



Use of the alien invasive species *Amaranthus retroflexus* L. in Armenia

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Research

Abstract

Background: Two editions of "Ethnobotany of the Caucasus" (2017 and 2025) include data on the use of the invasive species *Amaranthus retroflexus* L. in the Caucasian countries. We have now obtained new data on the use of this species in Armenia.

Methods: Data on the use of *Amaranthus retroflexus* were collected through surveys of local populations in four rural communities of the Lori region of Armenia, comprising 42 villages. The Australian Weed Risk Assessment was employed for the invasion risk assessment of the investigated species.

Results: Residents of the Lori region use *Amaranthus retroflexus* as a food plant. Young shoots and leaves are consumed in salads or pies. A decoction of the plant is also used medicinally for gastrointestinal ailments. Locals use this species as fodder for cattle and sheep, and for fattening pigs. Our estimates indicate that 90% of families in rural communities of the Lori Plateau harvest *Amaranthus retroflexus* during the three summer months, primarily for their own use, with a small quantity sold in the markets of Stepanavan, Vanadzor, and Yerevan, and supplied to some restaurants in these cities.

Conclusions: *Amaranthus retroflexus* is widespread in Armenia but is primarily used by the population in only one region of the country as a food and forage plant. People are largely unaware of its beneficial properties and potential medicinal uses. A special campaign should be launched to promote this species as a food plant, while also raising public awareness of its medicinal properties.

Keywords: Ethnobotany, Alien invasive species, *Amaranthus retroflexus*, Edible and medicinal plants

Background

The flora of Armenia is exceptionally rich and diverse, with approximately 3,800 species of vascular plants growing in an area of less than 30,000 square kilometres. Approximately 200 species are used by local populations as food, and more than 350 species employed medicinally (Fayvush *et al.* 2023). In 2017, the first edition of the fundamental work "Ethnobotany of the Caucasus" was published (Bussmann 2017), and a second, revised, and supplemented edition was prepared in 2025 (Bussmann *et al.* 2025). Both editions include the species *Amaranthus retroflexus* L., which is used in Georgia and Azerbaijan as a food, medicinal, ornamental, and forage plant (Batsatsashvili *et al.* 2017, Bussmann *et al.* 2025). Unfortunately, at the time of preparing these editions, we did not have any actual data on the use of this plant in Armenia. This article furnishes the missing information regarding the use of this species in Armenia.

Though *Amaranthus retroflexus* is currently widespread throughout almost all of Armenia, our attention was drawn to the Lori region, where this species is intensively used by the local population (Janjughazyan 2013).

Amaranthus retroflexus is an annual herbaceous plant with stems reaching up to 80 cm in height. The officially accepted Armenian name (Avetisyan 1956) is “Հավակատար սովորական” (*Havakatar sovorakan*), while in the Lori region, local residents refer to it as в Лорийской области местные жители называют его “Զիմել” (*Zimel*).

The species is native to the prairies and plateaus of the Great Plains of North America (Gleason 1963). It most probably appeared in Europe in Italy in the 14th century, but its introduction to Sweden in the botanical garden in Uppsala in the mid-18th century is reliably documented, from where this species was described by C. Linnaeus in 1750. It was subsequently recorded in France (1783), Italy (1785), Hungary (1791), Germany (1794), and Austria (1831) (Buyankin 1977). According to herbarium collections (LE, MW), by the 19th century, this species had spread widely across European Russia and penetrated Siberia, Central Asia, and the Far East (Vinogradova & Kuklina 2012). In Armenia, this species was first collected in 1922 (Herbarium of the Institute of Botany NAS RA: “Vicinity of Djelal-ogly [Stepanavan], weeds in the garden. 22.7.1922. Leg. A.B. Schelkovnikov, A. Troitzky, ERE 1277”). The species was most probably introduced to Armenia during the Russo-Turkish War (1877-1878), when the main route linking Tbilisi (Tiflis) and the theatre of military operations in Transcaucasia passed through Karaklis (Vanadzor) and Alexandropol (Gyumri). The seeds of *Amaranthus retroflexus* were possibly carried with forage for the Russian army's cavalry. It is also quite possible that the species appeared in connection with the construction and commencement of operation of the Tbilisi-Alexandropol-Kars railway (construction began in 1896, the first train arriving in Alexandropol in 1899).

By 1956, when the second volume of the *Flora of Armenia* was published, *Amaranthus retroflexus* was already known from the Lori, Sevan, Yerevan, and Darelegis floristic regions (Avetisyan 1956). This species is currently found throughout almost all of Armenia (Fig. 1). It primarily grows in wastelands, vegetable gardens, and along roadsides, often on heavily manured soils. In our study of the alien flora of Armenia, using the Australian Weed Risk Assessment (Gordon *et al.* 2010), we obtained a risk score of 10 for *Amaranthus retroflexus*, indicating a relatively high risk of invasion of this species into natural ecosystems and adjacent areas.

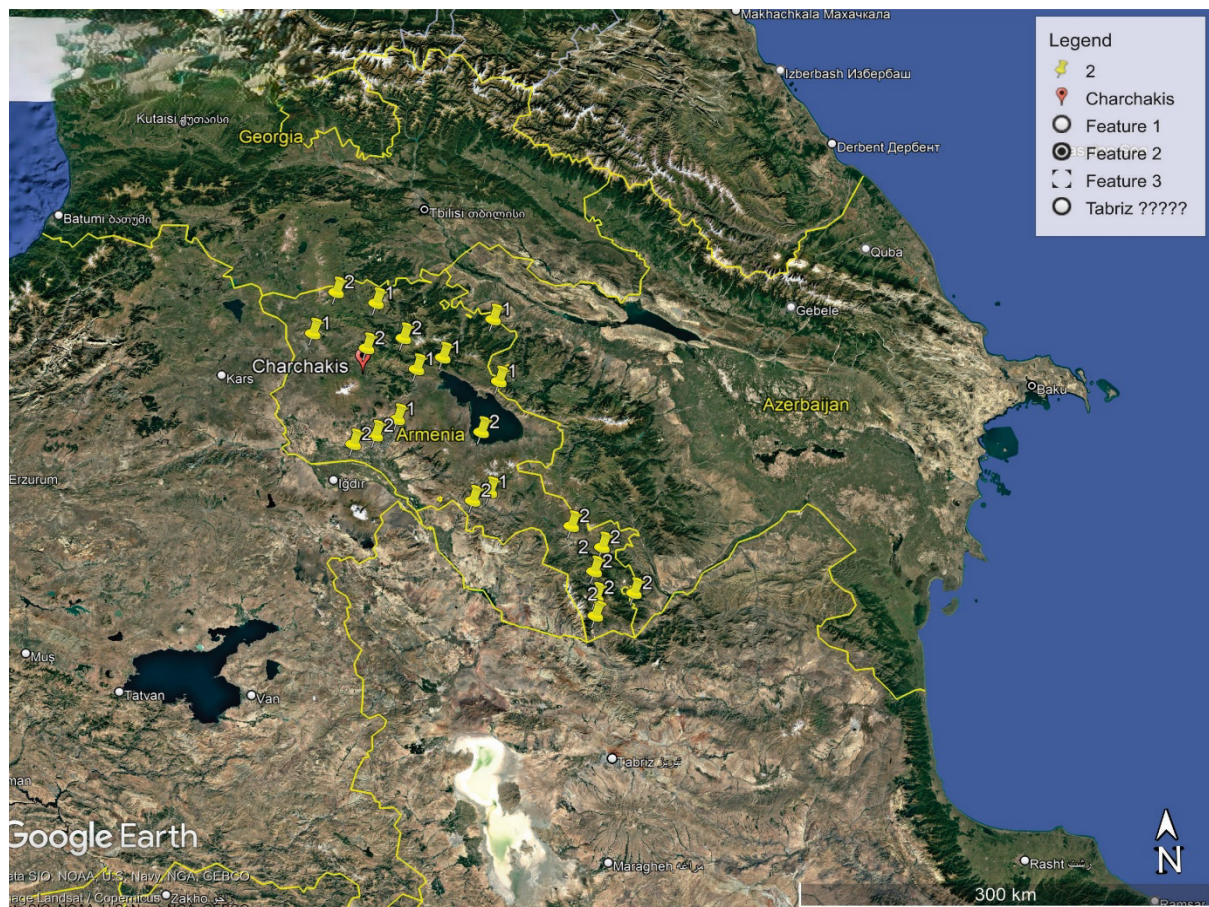


Figure 1. Map of the distribution of *Amaranthus retroflexus* in Armenia. 1 – Collections before 1956; 2 – Collections after 1956 (Herbarium ERE)

Materials and Methods

Study area

Armenia is a South Caucasian republic, bordered by Georgia, Azerbaijan, Turkey, and Iran. It is a landlocked country with a total area of 29,740 km², at a distance of about 145 km from the Black Sea and 175 km from the Caspian Sea. It lies between 38°50' and 41°18' northern latitude and between 43°27' and 46°37' eastern longitude, measuring 400 km along its main axis (north-west to south-east). Armenia is generally a mountainous country, with its lowest point at 375 m above sea level and its highest at 4095 m, with an average altitude of 1,850 m (Fayvush 2023).

The Lori region of Armenia is situated in the north of the republic and largely coincides with the Lori floristic region (Fig. 2, 3). The area is spread over 3,799 square kilometres, with a population of 229,200, of whom 101,400 reside in 121 rural settlements (armstat.am/file/Map/MARZ_06.pdf). The Lori floristic region encompasses the entire Lori plateau, with its southern border running along the watershed of the Bazum ridge, the eastern border along the watershed of the Lalvar and Lejan mountains, and the western border along the Javakh ridge, which separates it from the Upper Akhuryan floristic region. The northern border coincides with the state border of Armenia with Georgia. The region's flora includes 1,280 species of vascular plants, nine of which are endemic to Armenia (Fayvush et al. 2025). Vegetation is primarily represented by meadows and forests (oak and beech), as well as wetland vegetation of the relict lakes of the Lori Plateau. The region's altitudes range from 1,200 to 2,550 m above sea level (Tamanyan & Fayvush 2009).



Figure 2. Administrative regions of Armenia

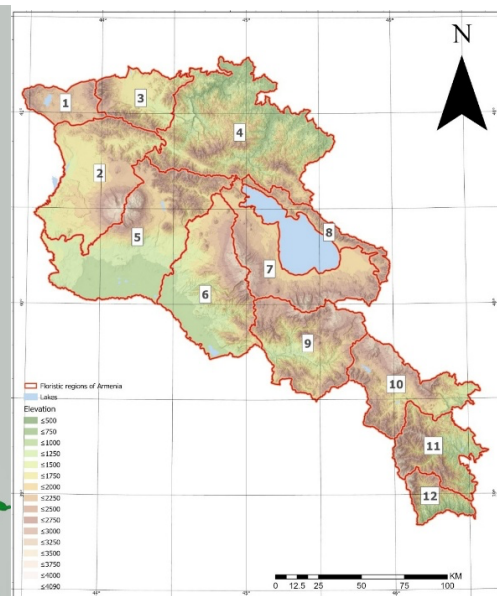


Figure 3. Floristic regions of Armenia. 1. Upper-Akhuryan, 2. Shirak, 3. Lori, 4. Idjevan, 5. Aparan, 6. Yerevan, 7. Sevan, 8. Areguni, 9. Darelegis, 10. North Zangezur, 11. South Zangezur, 12. Meghri.

Data collection

Data on the use of *Amaranthus retroflexus* were collected through surveys of local residents in four rural communities in the Lori region, comprising 42 villages. These communities are located on the Lori Plateau, where *Amaranthus retroflexus* is primarily harvested. Employees of two restaurants in the cities of Stepanavan and Vanadzor were also interviewed. The data were organised using Microsoft Excel spreadsheets.

Invasion risk assessment

To assess the invasion risk of *Amaranthus retroflexus*, we employed the Australian Weed Risk Assessment (Gordon et al. 2010), which has been adapted to many other regions of the world (Daehler & Carino 2000; Daehler et al. 2004; Křivánek & Pyšek 2006; Gassó et al. 2009; Singh & Priyadarshi 2014; Gordon et al. 2016; Vilizzi et al. 2022, 2024, 2025). This method involves answering 49 questions related to the bio-ecological characteristics of the assessed species. Each answer assigns certain points to the species. The sum of all points characterises the degree of invasion risk for the species. Invasion risk is considered high (i.e. the species is not recommended for cultivation for any purposes) when the total points exceed 6, and low when it is less than 1.

Results

According to data from local surveys, rural residents of the Lori region have been using *Amaranthus retroflexus* as a food plant since at least the 1940s (data for earlier periods are lacking) in significant quantities. Young shoots and leaves are consumed in salads (with the addition of dill, cilantro, onions, garlic, matsoni, or vinegar) or in pies. The plants are used fresh, dried, or frozen for winter consumption. As a medicinal plant, locals use a decoction of *Amaranthus retroflexus* for gastrointestinal ailments. This species is also used as fodder for cattle (cows, sheep, goats) and for fattening pigs. Locals report that adding *Amaranthus retroflexus* plants to cow feed (both adult plants and seeds) increases both milk production and fat content. Our estimates suggest that 90% of families in rural communities of the Lori Plateau harvest *Amaranthus retroflexus* plant material during the three summer months, primarily for their own use. A small amount of fresh plant material is sold in the markets of Stepanavan, Vanadzor, and Yerevan, and supplied to some restaurants in these cities. Assuming that nine out of ten families in the villages of the Lori Plateau (with a population of 26,748) harvest and use approximately 100 kg of *Amaranthus retroflexus* plant material annually, the total volume of fresh plant material amounts to over 300 tons.

Importantly, the invasive species *Amaranthus retroflexus* not only spreads rapidly through wastelands, along roadsides, or at field edges, but also infests fields of grain crops. Consequently, in recent years, many agricultural landowners have begun combating this species using various methods, including herbicides. Consequently, many residents have started cultivating *Amaranthus retroflexus* in their own garden plots, along the edges of vegetable gardens, or in wastelands. Under these conditions, plants of this species can produce two "harvests" of green foliage and set seeds during the growing season.

Discussion

Amaranthus retroflexus is an excellent food and forage plant, widely used by the populations of Georgia, Azerbaijan (Bussmann et al. 2025), and Northern Armenia (Lori Province). In other regions of Armenia, according to our observations, this plant is used by local populations in small quantities, if at all.

As mentioned, in Armenia, *Amaranthus retroflexus* is used as a medicinal plant only for gastrointestinal problems. Detailed biochemical studies of this species have not been conducted in Armenia, but it has been found that the aboveground parts of the plant in early August contained 0.387 mg/g crude carotene and 51.36 mg% vitamin E (Zolotnitskaya 1965). Meanwhile, in Azerbaijan, "extracts and decoction of the aboveground parts of the plant are used as a sedative and to normalise stomach activity, as a laxative, in cases of diarrhoea, and in dysentery. The leaves are used as a haemostatic and wound-healing agent. A decoction of dried leaves is used for fevers and as a gargle for ulcers and pustules in the mouth" (Alekperov 1992; Batsatsashvili et al. 2017). Further, in folk medicine worldwide, a decoction of the roots and seeds is used as a bath for diathesis, rashes, and allergies (especially in conjunction with *Bidens tripartita* and *Matricaria chamomilla*). Infusions are applied externally for skin conditions (eczema, psoriasis, dermatitis). A decoction of the roots is used for jaundice. Infusions and decoctions of the Amaranth herb are prepared to treat various tumours and fungal infections, as well as liver and heart disease. The bactericidal and diuretic effects of an aqueous solution of *Amaranthus retroflexus* have been experimentally proven (Plant Resources... 1987). Amaranth oil is used for burns, scars, bedsores, and insect bites, exhibiting anti-inflammatory and haemostatic properties. Amaranth leaves, which contain calcium, are beneficial as a preventative measure against myocardial infarction, stroke, osteoporosis, and other diseases (Chukhno 2007). In Afghanistan, the seeds are primarily used as flour, and as a medicinal plant, they are employed for wound healing, swollen skin, and diarrhoea. Further traditional uses include treatment for colitis, intestinal colic, constipation, as a haemostatic and diuretic, and for headaches (Keusgen et al. 2020). In India, specific studies have demonstrated that *Amaranthus retroflexus* exhibits antimicrobial activity against various pathogens and preliminary anticancer effects through cytotoxicity on cancer cell lines (Kumar 2024).

Amaranthus retroflexus is widely used as medicine plant in many countries where it grows. So, in Africa the root are using as diuretic, the bruised leaves as emollient and applied externally in cases of eczema, burns, wounds, boils, earache and hemorrhoids. The plant ash in solution is used to wash sores. Plant sap is used as an eye wash to treat ophthalmia and convulsions in children (Bussman et al. 2021). The leaves are used in the Ural as diuretic and for dysentery. An infusion is used to treat colitis, intestinal colic, and as a laxative for constipation, as hemostatic to treat hemoptysis, and menstrual and hemorrhoid hemorrhages, as anti-protist and anti-bacterial, to treat guinea worm and jaundice, and to treat headaches (Fedorov 1984, Bussmann et al. 2020). In South-East Asia decoction of the root is used to treat gonorrhea and is as an emmenagogue and antipyretic (Bussmann et al. 2021). In Ecuador the whole fresh plant is used to treat flu, headache, and fever (Béjar et al. 2002; Bussmann, Sharon 2006, 2007). As edible plant it also is using very wide. In Africa leaves and young plants are collected for home consumption as a cooked, steamed, fried vegetable, or as herb pie especially during periods of

drought (Mekonen et al. 2015). The ash is also used as a vegetable salt and in southern Africa it is used as a snuff, alone or with tobacco (Bussman et al. 2021). In the Caucasus, *Amaranthus retroflexus* is used as a food plant, especially in very different ways in Georgia. Many other plant species are also commonly included in dishes containing this plant (usually *Allium fistulosum*, *Anthriscus nemorosa*, *Anthriscus sylvestris*, *Arctium lappa*, *Artemisia vulgaris*, *Arum orientale*, *Aruncus vulgaris*, *Atriplex hortensis*, *Brassica campestris*, *Bunias orientalis*, *Campanula lactiflora*, *Campanula rapunculoides*, *Capsella bursa-pastoris*, *Cardamine hirsuta*, *Chaerophyllum aureum*, *Cichorium intybus*, *Convolvulus arvensis*, *Chaerophyllum bulbosum*, *Chenopodium album*, *Chenopodium foliosum*, *Cirsium incanum*, *Daucus carota*, *Falcaria vulgaris*, *Ficaria* ssp., *Galega orientalis*, *Heracleum asperum*, *Heracleum* sp., *Humulus lupulus*, *Lactuca serriola*, *Lamium purpureum*, *Lapsana grandiflora*, *Lathyrus roseus*, *Malva neglecta*, *Malva silvestris*, *Medicago* ssp., *Myosotis sparsiflora*, *Origanum vulgare*, *Papaver* ssp., *Phytolacca americana*, *Plantago major*, *Polygonatum* ssp., *Polygonum aviculare*, *Polygonum carneum*, *Portulaca oleracea*, *Pyrethrum* ssp., *Rapistrum rugosum*, *Rubia tinctorum*, *Rumex acetosa*, *Rumex* ssp., *Silene lacera*, *Silene wallichiana*, *Sonchus* ssp., *Stellaria media*, *Taraxacum confusum*, *Taraxacum* ssp., *Trifolium* ssp., *Urtica dioica*, *Valerianella locusta*, *Vicia narborensis*, *Viola* ssp., *Vitis vinifera*, *Xanthium spinosum*) (Bussmann et al. 2020).

As well *Amaranthus retroflexus* is used in different regions of the World as forage and said to increase the yield of milk in cattle, as fodder for pigs. The leaves are boiled with salt in Ethiopia to fatten livestock (Bussmann et al. 2011b; Luizza et al. 2013). Used to make brooms.

All this suggests that *Amaranthus retroflexus* is poorly studied in Armenia, while the local population, unaware of its beneficial properties, vastly underutilises it. It is also noteworthy that this species is an alien invasive with a relatively high invasive potential, and its collection from the wild in any quantity requires no restrictions and poses no threat to Armenia's biodiversity. Conversely, it even helps prevent its invasion of natural ecosystems, which could threaten their transformation.

Conclusion

Amaranthus retroflexus is currently widespread in Armenia but is relatively well-used by locals in only one region of the country. Even there, it is used almost exclusively as a food and fodder plant. People are largely unaware of its beneficial properties and potential medicinal uses. Clearly, a special campaign is warranted for promoting this species as a food plant (not only in Lori but also in other regions of Armenia), while also raising public awareness of its medicinal properties. Concurrently, there is no concern that unregulated harvesting will lead to the species' extinction or a significant reduction in its natural populations, as it is an invasive alien species. As per the Convention on Biological Diversity, all possible measures must be taken to prevent its spread and, in particular, to mitigate threats to local biodiversity.

Declarations

Ethics approval and consent to participate: The study adhered to the ethical and legal guidelines for research on traditional knowledge.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: Not applicable

Funding: Not applicable

Author contributions: Both authors (K.J. and G.F.) collected the data, analysed it, and wrote the text. K.J. prepared the theoretical background and data analysis, while G.F. wrote the final version of the text.

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