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Ванадзорский государственный университет имени О.Туманяна, кафедра биологии
Ванадзор, ул. Тигран Меци, 36
hasmik-mkhitaryan88@mail.ru

J. A. AKOPIAN

ON THE HISTORY OF HIGH MOUNTAIN PEA *VAVILOVIA FORMOSA* (STEVEN) FED. (*FABACEAE*) INVESTIGATION IN ARMENIA

The article presents information on the history of the field research of high mountain pea *Vavilovia formosa* (Steven) Fed. in the territory of Armenia from the beginning of the past century to present.

Vavilovia formosa, history of investigation, Armenia

Հակոբյան Ժ. Ա. Հայաստանում *Vavilovia formosa* (Steven) Fed. բարձր լեռնային ոլոռի հետազոտությունների պատմության վերաբերյալ: Հոդվածում ներկայացված են տեղեկություններ Հայաստանի տարածքում բարձր լեռնային ոլոռ *Vavilovia formosa* (Steven) Fed.-ի դաշտային ուսումնասիրությունների պատմության վերաբերյալ անցյալ դարի սկզբից մինչեւ այսօր:

Vavilovia formosa, ուսումնասիրման պատմությունը, Հայաստան

Акопян Ж. А. К истории исследования высокогорного гороха *Vavilovia formosa* (Steven) Fed. в Армении. В статье представлены сведения по истории полевых исследований высокогорного гороха *Vavilovia formosa* (Steven) Fed. на территории Армении с начала прошлого века по настоящее время.

Vavilovia formosa, история исследования, Армения

Wild perennial pea *Vavilovia formosa* (Steven) Fed. (*Fabaceae*) is a relic and endangered species of the alpine flora of Armenia, highly specialized to small areas of moving detritus and scree. *Vavilovia* Fed. is an independent branch in *Fabeae* tribe of *Fabaceae* family, which includes some of the most ancient and important crops like pea, lentil, vetch, vetchling. Wild perennial pea was separated into a monotypic genus *Vavilovia*, based on some morphological characteristics of the leaves and flowers, presence of creeping rhizomes, as well as characteristics of disjunctive distribution range, ecology and perennial habit (Fedorov, 1939).

V. formosa grows in high mountains of the Great and Lesser Caucasus, North and North-Western Iran, Northern Iraq, Anatolia and Lebanon. It belongs to representatives of cryophilic flora and Pliocene relicts, and is included in the category of paleoendemics (Prima, 1974; Kharadze, 1960). *V. formosa* has a high potential for breeding, due to its adaptive features: perennial life cycle, tolerance to frost, drought, pests and diseases, resistance to various biotic and abiotic stress. Crosses of *V. formosa* with *Pisum* species, as well as with other species from tribe *Fabeae*, are of significant theoretical and practical interest. It is highly ornamental species.

V. formosa is recognized as an endangered and protected plant. The existing populations of *V. formosa* in Armenia, as well as in other sites of the world, are in danger of extinction (Akopian, Gabrielyan, 2008; Akopian et al., 2010; Mikic et al. 2013, 2014; Tamanyan et al., 2010; Vishnyakova et al., 2016). Due to the narrow specificity of the habitat requirements, *Vavilovia* distribution range is considered to be regressing. Low competitiveness, isolation and fragmentation of populations are among expansion limiting factors. The main human-induced threat is grazing. Another possible threat to *V. formosa* is forecasted warming, conditioned by the influence of Global climate change, which can lead to redistribution of territories of different ecosystems. As models predict, species may respond to temperature increase by moving to higher altitudes, which is hard for the high-mountain pea *V. formosa*,

as it already occurs at the elevations of 3000–3500 m in Armenia. By the niche modeling results, *V. formosa* is expected to have further range reduction in various scenarios for climate change (Smýkal et al., 2017).

In Armenia *V. formosa* is distributed in Gegham (Mt. peaks Sevsar, Ziaret, Lake Aknalich) and Zangezur floristic regions (Mt. peaks Kaputjugh, Parakan, Mets Ishkhanasar, Ukhtasar) (Gabrielyan, 1962; Tamanyan et al., 2010). *V. formosa* occurs on south facing slopes of the Upper Quaternary volcanic gravel cones with volcanic gravel particle size varying from several mm up to 10 cm and more. The slope areas are usually situated in the neighborhood of crater lakes. The population on Geghama mountains is the largest, smaller populations are on Syunik upland mountains and on Kaputjugh mountain.

Field studies on the wild perennial pea *V. formosa* started on the territory of Armenia in the late twenties of the past century. For the first time *V. formosa* was collected in 1929 in southern Armenia on the slopes of Kaputjugh mountain in the alpine zone of the Zangezur mountain range, at the altitudes from 3.200 to 3.500 m, during the expedition organized by the Nature and History Museum of Armenia, led by A. Schelkovnikov. In 1929, during several expeditions, *Vavilovia* was also collected in the central Armenia, on the top of volcanic mountain Sevsar of Geghama highland by Y. Kazaryan, D. Sosnovskyi, H. Maghakyan (cited by An. Fedorov, 1939). In 1936 in the same area the plant was found by An. Feodorov, and in 1937 was collected by him on the slopes of Kaputjugh. Studies, conducted by An. Fedorov played an important role in the critical revision of the taxonomy of high-mountain pea and revealing its ecology. Based on field observations, An. Fedorov (1939) in his famous monograph "Wild mountain peas of Caucasus" in detail described the habitats of *V. formosa* in Armenia and the species' adaptive features of narrow specialization to areas with moving detritus and screes of black or red volcanic slags. In the monograph he recognized two species of genus *Vavilovia* (*V. formosa* (Steven) Fed. and *V. aucheri* Fed.) with different areas in the Great and Lesser Caucasus. But, as obvious transition plant forms were found on the Armenian material, both of the species were united by him again by the priority name *V. formosa* (Fedorov, 1952).

Cones with Upper Quaternary slag deposits are the most clearly visible in the Geghama highland, where the *Vavilovia* site is located. Geghama highland is dominated by about 30 large cones. The Sevsar mountain (3258.5 m), situated not far to the north of Aknalitch lake is among them. Habitats of *V. formosa*, located in the Geghama highland, were investigated by Y. Kazaryan in the summer of 1931 during the study of natural fodder lands. According to the classification developed by him, movable and fixed screes were observed on the Geghama ridge (Kazaryan, 1939). The movable screes are represented by large-gravel, fine-grained and sandy screes. *Vavilovia* does not grow on large-gravel slopes. The plant was found by Y. Kazaryan in the top area of south-eastern fine-grained movable slope of the mountain Sevsar and in the neighborhood of the crater lake Aknalich in 1931 and 1935. He mentioned that besides Sevsar, at that period *Vavilovia* occurred in vast numbers on other volcanic cones surrounding the lake Aknalich and was also recorded on sandy scree slopes (3000-3200 m) in 1.5 km on the east from mountain Vishapasar of Geghama ridge (Kazaryan, 1939).

From 1940s up to present, *V. formosa* has been repeatedly collected at both sites in southern and central Armenia by A. Takhtajan, A. Akhverdov and N. Mirzoeva, S. Tamamschyan, Y. Mulkijanyan, V. Avetisyan, E. Gabrielyan, V. Manakyan, V. Voskanyan, I. Arevshatyan, K. Tamanyan, G. Fayvush, M. Oganesian, E. Vitek, I. Gabrielyan and others. *Vavilovia* also occurs in another mountain of the Zangezur range near to Kaputjukh - Parakan, where it was collected at altitudes of 3200 m to 3300 m by S. Baloyan in 1986 (Baloyan, 1999).

In 1972 *V. formosa* was found during the expeditions of Federal Research Center the N. I. Vavilov All-Russian Institute of Plant Genetic Resources in Geghama range on two southern slopes (3300-3400 m) to south-east from Aknalich. Based on the studies of the material collected by the expeditions in the Stavropol area and in Armenia, authors revised the taxonomical position of *V. formosa* (Makasheva et al., 1973).

The third habitat of this species located in Syunik upland region at an altitude of 3.300–3.400 m, in the neighborhood of the mountains Mets Ishkhanasar and Ukhtasar (south-eastern Armenia), was identified relatively recently. *Vavilovia* was found on the eastern slope of the mountain Mets Ishkhanasar in 2003 by Heinz Parker and in the neighborhood of Mountain Ughtasar in 2006 by H. Kazaryan, where it was collected again in 2007 by I. Gabrielyan.

In 2006-2007 Geghama highland and Syunik upland populations of *V. formosa* were studied within the framework of the UNEP/GEF funded Crop Wild Relatives projects, during the expedition of 2006 led by I. Gabrielyan and A. Melikyan, some data on the species distribution in Armenia, population size and possibilities of *ex situ* conservation were given (Akopian et al., 2008).

Further field observations were carried out in July and August 2009. The expeditions were undertaken by scientists and researchers from the Agricultural Reform Support Project Implementation Unit (ARSPIU) of the Ministry of Agriculture of Armenia, Syunik Agricultural Support Regional Center, Institute of Botany of the Armenian National Academy of Sciences and Green Lane NGO. Three expeditions were organized: two to the Syunik upland re-

gion of the Mountain Ughtasar and one to the Geghama Mountains in the area of Aknalich lake (Akopian et al., 2010).

According to earlier records, *Vavilovia* has periodically been transplanted from nature during the numerous expeditions led by A. Akhverdov and N. Mirzoeva and grown in the research plot "Flora and Vegetation of Armenia" in the Yerevan Botanical Garden on the artificial alpine rocks since 1940 (Akhverdov and Mirzoeva, 1949). The creation of the alpine rock habitat was preceded by a period of long-term field researches of the biology and ecology of the alpine plants, which facilitated their introduction into relatively low-altitude (1200 m) cultivation from their native 2.800–3.500 m (Akhverdov and Mirzoeva, 1961, 1964). *V. formosa* growing in *ex situ* conditions is very complicated. Moderate air temperature, even lower ground temperature, continuous hydration (from melting glaciers), together with sufficient aeration of the substrate, dryness of the upper layers of the scree and a low concentration of mineral salts in the soil with pH 6.5-7.0 are important for the successful growing of this plant (Fedorov, 1939; Makasheva et al., 1973). Nevertheless, attempts to grow and study *V. formosa* in other conditions continue. Observations on *V. formosa* samples grown from seeds in laboratory conditions and in *ex situ* cultivation were conducted on the seed and living plant materials, collected during the expeditions of 2009 and 2014 in Sevsar and Ughtasar mountains (Akopian et al., 2010, 2014).

At present field investigations of *V. formosa* are continued in Armenia. Due to the observations of *Vavilovia* in natural habitats by many Armenian flora researchers and the study of the collected material, some significant peculiarities of its taxonomy, morphology, phenology and biology were revealed. The obtained data can also contribute to the protection of this relic and endangered high-mountain species and its *ex situ* conservation.

Specimina examinata. **Армения:** In mont. Kapudjich, 12.500`. 28. 07. 1929. A. Schelkovnikov et E. Kara-Murza **(ERE 15524, 15525);** Агмаганский хребет. Пастбище Елиджинского совхоза, западный склон горы Карадаг (Севсар), осыпь. 31.07.1931. Е. Казарян **(ERE 15526)**; Агмаганский хребет, на осыпях г. Кара-Даг (Севсар). 04.08.1935. Е. С. Казарян **(ERE 25651)**; Агмаганский хребет, на осыпях г. Кара-Даг (Севсар). 04.08.1935. Е. С. Казарян **(EREU 3372);** Агмаганский хребет. 05.08.1935. Е. Казарян (**ERE 25652**[a]); Ad latera austro-occidentali montis volcanici Karadagh jugi Ahmaghanensis. In lapidosis mobilibus. 28.08. 1936. An. A. Fedorov **(ERE 28551, 28552)**; Distr. Nor-Bajazed. Montis volcanic Sev-Ler (Kara-Dagh),in regione alpine, alt. 3100 m. 28.08. 1936. Andrej Fjodorov (**EREU 3370, 3371, 3372**); Distr. Nor-Bajazed. Montis volcanic Sev-Ler (Kara-Dagh), regione alpine, alt. 3100 m. 28.08. 1936. Andrej Fjodorov **(ERE 25652, 26064)**; Ad limites Armeniae et Nachiczevan. In cacumine montis Kapudzhich regione altoalpina. 12.09.1937. An. Fedorov **(ERE 26098)**. АрмССР, вулканическое нагорье Агмаган. К югу от оз. Канлы Гел. 31. 08. 1947. А. А. Ахвердов, Д. И. Сосновский. [Пересажено] в грядке N52, под деревьями **(ERE 129125)**; Кафанский район, гора Капуджух, восточный макросклон, ниже перевала, на осыпях, 3500 м над ур. м. 13.08.1955. Э. Габриэлян **(ERE 70838)**; Гегамский хребет, с-з окрестности оз. Акна-лич, свежие осыпи на крутых склонах из вулканического шлака. 07. 08. 1960. А.А. Ахвердов, Н.В. Мирзоева, П.П. Гамбарян **(ERE 129124)**; Абовянский р-он, г. Агмаган, оз. Акна-Лич, северо-восточный берег. Черные осыпи, южный склон. 04. 08. 1960. В. Манакян **(ERE 76250)**; Гегамский хребет, окр. оз. Акна-Лич, северо-восточный берег, г. Сев-Лер, на мелких осыпях, южный склон 3200 м, 04.08.1960. Э. Габриэлян **(ERE 66556)**; Котайкский р-н, г. Агмаган, оз. Акна-лич, сев.-вост. берег, черная осыпь, южный склон. 04.08. 1960. Э. Габриэлян **(ERE 69828, 69829, 69830, 69831)**; Гегамский хребет, окр. оз. Акна-Лич, осыпь, юго-западный склон, 3200 м. 30.08.1963. Мулкиджанян **(ERE 160378)**; Гегамский хребет, окр. оз. Акна-Лич, сев.-зап склон г. Ератумбер I, 3200 м над ур. м. Большой, крутой, открытый, сильно щебнистый склон. 08.08.1968. Ахвердов, Мирзоева, Джапаридзе **(ERE 129126)**; Гегамский хребет, склоны в окр. Акна-Лич, черные осыпи. 09.09.1970. Я. И. Мулкиджанян, В. Аветисян, П. Гамбарян, В. Восканян **(ERE 95065)**; Окр. оз Акна-Лич. 10.09.1981. П. Гамбарян, К. Борисова **(ERE 150283)**; Зангезурский хребт, г. Паракан, выс. 3200-3300 м над ур. м., на щебнистых склонах. 23.07.1986. С. А. Балоян **(ERE 134111)**; Кафанский район, г. Капутджух, осыпи, чингилы, ковры, близ вершины. 30.07. 1986. Э. Ц. Габриэлян, К. Г. Таманян, Г. М. Файвуш **(ERE 134112, 134113, 164504)**; Гегамский хребет, Севсар, осыпи, 3100 м. 24.08.2001. В. Манакян **(ERE 151386)**; Зангезур, г. Мец Ишханасар, восточная часть горы. 31. 08. 2003. Heinz Parker **(ERE 154718)**; Гегамский хребет, окр. Сев Лич, на вулканическом шлаке. 3140 м над ур. м. 40° 17` 20``, 44° 56` 04``. 14.10.2004. Аревшатян, Рухкян, Гамбарян **(ERE 156517)**; Обл. Сюник, Ухтасар, в окр. оз. Цхук, 3306 м над ур.м. 24.07. 2006. Г. Казарян **(ERE 163694)**; Kotayk marz (district), N-E slopes in vicinity of Akna Lich lake, Geghama mountains, on volcanic rocks, 3147 m, 40° 17`, 044° 50`. 29. 09. 2006. I. Gabrielyan, A. Melikyan **(ERE 164814)**; Sjunik Prov., Sisian distr., vicinity of Ughtasar mountain, alpine vegetation zone, 3335 m, N 39 °41`15``, E 046° 03`14``, 02, August, 2007. I. Gabrielyan, A. Bruch **(ERE 180384)**; Sjunik Prov., Sisian distr., vicinity of Ughtasar mountain, alpine meadow, south slopes, 3320 m, N39°68600, E046°05900. 17.07.2009. J. Akopian,

I. Gabrielyan, N. Sarukhanyan **(ERE 170018, 170019, 170020)**; Kotayk province, W slopes of Geghama mountain range, vicinity of Akna Lich N39.68623^0 E.46.05927^0 alt. 3335 m. 17.07. 2009. Iv. Gabrielyan **(ERE 189714)**; Syunik prov., c. 18,5 km NNNE Sisian, Mt. Ukhtasar, near the area with petroglyphs, gravel field e. 200 m NE of lake, 3300 m s.m. 39^{0}41᾽13᾽᾽ N46^{0}3᾽16᾽᾽E, 25.08.2012. E. Vitek, G. Fayvush, M. Oganesian, K. Tamanyan, K. Margaryan **(ERE 192167)**; Гегамский хребет, склоны г. Севсар. Красноватые, мелкощебнистые, подвижные осыпи, 3010 м над ур. м., N 40,28833° E 044,93877°. Высотные пределы данной популяции вавиловии, примерно, от 2995 до 3250 м над ур. м. 11.09.2014. Ж. Акопян, И. Габриэлян, Г. Шабоян, А. Хачатрян, А. Папикян **(ERE 189134, 189135)**. **Нахичеван:** Нахичеванская АССР, г. Капуджих, восточный макросклон, южная сторона, 3250 м. 12.08.1950. А. Л. Тахтаджян **(ERE 129742)**; НахАССР, г. Капуджих, восточный макросклон, к северу от родника, 3250 м. 12.08.1950. А. Тахтаджян (**ERE 59041);** Нахичеванская АССР, на горе Капутджих Зангезурского хребта, по осыпям щебня, на высоте около 3200-3300 м над ур. м. 14.08.1950. А. Тахтаджян, С. Черепанов **(ERE 136871)**.

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Institute of Botany after A.Takhtajyan NAS RA
0040, Yerevan, Acharyan, 1,
akopian_janna@inbox.ru