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Grapevine throughout the History of Anatolia

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Abstract: Anatolian peninsula has been the cradle of not only the ancient civilizations but also many agriculturally important crops. It has long been linked with the origins of viticulture and wine-making. Shrines, seeds, wine cups and reliefs have been discovered in different regions of the country. One of its accepted origins, Anatolia has not only the cultivated grapevine (*Vitis vinifera* L.) which has presented itself with numerous cultivars and types but also the wild grapevine (*Vitis sylvestris*). This paper is on the history of grapevine starting from prehistoric times to the current with classical and later on molecular studies, based on DNA such as RAPD, AFLP and SSR, on cultivar identification and potential in Anatolia.

Key words: Anatolia, Turkey, ancient grape, ampelography, cultivar, wild grape

INTRODUCTION

Geographically, Turkey forms a natural bridge between the old world continents of Asia, Africa and Europe. The Anatolian peninsula is the westernmost point of Asia, divided from Europe by the Bosphorus and Dardanelles straits. It covers an area of 814,578 square kilometers or 314,510 square miles.

Turkey is under the influence of three different climates, namely, Mediterranean, continental and oceanic. Most of Turkey is under the Mediterranean influence. The Central Anatolian Plateau and the more eastern mountainous parts enjoy continental climate. Oceanic climate occurs only in an enclave in the northeastern part around the Rize province (Akman and Ketenoglu, 1986; Baser, 2002). Turkey is situated at the junction of three important phytogeographic regions, namely Mediterranean, Irano-Turanian and Euro-Siberian. The Black Sea's coastal areas are in the Euro-Siberian region. Areas surrounding the Mediterranean, Aegean and Marmara Seas enjoy the characteristics of the Mediterranean regions and finally, the large part of Turkey stretching from the Central Anatolian Plateau to the borders with Iran and Iraq to the east and southeast lies in the Irano-Turanian region. Endemic species are largely found in the Mediterranean and Irano-Turanian regions. The Anatolian flora, especially in the more arid areas, is said to be in an active state of diversification (Davis, 1971).

Near-East, one of the origin centers of plant, contains parts of Iran, Iraq, Turkey, Syria, Jordan, Lebanon and Israel where the early development of food production took place (Miller, 2006). Plant cultivation in the Near-East started about 10,000 Before Present (BP). Two thousand years later, by 7,000 BC, most of the crop plants that the Near-East has contributed to food production had been brought into cultivation. At about 7000 BC village farming had become firmly established and agriculture had spread beyond its Near Eastern nuclear area (Van Zeist, 1992).

Anatolia has long been linked with the origins of viticulture and wine-making, especially in its eastern region to which the ancient authors commonly ascribe its origins (Gorny, 1996).

Earliest traces of viticulture have been recovered in the settlements dated back to Early Bronze Age, east of the Mediterranean basin, among which Troy and Kumtepe (Çanakkale) (Rhiel, 1999), Yenibademli Höyük (Gökçeada) and Gre Virike and Kurban Höyük (Sanliurfa) (Miller, 1986). Archaeological and historical evidence suggest that primo-domestication of grapevine occurred in the near-East (This *et al*., 2006). Refai (2002) reported that grapes, together with olive and fig, were more commonly used throughout the Bronze Age in the Mediterranean. Lloyd and Mellaart (1958) discovered grape pips in a shrine in western Turkey dating from the Early Bronze Age. A wine shop with storage jars and drinking cups from the Late Bronze age were also found (Macqueen, 1986). Seeds of domesticated grapes were also found in Turkey and Georgia dated from approximately 8000 years ago (Marinval, 1997). Donmez (2005) found very small quantities of grape seeds in Gökçeada, Çanakkale.

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The cultivation of vines for the making of wine originated some time before 4000 BC and possibly as early as 6000 BC in the mountainous region between the Black Sea and the Caspian Sea, bordering Turkey, Syria, Iraq, Iran and Georgia (Billiard, 1913; Lutz, 1922; Levadoux, 1956; Negrul, 1960; Younger, 1966; Ramishvili, 1983; Hyams, 1987; Johnson, 1989). This probable hearth of viticulture laid to the north of great plains of the Tigris and Euphrates, which formed the core of the Sumerian, Akkadian, Assyrian and Babylonian empires and also to the east of the heartland of the Hittite empire in what is now Turkey (Unwin, 1996). Viticulture was apparently quite well established in Anatolia by 1000 BC, supported by a relief at Ivriz, near Tarsus, showing a god adorned with a vine (Billiard, 1913) and by a pillar from Kahramanmaras that illustrates a god holding a bunch of grapes in one hand (Barnett, 1980). Schlee (1995) reported that chemical analysis of remnants in a cuvette found in Titris Höyük (Sanliurfa) revealed tartaric acid, indicating the possibility of using the cuvette for crushing grapes. Urartians (600-99 BC) who mainly situated around Van region mentioned in their written texts the viticulture and the wine making (Belli, 2006). Few grape seeds were excavated in Van, a sign of Urartian plant cultivation of grapevine (Donmez and Belli, 2007).

Wild grapevine (*Vitis vinifera* ssp. *sylvestris* Gmelin) has found itself a place from Portugal to Turkmenistan and from Rhine riversides to northern forests of Tunisia (Levadoux, 1956; Arnold *et al*., 1998; McGovern, 2004). Schumann (1977) and Agaoglu and Çelik (1987) reported the existence of wild grapevine in many places of Anatolia. The oldest wild grape (*Vitis sylvestris* Gmelin.) seeds were excavated in Turkey at Nevali Çori, near Urfa on the slope of Euphrates side valley 8400 years ago (Hauptmann, 1997; Pasternak, 1998). Analyses of chlorotype diversity in *sylvestris* populations showed central Mediterranean and eastern populations had higher diversity values than western populations (Arroyo-Garcia *et al*., 2006), in agreement with Negrul in 1938, suggesting that the Anatolian peninsula and Transcaucasia regions are the 'diversity center' of *Vitis vinifera*, based on phenotypic variation.

Cultivated grapevines are thought to have been domesticated from wild populations of *Vitis vinifera ssp. sylvestris* (Levadoux, 1956). *Vitis vinifera* L. is the only species of the genus Vitis indigenous to Eurasia and is suggested to have first appeared 65 million years ago (de Saporta, 1879). Zohary and Hopf (2000) stated that the domestication process involved the selection of hermaphrodite genotypes that produced larger and sweeter fruits of attractive colors and the development of techniques for their vegetative propagation. Analysis of variation in seed morphology aimed by Terral *et al*. (2010) to provide criteria for the discrimination between wild grapes and modern cultivars and to understand changes in functional traits in relation to the domestication process. The position of 'Henab' (Turkey) and 'Muscat à Petits Grains' (Greece) group within a cluster consisting of the 'Cabernet franc', 'Merlot' and 'Pinot' groups could suggest relationship between European and Eastern varieties. Authors speculated that this might reflect the scale of trade, which spread grapevine by vegetative propagation through the Mediterranean basin.

AMPELOGRAPHIC STUDIES

Earlier works on investigation of grapevine germplasm diversity in Anatolia have involved ampelographic studies mostly done by the researchers at the universities. First scientific ampelographic study was performed on grape cultivars grown in Ankara by Oraman (1937). Oraman and Aksoy (1945), Fidan *et al*. (1972), Marasali (1986) and Demir (1987) were the other scientists who investigated ampelographic features of grapes in the same area. Anameric (1964) and Odabas (1984) profiled grape cultivars grown in Çanakkale and Igdir, respectively. Celik (1989) and Celik (1990) investigated ampelographic characteristics of some grape cultivars grown in Amasya and Kastamonu, respectively. Other studies were as follows; in Tokat (Kara, 1990), Gevas, Van (Kelen and Tekintas, 1991), Southeastern Anatolia, mainly Urfa (Gursoz, 1993), Delice, Kirikkale (Dursun, 1994), Beypazari-Güdül, Ankara (Gemalmaz, 1994), Kalecik, Ankara (Aktepe, 1994), Diyarbakir and Mardin (Kaplan, 1993), Beysehir, Konya (Kara and Beyoglu, 1995), Gaziantep, Sanliurfa, Adiyaman and Kahramanmaras (Atli and Arpaci, 1995), Incesu, Kayseri (Türkkan and Agaoglu, 1999), Safranbolu, Karabük (Kucukhaskul, 1996), Sungurlu, Çorum (Diri, 1996), Meram, Konya (Akkurt, 1998), Harran plain, Urfa (Dilli, 1997), Isparta (Ecevit and Kelen, 1999), Ordu (Cangi, 1999), Malatya (Ünal, 2000), Silifke, Mersin (Sanliturk, 2000), Merzifon, Amasya (Kose *et al*., 2004), Diyarbakir and Mardin (Kaplan and Fidan, 2005), Pervari, Siirt (Guler, 2007), Aegean region (Kader and Dilli, 2009) and Afyon (Akdeniz and Altindisli, 2009). There were also some studies on the genetic diversity of Isabella grape cultivar (*Vitis labrusca* L.). Melek and Çelik (2005) collected 26 accessions of Isabella cultivar from Sinop and surrounding towns and profiled their ampelographic characteristics and found that at least 11 accessions were different from each other. Çelik *et al*. (2009) determined 13 Isabella genotypes collected from central Samsun city and Çarsamba. Fox grapes (*Vitis labrusca* L.) grown in Artvin and Rize provinces were ampelografically profiled by Celik *et al*. (2008).

Isoenzyme studies were also used to distinguish grapevine cultivars grown in Turkey (Agaoglu *et al*., 1995, 1998, 1999; Soylemezoglu *et al*., 1998, 2001; Türkben *et al*., 2002) with differing results in terms of the enzyme systems that help distinguishing grape cultivars.

After the development of Polymerase Chain Reaction (PCR) by Kary B. Mullis in 1983, molecular markers have helped in distinguishing grape cultivars and accessions on DNA level. Studies involving DNA markers, such as RAPD, AFLP and microsatellites have been frequently used for genetic identification of grape cultivars indigenous to Anatolia.

Seventeen grape cultivars (Amasya, Besni, Bogazkere, Bozcaada Çavusu, Emir, Hafizali, Hasandede, Hönüsü, Kadin parmagi, Kozak beyazi, Kozak siyahi, Müsküle, Narince, Öküzgözü, Papaz karasi, Razaki, Tahannebi) grown in different parts of Turkey were identified with RAPD markers (Ergul *et al*., 2002). The cultivars were separated into 4 groups on the basis of genetic variability and regional diversity.

There are several varietal groups of grapevine, such as Misket, Dimrit, Gemre, Parmak, Büzgülü and Amasya, widely cultivated all over Turkey. Ergul *et al*. (2004) studied five genotypes of 'Amasya' gathered from Çanakkale, Sakarya, Denizli, Tokat and Kocaeli for genetic identification using AFLP technique. According to the results, all 'Amasya' genotypes were different from each other. Aras *et al*. (2005) used 14 accessions of 'Büzgülü' varietal group from Antalya, Kütahya, Konya, Denizli, Eskisehir, Mugla and Ankara to determine genetic similarity with RAPD and they found that the genotypes had high level of genetic similarities. Soylemezoglu *et al*. (2005) genetically identified 13 'Iskenderiye Misketi' accessions collected from Edirne, Tekirdag, Denizli, Manisa, Mugla and Çanakkale using AFLP markers. Six genotypes were found closely related to 'Muscat of Alexandria', implying that these genotypes might have played some role in the development of this cultivar. Selli *et al*. (2007) analyzed genetic diversity within 'Dimrit' and 'Gemre' cultivar groups at eight microsatellite loci. 'Gemre' accessions (9) were collected from the regions of central Anatolia, Aegean and Thrace, while 'Dimrit' group (22) were from Mediterranean, central Anatolia and Aegean regions. The groups made two distinct groups with homonymous and synonymous cases within each group. Microsatellites were used to identify 22 accessions of grapevine cultivar 'Dimrit', collected from Mersin, Konya, Denizli, Mugla, Burdur, Isparta and Kirsehir (Boz *et al*., 2009). They found one synonymy and four homonymies. Geographical distribution and genetic relationship did not show any significant correlation, an indication of high genetic diversity in this varietal group.

Ergul *et al*. (2006) studied the AFLP-based genetic relations of the grapevine accession of two important Anatolian varietal groups, 'Misket' and 'Parmak'. 'Misket' accessions (10) were collected from Thrace and Aegean regions, while 'Parmak' accessions (15) were gathered from the regions of Mediterranean, Thrace, central Anatolia, southeastern Anatolia and western Black Sea. Results showed that both groups contained a number of homonymy and synonymy. Six of the Anatolian 'Misket' genotypes were very similar to 'Muscat of Alexandria'.

Karaagaç (2006) genetically characterized a total of 48 grape cultivars (*Vitis vinifera* L.) consisting of 35 local grape cultivars from Gaziantep and 11 cultivars from Tekirdag Viticulture Research Institute in National Germplasm Repository Vineyard with 2 reference cultivars were genetically characterized using 17 SSR markers. Two cases of synonymy were revealed for the genotypes (Dusuzu and Dimiski, Rumi from Gaziantep and Rumi from Tekirdag) and 5 cases of homonymy were observed. Kis üzümü and Sergi karasi, Sari Kabarcik and Serpenekiran from Gaziantep showed close genetic relationship. Therefore, the researcher reported that they may be regarded as the same cultivar.

Boz *et al*. (2007) used microsatellites to genotype 113 grape accessions gathered from the Marmara Region and 65 from SE Anatolia. No synonymy cases were detected in the regions. However, 14 and 5 cases of homonymy were observed from Marmara and SE Anatolia regions, respectively. No synonymy showed that these regions have very rich diverse genetic background.

Karatas *et al*. (2007) fingerprinted using SSR 16 grapevine cultivars that had the same name in Urfa and Gaziantep (Çilores, Çilorut, Hönüsü, Dimiski, Kabarcik, Külahi, Hatunparmagi, Sergi karasi, Kizlartahtasi, Azezi, Yediveren, Serpenekiran, Kizilbanki, Gülgülü, Horozkarasi and Muhammediye). The results showed a large degree of genetic variability among most of the homonymous cultivars.

Korkmaz (2007) compared five grape accessions collected from Urla, Izmir to 93 grapevine accessions which included 13 Europe accessions with SSR and AFLP markers. She found that two of the Urla accessions were completely different from the other accessions.

Thirty-five autochthonous grapevine cultivars growing in Çoruh Valley in NE Anatolia were investigated for their genetic relation using RAPD (Ercisli *et al*., 2008). Cluster analysis showed that genotypes present in the valley are very distinguishable.

Dilli (2008) studied on a total of 31 grape cultivars (*Vitis vinifera* L.) consisting of 5 types Sultani Çekirdeksiz, 9 clones of Pembe Gemre, Osmanca and Ipek cultivars selected by Manisa Viticulture Research

Institute and 15 local grape varieties plus 2 reference cultivars of economic importance in the Aegean Region to genetically characterize and establish genetic relationship using SSR. One case of homonymy was revealed for the genotypes of Foça Karasi collected from Aydin, Çanakkale, Izmir (Mordogan) and Dumanli Gemre variety.

Hizarci (2010) carried out a molecular identification with SSR study on 25 grapevine cultivars grown at Yusufeli district of Artvin province. The cultivars Razaki and Kirmizi Istanbul were found to be the closest with 92% similarity ratio. The lowest similarity ratio was observed between Kütük-Yag, Kokulu-Yag Kibris-Cabernet Sauvignon and Kiskinbur-Cabernet Sauvignon with 17% similarity ratio.

Some of the 21 local genotypes collected from central, Ercis and Gevas towns of Van province, six standard cultivars and 3 American grape rootstocks were investigated molecularly by RAPD method and similarity and relations among them were determined (Sensoy, 2008). Standard cultivars, Ercis and Gevas genotypes were generally discriminated in different groups. Moreover, based on the genetic variation among the genotypes, the variation in Gevas and Ercis genotypes were higher than that of standard cultivars.

Karatas and Agaoglu (2008) estimated genetic relationships among 46 grape cultivars of Gaziantep province using RAPD. There found to be high genetic variation among the cultivars in the region. In general no relationship was encountered between the genetic similarity and previous ampelographic analyses in the cultivars.

Genetic relationships between grape accessions grown in Iskilip, Çorum were investigated with RAPD (Agaoglu *et al*., 2009). The names of the accessions were Sapiuzun, Iskilip karasi, Misket, Sungurlu beyazi, Iskilip misketi, Oluklu üzüm, Sübe üzümü, Mahallikara, Beyazüzüm, Okçu, Sapli üzüm, Kokulu, Erkencisübe and Tilkikuyrugu. Results indicated that similarity index between Iskilip and Çorum local grape cultivars was high. Although genetic similarity index of cultivars was close to each other, some similar named cultivars showing similar morphological characteristics were grouped separately on the dendogram constructed using similarity values.

Genetic analyses of 59 grape cultivars of eastern Mediterranean region were performed using SSR (Tangolar *et al*., 2009). Homonymy (8 cases) and synonymy (5 cases) were determined. The control cultivars 'Merlot' and 'Cabernet Sauvignon' were distantly related.

Sabir *et al*. (2009) studied ampelographic and molecular (ISSR) characterization of 29 indigenous grape cultivars grown at the Research and Implementation area of Çukurova University, Adana.

VARIETY GERMPLASM COLLECTIONS

Vitis International Variety Catalogue, developed by Julius Kühn-Institut-Federal Research Centre for Cultivated Plants, stationed in Geilweilerhof, Germany, contains 19.539 registered cultivars from all around the world (http://www.vivc.de). Turkey has contributed to this catalogue with 808 cultivars, which comprises of 4.14% of the total cultivars. Turkey is preceded with France, Italy, United States of America and Germany in terms of the number of cultivars contributed to the catalogue.

Efforts to establish a cultivar germplasm collection in Turkey started in 1965 at the Viticulture Research Institute in Tekirdag with approximately 1200 cultivars collected from all regions of Turkey. Over time, there have been some genotypes added or, regrettably, lost to the collection. In 2006, one comprehensive research project has been launched with the financial support of TUBITAK by the Biotechnology Institute of Ankara University in cooperation with the Ministry of Agriculture and Rural Affairs to genetically identify all grapevine accessions in the National Grapevine Germplasm Collection at the Viticulture Research Institute, Tekirdag, Turkey. The project is completed, in which a total of 1150 cultivars were screened with 21 microsatellites and it was found that 850 cultivars were identified as unique genotypes.

One other germplasm collection was started at the grounds of Viticultural Research Institute of Manisa in 2004 and has now around 174 local grape cultivars grown mainly in Aegean region of Turkey (Saglam *et al*., 2009).

CONCLUSION

Anatolia has a long history in cultivation of many agriculturally important crops. Grape, especially wine, has played an especially significant role throughout its history. Studies presented here in this paper are only representative of a great genetic potential where maybe most of the country is still uninvestigated. Ampelographic studies, mostly involving molecular markers, have been underway on a either big or small scale throughout the country by the universities or state agricultural offices which would almost certainly increase the number of the grapevine cultivars and types grown.

REFERENCES

Agaoglu, Y.S. and H. Celik, 1987. Die arbeiten uber die Konservierung der Germplasm der Rebe in der Turkei. Ergebnisse Deutsch-Turkischer Universitats-Partnerschaften im Agrarbereich. Gottingen Symposium, pp: 221-230.

Agaoglu, Y.S., G. Soylemezoglu, A. Ergul and M. Caliskan, 1995. Identification of some table and wine grapes frown in Turkey by isozyme banding patterns. 2nd Natl. Hortic. Congr., 2: 567-571.

Agaoglu, Y.S., G. Soylemezoglu, M. Caliskan and A. Ergul, 1999. Researches on electrophoretic identification of ecotypes of Razaki grape cultivar grown in Turkey. Proceedings of the 3rd National Horticulture Congress, Sept. 14-17, Ankara, Turkey, pp: 389-394.

Agaoglu, Y.S., G. Soylemezoglu, M. Caliskan, A. Ergul and C. Turkben, 1998. Identification of some native and foreign grape varieties using isozyme banding patterns by polyacryl-amide gel electrophoresis. Proceedings of the 4th Vitic Symposium, Oct. 20-23, Yalova, Turkey, pp: 145-151.

Agaoglu, Y.S., H. Karatas and D. Degirmenci, 2009. Molecular characterization of some local (Iskilip-Corum) Anatolian grape cultivars (*Vitis vinifera* L.). Acta Hort. (ISHS), 827: 207-210.

Akdeniz, B.D. and A. Altindisli, 2009. Amphelograpy of some native grape varieties (*Vitis vinifera* L.) which tend to disappear in Afyonkarahisar region. Proceedings of the 7th National Vitic. and Technology Symposium, Oct. 5-9, Manisa, Turkey.

Akkurt, M., 1998. Viticulture in Meram Province and determination of ampelographic characters of grape varieties grown in the district. Proceedings of the 4th National Vitic. Symposium, Oct. 20-23, Yalova-Turkey, pp: 345-349.

Akman, Y. and O. Ketenoglu, 1986. The climate and vegetation of Turkey. Proc. R. Soc. Edinb. Sec. B, http://md1.csa.com/partners/viewrecord.php?requester=gs&collection=ENV&recid=1470968&q=The+climate+and+vegetation+of+Turkey.+In%3A+Proceedings+of+the+Royal+Society+of+Edinburgh&uid=788542712&setcookie=yes

Aktepe, N., 1994. Some characteristic of Kalecik Province's viticulture and the determination of ampelographic characters of grape varieties grown in the district. Master Thesis, Ankara University, Graduate School of Natural and Applied Sciences, Ankara.

Anameric, M., 1964. Canakkale ve uzumleri. Tarim Bakanligi Ziraat Isleri Genel Mudurlugu Yayinlari, Istanbul.

Aras, S., J.B. Polat, D. Cansaran and G. Soylemezoglu, 2005. RAPD analysis of genetic relations between Buzgulu grape cultivars (*Vitis vinifera*) grown in different parts of Turkey. Acta Bio. Cracov. Ser. Bot., 47: 77-82.

Arnold, C., F. Gillet and J.M. Gobat, 1998. Occurrence of the wild vine *Vitis vinifera* ssp. silvestris in Europe. Vitis, 37: 159-170.

Arroyo-Garcia, R., L. Ruiz-Garcia, L. Boulling, R. Ocete and M.A. Lopez *et al*., 2006. Multiple origins of cultivated grapevine (*Vitis vinifera* L. ssp. *sativa*) based on chloroplast DNA polymorphisms. Mol. Ecol., 15: 3707-3714.

Atli, H.S. and S. Arpaci, 1995. Determination of standard grape cultivars of Gaziantep, Sanliurfa, Adiyaman and Kahramanmaras Cities. Proceedings of the 2nd National Horticulture Congress, (NHC'95), Adana, Turkye, pp: 509-513.

Barnett, R.D., 1980. A winged goddess of wine on an electrum plaque. Anatolian Stud., 30: 169-178.

Baser, K.H.C., 2002. Aromatic biodiversity among the flowering plant taxa of Turkey. Pure Applied Chem., 74: 527-545.

Belli, O., 2006. Yoncatepe sarayi ve nekropolu. Anadolu Medeniyetleri Muzesi 2005. Yilligi, 20: 381-431.

Billiard, R., 1913. La vigne dans l'antiquite. Librairie H. Lardanchet, Lyon, (In French).

Boz, Y., C. Ozer, A.S. Yasasin, B. Akman and F. Yilmaz *et al*., 2007. High-throughput molecular identification of grapevine germplasm sources. Proceedings of the 5th National Horticulture Congress, Sept. 4-7, Erzurum, pp: 349-352.

Boz, Y., G. Soylemezoglu, M. Bakir, A.S. Yasasin, C. Ozer, H. Celik and A. Ergul, 2009. Genetic characterization of Dimrit group grape cultivars based on Simple Sequence Repeat (SSR). Proceedings of the 7th National Vitic. and Technology Symposium, Oct. 5-9, Manisa, Turkey.

Cangi, R., 1999. A study on determined ampelographic characters of some grape cultivars grown in Ordu. Proceedings of 3rd National Horticultural Congress, Sept. 14-17, Ankara, pp: 1009-1012.

Celik, H., 1990. A Research on vine cultivation of Kastamonu country and morphological charecteristics of some grape varieties grown in this province. Master Thesis, Graduate School of Natural and Applied Sciences, Ondokuz Mayis University, pp: 95

Celik, H., C. Kose and R. Cangi, 2008. Determination of fox grape genotypes (*Vitis labrusca* L.) grown in Northeastern Anatolia. Hort. Sci. (Prague), 35: 162-170.

Celik, H., F. Odabas, B. Kose and B. Cangi, 2009. Ampelographic characters of Izabella grape types (*Vitis labrusca* L.) grown in Samsun. Proceedings of the 7th National Vitic. and Technology Symposium, Oct. 5-9, Manisa, Turkey.

Celik, M., 1989. A Research on total soluble solids-acidic analysis and ampelographic description of grapes varieties in Amasya province. Master Thesis, Graduate School of Natural and Applied Sciences, Ondokuz Mayis University.

Davis, P.H., 1971. Distribution Patterns in Anatolia with Particular Reference to Endemism. In: Plant Life of South West Asia, Davis, P.H., P.C. Harper and I.C. Hedge (Eds.). Botanical Society of Edinburgh, Edinburgh, UK., pp: 15-27.

De Saporta, G., 1879. Le monde des plantes avant l'apparition de l'homme. La Revue Scientifique 11 Octobre 1879 (In French).

Demir, I., 1987. Description of the ampelographic characters of some introduced grape varieties grown in Ankara conditions. Master Thesis, Ankara University, Graduate School of Natural and Applied Sciences, Ankara.

Dilli, Y., 1997. Determination of yield and quality components with ampelographic characteristics of some grape cultivars grown in Harran plain conditions. Master Thesis, Harran University, Graduate School of Natural and Applied Sciences.

Dilli, Y., 2008. Researches on the characterization of some important grape varieties, types and clones in Aegean region by using microsatellite (SSR) markers. Ph.D. Thesis, Graduate School of Natural and Applied Sciences, Ege University.

Diri, A., 1996. Viticulture of Sungurlu province and amphelographic characteristics of grape varieties grown. Master Thesis, Graduate School of Natural and Applied Sciences, Ankara University.

Donmez, E.O. and O. Belli, 2007. Urartian plant cultivation at Yoncatepe (Van), Eastern Turkey. Econ. Bot., 61: 290-298.

Donmez, E.O., 2005. Early bronze age crop plants from yenibademli hoyuk (Gokceada), western Turkey. Environ. Archaeol., 10: 39-49.

Dursun, A., 1994. Viticulture in Delice and ampelographic characters of grape cultivars grown. Master Thesis, Graduate School of Natural and Applied Sciences, Ankara University.

Ecevit, F.M. and M. Kelen, 1999. Determination of ampelographic characters of grape cultivars grown in Isparta (Atabey). Truk. J. Agric. Forestry, 23: 511-518.

Ercisli, S., E. Orhan, Y. Hizarci, N. Yildirim and G. Agar, 2008. Genetic diversity in grapevine germplasm resources in the Coruh Valley revealed by RAPD markers. Biochem. Genet., 46: 590-597.

Ergul, A., B. Marasali and Y.S. Agaoglu, 2002. Molecular discrimination and identification of some Turkish grape cultivars (*Vitis vinifera* L.) by RAPD markers. Vitis, 41: 159-160.

Ergul, A., K. Kazan, S. Aras, V. Cevik, H. Celik and G. Soylemezoglu, 2006. AFLP analysis of genetic variation within the two economically important Anatolian grapevine (*Vitis vinifera* L.) varietal groups. Genome, 49: 467-475.

Ergul, A., M. Turkoglu and G. Soylemezoglu, 2004. Genetic identification of Amasya (*Vitis vinifera* L. cvs.) genotypes based on AFLP markers. Biotechnol. Biotechnol. Eq., 18: 39-43.

Fidan, Y., M.S. Tamer and A. Eris, 1972. Gudul ilcesi bagciligi gelistirme imkanlari ve onemli uzum cesitlerinin ampelografik vasiflari uzerinde arastirmalar. Ankara Universitesi Ziraat Fakultesi Yilligi, 21: 495-524.

Gemalmaz, N., 1994. Present situation of viticulture in beypazari and güdül Provinces and ampelographic characters of grape varieties. Master Thesis, Ankara University, Graduate School of Natural and Applied Sciences.

Gorny, R.L., 1996. Viniculture and Ancient Anatolia. In: The Origins and Ancient History of Wine, McGovern, P.E., S.J. Fleming and S.H. Katz (Eds.). Gordon and Breach Publishers, Amsterdam, pp: 133.

Guler, B., 2007. Ampelographic characteristies of local grapevine cultivars grown in Pervari (Siirt). Master Thesis, Graduate School of Natural and Applied Sciences, Yuzuncu Yil University.

Gursoz, S., 1993. GAP alanina giren guneydogu anadolu bolgesi bagciligi ve ozellikle sanli urfa ilinde yetistirilen uzum cesitlerinin ampelografik nitelikleri ile verim ve kalite unsurlarinin belirlenmesi uzerinde bir arastirma. Ph.D.Thesis, Cukurova University, Graduate School of Natural and Applied Sciences.

Hauptmann, H., 1997. Nevali cori. Oxford Encyclopedia Archaeol. Near East, 4: 131-134.

Hizarci, Y., 2010. Description of ampelographic characteristics and determine genetic relationships by using SSR markers among grapevine cultivars grown in Yusufeli district. Ph.D. Thesis, Graduate School of Natural and Applied Sciences, Atatur University.

Hyams, E., 1987. Dionysus: A Social History of Wine Vine. 2nd Edn., Sidgwick and Jackson, London.

Johnson, H., 1989. The Story of Wine. Mitchell Beazley, London.

Kader, S. and Y. Dilli, 2009. Comparison of ampelographic characteristics of Razaki descented grape varieties in Aegean region. Proceedings of the 7th National Vitic. and Technology Symposium, Oct. 5-9, Manisa, Turkey.

Kaplan, N., 1993. Determination of the ampelographic characters of grape variaties grown in Diyarbakir and Mardin. Ph.D. Thesis, Graduate School of Natural and Applied Sciences, Ankara University, Ankara.

Kaplan, N. and Y. Fidan, 2005. Investigations on the flower and fruit traits of the grape cultivars grown in Diyarbakir and Mardin provinces of Turkey. II. Cultivars for fresh consumption/drying and frying. Proceedings of the 6th Turkey Viticulture Symposium, Sept. 19-23, Tekirdag, Turkiye, pp: 525-531.

Kara, Z. and N. Beyoglu, 1995. Research on the ampelographic characters of grape cultivars grown in Beysehir, Konya. Proceedings of the 2nd National Horticulture Congress, (NHC'95), Adana, Turkey, pp: 519-523.

Kara, Z., 1990. Determination of the ampelographic characters of grape varieties grown in Tokat. Ph.D. Thesis, Graduate School of Natural and Applied Sciences, Ankara University, Ankara.

Karaagac, E., 2006. Molecular analysis of grapevine germplasm by SSR (Simple Sequence Repeats) marker in Gaziantep province. Ph.D.Thesis, Graduate School of Natural and Applied Sciences, Ankara University, Ankara.

Karatas, H. and Y.S. Agaoglu, 2008. Genetic diversity among Turkish local grape accessions (*Vitis vinifera* L.) using RAPD markers. Hereditas, 145: 58-63.

Karatas, H., D. Degirmenci, R. Velasco, S. Vezzulli, C. Bodur and Y.S. Agaoglu, 2007. Microsatellite ?ngerprinting of homonymous grapevine (*Vitis vinifera* L.) varieties in neighboring regions of South-East Turkey. Sci. Hort., 114: 164-169.

Kelen, M. and E. Tekintas, 1991. A study on the determination of ampelographic charecteristics of grape varieties grown in Gevas and around. YYU J. Agric Sci., 1: 12-34.

Korkmaz, G., 2007. Molecular analysis of historical wine grape variety candidates found in Urla. Master Thesis, Sabanci University Graduate School of Engineering and Natural Sciences, Istanbul, Izmir.

Kose, B., F. Odabas and H. Celik, 2004. A research on the determination of ampelographic characters of some local grape varieties grown in Merzifon. J. Agric. Fac. Ondokuz Mayis University, 19: 26-30.

Kucukhaskul, A., 1996. Viticulture in Safranbolu and ampelographic definition of grape cultivars. Master Thesis, Graduate School of Natural and Applied Sciences, Ankara University, Ankara.

Levadoux, L., 1956. Les populations sauvages et cultives de *Vitis vinifera* L. Annales de l'Amelioration des Plantes, 1: 59-118, (In French).

Lloyd, S. and J. Mellaart, 1958. Beycesultan excavations: Fourth preliminary report. Anatolian Studies, 8: 93-125.

Lutz, H.F., 1922. Viticulture and Brewing in the Ancient Orient. J.C. Hinrichs'sche Buchhandlung, Leipzig.

Macqueen, J.G., 1986. The Hittites and their Contemporaries in Asia Minor. Thames and Hudson, London.

Marasali, B., 1986. Determination of the ampelographic characters of some native standard grape varieties grown in Ankara conditions. Master Thesis, Ankara University, Graduate School of Natural and Applied Sciences, Ankara.

Marinval, P., 1997. Vigne sauvage et vigne cultivee dans le bassin mediterraneen. Emergence de la viticulture. Contribution archeo-botanique. In: L'histoire du vin, une Histoire de Rites. Office International de la Vigne et du Vin, Paris, pp: 137-172.

McGovern, P.E., 2004. Ancient Wine: The Search for the Origins of Viniculture. University Press, Princeton.

Melek, N. and H. Celik, 2005. The ampelographic characters of some Isabella grape (*Vitis labrusca* L.) types grown in Sinop. Proceedings of the 6th Viticulture Symposium. Sept. 19-23, Tekirdag.

Miller, N.F., 1986. Vegetation and Land Use. In The Chicago Euphrates Archaeobotanical Project 1980-1984: An Interim Report. Anatolica, 13: 37-148.

Miller, N.F., 2006. The Origins of Plant Cultivation in the Near East. In: The Origins of Agriculture: An International Perspective, Cowan, C.W. and P.J. Watson and N.L. Benco (Eds.). The University of Alabama Press, Alabama, pp: 39-58.

Negrul, A.M., 1960. Arkheologiceskie nakhodi semion vinograd. Sovetskaya Arkheologiya, 1: 111-119.

Odabas, F., 1984. Igdir ovasi bagciligi ve burada yetistirilen uzum cesitlerinin ampelografik ozellikleri uzerinde arastirmalar. Doga, 8: 57-64.

Oraman, M.N. and H. Aksoy, 1945. Y.Z.E. Bag-Bahce Enstitusu koleksiyon baginda yetisen en onemli uzum cesitlerinin ampelografileri ve cicek biyolojileri. Ankara Yuksek Ziraat Enstitusu Dergisi, 5: 148-171.

Oraman, M.N., 1937. Ankara vilayeti bagciligi ve Ankara'da yetisen baslica uzum cesitlerinin ampelografisi. Yuksek Ziraat Enstitusu Calismalari No. 6. Ankara.

Pasternak, R., 1998. Investigations of Botanical Remains from *Nevali cori* PPNB, Turkey. In: The Origins of Agriculture and Crop Domestication, Damania, A., J. Valkoun, G. Willcox and C. Qualset (Eds.). ICARDA., Syria, pp: 170-77.

Ramishvili, R., 1983. New archaeological evidence on the history of viniculture in Georgia. Matsne (Tbilisi), 2: 127-140.

Refai, M., 2002. Incidence and control of brucellosis in the Near East region. Vet. Microbiol., 90: 81-110.

Rhiel, S., 1999. Bronze Age Environment and Economy in the Troad: The Archaeobotany of Kumtepe and Troy. Mo Vince Verlag, Tubingen.

Sabir, A., S. Tangolar, S. Buyukalaca and S. Kafkas, 2009. Ampelografic and molecular diversity among grapevine (*Vitis* spp.) cultivars. Czech J. Genet. Plant Breed., 45: 160-168.

Saglam, H., O.C. Saglam, A. Yagci, O. Merken, A. Unal and M.S. Inan, 2009. Grapevine germplasm in the Aegean region. Proceedings of 7th National Vitic. and Technology Symposium, Oct. 5-9, Manisa.

Sanliturk, M., 2000. The ampelography of some grape cultivars grown in Silifke in the Lower Goksu valley vineyards. Master Thesis, Graduate School of Natural and Applied Sciences, Selcuk University.

Schlee, D., 1995. Paleobotanical investigations. In Titris hoyuk: A small EBA urban center in SE Anatolia, The 1994 season. Anatolica, 21: 13-43.

Schumann, F., 1977. Zur erhaltung der wildrebe *Vitis vinifera* L. var *silvestris* gmelin in den rheinischen Auwaldern. Pfalzer Heimat, pp: 150-154. (In German).

Selli, F., M. Bakir, G. Inan, H. Aygun and Y. Boz *et al*., 2007. Simple sequence repeat-based assessment of genetic diversity in Dimrit and Gemre grapevine accessions from Turkey. Vitis, 46: 182-187.

Sensoy, R.I.G., 2008. Determination of adaptation of some grape cultivars in Van ecological condition and using RAPD markers of some local grape genotypes belong to Van region. Master Thesis, Graduate School of Natural and Applied Sciences.

Soylemezoglu, G., Y. Boz, C. Ozer, H. Celik, M. Turkoglu and A. Ergul, 2005. Genetic relationship between Muscat of Alexandria and the Muscat group grown in Turkey based on AFLP. Proceedings of the 6th Vitic Symposium, Sept. 19-23, Tekirdag, Turkey, pp: 252-257.

Soylemezoglu, G., Y.S. Agaoglu and H.I. Uzun, 2001. Ampelographic characteristics and isozymic analysis of *Vitis vinifera* spp. sylvestris gmel. In Southwestern Turkey. Biotech. Biotech. Eq., 15: 106-113.

Soylemezoglu, G., Y.S. Agaoglu, B. Marasali, A. Ergul, M. Caliskan and C. Turkben, 1998. Identification of grape varieties by catechol oxidize (CO), peroxides (PER) and esterase (EST) enzymes extracted from leaves. Proceedings of the 4th Vitic Symposium, Oct. 20-23, Yalova, Turkey, pp: 138-144.

Tangolar, S.G., S. Soydam, M. Bakir, E. Karaagac, S. Tangolar and A. Ergul, 2009. Genetic analysis of grapevine cultivars from the Eastern Mediterranean region of Turkey, based on SSR markers. J. Agric. Sci., 15: 1-8.

Terral, J.F., E. Tabard, L. Bouby, S. Ivorra and T. Pastor *et al*., 2010. Evolution and history of grapevine (*Vitis vinifera*) under domestication: New morphometric perspectives to understand seed domestication syndrome and reveal origins of ancient European cultivars. Ann. Bot., 105: 443-455.

This, P., T. Lacombe and M.R. Thomas, 2006. Historical origins and genetic diversity of wine grapes. Trends Gen., 22: 511-519.

Turkben, C., G. Soylemezoglu, A. Ergul and Y.S. Agaoglu, 2002. Isoenzymatic polymorphism differentiation of Turkish grapevine cultivars by polyacrylamide gel electrophoresis. Biotechnology, 16: 148-151.

Turkkan, S. and Y.S. Agaoglu, 1999. Present situation of viticulture in Incesu (Kayseri) and the determination of ampelograohic characters of grape varieties grown in the province. Proceedings of 3rd National Horticultural Congress, Sept. 14-17, Ankara, pp: 1018-1022.

Unal, M.S., 2000. Researches on viticulture in Malatya and Elazig provinces and determination of ampelographic characteristics of grape varieties grown in Malatya province. Master Thesis, Graduate School of Natural and Applied Sciences, Cukurova University.

Unwin, T., 1996. Wine and the Vine: A Historical Geography of Viticulture and the Wine Trade. Routledge Taylor and Francis Group, London and New York, pp: 390.

Van Zeist, W., 1992. The origin and development of plant cultivation in the Near East. Japan Rev., 3: 149-165.

Younger, W., 1966. Gods, Men and Wine. The Wine and Food Society, London.

Zohary, D. and M. Hopf, 2000. Domestication of Plants in the Old World: The Origin and Spread of Cultivated Plants in West Asia. 3rd Edn., Europe and the Nile Valley, Oxford Univ. Press, New York.