التأثير التثبيطي لنبات السرو دائم الاخضرار في إنبات ونمو بذور الأعشاب الضارة في الأصص

Suppression Effect of Cypress (*Cupressus sempervirens* L.) on Some Weeds Germination and Growth in Pots

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الملخّص

نفذ البحث في دائرة المكافحة الحيوية للأعشاب الضارة التابعة لمركز بحوث ودراسات المكافحة الحيوية في كلية الزراعة بجامعة دمشق (سورية) خلال عام 2015، بهدف دراسة التأثير الأليلوباثي لمستخلصات نبات السرو دائم الاخضرار *Cupressus sempervirens* L. في إنبات بذور ونمو بعض الأعشاب في الأصص.

تم اختبار تأثير المستخلص الكحولي والمستخلص المائي لأوراق السرو في إنبات بذور أنواع الأعشاب التالية: عرف الديك *Amaranthus lividus* L.، الفجيلية *Diplotaxis erucoides* (L.) DC، القريص الكاذب *Lamium amplexicaule* L.، الشيلم *Lolium perenne* L.، الفصة العادية Medicago sativa L. والبقلة *Portulaca oleracea* L.

أظهرت النتائج التأثير المعنوي لمستخلصات السرو (المستخلص الكحولي 44.24 %، والمستخلص المائي 62.61 %) في إنبات الأعشاب المدروسة مقارنةً بالشاهد (94.61 %)، وأظهر المستخلص الكحولي تأثيراً قوياً في كل القراءات المسجلة مقارنةً بتأثير المستخلص المائي، إذ لم تنبت بذور الأنواع *D. erucoides*، و *L. amplexicaule* و *P. oleracea* المعاملة بالمستخلص الكحولي بينما أدى المستخلص المائي إلى نسب إنبات بلغت 11،33 و 0 و 33،35 % للأنواع السابقة بنفسها على التوالي. وكان أكثر الأنواع تأثراً هو عشب القريص الكاذب *L. amplexicaule*، إذ أدت كل تراكيز المستخلص الكحولي إلى منع إنبات بذوره. كما أدت المعاملات المختلفة إلى تأثير سلبي في الوزن الجاف للأنواع المدروسة، وحتى الأنواع التي حققت نسب إنبات مرتفعة مثل نبات الفصة العادية *M. sativa* (التي سجلت أعلى نسبة إنبات)، فقد انخفض وزنها الجاف وسجل (17،42 غ).

الكلمات المفتاحية: السرو *Cupressus sempervirens*،أعشاب، أصص، المستخلصات الكحولية والمائية، الوزن الجاف.

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Abstract

The research was carried out at the section of biological weed control which is affiliated to Biological Control Research and Studies Center, Faculty of Agriculture, Damascus University (Syria) during 2015, with the aim of studying the inhibitory effect of the extracts of cypress (*Cupressus sempervirens* L.) on germination and growth of some weed seeds in pots.

The alcoholic and aqueous extracts of cypress were tested for germination and growth of the weeds, *Amaranthus lividus* L., *Diplotaxis erucoides* (L.)DC., *Lamium amplexicaule* L., *Lolium perenne* L. *Medicago sativa* and *Portulaca oleracea* L. Results showed significant effects of Cypress extracts (Alcoholic extract 44.24% and aqueous extract 62.61 %) on the germination and growth of the tested weeds as compared to the control (94.61%). The alcoholic extract showed very inhibitory effects on all studied parameters, as compared to the aqueous extract, whereas the weeds, *D. erucoides*, *L. amplexicaule*, and *P. oleracea* showed 0% germination with the alcoholic extract and 11.33, 0 and 35,33% for the aqueous extract. The most affected weed was *L. amplexicaule,* as all the concentrations of the alcoholic extract suppressed its seed germination. Treatment affected negatively the dry matter of the studied weeds, even the seeds that showed higher germination percentages, viz. *M. sativa* which had the highest germination percentage but recorded a less dry weight (17.42g).

Keywords: Cypress, *Cupressus sempervirens*, Weeds, Pots, Alcoholic and aqueous extracts, Dry weight.

Introduction

ommon cypress, *Cupressus sempervirens* L. is native to the eastern Mediterranean region. This tree is mainly used as an ornamental tree due to its conical crown shape, but it can also be used for timber, as a privacy screen, and protection against wind as well. (Bagnoli *et al*., 2009). Phyto-preparation obtained from the core and young branches of *C. sempervirens* were reported to have antiseptic, aroma therapeutic, astringent, balsamic and anti-inflammatory activities. Cypress is also described to exert antispasmodic, astringent, antiseptic, deodorant, and diuretic effects, to promote venous circulation to the kidneys and bladder area, and finally to improve bladder tone and as a co-adjuvant in therapy of urinary incontinence and enuresis (Rawat *et al*., 2010). Essential oils and crude extracts of *C. sempervirens* have become a subject for a search of natural antioxidants, antibacterial, insecticidal activities, and inhibition of glucose-6-phosphatase and glycogen phosphorylase (Rawat *et al*., 2010). There are many reports on the chemical composition of essential oils isolated from various parts of C. sempervirens. Most of these reports indicate that monoterpene hydrocarbons like α-pinene and δ-3-carene are the main constituents of these oils (Sacchetti *et al*., 2005, Chéraif *et al*., 2005, Mazari *et al*., 2010), but to our knowledge, no study has been reported on their herbicidal so, the aims of this work were, we tested their herbicidal effects against germination and seedling growth of some common weeds.

Allelopathy symptoms are very clear under forest conditions due to large quantity of plant residues accumulated on the ground under forest tree, and those remain for a very long time without disturbance, resulted in increasing the effectiveness of the material released from the plants debris (Lisanework and Michelson, 1993; Daniel, 1999). This phenomenon could provide an alternative way to minimize the use of chemical compounds in pest control and reduces the risk towards

agroecosystems by serving alone or in a complementary way with herbicides. The aqueous extract of arizona cypress, *Cupressus arizonica* was completely inhibited seed germination of tall fescue, *Festuca arundinaceae* and had more inhibitory activity than other aqueous extracts on rye-grass, Lolium perenne (Arouiee *et al*., 2010). Various parts of same weed have different allelopathic effects on germination and crop growth (Aziz *et al*., 2008). Allelopathic compound not only reduced germination, but also delayed germination that was affecting seedling greater (Escudero *et al*., 2000). Allelochemicals may inhibit shoot/root growth and nutrient uptake (Qasem, 1995), and soluble protein contents (Rice, 1984). Chemicals that impose allelopathic influences are called allelochemicals or allelochemics.

Degradation of the plant material lead to leaching of allelopathic substances which cause inhibition of germination and growth of crop plants (Rice, 1984; Mann, 1987). Biodegradable natural plant products may act directly as herbicides or may provide lead structures for herbicidal discovery (Duke *et al*., 1999). There are many reports on the chemical composition of essential oils isolated from various parts of C. sempervirens. Most of these reports indicate that monoterpene hydrocarbons like α-pinene and δ-3-carene are the main constituents of these oils (Chéraif *et al*., 2005, Sacchetti *et al*., 2005, Emami et al., 2006, Mazari *et al*., 2010). The pistachio fruit hull, was noticed to caused no germination and growth of weeds and other plants in circle of about 50 cm around the pile of the hulls (Alyousef, 2014), therefore this investigation was carried out to ascertain this phenomenon, and explore the possibility to use Cypress in weed control.

Materials and methods

Botanical powder material:

Fully matured leaves of cypress were collected from the farm of Faculty of Agriculture, and were fully air dried in shade, then were ground into fine powder and stored in air tight colored glass bottles.

Plant material:

Seeds of weed species (amaranth, *Amaranthus lividus* L., white wall rocket, *Diplotaxis erucoides* (L.) DC., common henbit, *Lamium amplexicaule* L. perennial rye-grass, *Lolium perenne* L, Lucerne, *Medicago sativa* and common purslane, *Portulaca oleracea*) were obtained from the weed seed bank at the Biological Control Research and Studies Center, Faculty of Agriculture, Damascus University, Damascus, Syria.

The weed seeds were sterilized with 15:1 water/bleach (commercial NaOCl, 10 to 14 % available chlorine) solution for 5 minutes and subsequently washed with distilled water, then fully dried on blotter paper.

Extracts preparation:

Aqueous extract was prepared by soaking 10 gm of air-dried cypress leaves in 100 ml of distilled water for 2 hrs at room temperature. Then the extract was filtered using muslin tissues and later through filter paper (Whatman No. 1), the volume of the filtrate made to 100 ml and this considered as stock solution (100%) (Dhavan and Narwal, 1994). Stock solution was diluted appropriately with distilled water to give the final concentrations of 25%, 50%, 75% and 100%. The control treatment, distilled water, was used to estimate potential germination of seeds.

The alcoholic extract was prepared by soaking 10 gm of air-dried cypress leaves in 100 ml of

Ethanol (90%) for 24 hrs at room temperature. Next day the solution was filtered through muslin cloth and washed with 10 ml of Ethanol and then through filter paper (Whatman No. 1) and evaporated using the Rotary evaporator at 40˚C and final solution kept in dark glass bottles and stored in fridge (4˚C) until use.

Seed germination:

Weed seeds were sown in pots (20 cm diameter), filled with a mixed medium (equal quantity of soil, sand and organic matters). Medium was sterilized for 48 hours at 70 ° Celsius). 100 seeds of each weed species were placed on each pot and covered with 1 mm layer of very fine soil. Treatments were replicated three times in a Completely Randomized Design. Pots were kept in the net-house and watered uniformly. The pots were inspected every two days to check the germination and moisture.

Seedling weight:

Seedling were cut from the pots separately at the soil surface, then kept in shade for drying over 20 days.

Statistical analysis:

The trial was conducted in a complete randomized design (CRD) with three replicates. Germination reduction was calculated using the Abbot formula (Abbot, 1925), **= (control – treatment/control) * 100**

Finally percentage data were subjected to general treatment structure (in randomized blocks)) employing Duncan's test at (P ≤0.05) in GenStat 12 Programme.

Results and discussion

Obtained data were showed significant effects of suppression of weed seeds germination and seedling growth and a positive response to increasing the doses and type of extraction. These results proved the great allelopathic effect of the extracts of the Cypress, *Cupressus sempervirens* and explain the suppression of the plants grown under and near Cypress plantation, and from another side it could be utilize in controlling weeds in organic agriculture.

Effect of cypress extractions on germination of weed species:

Great effects on germination of the studied weed species were noticed among different treatments (Table 1). But in general the alcoholic effect was superior in its effect.

The highest germination percentage was noticed with the treatment of *M. sativa* seeds (81%) followed by *L. perenne* (71.25%) and A. *lividus* (57.42%) indicated the resistance of those species, to Cypress allelopathic compounds and that was recorded in our field observations regarding the noticing the same species could survive near the cypress tree especially the perennial grass *Lolium perenne*. Some very sensitive weed species viz. *Lamium amplexicaule, Diplotaxis erucoides and Portulaca oleracea* obtained lower germination percentages (39.25, 37.46 and 33.83% respectively) and they were also not noticed to grow around the cypress tree in field. This results could be exploited for the control of some weed species in organic plantations and other cases. These results coincide with the results of Callaway and Aschehoug (2000); Prati and Bossdorf (2004) as they mentioned that the allelopathic compounds can decrease the germination and growth of other plants. The allelopathic properties of Lavender was demonstrated by Goodwin and Taves (1950), who reported that the germination and seedling growth of wild oat (*Avena fatua*) was inhibited by its essential oil

Table. 1. Effect of *Cupressus sempervirens* on germination of weed species.

Treatments	(%) Germination percentage of the weed species							
	Con. (%)	*A. lividus*	*M. sativa*	*P. oleracea*	*L. amplexicaule*	*D. erucoides*	*L. perenne*	Average treatment
Control	-	90^{cde}	100^{a}	88.33^{de}	97.33^{ab}	95.67^{abc}	96.33^{abc}	94.61^{A}
Aqueous extraction	25	76.67^{f}	95^{abc}	40^{j}	97^{ab}	26^{k}	91.67^{bcd}	71.06^{B}
	50	51.67^{h}	85^{e}	11.67^{mn}	18.33^{l}	18.67^{l}	96.33^{abc}	46.94^{C}
	100	46.33^{i}	70^{g}	0^{p}	4^{op}	11.67^{mn}	92.33^{bcd}	37.39^{D}
Alcoholic extraction	25	53.33^{h}	90^{cde}	35.33^{j}	0^{p}	40.67^{j}	56.67^{h}	46.00^{C}
	50	36.67^{j}	71.67^{fg}	7^{no}	0^{p}	11.33^{mn}	30^{k}	26.11^{E}
	100	14.67^{lm}	36.33^{j}	0^{p}	0^{p}	0^{p}	10.33^{mn}	10.22^{F}
L.S.D. Treatments x extractions x species = 5.2								$LSD_{0.05}$ treatment = 1.501
Average species	-	57.42^{C}	81.00^{A}	33.83^{E}	39.25^{D}	37.46^{D}	71.25^{B}	LSD species = 1.839
CV(%) = 6								

***Similar letters indicated non-significant effect on corresponding line or column.**

Regarding the extraction types, the results very clearly showed the overcome of the treatment of alcoholic extract as compared to aqueous extract. At the concentration 100% the aqueous extracts showed lower percentages of germination for the weed species *A. lividus, M. sativa, P. oleracea, L. amplexicaule, D. erucoides* and *L. perenne* (46.33, 70, 0, 4, 11.67 and 92.33% respectively) while the alcoholic extract at 100% showed lowest figure for the previous species (14.67, 36.33, 0,0,0 and 10.33%). The germination fully inhibited with the alcoholic extract for the seeds of *L. amplexicaule* at all concentrations and at 100% concentration for the weeds, *D. erucoides* and *P. oleracea*. Alyousef (2014) showed that the alcoholic extract of pistachio has a greater effect on the seed germination and seedling length and weight as compared to aqueous extract at similar concentration.

Among treatments, the use of alcoholic extract at 100 % gave the best result in germination percentage for all studied weeds and the highest effect was for the weed species *P. oleracea, L. amplexicaule* and *D. erucoides* (0%).

Arouiee *et al*., (2010) found that the aqueous extract of arizona cypress, *Cupressus arizonica* was completely inhibited seed germination of tall fescue, *Festuca arundinaceae* and on rye-grass, *Lolium perenne*. Various parts of same weed have different allelopathic effects on germination and crop growth (Aziz *et al*., 2008), these result were incompatible with our finding.

The work on the shrub, *Lantana camara* showed the great effect of this plant in preventing the seed germination and seeding growth of *Phaseolus radiatus* (Gantayet *et al*., 2014). Alyousef and Ibrahim (2015) showed significant effect of pistachio on the germination and the growth of the weeds, that treated with 100 g powder of both fruit hull and leaf powder and concluded the

possibility of using pistachio residues to overcome the growth of the weeds in field. It could be concluded that *L. amplexicaule, D. erucoides* and *P. oleracea* were the most sensitive weeds to Cypress extracts especially with higher concentrations.

Germination reduction of weed seeds due to the effect of cypress extracts:

The results in Table 2 indicated the germination reduction percentages for the weed species, which clearly shows the effect of Cypress extract on the germination. The alcoholic extract caused 100% of the germination reduction with the species *L. amplexicaule*, *D. erucoides* and *P. oleracea* and the lowest germination reduction value was for the seeds of *L. perenne* (0%) with 50% of aqueous extracts, followed by the *L. amplexicaule* (0.34%) and *M. sative* (5%) with 25% of aqueous extracts (Table 2). Albarni *et al*. (2012a,b) mentioned to the importance of calculating the germination reduction due to extract effect and considered it an easy parameters to show the effectiveness of the extract.to show the effectiveness of the extract.

Table 2. Germination reduction of the studied weed species caused by Cypress, *Cupressus sempervirens* extracts.

Treatments		(%) Germination reduction of the treated weed species						
	Con. (%)	*A. lividus*	*M. sativa*	*P. oleracea*	*L. amplexicaule*	*D. erucoides*	*L. perenne*	Average treatment
Aqueous extraction	25	14.82^{n}	5^{op}	54.90^{j}	0.34^{p}	72.84^{g}	4.78^{op}	25.45^{E}
	50	42.59^{kl}	15^{n}	86.82^{cdef}	81.19^{ef}	80.48^{f}	0^{p}	51.01^{D}
	100	48.52^{k}	30^{m}	100^{a}	95.93^{ab}	87.80^{cde}	4.16^{op}	61.07^{C}
Alcoholic extraction	25	40.74^{l}	10^{no}	59.96^{ij}	100^{a}	57.49^{ij}	41.19^{l}	51.56^{D}
	50	59.26^{ij}	28.33^{m}	92.09^{bc}	100^{a}	88.15^{cd}	68.85^{gh}	72.78^{B}
	100	83.70^{def}	63.67^{hi}	100^{a}	100^{a}	100^{a}	89.27^{cd}	89.44^{A}
L.S.D. Treatments x extractions x species = 6.186								$LSD_{0.05}$ treatment = 1.786
Average species	-	48.27^{C}	25.33^{E}	82.30^{A}	79.58^{B}	81.13^{AB}	34.71^{D}	LSD species = 2.525
C.V. (%)	6.5							

*Similar letters indicated non-significant effect on corresponding line or column.

Effect of cypress extractions on germination of weed species:

Actually the dry weight indicator considered as the most valuable and trusted parameter for evaluating the effect of extraction. Because in many cases the seed germination may not get affected by the extracts but the growth and weight of the seedling stressed significantly (Albarni, 2012a,b, Alyousef and Ibrahim, 2015). Comparing between the germination percentages and dry matter weight we could noticed the highest germination recorded for the *M. sativa* (81%) and for *L. perenne* (71,25%) but the highest dry matter was for the *A. lividus* (27.04 g) (Table 3) with significant differences. Even for the lowest germination percentage (33.83% for the weed,

P. oleracea) the seedling dry weight obtained higher figured (14.58 g) compared to *D. erucoides* and *L. amplexicaule* (13.33 and 11 g, respectively) while they recorded higher germination percentages (39.25 and 37,46%, respectively). These results indicated the importance of studying many parameters and not only the seed germination.

Table. 3. Effect of Cypress, *Cupressus sempervirens* on dry weight of weed species.

Treatments	Dry weight (mg)							
	Con. (%)	*A. lividus*	*M. sativa*	*P. oleracea*	*L. amplexicaule*	*D. erucoides*	*L. perenne*	Average treatment
Control	-	34.67^{a}	19^{efghi}	34.67^{a}	21.67^{cdef}	23.67^{c}	21.33^{cdefg}	25.83^{A}
Aqueous extraction	25	33.67^{a}	20.33^{cdefg}	15.67^{ijklm}	21.67^{cdef}	14.67^{klmn}	16.33^{hijkl}	20.39^{B}
	50	27.67^{b}	18^{ghijk}	8^{q}	14.33^{lmn}	10.33^{opq}	20^{defg}	16.39^{C}
	100	23.33^{cd}	18^{ghijk}	0^{t}	8.67^{pq}	3.33^{rs}	18.33^{fghij}	11.94^{D}
Alcoholic extraction	25	27.33^{b}	19.67^{efgh}	15.67^{ijklm}	0^{t}	19.33^{efgh}	15^{iklmn}	16.17^{C}
	50	22.33^{cde}	16.33^{hijkl}	8^{q}	0^{t}	11.67^{nop}	11^{opq}	11.56^{D}
	100	12.67^{mno}	9^{pq}	0^{t}	0^{t}	0^{t}	4.67^{r}	4.39^{E}
L.S.D. Treatments x extractions x species = 5.2								LSD treatment = 0.869
Average species	-	27.04^{A}	17.42^{B}	14.58^{D}	11.00^{F}	13.33^{E}	16.00^{C}	$LSD_{0.05}$ species = 1.065
C.V. (%)	11.2							

***Similar letters indicated non-significant effect on corresponding line or column.**

In conclusion, the studied traits were influenced significantly with watering the pots with Cypress extracts, and the great effect was noticed with alcoholic extract. Albarni *et al*. ($2012^{a\ b}$) and Duke *et al.* (1999) mentioned that the allelochemicals can act directly as herbicides or may provide lead structures for herbicides discovery (Putnam, 1984). And in general conclusion it could be exploit the Cypress, *Cupressus sempervirens* residues as fast and easily available natural matter to overcome the growth of unwanted weeds especially with the crops panted by seedling.

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