

Compatibility Relationships Within and Between Ten Date Palm Cultivars (*Phoenix dactylifera* L). I- Fruit Set and Yield

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ABSTRACT

This study was conducted to examine the effects of ten pollen sources within or between ten date palm cultivars namely: "Succary", "Barhi", "Nebut Seif", "Seleg", "Khudari", "Menafey", "Saki", "Maktoumy", "Sefry" and "Serey" on the percentages of fruit set, unfertilized flowers, fruit drop, total yield (Kg/bunch), percent of fruits with grade (A), fruit pulp and seed weight as a percent to average fruit weight. Variations in the percentages of fruit set, unfertilized flowers, fruit drop and fruits with grade (A) were found among the ten cultivars according to pollen sources. Data of fruit set percentages showed a degree of cross incompatibility with "Saki" and "Serey" as a pollen sources with "Khudari" as a seed parent. Self incompatibility was also evident in "Khudari" cultivar, however, data showed some evidence of self compatibility that may exist in "Menafy" and "Barhi" cultivars. The variations in fruit set percentages among the ten cultivars might either be due to differences in pollen viability or differences in compatibility barriers. Also, the data showed that pollination of "Succary" flowers with "Maktoumy" and "Nebut Seif" pollens produced the highest total yield per bunch in 1999 and 2000 seasons, respectively. Also, "Barhi" cultivar produced higher total yield (kg/bunch) with "Saki" and "Maktoumy" pollens in the first and second seasons, respectively. As for the percentage of seeds weight, data showed that the "Succary" pollen produced significantly higher percentage of seed weight in most cultivars in the two seasons, while the opposite is true for "Seleg" cultivar in both seasons. Results also showed that "Barhi" as a seed parent produced the lowest percentage of fruits with grade (A) with "Nebut Seif" and "Serey" as a pollen parents in the first season and with "Seleg" and "Saki" in the second season. Moreover, pollination with different pollen sources did not give a clear trend for percent pulp weight in the ten date palm cultivars.

INTRODUCTION

The palm family (Arecaceae) possesses a great diversity of pollination modes. There is a common agreement among date growers that hand pollination of the female flowers produces fruits of superior quality compared with those produced by natural wind pollination (Shukr *et al.*, 1988 and Olesen and Balslev, 1990). The term "metaxenia" was first proposed by Swingle (1928) to label a phenomenon observed in the fruit of the cultivated date palm. He defined metaxenia as a direct effect of pollen from a male clone on the morphology and other characters of seed and fruit tissues surrounding the embryo and endosperm. This may be due to hormones secreted into the surrounding mother tissues from the fertilized embryo and associated endosperm. Thus, the implication is that metaxenia is also genetically, but indirectly (Osman *et al.*, 1974). The date palm (*Phoenix dactylifera* L) is a dioecious sp.; the male (staminate) and female (pistillate) flowers produced on separate palms.

It is well known that the type of pollen grains, used in pollination of date palm cvs. has a great effect on fruit set, fruit drop and total yield. (Hussein, 1970; El-Hammady *et al.*, 1977; El-Sabrou, 1979; Khalifa *et al.*, 1979; El-Ghayaty, 1983; Higazi *et al.*, 1983;

Shaheen *et al.*, 1989; Bacha *et al.*, 2000 and Aly, 2001). Moreover, the existence of partially self or cross incompatibility were reported in some date palm cultivars by Bacha *et al.* (2000) and Aly (2001) who determined the compatibility relationships within or between date palm cultivars.

In Saudi Arabia, (a major date palm producing country) which more than 400 cultivars are grown, among them ten most famous cultivars, produce good quality fruits but suffer of irregular productivity and less fruit setting under hand pollination with mixed pollens (method of pollination in the station). This may be due to unsuitability of pollen type used in pollination. Thus, the purpose of this investigation was to obtain information about the relationships within or between pollen sources and seed parents of ten date palm cultivars with variability of fruit set and drop, weight of pulp and seed and total yield. Also, to determine the degree of incompatibility within and between the ten date palm cultivars through the application of all possible crosses and reciprocal pollinations.

MATERIALS AND METHODS

This study was conducted during 1999 and 2000 seasons in the Experimental Research Station, College of Agriculture, King Saud University in Dierab, Riyadh, Kingdom of Saudi Arabia. The climate was arid and semi-arid (average yearly temperature was 67-106^o F.; average relative humidity 12-76 % and rainfall of 11.4 cm.).

Five trees of uniformity vigor were used as female parents from each of ten date palm cultivars namely; "Succary", "Barhi", "Nebut Seif", "Seleg", "Khudari", "Menafey", "Saki", "Maktourmy", "Sefry" (data recorded only in the second season) and "Serey". One vigorous male tree which was previously selected, evaluated and named to its cultivar by the Plant Production Department, College of Agriculture, King Saud University was used as a pollen source for each (male parent) cultivar. All trees were subjected to the same cultural practices carried out in the experimental research station. Ten spathes were left on each female tree and all unselected spathes and those produced thereafter were removed. The female spathes were immediately covered with paper bags before opening to protect the inflorescence from any unwanted pollen. The flower strands on each spathe were thinned to 60 strands to increase the efficiency of pollination treatments. Pollen grains of each male tree were extracted from the mature spathes on thin layer paper sheets and spreaded for 3-4 days till become dry, then placed in capped plastic vials and stored at 4^o C over crystalline CaCl₂ until pollination time.

In each cultivar, five female trees were used as replicates. One spathe on each replicate was pollinated with one male parent. The pollination treatments in each female cultivar were done using the pollen of the same cultivar and the other nine pollen sources. Pollination treatments were done by hand dusting with 2 gm pollen grains for each spathe. Pollinated spathes were immediately covered with paper bags to protect them from any foreign pollen grains. Protection bags were removed after 30 days from pollination date (a period enough to complete fruit setting).

Three strands from the middle part of spathes were taken immediately, after released from the bags, for counting the number of fruit setting, number of unfertilized flowers and number of both flowers and fruits dropping. The percentages of fruit set, unfertilized flowers and fruit drop were calculated as percentage of the total nodes. At harvest time,

total yield (Kg/bunch) was determined by bunch weight. Fruit samples from different pollination treatments were collected for grading the fruits to first grade (A) according to the shape and size of fruits (large fruits). Percent weight of fruit pulp and seed (as percentage to average fruit weight) were determined. Statistical analysis was done using the Randomized Complete Block Design (RCBD) according to Steel and Torrie (1981).

RESULTS AND DISCUSSION

1- Fruit set percentages:

It was evident from the data in Table (1) that the percentage of fruit set in the ten female cultivars varied according to the pollen source (pollen parent), seed parent and seasons. "Succary" trees as a seed parent, after pollination with "Maktoumy" and "Barhi" pollens gave the highest fruit set percentages in 1999 and 2000 seasons, respectively, while "Khudari" pollens produced the lowest fruit set in the first season and "Maktoumy" in the second season. As for "Barhi" female cultivar, the different pollen sources did not show any statistical differences in fruit set percentages in the first season, while the pollen of "Nebut Seif" statistically decreased the percentage of fruit set as compared with "Maktoumy" pollens in the second season. Also, "Nebut Seif" cv. data of fruit set percentages showed a degree of cross incompatibility with "Seleg" pollens in the first season and with "Maktoumy" in the second (Table 8). As for "Seleg" cultivar, the different pollen sources showed no statistical differences in fruit set percentages in both seasons. Also, it was noticed that, "Seleg" cultivar recorded the highest fruit set with different pollen sources. This data means a high cross compatibility were exist between "Seleg" female parent and all pollen parents used in this experiment (Table 8). In "Khudari" female parent, data revealed that, higher fruit set was achieved by "Nebut seif" pollen in the first season and "Barhi" in the second, while "Saki" and "Serey" produced the lowest in the first season. These data could indicate a degree of cross incompatibility between "Saki" and "Serey" pollen sources with "Khudari" female parent, while a degree of cross compatibility between "Nebut Seif" and "Barhi" pollen sources and "Khudari" female parent was clear (Table 8). As for "Menafy" female parent data showed that, in both seasons, the pollination with "Menafy" pollen produced the higher significant fruit set in the second season and the higher but not significant in the first season. This may indicates that "Menafy" cultivar is a self-compatible cultivar. On the other hand, data in Table (1) showed that "Succary" pollen source gave the highest fruit set percentage with "Saki" female parent in the second season. In "Maktoumy" female cultivar, it was found that "Saki" pollen, generally, increased the fruit set percentages in both seasons (it means cross compatibility), while "Menafy" pollens decreased (it means partial cross incompatibility). Data for "Sefry" cv. in 2000 season showed that "Barhi" pollens gave the highest significant fruit set percentages as compared with "Seleg" and "Menafy" pollens, it means high cross compatibility between "Sefry" and "Barhi" cultivars in one hand, and exist high cross incompatibility between "Sefry" and both of "Seleg" and "Menafy" on the other (Table 8). Also, the fruit set percentage in "Serey" cv. differed with the type of pollen used and the season. The differences in fruit set percentages among the ten cultivars might be due to either differences in pollen viability or differences in compatibility barriers (El-Hammady *et al.*, 1977; El-Ghayaty, 1983; Boughediri and Bounaga, 1987; Rahemi,

1998; Bacha *et al.*, 2000 and Aly, 2001). Also, the intereffect by using pollen cultivar and method of pollination varied with the female cultivar and its characters (Al-Idany, 1988). In general, statistical variation in percent fruit set between the different pollen sources occurred only in one of the two seasons in 6 cultivars, this may be due to the alternate bearing phenomenon and that the variations may be very clear in the off-year.

2- Unfertilized flower percentages:

The influence of different pollen sources on unfertilized flower percentages in the ten cultivars (female parents), is shown in Table (2). In general, the data of the present study revealed that, the higher differences were obtained according to either pollen sources or female parents used. The "Succary" female parent produced the highest unfertilized flower with "Khudari" pollen in 1999 season and with "Saki" pollen in 2000 season. At the same time, pollination of "Succary" flowers with "Maktoumy" and "Barhi or "Seleg" pollens produced the lowest values in the first and second seasons, respectively. As for "Barhi" cv. the pollination with "Menafy" pollen produced the highest percentages of unfertilized flowers in both seasons. In "Nebut Seif" and "Seleg" cultivars, the percentages of unfertilized flowers differed according to pollen sources and seasons. Regarding the percent of unfertilized flowers in "Khudari", "Menafy" and "Saki" female parents, the highest percentages of unfertilized flowers are found in "Menafy" female in comparison with the other two cultivars. Also, "Sefry", "Khudari" and "Barhi" as sources of pollens produced highest unfertilized flower percentage in "Khudari", "Menafy" and "Saki" female parents, respectively. Data on Table (2) also showed that "Nebut Seif" had the highest percent of unfertilized flowers in both seasons. Also, "Saki", "Maktoumy", "Sefry" and "Serey" pollen sources reduced the percent of unfertilized flowers in "Nebut Seif" in both seasons of study. Bacha *et al.* (2000) and Aly (2001) noticed the same trends of these results.

3- Fruit drop percentages:

Concerning the effects of different pollen sources on fruit drop percentages, data in Table (3) revealed that the fruit drop differed in the ten cultivars according to the cultivar, pollen source and the season. In "Succary" and "Barhi" cultivars, the pollination with different pollen sources did not affect significantly fruit drop percentages in the first season, while "Seleg" and "Maktoumy" significantly increased fruit drop percentages of "Succary" in the second season and "Nebut Seif" pollen caused a similar effect on "Barhi" in the same season. In "Nebut Seif" cv. it was noticed that, pollen of "Menafy" male parent produced the lowest fruit drop percentages in both seasons, while "Maktoumy" pollen caused the highest fruit drop in both seasons. Also data showed that in "Khudari" cv., using pollen of the same type ("Khudari") caused statistically high fruit drop percentages. This may be due to unsuitability of pollinating this cultivar with the same pollen due to probably partially self-incompatibility in this cultivar. These findings are in agreement with those obtained by Al-Ghamdi *et al.* (1988); Al-Idany (1988); Bacha *et al.* (2000) and Aly (2001). On the other hand, pollinating "Menafy" cultivar with pollen of "Menafy" produced the lowest fruit drop percentages in both seasons. It was also noticed that the "Seleg" cultivar is the least cultivar that drop the fruits, and so it might be due to the effect of different pollen sources on fruit drop percentages in this cultivar which was not statistically significant in both seasons. The results were similar to Al-Bedah (1996).

4- Total yield (Kg/Bunch):

Data of the present investigation in Table (4) showed the effects of pollen sources on total yield (Kg/bunch) of ten date palm cultivars. It was noticed that pollination of "Succary" flowers with "Maktoumy" and "Nebut Seif" pollens produced the highest total yield per bunch in 1999 and 2000 seasons, respectively. The highest total yield increment was achieved in "Barhi" cv. with "Barhi" and "Saki" pollens in the first season (it means high cross compatibility). In "Nebut Seif" cv. pollination with "Maktoumy" and "Menafy" pollens gave the lowest total yield per bunch in the first and second season, respectively (it means low cross compatibility). The same results were observed by "Menafy" and "Saki" pollens with "Seleg" female cultivar in 1999 and 2000 seasons, respectively. In "Khudari" female cultivar, statistical analysis revealed that the different pollination treatments produced no differences in total yield determined by Kg/bunch in the first season while "Khudari", "Sefery" and "Serey" pollen produced the lowest total yield in the second season and this again in case of "Khudari" pollen may support the assumption of self incompatibility. Also, the data showed that the pollination treatments produced the higher total yield per bunch in the first season compared with the second one. This might be due to the differences in some environmental conditions such as temperature and rainfall or due to the phenomenon of alternate bearing. In "Menafy" female cultivar, data showed that pollination with "Saki" pollen produced the lowest yield per bunch in the second season. In "Saki" female cultivar, the total yield per bunch was the highest, in the first season, when pollinated with "Serey" pollen, while the lowest total yield per bunch was exhibited when pollinated with "Khudari" pollen, however, the second season was not statistically significant. In "Maktoumy" and "Serey" female parents, data showed different trends according to pollen sources and seasons. The above mentioned data revealed that the total yield varied according to seed parents and pollen parents used. These findings are in line with those obtained by El-Sabrou (1979); Higazi *et al.* (1983); Ghalib *et al.* (1987); Al-Idany (1988); Rahemi (1998); Bacha *et al.* (2000) and Aly (2001).

5- Fruit grade:

The effects of pollen sources on fruit grade of the ten cultivars under study were illustrated in Table (5). In general, fruits with grade (A) significantly differed according to type of pollen used, type of female parents and seasons. It was found in "Succary" cultivar that, all pollen sources produced fruits with grade (A) in the first season, while in the second season all used pollinators did not give any fruits with grade (A) except "Maktoumy" pollen. In "Khudari" female cultivar, data revealed that pollination with "Khudari" pollen and cross-pollination with "Seleg" pollen, though not significant, produced the highest first grade fruits in the first and second seasons, respectively. This may be due to the heavy fruit drop noticed in this cultivar, which may be a result of self incompatibility observed with "Khudari". Also, no significant differences in the percentages of fruits grade (A) were found between pollinators used with "Khudari" female cultivar in both seasons. In "Menafy" female cultivar, data showed that pollination with "Barhi" and "Nebut Seif" pollen increased significantly the fruits with grade (A) as compared to other pollinators in the first season, while pollination with "Khudari" and "Menafy" pollens gave the lowest grade (A) fruits in the first and second seasons, respectively. This lower grade of fruits produced by "Menafy" when self pollinated may be due to the high fruit set in both

seasons which was reported earlier in this paper and which indicated the self compatibility in this cultivar. On the other hand, "Saki" female cultivar produced the lowest grade (A) fruit when pollinated with "Menafy" and "Serey" pollens in the first and "Barhi" and "Nebut Seif" in the second season. The same trends were found by Bacha *et al.* (2000) and Aly (2001).

6- Percent of fruit pulp and seed weight/fruit weight:

Data concerning the effect of different pollen sources on percent fruit pulp weight/fruit weight are shown in Table (6). Virtually, it was quit evident that "Seleg" pollens gave the highest percent of fruit pulp weight/fruit weight in "Succary"cultivar in both seasons. Data also, added that the differences in fruit pulp weight in different cultivars were observed with different pollen types (metaxenic effects). It was found in "Khudari" female cultivar that pollination with different pollen types did not significantly affect the percentage of fruit pulp weight in the first season. In "Menafy" female parent, data showed that the pollen types had no effect on the fruit pulp weight and percent of seed weight in the first season. Results concerning the effect of pollen sources on fruit percent pulp weight of "Saki" female cultivar, indicated that no differences were noticed in the first season. These results are in harmony with those obtained by Bacha *et al.* (2000) and Aly (2001).

Data of the two years of study (1999 and 2000) indicated generally that the "Succary" and "Seleg" are the highest percent seed weight/fruit weight (large seeded) compared to the other cultivars (Table 7). The "Succary" pollen, however, increased significantly the percent seed weight of four cultivars in the first season and three cultivars in the second one. This may propably be due to the xenic effect. "Seleg" pollen did not show similar effect. In "Menafy" female parent, data showed that the pollen types had no effect on percent of seed weight in the first season. As for the influence of pollen sources on percent of seed weight, data indicated that no clear trend was found in both seasons. These results are in accordance with those obtained by Hussein (1970); Ream (1976); El-Sabrou (1979); Al-Idany (1988); Rahemi, (1998); Bacha *et al.* (2000) and Aly (2001).

Table 1. The effect of pollen sources on percent fruit set of ten date palm cultivars in 1999 and 2000 seasons.

Cultivar	Succary	Barhi	Nebut Self	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
Pollen sources										
1999										
Succary	34.11 ab	62.38	46.75 a	80.57	41.07 ab	22.90	24.87	27.30 b	--	44.94 abc
Barhi	33.32 ab	59.32	42.53 abc	74.30	38.57 ab	31.67	16.66	34.75 b	--	34.91 abc
Nebut Self	26.59 b	55.94	36.30 bcd	81.83	54.14 a	25.11	20.21	32.32 b	--	39.22 abc
Seleg	36.89 ab	57.15	29.59 d	77.12	39.56 ab	35.11	15.66	42.44 ab	--	24.54 c
Khudari	24.63 b	54.11	33.52 cd	82.86	34.62 b	36.54	18.42	31.66 b	--	37.52 abc
Menafey	34.09 ab	56.23	46.19 ab	75.62	40.65 ab	40.64	20.67	34.44 b	--	56.94 a
Saki	31.83 ab	56.28	40.53 abc	71.86	34.43 b	31.12	17.67	59.38 a	--	30.59 bc
Maktoumy	42.24 a	53.96	34.54 cd	70.19	47.44 ab	29.23	24.24	45.76 ab	--	52.90 ab
Sefry	33.49 ab	52.07	40.04 abc	78.92	46.13 ab	38.17	25.59	46.87 ab	--	55.02 ab
Serey	29.84 ab	63.77	37.35 abcd	75.93	35.18 b	28.22	17.91	37.30 b	--	48.22 abc
L.S.D 5%	13.63	N.S.	9.997	N.S.	16.70	N.S.	N.S.	20.11	--	24.97
Pollen sources										
2000										
Succary	57.59 ab	61.04 ab	41.56 ab	66.00	24.96 b	55.10 ab	61.87 a	40.66	67.88 ab	35.44
Barhi	65.44 a	65.32 ab	50.39 ab	82.01	67.50 a	58.40 ab	25.02 b	43.99	71.24 a	37.49
Nebut Self	50.45 abc	47.65 b	40.45 ab	85.23	36.67 b	65.00 a	37.50 b	34.08	65.00 ab	26.09
Seleg	37.89 cd	55.66 ab	38.01 ab	81.36	38.75 b	35.02 b	26.75 b	42.64	57.15 b	37.80
Khudari	48.89 bcd	65.56 ab	36.85 b	72.42	39.92 b	56.45 ab	41.26 ab	43.98	58.90 ab	39.99
Menafey	50.96 abc	55.12 ab	53.59 a	84.47	32.86 b	59.51 a	44.28 ab	33.31	56.67 b	25.15
Saki	63.76 ab	62.23 ab	43.48 ab	76.79	32.88 b	71.63 a	28.65 b	45.58	64.97 ab	47.40
Maktoumy	34.49 d	66.33 a	38.55 ab	77.61	40.52 b	52.98 ab	30.40 b	40.74	66.08 ab	49.01
Sefry	60.88 ab	56.25 ab	37.45 ab	78.08	35.55 b	54.65 ab	38.68 ab	49.64	65.33 ab	32.38
Serey	60.92 ab	53.09 ab	43.42 ab	76.43	35.37 b	50.80 ab	38.94 ab	33.34	63.45 ab	56.55
L.S.D 5%	15.57	18.31	16.31	19.28	22.70	24.15	24.20	N.S.	13.83	N.S.

Means sharing the same letters within the column are not significantly different at 0.05.

Table 2. The effect of pollen sources on percent unfertilized flowers of ten date palm cultivars in 1999 and 2000 seasons.

Cultivar	Succary	Barhi	Nebut Self	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
Pollen sources										
1999										
Succary	3.69 bc	0.045 b	4.195 abc	0.044	0.057 b	0.057 ab	3.81 a	0.451 b	--	13.39
Barhi	2.77 bc	0.038 b	3.806 abc	0.295	0.054 b	0.067 ab	1.84 a	0.046 b	--	19.53
Nebut Self	9.37 bc	0.177 ab	2.885 bc	0.048	0.058 b	0.050 b	5.48 a	0.979 b	--	1.12
Seleg	5.13 bc	0.041 b	9.050 ab	0.043	0.054 b	0.052 ab	6.02 a	2.308 a	--	12.32
Khudari	26.09 a	0.038 b	10.059 a	0.172	0.049 b	0.070 a	5.14 a	0.188 b	--	0.17
Menafey	11.72 b	1.374 a	10.373 a	0.187	0.522 b	0.056 ab	11.18 a	0.314 b	--	0.18
Saki	2.09 bc	0.043 b	2.814 bc	0.338	0.049 b	0.050 b	8.03 a	0.621 b	--	18.60
Maktoumy	0.49 c	0.043 b	1.635 c	0.050	0.632 b	0.049 b	1.25 a	0.191 b	--	2.53
Sefry	10.49 b	0.161 ab	4.544 abc	0.050	1.709 a	0.052 ab	0.80 a	0.740 b	--	0.21
Serey	8.42 bc	0.310 ab	6.036 abc	0.050	0.568 b	0.055 ab	2.22 a	0.515 b	--	12.78
L.S.D 5%	10.01	1.275	6.981	N.S.	1.057	0.019	10.99	1.24	--	N.S.
Pollen sources										
2000										
Succary	1.82	0.074 b	15.60 ab	0.978 ab	6.83	0.085 b	2.88 b	0.335	0.159 b	19.68 ab
Barhi	0.10	0.620 ab	10.83 ab	0.352 b	0.15	0.062 b	25.07 a	0.604	0.162 b	21.01 ab
Nebut Self	0.95	1.042 ab	12.68 ab	0.937 ab	0.13	0.142 ab	1.16 b	0.553	0.197 b	24.53 ab
Seleg	0.10	0.337 ab	25.90 a	1.409 a	14.87	0.076 b	4.70 b	1.001	0.165 b	32.69 ab
Khudari	1.94	0.259 ab	16.90 ab	0.717 ab	4.22	0.080 b	8.71 b	0.854	0.170 b	27.67 ab
Menafey	0.84	2.261 a	18.29 ab	0.349 b	6.27	0.085 b	9.41 b	0.853	0.205 ab	30.68 ab
Saki	2.65	0.603 ab	6.13 b	0.436 ab	15.86	0.111 ab	7.30 b	1.533	0.597 a	22.57 ab
Maktoumy	1.27	0.561 ab	10.35 b	0.076 b	14.03	0.231 a	4.38 b	0.616	0.162 b	5.75 b
Sefry	2.51	0.072 b	4.69 b	0.289 b	14.68	0.076 b	1.50 b	1.111	0.169 b	40.33 a
Serey	0.95	0.078 b	6.45 b	0.252 b	0.54	0.080 b	5.35 b	0.301	0.168 b	9.57 b
L.S.D 5%	N.S.	2.024	15.48	0.978	N.S.	0.38	14.91	N.S.	0.394	29.30

Means sharing the same letters within the column are not significantly different at 0.05

Table 3. The effect of pollen sources on percent fruit drop of ten date palm cultivars in 1999 and 2000 seasons.

Cultivars	Succary	Barhi	but Seif	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
1999										
Succary	62.24	37.61	49.11 bc	19.43	58.92 ab	77.09	71.39	72.29 a	--	41.81 bc
Barhi	63.96	46.67	53.73 abc	25.44	61.43 ab	68.33	81.57	65.24 ab	--	45.71 abc
Nebut Seif	64.08	43.91	60.87 ab	18.16	45.85 b	74.88	74.37	66.73 ab	--	59.81 ab
Seleg	58.01	42.84	61.46 ab	22.87	60.43 ab	64.88	78.38	55.29 abc	--	63.30 a
Khudari	49.33	45.88	56.53 ab	17.00	65.37 a	63.45	76.50	68.19 ab	--	62.48 a
Menafey	54.23	42.43	43.49 c	24.23	58.88 ab	59.35	68.22	65.28 ab	--	43.06 bc
Saki	66.12	43.61	56.75 ab	27.84	65.56 a	68.87	74.36	40.04 c	--	50.97 abc
Maktoumy	57.34	46.03	63.89 a	29.80	51.98 ab	70.76	74.57	54.09 abc	--	44.76 abc
Sefry	56.06	47.80	55.49 abc	21.07	52.24 ab	61.82	73.67	52.43 bc	--	44.97 abc
Serey	61.78	35.95	56.69 ab	24.06	64.30 a	71.77	74.93	62.23 ab	--	39.19 c
L.S.D 5%	N.S.	N.S.	12.55	N.S.	16.73	N.S.	N.S.	19.75	--	19.31
2000										
Succary	40.70 b	38.95 ab	42.97 ab	33.08	68.36 a	44.90 ab	35.41 c	59.07	32.11 ab	45.16
Barhi	34.55 b	34.13 ab	38.89 ab	17.72	32.50 c	41.60 ab	50.10 abc	55.47	28.75 b	41.77
Nebut Seif	48.71 ab	51.39 a	47.00 ab	13.91	63.33 ab	35.00 b	61.48 ab	65.44	34.99 ab	49.68
Seleg	62.10 a	44.07 ab	36.26 ab	17.29	46.50 bc	64.98 a	68.71 a	56.42	42.84 a	29.77
Khudari	49.27 ab	34.24 ab	46.40 ab	26.93	56.08 ab	43.55 ab	50.23 abc	55.23	41.09 ab	32.63
Menafey	48.28 ab	42.70 ab	28.27 b	15.25	61.00 ab	40.49 b	46.49 bc	65.93	43.32 a	44.44
Saki	33.71 b	37.24 ab	50.51 ab	22.84	51.44 abc	28.37 b	64.19 ab	52.95	34.59 ab	30.37
Maktoumy	64.35 a	33.18 b	51.24 a	22.39	45.59 bc	47.02 ab	65.38 ab	58.71	33.91 ab	45.59
Sefry	36.71 b	43.74 ab	57.97 a	21.73	49.89 abc	45.35 ab	59.59 ab	49.31	34.66 ab	27.62
Serey	38.26 b	46.90 ab	50.25 ab	23.38	64.20 ab	49.20 ab	55.86 abc	66.41	36.54 ab	34.19
L.S.D 5%	16.56	17.86	22.37	N.S.	21.22	24.15	20.95	N.S.	13.91	N.S.

Means sharing the same letters within the column are not significantly different at 0.05

Table 4. The effect of pollen sources on total yield (kg/bunch) of ten date palm cultivars in 1999 and 2000 seasons.

Cultivars	Succary	Barhi	Nebut Seif	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
1999										
Succary	13.20 ab	23.36 ab	10.20 abc	25.70 a	23.03	17.70 ab	9.53 ab	16.53 a	--	7.53
Barhi	10.20 b	26.20 a	9.53 abc	19.53 abc	18.20	16.20 b	7.53 b	12.53 ab	--	8.03
Nebut Seif	11.86 ab	22.70 ab	9.20 abc	21.53 abc	24.93	22.86 a	9.86 ab	14.20 ab	--	8.20
Seleg	13.70 ab	21.86 ab	9.53 abc	23.36 ab	20.36	20.20 ab	8.20 ab	12.20 ab	--	7.70
Khudari	11.53 b	19.20 b	9.20 abc	20.70 abc	19.36	17.20 ab	7.86 b	14.53 ab	--	7.36
Menafey	11.53 b	20.86 ab	10.86 a	16.70 c	21.03	20.70 ab	10.20 ab	15.20 ab	--	8.26
Saki	10.53 b	26.60 a	10.53 ab	22.36 abc	20.20	17.86 ab	9.20 ab	14.53 ab	--	8.53
Maktoumy	15.70 a	21.53 ab	7.86 c	19.70 abc	20.70	19.53 ab	9.36 ab	14.53 ab	--	8.03
Sefry	12.36 ab	23.76 ab	9.20 abc	18.86 bc	17.53	17.20 ab	8.86 ab	10.53 b	--	7.03
Serey	11.20 b	23.36 ab	8.20 bc	18.20 bc	20.70	19.86 ab	12.53 a	13.86 ab	--	8.036
L.S.D 5%	2.10	6.60	2.60	6.19	N.S.	6.20	4.65	5.81	--	N.S.
2000										
Succary	9.86 ab	25.20	15.53 a	24.36	20.36 a	11.86 b	8.53	18.53	10.53	9.53 ab
Barhi	10.36 ab	26.86	14.70 ab	24.53	13.52 ab	12.20 ab	6.86	16.70	11.20	9.03 ab
Nebut Seif	12.03 a	28.20	16.03 ab	22.53	13.20 ab	13.86 ab	6.86	20.86	10.20	10.70 a
Seleg	8.70 b	26.86	11.53 ab	24.36	12.86 ab	13.86 ab	6.53	18.86	11.30	8.36 ab
Khudari	80.86 b	24.20	10.86 ab	21.86	9.20 b	16.53 a	7.20	18.86	11.20	8.03 ab
Menafey	11.36 ab	25.53	10.03 b	23.20	11.86 ab	13.53 ab	7.53	17.20	10.86	9.70 ab
Saki	9.03 b	23.20	13.86 ab	17.20	10.20 ab	11.86 b	6.53	22.03	10.53	9.36 ab
Maktoumy	9.70 ab	29.86	10.20 ab	22.53	12.53 ab	15.86 ab	8.20	17.36	9.20	7.53 b
Sefry	9.36 ab	27.53	14.86 ab	23.20	8.53 b	16.53 a	7.20	20.20	10.53	9.03 ab
Serey	11.03 ab	22.86	11.03 ab	24.53	8.86 b	13.20 ab	7.86	21.36	9.53	9.03 ab
L.S.D 5%	2.80	N.S.	5.98	N.S.	10.42	4.618	N.S.	7.25	N.S.	2.70

Means sharing the same letters within the column are not significantly different at 0.05

Table 5. The effect of pollen sources on percent fruit grade A of ten date palm cultivars in 1999 and 2000 seasons.

Cultivars	Succary	Barhi	ebut Self	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
1999										
Succary	79.1 ab	34.34	18.33 cd	74.01 ab	92.60	78.18 ab	84.39 a	64.15 ab	--	42.89 b
Barhi	89.4 a	57.08	14.32 d	55.82 ab	31.74	85.18 a	62.33 ab	67.32 ab	--	41.13 b
Nebut Self	77.44 ab	68.20	18.20 cd	48.05 b	51.98	88.05 a	81.42 ab	96.65 a	--	96.27 a
Seleg	74.79 ab	43.25	36.70 bcd	60.05 ab	94.25	59.98 ab	86.85 a	61.92 ab	--	74.36 ab
Khudari	75.36 ab	36.88	71.09 a	80.67 ab	97.58	41.29 b	76.77 a	74.34 ab	--	75.00 ab
Menafey	62.55 b	35.89	36.50 bcd	83.35 a	84.28	53.39 ab	47.14 b	40.18 ab	--	83.02 ab
Saki	81.31 ab	50.79	50.61 ab	84.70 a	75.77	72.59 ab	77.11 ab	17.14 b	--	57.74 ab
Maktoumy	32.83 c	51.34	49.91 ab	79.32 ab	88.92	77.95 ab	78.68 ab	82.92 a	--	35.15 b
Sefry	76.84 ab	60.74	19.96 cd	75.49 ab	83.27	53.25 ab	72.47 ab	61.96 ab	--	58.33 ab
Serey	67.68 ab	64.82	61.33 ab	52.13 ab	78.72	84.23 ab	46.95 b	37.35 ab	--	68.16 ab
L.S.D 5%	26.76	N.S.	33.92	34.02	N.S.	43.19	35.60	61.41	--	51.67
2000										
Succary	0 b	28.13 d	32.43	64.46 abc	60.50	66.67 ab	51.19 ab	4.96 b	47.40	42.66
Barhi	0 b	59.78 abcd	32.44	13.01 bc	42.69	55.87 ab	6.08 b	27.08 ab	29.32	44.52
Nebut Self	0 b	47.04 abcd	37.44	48.70 abc	49.50	41.85 ab	3.58 b	33.61 ab	47.72	12.33
Seleg	0 b	53.96 abc	70.73	85.11 a	69.89	66.77 ab	17.45 ab	16.32 ab	40.13	14.46
Khudari	0 b	33.81 d	69.47	2.58 c	49.40	42.80 ab	48.02 ab	26.94 ab	48.26	31.80
Menafey	0 b	79.07 abc	36.15	70.72 ab	63.61	8.02 b	48.27 ab	38.59 ab	53.17	9.21
Saki	0 b	39.15 cd	64.09	58.87 abc	49.22	55.66 ab	13.96 ab	41.64 ab	23.07	17.15
Maktoumy	38.14 a	41.08 bc	60.26	32.83 abc	11.35	35.11 ab	18.50 ab	68.25 a	46.35	20.38
Sefry	0 b	81.56 ab	0.0	50.05 abc	68.92	78.09 a	44.84 ab	31.49 ab	56.27	9.13
Serey	0 b	87.46 a	6.25	41.79 abc	28.81	0.0 b	58.56 a	34.50 ab	36.89	31.21
L.S.D 5%	21.01	41.40	N.S.	52.6	N.S.	68.02	51.74	60.94	N.S.	N.S.

Means sharing the same letters within the column are not significantly different at 0.05

Table 6. The effect of pollen sources on percent pulp weight of ten date palm cultivars in 1999 and 2000 seasons.

Cultivars	Succary	Barhi	ebut Self	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
1999										
Succary	79.14 b	87.84 c	91.42 c	87.07 ab	91.85	92.89	93.01	93.42 ab	--	92.30 bc
Barhi	90.91 a	90.13 a	92.97 ab	87.56 ab	90.22	92.23	93.68	94.11 a	--	91.86 bcd
Nebut Self	90.93 a	89.24 abc	93.69 a	76.14 ab	91.13	92.21	93.38	94.39 a	--	91.79 cd
Seleg	91.43 a	89.67 ab	93.09 ab	88.73 a	90.84	92.26	93.73	94.02 a	--	92.60 ab
Khudari	91.76 a	88.93 abc	93.51 ab	85.71 b	91.93	91.68	93.84	93.89 a	--	91.27 d
Menafey	91.10 a	88.58 abc	92.60 b	87.53 ab	92.05	91.71	93.27	93.02 ab	--	91.96 bcd
Saki	90.69 a	88.48 bc	92.92 ab	87.55 ab	90.90	91.36	93.22	91.97 b	--	93.31 a
Maktoumy	89.33 a	89.72 ab	92.78 ab	86.31 ab	91.47	91.39	93.09	93.80 a	--	91.51 d
Sefry	89.49 a	89.48 ab	92.88 ab	87.25 ab	91.43	91.11	93.79	92.72 ab	--	92.55 ab
Serey	91.56 a	88.97 abc	93.30 ab	85.95 b	91.11	92.27	93.35	93.22 ab	--	91.51 d
L.S.D 5%	9.88	1.626	1.043	2.77	N.S.	N.S.	N.S.	1.669	--	0.751
2000										
Succary	84.86 bc	90.66 ab	91.22	86.36	89.01 c	90.02 ab	91.99 bc	90.83 b	90.77 ab	91.23 bcd
Barhi	84.94 bc	90.89 ab	94.16	85.42	92.21 ab	90.04 ab	92.36 ab	93.11 a	91.22 ab	90.92 bcd
Nebut Self	85.70 abc	91.02 a	93.78	86.19	92.18 ab	89.32 ab	91.50 c	91.99 ab	91.42 ab	91.29 bc
Seleg	87.10 a	90.70 ab	93.92	85.51	92.30 ab	89.33 ab	92.84 a	93.47 a	91.14 ab	91.47 bc
Khudari	83.97 c	90.63 ab	94.64	82.36	90.24 bc	89.78 ab	92.80 ab	92.27 ab	91.47 a	91.88 ab
Menafey	85.19 abc	91.00 a	93.84	87.15	92.70 ab	89.10 ab	93.13 a	92.55 ab	91.65 a	91.41 bc
Saki	85.56 abc	89.32 b	94.17	82.30	91.55 abc	90.32 a	92.37 ab	92.12 ab	90.02 b	91.50 bc
Maktoumy	86.41 ab	90.15 ab	93.19	85.55	91.89 ab	89.12 ab	92.36 ab	93.25 a	91.49 a	91.84 cd
Sefry	85.49 abc	89.69 ab	93.59	83.90	93.19 a	89.81 ab	92.80 ab	93.04 a	91.50 a	90.31 d
Serey	86.69 ab	91.18 a	93.53	87.06	91.49 abc	88.39 b	92.51 ab	91.90 ab	91.30 ab	92.54 a
L.S.D 5%	2.153	1.653	N.S.	N.S.	2.67	1.750	0.845	1.808	1.417	0.964

Means sharing the same letters within the column are not significantly different at 0.05

Table 7. The effect of pollen sources on percent seed weight of ten date palm cultivars in 1999 and 2000 seasons.

Cultivars	Succary	Barhi	but Self	Seleg	Khudari	Menafey	Saki	Maktoumy	Sefry	Serey
1999										
Succary	20.85 a	12.15 a	8.57 a	12.92 ab	8.14	7.10	6.98	6.57 ab	-	7.69 bc
Barhi	9.08 b	9.86 c	7.02 a	12.43 ab	9.77	7.76	6.31	5.88 b	-	8.13 abc
Nebut Self	9.06 b	10.75 abc	6.30 c	12.58 ab	8.86	7.78	6.61	5.60 b	-	8.20 ab
Seleg	8.56 b	10.32 bc	6.90 bc	11.26 b	9.15	7.73	6.26	5.97 b	-	7.39 de
Khudari	8.23 b	11.06 abc	6.48 bc	14.28 a	8.06	8.31	6.15	6.10 b	-	8.72 a
Menafey	8.89 b	11.41 abc	7.39 b	12.46 ab	7.94	8.28	6.72	6.97 ab	-	8.03 abc
Saki	9.30 b	11.51 ab	7.07 bc	12.44 ab	9.09	8.63	6.77	8.02 a	-	6.68 d
Maktoumy	10.66 b	10.27 bc	7.21 bc	13.68 ab	8.52	8.60	6.90	6.20 b	-	8.48 a
Sefry	10.51 b	10.51 bc	7.11 bc	12.74 ab	8.56	8.88	6.20	7.27 ab	-	7.44 cd
Serey	8.45 b	11.02 abc	6.69 bc	14.04 a	8.88	7.72	6.64	6.77 ab	-	8.48 a
L.S.D 5%	9.88	1.626	1.064	2.775	N.S.	N.S.	N.S.	1.669	-	0.75
2000										
Succary	15.13 ab	9.33 ab	8.77 a	13.63	10.99 a	9.97 ab	8.00 ab	9.16 a	9.22 ab	8.77 abc
Barhi	15.05 ab	9.10 ab	5.83 b	14.57	7.78 bc	9.95 ab	7.63 bc	6.88 b	8.77 ab	9.07 abc
Nebut Self	14.29 abc	8.97 b	6.21 b	13.80	7.81 bc	10.67 ab	8.49 a	8.00 ab	8.57 ab	8.70 bc
Seleg	12.89 c	9.29 ab	6.07 b	14.48	7.69 bc	10.66 ab	7.15 c	6.52 b	8.85 ab	8.52 bc
Khudari	16.02 a	9.36 ab	5.35 b	17.63	9.75 ab	10.21 ab	7.19 bc	7.72 ab	8.52 b	8.11 cd
Menafey	14.80 abc	8.99 b	6.15 b	12.84	7.29 bc	10.89 ab	6.86 c	7.44 ab	8.34 b	8.53 bc
Saki	14.43 abc	10.67 a	5.82 b	17.69	8.44 abc	9.67 b	7.62 bc	7.87 ab	9.97 a	8.49 bc
Maktoumy	13.58 bc	9.84 ab	6.80 b	14.44	8.10 bc	10.87 ab	7.63 bc	6.74 b	8.50 b	9.15 ab
Sefry	14.50 abc	10.30 ab	6.40 b	16.10	6.80 c	10.18 ab	7.19 bc	6.95 b	8.49 b	9.68 a
Serey	13.30 bc	8.81 b	6.46 b	12.93	8.50 abc	11.60 a	7.48 bc	8.09 ab	8.69 ab	7.45 d
L.S.D 5%	2.153	1.653	1.675	N.S.	2.67	1.75	0.845	1.808	1.417	0.964

Means sharing the same letters within the column are not significantly different at 0.05

Table 8. Compatibility relationships within and between ten date palm cultivars (calculated concerning fruit set data in two seasons).

Cultivar	Succary	Barhi	Nebut Self	Seleg	Khudari	enafey	Saki	Maktoumy	Sefry	Serey
Succary	PSI	CC	PCI	CC	PCI	CC	CC	PCI	CC	PCI
Barhi	PCI	SC	PCI	CC	CC	CI	CI	PCI	CC	PCI
Nebut Self	PCI	CC	PSI	CC	CC	CI	CI	PCI	CC	PCI
Seleg	PCI	CC	PCI	SC	PCI	CI	CI	PCI	CI	CI
Khudari	PCI	CC	PCI	CC	PSI	CI	CI	PCI	CC	PCI
Menafey	PCI	CC	PCI	CC	PCI	SC	CI	PCI	CI	CC
Saki	PCI	CC	PCI	CC	PCI	CI	SI	CC	CC	PCI
Maktoumy	CC	CC	PCI	CC	PCI	CI	CI	PSI	CC	CC
Sefry	PCI	CC	PCI	CC	PCI	CI	CI	PCI	SI	CC
Serey	PCI	CC	PCI	CC	PCI	CI	CI	PCI	CC	PSI

CI: Cross - Incompatibility. CC: Cross Compatibility. SC: Self-Compatibility.
 SI: Self-Incompatibility. PSI: Partially Self-Incompatibility.
 PCI: Partially Cross Incompatibility.

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الملخص العربي

علاقات التوافق داخل وبين عشرة أصناف من نخيل البلح

١- عقد الثمار والمحصول

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أجريت هذه التجربة لاختبار تأثير ١٠ مصادر لقاح داخل وبين عشرة أصناف نخيل بلح وهي: السكري، البرحي، نبوت سيف، السلج، الخضري، المنيفي، الصقمي، المكتومي، الصفري والسري وذلك على عقد الثمار ونسبة الأزهار غير الملقحة ونسبة تساقط الثمار وكمية المحصول ونوعية الثمار (نسبة الثمار درجة أ، ثمار كبيرة الحجم) ونسبة وزن اللب ووزن البذور. وجدت اختلافات في نسبة العقد ونسبة الأزهار غير الملقحة ونسبة تساقط الثمار ونوعية الثمار بين العشرة أصناف وذلك حسب مصدر اللقاح حيث تعزى الاختلافات في نسبة عقد الثمار بين العشرة مصادر للقاح داخل وبين الأصناف العشرة إما لحيوية حبوب اللقاح أو احتمال وجود موانع للتوافق. أظهرت نتائج عقد الثمار درجة من عدم التوافق الخلطي بين الصنف الخضري ومصدري اللقاح الصقمي والسري كما أوضحت النتائج درجة من عدم التوافق الذاتي للصنف الخضري نفسه. كما أظهرت النتائج بعض الدلائل لاحتمال وجود عدم توافق ذاتي في الأصناف المنيفي والبرحي. لوحظ أن تلقيح أزهار الصنف السكري بلقاح المكتومي ولقاح نبوت سيف أعطى أعلى إنتاجية مقدرة بمتوسط وزن العنق في موسمي ١٩٩٩م و٢٠٠٠م على التوالي، كما أعطى الصنف البرحي أعلى إنتاجية (وزن العنق) باللقاح الصقمي والمكتومي في الموسم الأول والثاني على التوالي. نسبة وزن البذور كانت أعلى في معظم الأصناف وفي الموسمين عند استعمال مصدر اللقاح السكري بينما كانت أقلها وفي الموسمين عند استعمال مصدر اللقاح السلج. أما نوعية ثمار البرحي فقد كانت منخفضة بمصدري اللقاح نبوت سيف والسري في الموسم الأول والسلج والصقمي في الموسم الثاني. دلت النتائج على عدم وجود تأثير واضح ومتكرر على نسبة اللب في الثمار في الأصناف المختلفة نتيجة لمصادر اللقاح المختلفة.