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Tunisian wild olive (*Olea europaea* L. subsp. oleaster) oils: Sterolic and triterpenic dialcohol compounds

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ABSTRACT

The aim of the present investigation is to discriminate seven selected wild olive trees by studying their sterol and triterpenic dialcohol compositions with those of VOOs obtained from Chemlali and Chetoui olive cultivars, all growing in the in the same pedoclimatic conditions. The main sterol found in all the samples is β Sitosterol, followed by Δ5-avenasterol These two major sterols are strongly and negatively correlated, and there is a clear differentiation between cultivars. Thus, MAT22 oleaster shows the highest value for β-sitosterol (87.18%), whereas SB12 oleaster is characterised by the lowest percentage of β-sitosterol (71%) and the highest one of **Δ5**-avenasterol (21.73%). For the remaining varieties, the levels of b-sitosterol and Δ-5-avenasterol are within the range of 74–86% and 4–17%, respectively.

Two triterpenic dialcohols (erythrodiol and uvaol), were also detected besides the sterolic components. Sterol content of oils was below the upper legal limit of 4% in all nalysed samples, with a range from 1.05% to 3.40%. The statistical analyses (PCA and HCA) can explain the variability of the oil composition according to the cultivar. We note a good discrimination between varieties according to sterol and triterpenic dialcohol data. These components seem to be an effective tool to discriminate between the oleasters.

1. Introduction

Since the production of olive oil is much lower than demand (IOOC, 2017), there is a need to improve olive cultivation, both to produce more oil and to enhance its quality, particularly with regard to components beneficial to human health, such as natural antioxidants and sterols (Cercaci et al., 2007). Determination of sterol composition is a well established method and it is also used to detect the adulteration of olive oils, and it has been recently proposed as a way to classify virgin olive oils according to their fruit variety (Ranalli et al., 2002).

Tunisia is one of the countries in the olive oil producing world. It is the largest African exporter and in the fourth place worldwide after Spain, Italy and Greece (IOOC, 2004). Many varieties are cultivated in Tunisia but there are two, which stand out: Chemlali, a cultivar that occupies more than 2/3 of the total olive growing area, and it is cultivated in the centre and in the south of the country. The Chetoui variety, on the other hand, is the second main variety cultivated in Tunisia (Ben Temime et al., 2006). It is widespread in the north of the country, occurring in plains as well in mountain regions (Ben Temime et al., 2006). A major effort has been made recently to improve the quality of the olive oil produced in Tunisia (Baccouri et al., 2011).

This is a first study on the sterolic fraction of olive oils obtained from wild olive trees owing in Tunisia to define new cultivars well adapted to Tunisian environment and yielding high quality oils. The present work aimed to complete the characterisation of this wild olives, which was started by studying the influence of fruit ripening and crop yield on chemical properties (Baccouri et al., 2007a; Baccouri et al., 2008) and volatile compounds of studied virgin olive oils (Baccouri et al., 2007b).

Many publications report on the composition of sterol compounds of monovarietal oils, but there are no studies about the mentioned composition of oil obtained from wild olive trees. Although the study was carried out in Tunisia, it might be applied to other countries with wild olive trees, in order to contrast productivity and oil quality.

2. Materials and methods

2.1. Oil samples

Six wild olive populations (*Olea europaea* L. subsp. Oleaster)

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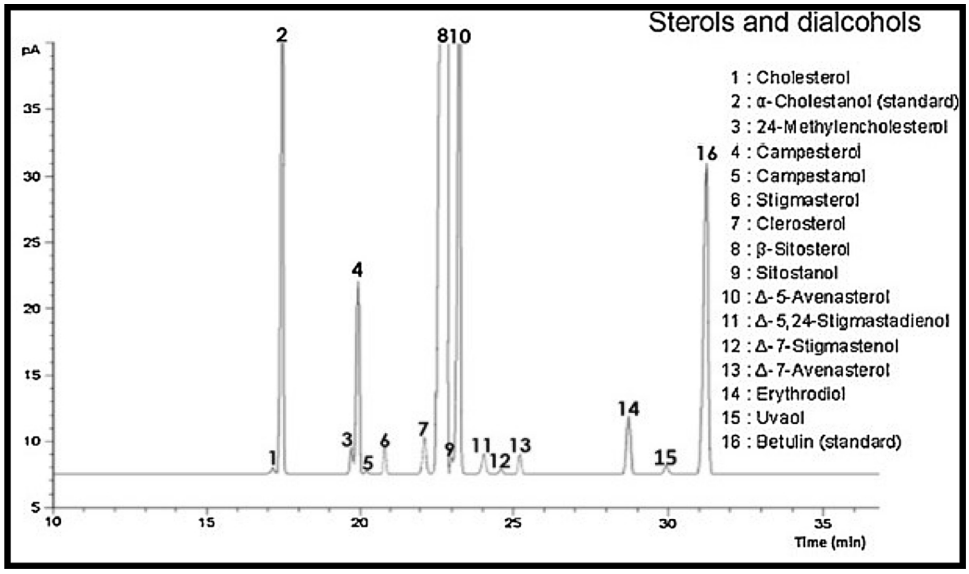

Fig. 1. Chromatogram of the sterol components of one of the analysed samples.

Table 1
Sterol and triterpenic dialcohol compositions of studied olive oil samples.

	H3	MAT7	MAT10	MAT22	SB12	ZI2	ZI1	Chemlali	Chetoui	Extra virgin olive oil (EEC, 2003)
Cholesterol	0.29^{a}	0.21^{a}	0.27^{a}	0.18^{a}	0.17^{a}	0.23^{a}	0.12^{a}	0.11^{a}	0.13^{a}	≤0.5%
24-methylencholesterol	0.22^{c}	0.39^{b}	0.13^{d}	0.07^{ef}	0.43^{a}	0.08^{e}	0.04^{f}	0.18^{dc}	0.30^{b}	
Campesterol	2.90^{b}	2.92^{b}	3.49^{a}	2.90^{b}	2.68^{c}	3.55^{a}	2.22^{d}	3.60^{a}	2.59^{c}	≤4%
Campestanol	0.22^{ab}	0.15^{ab}	0.19^{ab}	0.12^{b}	0.11^{b}	0.26 ^{a}	0.10^{b}	0.05^{c}	0.08^{b}	
Stigmasterol	1.83^{a}	0.89^{d}	1.60 ^{b}	1.32^{c}	0.20^{f}	1.40^{c}	0.68^{e}	0.39^{ef}	1.12^{c}	< Campesterol
Δ 7-Campesterol	0.10^{a}	0.14a	nd	0.13^{a}	0.14^{a}	nd	0.12^{a}	nd	nd	
Clerosterol	1.39^{a}	1.41^{a}	1.15^{a}	1.07^{a}	1.01^{a}	1.03^{a}	1.11^{a}	0.94^{b}	0.99^{a}	
β-Sitosterol	81.63^{e}	74.01^{f}	83.73^{d}	87.18^{a}	71.01^{g}	84.59^{c}	86.46^{b}	85.89^{bc}	77.97^{f}	
Sitostanol	0.93^{c}	0.78^{c}	1.47^{b}	0.38^{d}	0.44^{d}	1.89^{a}	0.91^{c}	0.38^{d}	0.27^{e}	
Δ5-Avenasterol	8.99^{c}	17.28^{b}	6.07^{d}	5.31^{de}	21.73^{a}	4.30^{e}	5.79^{d}	7.05^{dc}	15.42^{b}	
Δ 5,24 Stigmastadienol	0.62^{d}	0.90^{b}	0.68^{cd}	0.68^{cd}	1.03^{a}	0.81^{bc}	0.81^{bc}	0.56^{d}	0.69	
Δ 7-Stigmastenol	0.43^{d}	0.25^{f}	0.63^{c}	0.24^{f}	0.32^{e}	0.93^{a}	0.71^{b}	0.18^{g}	0.14	≤0.5%
Δ 7-Avenasterol	0.45^{d}	0.67^{bc}	0.59^{c}	0.44^{d}	0.71^{b}	0.92^{a}	0.93^{a}	0.67^{bc}	nd	
apparent β-Sitosterol*	93.56^{a}	94.37^{a}	93.10^{a}	94.61^{a}	95.23^{a}	92.63^{a}	95.08^{a}	94.82^{a}	95.33	≥93%

a,b,c: Different superscripts for the same quality parameter mean significant differences among varieties (n = 6; $p < 0.01$). nd: not detected.
* Apparent β-Sitosterol = β-Sitosterol + Δ5-Avenasterol + Clerosterol + Sitostanol + Δ5,24-Stigmastadienol. Results expressed as percentage of total sterols.

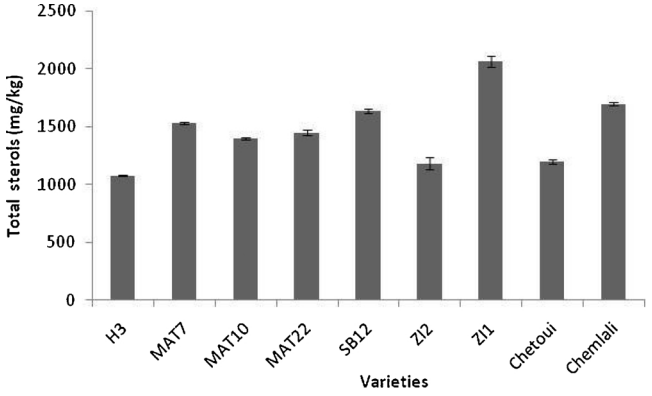

Fig. 2. Total sterols of studied olive oil samples.

originating from different regions of Tunisia (Mateur, Ichkeul, Enfidha, Grombalia, Sers and Neber) were sampled totalling 150 trees. All trees were tagged and their exact location was noted. Later, seven varieties showing the best fatty acid and pomological characteristics were selected (Baccouri et al., 2007a). Each variety was multiplied vegetatively and sampled for further chemical analysis.

The varieties investigated are pointed out for the moment by the following codes: MAT7, MAT10, Mat 22, SB12, ZI1, ZI2, H3. They have different genotypes. These varieties are wild plants selected among oleaster populations after agronomic and chemical evaluations (Baccouri et al., 2007a).

Olives were hand picked in perfect sanitary conditions. The selected wild olives, Chetoui and Chemlali varieties (the most abundant olive oil varieties in Tunisia) have been maintained in the Experimental Station of Tunis Biotechnology Center, under the same pedoclimatic conditions (20 km from Tunis, in the north of Tunisia; latitude, 36° 41' 17.2" N; longitude, 10° 22' 40" E; humidity, 47%; annual mean temp., 15°; annual mean rainfall, 500 mm), the climate is of Mediterranean type with hot and dry summers and mild winters. Olive fruits were picked at the same stage of ripeness (ripening index = 3.5), and their oils were extracted with the same processing system.

After harvesting, the olive fruit samples were immediately transported to the laboratory mill, where the oils were extracted using an Abencor analyzer (MC2 Ingenieriay Sistemas, Sevilla, spain). Olives (1.5–2 kg) were crushed with a hammer mill and slowly mixed for 30 min, centrifuged without addition of warm water, and then transferred into dark glass bottles. All samples were stored at 4 °C in darkness in amber glass bottles until analysis. Olive fruits from studied oleasters were handpicked during two crop seasons (2014–2015 and 2015–2016), three samples for each year.