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PLANT PRODUCTION

Effect of Self and Cross Pollination on Fruit Set, Seed Number, Fruit Quality and Yield of Three Pomegranate Cultivars

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Abstract. The effect of open, self and cross pollination within and between three cultivars of pomegranate, namely: Khob El-Jamil, Taiefe and Al-madina on fruit set, seed number, fruit quality and yield were studied for two consecutive years. Percent of male and perfect flowers varied considerably according to the cultivar. The proportions of male to perfect flowers were 0.12, 0.35 and 0.37 for Khob El-Jamil,Taiefe and Al-madina cvs., respectively. Lowest pollen viability percentage was in Al-madina and the highest pollen viability was in Khob El-Jamil cultivar. Hand self pollination (HSP) in Khob El-Jamil cultivar increased fruit set percentage, followed by hand cross pollination with pollen grains from Taiefe or Al-madina cultivars (HCPT and HCPM). Results of fruit set percentages and seed number per fruit revealed that a partial self incompatibility was existing in Al-madina cultivar. A certain degree of cross incompatibility was found when Al-madina as seed parent was pollinated with Taiefe cultivar. Hand self pollination in Khob El-Jamil and Taiefe cvs. gave higher yield compared to other pollinizers. Application of pollen from Khob El-Jamil to emasculated flowers of Al-madina cultivar significantly affected the weight, volume and size of fruits when compared with pollen of Taiefe cultivar. Also, open pollination (OP) treatment in Khob El-Jamil cultivar significantly decreased peel thickness and juice volume compared to hand self pollination. Cross pollination in Taiefe cv. with pollen from Khob El-Jamil increased TSS, acidity and anthocyanin content of peel and pulp.

Introduction

The pomegranate (*Punica granatum* L) is a native of Iran and extensively cultivated in Saudi Arabia and other countries [1]. Total acreage has increased rapidly during the past 20 years. Bacha *et al.*[2] stated that due to the expansion in the pomegranate crop industry, much attention should be drawn to improve yield, quality and induce new hybrids .

Little information is available about the common feature of pollination in local pomegranate varieties. Karale *et al.* [3] reported that fruit set characteristics of the pomegranate cultivars were significantly affected by the method of pollination and

concluded that the pomegranate, which is normally thought of as a cross- pollination crop, is capable of both open and self- pollination and the hermaphrodite flowers have a higher fruit set than the intermediate type flowers. On the other hand, Grossa [4] examined the factors affecting the efficiency of pollination in fruit trees, the choice of pollinizer cultivar in the case of self- incompatible cultivars, the ability of the honey bees to carry the pollen from one tree to the next, the growth of the pollen on the stigma and the provision of honey bees.

Vidal and Paolog [5] reported that the high percentages of staminate flowers as a result of pistil abortion was a main factor in keeping yields very low in most pomegranate cultivars. Thus, cross- pollination using pollen from other compatible cultivars is the way to give larger and more uniform crops. They found that, fruit set and fruit drop, particularly at the pre-harvest stage, is a serious problem as a result of which production is adversely affected and pollination is important in the production of fruit crops because of its direct relation to fruit set. Many investigators studied the effect of cross pollination in different fruit species [4; 6-9]. They all concluded that cross pollination increased fruit set, decreased fruit drop and increased the yield.

However, observations in Saudi Arabia showed that the yield and fruit quality of some pomegranate cultivars were much less when planted alone than when grown with other pomegranate cultivars. So, determining the pollination requirements and compatibility phenomena among these cultivars were the aim of the present study. Also, it is an attempt to induce superior individual through production segregation in the population of F1 seedlings for improving yield and quality of pomegranate cultivars (unpublished data).

Materials and Methods

This study was carried out in 1995 and 1996 seasons on mature trees grown at the Experimental Station, College of Agriculture, King Saud University in Dierab. Seventeen-year old uniform trees of Khob El-Jamil, Taiefe and Al-madina cultivars growing in a mixed planting were used as seed (female) and pollen (male) parents. Five vigorous trees of each of the three cultivars were selected for the study. The trees were subjected to the normal cultural practices performed in this orchard.

A survey of perfect and staminate flowers in the three pomegranate cultivars was carried out in mid April for two seasons to determine the percent of the perfect flowers. Samples of flowers (75 to 100 flowers) were taken at random from each tree and brought to the laboratory where the counts were made. The percentage of perfect and staminate flowers of each tree was recorded. The flowers were classified, as perfect, which actually set and staminate flowers which is non-functional. The two types of flowers occur mixed in the same tree. The proportions of perfect to male flowers were calculated according to the description by Karale *et al.* [3].

Viability of fresh pollen grains was determined by the acetocarmine technique described by Roberts' [10]. The length and diameter of pollen grains were measured using an ocular micrometer. Shape index of viable pollen was calculated as length to diameter ratio.

Pollination treatments for each seed parent included five replications. The treatments were: Open pollination (OP), hand self-pollination (HSP), and hand cross pollination with pollen of the other cultivars (HCP). All pollination treatments were applied at random to four different branches of each tree on 15 April in two seasons (about 400 flowers). Only two or three pomegranate blossoms per shoot were emasculated in the balloon stage before the petals unfold and the remaining flowers were removed. Pollen grains were collected from the flowers of the three cultivars, one day before pollination and kept in $CaCl_2$ desiccator. Pistils of emasculated flowers were pollinated as soon as stigmas were receptive with camels hairbrush [11]. All flowers included in this study were bagged in muslin bags except open pollination treatment.

Seed number per fruit, weight of 100 seeds (fresh and dry) in all pollination treatments were measured for the three cultivars. When fruits from controlled hybridization were ready for harvest, each combination was harvested separately, physical and chemical properties of fruits were determined according to A.O.A.C. [12]. Fruit length and diameter were determined by a vernier caliper. Total soluble solids(TSS) was determined by Abbe refractometer. Acidity was determined by titration with standard NaOH using phenolphthalene as an indicator. Anthocyanin content was determined using 70% ethyl alcohol. Data collected for each cultivar in the two seasons were analyzed as complete randomized blocks as advised by Steel and Torrie [13].

Results and Discussion

Sex ratio and pollen grain characteristics

The data of Table 1 showed that the percent of male and perfect flowers varied considerably according to the cultivar. Khob El-Jamil cultivar contained a higher percent of male flowers as an average of two seasons, while Al-madina cultivar gave the lowest percentage of male flowers. The number of perfect flowers, which actually set, is very low in Khob El-Jamil cultivar. The proportions of male to perfect flowers were 0.12, 0.35 and 0.37 for Khob El-Jamil, Taiefe and Al-madina cultivars, respectively. Ashari and Gholami [9] reported that the sex ratio of olive trees is influenced by the time of flowering, age, season and cultivar. Also, Vidal and Paolog [5] showed that the high percentages of staminate flowers as a result of pistil abortion in olives was a main factor in keeping yields very low. On the other hand, Karale *et al.* [3] reported that hermaphrodite pomegranate flowers have a higher fruit set than the intermediate type flowers.

Table 1. Flowers and pollen grain characteristics in Khob El-Jamil, Taiefe and Al-madina pomegranate cultivars (average two seasons)

Cultivars	Male flowers (%)	Perfect flowers (%)	Sex ratio	Pollen viability (%)	Length (L) (u)	Diameter (D) (u)	L/D ratio
Khob El-Jamil(K)	89.1a	10.9b	0.12b	96.5a	2.26a	2.17a	1.04a
Taiefe(T)	74.0ab	26.1a	0.35a	93.1ab	2.15b	2.09b	1.03ab
Al-madina(M)	73.1b	27.0a	0.37a	89.5b	2.20ab	2.16ab	1.01b

*Means not sharing the same letter within columns are significantly different (P<0.05) according to Duncan's multiple range test

Pollen viability percentages presented in Table 1 revealed that Al-madina cultivar had the lowest viable pollen percentage and Khob El-Jamil cultivar had the highest percentage. Very high variability in pollen viability was found by Mamedov and Sharma and Gaur [14,15] in pomegranate, while the length, diameter and length to diameter ratio for viable pollen of the three cultivars varied slightly.

Fruit set, fruit drop and yield percentages

Fruit set, fruit drop and yield percentages of the three pomegranate cultivars Khob El-Jamil, Taiefe and Al-madina as indications for the degree of compatibility were studied and illustrated in (Table 2).

In Khob El-Jamil cultivar, data showed that, HSP treatment increased in both seasons fruit set, followed by HCP with Taiefe pollen, HCP with Al-madina pollen and OP treatment. The same trend was found in Taiefe cultivar when used as a seed parent. The data indicate that Khob El-Jamil and Taiefe cultivars are self compatible, but each of them was partially cross incompatible with the two other cultivars when used as pollen parent.

Fruit set was lowest with HSP in Al-madina cultivar. The mean percentages of fruit set in this cultivar were 58.88, 28.69, 69.82 and 32.62 in OP, HSP, HCP with Khob El-Jamil pollen and HCP with Taiefe pollen. These results indicate the existence of a partially self incompatibility in Al-madina cultivar and a cross incompatibility between Al-madina and pollen of Taiefe. Cross incompatibility was not found between Al-madina as seed parent and Khob El-Jamil as pollen parent. Karale *et al.* [3] reported that fruit set percentages of six pomegranate cultivars varied from 26.4 to 79.0 with different pollination treatments. Also, Burgos *et al.* [16] found that controlled cross pollination of apricot gave fruit set that was sufficient to provide a good harvest in all crosses. Moreover, the present data revealed that Al-madina orchards should include additional compatible cultivars as pollinators to increase their production. These data are in line with those obtained in olive trees by Cuevas and Rallo [17].

Table 2. Effect of pollen source on fruit set, fruit drop and yield in Khob El-Jamil, Taiefe and Al-madina Pomegranate cultivars in 1995 and 1996 seasons

Pollination treatments	Fruit set (%)[x]		Fruit drop (%)[y]		yield (%)[z]	
	1995	1996	1995	1996	1995	1996
			KOB EL-JAMIL			
Open Pollination (OP)	33.3b	29.2b	10.0b	15.2ab	26.7ab	25.0ab
Hand Self Pollination (HSP)	80.0a	76.3a	13.3ab	8.2b	36.7a	41.3a
Hand Cross Pollination with Taiefe Pollen(HCPT)	63.3ab	70.3ab	21.1a	32.1a	33.3ab	35.2ab
Hand Cross Pollination with Al madina Pollen(HCPM)	53.3ab	42.1ab	25.0a	28.2ab	23.3b	18.2b
			TAIEFE			
Open Pollination (OP)	27.2b	25.3b	12.5ab	18.1ab	20.0a	18.2b
Hand Self Pollination (HSP)	77.2a	68.3a	0.0b	4.2b	36.7a	42.1a
Hand Cross Pollination with Khob-El Jamil pollen (HCPK)	50.5ab	42.1ab	13.3ab	22.2ab	33.3a	28.6ab
Hand Cross Pollination with Al-madina Pollen(HCPM)	60.1ab	72.8a	50.0a	48.1a	23.3a	21.7ab
			AL-MADINA			
Open Pollination (OP)	66.7a	51.1ab	20.0b	19.2b	36.7a	28.6a
Hand Self Pollination (HSP)	32.7a	24.7b	29.4ab	2.3ab	16.7b	13.1b
Hand Cross Pollination with Khob El-Jamil Pollen (HCPK)	67.3a	72.3a	20.0b	19.3b	16.7b	26.7ab
Hand Cross Pollination with Taiefe Pollen(HCPT)	33.3a	31.9a	40.0a	38.2a	16.7b	15.2ab

*Means not sharing the same letter within columns in each cultivar are significantly different ($P<0.05$) according to Duncan's multiple range test.

X : Fruit set(%) = Number of fruit set X 100/ Number of pollinated flowers

Y : Fruit drop(%) = (Number of fruit set – Number of mature fruits) X 100/ Number of fruit set

Z : Fruit yield(%) = Number of mature fruits X 100/ Number of pollinated flowers

The results revealed that HSP in Khob El-Jamil and Taiefe cultivars gave the lowest fruit drop percentage as compared with other pollination treatments. When pollens from Taiefe cultivar were used to pollinate emasculated flowers of Al-madina cultivar fruit drop percentage was increased. Generally, fruit drop percentages varied according to type of pollen used in the three pomegranate cultivars. Ashari and Gholami [9] found no significant difference in the percentage of fruit abscission of three olive cultivars when different pollen was used. On the other hand, many investigators reported that cross pollination decreased fruit drop percentage such as Chaudhary and Desai and Burgos *et al.* [6,16].

The data of Table 2 also showed that the percent yield varied considerably according to the type of pollen used. HSP treatments gave higher yield in Khob El-Jamil and Taiefe cultivars when used as seed parents compared with other pollinators, while the reverse was true with Al-madina when used as seed parent. It was also found that OP treatment decreased yield in Khob El-Jamil and Taiefe cultivars and increased yield of Al-madina

cultivar. This shows the importance of the presence of Al-madina cv. in a mixed planting with other compatible pomegranate cultivars. Good pollination is essential for increasing yield of many fruit species, and new orchards should contain an adequate number of pollinizer trees [16,18].

Effect of pollinizers on seed number and weight

The highest seed number per fruit (555.4) in Khob El-Jamil was obtained from HSP and the lowest seed number (442.6) was obtained from HCP with Taiefe. Open pollination and HCP with Al-madina gave 498.0 and 468.6 seeds per fruit, respectively. The data concerning number of seeds per fruit in Khob El-Jamil indicate no significant differences between OP, HSP and HCP with Al-madina pollen (Table 3).

Table 3. Effect of pollen source on average seed number per fruit and seeds weight in Khob El-Jamil, Taiefe and Al-madina pomegranate cultivars (average two seasons)

Pollination treatments	Average seed number/ fruit	Weight of 100 seeds(g)	
		fresh	dry
	KHOB EL- JAMIL		
Open Pollination (OP)	498.0ab	25.5ab	2.8ab
Hand Self Pollination (HSP)	555.4a	34.9a	2.5b
Hand Cross Pollination with Taiefe Pollen (HCPT)	442.6b	34.8a	2.6ab
Hand Cross Pollination with Al-madina Pollen (HCPM)	468.6ab	22.3b	3.0a
	TAIEFE		
Open Pollination (OP)	374.4b	30.4ab	2.5b
Hand Self Pollination (HSP)	462.0a	26.8ab	2.8ab
Hand Cross Pollination with Khob El-Jamil Pollen (HCPK)	392.2ab	24.7b	2.6b
Hand Cross Pollination with Al-madina Pollen (HCPM)	366.6b	31.7a	3.1a
	AL -MADINA		
Open Pollination (OP)	403.6b	32.5ab	3.2b
Hand Self Pollination (HSP)	521.2ab	31.0b	4.0a
Hand Cross Pollination with Khob El-JamilPollen (HCPK)	557.8a	36.3a	4.2a
Hand Cross Pollination with Taiefe Pollen (HCPT)	526.0ab	30.0b	3.6ab

*Means not sharing the same letter within columns in each cultivar are significantly different ($P<0.05$) according to Duncan's multiple range test.

In the cultivar Taiefe, HSP gave the highest seed number per fruit (462.0) following by HCP Khob El-Jamil which gave 392.2 seeds per fruit. The open pollination and HCPM treatments were not significantly different from each other in respect to seed number per fruit.

In Al-Madina cultivar, the data in Table 3 indicate that Khob El-Jamil was the best pollinizer and can be recommended for planting with Al-Madina cultivar in the same orchards. Pollen type had in most cases no significant effect on seed number per fruit or weight to 100 seeds. Eti and Stosser and Keulemans [19,20] found that cross-pollination increased seed number as well as seed weight, and the low number of seeds per fruit with open pollination may be due to presence of insufficient pollen on the stigma or pollination with unsuitable cultivars.

Effect of pollinizers on physical fruit properties

Data in Table 4 showed that when Khob El-Jamil cultivars were used as seed parent, weight, volume, length, diameter peel weight, peel thickness and juice volume of fruits were highest with HSP when compared with other pollinizers. HCP with Al-madina pollen gave the lowest values of weight, volume, length and diameter of Khob El-Jamil fruits. Also, pollens of Al-madina and Taiefe cvs. decreased peel weight, peel thickness and juice volume when compared to HSP treatment.

When Taiefe cultivar was used as seed parent, HCP with Al-madina pollen gave the lowest values of weight, volume, shape of fruits and peel thickness, while the reverse was true with HSP treatment. Open pollination treatment decreased peel thickness and juice volume significantly when compared to HSP treatment.

When Al-madina cultivar was used as seed parent, data showed that, pollination with Khob El-Jamil pollen grains significantly increased the weight, volume, length, diameter and shape of fruits when compared with pollination with Taiefe cultivar. The pollination of Al-madina cv. with Taiefe pollens decreased fruit length, diameter and juice volume compared to pollination with Khob El-Jamil pollens. These results clearly indicate that for good fruit production, new established orchards should contain an adequate number of a good pollinizer trees. Similar results were obtained by other investigators [6- 8] who found that fruit characters were strongly affected and varied by type of pollen.

Effect of pollinizers on chemical fruit properties

When Khob El-Jamil cultivar was pollinated with Taiefe pollen TSS, acidity and anthocyanin content in the pulp were increased, but TSS/acid ratio and anthocyanin content in the peel were decreased. Open pollination and HSP treatments improved the color in Khob El-Jamil fruits. Generally, data revealed that pollination Khob El-Jamil with pollens Taiefe or Al-madina cvs. significantly decreased the TSS/acid ratio. Meanwhile, fruit quality of Khob El-Jamil was better when the plants were self-pollinated (Table 5).

Table 4. Effect of pollen source on fruit physical properties of Khob El- Jamil, Taiefe and Al-madina pomegranate cultivars (average two seasons)

Pollination treatments	Fruit weight (g)	Fruit volume (cm^3)	Fruit length(L) (cm)	Fruit Diameter (D) (cm)	Fruit shape (L/D)	Peel weight (g)	Peel Thickness (cm)	Juice volume (cm^3)
				KHOB EL JAMIL				
Open Pollination (OP)	259.4ab	237.0ab	7.60ab	8.96ab	0.85b	85.0ab	0.33b	87.0ab
Hand Self Pollination(HSP)	364.0a	333.0a	8.92a	10.54a	0.85b	120.8a	0.38a	133.0a
Hand Cross Pollination with Taiefe Pollen (HCPT)	219.0b	197.0b	7.68ab	8.76ab	0.88a	71.4b	0.32b	75.0b
Hand Cross Pollination with Al-madina Pollen (HCPM)	199.8b	176.0b	.94b	8.30b	0.84b	88.4ab	0.32b	99.0ab
				TAIEFE				
Open Pollination (OP)	87.4ab	168.0ab	6.40ab	7.44b	0.86a	73.8ab	0.25b	56.0b
Hand Self Pollination(HSP)	197 8a	179.0a	6.84a	8.00ab	0.86a	73.2b	0.31a	99.0a
Hand Cross Pollination with Khob El-Jamil Pollen (HCPK)	188.8ab	171 0ab	6.35b	7.46b	0.85a	76.2a	0.29ab	76.0ab
Hand Cross Pollination with Al-madina Pollen (HCPM)	73.2b	159.0b	6.74ab	8.25a	0.82a	75.8a	0.24b	69.0ab
				AL-MADINA				
Open Pollination (OP)	251.8ab	236.0ab	7.38ab	6.84b	1.08a	69.4b	0.35a	68.0b
Hand Self Pollination(HSP)	266.4ab	43.0ab	.86b	8.28ab	0.83b	66.8b	0.28ab	115.0a
Hand Cross Pollen with Khob-El-Jamil Pollen (HCPK)	372.6a	346 0a	8.54a	9 70a	0.88ab	84 0a	0.25b	110.0ab
Hand Cross Pollination with Taiefe Pollen (HCPT)	203.8b	184.0b	6.68b	7.95ab	0.84b	70.2ab	0.30ab	72.0ab

*Means not sharing the same letter within columns in each cultivar are significantly different ($P<0.05$) according to Duncan's multiple range test.

Data in Table 5, also showed that when Taiefe cv. was used as seed parent, TSS, acidity and anthocyanin content in peel and pulp were high when the flowers were pollinated with Khob El-Jamil pollen. Open pollination treatment reduced TSS, TSS/acid ratio and anthocyanin content in peel and pulp when compared with other pollination treatments.

In Al-madina cultivar, data showed that HSP treatment significantly increased TSS and TSS/acid ratio, but decreased acidity and anthocyanin content in the pulp. Open pollination and HCP with Taiefe pollen increased significantly the anthocyanin in peel and pulp, respectively. Such changes in fruit quality resulting from various pollinizers could be attributed to metaxenic effect. This is in agreement with those obtained by Chaudhary and Desai, Mahanoglu *et al.* and Arafat *et al.* [6- 8].

Table 5. Effect of pollen source on fruit chemical properties of Khob El-Jamil, Taiefe and Al-madina pomegranate cultivars (average two seasons)

Pollination treatments	TSS (%)	Acidity (%)	TSS/acid ratio	Anthocyanin (content)	
				peel	pulp
			KHOB EL-JAMIL		
Open Pollination (OP)	17.28a	1.900a	9.09b	0.320a	0.205ab
Hand Self Pollination(HSP)	17.10ab	0.630b	27.14a	0.320a	0.008b
Hand Cross Pollination with Taiefe Pollen (HCPT)	17.16a	1.986a	8.64b	0.068b	0.296a
Hand Cross Pollination with Al-madina Pollen (HCPM)	16.28b	2.219a	7.34b	0.280a	0.317a
			TAIEFE		
Open Pollination (OP)	14.94c	0.815ab	18.33b	0.129b	0.029b
Hand Self Pollination(HSP)	16.30b	0.590b	27.63a	0.136b	0.046ab
Hand Cross Pollination with Khob-El-Jamil Pollen (HCPK)	17.66a	0.830a	21.28ab	0.180a	0.059a
Hand Cross pollination with Al-madina Pollen (HCPM)	16.36ab	0.647ab	25.29ab	0.134b	0.049ab
			AL- MADINA		
Open Pollination (OP)	17.50b	0.611b	28.64ab	0.491a	0.217b
Hand Self Pollination(HSP)	19.70a	0.602b	32.72a	0.410ab	0.205b
Hand Cross Pollination with Khob-El-Jamil Pollen (HCPK)	18.00ab	0.806a	22.33b	0.430a	0.218b
Hand Cross Pollination with Taiefe Pollen (HCPT)	17.00b	0.643b	26.44ab	0.220b	0.370a

*Means not sharing the same letter within columns in each cultivar are significantly different (P<0.05) according to Duncan's multiple range test.

Conclusion

In view of the above discussed results, controlled pollination can be recommended as a means of increasing the productivity of pomegranate trees especially in Al-madina cultivar, and this would emphasize the importance of mixed plantings with other compatible pomegranate cultivars such as Khob El-Jamil. Also, we suggest that Khob El-Jamil and Taiefe cvs. which seem to be self compatible can be grown in non-mixed plantings and without pollinizer cultivars.

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تأثير التلقيح الذاتي والخلطي على عقد الثمـــار وعدد البذور وجودة الثمار وكمية الإنتاج في ثلاثة أصناف من الرمان

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ملخص البحث. تمت دراسة نوع الأزهار ، وحيوية حبوب اللقاح ، وتأثير التلقيح المفتوح مقارنة بالتلقيح الذاتي والخلطي في ثلاثة أصناف من الرمان هي خب الجميل ، الطائفي والمدينة على عقد الثمار ، وعـدد البـذور ، ومواصفات ونوعية الثمار وكمية المحصول في موسمين متتاليين. وجد أن نسبة الأزهار المذكرة والكاملة تختلف تبعا للصنف.كانت نسبة الأزهار المذكرة إلى الأزهار الكاملة ٠,١٢ ، ٠,٣٥ ، ٠,٣٧ للأصناف خب الجميل ، الطائفي والمدينة ، على التوالي. وكانت النسبة المئوية لحيوية حبوب اللقاح أقل ما يمكن في صنف المدينة بينما كانت أعلى ما يمكن في صنف خب الجميل.أظهرت النتائج أن التلقيح الذاتي اليدوي في صنف خب الجميل أدى إلى زيادة النسبة المئوية لعقد الثمار تليها معاملة التلقيح الخلطي اليدوي باستعمال حبوب لقاح من صنف الطائفي ثم صنف المدينة. تشير نتائج النسبة المئوية لعقد الثمار وعدد البذور في الثمرة إلى عدم وجود توافق ذاتي جزئي في صنف المدينة ، بينما توجد درجة من عدم التوافق الخلطي بين صنف المدينة كأم عند تلقيحها بلقاح صنف الطائفي. أعطى التلقيح الذاتي اليدوي لصنف خب الجميل والطائفي أعلى نسبة مئوية من المحصول مقارنة بباقي الملقحات. وأدت إضافة لقاح خب الجميل إلى الأزهار المخصاة من صنف المدينة إلى حدوث زيادة معنوية في وزن وحجم الثمار مقارنة بمعاملة إضافة لقاح من صنف الطائفي. أيضا قللت معاملة التلقيح المفتوح في صنف خب الجميل معنويا سمك القشرة وحجم العصير عند مقارنتها بالتلقيح الذاتي اليدوي. كما أدى التلقيح الخلطي في صنف الطائفي باستخدام لقاح صنف خب الجميل إلى زيادة النسبة المئوية للمواد الصلبة الذائبة الكلية ، الحموضة ، ومحتوى القشرة واللحم من الأنثوسيانين.