Toxicity of Essential Oils Vapours to Two-spotted Spider Mite, *Tetranycus Urticae* Koch (Acari: Tetranychidae)

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Abstract
In an experiment conducted vapours of essential oils isolated by hydrodistillation from the leaves of Pistacia lentiscus, P. terebinthus and P. vera were found to be toxic against to the adults of 2 spotted spider mite, Tetranychus urticae (Acari: Tetranychidae). Among these plants species, P. vera is more effective than the other species.

Key words: *Pistacia* spp, *Tetranychus urticae*, Essential oils, Toxicity

Two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is a worldwide pest both in the field and greenhouses. A number of chemicals are used to control this pest. Furthermore, in greenhouses the short harvest schedules of many crops limit the use of highly residual acaricides, particularly during harvest periods. The aim of this investigation is to establish an alternate confidently control for two spotted spider mite in greenhouse and for this the affectivity of essential oils to control to spotted mite was studied in greenhouse. The plant species were *Pistacia lentiscus* L.,*Pistacia terebinthus* L. and *Pistacia vera* L. *P. terebinthus* and *P. vera* are very common in south-eastern Anatolia, while *P. lentiscus* is abundant Aegean and Mediterranean regions in Turkey (1). Fresh leaves of *Pistacia* species were collected at the beginning of summer and dried in a shady place. Chopped leaves of *Pistacia lentiscus, P. terebinthus* and *P.vera* (each one 500 g) were processed through hydrodistillation using a Clevenger type apparatus to isolate the essential oils for 4 hr. The hydrodistillation of *Pistacia lentiscus, P. terebinthus* and *P.vera* gave oils with a yield of 0.15, 0.25 and 0.30% respectively. The yields were based on dry materials and determined over (W/W). The oils were dried over anhydrous Na_2SO_4 and stored under N_2 in a sealed vial until required. The composition of these essential oils was analyzed by on a gas liquid chromatography and gas chromatography-mass speotrometry and reported previously (2).

Tetranychus urticae was obtained from cultures maintained in the Plant Protection Department, Faculty of Agriculture, Atatürk University and was reared on bean, *Phaseolus vulgaris* L. at 25±1 ºC and 65±5% relative humidity and L12:D12.Desiccators with a capacity of 4 liters were used as test cambers. Adults of 2 spotted spider mite on fresh leaves of bean were exposed separately to the essential oil of *P. lentiscus, P. terebinthus* and *P. vera*. A fine brush was used to transfer the test organism onto leaves. In order to maintain the tugor of leaves their petioles were dipped through a hole made in a rubber cap fitted to 15 ml capacity glass vials filled with tap water.One replicate consisted of 30 *T. urticae* placed on 1 leaf. For each dose and exposure time combination, 3 replicates were used and experiment was repeated twice. Tests were carried out under the rearing condition. The essential oils were applied with an automatic pipette on a blotting paper strip (6 cm X 3 cm) attached to the underside of the desiccators' lid. Initial tests were done to establish appropriate dose and exposure time ranges. The amount of essential oils applied was 4, 8, 16, 32 µl in each desiccators, corresponding to 1, 2, 4, 8 µl/l air. No material was applied the control desiccators. Exposure period was 12, 24, and 48 hr.

After exposure, leaves with 2 spotted spider mites were removed from the desiccators. Final mortality was determined 2 days later. If the 2 spotted spider mites did not move when prodded with a fine brush, they were considered to be dead. Phytotoxicity of essential oils to greenhouse vegetables was determined by exposing bean at highest dose (8 µl/l) and longest exposure period (48 hr) used in the tests. Five plants (2 and 3 leaves) of 10-14 cm height were placed separately in desiccators. No material was applied in control desiccators. To assess the insecticidal activities, one-way variance analysis (LSD and DUNCAN) was carried out by using SPSS 9.0 software package. The results are presented in (Fig. 1, 2, 3). The essential oils obtained from the leaves of *P. lentiscus, P. terebinthus*, and *P. vera* tested were toxic to 2 spotted spider mite (Table 1). Mortality, in general, increased with the increase in dose of essential oil and the exposure period.

All essential oils caused 100% mortality at or below the maximum dose or exposure period used. Among these, obtained from *P. vera* is more effective as compared with *P. lentiscus, P. terebinthus* in all dose and all time.

Table 1 Toxicity of essential oils vapours to *Tetranychus urticae* adults.

	Mortality (%) Exposure periods (hr)								
Dose,µl/l air	12	24	48	12	24	48	12	24	48
	Pistacia lentiscus			*Pistacia terebintus*			*Pistacia vera*		
1	4.2	56.3	78.7	5.2	55.2	81.7	12.3	67.2	90.3
2	43.3	68.7	91.3	44.2	64.7	93.3	54.2	81.5	98.3
4	56.7	62.4	92.5	61.7	74.3	98.3	72.2	94.4	100.0
8	76.7	89.3	100.0	72.3	91.1	100.0	96.1	100.0	100.0
Control	0.0	0.2	1.4	0.0	0.3	1.8	0.1	0.5	2.4

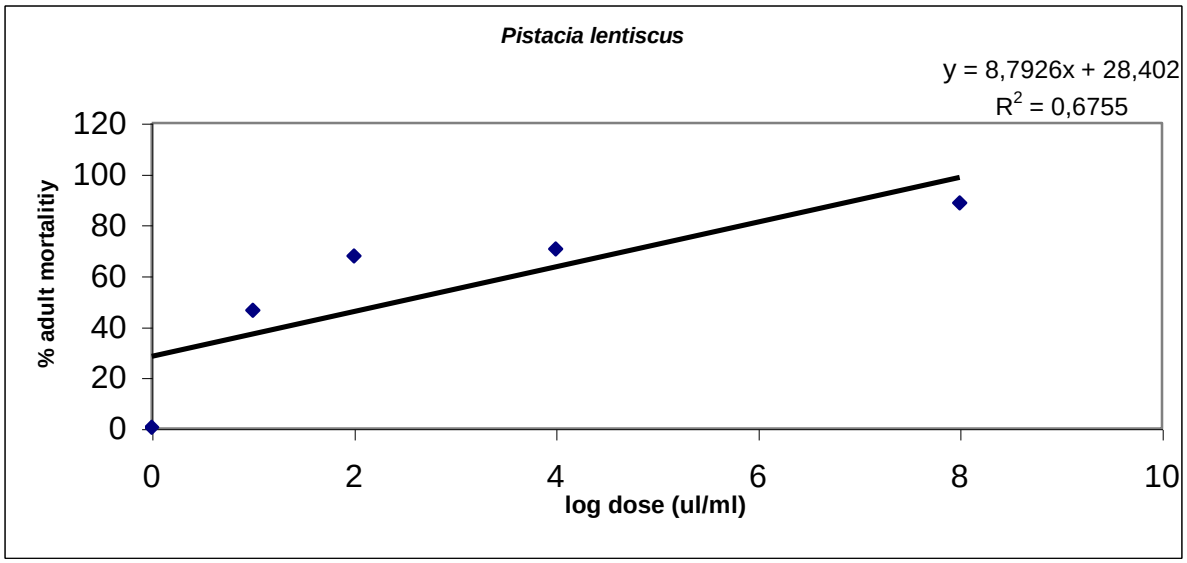

Fig 1 Regression of dose-response for *P. lentiscus* oil on the mortality of *Tetranychus urticae* adults

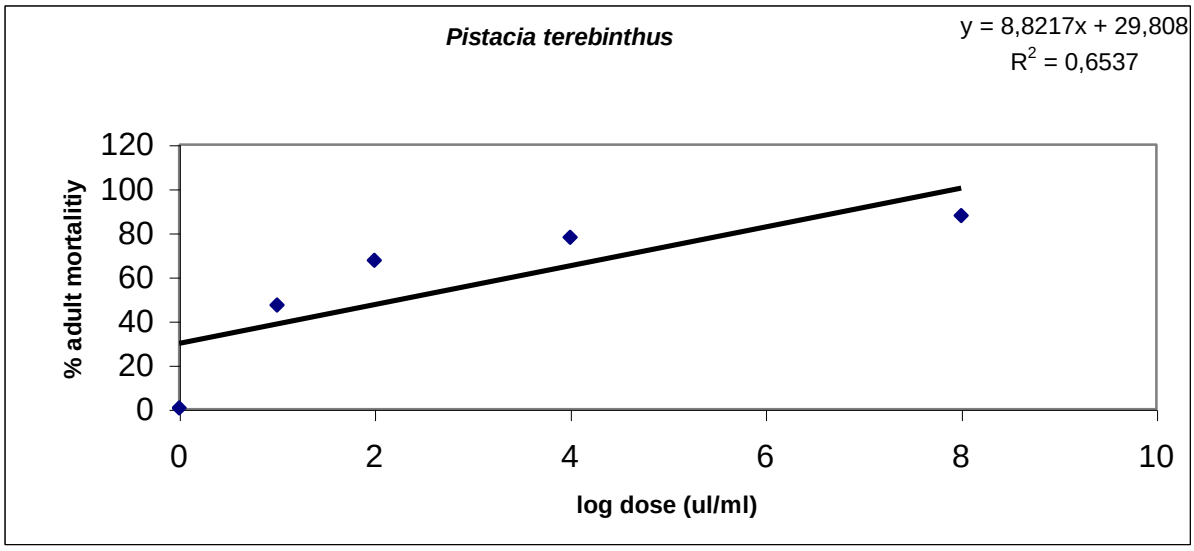

Fig 2 Regression of dose-response for *P.terebinthus* oil on the mortality of *Tetranychus urticae* adults

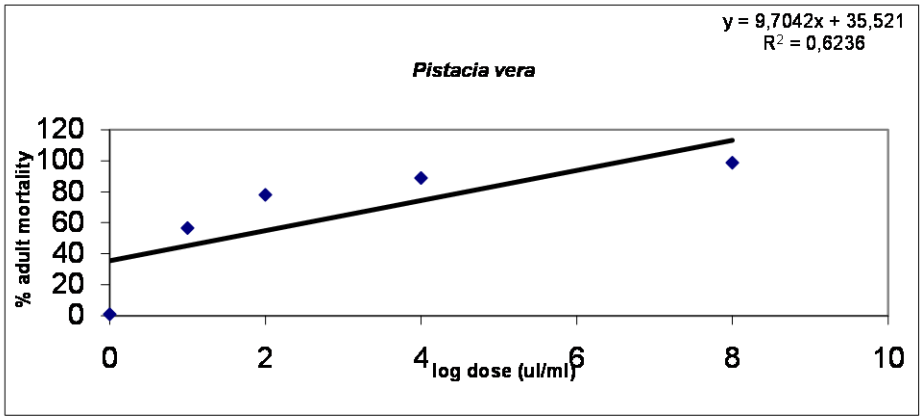

Fig 3 Regression of dose-response for *P. vera* oil on the mortality of *Tetranychus urticae* adults

Phytotoxicity of essential oils that we tested to study to bean was no toxic. Any difference in appearance was no watch for compared to treated plants with healthy plants. Obtained 100% mortality by vapours of essential oils of anise, cumin and oregano against the spider mite (3), *Tetranychus cinnabarinus* and aphids, *Aphis gossypi* females in exposure periods of 96 hr and at 2 µl/l air dose. Obtained 100% mortality by vapours of essential oils of anise and eucalyptus against the rose-grain aphid, *Metopolophium dirhodum* in 31.4 µl/l air dose and 93 hr (4). The composition of the leaves of *P. lentiscus*, *P. terebinthus* and *P. vera* growing in Turkey have been previously reported (2). They were chracterized the high content of monoterpene hydrocarbons and oxygenated monoterpenes. Terpinen-4-ol, □-terpineol, □-pinene and limonene were found as major components in the essential oils of these *Pistacia* spp. As can be seen from Table 1, the essential oil obtained from *Pistacia* spp. efficiently killed adult stages of *T. urticae* and have acaricides effect. Among these three species essential oil obtained from *P. vera* is more effective as compared with *P. lentiscus* and *P. terebinthus*.

In acaricidal activity was increased with increasing amount of doses in all essential oils. Previously, the investigation on the essential oils of *Pistacia* spp. with different origins shown mainly contained α- pinene, ß-pinene, limonene, myrcene, sabinene, terpinen-4-ol and α- terpineol (5,6,7). Likewise, these essential oils were also characterized to be rich in monoterpene hydrocarbons and oxygenated monoterpenes (7). On the other hand, pointed out that besides the toxicity, the residues of essential oils of some Labiatae species repelled and strongly reduced the fecundity of *T. cinnabarinus* females (8). In conclusion, the oils extracted from *Pistacia* spp. have potential as acaricide in the control of *T. urticae*. As a result, the acaricidal activity of the essential oils obtained from three *Pisracia* species is the mite, likely due to their major constituents. The toxicities of which were previously evaluated (3).

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