The effects of Eucalyptus, Matthiola and Salvia on seed germination and growth of some crops.

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Abstract:

Effects of volatile compounds, water extracts and dried plant branches of Eucalyptus rostrata (Family Myrtaceae), Matthiola incana (Family Brassicaceae) and Salvia splendens (Family Lamiaceae) were tested for seed germination and growth of clover (Trifolium repens), tomato (Lycopersicon esculentum) and wheat (Triticum aestivum).

Volatile compounds, of the three species, did not affect seed germination. Growth in length of radicle of clover, tomato and wheat affected by volatile compounds from S. splendens.

Water extracts and dried plant branches of E. rostrata, M. incana and S. splendens showed a remarkable effects on seed germination and plant growth of clover, tomato and wheat.

Introduction:

The effects of one plant or microorganism on another has been termed Allelopathy (1,2). The effects of volatile compounds of ground - ivy plants (Glechoma hederacea) on seed germination and growth of downy brome (Bromus tectorum) and radish (Raphanus sativus) was studied by Rice(3). Water extracts of whole plant residues of 90 weed and crop species were tested for root and shoot growth of purple top turnip (Brassica olearacea). Extracts of six species significantly stimulated root growth of turnip, and exftracts of 18 species significantly retarded root growth (3). Chopped alfalfa (Medicago sativa) added to soil stimulated the growth of tomato (Lycopersicon esculentum) cucumber (Cucumis sativus) lettuce (Lactuca sativa) several other plants. Residues from water extacts of weed and crop, species have given variable results(3). Water extracts and dried leaves of Nicotiana glauca were tested for thier effects on seeds germination and plant growth of clover, tomato and wheat (4).

The aim of the present study is to investigate the effects of volatile compounds, water exftracts and dried plant branches of Salvia splendens (Family Lamiaceae), Matthiola incana (Family Brassicaceae), and Eucalyptus rostrata (Family Myrtaceae) on seed germination and growth of clover (Trifolium repens) (Family Fabaceae) , tomato (Lycopersicon esculentum) (Family Solnaceae) and wheat (Triticum aestivum) (Family Poceae).

Materials and Methods

Effects of volatile compounds:

One hundred seeds of each of clover, tomato and wheat, were placed on filter papers, on a 9 cm. petri dishes, each with 10 seeds, saturated with 10 ml of distilled water. A beaker, with 2 g of fresh branches (leaves, flowers and fruits) of E. rostrata, M.incana and S. splendens, was placed in each test chamber. An empty beaker was placed in each control chamber before sealing. The chambers were then placed in an incubator at 25°c. The germination percentage was measured after 5 days, and the growth in length of radicles was measured after 10 days.

Effects of water extracts.

One hundred seeds of clover, tomato, and wheat were planted in pots (9 cm. in diam.) containing 400g of sandy loam soil , each with 10 seeds.One hundred ml of water extracts prepared as previously reported (4), was added at different concentrations (test), and 100 ml of distilled water (control) was added to the pots. The pots were placed in a growth chamber on a 18 hr. daylight (2000 lux) at 25°c. The pots were watered with 50 ml of the extracxs (test) or with 50 ml of distilled water (control) every three days. Germination percentage was measured after 7 days, shoot growth (oven - dry weight)

of the test plants and control were measured after 14 days.

Effects of dried plant branches on test plants.

The seeds of clover, tomato and wheat planted in pots (9 cm. in diam.) containing 5 g. of air-dried plant materials (leaves, flowers . and fruits), of E. rostrata, M. incana and S. splendens, per kilogram of sandy loam soil (test) , or 5 g of cellulose per kg of soil in the control pots. Growth conditions, seed germination percentage and shoot growth (oven - dry weight) were the same as for the above experiments.
All experimens were repeated twice.

Results and Discussion

Volatile compounds from E. rostrata, M. incana and S. splendens did not significantly affect seed germination of the tested plants, clover, tomato and wheat (Table 1).
Volatile compounds from E. rostrata and M. incana did not significantly affect growth of radicle of Clover , tomato or wheat (Table 2). However, volatile compunds of S. splendens significantly inhibited growth of radicle of tomato and wheat. On the other hand, volatila compounds of S. splendens has a significant stimulatory effects on growth of radicle of clover.
Water extracts of the plant branches, and dried materials of E. rostrata, M. incana and S. splendens decreased significantly seed germination of clover, tomato and wheat (Table 3).
Water extracts, of the three species, had a remarkable inhibitory effects on shoot growth of tomato and wheat. Water extracts of E. rostrata and M. incana had a significant inhibitory effects on shoot growth of clover. On the other hand, water extracts at low concentraction (25%) of S. splendens had a remarkable stimulatory effects on shoot growth of clover, while at high concentarations 50 and 100 % became inbibitory (Table 4).
Apart of the stimulatory effects of the dried materials of S. splendens on shoot growth of clover, all other treatments had a significant inbibitory effects on shoot growth compared to the control (there were no significant differences between the two controls, distilled water, and with and without cellulose).
In the present study, although the three species E. rostrata, M. incana and S. splendens given a variable effects, the evidence indicantes that S. splendens is strongly anllelopathic to the tested plants. Plants of S. splendens has a distinctive odor, as do many species of the mint family, (Lamiaceae). Rice (3) has shown that volatile compounds of the species Glochoma hederacea (Family Lamiaceae) , did not significantly affect seed germination or growth of radicle of either downy brome or radish, but the decayed leaves of G. hederacea decreased slightly the number of seeds of both downy brome and radish that germinated in all experiments; and had a remarkable stimulation effect on root and shoot growth of both species.
In the present study, water extracts of the plant branches, and dried leaves and flowers had avemarkable allelopathic effects on the tested plants, indicates that the leachates of the plants could have significant effects in the field. Putnam and Tang(5) stated that chemicals with allelopathic potential are present in all plant tissues, including leaves, flowers fruits, stems, roots, rhizomes and seeds. Whether these compounds are released into the environment in sufficiest quantities and with enough persistence to effect a neighboring or a succeeding plant, is regulated by environmental factors, such as water, potential, temperature, light intensity, soil moisture, nutrients, soil microorganisms and others (2,6). It must be stressed that allelopathy is caused by allelochemicals, which are plant metabolites or their product present in the microenvironment .Recently Al-Atabee and Wahbi (4) have reported that water extract or dried leaves of Nicotiana glauca significantly stimulate the growth of clover, and inhibits the growth of tomato. Compounds affecting other plants either directly by reducing cell division and for interacting with hormones, enzymes and mitochondrial functions, or indirectly by affecting certain microorganisms (7). In the present study, compounds affecting other plants needs to be identified.

References:

1- Molisch, H. 1937. Der Einfluses einer pflanze auf aie- allelopathie. Fischer, Jena.
2- Rice, E.L.1984. Allelopathy. 2nd. ed. Academic press. Orlando.
3- Rice, E.L. 1986.Allelopathic growth stimulation. In: Putnam, A.R. and Tang, C.S.(eds.). The Science of Allelopathy. John Wi-

ley & Sons. N.Y.
4-Al-Atabee, J.S. and Wahbi, R.(1998). Allelapathic potential of Nicotiana glauca R.C.Graham on some crops (submitted).
5-Putnam, A.R. and Tang, C.S. 1986. Allelopathy: state of the science. In: Putnam, A.R. and Tang, C.S. (eds.). The Science of Allelopathy. John Wiley & sans. NY.
6- Chou, C. H. 1983. Allelopathy in agroecosystems in Taiwan. In: Chou, C.H. and Wall.er, G.R. (eds.) Allelochemicals and pheromones. Academia Sinica. Taipei, Taiwan.
7- Einhelling, F.A. 1986. Mechanisms and modes of action of allelochemicals. In: Putnam, A.R. and Tang, C.S.The Science of Allelopathy, John Wiley and Sons. N.Y.

Table 1. Effects of volatile compounds on seed germination.

Test Plants	Seed germination (%)			
	Control	Volatile compounds		
		E.rostrata	M.incana	S.splendens
Clover	94.3a*	95.2a	94.7a	92.8a
Tomato	83.7a	85.1a	83.6a	83.0a
Wheat	97.2a	96.8a	94.6a	98.1a

*Means with same suffix letters within a row are not significantly different using Fisher's Exact Test ($P< 0.05$).

Table 2
Effect of volatile compound on growth in length of radicle.

Test Plants	Radicle length (mm)			
	Control	Volatile compound		
		E.rostrata	M. incana	S.splendens
Clover	23.1a*	24.7a	24.3a	28.4b
Tomato	26.3a	25.7a	26.8a	18.2b
Wheat	35.6a	33.1a	33.6a	24.7b

* Means with different suffix letters within a row are significantly different using Fisher's Exact Test ($P<0.05$).

Table 3:
Effects of water extracts and dried plant materials on seed germianation of clover, tomato and wheat.

Test Plants	seed germination (%)				
	Control	dried materials	Water extracts of E. rostrata (%)		
			25	50	100
Clover	95.3a*	90.2b	88.6b	81.4cd	66.3f
Tomato	84.1a	58.6b	32.2d	19.5f	11.4g
Wheat	98.2a	92.4b	89.5b	67.3d	44.9f

Test Plants	seed germination (%)				
	Control	dried materials	Water extracts of M. incana (%)		
			25	50	100
Clover	95.3a*	89.2b	85.3bc	79.4d	71.8e
Tomato	84.1a	61.8b	43.1c	24.8e	09.5g
Wheat	98.2a	90.6b	88.4b	73.5c	62.2e

Test Plants	seed germination (%)				
	Control	dried materials	Water extracts of S.splendens (%)		
			25	50	100
Clover	95.3a*	88.1b	85.3bc	71.6e	65.2f
Tomato	84.1a	57.2b	42.6c	23.8ef	12.7g
Wheat	98.2a	91.2b	88.6b	76.5c	30.4g

* Means with different suffix letters within a row, for each test plant, are significantly different using Fisher'r Exact Test ($P< 0.05$).

Table 4.
Effects of water extracts and dried plant materials on shoot growth (mg.dry weight).

Test Plants	shoot growth (mg.dry weight)				
	Control	dried materials	Water extracts of E.rostrata (%)		
			25	50	100
Clover	2.3 bc*	1.8 cd	1.8 cd	1.6 de	0.9 f
Tomato	2.8 a	2.2 bc	2..1 bc	1.6 cd	1.1 d
Wheat	8.4 a	7.3 bcd	7.1 cd	5.6 e	3.8 g

Test Plants	shoot growth (mg.dry weight)				
	Control	dried materials	Water extracts of M. incana (%)		
			25	50	100
Clover	2.3 bc*	1.7 cde	1.7 cde	1.5 def	1.1 ef
Tomato	2.8 a	2.1 bc	2.4 ab	1.2 d	0.9 d
Wheat	8.4 a	7.8 ab	7.3 bcd	6.8 d	4.6 e

Test Plants	shoot growth (mg.dry weight)				
	Control	dried materials	Water extracts of S. splendens (%)		
			25	50	100
Clover	2.3 bc*	2.8 cde	3.8 a	1.4 def	1.1 ef
Tomato	2.8 a	2.0 bc	1.8 c	1.1 d	0.8 d
Wheat	8.4 a	7.6 ab	7.4 bcd	4.3 fg	2.4 r

* Means with different suffix letters within a row, for each test plant, are significantly different using Fisher'r Exact Test (P< 0.05).

تاثير نباتات الـ Eucalyptus و Matthiola و Salvia على انبات ونمو بذور نباتات البرسيم والطماطم والقمح .

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الخلاصة :

لقد تم دراسة تأثير المواد المتطايرة من نباتات Eucalyptus rostrata و Matthiola incana و Salvia splendens , وكذلك المستخلص المائي للأغصان المحتوية على الأوراق والأزهار والثمار ، ومسحوق الأفرع الجافة ، على انبات بذور ونمو نباتات البرسيم والطماطم والقمح . أظهرت الدراسة بان المواد المتطايرة من النباتات الثلاث لا تؤثر على انبات بذور البرسيم والطماطم والقمح . غير ان تلك المواد تؤثر على نمو الجذير للنباتات الواقعة تحت الاختبار .

المستخلص المائي ومسحوق الافرع النباتية تؤثر تأثيرا معنويا على انبات بذور ونمو نباتات البرسيم والطماطم والقمح .

كما اظهرت الدراسة بان للمتسخلص المائي او مسحوق الافرع لنبات S.splendens تأثيرا محفزا لنمو نباتات البرسيم في التراكيز الواطئة ومثبطا عند التراكيز العالية.