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Biodiversity of grapevine in Azerbaijan

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ABSTRACT

Results of studies of the genetic diversity of grapes in Azerbaijan are discussed. The large distribution of local varieties and their wild relatives in the republic is presented. The main bio-morphological and economic characteristics of the samples are determined. The essential differences between varieties and wild samples were is defined. As a result their areal was determined, mechanical and chemical composition of fruits, biological-agricultural traits of collected varieties and wild forms were evaluated. Results indicated that in Azerbaijan wild grape samples are spread widely in large areas and along the banks and shores of river, lake and sea, and on mountain slopes. There are two kinds of wild grape in Azerbaijan: *typica* Negr. (with hairs) and *aberrans* Negr. (hairless). At present more than 600 local 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. Salt and drought tolerant varieties also reported. Most of the local threatened varieties are conserved for utilizing them in future improvement programme.

Keywords: Biodiversity, genetic resources of grapes, local varieties and wild grapes.

INTRODUCTION

Azerbaijan is considered one of evolution centers of cultivated plants. Practically all present-day major cultivated plants for the first time appeared in Azerbaijan several millennia B.C. As example there can be mentioned signs of farming, ancient horticulture discovered in a settlement westward of Goy-Gol town in the early second millennium B.C. Fruit crops (apple, pear, apricot, pomegranate, quince, fig, almond, walnut, hazelnut etc) and grape have been cultivated to meet the demand of the population for foodstuff and other products. Most of these crops are still considered major agricultural crops in the country.

Vine-growing was one of the most ancient and widely spread fields in economic life of people of Azerbaijan. From the results of different investigation and study like archaeological excavations, paleobotanical, ampelographic information, tongue and folklore samples, written sources, toponomic etc., Azerbaijan was determined as one of the cultural centers of vine-growing. The territory of Azerbaijan has very favourable conditions for improvement and development of vine-growing. Primitive men had collected wild fruits and berries, as well as wild grape, besides hunter and fishery and used them as tasty food stuffs.

In 1963 in the western part of Bozdagh (Goy Gol region) while geological investigations by Azerbaijan scientists, by chance found lots of plant remains in Absheron sediments which formed 1-2 million years ago. Most of these residues were tracks of wild grape leaves on stone. Formation of wild grape in this area (approximately 500, 000 years ago) was proved by stoned grape leave found in Nakhchivan (Allahverdiyev *et al.*, 1973; Babayev, 1988). This finding proves that, the region is one the ancient vine-growing centers. These discoveries are very valuable not only for historians but also specialists of other sciences like paleobotanics, ampelographics, fruit-growers, geologists and soil scientist. Researchers concluded that, the origin of cultured grape was from wild grape areas. According to a notable scientist N.I. Vavilov, as animals, plant domestication is also possible in areas which enriched with available species. By his long term investigations, he had determined that, Azerbaijan and Southern Caucasus are the main origin centers of crops, as well as grape (Vavilov 1931).

While archaeological excavations near Aghstafa region in 1962 year, various plant remains, also grape seeds had been found in “Shomutepe” monument belonged to V-IV millennium BC. Investigations had showed the culture and year parameters of grape seeds. Mainly on the base of this finding it was proved that, the history of cultured vine-growing in Azerbaijan has at least 7 millenniums.

MATERIALS AND METHODS

Materials of research work consisted of grapevines and yields of local grape varieties and wild grape forms. Ampelographic description of grape varieties and wild grapevines had been implemented on the base of common methods (Lazarevsky, 1963; Morozova, 1987; Negrul 1959; Smirnov *et al*., 1987). Phytopathological and

immunological descriptions and assessments of grapevines on natural background were carried out by appropriate methods (Nedov, 1985) and stress factors resistance of varieties and forms had been evaluated by appropriate methods (Kushnirenki *et al.*, 1976, Udovenko, 1988).

RESULTS AND DISCUSSION

In the Republic of Azerbaijan, the wild grape samples spread widely in large areas and 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 and etc. regions for studying the genetic resources of grape.

At the same time as it may be concluded that wild grape spread on the whole territory of Azerbaijan is very ancient formation. 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 18 m below sea-level (Kyur riverside, Salyan region) to 2000 m above sea- level (Gusar region). There are two kinds of wild grape in Azerbaijan: *typica* Negr. (with hairs) and *aberrans* Negr. (hairless).

While expedition in Guba-Khachmaz region it was known that, Guba region is enriched with wild grape. In forests of this region (Uzunmeshe, Alpan, Khujbala, Digah, Aghbil, Susay Gishlag, Dallakand villages) along Guruchay, Gusarchay, Gudyalchay rivers lots of wild grape forms were found. In Nabran forests of Guba-Khachmaz region dark and dark purple coloured grape forms were found. In forests of Khachmaz (Pir forest), Shaky (Oraban), Lankaran (Seligavul) and Gabala (Shongar) regions small seedy dark wild grape varieties were also determined. On 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 phitocenetic features of their spreading areas were described.

At the result of investigations it was determined that, different populations of wild grape in Azerbaijan republic spread mainly in three formations - tugay (streamside forest), typical broad-leaved forests and coastal area of the Caspian Sea. 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 wild grapevines spread mainly in tugay forests densely and widely. But typical forest formation of wild grape was found in Agharehimoba, Godekli, Gimilgishlag, Gadashoba, Nerecan and etc. villages and forests (forest number 1, Pir forest) of Khachmaz region, Seligavul forest of Lankaran region and Shongar spring of Gabala region.

Wild grape samples distinguish each other for their biomorphological traits. As rule male grapevines are strong while functional female grapevines are weak. All samples of wild grape can be divided into 4 groups for leaves bigness: very small (length up to 4,0-8,0 cm), small (length up to 8,0-12,0), medium (length 12,0-15,0 cm) and large leaved (length more than 15 cm). Most of studied varieties were involved to small and medium leaved group. Wild grape samples can be divided into 3 groups for leaves sub-sections: whole, medium and cross-section leaves. Some samples are covered with white net-shaped blooms, but in some cases under surface are bare. Samples are distinguished for leave sides. Sides are mainly sharp, triangular and round shaped. Stalk hollows are namely lira-shaped, but rarely sides are parallel and bottom is flat. Wild grape samples are two housed, that is they have male or female flower groups (Akparov *et al*, 2010).

Self-pollinated bisexual flower groups of wild grape samples were not found. According to some researchers' opinions that types of flower groups of wild grape are very important morphological trait for defining grape origin, because wild grape is two housed subspecies. Bunch flowers of wild grape can be distinguished each other for their forms, they are small or medium sized. As a rule, the bunch flowers of male grapevines are big and cone-shaped. But bunch flowers of female grapevines are small, cone-shaped-cylindrical or cylinder-shaped. Bunches of wild grape are small, the length is 7.0-13 cm and the width is 6-8 cm. There are 1-2 bunches on productive shoots. Bunches are mainly set on 3-5th churn-stuffs of new shoots. Skin of separate seeds of grape is dark or reddish dark. Seeds are oval-shaped. The surface is covered with thick wax layer. Most of wild grape varieties are resistant to mildew and oidium disease.

More famous local varieties of grapevine are cultivated in Absheron, Garabagh, Ganja-Gazakh, Shirvan, Guba-Khachmaz regions and Nakhchevan AR of Azerbaijan. Hundreds (according to some information about more than 600) of landraces of grapevine are grown in the Republic. White, red, black, pink colored table, technical and seedless grapevine varieties – 'Agh shani', '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', 'Devegozu', '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' and etc. are cultivated here. Most of them are only grown in definite areas and private courtyards by amateur gardeners (Akparov and Musayev, 2012, Musayev, 2003).

Physiological complete maturing period is characteristic inherited trait for each variety. Varieties, clones, new forms studied in genefund are distinguished each other for their maturing periods. It was determined by investigations that, maturing periods of fruits of local grape varieties in Azerbaijan Republic can be divided into the following groups. Existing local grape varieties are distinguished each other for their use directions in the Republic. Here table, technical and universal varieties are met. Between them the table grape more dominates.

Expeditions and investigations were implemented for the purpose of finding, collection and inventory of local grape varieties in Azerbaijan. Spreading areas of local grape varieties and wild grapevines found through expeditions and investigations, etiquette of grapevines were noted, their some morphological-biological and immunological characteristics were determined and mechanical and chemical investigation (in lab condition) of yields were carried out.

During expeditions and researches arranged in Absheron region 'Gavangir', 'Fatmayi', 'Haji Abbas', 'Sarigile', 'Absheron gelinbarmaghi', 'Ala shani' table grape varieties were found freshly. Gavangir and Sarigile varieties possess more juice extraction than others. Therefore doshab and grape juice are produced of them. It was known that, bunches and seeds of these varieties are medium and big-sized and this is characteristic for table varieties. The biggest separate seeds of variety belong to 'Absheron gelinbarmaghi' (berries size – 18-23x16-22 mm), 'Haji Abbas' (berries size - 20-26x19-24 mm), 'Ala shani' (berries size – 16-24x15-23 mm) varieties. This preference was reflected on the weight of 100 separate seeds of grapes. Sweetness of separate seeds of grape was 17.2 ('Gavangir') - 27.9 gr/100 cm^3 ('Sarigile'). Average weight of bunches was lower in 'Sarigile' (170 gram) and 'Fatmayi' (180 gram) varieties, in 'Absheron gelinbarmaghi' (250 gram), 'Ala shani' (240-278 gram), 'Haji Abbas' (286 gram) was medium, but in 'Gavangir' variety was higher (386,4 gram) (Akparov *et al*, 2010). It was known at the result of phenological observations that, studied varieties ripen averagely ('Sarigile', 'Fatmayi', 'Absheron gelinbarmaghi') and lately ('Gavangir', 'Haji Abbas', 'Ala shani').

It was determined while immunological assessments of local grape varieties of Absheron on the natural background that, they were resistant to oidium disease (2-2.5 points) and tolerant (3-3.5 points). The climate of Absheron is dry-subtropical and therefore in most cases development of mildew disease is not found there. At the result of observations it was known that, 'Gavangir' and 'Fatmayi' (3-3,5 points), 'Haji Abbas', 'Sarigile', 'Absheron gelinbarmaghi', 'Ala shani' varieties (2.5 point) were tolerant to grey rot disease.

25 local and 2 introduced grape varieties were observed while expedition in Garabagh-Mil region that, 12 of them were low spread local varieties. 'Agh Beylagani', 'Gelinbarmaghi', 'Nubari', 'Ari uzumu', 'Arayatli gara uzumu', 'Agh Gavra', 'Surmeyi', Fuzuli kechimemesi', 'Gizil uzum', 'Alikhanli kechimemesi', 'Bey uzumu' are such grape varieties. It was known during morphometric measurements that, their bunches were 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'), bid ('Agh beylagani') and bigger ('Gelinbarmaghi', 'Agh gavra', 'Surmeyi', 'Fuzuli kechimemesi', 'Gozel uzum', 'Alikhanli kechimemesi', 'Bey uzumu') sized.

It was concluded through phytopathological evaluation of above-mentioned varieties against mildew, oidium and grey rot diseases in natural situation that, '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. And other varieties showed resistance (3-3.5 points) to mildew and oidium diseases. It was also defined that, 'Nubari', 'Ari uzumu', 'Arayatli gara uzumu', 'Agh Gavra', 'Gozel uzum', 'Alikhanli kechimemesi', 'Bey uzumu' varieties were resistant (2.5 points) to grey rot disease. Above-mentioned varieties are local and they are mainly used freshly. 'Agh Beylagani', 'Gelinbarmaghi', 'Agh Gavra', 'Fuzuli kechimemesi', 'Gozel uzum', 'Alikhanli kechimemesi', 'Bey uzumu' can be conserved for a long time and even yield is kept on grapevines till winter. 'Arayatli gara uzumu' and 'Ari uzumu' varieties possess high juice extraction and sweetness, therefore red table wines are made of these varieties by local people (Akparov *et al*, 2010).

Research works on evaluation of biological-agricultural traits of grape varieties and forms (local, introduced) cultivated in ampelographic collection gardens and experimental fields were implemented. While evaluating disease and pest resistance of studied 74 varieties and forms it was noted that, a number of varieties were infected by oidium disease.

Among them 17 varieties – 'Agh uzum', 'Fuzuli kechimemesi', 'Gara Asma', 'Parkent', 'Sari Karan', 'Oktyabrski', 'Vishnyoviy', 'Tozlayici', and etc. showed tolerance (3-3.5 points). Only 'Bayanshire' variety was tolerant to mildew disease. 4 varieties and forms –'Nakhchivan gulabisi', 'Gara Nakhchivan Khatini', 'Kishmish Khishrau' and form number 2 were resistant to pests and were less infected (1 point).

Salt and drought resistance of 15 grape varieties and 21 wild samples were studied for their main physiological traits (stress depression of pigment complex in osmotic solution (sucrose 2% NaCL) in complete formation stage of leaves). It was known that, studied varieties and wild samples demonstrated different reaction to stress factors and plants showed unlike attitude to salt and drought. And it was possible to select resistant varieties on these bases. At the result of experiments high salt and drought resistance were observed in 5 varieties ('Agh kishmish', 'Tozlayıcı', 'Gara qush ureyi', 'Agh shanı', 'Bayanshire') and resistance in 3 varieties and 3 varieties ('Hafizeli', 'Sarıgile', 'Shamakhı merendisi') were observed as resistant to these stress factors. Among the wild samples, 7 samples (No. 71, 78, 43, 74, 34, 32, 72) were identified as resistant to both of these stress factors (Musayev and Huseynova, 2007, Musayev and Huseynova, 2012).

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