

## **SUMMARY AND CONCLUSION**

The present investigation was carried out during 1992 and 1993 seasons at the Citrus Orchard of the Faculty of Agriculture, Moshtohor, to study the chromosomal behaviour, pollen grains viability, fruiting and fruit quality in orange cultivars: Khalily Red, Tuncy, Centennial and Valencia. Also, Roga, Suckarry oranges and two sour orange cultivars i.e. Balady and Brazellian to investigate only the chromosomal behaviour and pollen grains viability.

the pollination treatments used in this study were as follows:

- 1- Open pollination (control).
- 2- Bagging only.
- 3- Emasculation and bagging.
- 4- Hand self pollination.
- 5- Cross pollination with Balady sour orange.
- 6- Cross pollination with Brazellian sour orange.
- 7- Cross pollination with Roga orange.
- 8- Cross pollination with Suckarry orange.

The histology of ovules fecundation and embryo development were also studied among the first four orange cultivars mentioned previously, to correlate these cultivars to fertility of each.

The results of these studies could be summarized as follows:

### **I- Cytological studies:**

#### **A- Chromosomal behaviour.**

- 1- The meiotic investigations of pollen mother cells showed that the chromosome number in all tested cultivars: Khalily Red, Tuncy,

Centennial, Valencia, Roga and Suckarry oranges as well as two sour orange cultivars: Balady and Brazellian was  $2n = 18$ . Thus, these cultivars were normal diploids.

2- In meiotic studies, it was found that the haploid number of chromosomes in all tested cultivars was  $n=9$ .

3- The chromosomal behaviour at meiosis in each of these cultivars showed 9 bivalents at late diakinesis and metaphase I stages. There were univalent chromosomes beside the bivalents in some pollen mother cells (PMC's) in different proportions.

More PMC's with univalents were observed in Centennial orange cultivar and Roga orange pollinizer than those in the other cultivars.

4- Cytological studies indicated that Suckarry orange and Balady sour orange cultivars showed more regular chromosomal behaviour than other tested cultivars did.

#### **B- Pollen grains viability:**

1- The percentages of pollen grains stainability and germination showed that the viability was highest in Suckarry orange and Balady sour orange, whereas it was lowest in Centennial orange cultivar.

2- There was a positive correlation between the percentages of stainable pollen grains and the percentages of germinated pollen grains.

3- It was found a negative correlation between the percentages of PMC's with univalents and the percentages of stainable pollen grains.

4- As a result of these cytological studies, one might conclude that Suckarry orange and Balady sour orange could be considered cytologically stable cultivars and can be safely used in breeding programs for citrus improvement.

2-2- Emasculation and bagging treatment did not give any fruits in all tested orange cultivars. That means, all these cultivars could not produce the parathenocarpic fruits.

2-3- It was found positive correlations between the percentages of well developed seeds per fruit on one hand and the percentages of each fruit set, remaining fruits after June drop and mature fruits on the other hand. The highest significant positive correlations were found in cross pollinations with Balady and Brazellian sour orange followed by cross pollination with Suckarry orange.

3- Concerning the interaction between investigated orange cultivars and different pollination treatments, it was found that combinations between Tuncy orange cultivar and cross pollinations with both Balady and Brazellian sour orange significantly caused the highest percentages of fruit set, remaining fruits after June drop and mature fruits, in addition significant increase in the percentage of fruit juice content and also, these combinations significantly gave the highest number of well developed seeds and the lowest number of shrivelled seeds per fruit in comparison with those of combinations between other three orange cultivars and remained pollination treatments. The combination between Tuncy orange cultivar and Suckarry orange as pollinizer, caused the lowest value of total acidity content and the highest value of T.S.S/acid ratio compared with those of other combinations.

The combinations of both Khalily Red and Valencia orange cultivars with different pollination treatments had significantly resulted in higher ascorbic acid content, while the interactions between different pollination treatments and both Tuncy and Centennial orange cultivars produced fruits of poorer ascorbic acid content.

### **III- Histological studies:**

- 1- Histological investigations showed that the initiation of embryo sac tookplace at the beginning of blooming in Khalily Red orange cultivar.
- 2- The embryo sac was completely differentiated and the two nucleate stages could be detected at the ballon stage of Valencia orange cultivar.
- 3- The Centennial orange cultivar showed the highest percentages of degenerated ovules, where degeneration of ovules in all tested orange cultivars was not observed within the first three days after treatments with the exception of Centennial orange cultivar when it's flowers were bagged only or emasculated and bagged.
- 4- The percentages of deteriorated ovules increased for all different pollination treatments within 7 to 30 days and reached to the maximum at 45 and 60 days after pollination treatments.
- 5- The fecundation occurred within 7-10 days after pollination of different orange cultivars.
- 6- The first divisions of free nuclear endosperm was noticed in the fertilized ovules within 15-20 days after hand self pollination of Khalily Red orange cultivar.
- 7- The first divisions of zygote took place at 30 days after cross pollination of Tuncy orange cultivar with Brazellian sour orange and the endosperm remained in the nuclear state.
- 8- The adventitious embryos appeared at 45 days after cross pollination of Tuncy orange cv. with Balady sour orange.
- 9- The sequent divisions of both sexual and adventitious embryos took place at 60 days after cross pollination of Tuncy orange cultivar with Brazellian and Balady sour orange, respectively.
- 10- Further development of nuclear endosperm forming cellular endosperm at 70 days after open pollination of Khalily Red orange cultivar.

- 11- The adventitious embryos developed to the main body with globular shape at 80 days after cross pollination of Tuncy orange cultivar with Balady sour orange.
- 12- The embryos reached to the cotyledonary stage and cellular endosperm began to disappear at 100 days after cross pollination of Tuncy orange cultivar with Suckarry orange.
- 13- The various parts of the complete embryo were formed (hypocotyle, radicle, cotyledons and plumule) and the seed coats were completely differentiated at 120 days after cross pollination of Tuncy orange cultivar with Brazellian sour orange.
- 14- Cross pollination with Suckarry orange pollen grains gave the lower percentages of deteriorated ovules and the high dimensions of fertilized ones in both Valencia and Khalily Red orange cultivars compared with those of other pollination treatments.
- 15- Cross pollination with Balady sour orange pollen grains gave the lowest percentages of degenerated ovules and the higher dimensions of fecund ones in Tuncy orange cultivar, while cross pollination with Roga orange pollen grains caused the low percentages of deteriorated ovules and the highest dimensions of fertilized ones in Centennial orange cultivar in comparison with other pollination treatments.