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Evaluation allelopathicpotential of some medicinal and vegetable plants on germination, and Seedling Growth of Common Lambsquarters *Chenopodium album*

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Abstract

This study was conducted in order to evaluate the allelopathic effects of medicinal and vegetable plants on the seed germination and seedling growth of common lambsquarters *Chenopodium album*. The experiment was done in complete randomized design (CRD) with 4 replications. Treatments included different plants including dill, garden cress, coriander, peppermint and rosemary and theirs different organs including (seed (except rosemary), seedling (exceptrosemary), root and shoot). Results showed that plant exudates were significantly effects ($P<0.01$) on germination percentage, germination rate, radicle length, plumule length and seedling length and seedling weight. The highest amount of all measured traits had in control conditions and shoot of dill and shoot of garden cress led to the highest inhibition effectson these traits.

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Introduction

The relative importance of allelopathy and resource competition in plant-plant interactions has been vigorously debated but seldom tested (Ridenour and Callaway, 2001).Some plants may inhibit germination, emergence and subsequent growth of other plants by exuding toxic substances which are called allelopathic chemicals or allelochemicals and the process is called allelopathy (Rice, 1984). Allelopathy is a mechanism by which weeds affect seed germination dynamics, and growth of field crops.

Allelopathy plays an important role in agricultural ecosystems and in a large scale, in the plant covers among the crop-crop, crop-weed and tree-crop covers (Panahyan *et al*, 2010). Fujii*et al*, (2003) during a test on allelopathic activities of 387 Japanese medicinalplant species on lettuce germination reported that41 species of different families showed more than 50% inhibitionin the radicle growth of lettuce seedling. Gillani *et al* (2010) reported that Pakistan endemic species *Seriphidiumkurramense*, *Andrachnecordifolia* and *Rhazyastricta* were stronger phytotoxic effect on lettuce seeds. There are several medicinal and vegetable plants in Iran which have used as medicine or food for a long time but little information is available on the allelopathic potentials of these plants therefore the aim of this study was to evaluate allelophaticeffects of the 5 medical an vegetable plants on common lambsquarters germination characteristics and seedling growth.

Materials and methods

Description of the project site and treatments

This study was done at the seed technology laboratory of Islamic Azad University,Shahr-e-Rey,Tehran Iran. Treatments included different plants including dill (*Anethumgraveolens),*gardencress (*Lepidiumsativum*), coriander (*Coriandrumsativum*), peppermint (*Mentha×piperita* L.) *and* rosemary *(Rosmarinusofficinalis)* and different theirs organs including (seed (exceptrosemary), seedling (exceptrosemary), root and shoot).These plant was produced in pods and then shoots and roots were separated, washed and then dried in oven (70°C for 48 h). For making aqueous extract, 50 grams of grinded material were soaked with 500 ml (10% w/v) of distilled water and continuously shacked for 24 hrs at 75 RPM. After that was added to petri dishes containing 25 seeds of Common lambsquarters.

40 seeds of Five species (exceptrosemary) were imbibed in 15 ml water (for 24 h unless otherwise stated) at 4 °C, which allows imbibition but not germination and minimizes any contamination from micro-organisms. After removing of the seeds,common lambsquartersseeds were placed in the same water and incubated for the next 14 days (Ighbal and Fery, 2012).

Forty seeds of seeds Five species (exceptrosemary)were incubated in 20°C and 16/8 (light/dark) period for only 3 days; the seedlings were then removed and the water+exudate was left in the Petri dish containing 25 seeds of common LambsquartersIghbal and Fery, 2012).

All common lambsquartersseeds were sterilized by shaking in sodium hypochlorite (10%) at room temperature for 5 min then washed with sterile water. Seed sterility were placed 9cm petri dishesWhatman No.1 paperin 20°C and 16/8 (light/dark) period).

Experimental design and data analysis

The experiment was done in complete randomized design (CRD) with 4 replications. Analysis of variance was done using SAS (9.1, SAS Institute Inc Cary, NC, USA) software and mean comparisons were identified with Duncan's multiple-range tests. Before statistical analysis, all data were passed normality test and were transformed were needed.

Results

Germination percentage and germination rate

Statistically significant ($P<0.01$) differences were found in germination percentage and germination

rateof *Chenopodium album*(Table 1). Based on mean comparison data (Table 2) the highest negative effect on germination percentge was showed in water extract of garden cress shoot, garden cress root and dill shoot (2, 39 and 54% respectively). Other treatments showed no significantly effect on this trait. On the other hand, shoot of garden cress and shoot of dill were the highest negative effect on germination rate (0.4 and 0.83 seed germinated per day, respectively). Khanh *et al.,* (2004) reported that *N. oleander* and *Helianthus tuberosus* showed the highest suppression of germination and growth of *Echinochloa crus-galli*(barnyardgrass) and *Monochoria vaginalis* (monochoria).

Table 1. Variance analysis for seed germination and seedling growth traits of *Chenopodium album*.

S.O.V	df	Rootlet length	Shootlet length	Seedling length	Seedling weight	Germination percentage	Germination Rate
Treatment	18	350.16**	183.21**	0.53**	0.00016**	908.98**	45.58**
Error	-	23.72	18.61	0.09	0.00001	90.50	5.08

**means non-significant, significant at 5 and 1% levels of probability, respectively.

Plant exudates were significantly effects (P<0.01) on radicle length, plumule length and seedling length (Table, 1). Similar results of prior part, shoot of garden cress and shoot of dill showed a huge negative effect on length of radical, plumule and seedling (Table 2). Furthermore extract of seedling of dill, seedling of peppermint and shoot of peppermint had low radical and seedling length and also seedling and shoot of peppermint showed a large negative in plumule lenght in compared with control (Table 2). Tsuchiya *et al.,* (1994) reported that methanol extracts of stem and root of red pepper strongly inhibited the radicle growth of red pepper and also methanol Extracts of leaf and root and water extract of root inhibited the hypocotyl growth. Medicinal and vegetable plants extract also was a significant effect on seedling weight (Tabe 1).

Table 2. Mean comparison of seed germination and seedling growth traits of *Chenopodium album*.

		Radicle length (mm)	Plumule length (mm)	Seedling length (mm)	Seedling weight (mm)	Germination percentage (%)	Germination Rate No/day
Control		32.25ab	24.25ab	56.50a	0.023a	71a	12ab
Coriander	Seed	27.17bc	21.08abc	48.25abc	0.018abc	65ab	5.86ef
	Seedling	24.75bcd	24.42ab	49.17abc	0.012defg	65ab	5.53f
	Root	25.22bc	23.33ab	48.53abc	0.016bcde	59ab	10.57abc
	Shoot	22.50cd	21.17abc	43.67c	0.011efg	64ab	5.19f
garden	Seed	33.89a	25.33a	59.22a	0.017bcd	69ab	12.36a
cress	Seedling	24.33bcd	20.33abc	44.67bc	0.018abc	65ab	9.90abcd
	Root	25.92abc	23.92ab	49.83abc	0.017abc	59ab	9.90abcd
	Shoot	1.25f	2.00d	3.25e	0.002h	2d	0.40g
Dill	Seed	27.22abc	24.67a	51.89abc	0.016bcde	59ab	6.52def
	Seedling	13.33e	20.00abc	33.33d	0.016bcde	56ab	6.38def
	Root	31.08ab	25.08a	56.17ab	0.020abc	54b	9.11abcd
	Shoot	1.08f	2.92d	4.00e	0.001h	39c	0.83g
peppermint	Seed	24.11bcd	24.44ab	46.56bc	0.015cdef	57ab	10.44abc

	Seedling	15.00e	17.22bc	32.22d	0.008g	56ab	10.21abc
	Root	32.08ab	24.50ab	56.58ab	0.023a	65ab	8.49bcdef
	Shoot	17.25de	14.67c	31.92d	0.009fg	64ab	4.82f
Rosemary	Root	24.83bcd	21.58abc	46.42bc	0.020abc	64ab	9.75abcd
	Shoot	27.80abc	21.00abc	48.83abc	0.022ab	56ab	7.78cdef

In each column, means with similar letters do not differ significantly at 0.05 probability level

There was the lowest amount of seedling weight in use of dill shoot extract and garden cress shoot. Germination rate is a powerful trait that can show seed vigor. Rapid seed germination will facilitate quick plant stand establishment and loss of competitive ability will largely due to a delay in germination. Therefore this is a important factor in competition between seed germination and establishment of weed and crops. According to this fact, using of plants with higher allelopathic potential is suitable strategy in sustainable weed management.

Based on obtained results, shoot (and some other parts) of coriander, garden cress, dill and peppermint have a high negative potential in control of weed germination and establishment. On the other hand, shoot of garden cress and dill showed a higher inhibition on length of radical and plumule of this weed. Therefore these two plants with a negative synchronous effect on germination rate and length of radical and plumule have a high allelopathic potential for weed control and have a high potential for using in sustainable programs of agriculture in future.

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