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DISTRIBUTION OF OLIVE (*OLEA EUROPAEA* L.) GENOTYPES IN THE SOUTHERN MARMARA REGION OF TURKEY

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Abstract

High quality olive oil can be produced from a standard cultivar with high olive oil quality. In this study, olive genotypes grown in the Southern Marmara Region has been determined using simple sequence repeats (SSR) markers. A total of 70 samples from 10 major olive growing locations in the Southern Marmara Region were collected. SSR analysis demonstrated that olive production in this region has been made using primarily a single genotype called "Gemlik". There were some genotypes (8%) were misidentified as "Gemlik" by the farmers since their SSR marker profiles were different from remaining "Gemlik" cultivars. Due to the repropagation of "Gemlik" using green cuttings, it has become the major olive cultivar grown in this region. On the other hand, traditional repropagation of olive using grafted seedlings increases time, expenses and technical expertise required for reproduction. Therefore, repropagation of "Gemlik" using green cuttings promoted the distribution this genotype in the Southern Marmara Region. Although "Gemlik" cultivar is popular and primarily consumed as table olive in Turkey, a standard olive oil production can be made using "Gemlik" cultivar grown in this region. Techniques to increase the quality of olive oil produced from "Gemlik" cultivar should be developed in the future.

Introduction

More than 95% of world olive production has been made in the countries in the basin of Mediterranean Sea and Turkey with the production of 700.000 tones ranks 5th following Spain, Italy, Greece and Syria (Anon., 2003). Turkey is one of the centers of origin for olive and during the olive cultivation for centuries, new cultivars or genotypes with better fruit and olive oil quality have been aroused due to the farmers selection among the seedlings of crosses among the olive varieties. Unlike many other plant species, olive germplasm does not seem to be affected by genetic erosion and loss of biodiversity because turnover with new genotypes has not occurred as fast as in other woody crops and old plants survive for a long time without cultivation (Angiolillo *et al*., 1999; Sensi *et al*., 2003). Therefore, it can be assumed that olive cultivation in Turkey has been made using many olive varieties or genotypes.

Marmara Region is one of the major olive producing regions in Turkey. In terms of olive production, Marmara Region ranks third after Mediterranean and Aegean Sea regions. Olive production in the Marmara Region is localized in the southern costal area of Marmara Sea. Although olive produced in this area has been focused on table olive consumption, significant amount of olive produced in the Southern Marmara Region has been used for olive oil production (Barut, 1999, Eriş & Barut 2000). Purpose of this study was to determine the genotypes used for olive production in the Southern Marmara Region using SSR markers. Determination of major olive cultivars or genotypes used for olive production can allow growers and olive processors to develop better ways for those olive varieties or genotypes to improve olive and olive oil quality.

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Table 1. Location, genotypes and the number of samples collected.

Locations	Genotypes								
	Gemlik	Çelebi	Samanlı	Karamürsel-su	Delice	Morca	Edinciksu	Kır zeytini	Total
Göynüklü	4 (1)	1	2	-	-	-	-	-	7
Zeytinbagi	4	1	1	1	-	-	-	-	7
Umurbey	6 (1)	1	1	-	-	-	-	-	8
Gemlik	6	-	-	-	-	-	-	-	6
Orhangazi	5	-	-	-	1	1	-	-	7
Iznik	3 (1)	1	-	1	-	-	-	-	5
Edincik	1	-	-	-	-	-	4	-	5
Erdek	7 (1)	-	-	-	-	-	1	-	8
Mürefte	9	-	-	-	-	-	-	2	11
Karacabey	6	-	-	-	-	-	-	-	6
Total	**51**	**4**	**4**	**2**	**1**	**1**	**5**	**2**	**70**

( ): Indicates the number of genotypes with different SSR marker profiles from the rest of "Gemlik" cultivar.

Materials and Methods

Sampling and DNA extraction: Young leaves of olive trees were sampled for DNA extraction. Leaf samples were taken from 10 major olive production locations in the Southern Marmara Region (Table 1). Olive trees in the production orchards were sampled and the names of the cultivars given by the farmers who own the orchards were recorded. A total of 70 leaf samples from these location samples were collected. Lyophilized leaf samples were ground to fine powder using mortars and pestles. DNA samples were extracted from about150 mg of powdered leaf samples using a modified CTAB method described by Futherer *et al*., (1995). Concentrations of DNA samples were determined using spectrophotometer and adjusted to DNA concentration of 50 ng/µL.

SSR analysis: Previously developed primer combinations, GAPU47 GAPU101, GAPU103 (Carriero *et al*., 2002) UDO99-006, UDO99-009, UDO99-011, UDO99-028 and UDO99-043 (Cipriani *et al*., 2002) were used for amplification of SSR markers in this study. Each 20 µL polymerase chain reaction (PCR) for amplification of SSR markers consisted of 0.75 Units of DNA polymerase (Fermentas, Hanover, MD, USA) with the reaction buffer supplied at 1× concentration, 0.8 mM of each primer, dNTPs at 200 mM each and 50 ng template DNA. Thermal cycling conditions were 2 min., at 94^{o}C, 9 cycles of 45 s at 94^{o}C, 1 min., at 64^{o}C (annealing temperature was reduced 1^{o}C after every cycle) and 1 min., and 30 s at 72^{o}C, 35 cycles of 45 s at 94^{o}C, 1 min., at 55^{o}C, and 1 min., and 30 s at 72^{o}C and a final extension step of 5 min., at 72^{o}C. For these reactions, an applied Biosystems Thermal Cycler was used. PCR products were separated with 4% AGAROSE SFR™ (Amresco Inc., Solon, Ohio, USA) in 1× Tris-Borate (TBE) buffer. Gels were stained with ethidium bromide (0.5 mg mL_1) (Sigma, St Louis, MO, USA) and photographed.

Results and Discussion

The Southern Marmara Region is one of the major olive growing locations in Turkey. All farmers communicated in this region indicated that they primarily grow the cultivar called "Gemlik" and they only planted other cultivars or genotypes for their own consumption or as a pollinator of "Gemlik". "Gemlik" cultivar has been primarily grown as a table type olive cultivar and it is very popular in Turkey for this purpose. However, in the recent years, it has been produced more than it was consumed as table olive and therefore, it has also been used for olive oil production.

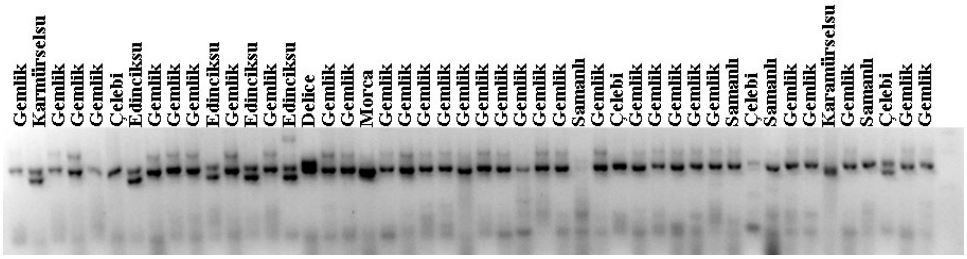

Fig. 1. Banding profile of SSR marker using UDO-28 primer pair (Cipriani *et al.,* 2002)

SSR marker profiles of these samples were analyzed. Only eight primer combinations were enough to differentiate all genotypes from each other. Similarly, Sarri *et al*., (2006) found SSR markers as a powerful marker technique for this purpose in olives. In all locations, the leaf samples from the trees of "Gemlik" have been collected and their SSR marker profiles were compared with the SSR marker profile of "Gemlik" cultivar hold at the Atatürk Central Horticultural Research Institute - Yalova as a control (Fig. 1). SSR analysis demonstrated that in the Southern Marmara Region, 51 of 70 collected samples were "Gemlik" as suggested by the farmers and 47 of 51 "Gemlik" samples had identical SSR banding profile with the "Gemlik" cultivar at the Atatürk Central Horticultural Research Institute Yalova. Although remaining four cultivars were called "Gemlik" by the farmers, they had different SSR markers from the "Gemlik" cultivar at the Atatürk Central Horticultural Research Institute, Yalova.

Although about 8% of the genotypes was wrongfully identified as "Gemlik" by the farmers, majority of "Gemlik" cultivars are identified correctly. Therefore, this olive cultivar was found to be the major cultivar grown in all locations where samples were taken. Olive has been primarily propagated by grafting seedlings and this repropagation method has been time consuming and expensive compared to the other repropagation method. On the other hand, "Gemlik" can be repropagated using green cuttings. Repropagation using green cuttings reduces expenses, time and technical expertise needed for propagation. Therefore, Propagation of "Gemlik" *via* green cuttings has promoted this cultivar to become a major cultivar grown in this region. "Gemlik" is one of the most important olive cultivars in the world for table olive consumption and it has a great economical importance in Turkey. This cultivar has high flesh stone ratio, thin fruit coat, high olive oil content, high total soluble solutes, and its flesh can be separated from stone readily (Eris & Barut, 1995).

Olive oil yield and quality largely depended on genotypes (Sanz-Cortes *et al*., 2003). Therefore, it has been suggested that a standard olive oil production can be possible if a standard olive cultivar with high olive oil quality are used for production. "Gemlik" has become a standard olive cultivar in the Southern Marmara Region. This can be used as an advantage in this region to produce standard olive oil production in addition to its consumption as table olive. In future, the techniques should be developed to increase quality of olive oil produced from "Gemlik" cultivar.

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