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Short report

Antifungal activities of the leaves of three *Pistacia* species grown in Turkey

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Abstract

The crude extracts obtained from the leaves of *Pistacia vera*, *Pistacia terebinthus* and *Pistacia lentiscus* were tested for antifungal activities against three pathogenic agricultural fungi, *Phythium ultimum*, *Rhizoctania solani* and *Fusarium sambucinum*. The extracts significantly inhibited the growth of *P. ultimum* and *R. solani*. However, the antifungal activity was not observed against *F. sambucinum*.

Keywords: *Pistacia* species; *Phythium ultimum*; *Rhizoctania solani*; *Fusarium sambucinum*; Antifungal activity

Plant material. *Pistacia vera* (L.), *Pistacia terebinthus* (L.) and *Pistacia lentiscus* (L.) (Anacardiaceae) leaves were collected from the Fethiye region, Turkey in July, 2000. The voucher specimens (No. P-101–103, respectively), have been deposited in the Department of Chemistry, Faculty of Science, Muğla University, Muğla (Turkey).

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

Plant[a]	Solvents			
	Petroleum ether	$CHCl_3$	Ethyl acetate	Ethyl alcohol
Pv	2.68	3.32	3.24	11.32
Pt	4.76	7.12	6.36	12.88
Pl	6.12	9.96	7.04	16.59

[a] Pv, *Pistacia vera*; Pt, *Pistacia terebinthus*; Pl, *Pistacia lentiscus*.

Uses in traditional medicine. The leaves of *P. lentiscus* L. are used in eczema treatment, paralys, diarrhea, throat infections, renal stones, jaundice, asthma, stomach-ache, as astringent, anti-inflammatory, antipyretic, pectoral and stimulant [1]. The fat extracted from *P. terebinthus* fruits is consumed in food and also used as raw material in soap production in some regions of Turkey [2,3]. Epilupeol and epilupeol acetate found in the resin of *Pistacia* species have antiviral activity against some virus in chicken embryo [4]. Bark of *P. lentiscus* has been widely used as a traditional folk medicine against hypertension in some regions of Spain [5]. In addition, the resin of *P. lentiscus* has antioxidant and antimicrobial activities [6,7].

Previously isolated classes of constituents. Flavonoids [8], triterpenoids [9–15], phenolics [16,17] and essential oils [7,18–20].

Tested material. Petroleum ether, chloroform, ethyl acetate and ethyl alcohol extracts individually obtained by three times maceration with 10 ml of solvents of the dried leaves of *P. vera*, *P. terebinthus* and *P. lentiscus* (each one 25 g). Yields are listed in Table 1.

Studied activity. Antifungal-Czapex Dox Agar (CDA) plates were prepared using 9-cm glass Petri dishes containing 20 μl CDA. Five-millimetre diameter discs of the test species were cut from the periphery of less than 1-week-old cultures on PDA plates and placed mycelial surface down on opposite edges of the test plates against the side of dishes. The plates were incubated in the dark at 22 ± 2 °C. After 2 days (*Phythium ultimum* and *Rhizoctania solani*) and 12 days (*Fusarium sambucinum*) of innoculation, extension of hypha towards the central wall was measured from the inner edge of the innoculums discs to the leading edges of colonies at a point nearest the wall. Mean growth measurements were calculated from five replicates of each of the fungal species at 2500- and 5000-ppm doses.

Results. The results of antifungal activity are reported in Table 2.

Table 2
Antifungal activity of the extracts of the leaves of *P. vera* (Pv), *P. terebinthus* (Pt) and *P. lentiscus* (Pl)

Materials	Extract	ppm	*P. ultimum*[#]		*R. solani*[#]		*F. sambucinum*[##]	
			Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)	Growth (mm)	Inhibition (%)
Pv	Petroleum ether	2500	61.8	31.0***	42.0	44.3***	54.0	−106.1***
		5000	90.0	−0.6	38.9	48.4***	34.1	−30.2*
	$CHCl_3$	2500	65.2	27.2**	52.3	30.6**	52.8	−101.5***
		5000	81.0	9.5	44.5	41.0***	36.1	−36.8**
	EtOAc	2500	61.1	31.7***	41.8	44.6***	57.2	−118.3***
		5000	85.5	4.5	47.5	37.0***	33.7	−28.6*
	EtOH	2500	58.8	34.3***	40.7	46.0***	55.7	−112.6***
		5000	75.5	15.6	68.0	9.8	57.2	−118.3***
Pt	Petroleum ether	2500	69.6	22.2**	63.4	15.9	47.9	−82.8***
		5000	75.7	15.4	67.6	10.3	61.1	−133.2***
	$CHCl_3$	2500	71.3	20.3*	70.4	6.6	51.0	−94.7***
		5000	73.3	18.1*	66.9	12.3	58.1	−121.8***
	EtOAc	2500	74.8	16.4	69.1	8.4	56.3	−114.9***
		5000	76.2	14.9	70.0	7.2	54.7	−108.8***
	EtOH	2500	72.0	19.6*	69.9	7.3	56.6	−116.0***
		5000	75.7	15.4	67.8	10.1	58.6	−123.7***
Pl	Petroleum ether	2500	70.6	21.1*	45.8	39.3***	59.9	−128.6***
		5000	68.6	23.4*	41.2	45.1***	70.2	−167.9***
	$CHCl_3$	2500	65.9	26.4*	53.3	29.3**	59.6	−127.5***
		5000	66.8	25.4*	39.8	47.2***	69.3	−164.5***
	EtOAC	2500	74.2	17.1	40.3	46.6***	72.0	−167.2***
		5000	68.8	23.1*	41.9	44.4***	60.3	−130.1***
	EtOH	2500	65.2	27.2**	57.3	24.0*	72.2	−175.6***
		5000	62.6	30.1**	47.4	37.1***	60.7	−131.7***
Control			89.5	–	75.4	–	26.2	–

*Significant at $P<0.05$; **significant at $P<0.01$; ***significant at $P<0.001$.
[#]After 2 days of inoculation; [##]after 12 days of inoculation.

Growth inhibition of the treatment against the control was measured by percentage calculated by the equation $(C-T/C)\times 100$ where C is hyphal extension (mm) of controls and T is hyphal extension (mm) of the crude extracts treated plates; in order to determine whether there is a statistically significant antifungal difference among the antifungal activities of the three types of fungi, one-way variance analysis (ANOVA) was carried out by using SPSS 9.0 software package; the results showed significant difference.

Conclusions. In many cases, petroleum ether, chloroform, ethyl acetate and ethyl alcohol extracts of the leaves of *Pistacia* species inhibited the growth of *P. ultimum* and *R. solani*. The activity for *R. solani* was greater than that of *P. ultimum* in all extracts of *P. vera* and *P. lentiscus.* Especially, the extracts of *P. vera* and *P. lentiscus*

inhibited the growth of *R. solani* between the range of 24 and 48%, but no significant activity in any extracts of *P. terebinthus* against *R. solani* was observed. The highest inhibition effects were found for *P. ultimum* in the 2500-ppm dose of ethyl alcohol extract (34.3%) and *R. solani* in the 5000-ppm dose of petroleum ether extract (48.4%) of *P. vera*. In contrast, all tested extracts significantly increased the growth of *F. sambucinum*, especially for the 2500-ppm dose of ethyl alcohol extract of *P. lentiscus* (−175.6%). In conclusion, the extracts obtained from the leaves of *Pistacia* species generally exhibited the antifungal activity against *R. solani* and *P. ultimum* although there were some exceptions.

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