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The Allelopathic Effect of *Pictacia* Leaf Extracts and Pure Essential Oil Components on *Pelargonium* Ringo Deep Scarlet F1 Hybrid Seed Germination

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Abstract: The allelopathic effects of leaf extracts obtained from *Pictacia vera*, *Pictacia lentiscus* and *Pictacia terebinthus* and limonene, β-pinene, α-pinene, α-terpinene and terpinen-4-ol, which occur in essential oils of plants, on seed germination at 1000 and 5000 ppm doses were investigated. Among the tested extracts, 1000 ppm doses of chloroform and ethyl alcohol extracts of *P. terebinthus* increased the seed germination with a rate of 80 and 76.67%. However, 1000 and 5000 ppm doses of terpinen-4-ol had very toxic effect on the seed germination. Both treated doses of this compound completely stopped the seed germination on *Pelargonium* Ringo Deep Scarlet F1 Hybrid. On the other hand, petroleum ether extract of *P. lentiscus* treated at 5000 ppm doses increased the seed germination rate.

Key words: Pelargonium, pictacia, leaf extract, allelopathy

INTRODUCTION

Allelopathy is defined as the direct or indirect harmful or beneficial effects of one plant on another through the production of chemical compounds that escape in to the environment These chemicals are called allelochemicals. Allelochemicals often have inhibitory or contributory effects on seed germination and plant growth (Rice, 1984). Earlier studies showed that the allelochemicals inhibited or stimulated seed germination of various plants (Kocacaliskan and Terzi, 2001; Kadioglu, 2004; Al-Humaida and Warrag, 1998; Twaha and Turk, 2003).

In plant production, all sown seeds can not germinated. The germination percentage of seeds varied between cultivars. Therefore to increase seed germination percentage are economically important. For this reason, in particular exogenous chemicals applied on seeds to obtain higher germination percentage .The effect of allelochemicals on seed germination of ornamental (*Pelargonium* sp.) plant are not sufficiently known.

The aim of this study is to determine if there are active allelochemicals in the leaves of *Pictacia* species and pure essential oil components present that would effect the germination of *Pelargonium* Ringo Deep Scarlet F1 hybrid seeds and to see if different concentration of the extracts and major substances had any significance in germination.

MATERIALS AND METHODS

Pictacia vera (L.), *Pictacia terebinthus* (L.) and *Pictacia lentiscus* (L.) (Anacardiaceae) leaves were collected from the Fethiye region of Turkey in July, 2003. The dried plant sample was powdered in a blender and than 25 g of it extracted individually with Petroleum ether, chloroform, ethyl acetate and ethyl alcohol in a Soxhlet apparatus. The solvents were evaporated under reduced pressure and temperature. Yields are listed (Table 1). The extracts were then tested on the pelargonium 'Ringo Deep Scarlet' F1 Hybrid seed germination.

The seeds of Pelargonium Ringo Deep Scarlet F1 Hybrid. were provided from Sluis and Groot Company (Holland) and sown in petri dishes 09 February 2004 and conducted 9 days in Erzurum..

At the beginning of the experiment, the seeds were treated with 2.5% Sodium Hypochlorite solution in a petri dish for 3 min (Smith, 1991). They were than washed several times with distilled water for 2-3 min.

Table 1: Yields (%) of the extracts obtained from the leaves of three *Pictacia* L. species

	Solvents			
Plant	Petroleum ether	Chloroform	Ethyl acetate	Ethyl alcohol
Pictacia vera	2.68	3.32	3.24	11.32
Pictacia terebinthus	4.74	7.12	6.36	12.88
Pictacia lentiscus	6.12	9.96	7.04	16.59

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Table 2: The treatments were as follow

No.	Treatment
1	Control
2	*Pistacia terebinthus* (chloroform-1000 ppm)
3	*Pistacia terebinthus* (chloroform-5000 ppm)
4	*Pistacia terebinthus* (ethanol-1000 ppm)
5	*Pistacia terebinthus* (ethanol-5000 ppm)
6	*Pistacia terebinthus* (petroleum ether-1000 ppm)
7	*Pistacia terebinthus* (petroleum ether-5000 ppm)
8	*Pistacia vera* (ethyl acetate-1000 ppm)
9	*Pistacia vera* (ethyl acetate-5000 ppm)
10	*Pistacia lentiscus* (petroleum ether-1000 ppm)
11	*Pistacia lentiscus* (petroleum ether-5000 ppm)
12	Limonene (1000 ppm)
13	Limonene (5000 ppm)
14	β-Pinene (1000 ppm)
15	β-Pinene (5000 ppm)
16	α-Pinene (1000 ppm)
17	α-Pinene (5000 ppm)
18	Terpinen-4-ol (1000 ppm)
19	Terpinen-4-ol (5000 ppm)
20	α-Terpinene (1000 ppm)
21	α-Terpinene (5000 ppm)
22	Acetone (control)

The extract and pure compound solutions were prepared at 1000 and 5000 ppm concentrates and treated (Table 2). The seeds were soaked with the solutions for 5 min. Ten seeds (three replicates of each experiment with total 220 seeds) were placed on petri dishes with whatman No. 1 filter paper. Then, 2.5 mL distilled water was added to the corresponding dish. Afterward, control dishes were watered with distilled water. The dishes were put in to the culture chamber with controlled lighting and temperature (light phase: 16 h at 22°C; dark phase 8 h at 22°C. The dishes supplied 2.5 mL distilled water every 2 days.

Germinated seeds in each dish were counted daily. Emergence of 1 mm of the radical was used as the criterion for germination (Gill *et al*., 1994). The study was continued for 9 days. The results were quantified as percentages and rates of germination. Data were subjected to analysis of variance (ANOVA) and means were separated by Duncan's multiple range test.

RESULTS

The effect of the leaf extracts of *Pistacia* species and pure limonene, α-pinene, β-pinene, α-terpinene and terpinen-4-ol, which are occurs in the essential oils of the plants, on the seed germination of *Pelargonium* F1 Hybrid. are shown in Table 3. All results on germination rates and percentages were found to be statistically significant. The highest germination percentage was found in the 1000 ppm dose of chloroform extract of *P. terebinthus* (80%) followed by ethanol extract (1000 ppm dose) of *P. terebinthus* (76.67%). However, no germination percentage was determined in treatment of both 1000 and 5000 ppm doses of terpinen-4-ol (0.0%). Terpinen-4-ol completely stopped the germination of *Pelargonium* F1 Hybrid. Furthermore, for the germination percentages, no statistical difference was found among the treatments 2, 4, 1, 14, 6, 11, 5, 20, 9, 16, 10, 3 and 8, although the differences between treatment 2 and 12, 15, 22, 13, 17, 21, 7, 18 and 19 were statistically significant ($p<0.01$). Table 3 shows that it can be concluded that *Pictacia* extracts and pure compounds reduced the germination of *Pelargonium* f1 Hybrid seeds out of *P. terebinthus* chloroform 1000 ppm and *P. terebinthus* ethanol 1000 ppm extract treatment as compared with the control. Generally the most inhibition effect seen by 5000 ppm treatments. There were no statistically significant differences between α-pinene (5000 ppm), α- Terpinene (5000 ppm) and *P. terebinthus* petroleum ether (5000 ppm) extract treatments.

Table 3: The effects of extracts and pure essential oil components on pelargonium seed germination

No.	Plant	Extract	Dose (ppm)	Germination percentage (%)	Germination rate
1	Control	-	-	73.33ab	29.52a
2	*P. terebinthus*	chloroform	1000.00	80.00a	26.55abc
3	*P. terebinthus*	chloroform	5000.00	56.67abcd	26.58abc
4	*P. terebinthus*	ethanol	1000.00	76.67ab	24.86abc
5	*P. terebinthus*	ethanol	5000.00	66.67abc	27.67ab
6	*P. terebinthus*	petroleum ether	1000.00	70.00abc	26.68abc
7	*P. terebinthus*	petroleum ether	5000.00	26.67e	17.49def
8	*P. vera*	ethyl acetate	1000.00	56.67abcd	24.2abcd
9	*P. vera*	ethyl acetate	5000.00	63.33abc	21.2bcde
10	*P. lentiscus*	petroleum ether	1000.00	60.00abc	25.67abc
11	*P. lentiscus*	petroleum ether	5000.00	70.00abc	30.11a
Compounds					
12	Limonene	1000	53.33bcd	15.52ef	
13	Limonene	5000	33.33de	14.56ef	
14	β-pinene	1000	73.33ab	23.85abcd	
15	β-pinene	5000	53.33bcd	16.08ef	
16	α-pinene	1000	63.33abc	15.13ef	
17	α-pinene	5000	26.67e	12.04f	
18	Terpinen 4-ol	1000	0.00f	0.00g	
19	Terpinen 4-ol	5000	0.00f	0.00g	
20	α-Terpinene	1000	66.67abc	17.70def	
21	α-Terpinene	5000	26.67e	16.03ef	
22	Aseton control		46.67cde	20.03cde	

Values with common letters within each row are not significantly different (Duncan, 1%)

Treatments showed very significant effect on germination rate as in germination percentage. The highest germination rate was determined for the treatment of 5000 ppm dose of *P. lentiscus* (treatment 11) with 30.22. However, the lowest germination rate was shown by the treatment of 5000 ppm dose of α-pinene (treatment 17) with 12.04. These results suggested that *Pictacia* extracts and pure compounds showed the reducing effect on the germination rate of *Pelargonium* seeds in comparison to the controls except for in 5000 ppm dose of *P. lentiscus* (treatment 11) (Table 3).

DISCUSSION

There are no studies on seed germination of Pelargonium Ringo Deep Scarlet F1 Hybrid releated of allelopaths. This is the first study the effect of allelochemicals on pelargonium seeds. The studies releated to allelopathy always have been focused on weed seeds.

Allelochemicals are synthesized in plants as secondary metabolites and located in certain specialized organs of donor plants (Kobayashi, 2004). Vandermast *et al.* (2002) Allelopathic chemicals in organic materyal can inhibit or sometimes, facilities seed germination (Leather and Einhellig, 1986). In our study treatment 2 (80%) and 4 (76.67%) increased seed germination percentage and rate treatment 11(30.11) to compare with control. We hypothesed that one or more substances in *P. therebinthus* leaf extracts that may be stimulated the germination of seeds.

The results are in accordance with other studies have similar results with this study (Gill *et al.*, 1994; Lamourex and Koning, 1998; Twaha and Turk, 2003, Tefera, 2002).

Treatment 18 (0.00%) and 19 (0.00%) have strongly inhibiting germination percentage and rate pelargonium seeds. The reason of this effects is that allelochemicals inhibit the cell division in the embriyonic meristems of the seeds (Agbagwa *et al.*, 2003). The present findings are in agreement with the results of Kadioglu *et al.* (2005) who studied the effects of *Solanum nigrum* L. and *Chenopodium album* L. extract on chickpea seed germination. The results suggest that allelochemicals is selectivity among target species and efficacy differences depend upon allelochemical source .

As a results, to increase pelargonium seed germination percentage and rate , extract of *P. terebinthus* chloroform 1000 ppm and *P. terebinthus* ethanol 1000 ppm can be recommended. Further works has been done to asses the effect of allelochemicals on seed germination, growth and blooming of ornamental plants experimentally.

REFERENCES

Agbagwa, I.O., F.A. Onofeghara and S.I. Mensah, 2003. Stimulation of growth and development of *Celosia argentea* L. By Crude extracts of *Sena alata* (L.) Roxb. J. Applied Sci. Environ. Manage., 7 : 9-13.

Al-Humaida, I. and M.O.A Warrag, 1998. Allelopathic effects of mesquite (*Prosopis juliflora*) foliage on seed germination and seedling growth of bermudagrass (*Cynodon dactylon*). J. Arid Environ., 38: 237-243.

Gill, L.S., G.O. Agnoliefo and U.V. Iduoze, 1994. Allelopathic effects of aquous extract from siam weed on the growth of cowpea. Third International Workshop on Biological Control Abd Management of *C. odorata.*

Kadıoglu, I., 2004. Effects of Hearleaf Cocklebur (*Xanthium strumarium* L.) extract on some crops and weeds. Asian J. Plant Sci., 3: 696-700.

Kadıoglu, I., Y. Yanar and U. Asav, 2005. Alleopathic effects of weeds extracts against seed germination of some plants. J. Environ. Biol., 26: 169-173.

Kobayashi, K., 2004. Factors affecting phytotoxic activity of allelochemicals in soil. Weed Biol. Manage., 4: 1-7.

Kocaçalışkan, I. and I. Terzi, 2001. Allelopathic effects of walnut leaf extracts and juglone on seed germination and seedling growth. J. Hortic. Sci. Biotechnol., 76: 436-440.

Lamourex, S. and R. Koning, 1998. The allelopathic potential of Apiacea seeds upon germination of lettuce. BBB (Biological Honor Society) Northeast district 1 convention at Workcaster.

Leather, G.L. and F.A. Einhellig, 1986. Bioassays in the Study of Allelopathy. In: Putnam, A.R., C.S. Tang, (Eds.), The Science of Allelopathy. Wiley, New York, pp: 317.

Rice, E.L., 1984. Allelopathy. 2nd Edn., Academic Press, New York, USA.

Smith, A.E., 1991. Allelopathy as a factor in the pasture ecosystem. The Georgia Agriculture Experimental Stations, the University of Georgia, Resaerch Bulletin, pp: 399.

Tefera, T., 2002. Allelopathic effects of *Parthenianum hystophorus* extracts on seed germination and seedling growth of *Erogristis tef.* J. Agron. Crop Sci., 188: 306-310.

Twaha, A.M. and M.A. Turk, 2003. Allelopathics effects of Black Mustard (*Brassica nigra*) on germination and growth of Wild Barley (*Hordeum spontaneum*). J. Agron. Crop Sci., 189: 5-298.

Vandermast, D.B., Van D.H. Lear and B.D. Clinton, 2002. American chesnut as on allelopaths in the southern Appaliachians. Forest Ecol. Manage., 165: 173-181.