* L., *Rumex dentatus,* L.) and two winter field crops (*Beta vulgaris* L. and *Vicia faba* L.) under laboratory conditions. Results revealed that Peanut water extract was recorded the highest mean inhibition values (31.25, 47.81, 89.58 and 74.22%) for *L. hirsutus, A. arvensis, V. faba* and *B. vulgaris*, respectively. On the other hand, the lowest mean inhibition values (97.92 and 85.16 %) were obtained from the maize water extract for *V. faba* and *B. vulgaris,* respectively. While, the highest inhibition values (27.50, 66.67, 59.83 %) were obtained from the interaction effect between Peanut extract with concentration 40% for *A. arvensis, V. faba* and *B. vulgaris*, the percentage inhibition of them were (69.44, 33.33, and 32.14 %), respectively. Peanut extract was recorded the highest mean inhibition values (6.12 and 7.06 cm) for shoot length of *A. arvensis* and *B. vulgaris,* respectively. On the other hand, maize extract was activated the growth of shoot *V. faba* values (17.26 cm). In addition, the highest inhibition percentages (80.22, 79.61, 75.86, 65.64, 51.79, 25.39 and 15.66%) were obtained from 40% concentration for shoot length of *M. polymorpha, R. dentatus, A. arvensis, S. oleraceus*, *P. minor, L. hirsutus* and *B. vulgaris,* respectively, as compared with control treatment, in 2014. Moreover, the interaction effect between maize extract and concentration 20% for was activated growth of shoot length *V. faba* values (20.15 cm) the percentage inhibition for him (55.00 %). Peanut extract was recorded the highest mean inhibition values (1.38, 1.81, and 2.05 cm) for root length of *S. oleraceus, P. minor* and *R. dentatus,* respectively. On the other case, Sunflower extract was activated growth of shoot *V. faba* values (11.86 cm) while, peanut extract was activated the shoot growth of *B. vulgaris* values (13.58 cm). Also, 20% concentration was activated the root growth of *B. vulgaris* and *V. faba* (39.36 and 23.79 %) respectively. The interaction effect between peanut extract and concentration 20% was activated root growth of *B. vulgaris* values (15.85 cm), while, sun flower extract with concentration 20% was activated root growth of *V. faba* values (14.95 cm). Therefore, the water extracts of peanut, sunflower and maize showed the inhibitory effects on the seedlings of winter weeds.

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INTRODUCTION

Weeds are the most abundant plant species, which do not only compete with crop plants for nutrients, water, space and light but also give refuge to pests and diseases; and occasionally interfere with crop growth by releasing allelopathic substances into the rhizosphere of the crop plants (Rice, 1984; Kumar and Chopra, 2013, 2016). Weed also interferes with harvest operations thus increase the processing costs and significantly reduce (21-45%) the crop yields (Ashiq and Ata, 2005; Kumar and Chopra, 2016). There are several methods used for weed control, which include prevention, cultural, mechanical, biological, and chemical means. Weed management is most success when it involves an integrated approach using a variety of methods. Negative effects of chemical herbicides used in the environment resulted in evolution of different weed management strategies (Einhelling, 1996 and Weston, 1996; Kumar, 2015), which can at least reduce the use of herbicides. Although use of herbicides cannot be eliminated, their use can be reduced by exploiting allelopathy as an alternate weed management tool for crop production (Cheema and Khaliq, 2000; and Jabran *et al.*, 2008). Allelopathy provides strategies for natural weed control either by mulching the soil, the use of allelopathic crops as cover crops; preparing water extracts of allelopathic crops and then sprayed over crops and weeds, the use of allelopathic crop as an intercrop, selection of allelopathic crop varieties or identification of new herbicide chemistry (Kumar, 2015).

The study of allelopathic increased in the 1970 and has under-

gone rapid development since the mid-1990 becoming a popular topic in botany, ecology, agronomy, soil science, horticulture, and other areas of inquiry in recent years. The allelopathic interaction can be one of the significant factors contributing to species distribution and abundance within plant communities and can be important in the success of invasive plants (Chou, 1999; Mallik, 2003; Field *et al.,* 2006; Inderjit *et al.,* 2006; Zheng *et al.,* 2015), such as water hyacinth (*Eichhornia crassipes*) (Jin *et al*., 2003; Gao and Li, 2004), spotted knapweed (*Centaurea stoebe* L. *micranthos*), Broeckling and Vivanco (2008) and garlic mustard (*Alliaria petiolata* M. Bieb) (Vaughn and Berhow, 1999). Allelopathy is also thought to be one of the indirect causes of continuous cropping obstacles in agriculture. Allelopathy may be used as a tool in weed management by applying the residues of allelopathic weeds or crop plants as mulches, growing them in successions and leaving their residues in the field (Altieri and Doll, 1978; Drost and Doll, 1980; Putnam and DeFrank, 1979).

The harmful effects of allelopathic substances include inhibition and delays in germination, seed darkening and turgidity, deformation of seedling, declines in roots, radical, stem, and coleoptiles development, swelling and necrosis of root or radical, paleness, lack of root hair, and decreasing in total dry matter (Jackulski and Rudnic, 1994). However, this can be managed in light of accurate screening before use. However, the use of allelopathic water extracts is economical and environment friendly, yet the reduction in weed biomass is less than herbicides and manual weeding. Moreover, for achieving this much weed control two to three sprays are needed which is neither practicable nor desirable. However, it may be possible to use these allelopathic water extracts with reduced rates of herbicides to increase their efficacy (Cheema *et al.,* 2003). The present investigation was aimed to study the effects of water extracts of some crops, its concentration and the interaction effect between them on germination and seedling growth of some winter weeds, *Vicia faba* and *Beta vulgaris* after 30 days from sowing in the laboratory.

MATERIALS AND METHODS

The experiment was conducted in Agronomy Department, Faculty of Agriculture, Cairo, Al-Azhar University, during the year 2014, to study the effects of summer crops water extracts on germination and seedling growth of some winter weeds and some field crops under optimum conditions. The experiment was arranged in completely randomized design with four replications per treatment.

Plant materials: The plant species used in the allelopathic investigation were divided into: (a) donor species (sources of plant extracts), and (b) receiver species (target weeds). The scientific and common names, families, as well as the used parts of the plants investigated for their biological and allelopathic activities are listed in Tables (1, 2). Donor plants were collected from fields located in Menouf, El-Monufyia Governorate at ripening stage.

Crops water extracts: Preparation of crops extracts Straw powders of three crops species were used to prepared water extract according to Abdallah *et al.* (1989) as follows; 25g from each of Straw dried ground tissue were placed in 500 ml Erlenmeyer flask with 250 ml of distilled water and mixture was shacked for 6h on a horizontal shaker (approximately 160 cycles per minute). All extracts were filtered through cheese cloth to remove debris and finally filtered using (Whatman No. 1) filter paper to have 100% concentration (100 g/L). The leachates of 20% (20 cm^3/L), 30% (30cm^3/L) and 40% (40 cm^3/L) concentrations were made by diluting the parent leachate with distilled water. All filtered water extracts were frozen in dark glass bottle for subsequent use.

Crop and weed seeds were sodium hypochlorite solution 0.3% for 5 minutes before germination test. Petri- dished (9 cm in diameter) were sterilized autoclave at 121°C for 15 minutes and lined later Whatman No. 1 filter paper as a seedbed. The extracts concentrations (0, 20, 30, and 40%) of crop straw parts evaluated on germination and growth of field crops and weeds seedlings. Fifteen-milliliter (except faba bean wherever 40 milliliter) of each extract or of distilled water control were added to Petri dishes. The Petri dishes were covered and placed in continuous dark in a controlled environment chamber, which provided a constant temperature of 20°C according to ISTA (1995).

The Petri dishes of each individual field crop were arranged in completely randomized design with four replications per treatment. After 30 days, number of germinated seeds was counted to determine germination percentage of crop and weed seeds in all treatments. Germination was deemed to occur only after the radical had protruded beyond the seed coat by at least 1 mm.

Data recorded: Germination percentage was recorded after adequate period of each crop according to ISTA (1995). The root length and shoot length was measured using the scale while inhibition percentage was calculated as follows:

Inhibition of germination (%) = [(control - treatment)/control] × 100.

Statistical analyses: The data of each experiment were statistically analyzed as a factorial experiment according to the methods described by little and Hills (1978). The treatments means were compared by least significant differences (LSD) at the 0.05 level of probability.

RESULTS AND DISCUSSION

Effect of crops water extracts on germination and seedling growth of some weeds and crops under optimum conditions

Germination percentage (%): Results presented in Table (3) shows the effect of some crops water extracts (peanut, maize, sunflower) on germination % of bur clover, sow thistle, and caley pea, lesser canary grass, scarlet pimpernel, dentated dock, broad bean and sugar beet in 2014 season. Results revealed that peanut water extract was recorded the highest mean inhibition values (31.25, 47.81, 89.58 and 74.22%) for *L. hirsutus, A. arvensis, V. faba* and *B. vulgaris,* respectively. In addition, sunflower water extract was recorded the highest mean inhibition values (24.31, 33.25 and 89.58 %) for *M. polymorpha, P. minor* and *V. faba*, respectively. On the other hand, the lowest mean inhibition values (97.92 and 85.16 %) were obtained from the maize water extract for *V. faba* and *B. vulgaris,* respectively. These results are corroborated with the findings of Hall *et al.* (1982), Leather (1982; 1983) and Naseem *et al.* (2003).

As for, crops extract concentration percentage gave a significant effect on germination % in 2014 season (Table 3), the highest inhibition percentage (89.40, 87.77, 86.11, 75.00, 73.61, 66.20, 25.00 and 21.43 %) were obtained from 40% concentration for germination % of *P. minor, S. oleraceus, M. polymorpha, L. hirsutus, R. dentatus, A. arvensis, V. faba* and *B. vulgaris,* respectively, as compared with control treatment for that trait. Cheema (1988) has reported similar selective effects of allelochemicals and Leather (1982, 1983) and

Naseem (1997), who reported that allelochemicals have selective effect against weed germination and dry matter accumulation. Inhibitory effect increased with the increasing concentration of Phenolics (Cheema, 1988; Hall *et al*., 1982; Naseem, 1997).

Regarding the interaction effect between crops extracts and extracts concentrations. Results showed that there was a significant effect on germination percentage (%), the highest inhibition values (27.50, 66.67, 59.83 %) were obtained from the interaction effect between peanut extract with concentration 40% for *A. arvensis, V. faba* and *B. vulgaris* the percentage inhibition of them were (69.44, 33.33, and 32.14 %), respectively. Results also cleared that the highest inhibition values (5.55, 5.00, 6.00, and 66.67%) were obtained from the interaction effect between sun flower extract with concentration 40% for *M. polymorpha, S. oleraceus, P. minor* and *V. faba* the percentage inhibition of them (91.68 , 94.94 , 93.18 and 33.33%), respectively. These results are corroborated with the findings of Hall *et al.* (1982), Leather (1982, 1983) and Naseem *et al*. (2003).

Shoot length (cm): Table 5 shows the effect of the concentration of water extract of some summer crops on shoot length (cm) of some winter weeds, *V. faba* and *B. vulgaris* after 30 days from sowing. Results indicated that the differences between summer crops extracts under study were significant effect on shoot length in 2014 season. Peanut extract was recorded the highest mean inhibition values (6.12 and 7.06 cm) for shoot length of *A. arvensis* and *B. vulgaris,* respectively, in addition, sunflower extract was recorded the highest mean inhibition values (7.74 and 12.59) for *P. minor* and *V. fabea*, respectively. On the other hand, maize extract was activated the growth of shoot *V. fabea* values (17.26 cm).

These results may be attributed to negative effect of chemicals released from peanut and sunflower on growth, consequently, on shoot length of weeds and crops under studied. Cheema *et al.* (1997), Rice (1984), Ahmad *et al*. (1991), and Cheema and Ahmad (1992) support these findings. With respect of crops extract concentrations % gave a significant effect on shoot length in 2014 seasons (Table 4). The results revealed that, the highest inhibition percentages (80.22, 79.61, 75.86, 65.64, 51.79, 25.39 and 15.66%) were obtained from 40% concentration for shoot length of *M. polymorpha, R. dentatus, A. arvensis, S. oleraceus, P. minor, L. hirsutus* and *B. vulgaris,* respectively, as compared with control treatment, in 2014 season.

At the same time, the results revealed that, the highest stimulation percentages (18.38 %) were obtained from 20 % concentration for shoot length of *V. faba* as compared with control treatment. The inhibition of shoot growth may be attributed to concentration increase allelochemicals in the shoot and it is active. Cheema (1988) has reported similar selective effects of allelochemicals and Leather (1982, 1983) and Naseem (1997), who reported that allelochemicals have selective effect against weed germination and dry matter accumulation. Inhibitory effect increased with the increasing concentration of Phenolics Cheema (1988), Hall *et al*. (1982), Naseem (1997).

Regarding the interaction effect between crops extracts and extracts concentrations. Results show that this interaction gave significant effect on shoot length trait for most weeds and crops under study. The maximum inhibition value (0.85, 5.5 and 11.90 cm) were obtained from the interaction effect between sunflower extract and concentration 40% for *M. polymorpha, P. minor* and *V. faba*, respectively, the percentage inhibition of them (90.65, 52.99 and 8.46 %) respectively, peanut extract with concentrate 40% values (6.08, 2.08 and 6.15 cm) for *L. hirsutus, A. arvensis* and *B. vulgaris*, respectively, the percentage inhibition of them (31.30, 82.07, and 22.93%) respectively, and maize extract with concentrate 40% values (3.13 and 5.50 cm) for *S. oleraceus* and *P. minor,* respectively, the percentage inhibition of them (67.90 and 52.99%), respectively. On the other case, the interaction effect between maize extract and concentration 20% for was activated growth of shoot length *V. faba* values (20.15 cm) the percentage inhibition for him (55.00 %) Cheema *et al.* (1997), Rice (1984), Ahmad *et al.* (1991), and Cheema and Ahmad (1992) support these findings.

Root length (cm): The root length (cm) of bur clover, Sow thistle, Caley pea, lesser canary grass, Scarlet pimpernel, Dent ated dock, broad bean and sugar beet as influenced by some crops water extracts (peanut, maize, sunflower), it concentrations and their interaction in 2014 season are presented in Table 6. Results revealed that root length was significantly affected by crops water extracts (peanut, maize, sunflower) under study. Peanut extract was recorded the highest mean inhibition values (1.38, 1.81, and 2.05 cm) for root length of *S. oleraceus, P. minor,* and *R. dentatus,* respectively, as for, Sun flower extract was recorded the highest mean inhibition values (5.58 and 1.81 cm) for *L. hirsutus,* and *P. minor,* respectively, as for, maize extract was recorded the highest mean inhibition values (1.64. and 9.63 cm) for *M. polymorpha* and *B. vulgaris,* respectively. On the other hand, sunflower extract was activated growth of shoot *V. faba* values (11.86 cm) while peanut extract was activated growth of shoot *B. vulgaris* values (13.58 cm). These results are in agreement with Wilson and Rice (1968), Macias *et al*. (1998, 2002) and Anjum, and Bajwa (2005).

Results presented in Table 4 raveled that the differences between crops extracts concentrations were significant for root length (cm) in 2014 season. The highest inhibition percentage (90.16, 90.00, 84.05, 81.74, 60.76 and 56.95 %) was obtained from 40% concentration for root length of *P. minor, S. oleraceus, M. polymorpha, A. arvensis, L. hirsutus* and *R. dentatus,* respectively. On contradictory, 20% concentration was activated the root growth of *B. vulgaris* and *V. faba* (39.36 and 23.79 %), respectively. These results are in agreement with Cheema (1988), has reported similar selective effects of allelochemicals and Leather (1982, 1983) and Naseem (1997), who reported that allelochemicals have selective effect against weed germination and dry matter accumulation. Inhibitory effect increased with the increasing concentration of Phenolics (Cheema, 1988; Hall *et al*. 1982; Naseem, 1997).

The interaction effect between crops extracts and extracts concentrations % was significant effect on this trait. The highest inhibition values (0.25, 0.45 and 1.08 cm) were obtained from the interaction effect between Peanut extract with concentration 40% for *S. oleraceus, P. minor,* and *R. dentatus* the percentage inhibition of them (93.90 , 90.78 and 63.39 %) respectively, while, the interaction effect between sunflower extract and concentration 40% recorded the highest inhibition values (3.50 and 0.45 cm) for *L. hirsutus* and *P. minor* the percentage inhibition of them (63.27 and 90.78 %) respectively, results also showed that the highest inhibition values for *M. polymorpha, V. faba* and *B. vulgaris* (0.53 , 9.20 and 8.93 cm), respectively, were obtained by the interaction effect between maize extract and concentration 40%, and the percentage inhibition of them (87.38, 1.39 and 8.41%), respectively. On contrary, the interaction effect between

Peanut extract and concentration 20% was activated root growth of *B. vulgaris* values (15.85 cm) and the percentage inhibition for it was (62.56 %), while, sun flower extract with concentration 20% was activated root growth of *V. faba* values (14.95 cm) and the percentage inhibition for it was (60.24 %). These results are corroborated with the findings of Hall *et al*. (1982), Cheema (1988), Leather (1982, 1983) and Naseem *et al*. (2003).

Table 1. Plants investigated for their biological and allelopathic activities.

Donor species (Sources of plant extracts)				
S.N.	**Scientific name**	**Family**	**Common name**	**Used part**
1	*Arachis hypogaea* L.	Leguminous	Peanut	Straw
2	*Helianthus annuus* L.	Compositeae	sunflower	Straw
3	*Zea mays* L.	Poaceae	Corn	Straw

Table 2. Description of winter crops and weeds used in the study.

Winter crops			
S.N.	**Scientific name**	**Family**	**Common name**
1	*Vicia faba* L.	Leguminous	Broad bean
2	*Beta vulgaris* L.	Chenopodiaceae	Sugar beet
Winter weeds			
1	*Medicago polymorpha* L.	Leguminosae	Bur clover or toothed medik
2	*Sonchus oleraceus* L.	Compositae	Sow-thistle
3	*Lathyrus hirsutus* L.	Leguminosae	Caley pea or hairy vetch ling
4	*Phalaris minor* Retz.	Poaceae	lesser-canary grass or small canary grass
5	*Anagallis arvensis* L.	Primulaceae	Scarlet pimpernel
6	*Rumex dentatus* L.	Polygonaceae	Dentated dock or Toothed dock

Table 3. Effect of water extract of some crops, it concentration and the interaction between them on germination % of some winter weeds, *V. faba* and *B. vulgaris* after 30 days from sowing.

Treatments		**Germination % (Lab.)**							
Extracts	**Concentration**	***M. polymorpha***	***S. oleraceus***	***L. hirsutus***	***P. minor***	***A. arvensis***	***R. dentatus***	***V. faba***	***B vulgaris***
Pea nut	0%	66.67	98.75	66.67	88.00	90.00	85.71	100.00	87.50
	20%	44.44	30.00	20.83	42.00	40.00	78.57	100.00	81.25
	30%	13.89	10.00	20.83	13.00	33.75	32.14	91.67	68.75
	40%	11.11	10.00	16.67	9.00	27.50	21.43	66.67	59.38
Mean		34.03	37.19	31.25	38.00	47.81	54.46	89.58	74.22
Maize	0%	66.67	98.75	66.67	88.00	90.00	85.71	100.00	87.50
	20%	36.11	37.50	45.83	49.00	46.25	67.86	100.00	87.50
	30%	25.00	31.25	33.33	21.00	37.50	35.71	100.00	87.50
	40%	16.67	26.25	16.67	13.00	31.25	25.00	91.67	78.13
Mean		36.11	48.44	40.63	42.75	51.25	53.57	97.92	85.16
Sun flower	0%	66.67	98.75	66.67	88.00	90.00	85.71	100.00	87.50
	20%	19.44	18.75	29.17	26.00	46.25	71.43	100.00	84.38
	30%	11.11	12.50	29.17	13.00	41.25	32.14	91.67	75.00
	40%	5.55	5.00	16.67	6.00	32.50	21.43	66.67	68.75
Mean		24.31	32.50	35.42	33.25	52.50	52.68	89.58	78.91
G.M. Concentration	0%	66.67	98.75	66.67	88.00	90.00	85.71	100.00	87.50
	20%	33.33	28.75	31.94	39.00	44.17	72.62	100.00	84.38
	30%	16.67	17.92	27.78	15.67	37.50	33.33	94.44	77.08
	40%	9.26	12.08	16.67	9.33	30.42	22.62	75.00	68.75
LSD at 5%									
Extracts		1.11	NS	1.50	0.48	0.55	NS	1.33	0.88
Concentration		1.56	3.01	2.00	0.64	0.70	2.29	2.00	1.13
Extracts × Concentration		4.56	9.02	NS	1.92	NS	NS	6.00	3.38

Table 4. Average inhibition of water extract concentration of some crops on germination %, shoot length and root length (cm) of some winter weeds, *V. faba* and *B. vulgaris* after 30 days from sowing.

Water extract Concentrations %	Crop traits	Average inhibition at a different concentrations							
		M. polymorpha	*S. oleraceus*	*L. hirsutus*	*P. minor*	*A. arvensis*	*R. dentatus*	*V. faba*	*B. vulgaris*
20%	Germination %	50.01	70.89	52.09	55.68	50.92	15.27	0.00	3.57
	Shoot length	48.00	42.05	14.61	22.31	42.07	13.29	-18.38	5.14
	Root length	36.19	70.00	45.96	64.55	31.30	14.24	-23.79	-39.36
30%	Germination %	75.00	81.85	58.33	82.19	58.33	61.11	5.56	11.91
	Shoot length	60.22	57.54	19.40	43.33	60.00	25.29	-16.77	10.28
	Root length	56.43	79.76	53.93	79.92	64.35	37.63	-22.51	-17.13
40%	Germination %	86.11	87.77	75.00	89.40	66.20	73.61	25.00	21.43
	Shoot length	80.22	65.74	25.39	51.79	75.86	79.61	-16.23	15.66
	Root length	84.05	90.00	60.76	90.16	81.74	56.95	-8.25	-10.38

Table 5. The effect of water extract of some crops, it concentration and the interaction between them on shoot length (cm) of some winter weeds, *V. faba* and *B. vulgaris* after 30 days from sowing.

Treatments		(Lab.) Shoot length							
Extracts	**Concentration**	***M. polymorpha***	***S. oleraceus***	***L. hirsutus***	***P. minor***	***A. arvensis***	***R. dentatus***	***V. faba***	***B. vulgaris***
Pea nut	0%	9.00	9.75	8.85	11.70	11.60	7.75	13.00	7.98
	20%	5.63	5.13	6.28	9.35	7.20	6.55	13.23	7.55
	30%	4.00	3.65	6.10	6.38	3.60	5.75	14.53	6.55
	40%	1.25	3.53	6.08	5.93	2.08	1.15	15.93	6.15
Mean		4.97	5.51	6.83	8.34	6.12	5.30	14.17	7.06
Maize	0%	9.00	9.75	8.10	11.70	11.60	7.75	13.00	7.98
	20%	3.70	6.50	7.40	10.83	7.25	6.85	20.15	7.40
	30%	3.38	4.03	6.73	6.88	5.78	5.83	18.38	7.23
	40%	3.25	3.13	6.13	5.50	2.63	1.73	17.50	6.98
Mean		4.83	5.85	7.09	8.73	6.81	5.54	17.26	7.39
Sun flower	0%	9.00	9.75	8.10	11.70	11.60	7.75	13.00	7.98
	20%	4.70	5.33	7.70	7.10	5.70	6.75	12.80	7.75
	30%	3.38	4.75	7.35	6.65	4.55	5.80	12.65	7.70
	40%	0.85	3.38	6.50	5.50	3.70	1.85	11.90	7.05
Mean		4.48	5.80	7.41	7.74	6.39	5.54	12.59	7.62
Overall mean extracts		4.76	5.72	7.11	8.27	6.44	5.46	14.67	7.36
G.M. Concentration	0%	9.00	9.75	8.35	11.70	11.60	7.75	13.00	7.98
	20%	4.68	5.65	7.13	9.09	6.72	6.72	15.39	7.57
	30%	3.58	4.14	6.73	6.63	4.64	5.79	15.18	7.16
	40%	1.78	3.34	6.23	5.64	2.80	1.58	15.11	6.73
LSD at 5%									
Extracts		NS	NS	NS	0.12	0.06	NS	0.07	0.08
Concentration		0.14	0.14	0.21	0.16	0.09	0.08	0.09	0.11
Extracts × Concentration		0.42	0.41	NS	0.48	0.26	NS	0.27	NS

Table 6. Effect of water extract of some crops, it concentration and the interaction between them on root length (cm) of some winter weeds, *V. faba* and *B. vulgaris* after 30 days from sowing.

Treatments		Root length (cm) (Lab.)							
Extracts	**Concentration**	***M. polymorpha***	***S. oleraceus***	***L. hirsutus***	***P. minor***	***A. arvensis***	***R. dentatus***	***V. faba***	***B. vulgaris***
Pea nut	0%	4.20	4.10	9.53	4.88	2.30	2.95	9.33	9.75
	20%	3.43	0.80	4.90	1.18	1.68	2.58	10.00	15.85
	30%	2.45	0.38	4.35	0.73	0.85	1.60	11.08	14.83
	40%	0.78	0.25	3.80	0.45	0.45	1.08	11.85	13.88
Mean		2.71	1.38	5.64	1.81	1.32	2.05	10.56	13.58
Maize	0%	4.20	4.10	9.53	4.88	2.30	2.95	9.33	9.75
	20%	1.10	1.13	5.50	3.03	1.45	2.30	9.70	10.65
	30%	0.75	0.83	4.58	1.25	0.80	2.30	9.33	9.18
	40%	0.53	0.33	3.93	0.53	0.38	1.63	9.20	8.93
Mean		1.64	1.59	5.88	2.42	1.23	2.29	9.39	9.63
Sun flower	0%	4.20	4.10	9.53	4.88	2.30	2.95	9.33	9.40
	20%	3.50	1.75	5.05	0.98	1.63	2.70	14.95	13.75
	30%	2.28	1.30	4.25	0.95	0.80	1.63	13.90	9.85
	40%	0.70	0.65	3.50	0.45	0.43	1.10	9.25	9.08
Mean		2.67	1.95	5.58	1.81	1.29	2.09	11.86	10.52
Overall mean extracts		2.34	1.64	5.70	2.01	1.28	2.15	10.60	11.24
G.M. Concentration	0%	4.20	4.10	9.53	4.88	2.30	2.95	9.33	9.63
	20%	2.68	1.23	5.15	1.73	1.58	2.53	11.55	13.42
	30%	1.83	0.83	4.39	0.98	0.82	1.84	11.43	11.28
	40%	0.67	0.41	3.74	0.48	0.42	1.27	10.10	10.63
LSD at 5%									
Extracts		0.05	0.03	0.03	0.03	NS	0.02	0.08	0.07
Concentration		0.07	0.04	0.04	0.04	0.03	0.03	0.10	0.10
Extracts × Concentration		0.20	0.12	0.13	0.12	NS	0.09	0.31	0.29

Conclusions

The present study concluded that the differences between summer crops extracts under study were significant effect on shoot length in 2014 season. The sunflower water extract was recorded the highest mean inhibition values (24.31, 33.25 and 89.58 %) for *M. polymorpha, P. minor* and *V. faba*, respectively while, the lowest mean inhibition values (97.92 and 85.16 %) were obtained from the maize water extract for *V. faba* and *B. vulgaris,* respectively. Peanut extract was recorded the highest mean inhibition values (6.12 and 7.06 cm) for shoot length of *A. arvensis* and *B. vulgaris,* respectively, in addition, sunflower extract was recorded the highest mean inhibition values (7.74 and 12.59) for *P. minor* and *V. fabea*, respectively. Thus, the water extracts of peanut, sunflower and maize showed the inhibitory effects on the seedlings of winter weeds (*M. polymorpha, S. oleraceus, L. hirsutus, P. minor*, *A. arvensis,* and *R. dentatus*).

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