Journal of Horticultural Science & Ornamental Plants 16 (1): 44-54, 2024
ISSN 2079-2158

DOI: 10.5829/idosi.jhsop.2024.44.54

Phenological Characterization of Some New Egyptian Olive Genotypes

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Abstract: In order to create new genotypes through cross-breeding between a number of prominent domestic and foreign cultivars, GIO project was started in 1994. These genotypes were initiated in Horticulture Res. Inst. in Giza's olive collection farm. The current study was carried out in two consecutive seasons (2022 and 2023) to phenologically characterize eleven olive genotypes (8 years old), to select the most superior ones that were suitable for planting in this region. Flowering periods, measurements, fruit set and yield parameters were studied. Most of table genotypes coincided in their beginning of flowering with the exception of genotype (G.)91 which was slightly earlier and G.102 was the earliest one and had the longest flowering period. G.48 recorded best values in perfect flower% and flowering density followed by G.97 in perfect flower% and G.102 in flowering density, G.66 was the best genotype followed by G.48 and G.69 genotypes in initial and final fruit set respectively. Moreover, G.48 recorded the greatest yield/tree while G.32 was the lowest one during 2022 and 2023 seasons. Abstractly from the general evaluation, G.48 then G.66 (Oil genotypes) followed by G.92 (table genotype) recorded superior results in total characteristics of the study, contrary genotype 32 was the least one. Based on all of the above results, Genotypes 48, 66 and 92 were recommended under conditions of the studying region, taken in consideration that, G.102 (table genotype) has a relative advantage in the earliest flowering genotype compared with the others under studying region conditions, which is an important aim of breeding programs.

Key words: Olive · Characterization · Genotypes · Flowering · Yield and Phonological

INTRODUCTION

The cultivation of the olive tree (*Olea europaea* subsp. Europaea) has a great importance in terms of its ecology, economy and culture in the Mediterranean region [1]. It is considered to be an agricultural ecosystem with significant potential for multi-purposes use opportunities (e.g. fruits, oil and wood), environmental impacts (e.g. water availability, CO_2 emission contribution) and cultural heritage (e.g. biodiversity conservation) [2].

The great efforts made in Egypt over the past three decades and the introduction of new cultivars, resulted in the extension of olive plantation in new reclaimed areas. The last statistics of the Ministry of Agriculture and land Reclamation [3] showed that, the total acreage grown with olive reached 268124 feddan and the fruiting area is 219014 with total production 1011444 tons.

Few breeding programs by crossing and selection in the progenies have been initiated in the past decades [4-6]. As a consequence, several new cultivars have been released such as Maalot, Tevere and Basento" [7]. A morphological scheme of primary descriptors which proved to be suitable for discriminating cultivars has been used [8]. The secondary characterization of many cultivars such as growth, productivity and fruit parameter were also completed [9].

However, Orlandi *et al.* [10] have also shown a notable influence of environmental variables on olive flowering phenology, which has been proposed as an indicator of climate change [11]. Olive tree flowering phenology has been found to be influenced by a variety of environmental conditions, including water availability and air temperature [12-14]. Also, the duration of the growth season, the flowering timing and intensity are important factors that determine the ultimate olive yield and they can be affected by climatic variability and the occurrence of extreme weather phenomena [15].

In the same line in Egypt, many recently introduced genotypes are the outcome of the olive breeding program, which was started in the Horticultural Research Institute

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in Egypt in 1994. The program involved crossing local and foreign cultivars to produce new genotypes of olives with some of the desirable traits of oil and table cultivars. The aim of the breeding program was enhancing existing cultivars' features and creating new cultivars with desirable traits like early bearing, high production, high oil quality, enhanced rooting ability and adaptability for mechanical harvesting [16, 17]

Several investigations have studied the morphological, phenological, physical and chemical characteristics of olive fruits and oil, to evaluate different cultivars [18-22]. Others studies also interested in the new Egyptian genotypes, including the rooting ability, morphological and the chemical characteristics [17, 23, 24, 25, 26]. More than, multi-environment experiments made it possible to effectively measure how genetic, environmental and their interactions affected the phenology of flowering and quality of flowers in olives [27].

Hence the importance of this investigation to complete the scene by studying the phenological characterization of these new Egyptian genotypes and their floral behavior under the conditions of the study region to give a complete and clear vision about their performance. We cannot ignore the fact of needs to many of these phenological studies in different regions especially under different expansion regions to obtain the most suitable genotypes under the conditions of each.

MATERIALS AND METHODS

Site Description: This study was carried out in the Horticulture Research Institute's experimental orchard at the Agricultural Research Center in Giza, Egypt, during 2022 and 2023 seasons on eight years old tree of eleven olive genotypes that generated by Genetic Improvement of Olive (GIO) project, 1994 and divided into three groups (as shown in Table 1), table olive genotypes (24, 32, 55, 91, 92, 97, 99 and 102), oil olive genotypes (48 and 66) and dual purpose olive genotype (69).

The same agricultural practices were applied to each genotype under investigation.

Soil chemical and physical characteristics and water chemical properties were determined by the laboratory of Soil, Water and Environmental Research Institute, Agricultural Research Center and were summarized in Tables (2 & 3).

Meteorological Data: Maximum, minimum and average temperature at the experimental orchard was obtained by Africa data hub [28].

Data Recorded
Phenological Characteristics:
Flowering Dates:

- Start of flowering date (when 10-25% of flowers were opened).
- Full bloom date (when 50-80% of flowers were opened).
- End of flowering date (when 25% of fruits were set).
- Flowering period (No. of days from start to end of flowering dates).

Flowering Measurements
Qualitative Measurements
Number of Flowers/Inflorescence: It was classified into low (<18 flowers). medium (18-25 flowers) and high (>25 flowers) according to IOC [29].

Inflorescence Length: It was classified into short (<2.5 cm), medium (2.5-3.5 cm) and long (>3.5 cm) based on IOC [29].

Intensity of Flowering: It was classified as into very low (<1-20 Inflorescence), low (20-40 Inflorescence.), medium (40-60 Inflorescence), high (60-80 Inflorescence) and very high (80-100 Inflorescence) according to Cimato and Attilio [30].

Quantitative Measurements
No. of Total Flowers/ Inflorescence: Thirty inflorescences at the middle portion of the shoot were randomly chosen from inner and outer portion of the tree canopy to determine the total number of flowers per inflorescence.

No. of Perfect Flowers/Inflorescence: Thirty inflorescences at the middle portion of the shoot were randomly chosen from inner and outer portion of the tree canopy to determine the number of perfect flowers per inflorescence.

Flowering Density Percentage: Flowering density was calculated [31], according to the following equation:

$$\text{Flowering density} = \frac{\text{No. of inflorescences}}{\text{Shoot length (cm)}} \text{x}100$$

Perfect Flower Percentage: It was calculated according to Hegazi & Stino [32] and Hegazi [33], as the following equation:

$$\text{Perfect flower \%} = \frac{\text{Number of perfect flowers}}{\text{Number of total flowers}} \text{x}100$$

Table 1: Sources of genotypes as indicated on GIO project map

Genotype	Mother	Derived from	Purpose
24	Aggizi Shame	♀ Aggizi Shame x Kalamata ♂	Table
32	Kalamata	Open pollination	Table
55	Manzanillo	Open pollination	Table
91	Manzanillo	Open pollination	Table
92	Manzanillo	Open pollination	Table
97	Manzanillo	Open pollination	Table
99	Manzanillo	Open pollination	Table
102	Manzanillo	Open pollination	Table
48	Coratina	♀ Coratina x Toffahi ♂	Oil
66	Toffahi	♀ Toffahi x Arpequina ♂	Oil
69	Tofahii	♀ Toffahi x Kalamata ♂	Dual

Table 2: Physical and chemical properties of the soil under study

Property	Value	Property	Value
Sand (%)	27.48	Available micronutrients (mg kg^{-1})	
Silt (%)	34.22	Fe	6.71
Clay (%)	38.30	Mn	6.52
Texture	Clay loam	Zn	4.68
$CaCO_3$ $gkg^{-1}{}_3$	45.6	Soluble ions (meq/L)	
EC (dS m^{-1})	2.92	Ca^{++}	13.8
pH (1:2.5) susp.	7.88	Mg^{++}	10.5
Organic matter (%)	2.29	Na^{+}	4.6
Available macronutrients (mg kg^{-1})	K^{+}	0.70	
N	33.30	HCO_3^{-}	5.8
P	5.50	Cl^{-}	8.0
K	360	SO_4^{--}	15.8

Table 3: The chemical analyses of the tested water sample (Nile water) collected from the experimental area

		Cations (meq/L)				Anions (Meq/L)			
E.C (dS/m)	pH	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}	SAR
0.55	7.84	1.50	1.53	1.32	0.18	1.40	1.40	1.73	1.07
				Some macro micro nutrients (ppm)					
N	P	K	Fe	Mn	Zn	Cu	Pb	Ni	B
1.36	0.54	7.02	0.02	0.04	0	0.04	0.01	0.01	0.07

Table 4: Maximum, Minimum and average temperature from the experimental area (Giza region) during 2022 and 2023 seasons

	2022			2023		
Month	Max.	Average	Min.	Max.	Average	Min.
January	17.89	12.5	7.43	21.48	15.33	9.51
February	20.16	14.49	9	19.56	14.03	8.87
March	20.51	15.3	10.24	24.86	18.9	13.23
April	28.87	22.3	16.14	27.4	21.33	15.42
May	30.41	24.42	18.99	30.11	24.32	18.9
June	33.99	28.18	22.95	33.58	27.9	22.42
July	35.19	29.15	23.78	36.82	30.41	24.4
August	35.28	29.44	24.25	35.75	29.71	24.23
September	33.74	28	22.65	34.67	28.8	23.11
October	29.3	24.12	19.19	30.55	25.25	20.15
November	25.54	19.94	14.48	27.54	21.86	16.34
December	23.3	17.3	11.65	23.5	17.80	12.10

Fruit Set and Yield

Initial Fruit Set Percentage: It was calculated after 20 days from full bloom according to the following equation.

$$\text{Initial fruit set \%} = \text{No. of fruits x } \frac{100}{\text{Shoot length (cm)}}$$

Final Fruit Set Percentage: It was calculated after 60 days from full bloom according to the same equation of the initial fruit set%.

Yield/tree (Kg): Fruits were harvested during ripe stage (pigmentation on more than 50% of the skin) and the average tree yield of each genotype was calculated.

General evaluation of the phenological characteristics and yield/trees of some olive genotypes:

The final evaluation of the investigated genotypes phonological characteristics was performed according El-Husseiny and Arafat [25]; the evaluation was calculated depending on the average of 2022 and 2023 seasons basis of 100 units, which were equality shared between 5 characteristics (20 units for each one) as follow: average total flowers/inflorescence, flowering density, perfect flowers%, initial fruit set% and yield/tree (kg).

Statistical Layout and Analysis: The experimental layout was in a simple arrangement, with one factor (olive genotypes) arranged in Complete Randomized Design (CRD). The obtained data were tabulated to analysis of variance and significant differences among means were determined according to Snedecor and Cochran [34]. Duncan's multiple range test was used for comparison between means of the studied treatments [35].

RESULTS AND DISCUSSION

Phenological traits, flowering and set characteristics during (2022 and 2023 seasons) of eleven olive genotypes were evaluated as follow:

Flowering Periods: From the data in Figure (1) and Table (5), it was noticed that, there were a slight difference in the flowering period of the two studied seasons from its beginning which ranged between (1) day in table olive genotypes and (2) days in both of oil and duel olive genotypes. While all of tested genotypes attained (2) days at the end of flowering in 2022 and 2023 seasons, that was related to the presence of differences in temperatures during the same period which was cleared in (the green circle of Fig. 1).

As resulted from Table (1) and Fig. (2) during 2022 and 2023 seasons, most of the table purpose genotypes coincided in their beginning of flowering (29 and 30 March respectively), with the exception of genotype 91 which was slightly earlier (27 and 29 March respectively) and genotype 102, which was the earliest one (25 and 26 March respectively) and had the longest flowering period (14 days), while the oil purposed genotype 48 is the most delayed of all (3 and 5 April respectively) . However, the oil purpose genotype 66 coincided with the dual purpose genotype 69 (26 and 28 March respectively in the two seasons of the study).

The aforementioned results agree with Moreno-Alias *et al.* [36] and Rosati *et al.* [37], who found that, flowering time was influenced by genetic sources. Also, El-Badawy *et al.* [38]and Cesaraccio *et al.* [39] noticed that the duration of flowering differed according to cvs., varied from one season to another and differed in its thermal requirement and their physiological status. Moreover, the phonological behavior of olive tree is largely influenced by environmental factors such as temperature. Olive cultivars have been categorized as having early, moderate, or late flowering [40-42]. Contrary to the environmental effect, this shows how challenging it is to use breeding to create new olive cultivars with early flowering, which could be desirable to avoid the high temperatures that are common in many areas where olives are grown, particularly in the climate change scenario. Finding consistent genetic variability for this characteristic may require evaluating a broader range of cultivars [27]. In the same line, Biagnami *et al.* [43] studied different varieties and ecologies, reported that the flowering dates of olive varieties changed when the temperature was 2°C higher. Meanwhile, Canözer [44] found that, there was no difference between the varieties in terms of the beginning date of flowering and the period between the beginning of flowering and full blooming was determined to be 10 days in these varieties.

Flowering Measurements

Qualitative Measurements: From Table (6) it was cleared that the descriptive characteristics of the number of-flowers/inflorescence were medium (18-25) in most genotypes, with the exception of genotype 48, which was high (>25), while genotypes 92 and 97 were low (<18). Also, all genotypes had a medium inflorescence length (2.5-3.5 cm), except for genotype 48, which had a long inflorescence (>3.5 cm). As for flowering density, it was medium for most genotypes (40-60 inflorescences), while genotypes 91, 102 and 48 had a high flowering density (60-80 inflorescences).

Table 5: Flowering Dates and flowering periods of some olive genotypes during 2022 and 2023 seasons

	Start of flowering		Full bloom		End of flowering		Flowering period	
Genotype	2022	2023	2022	2023	2022	2023	2022	2023
24	29-Mar	30-Mar	03-Apr	05-Apr	06-Apr	08-Apr	10 days	11 days
32	29-Mar	30-Mar	05-Apr	07-Apr	09-Apr	11-Apr	11 days	12 days
55	29-Mar	30-Mar	05-Apr	07-Apr	08-Apr	10-Apr	10 days	11 days
91	27-Mar	29-Mar	02-Apr	04-Apr	06-Apr	08-Apr	10 days	12 days
92	29-Mar	30-Mar	05-Apr	07-Apr	09-Apr	11-Apr	11 days	12 days
97	29-Mar	30-Mar	03-Apr	05-Apr	07-Apr	09-Apr	9 days	10 days
99	29-Mar	30-Mar	05-Apr	07-Apr	08-Apr	10-Apr	10 days	11 days
102	25-Mar	26-Mar	03-Apr	05-Apr	07-Apr	09-Apr	14 days	14 days
48	03-Apr	05-Apr	08-Apr	10-Apr	15-Apr	17-Apr	12 days	12 days
66	26-Mar	28-Mar	03-Apr	05-Apr	08-Apr	10-Apr	14 days	13 days
69	26-Mar	28-Mar	03-Apr	05-Apr	08-Apr	10-Apr	14 days	13 days

Table 6: Qualitative measurements of some olive genotypes during 2022 and 2023 seasons

	Number of flowers/inflorescence			Inflorescence length (cm)			Intensity of Flowering (No. of inflorescence/meter)				
Genotype	Low < 18	Medium 18-25	High > 25	Short < 2.5 cm	Medium 2.5-3.5 cm	Long > 3.5 cm	Very Low1-20	Low 20-40	Medium 40-60	High 60-80	Very High 80-100
24		—			—				—		
32		—			—				—		
55		—			—				—		
91		—			—					—	
92	—				—				—		
97	—				—				—		
99		—			—				—		
102		—			—					—	
48			—			—				—	
66		—			—				—		
69		—			—				—		

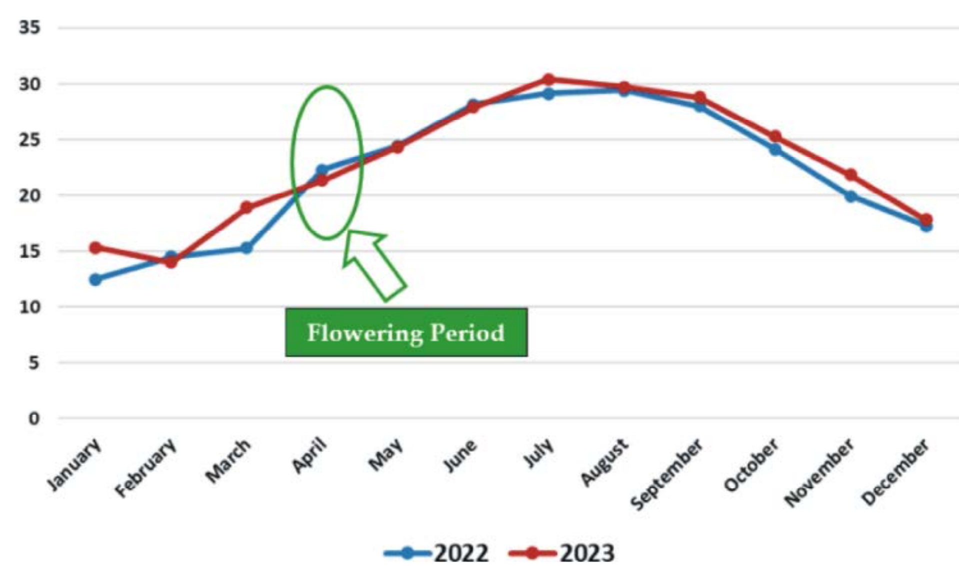

Fig. 1: The relationship between flowering periods of the studied olive genotypes and Average temperature during 2022 and 2023 seasons under Giza Region

Similarly, in accordance with the primary olive genotype characterization approach of IOC [29], most of tested genotypes had low number of flowers/inflorescence (< 18 flowers) and some had medium number of flowers/inflorescence (18-25 flowers). However, Laaribi *et al.* [45] Barranco *et al.* [46] found, that some of studied genotypes had short inflorescence length (< 25mm) and others had the long inflorescence (>35mm).

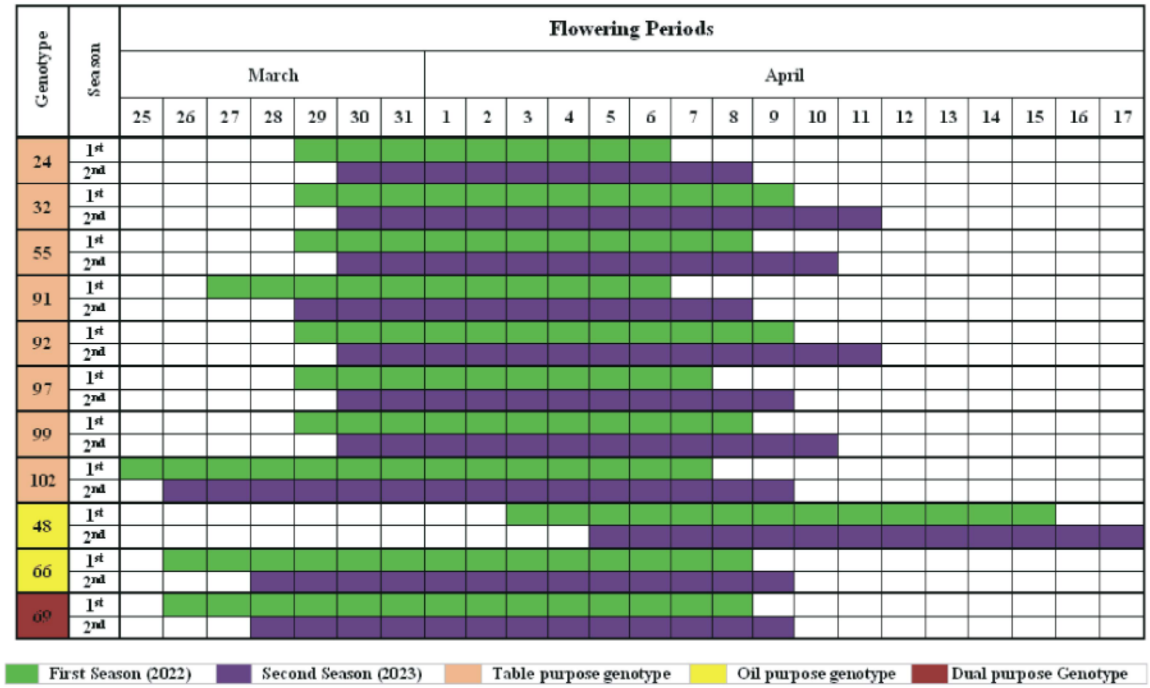

Fig. 2: Flowering periods of the studied olive genotypes during 2022 and 2023 seasons

Quantitative Measurements

No. of Total Flowers/ Inflorescence and No. Of Perfect Flowers/ Inflorescence: According to the presented in Table (7), the oil olive genotype (48) attained the highest total number of flowers (26.00 and 27.67) and number of perfect flowers (21.67 and 27.67) per the inflorescence compared with other genotypes respectively during 2022 and 2023 seasons. Similarly, genotypes 69 and 102 gave the highest total number of flowers (26.67 and 26.00) respectively in the second season, while genotypes 92 and 32 were the lowest in total number of flowers (14.33 and 15.67) and number of perfect flowers (3.00 and 5.67) respectively during the two seasons of the study.

Flowering Density Percentage and Perfect Flower Percentage: Data in Table (8) noticed that, genotype 48 showed significant superiority in the percentage of perfect flowers (91.55% and 100%) and flowering density (65.38 and 86.85), followed by genotypes 97 and 102 in percentage of perfect flowers (58.82% and 92.33%) and flowering density (59.76 and 74.19) respectively during the two seasons of study, while genotype 32 was the least in percentage of perfect flowers (13.04% and 23.63%) and genotype 69 in flowering density (38.26 and 46.55) respectively during 2022 and 2023 seasons.

The previous results go generally with those found by Moreno-Alias *et al.* [36]; Reale *et al.* [47]; Navas-Lopez *et al.* [48] and Rosati *et al.* [37] who noticed that flower quality are influenced by genetic resources, which revealed high genetic variability that could be a crucial factor in breeding programs aimed to increase production, given the evidence of a very high heritability for this trait [49]. Additionally, Bellini *et al.* [50]; El-Sayed [16] and Mikhail [17] reported that percentage of perfect flowers differed according to some factors such as cultivar, growing season, leaf to bud ratio, nutritional status and water stress during inflorescence development. Also, fluctuation was found from season to season, tree to tree, shoot to shoot, inflorescence to inflorescence, also, the perfect flowers% can be largely influenced by the flowering density [51, 23, 24]. In the same line, it has been demonstrated that high temperature and drought have a detrimental impact on olive flower quality such pistil abortion and formation of imperfect flowers [52, 53, 54]. Meanwhile, Cuevas and Rallo [55] reported that olive tree productivity is impacted by both direct and indirect effects of flowering density, one such influence was observed in the percentage of perfect flowers.

Fruit Set and Yield: Data in table (9) showed that, genotype 66 excelled in the initial (24.67% and 25.67%) and final fruit set (12.50% and 16.17%) respectively, during the two studied seasons, followed by genotype 48 in initial fruit set (23.00% and 23.33%) and genotype 69 in final fruit set (9.17% and 14.17%) respectively in 2022 and 2023 seasons, while genotype 48 showed superiority in the yield per tree

Table 7: No. of total flowers/ inflorescence and No. of perfect flowers/inflorescence of some olive genotypes during 2022 and 2023 seasons

	No. of total flowers/ inflorescence		No. of perfect flowers/inflorescence	
Genotype	2022	2023	2022	2023
24	18.00DE	18.67E	9.00C	12.00C
32	23.00B	24.00C	3.00G	5.67H
55	18.67DE	21.67D	8.00D	8.00G
91	18.33DE	24.00C	9.00C	10.67D
92	14.33F	15.67F	6.33E	9.33E
97	17.00E	17.33E	10.00B	16.00B
99	19.00D	22.33CD	10.33B	16.00B
102	21.00C	26.00AB	4.67F	9.00EF
48	26.00A	27.67A	21.67A	27.67A
66	23.33B	25.67B	10.67B	16.33B
69	23.67B	26.67AB	7.33D	8.33FG

There is no significant difference among means have the same letter in the same column at $p \leq 0.5$ according to Duncan multiple range test

Table 8: Percentages of perfect flowers and flowering density of some olive genotypes during 2022 and 2023 seasons

	Perfect flowers (%)		Flowering density (%)	
Genotype	2022	2023	2022	2023
24	50.00D	64.27D	39.22H	67.07D
32	13.04K	23.63K	43.86F	63.54F
55	42.85H	36.92H	38.26I	63.54F
91	49.10E	44.46G	54.11C	68.05D
92	44.17G	59.54F	52.75D	66.66E
97	58.82B	92.33B	42.86F	48.57H
99	54.37C	71.65C	38.26I	49.52G
102	22.24J	34.62I	59.76B	74.19B
48	91.55A	100.00A	65.38A	86.85A
66	45.74F	63.62E	45.29E	66.67E
69	28.19I	31.23J	38.26I	46.55I

There is no significant difference among means have the same letter in the same column at $p \leq 0.5$ according to Duncan multiple range test

Table 9: Percentages of initial, final fruit set and yield/tree of some olive genotypes during 2022 and 2023 seasons

	Initial fruit set %		Final fruit set %		Yield (kg/tree)	
Genotype	2022	2023	2022	2023	2022	2023
24	13.00E	15.00F	3.50GH	7.17DE	17.32E	24.00E
32	7.33I	7.33I	2.50H	5.50F	6.68G	13.32F
55	10.00H	10.33H	3.83FG	9.17C	13.32F	38.68C
91	11.67FG	14.67F	5.50DE	6.83DE	20.00DE	38.68C
92	23.00B	21.67C	6.17CD	9.83C	24.00C	40.00C
97	16.00D	14.00F	8.33C-E	6.17EF	9.99F	28.00D
99	11.33G	12.33G	4.83EF	7.50D	17.32 E	25.32DE
102	12.33EF	17.33E	6.83C	15.83A	21.32CD	38.68C
48	23.00B	23.33B	9.50B	9.50C	45.00A	50.00A
66	24.67A	25.67A	12.50A	16.17A	37.00B	42.32B
69	18.00C	19.00D	9.17B	14.17B	24.00C	40.00C

There is no significant difference among means have the same letter in the same column at $p \leq 0.5$ according to Duncan multiple range test

Table 10: General evaluation of phenological characteristics and yield/tree of some olive genotypes depending on the average of 2022 and 2023 seasons

Genotype	Average total flowers/infl.	Flowering density	Perfect flower %	Initial fruit set%	Yield/tree	Total
24	13.9	14.0	11.9	11.1	8.7	59.6
32	17.9	14.1	3.8	5.8	4.2	45.8
55	15.3	13.4	8.3	8.1	10.9	56.1
91	16.1	16.1	9.8	10.5	12.4	64.7
92	11.4	15.7	10.8	17.7	13.5	69.1
97	13.1	12.0	15.8	11.9	8.0	60.7
99	15.7	11.5	13.2	9.4	9.0	58.8
102	17.9	17.6	5.9	11.8	12.6	65.8
48	20	20.0	20.0	18.4	20.0	98.4
66	18.6	13.8	11.4	20.0	16.7	80.5
69	19.6	12.1	6.2	14.7	13.5	66

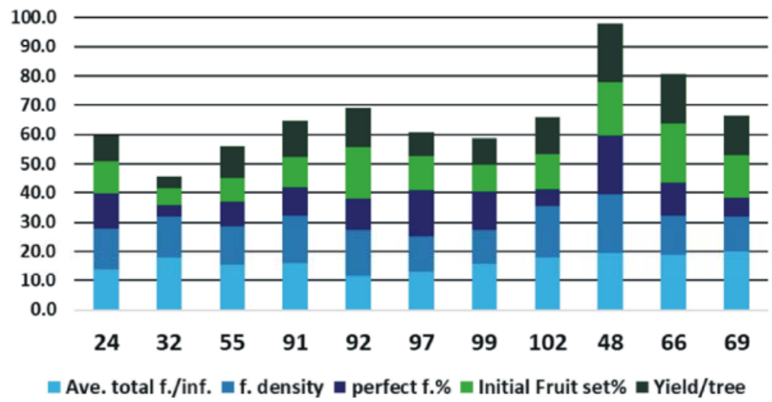

Fig. 3: General evaluation of the most main phenological characteristics and yield/tree of some olive genotypes depending on the average of 2022 and 2023 seasons

(45.00 Kg and 50.00 Kg), followed by 66 (37.00 Kg and 42.32 Kg) respectively during the two seasons of the study, However genotype 32 was the least one of all previous characteristics.

Similarly, the current result partially agrees with findings reported by Cuevas and Rallo [55]; Ferri *et al.* [56] and El-Badawy *et al.* [38] who indicated that variations in fruit set (%) among olive cultivars are caused by differing levels of self-fertility and cross-pollination requirements and percentage of perfect flowers which determining fruit set percentage. On the other hand, Mikhail [17]; Yamen *et al*. [57]; Dridi *et al*., [58] and Omran [26] showed that many of factors, including the biannual bearing phenomena, affect the olive yield with different levels according to the cultivar genotypes, environmental factors and relatively independent of the number of flowers. Also, yield/tree and fruit characteristics which were used as descriptive characteristics and thus are required for the new cultivar registration procedure for olive cultivar candidates in breeding studies [59, 60].

General evaluation of the most main phenological characteristics and yield/trees of some olive genotypes depending on the average of 2022 and 2023 seasons:

Tabulated data in Table (10) and Figure (3) demonstrated that, the evaluation units focused on 5 main characteristics, which are the most important ones in flowering, fruit set and productivity. Its results showed that the best genotypes in terms of the investigated phenological characteristics (in order) were genotypes 48, then 66 as oil purpose genotypes respectively recorded (98.4 and 80.5 units), then genotype 92 as table purpose genotype which recorded (69.1 units). However, the table purpose genotype 32 which recorded (45.8 units) was the least in total units of the selected phenological characteristics under the conditions of the study region. Taken in consideration, that although the fifth seat of ranking of genotype 102 in terms of flowering aspects and fruit set, it has the relative advantage which is early flowering under the condition of cultivation area, which is the aim of breeding program.

The previous general numerical evaluation of these olive genotypes are in harmony with those of El-Husseiny and Arafat [25] who found that data obtained from the system of numerical evaluation of tested genotype. The final evaluation was determined using a 100-unit basis, which were shared between the main investigated characteristics, the highest values of the genotypes received the "full mark" and the grand total of those characteristics determined the superior genotypes of the study. On the other hand, Jose [27] confirmed that, flower quality parameters showed a high genotype effect. Meanwhile, olive genotype with late flowering date generated a higher probability of damage caused by heat and/or water stress and the cultivation of genotypes with early flowering date was revealed to be a positive strategy [61].

CONOLUSION

Results of phenological parameter and the general evaluation table, illustrated that the best genotypes in terms of the investigated phenological characteristics (in order) were genotypes 48, then 66 as oil purpose genotypes, then genotype 92 as table purpose genotype. However, the table purpose genotype 32 was the least in total units of the selected phenological characteristics. Taken in consideration, that 102 (table purpose genotype) has a relative advantage in the earliest flowering one compared with the others under the condition of studying region, which is an important aim of breading program.

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