

## Effect of Some Local Pollinators on Fruit Characteristics of Three Pistachio Cultivars in Aleppo Area

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**Abstract:** A research experiment was conducted throughout 2007/2008 season, at which different *Pistachia* spp. (*P. vera*, 36, 38, 42, 57, *P. atlantica*, *P. palestina*, *P. khinjuk* and open pollination as a control) was used as a source of pollen grains for pistachio cultivars (Ashouri, Olaimi and Batouri) in the pistachio orchard at Arab center farm in Aleppo-Syria. The experiment was consisted of two main factors; male strains and the control, pistachio female cultivars, with a factorial arrangement in (RCBD) replicated four times. Results of the experiment showed that Ashouri cultivar gave the best fruit set, while Batouri gave the best fruit length, width, diameter, thickness, sphericity and smallest blank nuts, whereas *Pistachia khinjuk* was gave the best parameters in all cultivars in compare to other pollinizers (male strains).

**Key words:** pistachio, male strains, fruit dimension, female cultivars.

### INTRODUCTION

Syria is one of the worldwide major pistachio producing countries. The area planted with pistachio in Syria was about 60000 hectare covered by 4.5 million trees <sup>[1]</sup>. Pistachio is deciduous and dioecious tree, which means that male and female flowers are borne at different trees, and the female flowers that produce the nuts contain a single ovule. Pollination is done by wind and therefore, it requires the interspersed of male trees within an orchard for the necessity of effective pollination to get filled nuts <sup>[2]</sup>. In order to get good nut production, there should be sufficient male trees for pollination. And for this reason, male selection should be done for some female cultivars in different countries <sup>[2-4]</sup>. Similar studies were carried out in different regions <sup>[5,6]</sup>. Using different *Pistacia* spp. as a source of pollens for pistachio cultivars resulted in an increase in, stable production <sup>[2]</sup>. Riazi and Rahemi <sup>[7]</sup> worked on the effects of five different pollens on nut and seed characteristics of three pistachio cultivars. Their results obtained, confirmed the previous studies results in showing xenia and metaxenia effects. AK <sup>[8]</sup> studied the effects of *P. vera*, *P. atlantica* and *P. terebinthus* pollens on fruit dimensions and weight. Fruits obtained after pollinated with *P. vera* pollens were better than the other *pistachia* species pollens. Shelling percentage was also affected, at which, Ka-ka and AK <sup>[9]</sup> reported that *P. vera* pollens were found more effective to produce higher percentages of split nuts than pollens of *P. terebinthus* and *P. atlantica*. Riazi *et al* <sup>[10]</sup> reported that, pollens source had no effect on final fruit set and fruit weight. Kardoush and Bakeer <sup>[3]</sup> were worked on the

effect of pistachio male strains on Ashouri fruit characteristics. They found that C. strain of pistachio was the better strain than others on most fruit characteristics, whereas the open pollination gave the higher percentage of fruit set.

The aim of this study was to investigate the effect of different pollen grains source from *Pistachia* spp. on pistachio cultivars and determined the best pollinizer.

### MATERIAL AND METHODS

The experiment was carried out on 3 Local Pistachio cultivars (Ashouri, Olaimi and Batouri) grown in pistachio orchard at Arab center farm in Aleppo-Syria. The experiment layout was composed of 2 main factors (male strains and the control, pistachio female cultivars) at which factorial arrangement was used in a randomized complete block design with four replicates. The factors were pollen grains of four *P. vera* (36, 38, 42 and 57), three wild species (*atlantica*, *Palestina* and *khinjuk* and open pollination as a control) and three commercially grown cultivars (Ashouri, Olaimi and Batouri) which were used as female trees. Eight (8) uniform 25-year-old trees of each cultivar were selected randomly in the field at 18<sup>th</sup> March and considered as treatments. Four (4) shoots from each tree were randomly selected as blocks, and to prevent open pollination, female trees were isolated by using paper bags before blooming <sup>[2]</sup>. Treatments application time was done when the female flowers opened and stigma become receptive in the morning time throughout 26/3-3/4/2008 by using drawing brush. And the treated clusters were covered with paper bags until

7-13/4/2008, while the control treatment (wind pollination) was left uncovered. Harvesting was done on 30/8/- 3/9/2008 when the hulls separates easily from the shell as recommended by Herrera <sup>[11]</sup>.

**Pollen Grains Collection:** The branches of selected male clusters were taken to the laboratory conditions (20° c) before pollens dehisced, and they were put in glass container filled with water. After one night, the pollens had been taken and sowed with brush to different germination media for viability tested. Pollen that shed overnight were sealed in mineral cans and stored at 3°c in the refrigerators until female trees blooming. Pollens germinability were tested in vitro at 25°c according to protocol described by Polito and Luza <sup>[12]</sup> on a medium containing Agar (1%), sucrose(10%) and Boric acid (0.01%). Pollen grains that had more than 80% germinability were used for the experiment.

**Experimental Design:** Factorial arrangements design was used with 2 factors (7male strains,open pollination as control, and 3 cultivars) arranged in 4 replications. The mean separation of treatments were differences between means of different treatments were compared by the least significant difference (LSD) test using MSTAT-C Program at probability value  $p=0.05$ . Therefore a separate analysis of variance was conducted on each female cultivar.

**Measured Parameters:** The following parameters were taken into consideration to evaluate the efficiency of pistachio pollination; fruit set percentage(%) after 15days of pollination(Acar and Sinan.) <sup>[13]</sup>, fruit dimension(mm)using calliper to determine the diameter according to the equation  $D=(LWT)^{1/3}$  were D is the mean diameter, L=length, W=width, T= thiknes, and sphericity by equation  $\emptyset=(D/L)*100$  (Polat *et al.*) <sup>[14]</sup>, blank nut percentage (%) and fruit weight(g).

## RESULTS AND DISCUSSION

There was an interaction effect between pollen source and cultivated pistachio trees indicating that growth and development of pistachio nut is dependent on the source of pollen grains (Tables 1-8).Therefore a separate analysis of variance was conducted on each female cultivars.

**Fruit Set:** Study results about the average fruit set ratio in this experiments, showed that there was a statistical differences among pistachio cultivars,different *Pistacia* spp used as pollinizers and open pollination. When the hybridizations were compared as based on average fruit set , P.atlantica X Ashouri combination

had relatively higher percent of fruit set(79.9%) than other combinations, whereas male42 X Ashouri combination had the lowest percentage. And when P.atlantica pollen grains used, it was resulted in higher mean fruit set(59.4%) than other male strains ,whereas male42 pollens gave the lowest mean fruit set (39.3%) with a significant difference. On the other hand, in comparison of female cultivars, Ashouri and Olaimi, showed a significant difference than Batouri. While Ashouri ranked the first (63.5%) and Batouri exhibited the lowest fruit set (39.7%) (Table 1). Generally, P.atlantica was the best pollinizer for Ashouri and Olaimi cultivars, and Ashouri had the best mean fruit set.This situation may be due to the date of pollination (Ashouri was early flowering then Olaimi and Batouri the later) and genetic characteristic of cultivars and pollinizers, while the control(open pollination) gave high fruit set percentage because the stigma of flowers were exposed to pollen grains for long period, which is similar to the previous suggestions by Iisfendiyaroglugluglu *et al.*, <sup>[2]</sup>.

**Fruit Weight:** Fruit weights (Table 2) were arranged between 1.3 and 2.4. The largest fruit weight was obtained in the combination between P.khinjuk X Batouri (2.4g), with significant differences than other combinations, whereas male42X Ashouri combination exhibited the lowest fruit weight (1.3g). While P. khinjuk gave the largest fruit weight (2g) with a significant differences than the other male strains, whereas P.palestina gave the lowest (1.5g). Batouri had the highest significant fruit weight than the other two cultivars (2.1g) and Olaimi showed a significant difference than Ashouri, whereas Ashouri was the lowest (1.5g). The effect of various males on pistachio cultivars were differ due to genetic characteristic of cultivars and pollinizers <sup>[15]</sup>.Also heavy fruit load and higher percentage of blank nut resulted in small fruit weight in Ashouri cultivar.

**Blank Nuts:** The percentage of blank nuts (Table 3) showed significant differences according to pollinizers and cultivars (Table3). OlaimiX male36 and Ashouri X male36 combinations were gave the higher percentages of blank nuts (70.4%,100%respectively) ,whereas the lowest percentage was obtained by AshouriX Control (open pollination)(2.5%) combination . However, the highest mean percentage of blank nuts obtained by male36 (72.9%), while the control (open pollination) gave the lowest blank nuts percentage (35%). The higher mean percentage of blank nuts was obtained by Ashouri cultivar (50.9 %) in comparing to other cultivars, whereas Batouri had the lowest mean

**Table 1:** Effect of pollen sources on fruit set percentage (%) of three pistachio cultivars in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	63.5	54.2	39.1	52.3
P.atlantica	79.9	64.6	33.7	59.4
P.khinjuk	74	48	44.5	55.5
male 36	76.2	57.1	35.5	56.3
male 38	45.8	56.3	42	48
male 42	33.4	47.3	37.1	39.3
male 57	62.2	67	41	56.7
Control	73.1	61.2	44.6	59
Mean	63.5	56.9	39.7	53.4
LSD	female	9.45		
	male	15.43		
	femaleX male	26.73		

**Table 2:** Effect of pollen sources on fruit weight (g) of three pistachio cultivars at 2007-2008

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	1.3	1.3	1.9	1.5
P.atlantica	1.4	1.8	1.9	1.7
P.khinjuk	1.6	2	2.4	2
male 36	1.6	1.9	2.3	1.9
male 38	1.7	1.6	1.5	1.6
male 42	1.3	1.6	2.4	1.8
male 57	1.4	1.8	2.2	1.8
Control	1.4	1.4	1.9	1.6
Mean	1.5	1.7	2.1	1.7
LSD	female	0.1439		
	male	0.235		
	femaleX male	0.4071		

**Table 3:** Effect of pollen sources on blank nut percentage(%)of three pistachio cultivars in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	66.1	37.2	35	46.1
P.atlantica	60.7	36.8	43.7	47.1
P.khinjuk	60	30.3	43.7	44.7
male 36	100	70.4	48.4	72.9
male 38	60	34.6	50.3	48.3
male 42	14.8	63.1	33.3	37.1
male 57	43	32.1	37.1	37.4
Control	2.5	70.1	32.3	35
Mean	50.9	46.8	40.5	46.1
LSD	female	11.33		
	male	18.51		
	femaleX male	32.05		

percentage of blank nuts (40.5%). High percentages of blank nuts indicate ineffectiveness of pollination process due to weather conditions and genetic characteristic of pistachio cultivars and pollinizers [10]. Percentage of blank nuts was the highest in the combination between the cultivar Ashouri and male36, which indicate incompatibility of pollination between the two strains.

**Fruit Dimension:** The combination of P.khinjuk X Batouri exhibited the largest fruit length, width, thickness, diameter and sphericity (27.5, 16, 16, 23.5 and 85% respectively), whereas Control X Ashouri combination gave the lowest (24, 13.5, 16 and 66.4%) except fruit thickness which had the lowest under control conditions .On the other hand male42 X Batouri combination gave the largest thickness(17.8) , where P.palestina XAshouri had the lowest(13.8 ). The highest parameters (length, width, thiknes, diameter and sphericity) were obtained from Batouri cultivar (26.2, 15.7, 15.8, 21.3 and 81.3% ,respectively), whereas

Ashouri cultivar in all parameters except fruit length and Olaimi cultivar was the lowest. P.khinjuk male strain was exhibited the highest fruit parameters (26.1, 15.3, 15.3, 20.7 and 79% for length, width, thickness, diameter and sphericity, respectively), whereas the control (open pollination) had the lowest 24.3, 14.3, 14.5, 16.7 and 68.9% for length, width, thickness, diameter and sphericity, respectively) (Tables 4-8). These results were due to genetic characteristic of cultivars and pollinizers.

**Conclusion:** Ashouri cultivar and P.atlantica male gave the higher percentage of fruit set ,while Batouri cultivar and P.khinjuk male were gave higher fruit weight, length, width, thickness, diameter and sphericity. On the other hand, Batouri cultivar and control (open pollination) gave the lowest blank nuts, which can be used in pollination to ensure high fruit characteristic and quality.

**Table 4:** Effect of pollen sources on fruit length (mm) of three pistachio cultivars in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	25.3	24.5	26.3	25.4
P.atlantica	25.3	24.5	26	25.3
P.khinjuk	25.5	25.3	27.5	26.1
male 36	24.3	24.8	25.3	24.8
male 38	24.5	25.3	26.5	25.4
male 42	25	25.8	26.8	25.9
male 57	25.8	24.3	26.8	25.6
Control	24	24.8	24	24.3
Mean	25	24.9	26.2	25.4
LSD	female	0.591		
	male	0.965		
	femaleX male	1.671		

**Table 5:** Effect of pollen sources on fruit width (mm) of three pistachio cultivars in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	14.8	14.3	15.8	15
P.atlantica	14.8	14.5	15.8	15
P.khinjuk	15	15	16	15.3
male 36	14.8	15.3	15.5	15.2
male 38	14.5	15	15.8	15.1
male 42	14.8	15.3	15.8	15.3

**Table 5:** Continue

male 57	14.8	14.8	16	15.2
Control	13.5	14.5	14.8	14.3
Mean	14.6	14.8	15.7	15.
LSD	female	0.2646		
	male	0.432		
	femaleX male	0.7483		

**Table 6:** Effect of pollen sources on fruit thickness (mm) of three pistachio cultivars in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	13.8	15.5	15.8	15
P.atlantica	15	14.3	15.8	15
P.khinjuk	15	15	16	15.3
male 36	15	15.5	15.5	15.3
male 38	14.3	15.3	15.8	15.1
male 42	14.8	15.5	17.8	15.3
male 57	15	15.3	16	15.4
Control	14.8	14.8	14	14.5
Mean	14.7	15.2	15.8	15.1
LSD	female	0.2457		
	male	0.4013		
	femaleX male	0.695		

**Table 7:** Effect of pollen sources on fruit diameter (mm) of three pistachio cultivars flowers in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	17.1	18.1	21.8	19
P.atlantica	18.7	16.9	21.6	19.1
P.khinjuk	19.1	19.5	23.5	20.7
male 36	17.9	19.5	20.3	19.2
male 38	16.9	19.2	21.9	19.3
male 42	18.2	20.3	22.1	20.2
male 57	19	18.3	22.8	20
Control	16	17.7	16.5	16.7
Mean	17.9	18.7	21.3	19.3
LSD	female	0.72		
	male	1.176		
	femaleX male	2.037		

**Table 8:** Effect of pollen sources on fruit sphericity(%) number of three pistachio cultivars flowers in 2007-2008 season.

Female / Male	Ashouri	Olaimi	Batouri	Mean
P.palestina	67.7	73.7	82.7	74.7
P.atlantica	73.9	68.9	82.8	75.2
P.khinjuk	74.6	77.	85.3	79
male 36	73.6	78.8	80.2	77.5
male 38	68.8	75.9	82.6	75.8
male 42	72.6	78.8	82.6	78
male 57	73.6	75.1	85.2	78
Control	66.4	71.5	68.8	68.9
Mean	71.4	75	81.3	75.9
LSD	female	1.75		
	male	2.857		
	femaleX male	4.949		

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