



**IN THE NAME OF ALLAH,
MOST GRACIOUS, MOST MERCIFUL**

Effect of Some Local Pollinators on Fruit Set Percentage and Fruit Characteristics of Three Pistachio Cultivars in Aleppo, Syria

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Abstract. The experiment was conducted during 2008 grown season, in the pistachio orchard at Arab center farm in Aleppo, Syria. The purpose of the study was to investigate the effect of different pollen grains sources from *Pistachia* spp. on fruit set and fruit characteristics of Ashouri, Olaimi and Batouri pistachio cultivars. Pollinators used as a source pollen grains: *P. vera* (36, 38, 42 and 57 male strains), *P. atlantica*, *P. palestina*, *P. khinjuk* and open pollination as a control. The obtained results revealed that Ashouri cultivar gave the best fruit set compared with Olaimi and Batouri cultivars. *P. atlantica* pollinator was the best pollinizer for Ashouri and Olaimi cultivars, while, *P. khinjuk* pollinator and open pollination had the best fruit set for Batouri cultivar. Batouri cv. with *P. khinjuk* pollinator gave higher fruit weight, length, diameter and sphericity. On the other hand, open pollination (control) gave the lowest blank nuts.

Introduction

Syria is one of the worldwide major pistachio producing countries. The area planted with pistachio in Syria is about 60,000 hectar covered by 4.5 million trees (S.G. of Agri., 2007). Pistachio is deciduous and dioecious tree, which means that male and female flowers are born 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 (Iisfendiyarogluglugu *et al.*, 2001). 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 (Iisfendiyarogluglugu *et al.*, 2001; Kardoush and Bakeer, 2007; Ozeker *et al.*, 2005). Similar studies were carried out in different regions (Atli *et al.*, 1995; Ak *et al.*, 2001). Using different *Pistachia* spp. as a source of pollens for pistachio cultivars resulted in an increase in stable production (Iisfendiyarogluglugu *et al.*, 2001). Riazi and Rahemi (1995) worked on the effects of five different pollens on nut and seed characteristics of

three pistachio cultivars. Their results obtained and confirmed the results of the previous studies in showing xenia and metaxenia effects. Ak (2001) 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, Kaka and Ak (1996) 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.*, (1996) reported that, pollens source had no effect on final fruit set and fruit weight. Kardoush and Bakeer (2007) worked on the effect of pistachio male strains on Ashouri fruit characteristics. They found that male 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 fruit set and fruit characteristics for three pistachio cultivars and to determine the best pollinators.

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 two main factors 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 male strains), 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 a female trees. Eight uniform 25-year-old trees of each cultivar were selected randomly in the field on 18 March and considered as treatments. Four shoots from each tree were randomly selected as blocks, and to prevent open pollination, female trees were isolated by using paper bags before blooming (Iisfendiyaro-glugluglu *et al.*, 2001). Treatments application time was done when the female flowers opened and the stigma became receptive in the morning time throughout 26/3-3/4/2008 by using drawing brush. 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 were separated easily from the shell as recommended by Herrera (1997).

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 a 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 was sealed in mineral cans and stored at 3°C in the refrigerators until female trees bloomed. Pollens germinability were tested in vitro at 25°C according to a protocol described by Polito and Luza (1998) 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 two factors (7 male 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 $p \geq 0.05$. 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 15 days of pollination (Acar and Sinan, 2007), fruit dimension (mm) using calliper to determine the diameter according to the equation $D = (LWT)^{1/3}$ where D is the mean diameter, L=length, W=width, T=thickness, and sphericity by equation $\phi = (D/L) \times 100$ (Polat *et al.*, 2007), 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 and 2). Therefore, a separate analysis of variance was conducted on each female cultivars.

Fruit set

Results about the average fruit set in these experiments showed that there were statistical differences among pistachio cultivars, different *Pistachia* 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 male 42 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 strain, whereas male 42 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 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 Iisfendiyarogluglu *et al.*, (2001).

Table 1. Effect of pollen source on fruit characteristics of pistachio cultivars in 2008 season

pollinators/cultivars	fruit set %				fruit weight (g)			
	Ashouri	Olaimi	Batouri	Mean	Ashouri	Olaimi	Batouri	Mean
P.palestina	63.5	54.2	39.1	52.3	1.3	1.3	1.9	1.5
P.atlantica	79.9	64.6	33.7	59.4	1.4	1.8	1.9	1.7
P.khinjuk	74	48	44.5	55.5	1.6	2	2.4	2
male 36	76.2	57.1	35.5	56.3	1.6	1.9	2.3	1.9
male 38	45.8	56.3	42	48	1.7	1.6	1.5	1.6
male 42	33.4	47.3	37.1	39.3	1.3	1.6	2.4	1.8
male 57	62.2	67	41	56.7	1.4	1.8	2.2	1.8
Control	73.1	61.2	44.6	59	1.4	1.4	1.9	1.6
Mean	63.5	56.9	39.7	53.4	1.5	1.7	2.1	1.7
LSD$\geq$0.05	cv.	9.45				0.1439		
	Pol.	15.43				0.235		
	Pol. $\times$ cv.	26.73				0.4071		
pollinators/cultivars	blank nut %				fruit length (mm)			
	Ashouri	Olaimi	Batouri	Mean	Ashouri	Olaimi	Batouri	Mean
P.palestina	66.1	37.2	35	46.1	25.3	24.5	26.3	25.4
P.atlantica	60.7	36.8	43.7	47.1	25.3	24.5	26	25.3
P.khinjuk	60	30.3	43.7	44.7	25.5	25.3	27.5	26.1
male 36	100	70.4	48.4	72.9	24.3	24.8	25.3	24.8
male 38	60	34.6	50.3	48.3	24.5	25.3	26.5	25.4
male 42	14.8	63.1	33.3	37.1	25	25.8	26.8	25.9
male 57	43	32.1	37.1	37.4	25.8	24.3	26.8	25.6
Control	2.5	70.1	32.3	35	24	24.8	24	24.3
Mean	50.9	46.8	40.5	46.1	25	24.9	26.2	25.4
LSD$\geq$0.05	cultivars	11.33			0.591			
	pollinators	18.51			0.965			
	pollinators $\times$ cultivars	32.05			1.671			

Fruit weight

Fruit weights (Table 1) were arranged between 1.3 and 2.4. The largest fruit weight was obtained in the combination between *P. khinjuk* X Batouri (2.4 g), with significant differences than other combinations, whereas male 42 X Ashouri combination exhibited the lowest fruit weight (1.3 g). While *P. khinjuk* gave the largest fruit weight (2 g) with a significant differences than the other male strains, *P.palestina* gave the lowest (1.5 g). Batouri had the highest significant fruit weight than the other two cultivars (2.1 g), and Olaimi showed a significant difference than Ashouri, whereas Ashouri was the lowest (1.5 g). The effect of various males on pistachio cultivars was different due to genetic characteristic of cultivars and pollinizers (Abu-Zahra and Al-Abbadi, 2007). Also, heavy fruit load and higher percentage of blank nut resulted in small fruit weight in Ashouri cultivar.

The percentage of blank nuts (Table 2) showed significant differences according to pollinizers and cultivars (Table 2). Olaimi X pollinator 36 and Ashouri X pollinator 36 combinations gave the highest percentages of blank nuts (70.4%, 100%

respectively), whereas the lowest percentage was obtained by Ashouri X Control (open pollination) (2.5%) combination. However, the highest pollinator percentage of blank nuts obtained by pollinator 36 (72.9%), while the control (open pollination) gave the lowest blank nuts percentage (35%). The higher percentage of blank nuts was obtained by Ashouri cultivar (50.9%) in comparing to other cultivars, whereas Batouri had the lowest percentage of blank nuts (40.5%). High percentages of blank nuts indicated ineffectiveness of pollination process due to weather conditions and genetic characteristic of pistachio cultivars and pollinizers (Riazi *et al.*, 1996). Percentage of blank nuts was the highest in the combination between the cultivar Ashouri and male 36, which indicate incompatibility of pollination between the two strains.

Fruit dimension

The combination of *P. khinjuk* X Batouri exhibited the largest fruit length, width, diameter and sphericity (27.5, 16, 23.5 and 85%, respectively), whereas control X Ashouri combination gave the lowest (24, 13.5, 16 and 66.4%). Fruit thickness had

Table 2. Effect of pollen source on fruit dimation of pistachio cultivars in 2008 season

Pollinators/cultivars	Fruit width(mm)				Fruit thikness (mm)			
	Ashouri	Olaimi	Batouri	Mean	Ashouri	Olaimi	Batouri	Mean
<i>P.palestina</i>	14.8	14.3	15.8	15	13.8	15.5	15.8	15
<i>P.atlantica</i>	14.8	14.5	15.8	15	15	14.3	15.8	15
<i>P.khinjuk</i>	15	15	16	15.3	15	15	16	15.3
male 36	14.8	15.3	15.5	15.2	15	15.5	15.5	15.3
male 38	14.5	15	15.8	15.1	14.3	15.3	15.8	15.1
male 42	14.8	15.3	15.8	15.3	14.8	15.5	17.8	15.3
male 57	14.8	14.8	16	15.2	15	15.3	16	15.4
Control	13.5	14.5	14.8	14.3	14.8	14.8	14	14.5
Mean	14.6	14.8	15.7	15.	14.7	15.2	15.8	15.1
LSD$\geq$0.05	cv.	0.2646			0.2457			
	Pol.	0.432			0.4013			
	Pol. $\times$ cv.	0.7483			0.695			
Pollinators/cultivars	Fruit diameter(mm)				Fruit sphericity (%)			
	Ashouri	Olaimi	Batouri	Mean	Ashouri	Olaimi	Batouri	Mean
<i>P. palestina</i>	17.1	18.1	21.8	19	67.7	73.7	82.7	74.7
<i>P. atlantica</i>	18.7	16.9	21.6	19.1	73.9	68.9	82.8	75.2
<i>P. khinjuk</i>	19.1	19.5	23.5	20.7	74.6	77.	85.3	79
Male 36	17.9	19.5	20.3	19.2	73.6	78.8	80.2	77.5
Male 38	16.9	19.2	21.9	19.3	68.8	75.9	82.6	75.8
Male 42	18.2	20.3	22.1	20.2	72.6	78.8	82.6	78
Male 57	19	18.3	22.8	20	73.6	75.1	85.2	78
Control	16	17.7	16.5	16.7	66.4	71.5	68.8	68.9
Mean	17.9	18.7	21.3	19.3	71.4	75	81.3	75.9
LSD$\geq$0.05	cultivars	0.72			1.75			
	pollinators	1.176			2.857			
	pollinators $\times$ cultivars	2.037			4.949			

the lowest under control conditions. On the other hand, male 42 X Batouri combination gave the largest thickness (17.8), where *P. palestina* X Ashouri 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 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 1 and 2). These results were due to the genetic characteristic of cultivars and pollinizers.

Conclusion

Ashouri cultivar and *P. atlantica* pollinator gave

the higher percentage of fruit set, while Batouri cultivar and *P.khinjuk* pollinator gave higher fruit weight, length, width, 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.

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(قدم للنشر في ١٢/٢/١٤٢٨هـ؛ وقبل للنشر في ١١/١٠/١٤٣٠هـ)

: ملفحات محلية، نسبة عقد الثمار، خصائص ثمار الفستق الحلبي.

تم إجراء هذه الدراسة خلال الموسم الزراعي عام ٢٠٠٨م باستخدام بعض سلالات الفستق الحلبي المذكورة (٣٦، و٣٨، و٤٨، و٥٧ إضافة إلى البطم الأطلسي والفلسطيني والكنجوك) كمصادر لحبوب اللقاح لتلقيح أصناف الفستق المؤنثة (عاشوري، عليمي وباتوري)، وذلك في بستان الفستق الحلبي التابع للمركز العربي لدراسة المناطق الجافة والقاحلة في منطقة حلب - سوريا. تتكون التجربة من عاملين الأول يضم الأصناف المؤنثة وعددها ثلاثة، والعامل الثاني مصادر حبوب اللقاح إضافة للتلقيح الحر (المفتوح) كشاهد وبأربع مكررات بتجربة عاملية استخدم فيها تصميم القطاعات العشوائية الكاملة (RCBD)، كما استخدم (LSD) لاختبار الفروق بين المتوسطات. أظهرت نتائج الدراسة أن الصنف عاشوري كان أفضل الأصناف من حيث نسبة العقد بغض النظر عن الملقح، في حين كان الصنف باتوري الأفضل في جميع مواصفات الثمرة المدروسة (الطول، والعرض، والارتفاع، والقطر، ونسبة تكور الثمرة). مع استخدام الملقح بطم الكنجوك هو الأفضل في أغلب الصفات المدروسة.