

New data on globally threatened pear species (*Pyrus* spp.) in Armenia

ANNA ASATRYAN 

Abstract Armenia is notable for its wild pear diversity, which includes a large number of globally threatened endemic species. Despite progress in recent studies there still remains, however, a lack of data on the distribution and population sizes of some species, and any threats to them. This information is necessary to assess their conservation status and for the planning and implementation of conservation actions. I present the results of fieldwork in the Vayots Dzor province of Armenia on the globally threatened endemic pear species *Pyrus daralagezi* Mulk., *Pyrus hajastana* Mulk. and *Pyrus gergerana* Gladkova. I report new data on distribution, threats and species biology. I inventoried individual trees, discovering five new individuals of *P. daralagezi* in Herher sanctuary, rediscovering a population of *P. hajastana* in its locus classicus 52 years after the first record, and finding a new locality for *P. gergerana* around the village of Artavan. I make recommendations for the further study and conservation of these threatened pear species.

Keywords Armenia, crop wild relatives, endemic, flora, *Pyrus*, threats, wild pear

The wild relatives of agricultural crops and other socio-economically valuable plant species are inextricably linked with human history. Among them are wild pears (genus *Pyrus* L.), a valuable gene pool of conservation concern. The centres of diversity for *Pyrus* are in the mountainous regions of East Asia, the Mediterranean and Southwest Asia, including the Caucasus. Estimates of species numbers in *Pyrus* range from 20 to 80 (Korotkova et al., 2018). Armenia, in the Caucasus Ecoregion, is notable for its wild pear diversity, with 32 species, 12 of which are endemic to the country (Akopian, 2007) and 10 of which are globally threatened (IUCN, 2023). Their habitats are arid open woodlands and deciduous forests, roadsides, hay meadows, field edges and abandoned orchards at 800–2,300 m altitude. In the south of Armenia at the lower forest border there are sparse woodlands comprising wild fruit trees such as apples *Malus orientalis*, hawthorns (*Crataegus* spp.), plums *Prunus divaricata* and pears. These habitats originated as a result of selective logging in which fruit trees were spared because of their economic value. There are also sites above the forest where sparse pear communities have

formed as a result of natural reproduction by seed, distributed by wild animals, primarily the brown bear *Ursus arctos*.

The wild pears of Armenia are generally either mesophilic or xerophilic, although some species have intermediate features, probably a result of hybridization (Asatryan, 2019). The mesophilic *Pyrus daralagezi* Mulk., a tree up to 12 m tall occurring in broadleaved forests at 1,700–2,200 m, is categorized as Endangered on the IUCN Red List (Oganesyan, 2014); the xerophilic *Pyrus hajastana* Mulk., a thorny tree up to 5 m tall occurring in open, dry, stony habitats in sparse woodlands at 1,800–2,100 m, is categorized as Endangered (Nersesyan, 2014); and the intermediate *Pyrus gergerana* Gladkova, a thorny tree up to 13 m tall occurring on roadsides and beside fields and hay meadows at 1,600–2,100 m, is categorized as Critically Endangered (Fayvush, 2014). All three are endemic to Armenia (Plate 1), occurring only in the province of Vayots Dzor (Akopian, 2022), which includes three of the six pear diversity hotspots in Armenia (Asatryan, 2019).

These three species were previously known from only a few localities, with little data on their population size or area of occupancy. I collected data on the distribution of all three species during 2016–2018 in the framework of scoping projects with funding from Fauna & Flora International and The Global Trees Campaign (Asatryan, 2018, 2019). My field surveys, targeting these three species and also *Pyrus tamamschianae* Fed. and *Pyrus sosnovskyi* Fed., continued during 2020–2021 as part of a project on conservation translocations of threatened pear species (Asatryan, 2024). One of the aims was to find mature trees as sources of seeds for reproduction in nurseries. My field observations and data collected from the literature and from the herbarium of the Takhtajyan Institute of Botany of the National Academy of Sciences of the Republic of Armenia (herbarium code ERE) indicated that the five species were most likely to occur in the Yeghegis River gorge, areas around the village of Artavan, the Herher open woodland state sanctuary, and the areas along the road to the village of Herher (Fig. 1). During September–October 2020 and 2021, I searched these sites, identifying and inventorying individual trees.

I was unable to locate *P. tamamschianae* or *P. sosnovskyi*, but recorded five new individuals of *P. daralagezi* in the oak forest in Herher open woodland state sanctuary, adding to the four already known from this area (Table 1). I rediscovered a small population of *P. hajastana* in the species' locus classicus, the site from which it was collected in 1968 and described in 1969 (Akopian, 2022). I also found a new locality for *P. gergerana* in the Artavan area, with five

Corresponding author, crocus@post.com
Takhtajyan Institute of Botany of the National Academy of Sciences of the Republic of Armenia, Yerevan, Armenia

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PLATE 1 (a) *Pyrus hajastana* and (b) its population in the Yeghegis area, (c) *Pyrus daralagezi* in Herher open woodland state sanctuary, and (d) *Pyrus gergerana* by the road to the village of Herher.

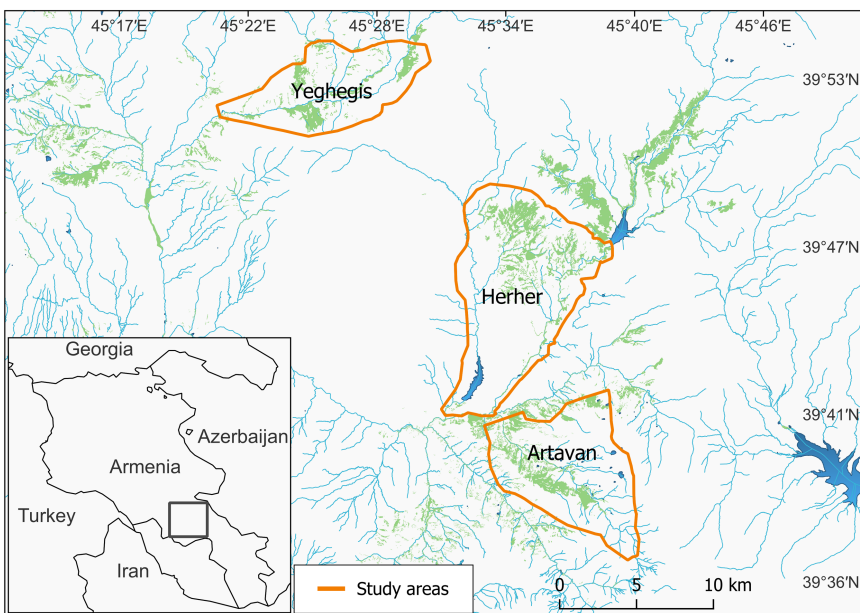


FIG. 1 The three study areas of Yeghegis, Herher and Artavan in Vayots Dzor province, Armenia.

mature trees in hay meadows and beside unmade roads, a few km from each other, bringing the total number of known individuals in the study area to seven. Two are remarkable for their large size and attractive shape, and both produce a large amount of fruit. Geographical coordinates were recorded for all individual trees, for monitoring and seed collection.

My observations indicate that two principal causes are limiting the natural reproduction and expansion of *P. daralagezi*: low seed viability, and fruit structure. Trees bear low numbers of fruits and c. 50% of the seeds were empty and infested, and only half of the healthy seeds germinated in later

propagation at Yerevan Botanical Garden. The fruits have little flesh and are hard, containing a large number of stone cells (sklereids), making them unattractive to animals and thus limiting seed dispersal and germination. In comparison, the widespread species *P. pseudosyrriaca* Gladkova, which co-occurs with *P. daralagezi* in the Herher area, reproduces well and is more common; trees bear relatively large and juicy fruits that are favoured by bears.

The rediscovered population of *P. hajastana* comprises 28 mature individuals and a large number of young trees, germinated naturally from seed, with c. 1,200 in an area of c. 250 m². I observed almost no variability in morphological

TABLE 1 Recorded individuals of the three pear *Pyrus* species recorded in the province of Vayots Dzor, Armenia (Fig. 1), with localities, height, number of trunks and girth (measured at a height of 1.5 m above ground level).

Tree ID	Locality	Height (m)	Number of trunks	Girth (cm)
<i>P. hajastana</i>				
Y1–28	Yeghegis	3–5	1–6	25–30
<i>P. gergerana</i>				
Y29	Yeghegis	13	1	300
H10	Herher	13	1	315
A1	Artavan	4	1	78
A2	Artavan	6	3	42, 62, 66
A3	Artavan	2.5	1	45
A4	Artavan	4	2	28, 41
A5	Artavan	3.5	3	26, 38, 40
<i>P. daralagezi</i>				
H1	Herher	12	1	46
H2	Herher	9	1	134
H3	Herher	6	1	67
H4	Herher	6	4	40, 45, 42, 50
H5	Herher	7	2	42, 98
H6	Herher	7.5	3	50, 70, 76
H7	Herher	9	2	56, 74
H8	Herher	4	3	28, 38, 40
H9	Herher	6	10	30–48

features between trees. This is unusual amongst Armenia's endemic pears, which usually demonstrate some variability between individuals and occur as single trees or small groups of trees rather than forming groves. The successful germination of *P. hajastana* in this population is most likely a result of dispersal by animals: I observed a large number of vole (*Microtus* sp.) holes and bear excrement containing *P. hajastana* fruit remains. The comparatively sparse grass cover in this stony habitat does not hinder the development of tree seedlings, in contrast to the surrounding meadow grass that is probably a barrier to further expansion of this pear grove. I found both *P. hajastana* and *P. gergerana* close to settlements, on roadsides, and by arable lands and hay meadows, which makes them vulnerable to habitat destruction.

The mountainous landscape, general absence of roads and often impenetrable vegetation in wild pear habitats is a challenge to fieldwork. These conditions, along with the difficult taxonomy of *Pyrus* species (Asatryan, 2019), explain the lack of comprehensive data on the distribution of threatened pear species. Because of polymorphism in the populations and variability of the main diagnostic features (e.g. fruit and leaf shape, colour, size, pubescence), I recommend that botanists work as far as possible with fresh material, prioritizing on-site identification. The first half of autumn, when pear fruits are ripe but leaves have not fallen, is the best time for fieldwork.

Threatened wild pear species occur in Important Plant Areas and Key Biodiversity Areas such as the Deciduous Open Forest of Herher Important Plant Area (Asatryan, Fayvush, 2013) and Jermuk–Eghegis Key Biodiversity Area (Zazanashvili et al., 2020) within this area, and their study and conservation helps fulfil the aims of the Global Strategy for Plant Conservation (CBD, 2023) and the Kunming–Montreal Global Biodiversity Framework (CBD, 2022). Conservation of individual trees in their habitat will not only contribute to protection of wild pear genetic diversity and their habitats, but will also ensure continuation of the natural process of speciation.

Wild pear fruits are an important food source not only for wildlife; they are widely used by local communities (Asatryan, 2019). The gene pool of wild pears is a valuable source for selection. There is a need for long-term science-based conservation programmes, to increase the number of individuals in the populations and to create new localities for threatened pear species within their natural range. Further studies on the distribution and population size of threatened pear species are required to support reassessment of their conservation status, and investigations of interactions with pollinators and seed dispersers are needed for an improved understanding of reproduction mechanisms.

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Competing interests None.

Ethical standards This research abided by the Oryx guidelines on ethical standards.

Data availability The data supporting the findings of this study are available within the article.

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