

**Collection, study and use of crop wild relatives of fruit plants in Azerbaijan**

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**ABSTRACT**

Azerbaijan is considered as being a primary or secondary center of origin, domestication and diversity of many fruits, grapevine and nuts, taking their basis from the Crop Wild Relatives (CWR) of the region. The wild relatives of major fruits and nuts like grapevine, apple, pear, quince, medlar, pomegranate, fig, cherry, apricot, almond, hazelnut, walnut, chestnut, pistachio and others are presented with many genera in the flora of Azerbaijan. Despite broad utilization of native varieties in the conventional agriculture, the traditional use of CWR as fresh food, food additives or for maintaining the ecological diversity still persists among the populace. These wild relatives form an important constituent of traditional foods ('Doshab', 'Behmez', 'Narsharab', 'Nardancha', 'Axta', 'Lavashana' and others), as feed for domestic animals and as a basic genetic material for breeding of new improved cultivars. Except fruit utilization the WR are operate as rootstocks and for live fences; they are honey, decorative and medical plants, suitable for making anti-erosion and wind-brake line plantations, forest garden construction. The CWR in Azerbaijan are conserved in protected areas and botanical gardens, while *ex-situ* and *on-farm* conservation are limited in spite that some species are included in the local "Red Books". There are few projects increasing the importance of CWR here. Including in the global databases, in applied research and breeding programs can enlarge public awareness of CWR, promoting traditional ways for their usage.

**Keywords:** Biodiversity, conservation, folk selection, fruit species, traditional cuisine,

**INTRODUCTION**

Azerbaijan has got a global importance, being one of the richest countries in plant, animal and microorganism diversity in the world. . Agricultural biodiversity can be protected and taken forward only by rural communities using traditional and ecological agricultural techniques, and implements. Many of these globally important environment and human friendly traditional agricultural production practices and are abandoned by producers due to the development of modern agricultural techniques and marketing problems. Thus are at the verge of extinction. Traditional agricultural knowledge which is related to indigenous technologies and traditional farming and crop beliefs associated with different cycles of crop cultivation or utilization are deteriorating faster than their biological/genetic diversity which are used by local farmers for different purposes of their consumption. Local people are often excellent resource managers when they are allowed to manage their own resources for their own benefit. Land races are the products of their selection and even multiplication over long periods of time.

Therefore, their participation to the conservation of bio/agro-biodiversity is essential to identify how more complex traditional systems can be adapted to modern needs, while still retaining the bio/agro-biodiversity of both agro-ecosystem and its surroundings.

Flora of Azerbaijan Republic comprises of more than 5000 species of vascular plants, which include 800 oil yielding, 600 medicinal, 500 aromatic, 500 of vitamin-importance, 850 for dyeing and 1500 species with tannins, 237 of these are endemic. They sprout along Major and Minor Caucasus slopes and in subtropics of Talish Mountains. The South Caucasus is being considered as a primary or secondary center of the origin, domestication and diversity of many fruits, grapevine and nuts taking their basis from the CWR of the region, while the WR of major fruits and nuts like grapevine, apple, pear, quince, medlar, pomegranate, fig, cherry, apricot, almond, hazelnut, walnut, chestnut, pistachio and others are presented with many genera in the flora of these countries. According to Zhukovskii (1964) the South Caucasus should be considered as a hearth of evolution for cultivated plants of the great importance.

Vavilov (1926) in his works about the world centers of origin of cultivated plants includes South Caucasus in the Southwest Asia Center and pointed out (Vavilov, 1931) about exist of 80 species and genus of fruit trees in the Caucasus. He specifies the South Caucasus as the major region for fruits in the Caucasus, the centre of origin and center of domestication of grapevine, pears, cherry plum, pomegranate, sweet cherry, walnut, quince, almond, fig, medlar, Cornelian cherry (*Punica granatum* L., *Cydonia oblonga* Mill., *Diospyros lotus* L., *Pyrus eleagrifolia* Pall., *Pyrus syriaca* Boiss., *Cerasus incana* Spach., *Cerasus micocarpa* Boiss., *Amygdalus georgica* Desf., *Ficus carica* L., *Corylus colurna* L., *Corylus colchica* Alb., *Prunus divaricata* Lebed., *Cerasus avium* (L.) Moench, *Mespilus germanica* L., *Vitis vinifera* L., *Cornus mass* L.). He also indicates growing and wide form origin processes for *Laurocerasus officinalis* L., *Castanea sativa* Mill., *Amygdalus fenzliana* (Fritsch) Lipsky., *Amygdalus orientalis* Mill., *Pyrus communis* L., *Corulus avellana* L., *Juglans regia* L. here. The area of distribution for *Pyrus communis* L., *Malus domestica* Borkh., *Corylus avellana* and *Jeglans regia* are wide and goes out of the Caucasus, but in the South Caucasus they have rich local germplasms.

## MATERIALS AND METHODS

Materials for research included the wild relatives and local varieties of fruit crops grown in field collections of the Institute of Genetic Resources of the National Academy of Sciences of Azerbaijan and other institutions and by farmers in different regions (E38<sup>0</sup>41<sup>0</sup>738' N48<sup>0</sup>24<sup>0</sup>526' 1310 m, N-41.17.928 E-047.06.601;772m, N38<sup>0</sup>53,357'E048<sup>0</sup>43,556'34 m, N 41<sup>0</sup> 21' 59,5<sup>11</sup> E 048<sup>0</sup> 24' 03,0<sup>11</sup> 905m) of the country. Phenological phases, growth, biomorphological description and productivity, fruit quality traits, resistance to disease and pests were studied by using the common description methods of fruit plants (Marozova, 1987.; Smirnov *et al.*, 1987; Michurinsk, 1978; Michurinsk, 1980).

## RESULTS AND DISCUSSION

In the territory of Azerbaijan, 149 species of fruit crops belonging to 39 genera and 15 families can be found. The big number of genera and species of wild fruit and fruit-berry plants spread in forests and rural regions of

Azerbaijan provides the greatest diversity of fruit crops: *Amygdalus communis* L., *Armeniaca vulgaris* Lam., *Berberis vulgaris* L., *Castanea sativa* Mill., *Cerasus avium* (L.) Moench, *C. vulgaris* Mill., *Cornus mas* L., *Corylus avellana* L., *Crataegus orientalis* Pall. ex M. Bieb., *Cydonia oblonga* Mill., *Ficus carica* L., *Fragaria vesca* L., *Hippophae rhamnoides* L., *Juglans regia* L., *Malus domestica* Borkh., *Mespilus germanica* L., *Morus* L., *Persica vulgaris* Mill., *Pistacia mutica* Fisch. & C. A. Mey., *Pistacia vera* L., *Prunus cerasifera* Ehrh., *P. domestica* L., *P. spinosa* L., *Punica granatum* L., *Elaeagnus angustifolia* L., *Pyrus communis* L., *Rubus* L., *Vitis vinifera* L. subsp. *sativa* D.C., *V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi. and etc. One can find many wild forms of apple (*Malus* L.) in large tracts of forest, in river valleys and other places. Wild forms of quince are found in coastal forest area of Caspian Sea. These forests represent service tree (*Sorbus* L.) with 11 species (5 of them are endemic to the Caucasus); hawthorn (*Garataegus* L.) has 9 species; plum (*Prunus* Mill.) – 3, almond (*Amygdalus* L.) – 2, cherry (*Cerasus* Juss.) – 5, blackberry and raspberry (*Rubus* L.) – and 14 currant (*Ribes* L.) with 2 species. Furthermore, one can find wild medlar (*Mespilus germanica* L.), sloe (*Prunus spinosa* L.), alycha (*Prunus divaricata* lebed.), pomegranate (*Punica granatum* L.), sweet cherry (*Cerasus avium* (L.) Moench.), dog-rose (*Rosa* sp.), sea-buckthorn (*Hippophae rhamnoides*), cornel (*Cornus mas* L.), grape (*Vitis sylvestris* Gmel.), nuts and other fruit and fruit-berry crops in the forest and shrubberies, and in mountainous and foothill regions of the Republic (Akparov and Musayev, 2012.; Musayev and Akparov, 2012.; Asadov and Asadov, 2001.; Maghradze *et al.*, 2012.; Mammadov *et al.*, 2000).

Among 27 Caucasian pear species 19 grow in Azerbaijan (*Pyrus boissieriana* Buhse., *P. hyrcana* Fed., *P. grossheimii* Fed. *P. communis* L., *P. caucasica* Fed., *P. eldarca* A.Grossh., *P. voronovii* Rubtz., *P. syriaca* Bioss., *P. salicifolia* Pall., *P. zangezura* Maleev, *P. elata* Rubtz, *P. raddeana* G.Woron, *P. serotina* Rehd., *P. nutans* Rubtz, *P. vsevolodi* Heidemann., *P. oxyprion* G.Woron., *P. complexa* Rubtz., *P. medvedevii* Rubtz. və *P. georgica* Kuth.), having a number of hybrids.

In Azerbaijan there were more than 400 landraces only of pear and half of them were

endangered (Rajabli, 1966). Here are included some varieties of pear (*Pyrus communis* L.) – Abbasbeyi, Agh gulabi, Aghagormez, Aghsach armud, Akhund armudu, Bildirchin budu, Jirnadiri, Hazar armud, Letenzi, Nar armud, Nelbeki armud, Peyghambari armud, Shekeri, Sulu armud, Tir armudu, Tursh sini armud, Turshmalasi armud, Usun armud, Usun sap armud, Yag armud, etc. These varieties differ in ripening time (summer, autumn and winter), size, taste quality, productivity and different factors, for instance, Aghagormez, Bildirchin budu are early ripening, whereas Goy armud is productive (1 ton per tree) (Akparov and Musayev, 2012).

The wild medlar (*M. germanica* L.) is widely spread together with wild pomegranate (*P. granatum* L.) and quince (*C. oblonga* Mill.) in Talish region of Azerbaijan. Some cultivated medlar varieties are ‘Khan ezgili’, ‘Nelbeki’, ‘Kitil’, ‘Agh ezgil’, ‘Arkivan ezgili’ (Akparov and Musayev, 2012.; Imamaliyev, 1988). Zhukovski (1964) opined, that the medlar was domesticated by Caucasian inhabitants, especially in the Talish region of Azerbaijan.

Cornelian cherry (*C. mas* L.) is widely spread in the country and used in local cuisine. It grows in forests with other fruit species like cherry plum, sloe, hawthorn, dog-rose, apple, pear, quince, medlar, hazelnut, currant, raspberry and others. There are various types of cornelian cherries in Azerbaijan differing in color, size and shape of fruits. More than 40 varieties of cornelian cherries were selected by the local population (Mammadov and Musayev, 2011).

The Common (syn. Persian, English) walnut *J. regia* L. wildy grows in Azerbaijan in lower and middle slopes of the Major and Minor Caucasus and in subtropics of Talish Mountains. According to Safarov (1981), the total forest area under walnut is more than 25.000 ha in Azerbaijan. On the basis of fossil records it is approved that the walnut was spread in Azerbaijan during the Tertiary Period and it is a relict plant of Cretaceous Period. The local wild forms of *J. regia* being basis of native walnut germplasm. The Azerbaijan walnut selections like ‘Kaghizi’, ‘Katan koynak’, ‘Araz’, ‘Disar’, ‘Darvish papag’, ‘Nazikgabig’ are well known outside the country too: ‘Evricea’ and ‘Blecmere’

cultivars had been selected from ‘Kaghizi’ cultivar (Akparov and Musayev, 2011, Ibrahimov, 2007).

Wild grapevine - *V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi., the wild ancestor of the cultivated grapevine *V. vinifera* ssp. *sativa* D.C., is a typical flora in Azerbaijan, spread widely in large areas and on the banks and shores of river, lake and sea and mountain slopes. Confirmations of this opinion are high number of autochthonous varieties with ample diversity of berry colour and technological aptitudes; historical information; linguistic and folk data; and certainly, rich palaeobotanical artefacts and archaeological findings discovered since “*Shomutapa culture*”, dated back to VI-IV millennium BC (Pipia et al. 2012., Amanov et al., 2012).

At the same time as it may be concluded that wild grape spread in the whole territory of Azerbaijan during the early times. In general, more than 3000 samples of wild grapes were found in expeditionary regions and phytocenotic features of their spreading areas were described. Wild grape - *V. vinifera* L. subsp. *sylvestris* (C. C. Gmel.) Hegi. of Azerbaijan is distinguished with specific characters. It exists on the territory of Azerbaijan at the elevation of 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: *V. vinifera* L. *typica* Negr. (with hairs) and *V. vinifera* L. *aberrans* Negr. (hairless). In Nabran forests of Guba-Khachmaz region dark and dark purple coloured grape forms were found. 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 forests of Khachmaz (Pir forest), Shaky (Oraban), Lankaran (Seligavul) and Gabala (Shongar) regions small seedy dark wild grape varieties were also observed. On the banks of Kondalanchay river in Fuzuli region dark, dark red, dark purple coloured grape seed forms were observed.

At the end of investigations it was proposed that, different populations of wild grape in our 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 and coastal formation was found in Nabran forests of Khachmaz region (Musayev and Akparov, 2013)

Despite broad utilization of native varieties in the conventional agriculture the tradition of direct usage of CWR for food, food additives or environmental purposes still keeps among populations within the Azerbaijan Republic:

i) Direct fresh fruit consumption like almond, pear, medlar, wild strawberry, raspberry, blackberry, barberry, hawthorn, sea-buckthorn, hazelnut, walnut, cherry plum, cornelian cherry, chestnut, mulberry, Caucasian persimmon, pomegranate and others;

ii) As a raw material for processing and traditional cuisine like wild fig, mulberry, pomegranate, walnut, sloe, apple, pear, apricot, cornelian cherry, persimmon, oleaster, ash berry, bilberry, current, cherry plum, cherry laurel, gooseberry, hazelnut, hawthorn, Caucasian persimmon, sea-buckthorn, snowball, quince, wild rose and others. The fruits used for preparation juice, syrup ('Behmez', 'Doshab'), puree, preserve ('Muraba', 'Compote'), dried fruits ('Axta', 'Movuc', 'Alana', 'Mianpur'), dried layers ('Lavashana'), jam, mose, alcoholic (Wine, 'Araki, Liqueur) and non-alcoholic ('Limonade') beverages, candy, species and souces per dishes ('Lavangi', 'Abgora', 'Sujuq', 'Narsharab'), surrogates (tea, coffee), marinade, 'Kiesel', confectionery ('Badambura', 'Halva', 'Shakarbura', 'Pakhlava', 'Fasali'), others;

iii) including in a food chain as a feed for domestic animals like sea-buckthorn, mulberry, nuts and others;

iv) as the WR of pear, apple, *Pirus salcifolia*, *Pirus sachociana*, quince, cornelian cherry, cherry plum, sloe, Caucasian persimmon, wild rose, hawthorn are used;

v) as live fences - blackberry, barberry, sea-buckthorn, hawthorn, oleaster, cherry plum, sloe, *Pyrus salicifolia* and others;

vi) as decorative and medical plants, suitable for making anti-erosion and wind-brake line plantations; forest garden establishment.

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