

Effect of Self and Cross-Pollination in Some Local Mango Cultivars on Fruit Set and Retained Fruits

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Abstract: Mango (*Mangifera indica* L.) considered one of the oldest cultivated trees in the world. Low productivity of some mango cultivars is associated with low fruit setting and/or high fruit drop of immature fruits. The self and cross incompatibility has been reported as one of the serious factor affecting fruit set in many mango cultivars. In this respect, four mango cultivars (Alphonse, Ewais, Hindi khassa and Zebda) were used to examine the effective of cross and self-pollination between them on fruit setting and number of retained fruits. The fluorescence microscope was used to determine the growth of pollen tube in the style tissue after pollination. The results of the present study indicated that, open pollination followed by cross-pollination gave the highest initial number of fruitlets per panicle in all cultivars under study than self-pollination. Florescence microscope showed incompatibility symptoms with self-pollination treatments of Alphonse, Ewais, Hindi khassa and Zebda cultivars in most of resulted pollen tubes such as short tubes, which were unable to penetrate the style. Plugs appeared along of the Alphonse, Hindi khassa and Zebda styles when crossed by Ewais pollens, this lagging in pollen tube growth delays its arrival to the base of the style end. Moreover, pollen tubes grew slowly when use Alphonse as a pollinizer for Ewais and Hindi khassa cultivars, this slowly grow in pollen tube delays its arrival to the base of the style end after 7 days from pollination. The germination of Zebda pollen grains on Hindi khassa stigmatic surface, were higher than other combinations and such pollen tubes reached to the base of the style in 4 days after pollination, this is an indication of high cross compatible between these two cultivars. Ewais gave the lowest percentage of pistils with pollen tubes reaching the base of the style 7 days after self-pollination. Generally, self-pollination of each cultivar induced lower number of pollen tubes at style bases compared with crossing by other cultivars. The highest initial number of fruitless per panicle resulted from cross-pollination was observed when Hindi Khassa cv. crossed by Zebda pollen grains, meanwhile, the lowest initial number of fruits per panicle value was noticed when Ewais cv. was selfed. Concerning the number of retained fruits at harvest date, all cross combinations reach the maximum value of fruit drop (100 %) after 15 weeks from pollination treatments except the combination of (Hindi Khassa crossed by Zebda pollen) and the open pollination in the four studied cultivars.

Key words: Mango · Zebda cultivar · Self-pollination · Compatibility · Fruit set · Fruit drop %

INTRODUCTION

Mango (*Mangifera indica* L.) member of family Anacardiaceae is one of the important fruits of the tropical and subtropical regions of the world. Mango grows on a wide range of climatic and soil conditions so; it is cultivated in many countries of the world, although most of all the production comes from developing countries [1]. In Egypt, the total cultivated area with mango reached 241101 feddan in 2013 (one feddan= 0.42ha) and the

average yield per feddan is only 3.54 ton [2]. Mango tree produces a large number of the panicles, each bears hundreds or even thousands of bisexual flowers. Only a small percentage of these flowers are perfect (hermaphrodite flowers) and capable of producing fruits. Hermaphrodite flowers are self-pollinated but incompatibility of some pollen grains and stigmas cause failure in mango fruit set [3, 4]. Although, under normal conditions, the percentage of fruit setting in Mango varies according to cultivar and ranges between 0.5 % to

28% [5]. Only less than 1% of each panicle flowers developed to fruits [6] and this lower percentage is dependent on the pollination compatibility between cultivars, the number of hermaphrodite flowers, pollen viability and the environmental conditions during pollination. Low cropping of some mango cultivars is associated with low fruit set and/or high fruit drop of immature fruits. There are some factors which affect fruit set and fruit drop, such as genetics, bearing season, tree aspect, part of inflorescence, sex ratio and growth regulators [7].

In this respect, Alphonse, Ewais, Hindi khassa and Zebda mango cultivars were used in this study to investigate the effective of self and cross-pollinations between them on fruit setting and number of fruit retention.

MATERIALS AND METHODS

Plant Materials: The present study was conducted during two successive seasons (2013 and 2014) at the Horticulture Research Station in El-Qanater El-Khairia, Qalyubia Governorate, Egypt. Four mango cultivars namely (Alphonse, Ewais, Hindi khassa and Zebda) were used in this study. Five trees in complete randomized design were chosen from each cultivar, similar in vigor and size and in the same bearing phase. Trees planted 7 meters apart and subjected to regular horticultural practices.

Pollen Grains Collection and Germination Percentage: Pollen grains of each male parent were prepared by collecting freshly opened flowers that have not yet dehisced; anthers were isolated immediately and placed onto absorbent paper for drying, then allowed to dehisce for 12-24 hours at ambient room temperature. After one day, pollen grains of each pollinator were separately potted in small glass bottle to be used in all cross-combinations. Pollen grains germination was tested on Agar plates (an artificial sterilized medium consists of 1% agar and 20 % sucrose into petri dishes) and incubated at 26°C for 24 hours, then examined by light microscope as described by Spencer and Kennard [8]. Pollen germination percentage calculated as follows:

$$\text{Pollen germination (\%)} = \frac{\text{No. of germinated pollen grains}}{\text{Total No. of pollen grains}} \times 100$$

Pollination Experiments: Five ideal panicles from each tree were chosen for each treatment [self and cross-pollinations by hand and the open pollination (each panicle considered a replicate)]. According to Bally *et al.*

[9], flowers at a similar stage of development were chosen (about sixty flowers on each panicle) for each pollination treatment (self and cross pollinations by hand); and removed all other opened flowers and unwanted branchlets from these selected panicles; then each prepared panicle was bagged with pergamin bag before anthesis to prevent insect pollination. In the next day, the selected flowers were emasculated using fine scissor and forceps (by removing sepals, petals and stamens before the anthers have a chance to dehisce), hand pollinated by applying the specific pollen to receptive stigmas using the rubber tip of a pencil and then each panicle was bagged with pergamin bag to prevent any undesirable pollination. For the open pollination treatments, its selected panicles were labeled and the flowers were left without any treatment under the natural conditions of the orchard. The number of fruitlets per each panicle was counted [after 3 weeks from different pollination treatments (initial fruit set)] and recorded every 2 weeks intervals until 17 weeks after pollination treatment. Besides, the number of retained fruits/panicle was recorded. In addition, all cross combinations of season 2013, were done in the first week of April while, it were done in the last week of March in 2014 season.

Microscopic Preparations: Samples of five pistils from each combination were taken every 24 hours for the seven successive days after pollination and fixed immediately in FPA (10:5:50:35 by volume Formalin: Propionic acid: Ethanol and distilled water). Samples of pistils were softened in (8 N) NaOH solution for 2 hours; washed with tap water for 24 hours. Staining is accomplished in 0.1 % solution of water-soluble aniline blue dye dissolved in 0.1 N K₃PO₄; then examined with Leica fluorescence microscope (WILD LEITZ GMBH, Type 020-505-030, Leitz Wetzlar Germany) according to the method used by Martin [10] and Kho and Baër [11].

Statistical Analysis: Experiment was designed in complete randomized with five trees and five panicles for each cross combination on each tree (panicle- as a replicate). The obtained data were subjected to analysis of variance (ANOVA). Duncan's multiple range test at 5% level of significance (p=0.05) was used for means comparisons according to Gomez and Gomez [12].

RESULTS AND DISCUSSIONS

Data in Table 1 revealed that pollen germination percentages varied insignificantly according to the four cultivars grown under El-Qanater El-Khairia region conditions in 2013 and 2014 seasons.

Alphonse cv. recorded the highest percentage of pollen germination in the two seasons of study (65.62% and 66.39%), while, Hindi Khassa cv. recorded the lowest percentage of pollen germination (54.04% and 56.29%) in 2013 and 2014 seasons, respectively. These results are in harmony with those obtained by Dahshan [13], who stated that pollen grains viability of (Zebda cv.) was 72%,

while this percentage in (Taimour cv.) was 35% in early inflorescences and increased to 65% in normal inflorescences and to 74% in late inflorescences. Also, these results are in agreement with the findings reported by Sukhvibul *et al.* [14], who reported that percentages of pollen germination varied according to different mango cvs.

Table 1: Pollen germination percentages of Alphonse, Ewais, Hindi khassa and Zebda mango cultivars during 2013 and 2014 seasons.

Cultivars	Pollen germination % after 24 h.		Mean
	2013	2014	
Alphonse	65.62 a	66.39 a	66.05 A
Ewais	61.23 a	63.37 a	62.30 A
Hindi Khassa	54.04 a	56.29 a	55.16 A
Zebda	61.46 a	65.57 a	63.51 A

Means with the same letter in each column are statistically insignificant at 5 % level of Duncan's multiple range tests.

Table 2: Average number of fruits / panicle from initial fruit set* to maturity in Alphonse, Ewais, Hindi khassa and Zebda mango cultivars after different pollination treatments between them in 2013 season.

		*Initial fruit set (Avg. No. of fruitlets per panicle)						Avg. No. of fruits / panicle after 5 weeks of pollination treatment					
♀	♂	Alphonse	Ewais	Hindi khassa	Zebda	Open	Mean	Alphonse	Ewais	Hindi khassa	Zebda	Open	Mean
Alphonse		4.8 jk	5.2 i	5.2 i	5.8 gh	17.8 b	7.76 D	3.2 hi	4.6 d-f	4.4 e-g	4.0 f-h	8.6 bc	4.96 A
Ewais		5.6 h	3.4 l	6.0 fg	7.8 de	16.6 c	7.88 C	3.6 gh	2.4 ij	4.2 fg	5.4 d	8.4 c	4.80 A
Hindi khassa		5.8 gh	5.0 ij	4.6 k	8.0 d	16.6 c	8.00 B	2.6 ij	2.2 j	2.0 j	5.4 d	9.4 ab	4.32 B
Zebda		7.6 e	5.6 h	6.2 f	5.2 i	20.4 a	9.00 A	5.2 de	2.6 ij	3.2 hi	2.0 j	10.0 a	4.60 AB
Mean		5.95 C'	4.80 E'	5.50 D'	6.70 B'	17.85 A'	--	3.65 C'	2.95 D'	3.45 C'	4.20 B'	9.10 A'	--
Avg. No. of fruits / panicle after 7 weeks of pollination treatment							Avg. No. of fruits / panicle after 9 weeks of pollination treatment						
Alphonse		1.6 ij	3.4 de	3.2 e	2.8 f	6.8 ab	3.56 A	1.0 h	2.8 d	2.4 e	1.4 g	5.6 a	2.64 A
Ewais		1.8 hi	1.6 ij	2.2 g	3.2 e	5.8 c	2.92 C	1.4 g	1.2 gh	1.4 g	1.0 h	4.4 c	1.88 B
Hindi khassa		1.4 j	1.6 ij	1.8 hi	3.2 e	6.6 b	2.92 C	1.0 h	0.0 i	0.0 i	2.0 f	5.0 b	1.60 C
Zebda		3.6 d	2.0 gh	2.0 gh	1.6 ij	7.0 a	3.24 B	2.8 d	1.0 h	1.8 f	1.4 g	5.8 a	2.56 A
Mean		2.10 D'	2.15 D'	2.30 C'	2.70 B'	6.55 A'	--	1.55 B'	1.25 D'	1.40 C'	1.45 BC'	5.20 A'	--
Avg. No. of fruits / panicle after 11 weeks of pollination treatment							Avg. No. of fruits / panicle after 13 weeks of pollination treatment						
Alphonse		0.0 j	0.0 j	1.2 h	1.0 i	3.6 b	1.16 B	0.0 g	0.0 g	0.0 g	0.0 g	2.4 b	0.48 C
Ewais		0.0 j	0.0 j	1.4 g	0.0 j	2.8 c	0.84 C	0.0 g	0.0 g	0.0 g	0.0 g	2.0 c	0.40 D
Hindi khassa		0.0 j	0.0 j	0.0 j	1.2 h	2.6 d	0.76 D	0.0 g	0.0 g	0.0 g	1.2 e	1.8 d	0.60 B
Zebda		2.0 e	0.0 j	1.8 f	1.0 i	3.8 a	1.72 A	0.8 f	0.0 g	1.8 d	0.0 g	2.6 a	1.04 A
Mean		0.50 D'	0.00 E'	1.10 B'	0.80 C'	3.20 A'	--	0.20 B'	0.00 C'	0.45 B'	0.30 B'	2.20 A'	--
Avg. No. of fruits / panicle after 15 weeks of pollination treatment							Avg. No. of fruits / panicle after 17 weeks of pollination treatment						
Alphonse		0.0 e	0.0 e	0.0 e	0.0 e	1.8 b	0.36 B	0.0 c	0.0 c	0.0 c	0.0 c	1.8 b	0.36 B
Ewais		0.0 e	0.0 e	0.0 e	0.0 e	2.0 a	0.40 B	0.0 c	0.0 c	0.0 c	0.0 c	2.0 a	0.40 A
Hindi khassa		0.0 e	0.0 e	0.0 e	1.2 d	1.4 c	0.52 A	0.0 c	0.0 c	0.0 c	0.0 c	0.0 c	0.00 C
Zebda		0.0 e	0.0 e	0.0 e	0.0 e	2.0 a	0.40 B	0.0 c	0.0 c	0.0 c	0.0 c	2.0 a	0.40 A
Mean		0.00 C'	0.00 C'	0.00 C'	0.30 B'	1.80 A'	--	0.00 B'	0.00 B'	0.00 B'	0.00 B'	1.45 A'	--

* Initial fruit set (No. of fruits per panicle) were recorded after 3 weeks from pollination treatment.

Means with the same letter in the column show no differences among parental group through Duncan's test with 5 % probability.

Table 3: Average number of fruits / panicle from initial fruit set* to maturity in Alphonse, Ewais, Hindi khassa and Zebda mango cultivars after different pollination treatments between them in 2014 season.

		*Initial fruit set (Avg. No. of fruitlets per panicle)					Avg. No. of fruits / panicle after 5 weeks of pollination treatment						
♀	♂	Alphonse	Ewais	Hindi khassa	Zebda	Open	Mean	Alphonse	Ewais	Hindi khassa	Zebda	Open	Mean
Alphonse		4.4 k	5.2 j	5.0 j	5.4 j	19.2 b	7.84 B	3.0 h	2.6 j	2.4 k	4.0 f	8.6 b	4.11 B
Ewais		5.2 j	4.0 k	6.6 h	7.2 g	16.0 d	7.80 B	3.8 g	1.8 m	2.6 j	3.0 h	7.8 d	3.80 C
Hindi khassa		5.2 j	5.0 j	4.4 k	9.4 e	20.0 a	8.80 A	2.6 j	1.6 n	1.8 m	4.8 e	11.0 a	4.36 A
Zebda		8.0 f	6.6 h	7.0 gh	6.0 i	17.0 c	8.90 A	3.0 h	2.8 i	1.6 n	2.2 l	8.0 c	3.50 D
Mean		5.70 C'	5.20 D'	5.75 C'	7.00 B'	18.15 A'	--	3.10 C'	2.20 D'	2.10 E'	3.50 B'	8.85 A'	--
Avg. No. of fruits / panicle after 7 weeks of pollination treatment							Avg. No. of fruits / panicle after 9 weeks of pollination treatment						
Alphonse		2.2 f	1.2 k	2.2 f	1.4 j	6.0 b	2.60 B	1.0 g	0.4 i	1.4 f	0.8 h	5.2 B	1.76 B
Ewais		1.8 h	0.8 m	1.6 i	1.4 j	5.4 d	2.20 D	1.0 g	0.2 j	1.0 g	0.4 i	4.8 c	1.48 C
Hindi khassa		0.8 m	0.6 n	1.4 j	3.0 e	8.0 a	2.76 A	0.4 i	0.0 k	0.0 k	1.8 D	6.8 a	1.80 B
Zebda		2.0 g	2.0 g	1.0 l	1.8 h	5.8 c	2.50 C	1.6 e	0.8 h	1.0 g	1.6 e	4.8 c	1.96 A
Mean		1.70 C'	1.15 E'	1.55 D'	1.90 B'	6.30 A'	--	1.00 C'	0.35 E'	0.85 D'	1.15 B'	5.40 A'	--
Avg. No. of fruits / panicle after 11 weeks of pollination treatment							Avg. No. of fruits / panicle after 13 weeks of pollination treatment						
Alphonse		0.0 g	0.0 g	0.6 e	0.6 e	3.6 a	0.96 A	0.0 f	0.0 f	0.0 f	0.0 f	2.0 b	0.40 B
Ewais		0.0 g	0.0 g	0.6 e	0.0 g	3.0 b	0.72 B	0.0 f	0.0 f	0.0 f	0.0 f	2.0 b	0.40 B
Hindi khassa		0.0 g	0.0 g	0.0 g	1.0 d	3.6 a	0.92 A	0.0 f	0.0 f	0.0 f	1.0 d	2.2 a	0.64 A
Zebda		1.0 d	0.0 g	0.6 e	0.4 f	2.6 c	0.92 A	0.6 e	0.0 f	0.6 e	0.0 f	1.8 c	0.60 A
Mean		0.25 C'	0.0 D'	0.45 B'	0.50 B'	3.20 A'	--	0.15 C'	0.0 C'	0.15 C'	0.25 B'	2.0 A'	--
Avg. No. of fruits / panicle after 15 weeks of pollination treatment							Avg. No. of fruits / panicle after 17 weeks of pollination treatment						
Alphonse		0.0 f	0.0 f	0.0 f	0.0 f	2.0 b	0.40 B	0.0 d	0.0 d	0.0 d	0.0 d	2.0 a	0.0 B
Ewais		0.0 f	0.0 f	0.0 f	0.0 f	1.4 d	0.28 C	0.0 d	0.0 d	0.0 d	0.0 d	1.40 c	0.0 B
Hindi khassa		0.0 f	0.0 f	0.0 f	1.0 e	2.2 a	0.64 A	0.0 d	0.0 d	0.0 d	0.0 d	0.0 d	0.0 B
Zebda		0.0 f	0.0 f	0.0 f	0.0 f	1.8 c	0.36 C	0.0 d	0.0 d	0.0 d	0.0 d	1.6 b	0.12 A
Mean		0.00 C'	0.00 C'	0.00 C'	0.25 B'	1.85 A'	--	0.00 B'	0.00 B'	0.00 B'	0.00 B'	1.25 A'	--

* Initial fruit set (No. of fruits per panicle) were recorded after 3 weeks from pollination treatment.

Means with the same letter in the column show no differences among parental group through Duncan's test with 5 % probability.

The effect of different cross, self and open-pollination treatments on the average initial number of fruit set (after three weeks from pollination) and number of retained fruits of Alphonse, Ewais, Hindi khassa and Zebda mango cultivars during the two seasons as presented in Tables 2 and 3 and Figs 1, 2, 3 and 4. In general, open pollination gives the highest initial number of fruitlets per panicle in the four studied cultivars. After three weeks of self-pollination by hand of each cultivar, the resulted fruitlets per panicle (initial fruit set) ranged from 3.4 in (Ewais) to 5.2 in (Zebda) in the first season and ranged from 4.0 in (Ewais) to 6.0 in (Zebda) in the second season. This present data supports early findings of Tawfik [15], who found that, the lowest initial number of fruits per panicle was noticed with Ewais cv. when self-pollinated compared with the three other studied cultivars (Tommy atkins, Keitt and Sedik). In addition, it could be

noticed that fruit drop percentage increased dramatically and reached the maximum value (100%) at 9 weeks after pollination only with (Hindi khassa) when crossed by Ewais pollens in the two seasons of this study. After 11 weeks from pollination treatments, a complete fruit drop (100%) occurred with 1) Alphonse cv. when self-pollinated and crossed by Ewais pollen, 2) Ewais cv. When self-pollinated and crossed by Alphonse and Zebda pollen, 3) Hindi khassa cv. when crossed by Alphonse pollen and 4) Zebda cv. When crossed by Ewais pollen in the two seasons. While, fruit drop percentage reached (100 %) in the two seasons of study after 13 weeks from pollination treatments with 1) Alphonse cv. when crossed by Hindi Khassa and Zebda pollen, 2) Ewais cv. when crossed by Hindi Khassa pollen, 3) Hindi khassa cv. when self-pollinated and 4) Zebda cv. when self-pollinated. Zebda cv. reached to completely

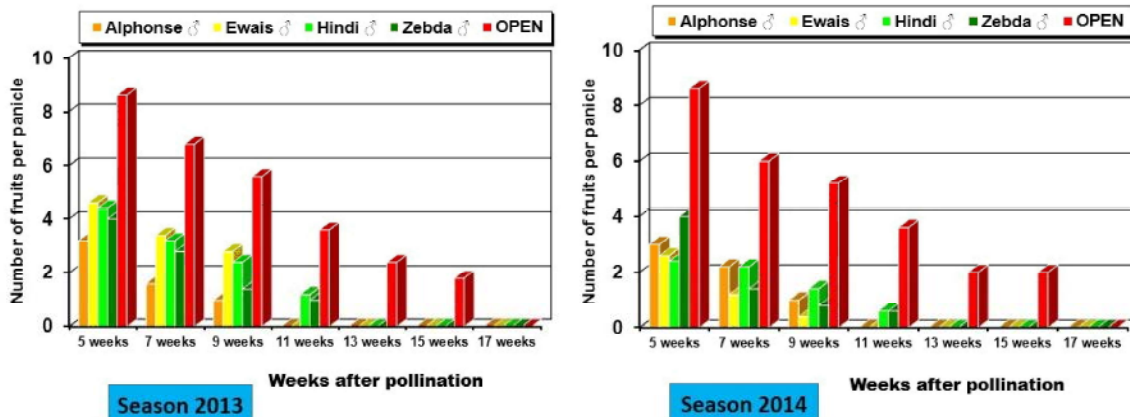


Fig. 1: Average number of fruits per panicle from fruit set to maturity in Alphonse mango cultivar (as a female parent) after different pollination treatments with Alphonse (selfing), Ewais, Hindi khassa, Zebda pollen and open pollination (as a control) during 2013 and 2014 seasons.

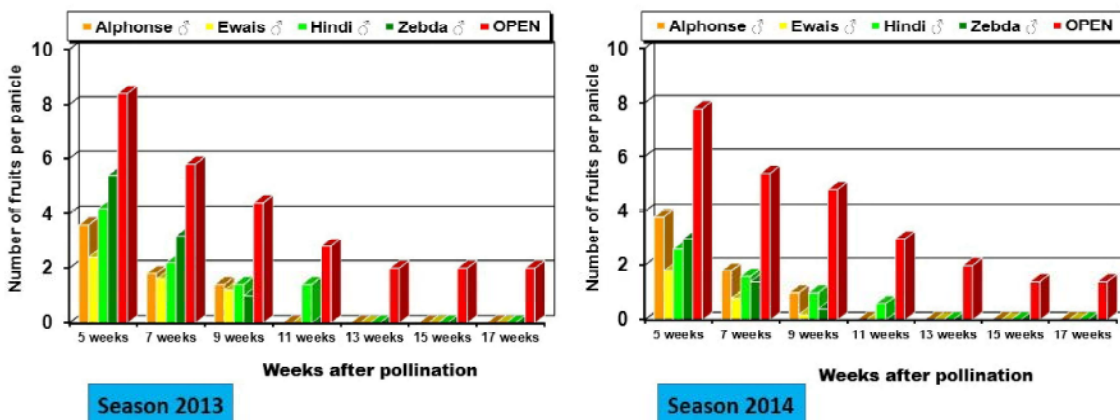


Fig. 2: Average number of fruits per panicle from fruit set to maturity in Ewais mango cultivar (as a female parent) after different pollination treatments with Alphonse, Ewais (selfing), Hindi khassa, Zebda pollen and open pollination (as a control) during 2013 and 2014 seasons.

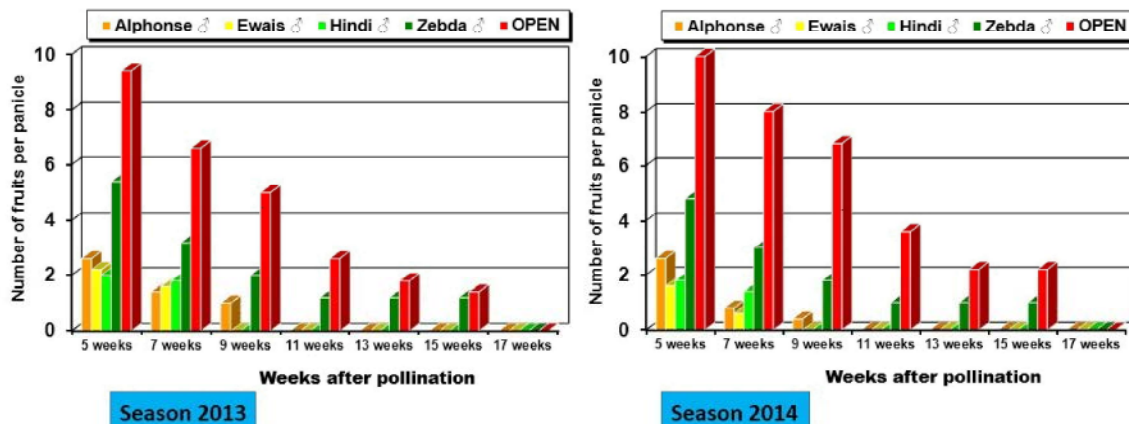


Fig. 3: Average number of fruits per panicle from fruit set to maturity in Hindi Khassa mango cultivar (as a female parent) after different pollination treatments with Alphonse, Ewais, Hindi khassa (selfing), Zebda pollen and open pollination (as a control) during 2013 and 2014 seasons.

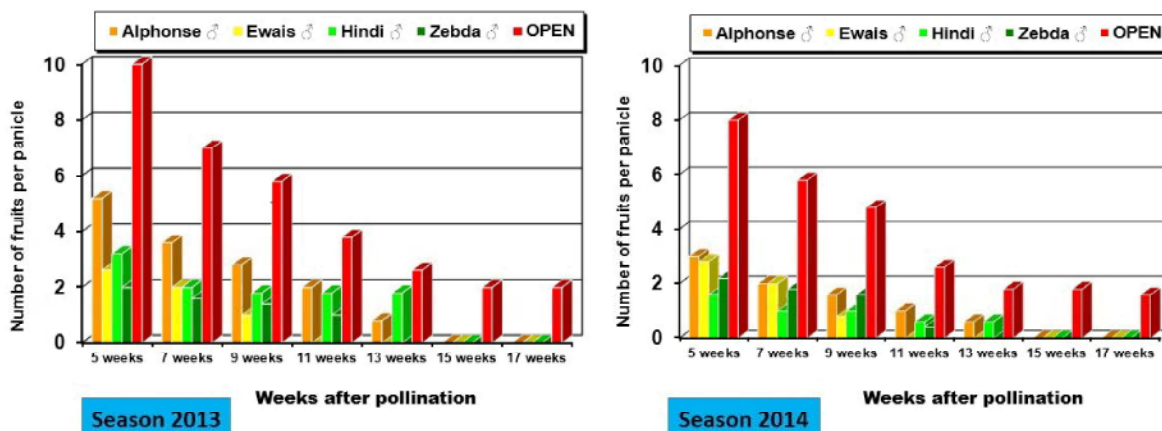


Fig. 4: Average number of fruits per panicle from fruit set to maturity in Zebda mango cultivar (as a female parent) after different pollination treatments with Alphonse, Ewais, Hindi khassa, Zebda (selfing) pollen and open pollination (as a control) during 2013 and 2014 seasons.

dropping (100%) after 15 weeks from pollination treatments. Fruit drop was generally greatest during April and correlated positively with fruit growth (length and breadth). These results are in agreement with those obtained by Guzman-Estrada [16], who found that, most fruit drop occurred 25-50 days after fruit set, in five mango cultivars namely, "Manila, Tommy Atkins, Haden, Kent and Keitt". Similar results were obtained with Tawfik [15], who reported that, complete fruit drop (100 %) were occurred in "Sediek" and "Ewais" 30 - 45 days after pollination when self-pollinated. Moreover, Singh *et al.* [7] stated that, abscission of immature fruit occurs in all mango cultivars at all stages of fruit development and it is high especially during the first three to four weeks after pollination. Besides, Dutta *et al.* [17], who revealed that, self-pollination resulted in 75% degenerated ovules in 'Amrapali' and 'Mallika', which dropped within 21 days after pollination.

Concerning the number of retained fruits at harvest date, all cross combinations reach the maximum value of fruit drop (100 %) after 15 weeks from pollination treatments except the combination of (Hindi Khassa crossed by Zebda pollen) and the open pollination in the four studied cultivars. The average number of retained fruits per open pollinated panicles ranged from 1.4 in (Hindi Khassa) to 2.0 in (Ewais and Zebda) in the first season and ranged from 1.4 in (Ewais) to 2.2 in (Hindi Khassa) in the second season. While, the average number of retained fruits per Hindi khassa panicles crossed by Zebda pollen were 1.2 and 1.0 in 2013 and 2014 seasons, respectively. These results are in agreement with early findings of Pinto *et al.* [18], who found that fruit retention increased by cross-pollination.

Fluorescence-Microscopic Examination: Using fluorochrome dye such as aniline blue with ultraviolet light through fluorescence microscopic method allow pollen tubes to be traced through the style tissue, this technique had been already described by Martin [10] and Kho and Baër [11]. In this respect, Fig. 5, a and b showed some incompatibility characteristics with self-pollination treatments of Alphonse, Ewais, Hindi khassa and Zebda cultivars in most of resulted pollen tubes such as short tubes, which were unable to penetrate the style; and plugs which appeared along of the Alphonse, Hindi khassa and Zebda styles when crossed by Ewais pollen. This lagging in pollen tube growth delays its arrival to the base of the style end after 7 days from pollination. Stösser and Anvari [19] and Abou El-Nasr *et al.* [20] reported that incompatible tubes contained frequent large callose plugs which, sometimes continuous depositions along the tubes. Also, Afifi *et al.* [21] found in microscopic examination of pollen tubes revealed that both Langra and Fajri kalan cultivars were self-incompatible cultivars. Moreover, pollen tubes grew slowly when use Alphonse as a pollinizer for Ewais and Hindi khassa cultivars (Fig. 5 c and d), this slowly grow in pollen tube delays its arrival to the base of the style end after 7 days from pollination. Abou El-Nasr *et al.* [20] reported similar findings, with Taimour stigma when pollinated by Zebda pollen, they found that the germination of Zebda pollen on Taimour stigma was poor and the pollen tubes grew very slowly. When use Hindi khassa as a pollinizer for all crosses, pollen tubes grew to about 1/3 length of the style (Fig. 6 a) and pollen tubes started to reach the base of the style after 6 days from pollination. Fig. 6 b showed that, the partially cross compatible when use a Zebda cv.

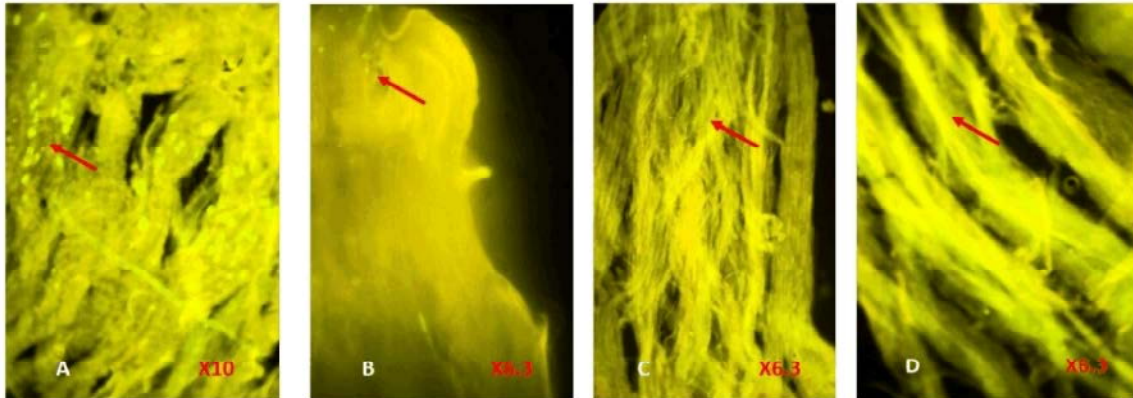


Fig. 5: Incompatibility characteristics.

- A.Plugs, which appeared along of the style.
- B.Short pollen tubes, which were unable to penetrate the style.
- C.Pollen tubes grew slowly in the style.
- D.Slowly grow in pollen tubes delays its arrival to the base of the style end.

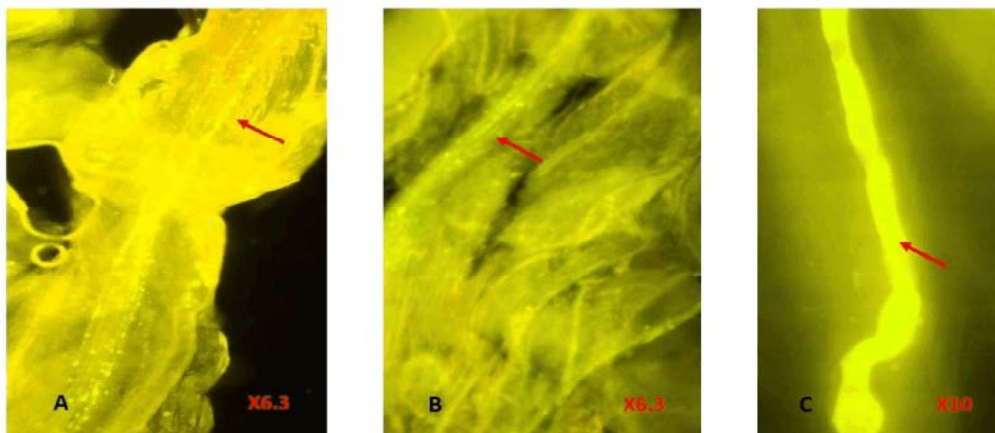


Fig. 6: Pollen tube growth:

- A.Pollen tubes grew to about 1/3 length of the style.
- B.Pollen tubes grew and reached to about 2/3 length of the style.
- C.Pollen tubes started to reach the base of the style.

as a pollinizer, pollen tubes grew and reached to about 2/3 length of the Alphonse style after 4 days from pollination and they started to reach the base of the style after 5 days from pollination. Additionally, Fig. 6 c showed that, pollen tubes started to reach the base of Hindi khassa style after 4 days from pollination. This combination seemed to be as compatible combination when use Zebda cv. as a pollinizer for Hindi khassa cultivar. The appearance and behaviors of pollen tubes were as detected in the observations made by Abou El Nasr and Stösser [22], Abou El Nasr and Ismail [23], Maklad *et al.* [24] and Maklad [25] who found that, tubes resulting from compatible cross-pollinations, grew rapidly down the style. While, in the incompatible self-pollinated mango

cvs., Maklad *et al.* [24] Gehrke-Velez *et al.* [4] and Maklad [25] observed slow pollen tube growth.

CONCLUSION

It can be concluded that the present results indicated that the highest initial number of fruitlets per panicle resulted from cross-pollination was observed with Hindi Khassa cv. when crossed by Zebda pollen. Meanwhile, the lowest initial number of fruitlets per panicle observed with Ewais cv. when self-pollinated by hand. Besides, the microscopic examination cleared that, germination of Zebda pollen grains on Hindi khassa stigmatic surface, were higher than other combinations and such pollen

tubes reached to the base of the style in 4 days after pollination, this is an indication of high cross compatible between these two cultivars. While, Ewais gave the lowest percentage of pistils with pollen tubes reaching the base of the styles 7 days after self-pollination. Moreover, it is noticeable that complete fruit drop occurred when the four cultivars were self-pollinated (by hand) which, indicated self-incompatibility in this four cultivars.

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