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CENTENNIAL OLIVE TREES IN LEBANON: A SUBSTANTIAL PATRIMONY

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Abstract

This study aimed to assess the centennial olive trees growing across Lebanon, with the perspective of conservation of the ancient germplasm. The survey indicated the existence of numerous centennial olive trees distributed in different agro-climatic areas, from 80 to 1350 meters altitude across the country. Centennial olives were found in large size orchards and scattered as well as in young orchards, road hedges and gardens for ornamental purposes. Yet, no reliable information is available regarding the age of the centennials, but they can be considered as 500 to 1000 years old. Among these, only six centennials located in *Bcheale* village in the north of the country at 1000 meters altitude are considered as “millennials” or “monumentals” by the Ministry of Tourism, while the remaining ones widespread across the country are still ignored. As a preliminary morphological characterization of the trees conducted on 292 centennials spread in 48 orchards, a large variability was recorded for foot, trunk and central cavity sizes. Principal component analysis showed that foot and trunk circumferences as well as central cavity diameter were the most discriminating descriptors. Most of the 48 orchards were clustered together in one pool sharing similar traits. The most outstanding orchards were located in 10 locations distributed across Lebanon. At the tree level, six single trees located in North and Mount Lebanon were well differentiated by their large sized foot, trunk and central cavity diameter. These centennials should be further characterized using morphological and agronomical descriptors in order to understand their performance through time and to valorize them in selection programs.

Keywords: *Olea europaea* L., centennials, Lebanon, distribution, trees characteristics.

Introduction

Olive history in Lebanon is very old dating back to the old era (Zohary and Hopf, 2000). Centennial and millennial trees are still growing across the country (Mahfoud, 2007). Few of these old trees have an important historical and ornamental value and are already classified as monumental. Few of these ancient olive trees have been recently assessed and compared to traditional local cultivars by using SSR markers, they were found to clearly match the widespread traditional common variety called "Baladi" (Chalak et al., in press). This ancient germplasm may be linked to the beginning stages of olive growing in the country playing an important role in the domestication process. Other findings in Italy and Spain supported the hypothesis that ancient olive trees might be unknown traditional cultivars that remained uncharacterized and suggested they might

represent early stages in the domestication processes of the olive tree in the Mediterranean (Baldoni et al., 2006; Erre et al., 2010; Diez et al., 2011). Unfortunately, the ancient olive trees of Lebanon are threatened of disappearing due to their increasing ornamental value and to the progressive transformation of traditional olive groves into new commercial orchards. Hence, the conservation and characterization of the ancient Lebanese olive germplasm become a priority task.

In the present study we undergone a survey of the old groves spread in different agroclimatic areas of the country with a general assessment of the groves status. Also we established a morphological characterization of the centennials by examining mainly the tree dimensions. Further, a set of old groves is recommended for evaluation, valorization and preservation purposes.

Materials and Methods

Survey and characterization of the groves. A survey was carried out throughout Lebanon during the summer 2013 to identify ancient olive groves or trees growing across Lebanon, particularly in the principal areas of olive production (Fig. 1). Forty eight groves were visited spread between 80 to 1350 m of altitude, 35°46'30" to 35°50'34" of longitude, and 33°44'28" to 34°12'22" of latitude.

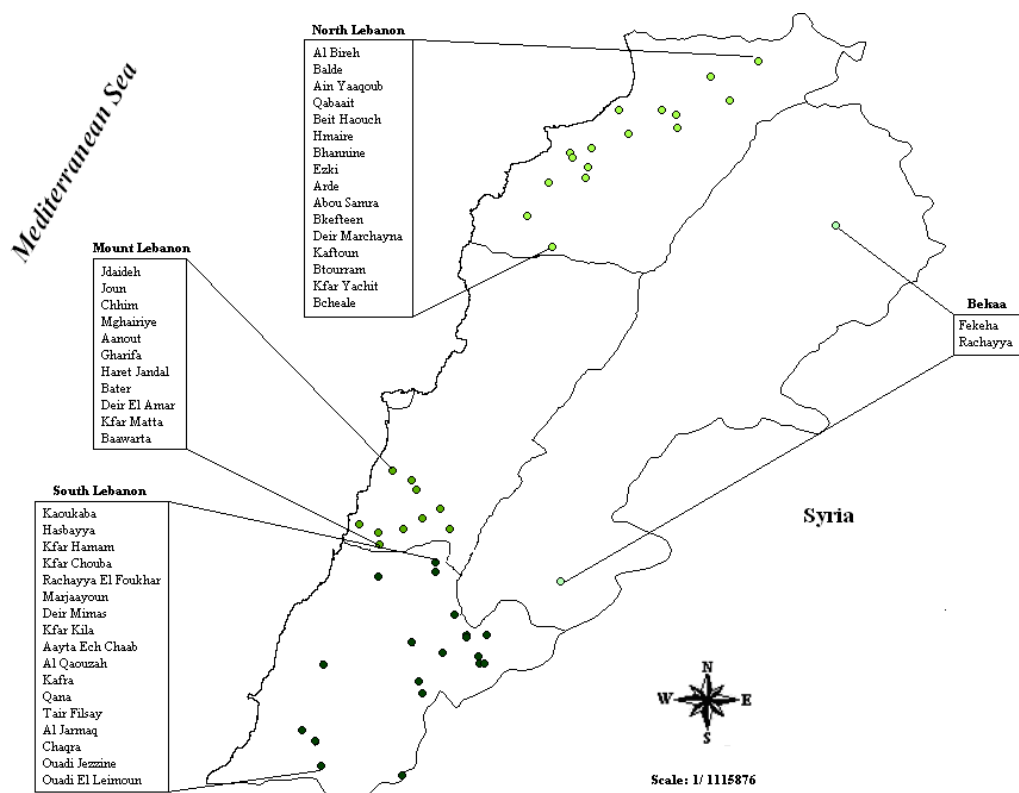


Fig. 1. Distribution of the 48 centennial olive groves surveyed in Lebanon.
General information.

A questionnaire following directive and semi-directive method was addressed to the owners, habitants and municipalities in order to assess the general status of the centennial olive trees. It covered in particular the trees age, origin, restoration, land estate, field maintenance, production and phytosanitary status. Personal observations were also noted. Moreover, municipalities and old people were asked for old texts regarding ancient olive trees.

Morphologic characterization. A total of 292 trees growing in the 48 groves, with a circumference > 2.3 m and assumed to have more than 300 years old according to information given initially by farmers, were examined for their morphological characteristics. Tree traits were examined including the canopy height, central cavity diameter, trunk circumference at 1.3 m height, trunk foot circumference, crown projection diameter and total height of tree.

Results and Discussion

Groves distribution and size. Old groves were found in various agro-climatic areas at altitudes ranging from 80 m (*Bhannine* in the North) to 1350 m (*Bcheale* village in the North) where minimal winter temperature may sink to -0.01°C. The annual rainfall ranked between 185 mm (*Fakehe* stand in the province of Baalbek-Hermel) and 600 mm (*Deir Mimas* in the South). It is worthy noted that groves located in *Bcheale*, *Qabaait* and *Chaqra* groves are covered with snow during winter.

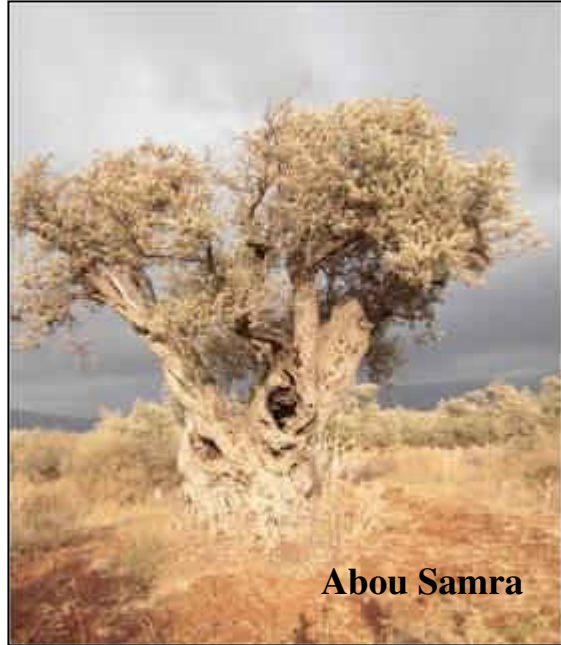
Large old groves were found in both South and North Lebanon, either in terraces or in straight lands (Fig. 2). One of the largest centennial groves was located in *Deir Marchayna* (Zgharta) where 1,400 centennials are still growing in around 2 ha, thus in mixture with other olive trees of all ages. Then comes *Kfar Matta* with 400 centennials extended in 1.2 ha followed by *Marjaayoun* (South) with around 225 centennials, the valley of *Tair Filsay* (South) where more than 100 centennials were scattered among young olive trees. On the other hand, large old groves in *Kfar Hamam* and *Hasbayya* (South) were remarkably homogenous with hundreds of centennials having apparently the same age.

Centennials were also found as scattered trees in road hedges, family gardens and yards growing mostly as ornamentals. The six old trees located in *Bcheale* village in North Lebanon and classified as “millennials” or “monumentals” by the Ministry of Tourism are still standing. Other centennials are still surviving as single in many locations such as *Haret Jandal* (Mount Lebanon), *Abou Samra* (Tripoli) and *Ezki* (Minieh-Denneieh).

Age, history and related information. Yet no accurate information has been published on the age of the Lebanese olive centennials. Only little oral information given by the habitants and few short texts in newspapers are available. In 1964 *Al Nahar* newspaper published a short article about the centennials of *Kfar Matta*, saying they are dating back to 3100 years ago. According to an unpublished study on *Bcheale* centennials, the oldest trees were estimated to be 1500 years old where others in the same village are thought to be 500 years old (Bou Yazbeck, Pers. Comm.). Many touristic websites mentioned the groves of *Bcheale*, *Chaqra* (South) and *Kaoukaba* (South) as housing centennial olive trees. In some areas, centennials are still designated by the historic era to which they belong. For instance most of the centennials in Mount Lebanon are called Maani, where the Maani's introduced the olives around 1500 years ago. In the South, most of the centennials are called Romanian going back to the time of Romanians 2000 years ago.



Bcheale



Abou Samra



Chaqra



Kfar Matta

Fig. 2. Centennials believed to be the oldest in Lebanon.

Property estate. Most of the visited centennial groves are of familial property inherited from ancestors through time. Some other centennials located in the North such as *Deir Marchayna*, *Ezki*, and *Bcheale* are of endowment property. Only *Bcheale* centennials are maintained by the Ministry of tourism while all others are not yet considered by any governmental or non-governmental organizations.

Agricultural practices. Most of the centennial groves as well as the scattered ones are apparently healthy and well maintained in terms of growth without any particular visual problem or nutrient deficiencies. Some centennials are restored by cutting back the trunk and grafting of new varieties (e.g. *Qarkaf*) while many of them, mostly in the North and Mount Lebanon, are just cut at 50 cm from the base to let the trunk grow its new branches for rejuvenation and production increase. It is worthy to note the neglected and abandoned status of the unique centennial available in *Ezki* (North) and the three centennials in *Kafra* (South); however these old trees are still surviving.

Production. All the centennial groves visited are still productive and harvested. Olives and oil produced by centennials are usually consumed by the owners, except for the large sized exploitation while productions of the centennials and young groves are mixed together before being commercialized. Recently some information circulated regarding the exportation to USA of Lebanese oil said being harvested on “the world’s oldest living olive trees, *Bcheale* centennials” (www.dailystar.com.lb/.../193293-bechealehs-ancient-t...).

Threats. Many old groves are progressively transformed into new commercial orchards. Others are eradicated to be replaced by buildings and roads. As mentioned above, single centennials are still standing in many areas in the country, alone, witnessing the existence in the past of old groves. In the last few decades, old olive trees have been increasingly used as ornamentals in the yards of mansions and houses, hotels and touristic resorts, schools and universities, rings and edges of road edges thus after been hollowed out from their original place. Unfortunately, numerous centennials are frequently seen nowadays on the highway sides prepared in large containers to be sold for decoration.

Morphological characterization. A total of 292 centennials growing in 48 groves were examined in this study for the morphological characteristics of the tree (data not shown). On the 48 groves studied, only 8% had polycormic trunk, while 92% were monocormic. Large foot circumferences were found in the visited groves varying from 3.25 m (e.g. *Aayta Ech Chaab*) to 18.7 m (e.g. *Haret Jandal*). Trunk circumferences (at 1.3 m height from the ground) were comprised between 2.3 m (e.g. *Bhannine*) to 15.2 m (e.g. *Haret Jandal*) while most groves have trunk circumferences comprised between 2.3 m and 4.94 m. Trunk cavity was absent in *Hmaire*, *Al Qaouzah*, *Fakehe* and *Chhim* groves while small to large trunk cavities were found in the other groves with diameter comprised between 0.07 m (e.g. *Ouadi Jezzine*) to 3.4 m (e.g. *Haret Jandal*, *Kaoukaba*, and *Kfar Matta*). Tree height ranged from 2.85 m (e.g. *Al Bireh*, Akkar) to 8.1 m (e.g. *Hasbayya*, South) while many trees had an average height of 5.82 m. The canopy height was comprised between 2.4 m to 7.06 m while most of the trees had an average of 4.49 m. Diameter of crown projection ranged between 5 m (e.g. *Hmaire*) to 13.7 m (e.g. *Haret Jandal*) while the majority of the trees had an average of 8.13 m (e.g. *Kaftoun*, *Kfar Kila*, and *Balde*). In some groves such as *Al Bireh* (Akkar), some centennials had trunk circumference (2.3 m) quietly three times smaller than foot circumference (6.03 m), thus due to the old practice of cutting back the trunk for rejuvenation purpose and leaving just one sucker to grow as a trunk.

Most distinguished centennial groves. A two-dimensional principal component analysis was conducted to differentiate between the 48 centennial groves studied on the base of the tree characteristics (Fig. 3). Principal coordinate PC1 clustered the groves according to the foot circumference while the second coordinate PC2 clustered them on the base of central cavity diameter and trunk circumference. The majority of the groves were clustered

together in one pool sharing similar traits while few others are found out in terms of large sized foot and trunk circumferences and central cavity diameter. The most outstanding groves were: *Kafra* (South) with a foot circumference of 12.9 m; *Kaoukaba* (South) with a central cavity diameter of 1.54 m; *Balde* (North) with a foot circumference of 12.74 m and a central cavity diameter of 1.33 m; *Bcheale* (North) with a foot circumference of 12.05 m, a trunk circumference of 6.32 m and a central cavity diameter of 1.88 m; *Deir Marchayna* (North); *Baawarta* (Mount Lebanon); *Kfar Matta* (Mount Lebanon); *Tair Filsay* (South); *Kfar Chouba* (South); *Kfar Kila* (South) with a foot circumference 8.67 m; trunk circumference 3.54 m; central cavity diameter 1.5 m.

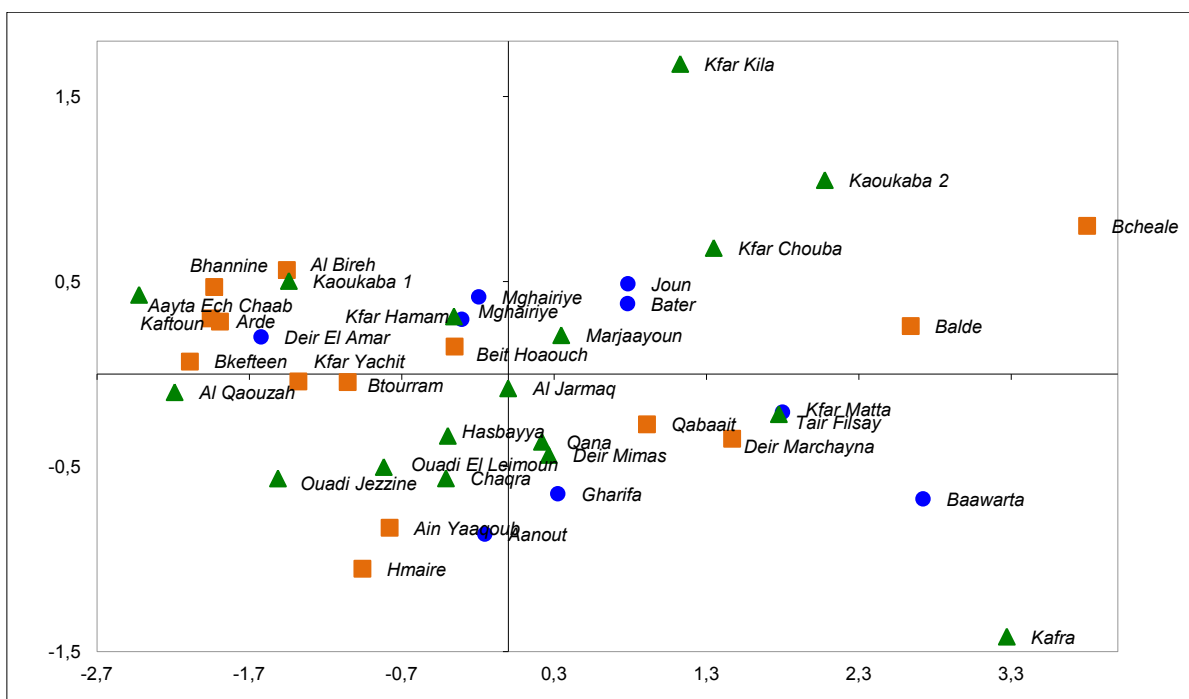


Fig. 3. Bi plot on the F1 and F2 axes of PCA for centennial olive trees based on tree traits. Groves of the south are shown in green color, those of the north in red, Mount Lebanon in blue.

Most distinguished centennials. According to the individual data collected on each of the 292 centennials, many trees were differentiated for their highest sizes of foot and trunk circumferences and central cavity diameter. The most particular distinguished trees could be listed as following: *Haret Jandal* (Mount Lebanon) with foot circumference 18.7 m, trunk circumference 15.2 m, central cavity 3.4 m; *Bcheaale NLC1* (North) with foot circumference 21 m, trunk circumference 13.5 m, central cavity diameter 4 m; *Bater MLC265* (Mount Lebanon) with foot circumference 10 m, trunk circumference 6.45 m, central cavity diameter 2 m; *Ezki* tree (North) with foot circumference 10 m, trunk circumference 12.3 m, central cavity diameter 2.9 m; *Joun MLC228* (Mount Lebanon) with foot circumference 10 m, trunk circumference 6.5 m, central cavity diameter 0.9 m; *Abou Samra* (North) with foot circumference 9.7 m, trunk circumference 5.1 m, central cavity diameter 1.4 m.

Conclusions

This is the first report on the assessment of centennial olive groves growing across Lebanon, with the perspective of valorization, conservation and sustainable utilization of the ancient germplasm. Most of the 48 groves studied were sharing similar traits while other groves were outstanding in terms of large foot, trunk and cavity sizes. Moreover, several centennials were differentiated within the groves studied for their large dimensions. Centennials will be further submitted to molecular characterization by DNA markers in order to assess their genetic diversity (Sefc et al., 2000; de La Rosa et al., 2002; Khadari et al., 2008) and to understand the role of the ancient olive germplasm in the global domestication process (Besnard et al., 2013). Furthermore, centennials should be submitted to a detailed morphological and agronomical characterization in order to understand their performance despite their age and to valorize them in selection programs. For that end, the preservation of the centennial groves of Lebanon is crucial.

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