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# Effects of some *Pistacia* spp. pollen on different parts of the pistachio fruits such as hull, shell and kernel

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**Abstract.** Pistachio (*Pistacia vera* L.) trees are dioecious. That means male and female flowers are borne by different trees. Pollination and fecundation are necessary in order to get filled nuts. Pollination is very important to obtain economical yield. Pistachio female flowers may set nuts after they are pollinated with pollen of other *Pistacia* species such as *P. terebinthus*, *P. khinjuk*, *P. atlantica*, etc. besides of *P. vera*. There is plenty of research on the effect of pollen on the fruit quality such as splitting, filling nut, kernel and nut weight, etc. In this experiment, the effects of *P. vera*, *P. atlantica* and *P. terebinthus* pollen on different parts of fruits such as hull, shell and kernel were investigated. Siirt, Ohadi, Bilgen and Vahidi pistachio cultivars were used in the research. According to the results, the pollen source affected hulls and kernels in Siirt cultivar, and it affected all three parts of nuts in Ohadi cultivar; while it affected only kernel part in Vahidi cultivar, it affected both hull and kernel in Bilgen cultivar.

**Keywords.** *Pistacia* – Pollen – Hull – Shell – Kernel – Cultivar.

**Effet du pollen de certaines espèces de *Pistacia* sur différentes parties des pistaches telles que la cosse, la coque et l'amandon**

**Résumé.** Les pistachiers (*Pistacia vera* L.) sont des arbres dioïques. Ceci signifie que les fleurs mâles et femelles se trouvent sur des arbres différents. Afin d'obtenir des fruits pleins, la pollinisation et la fécondation sont nécessaires. La pollinisation est très importante pour obtenir une production rentable. Les fleurs femelles de pistachier peuvent fructifier après leur pollinisation avec du pollen d'autres espèces de *Pistacia* telles que *P. terebinthus*, *P. khinjuk*, *P. atlantica* etc. en plus de *P. vera*. Il existe beaucoup de recherches concernant l'effet du pollen sur la qualité du fruit, par exemple sur les fruits ouverts, le remplissage du fruit, le poids de l'amandon et du fruit, etc. Dans cette expérience, les effets du pollen de *P. vera*, *P. atlantica* et *P. terebinthus* sur différentes parties des fruits comme la cosse, la coque et l'amandon ont été étudiés. Les cultivars de pistachiers Siirt, Ohadi, Bilgen et Vahidi ont été utilisés dans cette recherche. Selon les résultats, la source de pollen affectait les cosses et amandons du cultivar Siirt, et affectait les trois parties du fruit chez le cultivar Ohadi. Tandis que pour Vahidi uniquement l'amandon était affecté, chez le cultivar Bilgen la cosse et l'amandon étaient influencés.

**Mots-clés.** Pistachier – Pollen – Cousse – Coque – Amandon – Cultivar.

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## I – Introduction

Pistachio (*Pistacia vera* L.) trees are dioecious. That means that male and female flowers are borne by different trees. In order to get filled nuts, pollination and fecundation are necessary. Pollination is very important to obtain economical yield. Pistachio female flowers may set nuts after they are pollinated with pollen of other *Pistacia* species such as *P. terebinthus*, *P. khinjuk*, *P. atlantica*, etc., besides of *P. vera*. There are plenty of researches on the effect of pollen on the fruit quality such as splitting, filling nut, kernel and nut weight, etc. (Ak, 2001; 1992).

All of the pollen obtained from male trees of *Pistacia* spp can be used without any problem cytologically (Özbek and Ayfer, 1957). But the pollen should be alive to provide fecundation.

Crane and Iwakiri (1980) reported no differences in fruit size or time of maturity of Kerman pistachio following pollination with pollens from five different sources. They stated that degree of shell dehiscence was related to kernel development rather than the type of pollen.

Riazi and Rahemi (1995) worked on the effects of five different pollens on nut and seed characteristics of three pistachio cultivars. Their results confirmed previous studies showing xenia and metaxenia effects. *P. vera* tended to retard nut development. Effects upon kernel weight and shell dehiscence were greatest when *Pistacia mutica* pollen was used, followed by *Pistacia atlantica* pollen. Larger kernel and higher shell splitting resulted from the use of *Pistacia vera* pollen.

Peebles and Hope (1936) claimed that the three characters affected by the different pollens were maturation, and, less definitely, dehiscence and length of pericarp.

Kaska and Ak (1996) reported that *Pistacia vera* pollen was found more effective to produce higher percentages of split nuts than the pollen of the *P. terebinthus* and *P. atlantica*.

In this experiment, the effects of *P. vera*, *P. atlantica* and *P. terebinthus* pollen on different parts of fruits such as hull, shell and kernel were investigated. Siirt, Ohadi, Bilgen and Vahidi pistachio cultivars were used in the experiment.

## **II – Materials and methods**

This work was carried out in the pistachio orchards of Ceylanpinar State Farm (TIGEM) and in the laboratories of the Department of Horticulture. The tree grows rainfed conditions.

### **1. Pollen sources**

Pollinations were performed with the pollen collected from the selected male trees *Pistacia vera* L. *Pistacia atlantica* Desf. and *Pistacia terebinthus* L.

### **2. Pollen collection**

The branches carrying staminate clusters were collected from male *Pistacia* spp. trees mentioned above, just prior to pollen shedding time and pollens put into glass vials. They were kept in deep freezer (-18 °C) until used.

### **3. Artificial application**

The selected female trees used in the research belong to Siirt, Ohadi, Bilgen and Vahidi pistachio cultivars. Four branches on each at the 4 directions and 3 female flower clusters on each branch were chosen and they were bagged. In addition to bagged female flower, clusters some clusters were marked and left on the tree for natural open pollination. The pollen were not mixed with any carrier and they were sprayed by means of a hand duster. When the nuts of the adjacent trees in the same plot with the experimental trees were ready to harvest, that is when their exocarp could be easily dehulled (Ayfer, 1964; Crane, 1978), nuts of the artificially pollinated clusters were harvested. The harvested fruits were sun dried and kept in the laboratory until they were subjected to physical analysis. Of course the nuts of different treatments were separately collected at harvest.

### **4. Fruit evaluation**

After harvesting and sun dried, nuts were kept in laboratory. They were kept in oven at 35 °C in case may take humidity before to start analysis. Fruits were weighted (g) and measured with hull, shell and kernel (Fig. 1). The data were converted to percentage. The measurements of

fruits were done 5 replications, each replication containing 20 fruits. Statistical analysis of the values were done according to randomized plot design. The obtained average results compared with Least Significant Difference (LSD) at 5% (Bek, 1983).



Fig.1. Different parts of nut. From left to right: Whole fruit, shell, hull and kernel.

### III – Results and discussion

The results obtained are given in the tables below. According to this experiment, The pollen source affected hulls and kernels in Siirt cultivar (Table 1). Rates between hull and total weight changed between 17.02% and 21.62%. Shell rate changed from 41.52% to 46.07%. Kernel rate changed between 34.86% and 38.73%. In average, hull rate was 19.16%, shell rate was 43.84% and kernel rate was 37.00% (Table 1).

Table 1. Effects of some pollen sources on different parts of Siirt pistachio cultivar nuts

Pollen sources	100 nut weight	Hull		Shell		Kernel	
		Weight (g)	Rate (%)	Weight (g)	Rate (%)	Weight (g)	Rate (%)
<i>P. vera</i>	146.8	26.4	17.93ab	68.0	46.07 a	52.4	36.00
<i>P. atlantica</i>	114.8	23.2	20.05ab	47.6	41.52 b	44.0	38.43
<i>P. terebinthus</i>	124.2	21.0	17.02 b	55.0	44.25ab	48.2	38.73
Natural poll.	141.4	30.8	21.62 a	61.8	43.52ab	48.8	34.86
Average	131.8	25.35	19.16	58.1	43.84	48.35	37.00
LSD(5%)	--	--	3.83	--	3.83	--	N.S.

The effect of different pollen sources on the different parts of Ohadi cultivar nuts are given in Table 2. Pollen source affected all the three parts of nuts in Ohadi cultivar.

Table 2. Effects of some pollen sources on different parts of Ohadi pistachio cultivar nuts

Pollen sources	100 nut weight	Hull		Shell		Kernel	
		Weight (g)	Rate (%)	Weight (g)	Rate (%)	Weight (g)	Rate (%)
<i>P. vera</i>	112.0	21.4	19.08 b	43.6	38.95 b	47.0	41.97a
<i>P. atlantica</i>	108.0	23.2	21.47 a	45.4	42.10 a	39.4	36.43b
<i>P. terebinthus</i>	108.4	21.4	19.74ab	41.8	38.55 b	45.2	41.71a
Natural poll.	110.6	22.0	19.89ab	46.8	42.31 a	41.8	37.80b
Average	109.8	22.00	20.05	44.40	40.48	43.35	39.47
LSD(5%)	--	--	2.26	--	2.03	--	3.01

Hull rates were affected by pollen source significantly. The highest value (21.47%) was obtained with *P. atlantica* pollen. Shell rate was also affected by *P. atlantica*. The highest value of kernel weight rate (41.97%) was obtained by *P. vera* pollen application. The average rates were 20.05, 40.48 and 39.47% respectively.

The effect of the pollen sources on different parts of the nuts of Bilgen cultivar is shown in Table 3. Generally pollen affected hull and kernel in Bilgen cultivar according to statistical comparisons. When it is considered by average, hull rate was 17.56%, shell rate was 39.79% and kernel rate was 42.65% in Bilgen cultivar.

**Table 3. Effects of some pollen sources on different parts of Bilgen pistachio cultivar nuts**

Pollen sources	100 nut weight	Hull		Shell		Kernel	
		Weight (g)	Rate (%)	Weight (g)	Rate (%)	Weight (g)	Rate (%)
<i>P. vera</i>	153.8	27.8	18.10a	60.8	39.56	65.2	42.34ab
<i>P. atlantica</i>	143.8	22.0	15.08b	57.2	39.94	64.6	44.98 a
<i>P. terebint.</i>	160.8	30.6	19.02a	63.8	39.68	66.4	41.30 b
Natural poll.	155.4	28.0	18.03a	62.2	39.97	65.2	42.00ab
Average	153.5	27.10	17.56	61.00	39.79	65.35	42.65
LSD(5%)	--	--	2.85	--	N.S.	--	3.38

Effects of pollen sources on different parts of Vahidi pistachio cultivar nuts are given in Table 4. According to the results only kernel rate was affected by pollen source in Vahidi cultivar. The highest rate value (17.12%) was obtained by natural pollination. The hull rate changed between 11.45% and 17.12% in this cultivar.

**Table 4. Effects of some pollen sources on different parts of Vahidi pistachio cultivar nuts**

Pollen sources	100 nut weight	Hull		Shell		Kernel	
		Weight (g)	Rate (%)	Weight (g)	Rate (%)	Weight (g)	Rate (%)
<i>P. vera</i>	179.4	27.2	15.14a	80.4	44.85	71.8	40.01
<i>P. atlantica</i>	166.6	19.2	11.45b	77.8	46.65	69.6	41.90
<i>P. terebinthus</i>	173.8	27.4	15.77a	76.8	44.17	69.6	40.06
Natural poll.	191.0	32.8	17.12a	83.2	43.66	75.0	39.22
Average	177.7	26.65	14.87	79.55	44.83	71.50	40.30
LSD(5%)	--	--	3.40	--	N.S.	--	N.S.

The different parts rates of the different cultivars nuts are gathered in Table 5. The lowest (14.87%) hull rate belonged to Vahidi cultivar. The lowest shell rate belonged to Bilgen cultivar while the highest (42.65%) kernel belonged to Bilgen cultivar. The average percentages of hull, shell and kernel over nut weight were determined as 17.91, 42.24 and 39.86% respectively.

## IV – Conclusion

To get filled nuts, pistachio female trees should be pollinated by suitable male's pollen. Pollen source can be *P. vera* male or the other *Pistacia spp.* All *Pistacia spp.* pollen may pollinate the other species (Ak, 1992; 2001; 2002). The pollen source affected hulls and kernels weight rates in Siirt cultivar, and hull, shell and kernel weight rate in Ohadi cultivar. At the same time. Pollen source affected only in kernel part in Vahidi cultivar, and hull and kernel rates in Bilgen cultivar.

These materials except kernel, can be used for different purposes. The waste materials (60%) have different elements or may be used as organic matter for soil.

**Table 5. Weights and rates of the different parts of nuts of some pistachio cultivars**

Pollen sources	100 nut weight	Hull		Shell		Kernel	
		Weight (g)	Rate (%)	Weight (g)	Rate (%)	Weight (g)	Rate (%)
Siirt	131.8	25.35	19.16	58.10	43.84	48.35	37.00
Ohadi	109.8	22.00	20.05	44.40	40.48	43.35	39.47
Bilgen	153.5	27.10	17.56	61.00	39.79	65.35	42.65
Vahidi	177.7	26.65	14.87	79.55	44.83	71.50	40.30
Average	143.2	25.28	17.91	60.76	42.24	57.14	39.86

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