
WILD PEARS OF ARMENIA: DIVERSITY, ENDEMIC AND CONSERVATION

Anna Asatryan

*Institute of Botany after A.L. Takhtajyan, National Academy of Sciences of the
Republic of Armenia, Acharyan str. 1, Yerevan 0040, Armenia;
E-mail: crocus@post.com*

Abstract: The paper presents the wild pear diversity and distribution in Armenia with focus on endemism. As result of the fieldwork, literature and herbarium studies six main “hotspots” for pear diversity are identified within the country. The list of pear species for each site are given. The questions and challenges in research and conservation of *Pyrus* L. in Armenia are discussed - the main difficulties are linked with the proper evaluation of the morphological polymorphism in populations and ongoing hybridization processes within the genus. It is mentioned, that there is strong need for critical taxonomic review of *Pyrus* sp. in Armenia and so the taxonomic status of some endemic pear species need to be clarified.

Keywords: *Pyrus* sp. in Armenia, wild pears, flora of Armenia, endemic pears, *Pyrus gergerana*, *Pyrus daralagezi*

INTRODUCTION

Armenia is located in the Caucasus Ecoregion – one of the Planet’s biodiversity hotspots. This small mountainous country is remarkable for its rich and diverse flora and vegetation. Flora of Armenia includes about 3800 vascular plant species, 144 of which are local endemics (Anonymus 2014). Rare species, genetic diversity within a number of taxa, including wild relatives of cultivated plants and habitats of regional and global conservation concern are of particular scientific interest and conservation importance. *Pyrus* L. is one of the most interesting genera in this context: there are 32 pear species in the flora of Armenia 12 of which are endemics of Armenia and 6 are endemics of the Southern

Transcaucasia. 18 from all the known pear species were described from Armenia (Akopian 2007).

Pyrus L. represents deciduous tree and shrub species, estimated number of which differs considerably, ranging from 20 to 80 species. They are distributed in temperate Eurasia, reaching the Atlas Mountains in North Africa as well as Japan and South China. The centers of diversity for *Pyrus* are in the mountainous regions of East Asia, the Mediterranean, and South-West Asia, including the Caucasus (Korotkova *et al.* 2018).

Transcaucasia is considered as one of the speciation and evolution centers for pear species (Gabrielyan 1988). Gladkova (1990) mentions the Caucasus to be the main center for diversity of wild pears. Wild pears in the Caucasus form two main ecological groups: mesophytic and xerophytic and, accordingly, found in arid open woodlands and in deciduous forests, where occur mixed with oak or form small groves on forest glades and by the forest edges. Wild pears actively reproduce on open grasslands left after felling as pear is one of the “pioneers” of the forest vegetation (Sokolov 1954). One can also see sparse pear communities by the lower limit of deciduous forests – result of the trees selective cutting.

Especially remarkable for the wild pear diversity are the southern provinces of Armenia: except the fact, that all 32 pear species of Armenian flora are found there, half of them are characteristic only to this part of Armenia. Particularly interesting is Vayots Dzor province with 25 pear species, 9 of which are national endemics.

In general, 10 pear species are listed in the Red Data Book of Armenia (Tamanyan *et al.* 2010) and all under threatened categories; 7 of them are Armenian endemics. 9 pear species from Armenian flora are included in the IUCN Red List (<http://www.iucnredlist.org/>) under threatened categories – all are national endemics.

Here is their list with the IUCN Red List status: *Pyrus browiczii* Mulk. (CR), *P. sosnovskyi* Fed. (EN), *P. tamamschjanae* Fed. (EN), *P. complexa* Rubtzov (VU), *P. theodorovii* Mulk. (EN), *P. hajastana* Mulk. (EN), *P. daralagezi* Mulk. (EN), *P. voronovii* Rubtzov (CR), *P. gergerana* Gladkova (CR).

Not only particular species, but wild pear communities of Armenia are of conservation importance (Asatryan and Fayvush 2013). Lack or absence of data on distribution, biology and threats

to these unique botanical objects as well as absence of any research on population level arouse difficulties for their effective conservation.

In 2016 and 2017 we carried out work with literature, herbarium studies and field research on some endemic pears of Armenia in order to clarify their distribution and to collect data on the threats to the species. With support from Fauna and Flora International (FFI) in the framework of the Global Trees Campaign (GTC) the following scoping grants have been implemented by "Nature Rights Protection" NGO: "Herher pear scoping project", "Scoping wild pears in southern Armenia" in 2016, "Identification of the pear species and their distribution in the Herher state sanctuary" in 2017–2018. *P. gergerana* (Figure 1) was chosen as the main target species, and two other rare endemic pear species *P. daralagezi* (Figure 2) and *P. voronovii* were involved too as their distribution areas partially overlap with the area of *P. gergerana*.

So, the main objectives of the studies were the following:

- 1) to check the presence of endemic species *P. gergerana*, *P. daralagezi* and *P. voronovii* in the locations, known for them from previous investigations;
- 2) to make an assessment of the pear diversity on the territory of Herher state sanctuary.

Only two trees of *P. gergerana* were found in the area around village Goghtanik, Vayots Dzor province and one – on the sanctuary's territory. Four trees of *P. daralagezi* were found on the territory of Herher state sanctuary and this was a new location for the species. The presence of *P. daralagezi* near Kechut reservoir (its locus classicus) was confirmed. As a result of our research we consider the taxonomic status of *P. voronovii* doubtful. None of the available herbarium specimens has rhomboid leaves as given in the original description of the species and seen on the type specimen. Also, we didn't find any individual which could be identified as *P. voronovii*.



Figure 1. *Pyrus gergerana* Gladkova. The tree is found by the road to Herher village and the locals consider it a symbol of the village. This is the biggest known individual for the species (photo by A. Asatryan)



Figure 2. *Pyrus daralagezi* Mulk. (photo by A. Asatryan)

Except *P. gergerana* and *P. daralagezi*, the following pear species have been identified as occurring on the sanctuary's territory: *P. salicifolia*, *P. pseudosyriaca*, *P. nutans*, *P. caucasica*, *P. medvedevii*, endemics of Armenia *P. elata* and *P. hajastana*. Also, four hybrid forms, possibly between *P. salicifolia* and *P. oxyprion*, *P. pseudosyriaca* and *P. nutans*, *P. pseudosyriaca* and *P. daralagezi*, *P. pseudosyriaca* and *P. elata* were found (Asatryan 2018).

Sensible intrageneric and intraspecific variability of the taxonomically important traits such as, leaf (*Figure 3*) and fruit (*Figure 4*) shape, size, colour and texture often creates difficulties in identification and so, assessment of the species distribution.



Figure 3. Diversity of Armenia's wild pear leaves (photo by A. Asatryan)

The research let us to identify sites of 'concentration' of genetic diversity of wild pears in Armenia, to explore the distribution of some endemic species and to outline the difficulties in effective conservation of wild pears in Armenia.



Figure 4. Fruit diversity within *Pyrus pseudosyriaca* Gladkova (photo by A. Asatryan)

The main aim of the study was to process the collected data to identify the main ‘hotspots’ of the pear diversity in Armenia and give their descriptions. Some questions aroused during the implementation of the above mentioned projects are discussed as well.

MATERIALS AND METHODS

The research has been carried out in 2016–2018 and included field surveys in the south of Armenia (Vayots Dzor and Syunik provinces). The itinerary was designed in accordance with the target species’ (*P. gergerana*, *P. daralagezi* and *P. voronovii*) distribution data, taken from the herbarium of the Institute of Botany after A.L. Takhtajyan of the National Academy of Sciences, Republic of Armenia (ERE).

Almost all pear trees along the roadsides have been studied along the trip (most of the known locations for the target species were by the roads), herbarium samples were taken for further

processing and identification. The specimens of special interest were marked with labels.

The literature on pear species and their habitats in Armenia was studied; special attention was paid to the original descriptions of the target species and other endemics in order to be prepared to distinguish them both in the field and during identification of the collected herbarium.

Herbarium material – about 150 sheets, on *Pyrus* sp. kept in the Institute of Botany NAS RA were studied. For the endemics we analysed the original descriptions of the species and the herbarium samples (including the type specimens) to understand the main diagnostic features for the target species and to make comparisons with the herbarium identifications made by previous researchers.

The research area covered roads to Herher village, then Yeghegis river gorge, way to Jermuk and its surroundings, including the forest near Kechut reservoir, the roads from Kapan to Vachagan and Srashen villages, Geghi river gorge, Tashtun pass, surroundings of Tashtun and Lichq villages. The field research covered also the area of Herher state sanctuary (6139 hectares) in Vayots Dzor province.

The pear diversity hotspots were identified by analysing the data on the species' distribution, taken from the herbarium of the Institute of Botany of the NAS RA (ERE) and from our field research.

Certain difficulties and problems became evident during the work. We had difficulties trying to identify some samples – they just did not match any of the described taxa. High level of polymorphism in populations, variability of diagnostic features of the species, big number of hybrid forms etc. made the identification process challenging. There is strong need of critical taxonomic review of the group, based on field observations, statistical data, DNA studies etc.

RESULTS

About 120 herbarium samples have been collected during our fieldtrips and processed later.

Six main diversity hotspots for *Pyrus* sp. in Armenia have been identified (*Figure 5*). The pear diversity for each of them is represented below – based on herbarium and literature studies and

data, collected during our fieldwork. The sites on the map are marked according to their numbers given here.

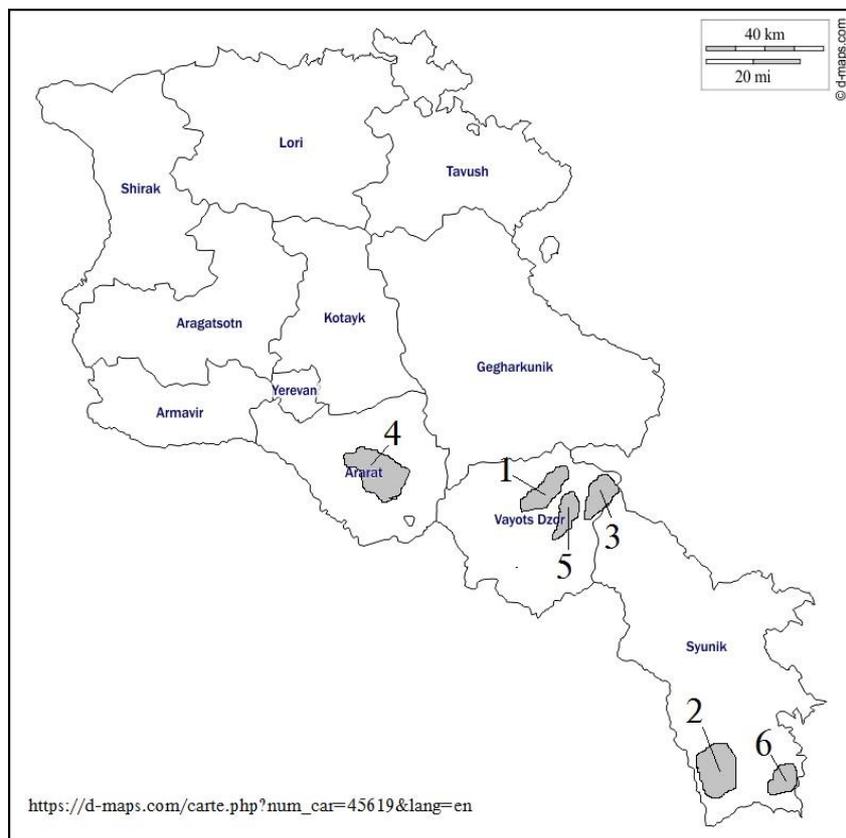


Figure 5. Wild pear diversity hotspots in Armenia (d-maps.com)

1. Yeghegis river gorge, Vayots Dzor province

The total number of pear species is 25, 8 of them are endemics of Armenia.

According to the herbarium data: *P. ketzkhovellii*, *P. vsevolodii*, *P. demetrii*, *P. hyrcana*, *P. turcomanica*, *P. caucasica*, *P. raddeana*, *P. acutiserrata*, *P. syriaca*, *P. medvedevii*, *P. fedorovii*, *P. georgica*, *P. takhtadzhianii*, *P. communis* and following endemics *P. browiczii*, *P. elata*, *P. complexa*, *P. daralagezi*, *P. sosnovskyi*, *P. hajastana*, *P. tamamschjanae*; we added to the list *P. salicifolia*, *P. oxyprion*, *P. pseudosyriaca* and the endemic *P. gergerana*.

2. Tashtun pass, surroundings of Tashtun and Lichq villages and part of Megri Pass, Syunik province

The total number of pear species is 22, 8 of them are endemics of Armenia. According to the herbarium data: *P. grossheimii*, *P. hyrcana*, *P. demetrii*, *P. raddeana*, *P. takhtadzhianii*, *P. acutiserrata*, *P. syriaca*, *P. salicifolia*, *P. medvedevii*, endemics *P. voronovii*, *P. daralagezi*, *P. complexa*, *P. gergerana*, *P. tamamschjanae*, *P. elata*; we added to this list *P. caucasica*, *P. zangezura*, *P. nutans*, *P. pseudosyriaca*, *P. georgica* and two endemics *P. megrica*, *P. hajastana*.

3. Surroundings of Jermuk town, Vayots Dzor province

The total number of pear species is 19, 5 of them are endemics of Armenia. According to the herbarium data: *P. nutans*, *P. fedorovii*, *P. takhtadzhianii*, *P. medvedevii*, *P. caucasica*, *P. ketzkhoveli*, *P. syriaca*, *P. pseudosyriaca*, *P. zangezura*, *P. salicifolia* endemics *P. sosnovskyi*, *P. hajastana*, *P. daralagezi*, *P. gergerana*, *P. megrica* we found *P. oxyprion*, *P. taochia*, *P. georgica*, *P. acutiserrata*.

4. “Khosrov Forest” state reserve, Ararat province

The total number of pear species is 15, 5 of them are endemics of Armenia. According to the herbarium data: *P. communis*, *P. caucasica*, *P. vsevolodii*, *P. turcomanica*, *P. syriaca*, *P. salicifolia*, *P. medvedevii*, *P. oxyprion*, *P. fedorovii*, *P. takhtadzhianii* and endemics *P. tamamschjanae*, *P. sosnovskyi*, *P. theodorovii*, *P. hajastana*, *P. chosrovica*.

5. Surroundings of Herher village and Herher state sanctuary, Vayots Dzor province

The total number of pear species is 14, 5 of them are endemics of Armenia. According to the herbarium data: *P. demetrii*, *P. fedorovii*, *P. takhtadzhianii*, *P. salicifolia* and endemics *P. gergerana* and *P. hajastana*; we added to the list *P. nutans*, *P. communis*, *P. pseudosyriaca*, *P. caucasica*, *P. medvedevii* and endemics *P. sosnovskyi*, *P. daralagezi*, *P. elata*.

6. Shikahogh state reserve, Syunik province

The total number of pear species is 12, 3 of them are endemics of Armenia. According to the herbarium data: *P. communis*, *P. hyrcana*, *P. caucasica*, *P. zangezura*, *P. raddeana*, *P. syriaca*, *P. medvedevii*, *P.*

fedorovii, *P. takhtadzhianii* and endemics *P. tamamschjanae*, *P. megrica* and *P. gergerana*.

DISCUSSION

The main characteristics of the 'hotspots' for pear diversity in Armenia are the following: they located in deep gorges and valleys and include fragments of arid open forest where narrow leaved pear species occur (mainly *P. salicifolia* and *P. oxyprion*) and deciduous forest, where broad leaved mesophytic species occur (*P. caucasica*, *P. syriaca*, *P. pseudosyriaca*, *P. daralagezi* and others).

The pear diversity areas contain also old settlements (at least one village) and the roads. The 'intermediate' leaved pear species and hybrid forms are found mostly by the roadsides and on the glades in the deciduous forests. So, all the pear trees found in the area, including ones in orchards and village gardens have been involved in hybridization process. Certain questions appear in relation to the original descriptions of some rare endemic species, which have been described from just one tree with no data on population and distribution of the particular taxon. Clarifications of their taxonomic status need to be done.

According to Gladkova (1989) *P. sosnovskyi*, *P. demetrii*, *P. tamamschjanae*, *P. vsevolodii* are close and represent garden escapees on the different stages of transformation from *P. communis* group. Such a high level of polymorphism in *Pyrus*, according to her (Gladkova 1990) is caused by two groups of factors: one represents natural evolution, the other is linked with human activity. She thinks that it is here, in the Caucasus region, where the ways of evolution of two ecological groups of species, formed in different ecological conditions, linked. The first group is formed with more or less mesophile species, which ancestors have been part of ancient Tertiary forest flora, remnants of which are still found in relic refugiums in Eastern Asia and Transcaucasia. Our target *P. daralagezi* belongs to this group. The second group is formed with xerophyte species of *P. salicifolia* type, which have been formed in later ages – in arid conditions of the Mediterranean area. Intensive hybridisation processes between representatives of these two groups have been the causes of appearance of many more or less stabile forms carrying the intermediate features of

both groups. The other target species *P. gergerana* is from this group.

Gladkova (1990) writes, that morphologically similar forms appear in different spots of the distribution area as a result of hybridisation of the parental forms. Very often they occur by the roadsides and nearby villages. Many of these individual trees of hybrid origin became the only specimens, which have been considered in description of new species.

Armenia is located in the South-Western Asian – one of the Vavilov's world centers of origin of cultivated plants (Vavilov 1926) and is notable for great diversity of wild relatives of cultivated plants. Caucasus is known as one of the most ancient centres of agriculture and domestication of wild plants. Human activity has been another factor, promoting active hybridisation in populations of wild pears. Main centres for pear diversity are linked with ancient settlements – still existing or abandoned. During many centuries wild forms have been domesticated with further selection activities, at the same time the opposite process of escaping from gardens used to take place. One can still find many ancient pear sorts all over Armenia, which are close to wild forms.

Fruits of wild pears particularly, fruits of Caucasian pear (*P. caucasica*), which is more common in the north of the country, also *P. salicifolia* and *P. pseudosyrriaca* in the southern Armenia are used widely in Armenia by local communities and companies to produce compote, vodka, vinegar. In the southern Armenia, where the diversity of species and forms is much higher locals distinguish particular trees by characteristics of the fruits such as the taste, juiciness and the time when they are perfect for eating: some pear fruits have astringent taste and become edible (soft and brown) some weeks after they fell from a tree. This data, which comes from ages-long observations and practice on site may be very valuable not just for promoting *in-situ* conservation, but for researchers who work on taxonomy of this group. Wild pear seedlings are used as rootstocks for grafting (Sokolov 1954).

Pyrus L. is the largest among the genera of Armenian flora, represented in the IUCN Red List. 9 of total 71 plant species of Armenian flora, listed there under threatened categories are pear species. As mentioned before, 10 pear species are included in the Red Data Book of Armenia, but only part of the populations of just 5

of them are located on the protected areas, others are not protected (Tamanyan *et al.* 2010).

Some of the wild pear species of Armenia are under *ex-situ* protection in the Institute of Botany of the NAS RA: seeds of 7 species (*P. caucasica*, *P. demetrii*, *P. fedorovii*, *P. georgica*, *P. medvedevii*, *P. salicifolia*, *P. syriaca*) are stored in the Seed bank of Armenian flora and 13 species are represented in the live collections of Yerevan Botanical Garden, which is a part of the institute; those are *P. caucasica*, *P. communis*, *P. daralagezi*, *P. fedorovii*, *P. georgica*, *P. medvedevii*, *P. oxyprion*, *P. salicifolia*, *P. sosnovskyi*, *P. takhtadzhianii*, *P. tamamschjanae*, *P. zangezura* (Akopian 2015) and *P. gergerana*.

Acknowledgements – I want to express my gratitude to the team members Dr, Prof. George Fayvush and Kristina Ananyan for their contributions and would like to address special thanks to the project partner “Hayantar” SNCO and particularly, chief forester of Herher state sanctuary Ishkhan Gevorgyan.

REFERENCES

- AKOPIAN, J.A. (2007). On the *Pyrus* L. (*Rosaceae*) species in Armenia. *Flora, Vegetation and Plant Resources of Armenia* **16**: 15–26.
- AKOPIAN, J.A. (2015). *Wild growing fruit plants in the Yerevan Botanical Garden “Flora and Vegetation of Armenia” Plot collection*. Proceedings of the international conference dedicated to the 80th anniversary of the Yerevan Botanical Garden, Edit Print Printing House, Yerevan, pp. 396–402.
- ANONYMUS (2014). The 5th national report on the convention on biological diversity (Republic of Armenia). “Center for Environmental Projects” SNCO, Ministry of Nature Protection of RA, Yerevan, 106 pp.
- ASATRYAN, A. (2018). New data on distribution of some rare plant species (*Pyrus gergerana* Gladkova, *P. daralagezi* Mulk., *P. voronovii* Rubtzov, *Orchis punctulata* Steven ex Lindl.) in Armenia. *Takhtajania* **4**: 51–53.
- ASATRYAN, A. & FAYVUSH, G. (2013). Important plant areas representing the rare and threatened habitat types of Armenia. AG Print Printing House, Yerevan, 77 pp.
- GABRIELYAN, E. (1988). The Red Book of Plants of Armenian SSR. Hayastan Publishing House, Yerevan, 284 pp.
- GLADKOVA, V.N. (1989). Notes on the species of genus *Pyrus* L. (*Rosaceae*) of the flora of Caucasus. *News of higher plants* **26**: 104–113.
- GLADKOVA, V.N. (1990). The synopsis of the species of the genus *Pyrus* L. (*Rosaceae*) for the flora of the Caucasus. *Botanical journal* **75**(6): 874–883.
- KOROTKOVA, N., PAROLLY, G., KHACHATRYAN, A., GHULIKYAN, L., SARGSYAN, H., AKOPIAN, J., BORSCH, T. & GRUENSTAEUDL, M. (2018). Towards resolving the evolutionary history of Caucasian pears (*Pyrus*, *Rosaceae*) – Phylogenetic relationships, divergence times and leaf trait evolution. *Journal of Systematics and Evolution* **56**(1): 35–47. <https://doi.org/10.1111/jse.12276>

- SOKOLOV, S. (1954). Trees and Shrubs of the USSR. The USSR Academy of Sciences Publishing House, Moscow-Leningrad, 871 pp.
- TAMANYAN, K., FAYVUSH G., NANAGYULYAN, S. & DANIELYAN, T. (eds.) (2010). The Red Book of Plants of the Republic of Armenia. Higher Plants and Fungi. Zangak-97 Publishing House, Yerevan, 591 pp.
- VAVILOV, N.I. (1926). Studies on origin of cultivated plants. Printing house after Guttenberg, Leningrad, 248 pp.

(submitted: 10.12.2018, accepted: 02.09.2019)