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Effects of different rootstocks on physical traits of Siirt and Ohadi pistachio cultivars

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Abstract. Rootstocks are a very important part of pistachio cultivars because of their different effects on yield. There are different purposes for the use of rootstocks. Generally, they are used for diseases and pests control, besides of getting good quality and more yield, and for the uptake more nutrients from the soil. Because of the different vigor levels of the rootstocks, they have influence on the growth and development of the scions. In this experiment, the effects of three different pistachio rootstocks (*P. vera*, *P. khinjuk* and *P. atlantica*) on shell dehiscence, filling and empty fruits of two different cultivars (Siirt and Ohadi) were investigated. According to the results, rootstocks were effective on shell dehiscence and empty fruit and total filled nuts. The effectiveness of rootstocks was different depending on the traits.

Keywords. Pistachio – Siirt – Ohadi – Rootstocks – Physical traits.

Effet de différents porte-greffes sur les caractères physiques des cultivars de pistachier Siirt et Ohadi

Résumé. *Les porte-greffes sont une part très importante des cultivars de pistachier étant donné leurs différents effets sur la production. L'utilisation de porte-greffes répond à différentes finalités. En général, ils sont employés pour lutter contre les maladies et ravageurs, outre le fait d'obtenir une meilleure qualité et une plus forte production, et d'absorber plus de nutriments du sol. En raison du niveau différent de vigueur des porte-greffes, ils sont effectifs sur la croissance et le développement des greffons. Dans cette expérience, on a étudié les effets de trois porte-greffes différents de pistachier (*P. vera*,* P. khinjuk *et* P. atlantica*) sur la déhiscence de la coque, le remplissage du fruit et les fruits vides chez deux cultivars différents (Siirt et Ohadi). Selon les résultats obtenus, les porte-greffes étaient effectifs sur la déhiscence de la coque, les fruits vides et les fruits pleins totaux. L'effectivité des portegreffes dépendait des caractères mesurés.*

Mots-clés. *Pistachier – Siirt – Ohadi – Porte-greffe – Caractères physiques.*

I – Introduction

Choosing the rootstock is one of the most important decisions in orchard development. Rootstock are used for fruit trees for many purposes, such as: resistance to pest and disease, drought, salinity, growth and development, alternate bearing, yield and quality, splitting, empty fruits, flowering, early splitting, uses of elements, etc. In Turkey there are four common *Pistacia* species (*P. vera, P. atlantica, P. khinjuk* and *P. terebinthus*) used as rootstocks. Apart from *P. vera* they are not commonly used as seedling because of their low percentage of seed germination. According to observation, Siirt cultivar seeds have better growth and development than the other cultivars (Ak, 1992).

P. vera seedlings are stronger and more homogenous than the other rootstocks. Budded trees on this rootstock grow slowly during the first year but growth becomes faster in the following years. There is no incompatibility in budding with cultivars of pistachio. In the budded trees the juvenil period lasts long; therefore, the trees bear fruit quite late. In arid zones the trees reach the bearing stage 15 to 20 years after planting. They can withstand drought, high lime content and salinity in the soil but they are sensitive to high soil moisture. The trees of *P. terebinthus* are

grown generally as bushes. The plant has a strong and deep root system. Therefore it can be grown in poor rocky and stony soils. It is a kind of dwarfing rootstock for *P. vera* L., so the trees budded on this rootstock can be easily recognized. *P. terebinthus* is as hardy as *P. vera* but hardier than *P. atlantica.* Therefore it is preferred to *P. atlantica* in cold areas. In Turkey it can be grown successfully at elevations up to 1200 m. *P. terebinthus* is suitable for planting in calcareous soils along the Mediterranean coast. It grows very well in places where the annual precipitation is about 400 to 600 mm (Kaska, 1995; Ak, 2002).

Krueger and Ferguson (1995) run an experiment on the effect of uptake on elements. In this experiment, indicated that PGII and *P. atlantica* were good and average respectively on Zn absorption and that the efficiency of UCBI and *P. integerrima* was less than that of *P. terebinthus*. The highest Cu and Zn absorption efficiency has been observed in UCBI, *P. atlantica* and *P. integerrima*.

Brown *et al.* (1994) studied nutrient elements absorption in *P. atlantica*, *P. integerrima*, PGII, UCBI and *P. terebinthus* rootstocks. B, Cu and P in leaf of Kerman cultivar budded on *P. atlantica* rootstock were higher than in others. But the percentage of Mg absorbed by UCB1, PGII and *P. integerrima* rootstocks was higher than in *P. atlantica* rootstocks. The absorption of Ca in *P. integerrima* rootstocks was higher than in *P. atlantica*. There is no any significant differences between the rootstocks mentioned in Mn and Fe absorption.

Brown (1995) claimed that rootstock significantly influences nutritional status of Kerman pistachio. The trees on *P. atlantica* typically have higher concentrations of Zn, Cu, Mg and B, while trees on PG-II had higher concentrations of Ca, Cu and Mn. PG-I had lower levels of Zn than other rootstocks. Choice of rootstock can significantly influence the occurrence of nutrient deficiencies in Kerman pistachio cultivar.

Tajabadipour *et al.* (2006) reported that early splitting and cracks on pistachio hull are one of the most important factors that lead to contamination by aflatoxins in the orchard. The most important factors that may be affecting early splitting and cracks on pistachio hull are the type of the cultivar and the rootstock. The percentages of early splitted pistachios with either soft and smooth hulls or shriveled and dry hulls were higher in Baneh and *P. atlantica* rootstocks than in Ahli. The percentage of early splitting in Ahli scion was lower than Kalleh-Ghuchi scion. The percentage of cracks on pistachio hull in grafted scions on Ahli rootstock was the lowest, but showed no significant differences with other rootstocks. Kalleh-Ghuchi scion showed the lowest percentage of cracks on pistachio hull.

The aim of this experiment was the determination of the effects of *P. vera*, *P. khinjuk* and *P. atlantica* on shell splitting, total filled nuts rate and empty (blank) nuts of Siirt and Ohadi pistachio cultivars.

II – Materials and methods

The site: This experiment was conducted in Gaziantep, in Turkey. Altitude: 705 m. There is not irrigation.

The rootstocks: *Pistacia vera*, *P. Khinjuk*, *P. atlantica*.

Cultivars: Siirt and Ohadi, 26 years old.

Distances: 4 m × 2 m.

The physical analyses: 100 fruits × 5 replications (each cultivar 500 fruits were analyzed: splitting rate (%), blank nut rate (%), total filled nuts rate (%) were determined.

Experimental design: there are 3 rootstocks × 3 trees × 2 cultivars. Totally 18 trees were used. Statistical analysis of the values were done according to randomized plot design. The obtained average results were compared with "Least Significant Difference (LSD)" 5% (Bek, 1983).

III – Results and discussion

Splitting of pistachio nut depends on cultural practices such as irrigation, fertilization and soil cultivation. But it is a genetical character. Generally it depends on kernel development. Rootstock is also one of the factors affecting splitting rate of pistachio nut (Ak, 2002).

Effects of some pistachio rootstocks on shell splitting rate of Siirt and Ohadi cultivars are given in Tables 1 and 2. According to the obtained data, shell splitting rate of Siirt cultivar (78.28%) is higher than in Ohadi cultivar (47.44%). The shell splitting average of two years was affected by *P. atlantica* in both cultivars (Tables 1 and 2).

Table 1. Effects of some pistachio rootstocks on shell splitting rate of Siirt and Ohadi cultivars (%)

Cultivars	Rootstocks	2001	2002	Average
Siirt†	*P. vera*	81.00 ab	78.68 ab	79.84
	P. khinjuk	76.02 ab	68.93 b	72.48
	P. atlantica	85.34 a	79.66 ab	82.50
	Average	80.79	75.76	78.28
Ohadi††	*P. vera*	30.69 b	52.34 ab	41.52
	P. khinjuk	28.60 b	52.85 ab	40.73
	P. atlantica	60.29 a	59.84 a	60.07
	Average	39.86	55.01	47.44

†LSD(Rootstock) 5%: N.S., LSD(Year) 5%: N.S., LSD(Rootstock x Year) 5%: 15.52.
††LSD(Rootstock) 5%: N.S., LSD(Year) 5%: N.S., LSD(Rootstock x Year) 5%: 27.83.

Table 2. Effects of some pistachio rootstocks on shell splitting rate (%)

Rootstocks	Years		Average
	2001	2002	
Pistacia vera	55.85	65.51	60.68
Pistacia khinjuk	52.31	60.89	56.60
Pistacia atlantica	72.82	69.75	71.29
Average	60.33	65.38	62.86

The effects of some pistachio rootstocks on total filled nuts rate of Siirt and Ohadi cultivars are shown in Tables 3 and 4. According to data, total filled nut rate highest value (88.22%) was obtained from Siirt cultivar, as Ohadi was 57.83% in 2001. Average of total filled nut was better in Siirt (84.70%) than in Ohadi (64.81%). Ohadi cultivar's value was lower than Siirt, however similar results were obtained I the case of *P. atlantica* rootstock.

The effect of the different rootstocks on total filled nuts rates changed from one year to another year (Table 4). The two years average for *P. atlantica* was better than for the other two rootstocks and the first year's value (82.97%) was higher than the second year's.

Table 3. Effects of some pistachio rootstocks on total filled nuts rate of Siirt and Ohadi cultivars (%)

Cultivars	Rootstocks	2001	2002	Average
Siirt†	*P. vera*	89.40 a	82.62 ab	86.01 ab
	P. khinjuk	82.09 ab	76.71 b	79.40 b
	P. atlantica	93.17 a	84.22 ab	88.69 a
	Average	88.22 a	81.18 b	84.70
Ohadi††	*P. vera*	60.10 ab	70.74 a	65.42
	P. khinjuk	40.61 b	69.02 ab	54.81
	P. atlantica	72.77 a	75.58 a	74.18
	Average	57.83	71.78	64.81

†LSD(Rootstock) 5%: 8.17, LSD(Year) 5%: 6.67, LSD(Rootstock x Year) 5%: 11.55.
††LSD(Rootstock) 5%: N.S., LSD(Year) 5%: N.S., LSD(Rootstock x Year) 5%: 29.74.

Table 4. Effects of some pistachio rootstocks on total filled nuts rate (%)

Rootstocks	Years		Average
	2001	2002	
Pistacia vera	74.75	76.68	75.72
Pistacia khinjuk	61.35	72.87	67.11
Pistacia atlantica	82.97	79.90	81.44
Average	73.02	76.48	74.75

Although blank nut formation is a varietal character, it is extensively affected by climate, efficiency of pollination, fertilization, irrigation and rootstocks. Blank nuts found in the Turkish cultivars are due to inefficient pollination and lack of irrigation.

Insufficient pollination conditions of the orchards are mainly responsible for high blank nut percentages. Beside this, vegatative or stimulative parthenocarpy and embryo abortion have also impacts on blank nut formation. The tendency to parthenocarpy and the percentage of abortive embryos can change from one cultivar to another (Caglar *et al.*, 1997).

Crane (1975) claimed that production of blank nuts in the Kerman cultivar result from seed abortion as well as from parthenocarpy. Because of a strong parthenocarpy tendency in that cultivar, fruits that abort their seeds do not abscise. They become blanks, and together with parthenocarpic fruits, constitute, on the average, 26% of the total nuts harvested.

The effect of rootstocks on blank nut rate which is shown in Tables 5 and 6. As it is seen in Table 5, the highest blank nut rate was obtained by Siirt in *P. khinjuk*. The lowest rate was obtained by Siirt cultivar in *P. atlantica*. In Ohadi cultivar blank nut rates were higher than in Siirt. When the rootstocks are considered, the highest value (44.02%) is obtained from *P. khinjuk* (Tables 5 and 6).

Table 5. Effects of some pistachio rootstocks on blank nut rate of Siirt and Ohadi cultivars (%)

Cultivars	Rootstocks	2001	2002	Average
Siirt†	*P. vera*	10.60 b	17.38 ab	13.99 ab
	P. khinjuk	17.91 ab	26.92 a	22.41 a
	P. atlantica	06.83 b	15.78 ab	11.31 b
	Average	11.78	20.03	15.91
Ohadi††	*P. vera*	39.90 ab	29.26 ab	34.58
	P. khinjuk	59.39 a	28.65 b	44.02
	P. atlantica	27.23 b	24.45 b	25.84
	Average	42.17	27.45	34.81

†LSD(Rootstock) 5%: 10.11. LSD(Year) 5%: N.S., LSD(Rootstock x Year) 5%: 14.29.
††LSD(Rootstock) 5%: N.S., LSD(Year) 5%: N.S., LSD(Rootstock x Year) 5%: 30.36.

Table 6. Effects of some pistachio rootstocks on blank nut rate (%)

Rootstocks	Years		Average
	2001	2002	
Pistacia vera	25.25	23.32	24.29
Pistacia khinjuk	38.65	27.78	33.22
Pistacia atlantica	17.03	20.12	18.58
Average	26.98	23.74	25.36

IV – Conclusion

In this research, the effects of three different pistachio rootstocks (*P. vera*, *P. khinjuk* and *P. atlantica*) on shell splitting, total filled nut and empty or blank fruits of two different cultivars (Siirt and Ohadi) were investigated. In shell splitting rate and total filled nuts rate (%), Siirt cultivar was better than Ohadi (Siirt > Ohadi). Among the rootstocks *P. atlantica* was more effective then the other ones (*P. atlantica* > *P. vera* > *P. khinjuk*). Blank or empty nut rates also changed between the cultivars and rootstocks: Siirt < Ohadi and *P. atlantica* (18.58%) < *P. vera* (24.29%) < *P. khinjuk* (33.22%).

According to the results Siirt cultivar is better than Ohadi cultivar in the conditions of the experiment. Among the rootstocks, *P. atlantica* is better then the others. The most negative results were obtained by *P. khinjuk* Desf. This *Pistacia* species is accepted to be a very strong rootstock by comparison to the other *Pistacia* species. Blank nut rate was higher than in the other rootstocks because of its strong features. Generally empty or blank fruits are falling down during June drop period, but this rootstock keeps all the fruits on the branches. Because of this reason, at harvest time blank nut rate is higher than in the other rootstocks.

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