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Allelopathic Potential of Five Weed Extracts on *Portulacaolercea* l. and *Setariaglauca* l. Beauv

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ABSTRACT

Five weeds (*Echnichloacolonum, Cyperusrotundus, Xanthium pungens*wallr, *Solanum nigrum*and *Echinochloa crus galli*) were tested for allelopathiceffect *onPortulaceaoleracea* L.and *Setariaglauca*L. Beauv. in faculty of Agriculture, Alexandria University. Different concentrations (2.5, 5, 10, 20, 30 and 50%) from the stock solution of leaf extract were used to evaluate its effect on germination, shoot and root length as well as vigour index. The results showed that low concentrationsdid not affect tested parameters but higher concentrations specially 30 and 50% caused significant reduction in all these parameters.Allelopathic effect of these weeds was observed especially in the case of *Xanthiumpungens, Echnichloacolonum* on *Portulaceaoleracea* and *Echnichloacolonum, Cyperusrotundus* on *Setariaglauca*.

Keywords: Allelopathy,*Echnichloacolonum, Cyperusrotundus, Xanthium pungens*wallr, *Solanum nigrum, Echinochloa crus galli, Portulaceaoleracea, Setariaglauca,* vigour index.

INTODUCTION

Weeds are one of the most serious problems in agricultural production. According to the FAO, from the total losses worldwide caused by the crop pests, the weeds account for 35% of losses in wheat, 28% in vegetables and 29% in fruit species.

In recent years, data were published on different side effects of herbicides on humans, animals, crops and the environment as a whole. Therefore, the increased interest for biological weed control lately is reasonable, since its improvement and expansion will contribute to limiting excessive use of herbicides, respectively their harmful effects and will support the successful implementation of complex weed control.(Petrova*et al*., 2015).

Chemicals that are released from plants which impose allelopathic influence on other plants are called allelochemicals or allelochemics. Allelochemicals that are toxic may inhibit shoot/root growth, nutrient uptake, or may attack a naturally occurring symbiotic relationship thereby destroying the plant's usable source of a nutrient. The consequent effects may be inhibited or retarded germination rate, reduced root or radicle and shoot or coleoptile extension, lack of root hairs, swelling or necrosis of root tips, curling of the root axis, increased number of seminal roots, discoloration, reduced dry weight accumulation and lowered reproductive capacity (An *et al*., 1996 and Ayeni *et al*., 1997).

Generally, germination is less sensitive to the allelopathic chemical than is seedling growth (Miller, 1996).

Many weeds are now achieving importance as an agent of weed control for having special types of allelochemicals. These allelochemicals are capable of suppressing germination and growth of several other weeds, some of which are herbicide resistant (Bhadoria, 2011).

Xanthium species is one of the most competitive weeds incrop fields as well as wastelands. Inam *et al*. (1987) found that aqueous extracts of *Xanthium strumarium* from different plant parts reduce germination, early growth and dry weight of *Brassica compestris*,*Lactuca sativa*, and *Pennisetumamericanum*.

Germination and seedling growth of okra, bitter gourd, tomato and onion was reduced by water extract of dry plants of *Cyperusrotundus*. It was reported that the phenolic acids which were present in water extracts of dry plant organs were the cause of inhibition of germination and seedling growth of tested crops it was also found that *Cyperusrotundus* aqueous extract caused a significant reduction in vigour index of sesamum and okra indicating that this weed inhibited growth by the production of inhibitory substances (Ameena and Sansamma, 2002; Ameena*et al* 2014). The phytotoxicity of *Cyperusrotundus* was also tested against the growth of number of crop plants. Aqueous tuber extracts of *Cyperusrotundus* reduced seed germination and seedling growth of rice, corn, cucumber, tomato, sorghum, and onion (Meissner *et al*., 1979). *Cyperusrotundus* infested soil also reduced the seedling growth of barley (Horowitz and Friedman, 1971), It was also found that the shoot extracts of *Cyperusrotudus* were inhibitory to the seedling length, fresh and dry weight of tomato seedlings and the degree of inhibition was concentration dependent (Dadar*et al*, 2014).

There are great number of weeds containing allelochemicals which affect other plants like catechol tannins and sesquiterpenes in *Cyperusrotundus* as well as *m*. coumaric acid, *p*. coumaric acid and vanilic acid in *Echinochloa crus galli* (Komai and Ueki, 1975 and Abbas *et al*, 2014).

Verma and Rao (2006) tested four weed species extracts on germination, growth and protein in different varieties of soy bean. They found that *Solanum nigrum*was most effectiveweed in inhibiting seed germination percentage and seedling growth.

The aim of this work is to report the effect of aqueous extract of five weeds on germination and growth of two widely spread summer weeds in Egypt.

MATERIALS AND METHODS

An experiment was conducted to determine the effect of five summer weed extracts (*Echnichloacolonum, Cyperusrotundus, Xanthium pungens*wallr, *Solanum nigrum*and *Echinochloa crus galli*) on *Portulaceaoleracea*

L.and *Setariaglauca*L. Beauv., atrazine and fenoxaprop ethyl were used as standards for both broad and grassy weeds, respectively.

The healthy weeds were collected from Elhagger, El-Beheiragovernorate, Egypt. Weed extracts were prepared according to Mali and Kanade (2014). 10g fresh leaves of each weed were homogenized in 10ml distilled water, then filtered through Whatman No. 1 filter paper and volume was made to 100ml with distilled water. This solution was treated as stock solution (10%), then 2.5, 5, 10, 20, 30 and 50% concentration of stock solutions were prepared for treatment, also standard herbicides were prepared with the same concentrations from main stock solution of 10%.

Seeds of *Portulaceaoleracea* and *Setariaglauca* were first sterilized with ethanol 70% for 30 seconds then washed several times with distilled water.Ten seeds for each treatment were placed on filter paper in Petri dishes(12 cm in diameter)containing 2.5, 5, 10, 20,30 and 50% concentrations of weed extracts, simultaneously control was made using distilled water at room temperature. The germination of seeds was monitored daily and the evaporated contents were compensated with distilled water for the control or aqueous solution of weed extracts for treatments if necessary. Radicle emergence was considered as an index of germination and expressed as germination percentage. After ten days the number of germinated and non-germinated seeds was counted and final shoot and root length were measured then vigour index was calculated according to Abdul-Baki and Anderson (1973), where Vigour Index = Germination percentage x average seedling length.

The experiment was done in randomized completely block design and statistical analysis of data was carried out according toassistat software version beta,(Silva and Azevedo, 2009).

RESULTS AND DISCUSSION

The data obtained from this work showed that germination percentages were affected in most cases by high weed aqueous extract concentrations as it reached 40% for *Portulacaoleracea* (compared with 80% for the control) in the case of *Xanthium pungens*wallr(table 5) and 36.67% for *Setariaglauca*(compared with 100% for the control)in the case of*Echinochloacolonum* (table 2) . It was noticed that low aqueous extract concentrations did not affect the germination in all cases.

The experiment also showed that shoot length did not show significant inhibition at low extract concentrations, on contrary high concentrations (20, 30 and 50%) showed a noticeable reduction percentage with no significant effect between them especially between 30 and 50% aqueous concentrations.

Tables (1 and 5) showed that the highest reduction percentage in both shoot and root length of *Portulacaoleracea* was obtained from *Echinochloacolonum* and *Xanthium pungens*wallras the highest concentarion ofaqueous extract of the both weeds caused growth reduction by 80.91, 79 % for the first weed and 82.27, 70% for the second weed for both shoot and root length, respectively.

Table (1): Effect ofaqueous extract of*Echinochloacolonum* on*Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	80.0	2.15	2.27	0.99	1.0	3.14	251.20
5	76.67	1.91	13.18	0.91	9.0	2.82	216.21
10	73.33	1.71	22.27	0.76	24.0	2.47	181.13
20	70.0	0.54	75.45	0.32	68.0	0.86	60.20
30	60.0	0.46	79.09	0.24	76.0	0.70	42.0
50	60.0	0.42	80.91	0.21	79.0	0.63	37.80
control	80.0	2.20		1.00		3.20	256.0
LSD 0.05		0.13		0.07		0.23	

Table (2): Effect ofaqueous extract of*Echinochloacolonum* on*Setariaglauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	7.50	7.41	3.21	2.73	10.71	1071.00
5	100.00	4.10	49.38	2.64	20.00	6.74	674.00
10	100.00	3.30	59.26	1.98	40.00	5.28	528.00
20	80.00	2.10	74.07	1.25	62.12	3.35	268.00
30	60.00	1.60	80.25	0.49	85.15	2.09	125.40
50	36.67	1.38	82.96	0.45	86.36	1.83	67.11
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		0.67		0.31		1.13	

Table (3): Effect ofaqueous extract of*Cyperusrotundus* on *Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	80.00	2.10	4.55	0.93	7.00	3.03	242.40
5	76.67	1.92	12.73	0.91	9.00	2.83	216.98
10	73.33	1.89	14.09	0.76	24.00	2.65	194.32
20	73.33	0.97	55.91	0.62	38.00	1.59	116.59
30	70.00	0.75	65.91	0.43	57.00	1.18	82.60
50	60.00	0.64	70.91	0.33	67.00	0.97	58.20
control	80.00	2.20		1.00		3.20	256.00
LSD 0.05		0.16		0.10		0.36	

Table (4): Effect of aqueous extract of *Cyperusrotundus* on *Setariaglauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	7.31	9.75	3.24	1.82	10.55	1055.00
5	100.00	6.99	13.70	3.14	4.85	10.13	1013.00
10	80.00	6.97	13.95	2.99	9.39	9.96	796.80
20	70.00	5.41	33.21	0.97	70.61	6.38	446.60
30	50.00	1.86	77.04	0.81	75.45	2.67	133.50
50	46.67	1.23	84.81	0.73	77.88	1.96	91.47
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		0.54		0.41		0.87	

In the case of *Setariaglauca* (tables 2 and 4) the highest reduction percentage in both shoot and root length was obtained from highest extract concentration of *Echinochloacolonum* (82.96, 86.36) and *Cyperusrotundus* (84.81, 77.88%) for both shoot and root, respectively. This results agreed with El-Rokiek*et al*, 2010 who mentioned that the allelopathic effect of *Cyperusrotundus*extract on both tested weeds (*Chorchorusolitorius* and *Echinochloa crusgalli)* reduced weed competition and increased soybean yield, also these results were slightly close to the standard herbicide (fenoxaprop ethyl) which showed86.42 and 93.09% in the reduction percentage of shoot length at 30 and 50% concentration and 83.64, 90% reduction percentage for root length at the same concentrations , respectively.

Table (5): Effect ofaqueous extract of *Xanthium pungens*wallr on *Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	76.67	1.75	20.45	0.75	25.00	2.50	191.68
5	73.33	1.71	22.27	0.68	32.00	2.39	175.26
10	70.00	1.70	22.73	0.65	35.00	2.35	164.50
20	60.00	0.64	70.91	0.38	62.00	1.02	61.20
30	60.00	0.45	79.55	0.32	68.00	0.77	46.20
50	40.00	0.39	82.27	0.30	70.00	0.69	27.60
control	80.00	2.20		1.00		3.20	256.00
LSD 0.05		0.21		0.07		0.25	

Table (6): Effect of aqueous extract of *Xanthium pungens*wallron *Setariaglauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	7.61	6.05	3.21	2.73	10.82	1082.00
5	100.00	7.10	12.35	3.10	6.06	10.20	1020.00
10	96.67	6.70	17.28	2.70	18.18	9.40	908.70
20	76.67	4.89	39.63	2.69	18.48	7.58	581.16
30	70.00	3.00	62.96	1.31	60.30	4.31	301.70
50	53.33	2.40	70.37	1.24	62.42	3.64	194.12
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		0.71		0.43		0.99	

Tables (3 and 6) illustrated that both *Cyperusrotundus* on *Portulacaoleracea* and *Xanthium pungens*wallr on *Setariaglauca* had moderate reduction effect on shoot and root length at their highest concentration (50%).

Data in tables 7 and 8 showed that *Solanum nigrum* showed good control on *Portulacaoleracea* on both shoot and root length on contrary *Setariaglauca* was not affected to a hight extent by this weed extract, this result agreed with sabh and Ali (2010) who tested extract and residue of *Solanum nigrum* on the seedling growth and chlorophyll content of certain weeds and crops. They found that only shoot length of London rocket and root length of sowthistle were the most sensitive plants based on I_{50} and I_{90} values to the aqueous extract of this weed, whereas wheat was the least sensitive plant.

The least negative effect was obtained from the aqueous extract of *Echinochloa crusgalli* on both weeds as the reduction percentages were 45.45 and 33% for shoot and root length of *Portulacaoleracea*, respectively and 36.67 and 20.30% in the case of *Setariagalauca* shoot and root lengths, (tables 9 and 10).

Table (7): Effect of aqueous extract of*Solanum nigrum* on *Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	80.00	2.10	4.55	0.96	4.00	3.06	244.80
5	73.33	1.98	10.00	0.97	3.00	2.95	216.32
10	70.00	1.79	18.64	0.79	21.00	2.58	180.60
20	60.00	0.98	55.45	0.51	49.00	1.49	89.40
30	50.00	0.70	68.18	0.43	57.00	1.13	56.50
50	50.00	0.57	74.09	0.33	67.00	0.90	45.00
control	80.00	2.20		1.00		3.20	256.00
LSD 0.05		0.15		0.11		0.47	

Table (8): Effect of aqueous extract of *Solanum nigrum*on*Setariaglauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	7.64	5.68	2.80	15.15	10.44	1044.00
5	100.00	7.21	10.99	2.41	26.97	9.62	962.00
10	83.33	5.12	36.79	2.14	35.15	7.26	604.98
20	76.67	4.11	49.26	1.78	46.06	5.89	451.59
30	73.33	3.14	61.23	1.56	52.73	4.70	344.65
50	56.67	2.99	63.09	1.39	57.88	4.38	248.21
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		1.23		0.65		1.11	

Table (9):Effect ofaqueous extract of*Echinochloa crus galli* L. on *Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	80.00	1.96	10.91	0.92	8.00	2.88	230.40
5	70.00	1.85	15.91	0.85	15.00	2.70	189.00
10	70.00	1.54	30.00	0.74	26.00	2.28	159.60
20	63.33	1.50	31.82	0.70	30.00	2.20	139.33
30	60.00	1.27	42.27	0.69	31.00	1.96	117.60
50	60.00	1.20	45.45	0.67	33.00	1.87	112.20
control	80.00	2.20		1.00		3.20	256.00
LSD 0.05		0.09		0.12		0.14	

Table (10): Effect ofaqueous extractof *Echinochloa crus galli* L. on Setaria*glauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	7.41	8.52	3.10	6.06	10.51	1051.00
5	100.00	7.36	9.14	3.20	3.03	10.56	1056.00
10	96.67	7.54	6.91	2.91	11.82	10.45	1010.20
20	96.67	6.22	23.21	2.73	17.27	8.95	865.20
30	76.66	5.76	28.89	2.54	23.03	8.30	636.28
50	70.00	5.13	36.67	2.63	20.30	7.76	543.20
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		0.25		0.86		1.78	

From the data of all tables, the vigour index showed great reduction with high concentrations(20, 30 and 50%) which was mostly observed in the case of *Xanthium pungens*wallr at highest concentration(50%) on *Portulacaoleracea*(27.6 compared with 256 for the control). Similarly *Echinochloacolonum* at concentration 50% showed highest reduction in vigour index on *Setariaglauca* which was 67.11 compared to 1140 for the control.

Table(11): Effect of atrazine on *Portulacaoleracea*

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	30.00	1.23	44.09	0.98	2.00	2.21	66.30
5	20.00	0.56	74.55	0.82	18.00	1.38	27.60
10	0.00	0.00	100.00	0.00	100.00	0.00	0.00
20	0.00	0.00	100.00	0.00	100.00	0.00	0.00
30	0.00	0.00	100.00	0.00	100.00	0.00	0.00
50	0.00	0.00	100.00	0.00	100.00	0.00	0.00
control	80.00	2.20		1.00		3.20	256.00
LSD 0.05		0.18		0.11		0.74	

Table (12): Effect of fenoxaprop-ethyl on *Setariaglauca* L. Beauv

Extract concentration (%)	% Germination	Shoot length	% Reduction	Root length	% Reduction	Total seedling length	Vigour index
2.5	100.00	4.98	38.52	1.91	42.12	6.89	689.00
5	100.00	4.31	46.79	1.71	48.18	6.02	602.00
10	80.00	2.20	72.84	0.81	75.45	3.01	240.80
20	40.00	2.12	73.83	0.70	78.79	2.82	112.80
30	20.00	1.10	86.42	0.54	83.64	1.64	32.80
50	10.00	0.56	93.09	0.33	90.00	0.89	8.90
control	100.00	8.10		3.30		11.40	1140.00
LSD 0.05		0.42		0.17		0.61	

From this experiment we can conclude that the standard herbicides used had the upper hand in controlling germination, tables 11 and 12, but there were some treatments that gave very good control on both weeds specially in reducing both shoot and root length of tested weeds and were very close to standard herbicides, which needs more work to put this weed extracts in formulations to improve there action.

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التأثير الأليلوبائى المحتمل لخمسة مستخلصات حشائش على الرجلة و ذيل القط

محمود شحاتة محمود

قسم كيمياء و تقنية المبيدات ـ كلية الزراعة- جامعة الاسكندرية

تم إختبارتأثير المستخلصات المائية لخمسة أنواع من الحشائش (أبو ركبة، السعد، الشبيط،عنب الديب و الدنيبة) على الرجلة و ذيل القط فى كلية الزراعة – جامعة الإسكندرية، تم استخدام سلسلة من التركيزات (٢.٥، ٥، ١٠، ٢٠، ٣٠ و ٥٠%) من المحلول الأساسى المستخلص من الأوراق لتقييم تأثيرها على الانبات، طول الساق و الجذر و معامل القوة للحشائش. أظهرت النتائج أن التركيزات المنخفضة لم تحدث اى تأثير معنوى بينما كان للتركيزات المرتفعة (٣٠و ٥٠%) تأثير معنوى واضح على الحشائش المختبرة و التى كانت واضحة فى حالة الشبيط و أبو ركبة على الرجلة و كذلك أبو ركبة و السعد على ذيل القط مما يدل على وجود تأثير سلبى لحشائش الشبيط و أبو ركبة و السعد على الرجلة و ذيل القط.