

Biodiversity and breeding of grapes : a study in Azerbaijan

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ABSTRACT

*A detailed investigation about the biodiversity and breeding of grapes was undertaken at Azerbaijan. Azerbaijan is a rich source of plant genetic resources due to diverse soil and climatic condition. Vine growing is one of the most ancient and widely adopted culture to support the economic life of the people. Different information indicated that the history of cultured vine growing in Azerbaijan has at least 7 millenium. Scientist and tresearchers indicated that centre of origin of grape in Azerbaijan and Southern Caucasus. Wild grape [*V. Vinifera L. Subsq. sylvestris (C.C. Gmel) Hegi*] spreads on the territory of Azerbaijan from 12m below sea level to 200m above sea level. There are two kinds of wild grape: *Typica negr (with hair)* and *Aberrans negr (hairless)*. At present more than 600 lacial and introduced grape varieties are spread in Azerbaijan, of which more than 100 varieties are threatened. White, red, black and pink coloured table, technical and universal grape varieties are cultivated. Wide variation in duration for maturity (120 to more than 171 days) was observed among the types. Plartid DNA sequence variation study revealed presence of three polymorphic sites in DNA: on in *tra H-psp A* intergenic region and two in *rpl 16* intron area. The varieties were divided into four different haplotypes: AAA, ATT, GTA and ATA. Some resistant varieties against mildew, oidinm and grey rot diseases identified. Salt and drought tolerant varieties also reported. Most of the local threatened varieties are conserved for utilizing them in future improvement programme.*

Key words: Diversity, genetic resources, local varieties and wild grapes.

Azerbaijan is an ancient country located in the South-East of the Caucasus Mountain and North-West of Irarian Plateany at the cross road of Eastern Europe and South-West Asia. It is a rich source of plant-genetic resources due to diverse soil and climatic condition. More than 4700 higher plants have been registered of which 237 are endemic. Historically, wild fruits are used by people for food, medicine and other purposes. Fruits crops like apple, pear, apricot, pomegranate, quince, fig, almond, walnut, hezelment, grapes etc. have been cultivated. 149 species of fruit crops belonging to 39 general and 15 families are distributed on the territory of Azerbaijan.

Vine growing is one of the most ancient and widely adopted culture to support the economic life of the people. Information from archaeological excavations, paleobotanical ampelographic, toponomic, geological investigations etc. indicated the history of cultured vine growing in Azerbaijan has at least 7 millenniums. Grape seeds, stone tools for vine production and different cultural materials found in Uzer Liktepe monument Goy Gol region and ancient monument of Nakhchivan during archaeological exavations near Aghdam region indicated that vine growing had played an important role in farmer's life. Grape seeds found in Uzerliktepe belong to 3500 years ago, Findings in Ganjachay territory showed that people had occupied with horticulture as well as Vine growing in Bronze age. Written sources information (Latin, Greek, Syrian, Arabic, Persian, Turkish etc.)

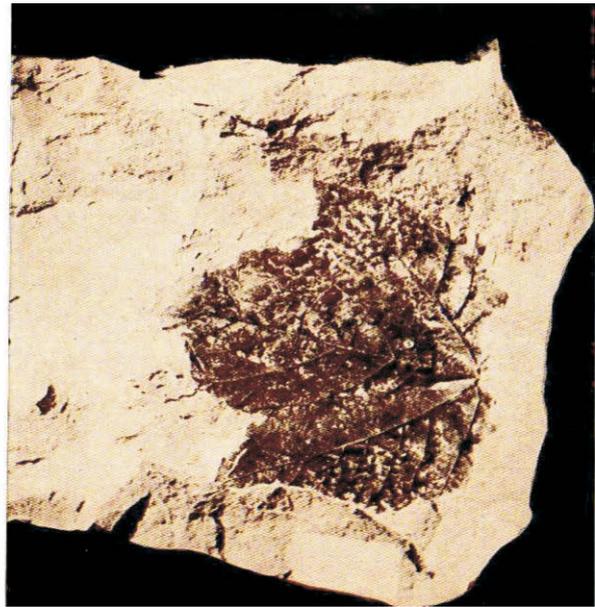
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are very important in determining the crop husbandary of vine growing of Azerbaijan population. Greek scholar Herodotus during 5th century BC gave information about vine growing in Azerbaijan. Significance of quality grapes is more as compared to Iran, Babylon and Greece. Roman scholar Great Plini (23-79 years BC) admired in exhaustible resources and high farming culture of Azerbaijan territory. Scientists and researchers indicated that centre of origin of grape in Azerbaizan and Southern Caucasus (Vavilon, 1926 and 1931; Zhukovskii, 1964). In modern Azerbaijan, Vine growing and vine making are considered as the most profitable aspect in agriculture.

At present more than 600 local and introduced grape varieties are spread in Azerbaijan of which more than 100 varieties are threatened. The local and wild grape varieties generally observed in old vine yards, small farmers and country wards etc. And they cover insignificant parts of national grape gene funds. Recently, new ampelographic collections ahve been established and enriched with local and introduced grape varieties and wild grape species in Genetic Resources Institute of ANAS. Most of the threatened local grape varieties had been collected through expeditions, conserved for utilizing them in future improvement programme.

MATERIALS AND METHODS

The investigation mainly carried out with local and wild grape types. Ampelographic description of



Picture 1: Stoned remains of *V.vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi. species in the Eastern part of Araz river in Nakhchivan AR



Picture 2. Formation of wild grape in Nabran. Coastal Area of the Caspian Sea

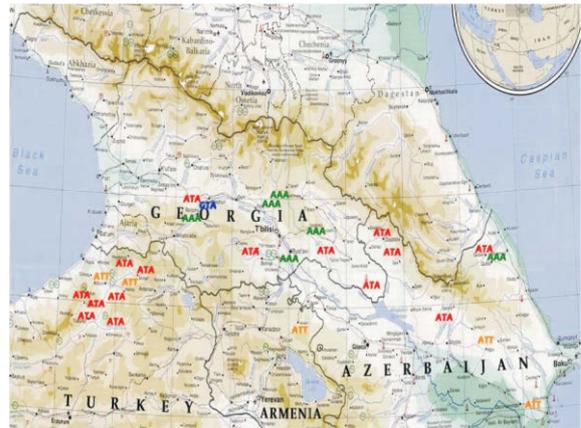


Figure 1: The distribution of haplotypes in the SouthCaucasus



Picture 3: Samples of wild grapes in forest number 1 (Khachmaz d.)



Picture 4: Sample of wild grape in Gabala (Shongar).

grapevines had been implemented on the base of common methods (ALazarevsky, 1963; Makarov, 1964, Morozova, 1987, Prostoserdov, 1963 and Smirnov *et. al.*, 1987. Phytopathological and immunological descriptions and assessments of grapevines on natural background were carried out by appropriate methods. The stress factors resistance of varieties and forms had been evaluated by modern methods (Kushnirenko, 1976 and Udovenko, 1988). Total genomic DNA was isolated from young grape leaves. The leaves were ground in liquid nitrogen. For DNA isolation the CTAB based extraction procedure was followed (Lodhi, *et al.*, 1994). Extracted DNAs were purified with GenElute columns (Sigma-Aldrich, St. Louis, MO). In case of silica dried leaves DNA was isolated by Plant genomic DNA extraction miniprep system (VIOGENE, USA). Sequence diversity polymorphism of wild grape samples were investigated at two non-coding plastid DNA regions (the *trnH-psbA* intergenic spacer and the *rpl16* intron).

The *trnH-psbA* intergenic spacer was amplified with the primers “trnH” and “psbA”. The *rpl16* intron was amplified with the primers “*rpl16-5*” and “*rpl16-3*” (Schaal, *et al.*, 2010 and Beridze *et al.*, 2011). The primers were synthesized by Integrated DNA Technologies, Inc., Coralville, IA and Sequencing Service of Institute of Biochemistry and Biophysics, Polish Academy of Science (Poland).

PCR conditions included 1 minute denaturing at 94°C, 30 cycles of 94°C denaturing (1 minute), 55°C annealing (1 minute), and 72°C extension (2 minutes), followed by a final extension step at 72°C (5 minutes). PCR products were purified with GenElute PCR Clean-Up Kits (Sigma-Aldrich, St. Louis, MO), dye-labeled using a Big Dye Terminator Kit (Applied Biosystems, Foster City, CA) and analyzed on either Applied Biosystems 3100 or 3700 genetic analyzers (Biology Department of Washington University, St. Louis, MO and Laboratory Services Division of the University of Guelph, ON, Canada). MEGA and SeqMan softwares were used for sequence analysis.

The coordinates of spreading areal of wild grape varieties which found within researches were defined by GPS, photos were taken with digital cameras, some ampelographic indicators and phytocenotic traits were described.

RESULTS AND DISCUSSION

The interest for wild grape has been increased in the world which caused widening of areal of investigations on this aspect. Wild grape form possess

some positive bio-agricultural traits and different biotic-abiotic factors resistant genes which may utilized in improvement programme. Research works on collection, improvement, investigation and sustainable utilization of genetic resources of wild grape are giving importance in Azerbaijan Republic

Wild grape types spread mainly in the banks and shores of river, lake and sea and mountain slopes of Absheron, Nakhchivan AR, Ganja-Gazakh, Garabagh, Mil-Mughan, Shirvan, Talysh and etc. A number of researches were implemented in Khachmaz, Guba, Khudat, Nabran, Gusar, Shamakhi, Ismayilli, Aghsu, Oghuz, Gabala, Shaky, Zagatala, Lankaran, Fuzuli. They were used for studying the genetic resource of grape.

Wild grape [*V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi] of Azerbaijan is distinguished with specific characters. It is spread on the territory of Azerbaijan from 12 m below sea-level (Kyr riverside, Salyan region) to 2000 m above sea-level (Gusar region). There are two types: *typica* Negr. (with hairs) and *aberrans* Negr. (hairless).

According to many researchers, the Caucasus region (north-western Turkey, northern Iraq, southern Russia, Azerbaijan, Georgia) and adjacent areas (Anatolia, modern day Syria, Lebanon, Israel), are the geographic areas where grapes were most likely first domesticated (Zhukovskii, 1964; Negrul, 1946; Saner *et al.*, 1993 and Jackson, 1994). Special climatic conditions of this area are favourable for diversification of wild varieties from which cultivated grapes were domesticated. South Caucasus region is regarded as the potential place for domestication of cultivated grapes. The natural distribution of *V. vinifera* most closely approaches the probable origin of the crop (Jackson, 1994). This assumption is supported by the recent chemical analysis of archeological pottery from Georgia and Eastern Anatolia which showed that wine making dates back to early 6th millennium BC in these regions. Distribution of *V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi. is very wide *i.e.*, Europe, Northern Africa and middle east, including Mediterranean, Black and Caspian Sea Basins from Spain to Turkmenistan (Arroyo-Garcia *et al.*, 2006).

The main goal of this study was the investigation of plastid DNA sequence in the diverse set of South Caucasian *V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi. The greater Caucasus region is the area where domestication of grape began (Negrul, 1946 and Phillips, 2000). This information is of great interest

from an ethno-botanical standpoint and relates to crop improvement. It's well known that cultivated varieties of grapevine differ greatly in their resistance to pests and diseases, and ancestral wild populations are of first targets for use in breeding and genetic engineering.

Forty five wild grape samples from the South

Caucasus were analyzed which included 19 samples from the Republic of Georgia, 10 samples from Azerbaijan, 2 samples from Armenia and 14 samples from Turkey. Plastid DNA sequence variation study revealed presence of three polymorphic sites in DNA: one in *trnH-psbA* intergenic region and two in *rpl16* intron area. According to this observation investigated

Table 1 : Information of samples from Azerbaijan.

Population	Geographic region	River basin	Coordinates
Quba distr.,village Alpan	North Azerbaijan	Quruçay	N 41°21' 17,2" EO 48°22' 01,2"
Quba distr.,village Ağbil	North Azerbaijan	Quruçay	N 41°26' 03,7' EO 48°33' 49,1'
Quba distr.,village Ağbil	North Azerbaijan	Quruçay	N 41°26' 03,7' EO 48°33' 49,1'
Quba distr.,village Susay-Qışlaq	North Azerbaijan	Quruçay	N 41°28' 02, 3' EO 48°34' 43,3'
Agsu distr.	Central Azerbaijan	Girdmancay	N 40°55' EO 48°15'
Qobustan distr., in Gorge	East Azerbaijan	-	N 40°10' E 49°20'
Quba distr., village Susay-Qışlaq	North-East Azerbaijan	Qusarçay	N 41°28.25,5' EO 48°36.14,0'
Balakan distr.	North-West Azerbaijan	Balakancay	N 41°43' EO 46°25'
Qabala distr.	North-West Azerbaijan	Turyancay	N 40°47' 814" EO 47°38' 334"
Zaqatala distr.	North-West Azerbaijan	Alazan	N 41°25' EO 46°45'

the samples which were divided into four different haplotypes: AAA, ATT, GTA and ATA (Pipia *et. al.*, 2012). For each haplotype the first nucleotide represents single polymorphism at *trnH-psbA* intergenic region and another two nucleotides at two targeted sites from *rpl16* intron area. The AAA haplotype is restricted to the East Georgia and Azerbaijan but ATA haplotype is distributed randomly across the entire study area and ATT haplotype is distributed in the southern part of the study area from the Black Sea to the Caspian Sea. The single GTA haplotype was found in the South-West part of Georgia (Fig. 1).

The AAA haplotype is of both wild and cultivated (*V. vinifera* subsp. *vinifera*) grape samples from the Caucasus.

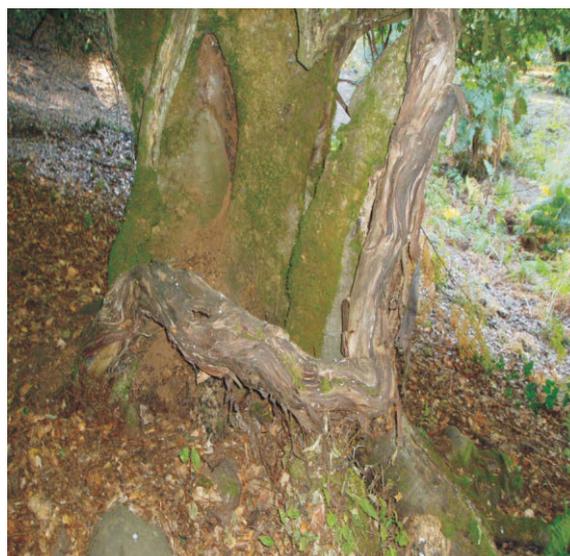
In Nabran forests of Guba-Khachmaz region, dark and dark purple coloured grape forms were found. During expedition in Guba-Khachmaz region, it was observed that, Guba region is enriched with wild grape. Lots of wild grape forms were found in forests

of (Uzunmeshe, Alpan, Khujbala, Digah, Aghbil, Susay Gishlag, Dallakand villages) along with Guruchay, Gusarchay, Gudyalchay rivers. In forests of Khachmaz (Pir forest), Shaky (Oraban), Lankaran (Seligavul) and Gabala (Shongar) regions small seedy dark wild grape varieties were also observed. In the banks of Kondalanchay river in Fuzuli region dark, dark red, dark purple coloured grape seed forms were observed. In general, more than 3000 forms of wild grapes were found in expedited villages and regions and photocenetic features of their spreading areas were described.

The populations of wild grape were spread mainly in three formations - tugay (streamside forest), typical broad-leaved forests and coastal area of the Caspian Sea. Wild grapevines spread mainly in tugay forests densely and widely. On the banks of Kungut river (Oraban village) of Sheki, Guruchay, Gusarchay, Gudyalchay rivers (Uzunmeshe, Alpan, Khujbala, Digah, Akbil, Susay Gishlag, Dallakand villages) of Guba region. But typical forest formation of wild



Picture 5. Absheron qizil uzumu



Picture 6. Gara qushereyi



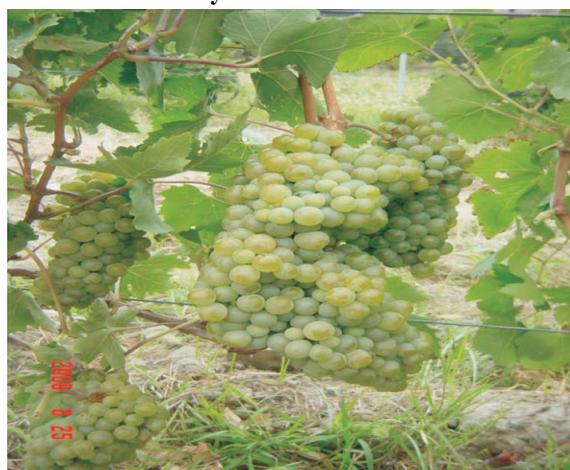
Picture 7. Hafizali



Picture 8. Chehrayi kishmish



Picture 9: Nargizi



Picture 10: Alince

grape was found in Agharehimoba, Godekli, Gimilgishlag, Gadashoba, Nerecan and forests of Khachmaz region, Seligavul forest of Lankaran region and Shongar spring of Gobala region.

Wild grape samples distinguish each other for their biomorphological traits. As a rule male grapevines are strong but functional female grapevines are weak. All samples of wild grape can be divided into 4 groups on the size of leaves: very small (length up to 40-80 cm), small (length up to 80-120), medium (length 120-150 cm) and large (length more than 15 cm). Most of the varieties belong to small and medium group. Wild grapes can be divided into 3 groups for leaves sub-sections: whole, medium and cross-section. Some samples are covered with white net-shaped blooms, but under surface in some cases are bare. Samples are also distinguished for leave sides. Sides are mainly sharp, triangular and round shaped.

Self-pollinated bisexual flower of wild grape samples were not observed. Bunch flowers of wild grape can be distinguished for their forms, they are small or medium sized. Generally the bunch of male flowers are big and cone-shaped, but female flowers are small, cone-shaped-cylindrical or cylinder-shaped.

Bunches of wild grape are small, 7-13 cm length and 6-8 cm width. There are 1-2 bunches on productive shoots. Bunches are mainly set on 3-5th churn-stuffs of new shoots. Skin of seeds is dark or reddish dark, oval-shaped, the surface covered with thick wax layer and most of them are resistant to mildew and oidium disease.

The famous local varieties are cultivated in

Absheron, Garabagh, Ganja-Gazakh, Shirvan, Guba-Khachmaz regions and Nakhchevan AR of Azerbaijan. White, red, black, pink colored table, technical and seedless grapevine varieties are – Agh shani, Absheron's gyzyt uzumu, Alvan, Amiri, Askari, Agh Sahibi, Agh Aldara, At uzum, Aghri, Arnaqrna, Bandi, Rishbaba, Chilal, Kishmishi, Tulkuguyrugu, Huseyni, Madrasa, Marmari, Qara Aldara, Qoc uzumu, Tabrizi, Molla Ahmadi, Novrast, Karimgandi, Durna gozu, Davagozu, Kechiamcayi, Khazri, Khalili, Gara shani, Gizil uzum, Chil uzum, Beylagani, Kharci, Khan uzum, Pishras, Malayi, Mahmudabi, Misgali, Khindogny, Hafizeli, Hachabash, Haji Abbas, Hamashara, Sarigila, Shiray, Shirvanshahi, Shireyi, Shirshira, Shafeyi, Shakarbura, Shahangir, Shakari, Sisag etc. Most of them are only grown in definite areas and private courtyards by amateur gardeners (Salimov and Musayev, 2007 and Musayev, 2003).

Existing local grape varieties are distinguished each other for their use directions in our Republic. Here table, technical and universal varieties are met. Between them the table grape more dominates. Depending on the use local grapes also categorizes into three groups namely:

- i) **Table grape varieties:** These grape varieties are used freshly. The varieties are: Absheron gelinbarmaghi, Absheron khatini, Absheron kechiemceyi, Absheron gizil uzumu, Agh gavra, Absheron merendisi, Salyan uzumu, Shireyi, Agh kishmishi, Agh Beylagani, Khalaj, Khalbasar, Khan uzum, Aghdam khezerisi, Fatmayi, Gavangir, Haji Abbas, Gul merendi, Aghdam kechiemceyi, Agh goy bendem, Gara

Table2: Grape varieties of different maturity group

Sl. No.	Types	Duration (days)	Varieties
i)	Earliest	120	Girmizi huseyni, Agh khelili, Gara khelili, Agh kurdashi, Gara kurdashi
ii)	Early	120-130	Gara pishras, Salyani, Agh chileyi, Gara kishmishi, Gehveyi kishmishi, Yumrugile sari kishmishi
iii)	Middle fast	131-140	Agh kishmishi, Nakhchivan huseynisi
iv)	Middle	141-150	Agh Shani, Asgari, Beylagani, Gavangir, Gulabi, Gara shani, Sarigile, Fatmayi, Absheron gelinbarmaghi, Tebriz, Shireyi, Girmizi kishmishi, Xirdagile kishmishi, Sari shafeyi, Shekerbura
v)	Middle late	161-170	Gavangir, Ala shani, Haji Abbas, Bendi, Goy bendem, Julu merendi, Inekemceyi, Shamakhi merendisi, Girmizi shafeyi, Nakhchivan agh tayfisi, Kechiemceyi, Gulabi, Bendi, Negshebi, Miskali, Nakhchivan gara shanisi, Hachabash, Khatinbarmaghi, Khezani, Meshedi Ali, Zeyneddin uzumu, Shangirey, Narinjigile, Henegirma, Shakhtakhti, Jelali, Gara serme, Meleyi, Bilev uzumu, Ayiboghan, Khanimi, Hafizeli, Talibi, Mukhtari, Sari shireyi
vi)	latest	171 and more days	Agh derbendi, Devechi gizil uzumu, Khezeri, Kechiemceyi, Nakhchivan girmizi shanisi, Nakhchivan gizil uzumu, Khatini, Kehreba uzum, Agh uzum, Nebi, Gizili sebze, Beneniyar, Durzali, Sari aldere, Agh aldere, Goyungozu, Sahibi, Abbasi, Gara aldere, Batikh, Gara henegirma, Khetmi, Khanlari, Zalkha, Dashgara, Rizagha, Agh uzum, Chol uzumu, Zereni gorasi, Nakhchivan gara uzumu, Girmizi henegirma, Goy uzum, Innabi, Khan uzumu, Agh kelenpur, Girmizi gemeri, Khalli uzum, Pishik uzumu, Badamli

kishmishi, Girmizi kishmishi, Gehveyi kishmishi, Yumrugile sari kishmishi, Mermeri, Sari aldere, Sarigile, Seyid Amiri, Siyezen agh uzumu, Shabrani, Sari kishmishi, Khirdagile sari kishmishi, Asgari, Ayiboghan, Agh khalili, Agh uzum, Agh kurdashi, Bendi, Girmizi Inekemceyi, Gara kurdashi, Gara khelili, Gara shafeyi, Gizili sebze, Girmizi shafeyi, Girmizi chileyi, Girmizi kherji, Girmizi merendi, Girmizi huseyni, Inekemceyi, Kechiemceyi, Kehraba, Miskali, Nakhchivan girmizi shanisi, Nakhchivan agh tayfasi, Nakhchivan gara shanisi, Nakhchivan gara shanisi, Nakhchivan gizil uzumu, Nakhchivan huseynisi, Nebi, Nekhshebi, Sari shafeyi, Shamakhi merendisi, Khatinbarmaghi, Khatini, Gara salyan uzumu, Hachabash, Gulabi etc.

ii) Technical grape varieties: It is used in making different alcoholic and non alcoholic drinks, total juice extract is more than 75%. The varieties are: Arayatli gara uzum, Ari merendi, Bayanchire, Shirvanshai, Medrese, Tatli, Aghdam gizil uzumu, Sherabi, Arazvari, Agh kelenpur, Hamashara, Khindogni, Gara khatuni, Agh Almerdan, Bilev uzumu, Gara serme, Gara henegirna, Goch uzumu, Girmizi gemeri, Girmizi henegirna, Dashgara, Dagh uzumu, Dabbi gulabi, Jelali, Zalkha, Zereni gorasi, Innabi, Mukhtari, Meleyi, Nakhchivan gara uzumu, Rizagha, Sari shireyi, Sari uzum, Gara aldere, Tulagozu, Talibi, Khalli uzum, Khan uzumu, Khanlari, Kherji, Khetmi, Chol uzumu, Shahtakhti, Shahangul, Shekerbura, Haji Ahmadi, Henegirna, Goy uzum are technical varieties

iii) Universal varieties: These are varieties distinguish table and technical varieties for their biomorphological and agrobiological traits. They ripen in different times and possess separate agrobiological parameters. These varieties are used freshly and for technical purposes. Abbasi, Agh aldere, Agh gulabi, Khungi, Gara merendi, Gara okuz gozu, Gara sebze, Boz merendi, Badamli, Batikh, Beneniyar, Talibi, Goyungozu, Durzali, Zeyneddin uzumu, Mehse Ali, Mahmudu, Narinjigile, Pishik uzumu, Sari aldere, Sahibi, Tabarza, Khanimi, Gara khazani, Shangirey, Shekerbura, Hafizeli are universal varieties.

The size of bunch and seed of table varieties are generally big and medium. The biggest seed found in

Absheron gelinbarmaghi (berries size – 18-23x16-22 mm), Haji Abbas (berries size - 20-26x19-24 mm) and Ala shani (berries size – 16-24x15-23 mm). The preference was reflected on the weight of 100 separate seeds of grapes. Sweetness of grape was 172 (Gavangir) -279 gr.100 cm³ (Sarigile). Average weight of bunches was lower in Sarigile (170 gm) and Fatmayi (180 gm) varieties, in Absheron gelinbarmaghi (250 gm), Ala shani (240-278 gm), Haji Abbas (286 gm) was medium, but in Gavangir variety was higher (3864 gm).

From immunological assessment, it is observed that local grape varieties of Absheron were resistant to oidium disease (2-2.5 points) and tolerant (3-3.5 points). The climate of Absheron is dry-subtropical and mildew is not found here. Gavangir and Fatmayi (3-3.5 points), Haji Abbas, Sarigile, Absheron gelinbarmaghi, Ala shani varieties (2.5 point) were found tolerant to grey rot disease (table 3).

During expedition in Garabagh-Mil region 25 local and 2 introduced grape varieties were found, 12 of them were low spread local varieties. (Agh Beylagani, Gelinbarmaghi, Nubari, Ari uzumu, Arayatli gara uzumu, Agh Gavra, Surmeyi, Fuzuli kechimemesi (Kehrabayi), Gizil uzum, Alikhanli kechimemesi and Bey uzumu). From morphometric measurements the grape varieties may be categorised into two groups namely medium (Nubari, Arayatli gara uzum, Alikhanli kechimemesi) and big sized (Agh Beylagani, Gelinbarmaghi, Agh Gavra, Surmeyi, Fuzuli kechimemesi, Gizil uzum, Gozel uzum, Bey uzumu). Separate seeds of studied varieties were different-coloured, formed, mainly small (Nubari), medium (Ari uzumu, Arayatli gara uzumu, Gizil uzum), big (Agh beylagani) and bigger (Gelinbarmaghi, Agh gavra, Surmeyi, Fuzuli kechimemesi, Gozel uzum, Alikhanli kechimemesi, Bey uzumu) sized.

Through phytopathological evaluation it was observed that both of above-mentioned varieties against Agh Beylagani and Gelinbarmaghi varieties were not resistant to mildew disease (4 points), but showed average resistance (3 points) to oidium and grey rot diseases. Surmeyi variety was tolerant (3.5 points) to mildew and oidium diseases, but bunches were low tolerant (5 points) to grey rot disease. Other varieties showed resistance (3-3.5 points) to mildew and oidium diseases. The varieties Nubari, Ari uzumu, Arayatli gara uzumu, Agh Gavra, Gozel uzum, Alikhanli kechimemesi, Bey uzumu were resistant (2.5 points) to grey rot disease (Table 4).

Table3: Some morphological and technological traits of local grape varieties collected through expedition

No	Region and name of varieties	Bunch size(cm)	Seed size(mm)	Number of seeds	Weight of 1000 seeds (g)	Average weight of bunches (g)	Sweetness of seeds, (g.100cm ⁻³)	Seed acidity (gdm ⁻³)	Vegetation period (day)
Garabagh-Mil region (Fuzuli, Beylagan region)									
1	Agh Beylagani	18-22x11-15	18-23x17-22	104	266	276,0	19,6	4,62	166
2	Gelinbarmaghi	18-26x12-16	28-36x20-22	84	542	386,5	18,6	5,76	177
3	Nubari	8-17x5-8	10-15x10-15	52	216	126,8	15,9	6,05	120
4	Ari uzumu	11-21x7-10	15-17x15-16	102	224	200,0	19,2	5,70	146
5	Arayatli gara uzum	13-16x7-9	15-18x14,5-17,5	96	307	180,0	18,2	6,00	139
6	Agh Gavra	20-28x16-20	26-32x19-22	88	396	335	18,6	5,27	177
7	Surmeyi	16-26x11-15	22-26x15-18	72	423,7	210,6	16,2	5,89	147
8	Fuzuli kechimemesi (Kehrabayi)	13-27x8-14	27-35x19-20	96	527,8	441	15,2	6,41	152
9	Gizil uzum	18-21x7-8	15-18x14,5-17,5	108	298,5	234,5	17,5	5,18	176
10	Gozel uzum	15-27x7-12	20-27x14-19	88	424	322	17,0	6,04	171
11	Alikhanli kechimemesi	13-15x8-12	20-27x13-17	82	336	253	16,0	5,97	155
12	Bey uzumu	17-28x12-15	23-28x18-21	130	421	564,8	17,5	5,15	155
Absheron region									
1	Gavangir	15-20x10-14	14-20x14-19	152	230,8-286,4	386,4	17,2	6,60	162
2	Fatmayi	18-24x10-14	15-21x14-20	125	210	180,0	18,5	5,25	150
3	Haji Abbas	18-25x12-19	20-26x19-24	92	336	286,0	18,2-24,6	5,62-3,46	162-168
4	Sarigile	15-22x10-15	15-21x12-20	84	240	170,0	21,8-27,9	3,9-7,3	146
5	Absheron gelinbarmaghi	17-22x14-18	18-23x16-22	80	406	250	20,3	5,7	152
6	Ala shani	14-22x12-16	16-24x15-23	112	325	240-278	18,5	6,5	156

Table 4: Resistance of local grape varieties to main diseases

No.	Regions and varieties	Mildew	Oidium	Grey rot		
		Leave	Fruit	Leave	Fruit	Fruit
Garabagh-Mil region						
1	Agh Beylagani	4	4	3	3	3
2	Gelinbarmaghi	4	4	3	3	3
3	Nubari	3	3	3	3	2.5
4	Ari uzumu	3	3	3	3	2.5
5	Arayatlı gara uzum	3.5	3.5	3	3	2.5
6	Agh Gavra	3	3	3	3	2.5
7	Surmeyi	2.5	2.5	3.5	3.5	5
8	Fuzuli kechimemesi	3	3	3	3	3
9	Gizil uzum	3.5	3.5	3.5	3.5	3.5
10	Gozel uzum	3.5	3.5	3	3	2.5
11	Alikhanli kechimemesi	3	3	3	3	2.5
12	Bey uzumu	3	3	3	3	2.5
Absheron region						
1	Gavangir			3	3	3
2	Fatmayi			2.5	2.5	3
3	Haji Abbas			3	3	2.5
4	Sarigile			3	3	2.5
5	Absheron gelinbarmaghi			2.5	2.5	2.5
6	Ala shani			2.5	2.5	2.5

Note: 0-point-immune 1 point – more resistant 2-2.5 points - resistant 3-3.5 points - tolerant 4-4.5 points – not resistant 5 points – not more resistant

The juice content and sweetener of two black seeded variety namely Ari uzumu and Arayatli gara uzumu were high and utilize for preparation of red table wines by local people [28].

From evaluation of 74 varieties it was observed that, 17 varieties namely Agh uzum, Fuzuli kechimemesi, Gara Asma, Parkent, Sari Karan, Oktyabrski, Vishnyoviy, Tozlayici, etc. showed tolerance (3-3.5 points) to oidium disease. Only Bayanshire variety was tolerant to mildew disease. 4 varieties and forms –Nakhchivan gulabisi, Gara Nakhchivan Khatini, Kishmish Khishrau were resistant to pests and were less infected (1 point).

Among the wild samples, 7 sample (№ 71, 78, 43, 74, 34, 32, 72) were identified as resistant to both of these stress factors (Musayev and Huseynova, 2007 And 2012).

From evaluation of 15 grape varieties and 21 wild samples against salt and drought resistance, it was observed that 8 varieties (Agh Kishmish, Tozlayici, Garaquash ureyi, Agh shani, Bayan shire, Hafizeli, Sarigite, Swamakhi merendisi) show resistance against such stress condition.

The ampelographic and agricultural characteristic of two new Forms of grape namely Nargizis Alinec ouzumu and Nargizi are given table-5.

A number of expeditions were organized in different regions of Republic for collection of ancient variety and their wild relatives. Biological-agricultural traits of collected varieties and forms were evaluated. But first time ampelographic descriptions of threatened new varieties were done and collected varieties were certificated and included in database. Some phytopathological, immunological and

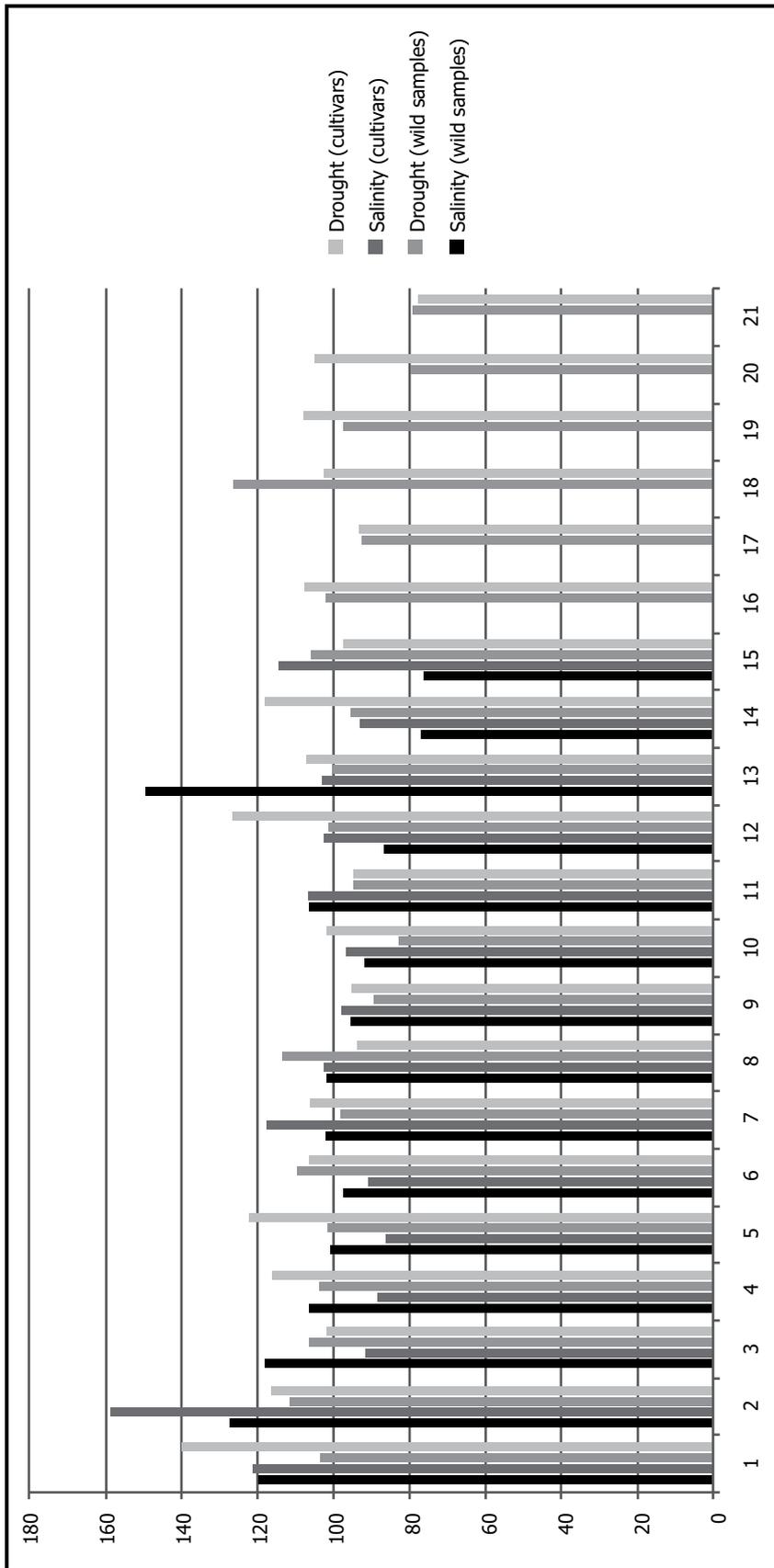


Figure 2. Changing the amount of chlorophyll in some grape varieties and wild samples of stress due to salinity and drought.

Cultivars - 1. *Agh kishmish 2. Tozlayıcı 3. Gurmizi kishmish 4. Tabrizi 5. Misqali 6. Naxchivan sari kishmishi 7. Hafizeli 8. Bayanshire 9. Shamakhi merendisi 10. Sangile 11. Gara qush ureyi 12. Gizal uzum 13. Aghshani 14. Medrese 15. Gara shani;
Wild samples - 1. № 71, 2. № 78, 3. № 74, 4. № 34, 5. № 13, 6. № 43, 7. № 79, 8. № 10, 9. № 80, 10. № 4, 11. № 9, 12. № 72, 13. № 90, 14. № 17, 16. № 13, 17. № 87, 18. № 76, 19. № 75, 20. № 7, 21. № 73*

Table5: Characteristics of Nargizi and Alince grape

Character	Nargizi	Alince
Bunch	Winged-conical shaped very big and dense. (450-1200 g) Length of bunches was 160-210 cm, width is 100-120 cm. Stalk is short (4-6 cm), green-coloured. Harvest is pulled up from its branch hardly.	Bunches are winged-cylindrical and very dense. Average length of bunches is 280 cm, width is 140 cm. Length of some bunches is 40-45 cm. Average weight of bunches is 400-520g, number of berries of a bunch is 140-2300 pcs. 650-800 weighted bunches are often met. Bunch stalk is 4-7 cm.
Berry	Berries are big, round shaped, light blue coloured and are covered with white scale. Diameter is 220-240 mm. Skin is medium-sized thick, seeds are pulpy-juicy, have flavour muscat taste. Skin is difficult to separate from pulp	Berries are round-shaped, sometimes ovoid, diameter is 18-20 mm, dark-reddish coloured and are covered with wax layer. Skin changes its colour to bright darkish-red when it is wiped. Berries are juicy, skin is thick, pulpy part is colourless. Length of stalk is medium-sized. Berries are hardly separated from stalk. Juice is greyish-dark coloured.
Vegetative period	It is late maturing variety (170-175 days). Complete physiological maturity in the second half of October. 4380-4403°C temperature is spent for complete physiological maturity	It is medium-early maturing variety (155-165 days). Complete physiological maturity of bunches occurs at the end of September and in the beginning of October. 3650-3660°C temperature is spent for complete maturing.
Productivity	It is very productive. Productivity is 15-20 kg, average yield is 40-45 ton ha ⁻¹ . During technical ripening period the juice sweetness is 18%, acidity is 6 g.l ⁻¹ and juice extraction is 82%.	It is very productive. Productivity is 12-15 kg, but 26-31 tons for a hectare. Juice sweetness is 180-200gr/100cm ³ , acidity is 50-60g/dm ³ while technical maturing period. The second ten days of October, juice sweetness may be increased up to 220g/100cm ³ .
Special feature	It is used for table and technical purposes. Tasting value is 85 points. This variety can be widely used in making dark wine.	It is a technical variety. Suitable for high quality sweet and dark wines, grape juices. Mature fruit may be kept on vines for a long time. It can tolerate long transport.

physiological parameters of grape varieties conserved in collection were evaluated and new resistant varieties were selected. Collected materials were included in gene pool to enrich the collections. Growing of above mentioned grape have great perspectives not only in Azerbaijan, but also in countries with similar climatic conditions.

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