Studies on physiological behaviour in relation to fertility and fruiting in sorv1e orange cultivars

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The present investigation was carried out during 1992 and 1993seasons at the Citrus Orchard of the Faculty of Agriculture, Moshtohor, tostudy the chromosomal behaviour, pollen grains viability, fruiting and fruitquality in orange cultivars: Khalily Red, Tuncy, Centennial and Valencia.Also, Roga, Suckarry oranges and two sour orange cultivars i.e. Baladyand Brazellian to investigate only the chromosomal behaviour and pollengrains 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.6w 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 werealso studied among the first four orange cultivars mentioned previously, tocorrelate these cultivars to fertility of each.The results of these studies could be summarized as follows:1- Cytological studies:A~.Chromosomal behaviour.I-The meiotic investigations of pollen mother cells showed that thechromosome number in all tested cultivars: Khalily Red, Tuncy, Centennial, Valencia, Roga and Suckarry oranges as well as two sourorange cultivars: Balady and Brazellian was 2n = 18. Thus, these cultivarswere normal diploids.2- In meiotic studies, it was found that the haploid number ofchromosomes in all tested cultivars was n=9. 3- The chromosomal behaviour at meiosis in each of these cultivarsshowed 9 bivalents at late diakinesis and metaphase I stages. There wereunivalent chromosomes beside the bivalents in some pollen mother cells(PMGs) in different proportions.More PMC’s with univalents were observed in Centennial orangecultivar and Roga orange pollinizer than those in the other cultivars.4- Cytological studies indicated that Suckarry orange and Baladysour orange cultivars showed more regular chromosomal behaviour thanother tested cultivars did.B- Pollen grains viability:1- The percentages of pollen grams stainability and germinationshowed that the viability was highest in Suckarry orange and Balady sourorange, whereas it was lowest in Centennial orange cultivar.2- There was a positive correlation between the percentages ofstainable pollen grains and the percentages of germinated pollen grains.3- It was found a negative correlation between the percentages ofPMGs with univalents and the percentages of stainable pollen grains.4- As a result of these cytological studies, one might conclude thatSuckarry orange and Balady sour orange could be considered cytologicallystable cultivars and can be safely used in breeding programs for citrusimprovement.II-Studies on fruiting and fruit quality:1- It was found from specific effect of orange cultivar that Tuncyorange significantly gave the highest percentages of fruit set, remainingfruits after June DROP and mature fruits (yield), in addition, significantincrease in the percentage of fruit juice content and an increasing inT. S.S/acid ratio about three times as much as in fruits of three othercultivars. Also, Tuncy orange showed the lowest acidity content with anaverage of nearly one-third of that for three other cultivars. It significantlygave the highest number of well developed seeds and the lowest number ofshrivelled seeds per fruit in comparison with three other cultivars. Also,both Khalily Red and Valencia oranges had fruits of juice more richer intheir ascorbic acid content than both Tuncy and Centennial orangecultivars. 2-1- Regarding the specific effect of different pollination treatments,it was found that cross pollinations with Suckarry orange and Brazelliansour orange pollen grains caused significantly the highest percentages offruit set, remaining fruits after June DROP and mature fruits.Also, both pollinizers caused significant increase

in fruit weight andit's juice content expressed as weight in gm. per fruit. The two pollinizersignificantly gave the highest number of well developed seeds and thelowest number of shrivelled seeds per fruit when both were compared withother pollination treatments. Cross pollination with Suckarry orange pollengrains had significantly resulted in an increase in T.S.S/acid ratio andreduced the total acidity and ascorbic acid contents, but the reverse wastrue _by cross pollination with Balady or Brazellian sour orange, whereboth pollinizers caused thickest peel.2-2- Emasculation and bagging treatment did not give any fruits inall tested orange cultivars. That means, all these cultivars could notproduce the parathenocarpic fruits.2-3- It was found positive correlations between the percentages ofwell developed seeds per fruit on one hand and the percentages of eachfruit set, remaining fruits after June DROP and mature fruits on the otherhand. The highest significant positive correlations were found in crosspollinations with Balady and Brazellian sour orange followed by crosspollination with Suckarry orange.3- Concerning the interaction between investigated orange cultivarsand different pollination treatments, it was found that combinationsbetween Tuncy orange cultivar and cross pollinations with both Baladyand Brazellian sour orange significantly caused the highest percentages offruit set, remaining fmits after June DROP and mature fruits, in additionsignificant increase in the percentage of fruit juice content and also, thesecombinations significantly gave the highest number of well developedseeds and the lowest number of shrivelled seeds per fruit in comparisonwith those of combinations between other three orange cultivars andremained pollination treatments. The combination between Tuncy orangecutivar and Suckarry orange as pollinizer, caused the lowest value of total acidity content and the highest value ofT.S.S/acid ratio compared withthose of other combinations.The combinations of both Khalily Red and Valencia orangecultivars with different pollination treatments had significantly resulted inhigher ascorbic acid content, while the interactions between differentpollination treatments and both Tuncy and Centennial orange cultivarsproduced fruits of poorer ascorbic acid conten Histological studies:1- Histological investigations showed that the initiation of embryo sactookplace at the beginning of blooming in Khalily Red orange cultivar.2- The embryo sac was completely differentiated and the two nucleatestages could be detected at the ballon stage of Valencia orange cultivar3- The Centennial orange cultivar showed the highest percentages ofdegenerated ovules, where degeneration of ovules in all tested orangecultivars was not observed within the first three days after treatmentswith the exception of Centennial orange cultivar when it's flowers werebagged only or emasculated and bagged.4- The percentages of deteriorated ovules increased for all differentpollination treatments within 7 to 30 days and reached to the maximumat 45 and 60 days after pollination treatments.5- The fecundation occurred within 7-10 days after pollination of differentorange cultivars.6- The first divisions of free nuclear endosperm was noticed in thefertilized ovules within 15-20 days after hand self pollination of KhalilyRed orange cultivar.7_ The first divisions of zygote took place 'at 30 days after crosspollination of Tuncy orange cultivar with Brazellian sour orange andthe endosperm remained in the nuclear state.8- The adventitious embryos appeared at 45 days after cross pollination ofTuncy orange cv. with Balady sour orange9- The sequent divisions of both sexual and adventitious embryos tookplace at 60 days after cross pollination of Tuncy orange cultivar withBrazelhan and Balady sour orange, respectively.10- Further development of nuclear endosperm forming cellular endospermat 70 days after open pollination of Kha1ily Red orange cultivar.11- The adventitious embryos developed to the main body with globularshape at 80 days after cross pollination of Tuncy orange cultivar with Balady sour orange.12- The embryos reached to the cotyledonary stage and cellularendospenn began to disappear at 100 days after cross pollination ofTuncy 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 completelydifferentiated at 120 days after cross pollination of Tuncy orangecultivar with Brazelhan sour orange.14- Cross pollination with Suekarry orange pollen grains grains gave thelower percentages of deteriorated ovules and the high dimensions offertilized ones in both Valencia and Khalily Red orange cultivarscompared with those of other pollination treatments.15- Cross pollination with Balady sour orange pollen grains gave thelowest percentages of degenerated ovules and the higher dimensions offecund ones in Tuney orange cultivar, while cross pollination withRoga orange pollen grains caused the low percentages of deterioratedovules

and the highest dimensions of fertilized ones in Centennialorange cultivar in comparison with other pollination treatments.