A Preliminary Study on Morphological Characters of Genetic Diversity of The Oldest Libyan Wild Olive Trees at The Jabal Al-Akhdar Region

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Received: 23/12/2023

Abstract: The genetic diversity of wild olive trees sampled from the seven oldest different trees from the Jabal Al-Akhdar region, at Albayada (Alwardya, Belhaded and Alhejab)- Libya, was evaluated using agro-morphological characters. The aim of this study is to determine morphological characters of the seven oldest wild olive trees (unknown genotypes). High significant variation among various trees was detected. The characters which were measured such as, mean number of fruit/kg, mean of fruit weight, size and shape, flesh thickness, and weight, and humidity percentage. The stone weight, shape, fruit flesh/stone ratio. Fruit oil content was measured as weight and dry matter for both wet and dry matter. These data sets were used to morphologically identify and desirable Libyan wild types, which were used to discriminate between use of fruit (oil, table or dual-purpose) as well as this research demonstrates that wild Libyan types have unique characteristics that differentiate them from imported varieties.

Keywords: Oleaster, wild olive, genetic diversity, Libya

INTRODUCTION

Olive tree (*Olea europaea* L) is considered one of the most widely cultivated fruit crop in the countries located around the Mediterranean basin. So, it has many varieties with a high genotypic and phenotypic diversity, as a result of natural selection for thousand years (Ouazzani et al., 1996; Abdessemed et al., 2015). It is considered one of the distinctive features of the Mediterranean region. That olives generally exist in two forms: the wild form (Olea europaea subsp. europaea var. sylvestris), and the cultivated form (Olea europaea subsp. europaea var. europaea) (Belaj, et al., 2007), both of them have the same number of chromosomes (Contento et al., 2002), so it's difficult to distinct morphologically between these two-form owing to their similar phenotypes (Bronzini de Caraffa et al., 2002a). Wild olive populations play an important role from an ecological standpoint in protecting the environments in which they grow to confront the manifestations of desertification, due to their great ability to adapt to drought, frost, and the effects of wind, especially the very long life span for the trees which allows it to grow and survive for thousands of years ((Mulas and Deidda, 1998; Belaj et al., 2007). According to Zohary and Spiegel-Roy, (1975), the Oleaster has settled and spread in harsh environments and climatic conditions, including arid or semi-arid, as well as saline soil in the Mediterranean basin. The presence of wild olives is also considered the best bioindicator for a region Mediterranean floristic (Rubio et al., 2002). Wild olives reproduce sexually, as pollination is carried out by wind, and birds also help dispersed their seeds mainly (Alcantara and Rey, 2003). According to Mendilcioglu, (1999); Sesli and Yegenoglu, (2010); Boucheffa et al., (2019), the wild olive is very important in terms of breeding programs, where it is frequently used as rootstock in olive cultivation (Kole, 2011), and serves as a source of genes for resistance against diseases and abiotic stresses. Through studies, it was become clear that wild olives exist in only two regions in Libya, namely the Jabal Al-Akhdar region and the Western Mountain region. Therefore, 7 of the oldest trees, each over 200 years old, were chosen to study the morphological characteristics of their fruits due to their genetic diversity in order to preserve them and preserving biodiversity, which is threatened by urban expansion. The morphological description served as the primary identification tool, which includes the most important morphological characteristics for trees and its fruits (Ipek et al., 2012).

The aim of this study is to characterize some the oldest wild Libyan olive trees (genotypes) to look for extending of the possibility of improving the characteristics of cultivated varieties. To reach this aim, we examined morphological traits related to the fruits, stones, and oil content.

MATERIALS AND METHODS

Study region:

The research was conducted in the Jabal Akhdar region, southeast of Benghazi Governorate - which located on the Mediterranean coast in northeastern Libya. Samples were collected during field missions in 2021 and 2022. Seven of the oldest wild olive trees, each over 200 years old, were selected to study the morphological characteristics of the fruits.

Morphological measurements: -

-Fruits measurements:

The fruits samples were collected in 4 replications (100 fruits per replicate) to determined mean of fruit weight (g), mean of fruit shape, was determined from length (L) and width (W) ratio which divided to 3 groups: Spherical (L/W < 1.25), Ovoid (L/W 1.25-1.45), and Elongated (L/W > 1.45), mean of flesh thickness (cm), mean of fruit flesh/stone ratio (%).

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-Stone measurements:

The mean of stone weight (g), mean of stone shape, was determined from length (L), and width (W) ratio which also divided to 4 groups: Spherical (L/W < 1.4), Ovoid (L/W 1.4-1.8), Elliptic (L/W 1.8-2.2) and Elongated (L/W > 2.2).

-Olives oil percentage in fruits(%) :

Olive oil percentage was determined in olive fruits by using that equation:

$$\text{Olive oil content in dry matter (\%)} = \left[\frac{\text{weight of oil}}{\text{weight of dry matter}} * 100\right]$$

$$\text{Olive oil content in wet matter (\%)} = \left[\frac{\text{weight of oil}}{\text{weight of wet matter}} * 100\right]$$

The percentage of olive oil was estimated by using a Soxhlet, at the Laboratory of Agricultural Research at Al-Fataeh station in Derna city.

-Statistical analysis:

Data were analyzed using SPSS statistical analysis software, where analysis of variance was performed using least significant difference (LSD 0.05), according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Fruits characteristics:

The following Figure (1) shows some of the characteristics of the fruits of the seven oldest wild olive trees genotypes in the Jabal al-Akhdar region in Benghazi city in Libya, specifically focusing on fruit size, fruit weight, fruit shape. The data showed that there are clear differences among the fruit characteristics of these seven genotypes under study, as we find that the smallest average fruits size was 0.17 cm3 in the sixth genotype, while the largest average size of the fruits was 1.05 cm3 in the second genotype. Additionally, there was a similarity in fruit size across 3 genotypes, which reached 0.48cm3 in the third, fourth and fifth.

The average fruit weight also varied among the seven trees, as the highest mean fruit weight was 0.84 g/fruit, and thus the mean number of fruits reached 1190 fruits/kg in the second genotype. On the other hand, the lowest average fruit weight was 0.27 g/fruit, and thus the average number of fruits reached 3704 fruits/kg in the sixth genotype. Therefore, the second genotype exhibited superior in fruit characteristics (size and weight) compared to the other genotypes.

As for the shape of the fruits, the genetic structures differed among themselves in the shape of the fruits, ranging from spherical, oval, and elongated. The shape fruits of the third genotype were spherical, but the shape of fruits was oval in the first, fifth and sixth genotypes, and in the end the shape fruits were elongated in the second, fourth and seventh genotypes. Figure (2) shows the characteristics of the fruit flesh of wild olive trees in the Jabal Al-Akhdar region, where notice the difference in the flesh thickness between the seven genotypes. The fifth genotype exhibited the greatest average flesh thickness, which measuring 0.98 cm, while the second genotype had the smallest average thickness, which amounted to 0.22 cm. Although the second genotype having the thinnest flesh, it had the maximum average weight of the fleshy part, which reached 0.54 g, an increase of 217.65% compared to the sixth genotype, which recorded the lowest weight of the fleshy part of the olive fruits. It is also clear that there is great similarity between the sixth and seventh genotype in terms of the thickness and weight of the fleshy part of the fruits. Figure (3) shows the characteristics of olive Endocarp (stone) in terms of average weight and shape of the seven oldest wild olive trees in Al Jabal Al-Akhdar region. The shape of the olive stones varied among genotypes, with shapes including spherical, ovoid, and elliptical. The olive stone shape in the first and fifth genotypes was spherical, while the stone shape of the third, sixth, and seventh genotypes the stone were oval, and finally the olive stone shape of the second and fourth were elliptical. On the other hand, the weight of the olive stone remained consistent across genotypes, as it was all low, not all exceeding 0.3 g. The highest mean weight of the olive stone was 0.3 g for the second genotype olive stones, while the lowest was 0.1 g for the sixth genotype. The data in Figure 4 shows the olive flesh /stone ratio, and the percentage of moisture in wild olive fruits in Al Jabal Al-Akhdar region. The moisture percentage in olive fruits ranged from 20.8% to 30.5%, with the third genotype exhibited the lowest average moisture percentage in the fruits, while the highest average moisture percentage was in the fruits of the second genotype. On the other hand, the fourth genotype recorded the highest average for fruit flesh/stone ratio, which amounted to 67.3, while the lowest average was 51.35 for the seventh genotype. Figure (5) shows the oil content of the fruits of some genotypes of wild olives in Al Jabal Al-Akhdar region, The results show the clear variance between the seven genotypes in the oil content of fruits, whether relative to wet or dry weight. The results showed the superiority of the fourth genotype in the oil content of its fruits, which reached 26.24% and 33.8% for wet and dry weight, respectively, and then it was followed by the first genotype, 22.7%, 18.76%, then the second genotype, 22.2%, 17%. On the other hand, the sixth genotype recorded the lowest oil percentage in the fruits, whether for fresh or dry weight, as the oil percentage reached 5.98% and 9.36% for both wet and dry weight, respectively.

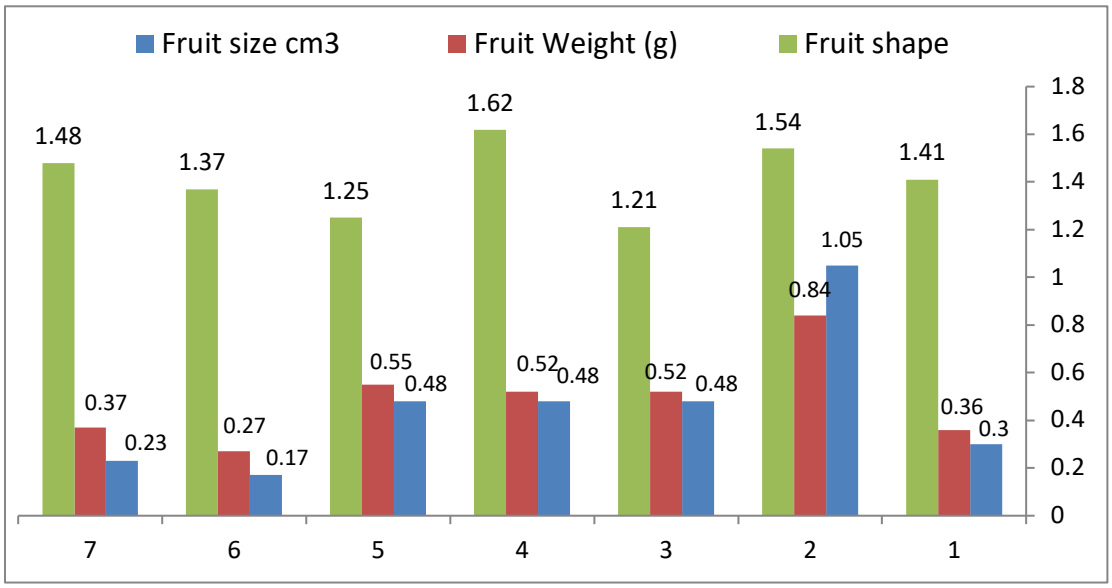

Fig. (1): Characteristics of the fruits of wild olive trees in Al Jabal Al-Akhdar region (LSD 0.05: Fruit size 0.039, Fruit weight 0.044, Fruit shape 0.148)

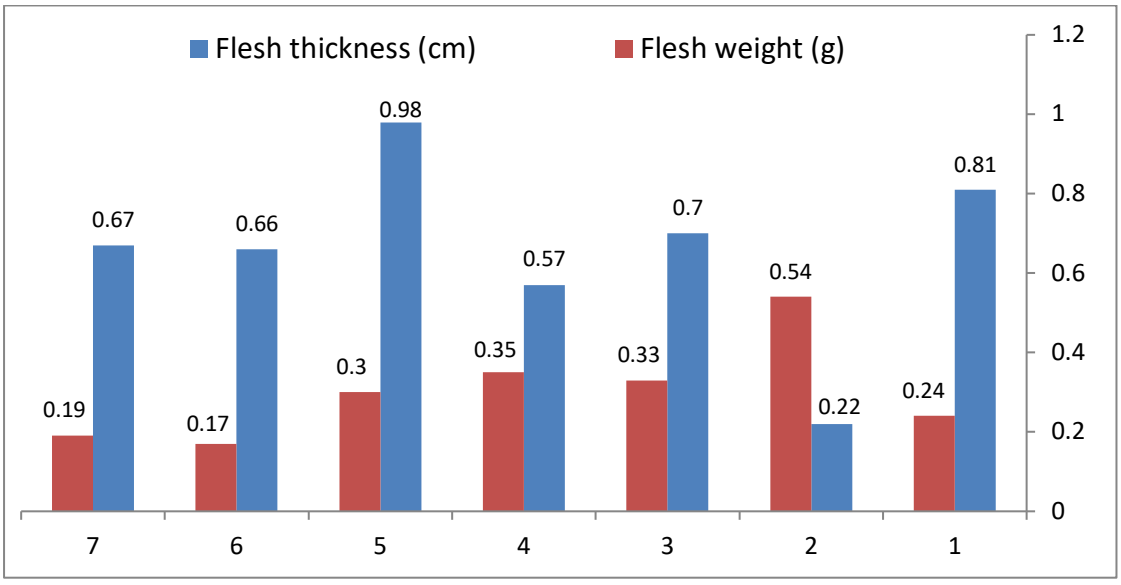

Fig. (2): Characteristics of the fruits flesh of wild olive trees in Al Jabal Al-Akhdar region (LSD 0.05: Flesh thickness 0.092, Flesh weight 0.027)

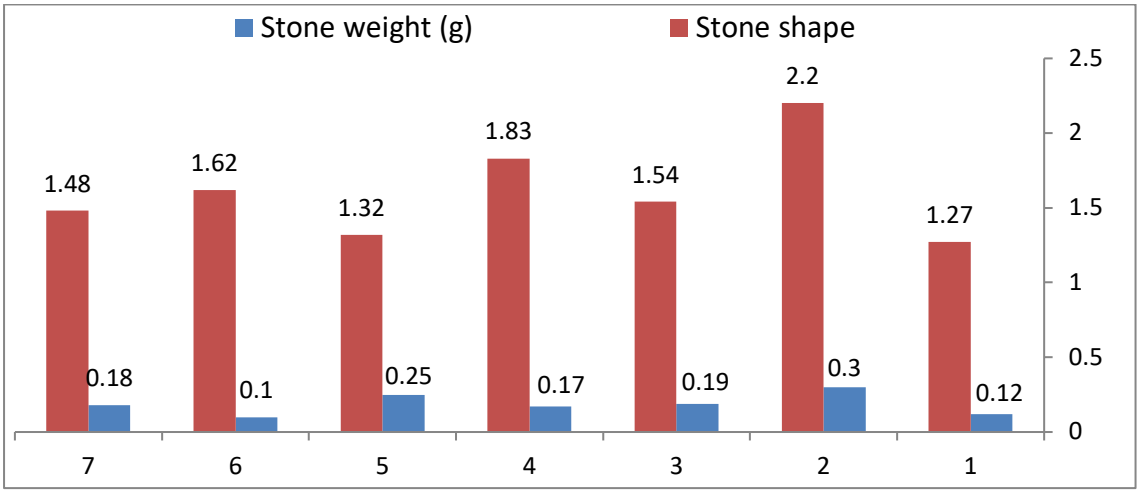

Fig. (3): The stones characteristics of wild olive trees in Al Jabal Al-Akhdar region (LSD 0.05: Stone weight 0.034, Stone shape 0.166)

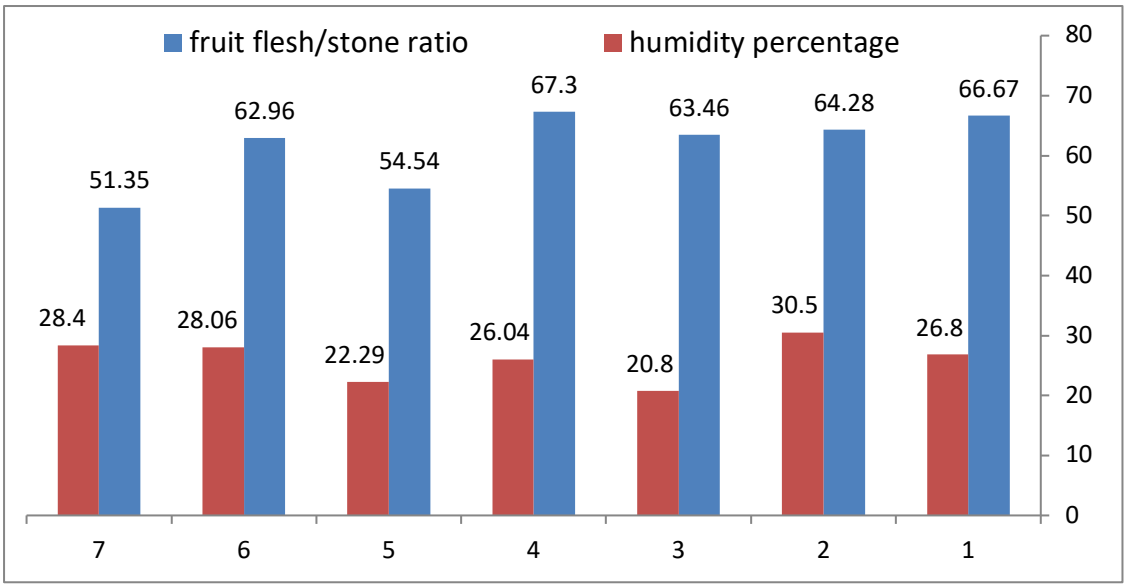

Fig. (4): The fruit flesh/stone ratio and humidity percentage in wild olive fruits (LSD 0.05: fruit flesh/stone ratio 0.487, humidity percentage 0.617)

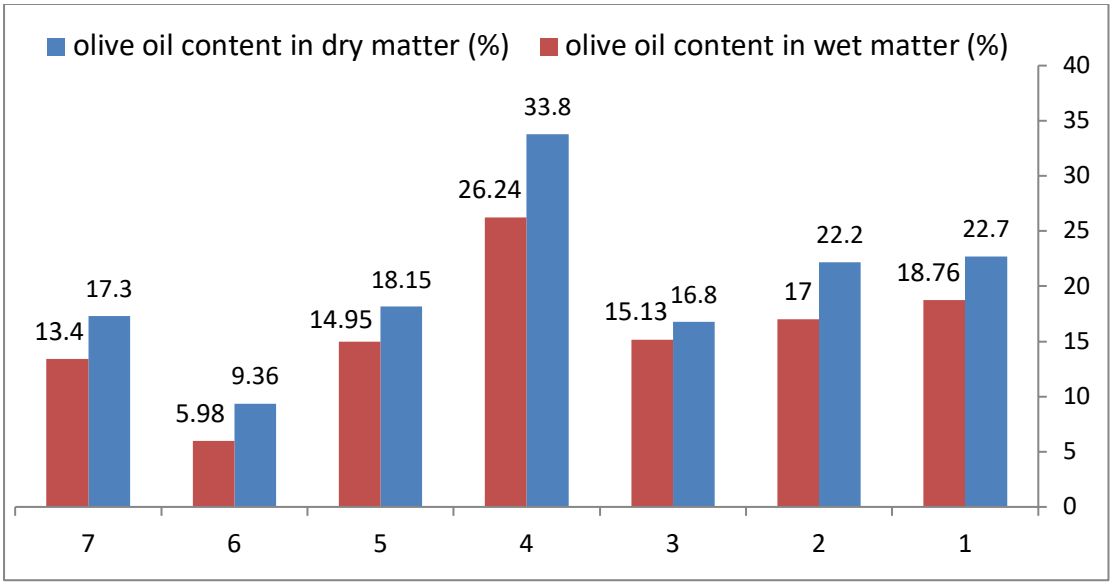

Fig. (5): The oil percentage of wild olive trees in Al Jabal Al-Akhdar region (LSD 0.05: oil content dry matter 0.417, wet matter 0.433)

Conclusion

It is clear from the above that there is a great disparity and difference in the morphological characteristics among the oldest genetic compositions of wild olives in the Jabal Al-Akhdar region in Libya, which is one of the areas where wild olives are widespread, and which is a very good source of genetic assets, as well as biological diversity among varieties, which can play an important role in breeding programs to improve the characteristics of cultivated olives due to their acclimatization and adaptation under environmental conditions and changes over hundreds of years or even thousands of years.

Acknowledgement

The authors extend their sincere thanks and appreciation to the Director and members of the Technical Affairs Department at the Agricultural Research Center - Albyda, Libya, and everyone who participated in collecting samples to complete this work.

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دراسة أولية للتنوع الوراثي والخصائص المورفولوجية لأقدم أشجار الزيتون البرية الليبية بمنطقة الجبل الأخضر

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المستخلص :

تم تقييم التنوع الوراثي لأقدم سبعة أشجار من الزيتون البري المختلفة في منطقة الجبل الأخضر ، بمنطقة البياضة (الوردية ، بالحديد ، الحجاب) – ليبيا ، من خلال دراسة بعض الصفات المورفولوجية الزراعية . حيث تهدف هذه الدراسة إلى تحديد الصفات المورفولوجية لأقدم سبع أشجار زيتون بري (طرز وراثية غير معروفة) . وأظهرت النتائج وجود تباين كبير بين الأشجار المختلفة تحت الدراسة . تم دراسة العديد من الصفات مثل متوسط عدد الثمار/ كجم ، متوسط وزن ، حجم ، وشكل الثمرة ، كذلك سمك ووزن الجزء اللحمة ، نسبة الرطوبة ، وزن ، وشكل النواة الحجرية ، نسبة الجزء اللحمي : النواة الحجرية كذلك تم تقدير نسبة الزيت في الثمار . وقد تم دراسة تلك الصفات المورفولوجية لتحديد الأنواع البرية الليبية المرغوبة شكليا ، والتي تم استخدامها للتمييز بين أصناف الزيت أو المائدة أو ثنائية الغرض ، وكذلك يوضح هذا البحث أن الأنواع البرية الليبية لها خصائص فريدة تميزها عن تلك الأصناف المستوردة .

الكلمات المفتاحية : الزيتون البري ، التنوع الوراثي ، ليبيا