

MORPHOLOGICAL AND PHYSIOLOGICAL STUDIES ON FLOWERING, POLLINATION AND FRUITING OF "PICUAL" OLIVE TREES

II- EFFECT OF SELF, OPEN, AND CROSS POLLINATION ON FRUIT SET, FRUIT DROP AND FRUIT CHARACTERISTICS

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ABSTRACT

The influence of self, open and cross pollination (with two pollinizers, i.e. Kronaki and Coratina olive cvs.) on fruiting of Picual olive trees were studied during 1997 and 1998 seasons under Giza conditions. Cross pollination significantly gave the highest number of fruit set per meter followed by open pollination, while self pollination ranked latter. Cross pollination with Kronaki pollen was more effective than Coratina pollen. In addition, cross pollination using Kronaki pollinizer showed the heaviest and largest fruits as compared to other pollination treatments. Moreover, Picual trees under cross pollination either by Kronaki or Coratina pollen as well as open pollination yielded fruits with higher dimensions than those resulted from self pollination treatment. Generally, cross pollination gave fruits of oblong shape, while fruits yielded from self pollination tended to have round shape. On the other hand, no significant influence on both flesh/fruit percentage and moisture content was observed according to the different pollination treatments. A slight increase in fruit oil content was recorded under cross and open pollination as compared to self pollination.

Keywords: Olive- Picual- pollination- - pollen grains- fruit set- fruit characteristics

INTRODUCTION

The majority of olive cultivars are self incompatible and failed to give satisfactory yield due to absence of suitable pollinizers (Morettini, 1957). Studies on pollination requirements of commercial olive orchards carried out by, Griggs *et al.* (1975); Lavee and Datt (1978); Singh and Kar (1980); Sutcu (1983); Bini (1984); Kar and Singh (1984), Suarez and Rallo (1987); Androulakis and Loupassaki (1990); Eassa (1993); Fernandez (1993); Hassan (1996) and Atawia (1997) indicated that cross and open pollination of different olive cultivars resulted in significant increases in fruit set, large and more uniform crops than self pollination. Therefore, to ensure maximum fruit production from olive orchards interplanted cultivars with sufficient overlap in bloom, to permit adequate cross pollination, is necessary.

The aim of this study was to overcome the low productivity of Picual olive cultivar by studying the influence of self, open and cross pollination treatments on the fruiting behaviour of the trees.

Thus, the present experiment was carried out to evaluate fruit set response of Picual olive trees to self, open and cross pollination with two

pollinizers and to determine the pollen pattern influence on fruit characteristics.

MATERIALS AND METHODS

The present study was conducted during 1997 and 1998 seasons on Picual olive trees of 8-10 years, the trees were planted six meters apart mixed with another olive cultivars in a private orchard in Giza Governorate.

In each season of the study, five replicate trees were chosen and after inflorescence appearance 40 shoots (one year old) were labelled and divided randomly into four groups (each of ten shoots) and examined for either self, open and cross pollination. The 10 self pollinated shoots were enclosed with pergamine bags and the top of the bags were wrapped to prevent entrance of unwanted pollen. This was done before flower opening by about 3-4 days to 14 days after full bloom. On the other side, 10 shoots per each tree were used for open pollination and left under natural conditions of the orchard. Meanwhile, cross pollination was done on the rest 20 shoots. When the inflorescences were at the balloon stage flowers on the selected 20 shoots were hand emasculated; covered with pergamine bags till reached the stage of anthesis and divided into 2 equal groups. Flowers of the first group were pollinated with pollen from Kronaki cv and flowers on the other 10 shoots were pollinated with Coratina pollen. Pollen grains of Kronaki and Coratina cvs pollinizers were collected from one-year-old flowering shoots at balloon stage before pollen discharge and the shoots were kept on sheets of paper over night at room temperature to encourage anther deiscence and then pollen grains for each cultivar were collected from inflorescences. In the next day, Picual shoots were cross pollinated with pollen of each of the two tested pollinizers.

Data were recorded for the following parameters:

- a- Fruit set: at the beginning of June 1997 and 1998 seasons (about 45 days after full bloom) and every 30 days interval during the fruit development, numbers of fruits setted on representative labelled shoots for each pollination type were recorded.
- b- Fruit drop: fruit drop percentage was recorded periodically every 30 days from the beginning of June till the beginning of September on the labelled shoots.
- c- Fruit physical and chemical characteristics: black mature samples were collected on the 15th of October of 1997 and 1998 seasons from the examined shoots of each pollination type to determine fruit weight (gm), fruit volume (cm³), fruit length (cm), fruit width (cm), fruit shape index, seed weight (gm), flesh/fruit (%), fruit moisture content (%) and fruit oil content (percentage/ 100 gm dry weight). The latter characteristic was determined by means of the soxhelt extraction apparatus using Hexan of 60-80°C boiling point as described by A.O.A.C. (1975).

The obtained data were statistically tested for analysis of variance using and means were compared using multiple L.S.D values at 0.05 level (Waller and Duncan, 1969).

RESULTS AND DISCUSSION

a-Fruit set

Table (1) showed the numbers of setted fruits per meter of Picual olive trees under self, open and cross (with either kronaki or Coratina pollen grains) pollination conditions which were recorded after about 45 days from full bloom and then periodically every 30 days during 1997 and 1998 seasons (*i.e.*, 1/6, 1/7, 1/8 and 1/9). It is cleared that, cross pollination was more effective and resulted in the highest significant number of fruit set per meter in all tested dates rather than self and open pollinations.

It is evident from the present results that cross pollination with Kronaki pollen gave the highest numbers of fruit setting/meter followed by cross pollination with Coratina and then open pollination, while self pollination ranked latter in this respect. These results are in line with the results of Lavee and Datt (1978); Sing and Kar (1980); Villemar *et al.*(1983); Sutcu (1983; Bini (1984) ; Kar and Sing (1984); Suarez and Rallo (1987); Androulakis and Loupassaki (1990) ; Eassa (1993); Fernandez (1993); Hassan (1996); Atawia (1997) as they reported that cross pollination increased fruit set in olives as compared with self pollination.

b- Fruit drop

Fruit drop percentage recorded periodically during 1997 and 1998 seasons (*i.e.*, 1/6 – 1/7, 1/7 – 1/8 , 1/8-1/9) under self, open and cross pollination conditions are presented in Table (2) . It can be noticed marked and higher dropping percentages in the olive fruitlets took place during early period of fruit development. Thereafter, these percentages gradually were decreased to their minimum values at pre-harvest. This observation was true for all different pollination types in the two studied seasons. As for the effect of pollination type on fruit drop, the obtained results showed that no apparent correlation could be detected between any of the different pollination types under study.

c- Fruit physical and chemical characteristics

c-1- Fruit weight and volume

Results in Table (3) and Plate (1) showed the values of fruit weight and volume of Picual olive trees under self, open and cross pollination conditions during 1997 and 1998 seasons. It is evident that cross pollination with Kronaki pollen grains gave the heaviest and largest fruits during the two studied seasons, followed by cross pollination with Coratina pollen grains and those under open pollination conditions. While self pollination had the least values in this respect.

These results agreed with those obtained by Eassa (1993) and Hassan (1996) who found that olive fruit weight and volume were higher under cross and open pollination rather than self pollination.

c-2- Fruit length, width and shape index

Results in Table (3) showed the effect of different pollination types on fruit length , width and shape index of Picual olive trees during 1997 and 1998 seasons.

The obtained results indicated that, cross pollination either by Kronaki or Coratina pollen as well as open pollination yielded fruits with higher dimensions as compared to those resulted under self pollination. The differences in some cases were non significant.

It can be concluded that, fruit length, width and consequently fruit shape index showed some differences regarding the pollination type and generally cross and open pollination had fruits of oblong shape, meanwhile those fruits resulted from self pollination tended to be round in shape.

The above results agreed with those obtained by Eassa (1993) and Hassan (1996) who found that olive trees under cross and open pollination conditions yielded fruits with significant higher dimensions rather than those under self pollination. While fruit shape index was not affected due to pollination type.

c-3- Seed weight

Results in Table (4) cleared that seed weight of Picual olive cv. under different pollination regimes recorded (0.90, 0.86 gm), (0.85, 0.82 gm), (0.87, 0.83 gm) and (0.70, 0.74 gm) for cross pollination with Kronaki and Coratina pollen, open and self pollination in 1997 and 1998 seasons, respectively.

Generally, it can be concluded that olive seed weight was significantly affected with different pollination types. As the self pollination showed the least values of seed weight in both seasons of study, while those produced under cross pollination with Kronaki pollen were the heaviest ones. Although the differences were significant only in the first season, they were insignificant in the second one.

These results are in harmony with those found by Eassa (1993) and Hassan (1996) who found that seed weight were higher under cross and open pollination as compared with those of self pollination.

c-4- Flesh / fruit ratio

Results presented in Table (4) showed the effect of different pollination types on the flesh /fruit percentage of Picual olive fruit. There were (83.36, 85.17%), (83.55, 84.46%), (81.91, 83.06%) and (82.63, 82.17%) for cross pollination with Kronaki and Coratina pollen, open and self pollination in 1997 and 1998 seasons, respectively. It could be noticed that, flesh /fruit percentages were not significantly affected by pollination types.

These results agreed with those of Eassa (1993) and Hassan (1996) who found that pollination type had no effect on the flesh /fruit percentage.

c-5- Fruit moisture content

Results present in Table (4) showed the effect of self, open and cross pollination on moisture content of Picual olive fruits during 1997 and 1998 seasons. Fruit moisture content values recorded were (58.11, 59.02%), (56.88, 60.37%), (59.25, 61.04%) and (58.81, 60.87%) for self, open and cross pollination with Kronaki and Coratina pollens in 1997 and 1998 seasons, respectively. It can be also noticed that the differences in fruit moisture content according to self, open and cross pollination were not obvious.

c-6- Fruit oil content

Oil content on dry weight basis of Picual fruits under the different pollination treatments were (32.45, 34.44%) , (34.52, 35.49%) , (36.54, 36.61%) and (36.24, 36.13%) for self, open and cross pollination with Kronaki and Coratina pollen in 1997 and 1998 seasons, respectively (Table, 4).

The obtained results recorded slight increases in fruit oil content under cross and open pollination rather than self pollination. In this respect, Eassa (1993) and Hassan (1996) found that oil content of olive fruits was higher under cross and open pollination as compared to those of self pollination.

Generally, it can be concluded from the obtained results, in the present study, that cross pollination of Picual olive trees with Kronaki pollen grains was more effective and resulted in the highest significant number of fruit set, fruit weight, volume, length and width followed by cross pollination with Coratina and then open pollination, while self pollination ranked latter in this respect.



Plate (1): Effect of different pollination treatments on fruits and seeds of Picual olive trees at ripe stage in 1998 season
1- Self Pollination 2- Open pollination
3- Picual X Coratina 4- Picual X Kronaki

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دراسات مورفولوجية و فسيولوجية على التزهير و التلقيح و الإثمار لأشجار
الزيتون "صنف البيكوال"

١- تأثير التلقيح الذاتي و المفتوح و الخلطي على العقد و التساقط و مواصفات
الثمار

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أجريت هذه الدراسة لبحث تأثير التلقيح الذاتي لأشجار الزيتون صنف البيكوال، التلقيح المفتوح و التلقيح الخلطي باستخدام صنفين من الزيتون كملقحات (الكروناكي و الكوراتينا) على الأثمار خلال موسمي ١٩٩٧ و ١٩٩٨. أوضحت نتائج الدراسة أفضلية التلقيح الخلطي حيث أدى إلى زيادة معنوية في عقد الثمار (عدد الثمار / المتر الطولي) عن التلقيح المفتوح و قد كانت نسبة عقد الثمار في التلقيح الذاتي الأقل معنوياً. التلقيح الخلطي باستخدام حبوب لقاح الصنف الكروناكي كان أكثر كفاءة من التلقيح الخلطي باستخدام حبوب لقاح الصنف الكوراتينا. بالإضافة إلى ما سبق، فإن أكبر الثمار وزناً و حجماً تكونت نتيجة للتلقيح الخلطي مقارنة بمعاملات التلقيح الأخرى. كما أوضحت نتائج الدراسة أن التلقيح الخلطي سواء بحبوب لقاح الكروناكي أو الكوراتينا نتج عنه ثمار ذات أبعاد أكبر من تلك الناتجة عن التلقيح الذاتي. وبصفة عامة فإن الثمار الناتجة عن التلقيح الخلطي كانت تميل إلى الشكل المطاول (وهو المرغوب) بينما الثمار الناتجة من التلقيح الذاتي أخذت الشكل الأقرب إلى الاستدارة (غير مرغوب). لم تتأثر نسبة اللحم في الثمار وكذلك محتوى الثمار من الرطوبة بمعاملات التلقيح المختلفة. لوحظ زيادة طفيفة في محتوى الثمار من الزيت نتيجة للتلقيح الخلطي و المفتوح مقارنة بالتلقيح الذاتي.

يمكن التوصية من خلال نتائج هذه الدراسة بضرورة استخدام التلقيح الخلطي مع الصنف البيكوال خاصة استخدام الصنف الكروناكي حيث أظهر كفاءة أعلى في زيادة نسبة العقد و تحسين جودة الثمار.