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The first record of *Allium anacoleum* (Amaryllidaceae) from Iran

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Summary. In a study of herbarium specimens collected from the Agh-Dagh Mountain (Ardabil province) in Northwest of Iran, an interesting specimen of the genus *Allium* was discovered and determined as *A. anacoleum*. The species belongs to section *Longivaginata* of subgenus *Allium* and is endemic to Turkey and Iraq. It grows in subalpine to alpine rocky grooves and mountainous steppes at altitudes of 2700–2850 meters. Morphological characters, images, habitat of the species and further insights into its taxonomy are discussed. Also, distribution map of the species, and an identification key for the section *Longivaginata* in Iran are presented.

Первая находка *Allium anacoleum* (Amaryllidaceae) в Иране

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Ключевые слова: Аг-Даг, альпийская флора, Ирано-Туранский регион, секция *Longivaginata*, Халхал.

Аннотация. При изучении гербарных образцов, собранных на горе Аг-Даг (провинция Ардебиль) на северо-западе Ирана, был обнаружен интересный экземпляр рода *Allium*, который был определён как *A. anacoleum*. Вид относится к секции *Longivaginata* подрода *Allium* и является эндемиком Турции и Ирака. Он произрастает в субальпийских и альпийских скалистых оврагах и горных степях на высоте 2700–2850 м над ур. м. Обсуждаются морфологические признаки, изображение, местообитание вида и дальнейшее изучение его таксономии. Также представлены карта распространения вида и ключ для определения видов секции *Longivaginata* в Иране.

Introduction

The genus *Allium* L. (Amaryllidaceae J. St.-Hil.) stands out as one of the largest and most diverse

genera among monocotyledons, comprising approximately 1000 species distributed primarily across the Northern Hemisphere (Fritsch, Friesen, 2002; Friesen et al., 2022; *Allium*, 2026). This

remarkable genus includes many familiar plants such as onions, garlic, leeks, and chives, as well as a wealth of wild species that play vital ecological and economic roles. The evolutionary success of *Allium* is reflected in its broad morphological diversity, ecological adaptability, and high levels of endemism, particularly in regions such as North America, Asia, and the Mediterranean Basin (Brullo et al., 2019; Sharma et al., 2024).

The principal center of *Allium* diversity extends from the Mediterranean Basin through the Caucasus and Iran, eastward to Central Asia and Pakistan (Friesen et al., 2006). Secondary centers of diversity are found in Western North America and Eastern Asia, further highlighting the genus's remarkable evolutionary radiation (Fritsch, Friesen, 2002).

Iran occupies a unique position within this biogeographic mosaic. Largely situated in the Irano-Turanian phytogeographical region, Iran harbors an exceptionally rich *Allium* flora. Recent estimates indicate that the country is home to approximately 129 *Allium* species, of which 58 are endemic (Amini Rad, 2023). This high level of endemism is a testament to Iran's diverse landscapes, which range from arid sub-deserts to lush alpine meadows at elevations exceeding 4000 meters.

The study of Iranian *Allium* species has a rich history, dating back to the foundational work of Wendelbo (1971) in "Flora Iranica". Subsequent research by Fritsch and Keusgen (2006), Khassanov and Memariani (2006), Amini Rad (2023), and others have refined our understanding of the taxonomy and phylogeny of the genus in Iran, currently recognized six subgenera and 32 sections within the country's borders (Friesen et al., 2006). Despite this progress, new discoveries continue to emerge, underscoring the need for ongoing botanical exploration.

In Iran, section *Longivaginata* (Kamelin) F. O. Khass., R. M. Fritsch et N. Friesen has three species *A. arlgirdense* Blakelock, *A. longivaginum* Wendelbo and *A. autumniflorum* F. O. Khass. et Akhani (Amini Rad, 2022). This section is characterized by long leaf sheaths to $\frac{3}{4}$ stem length or below inflorescence and leaves with sheaths smooth or papillose or puberulent.

Northwest Iran (East and West Azerbaijan and Ardabil provinces), especially border areas, has a high plant diversity and many unknown plants can still be found as records or new to Iran (Mirtadzadini et al., 2024). In this context, our recent fieldwork in the Agh-Dagh Protected Area (Ardabil Province, NW Iran) led to the discovery of a population of *Allium anacoleum* Hand.-Mazz. belonging to sect.

Longivaginata and being native species in E. Turkey to N. Iraq. Here, we present a detailed morphological description, ecological observations, and taxonomic notes on this newly recorded species for the Iranian flora, contributing to the growing understanding of *Allium* diversity in this biodiversity hotspot.

Materials and Methods

Fieldwork was carried out in summer 2024 in the Agh-Dagh Protected Area, Ardabil Province, NW Iran, where a distinctive *Allium* population was collected from high-altitude rocky slopes.

Species identification was based on diagnostic keys from regional floras, including "Flora Iranica" (Wendelbo, 1971), "Flora of Turkey" (Kollmann, 1984), "Flora of Iraq" (Wendelbo, 1985), and "Flora of the USSR" (Vvedensky, 1931), as well as the treatment for Iranian species by Amini Rad (2023). These sources enabled comparison with *Allium* species in Iran and neighboring regions. Online resources such as the "Global Biodiversity Information Facility" (GBIF. URL: <https://www.gbif.org/>) and "World Checklist of Vascular Plants" (Govaerts, 2024) were to obtain updated taxonomic information, digital herbarium specimen images, and distributional data. Herbarium specimens were compared with collections from E, JACQ, K, MHA, and P (Thiers, 2024). Voucher specimens were deposited in the GILAN and TARI Herbaria. The species is illustrated with photographs, map, key to sect. *Longivaginata* species in Iran, and described together with notes on its ecology and taxonomy.

Results

Section *Longivaginata* (Kamelin) F. O. Khass., R. M. Fritsch et N. Friesen, 2006, Aliso 22: 389. Type: *A. longivaginum* Wendelbo.

Syn.: *Allium* subsect. *Longivaginata* Kamelin, 1973, Florogenet. Anal. Estest. Fl. Gorn. Sred. Azii: 238.

Allium anacoleum Hand.-Mazz., 1914, Ann. K. K. Naturhist. Hofmus. 28: 17. **Syntype:** "Turkey: Kurdistania occidentalis: Taurus Armenius. In monte Hasarbaba Dag ad lacum Göldschik (fontes Tigridis occid.), inter rupes cacuminis humilioris, 2400–2430 m. 29 VII 1910. Handel-Mazzetti, 2609" (WU).

***Allium anacoleum*:** "Iran, Ardabil Province, Agh-Dagh Protected Area, Mianroudan to Susahab village, alpine rock and scree, 37°25'47"N, 48°33'14"E, 2830 m. 30 VII 2024. M. Bidarlord,

11894" (GILAN, TARI); "Iran, Ardabil, Khalkhal, Agh-Dagh Protected Area, Lerd village, Samarakhani Altitudes, 37°22'37"N, 48°39'13"E, 2800 m a. s. l. 5 VIII 2024. M. Bidarlord, 112032" (TARI) (Fig. 3).

Description. Perennial. Bulbs solitary or rarely double, 1–2 cm long and 1.5 cm wide, ovoid; outer tunics blackish, inner tunics coriaceous, whitish. Scape 15–25 cm, thin, rigid, covered for more than two-thirds stem to almost under inflorescence by the sheath of the uppermost leaf. Stem with prominent ribbed, scabrous. Leaves 3–4, 10 cm long and 0.5–1.5 mm broad, shorter than the stem; sheaths with prominent ribs, scabrous or smooth; blades to 10 cm length and 1–1.5 mm width, twisted, with involute edge, scabrous along the margins and midnerve, fistulose-filiform, glabrous, ribbed, swollen at the base. Inflorescence globose, 1–2 cm length and 1–1.2 cm width, Spathe 5–8 mm long, 2-valved, half as long as or shorter than the inflorescence, acute, persistent. Inflorescence 1–2.5 × 1–2 cm, hemispherical, many-flowered, loose; bracts white, membranous, up to 2 mm long; pedicels unequal, thin, 3–12 mm length, smooth. Perianth campanulate; at first pale pink or purple, becoming yellow when dried, 3–3.5 mm; outer

tepals elliptic-oblong, inner ovate-lanceolate, obtuse, surface smooth. Filaments distinctly exserted; outer filiform, inner broader, with or without small teeth at base; anthers brown. Ovary green; style filiform. Capsule 2.5–3 × 2 mm, ovoid or ellipsoid (Fig. 1, 2, 3).

Specimens examined:

Turkey: "Kurdistania occidentalis: Taurus Armenius. In monte Hasarbaba Dag ad lacum Göldschik (fontes Tigridis occid.), inter rupes cacuminis humilioris, 2400–2430 m. 29 VII 1910. Handel-Mazzetti, 2609" (WU); "Kurdistania media: Taurus Armenius. In monte Meleto (Meretug) Dag, districtus Bitlis. In lapidosis circa cacumen, 2900–3100 m. 11 VIII 1910. Handel-Mazzetti, 2751" (WU); "Siirt: distr. Ramorân, Halakur-Dar (Herakol Da.), N. of Ğeziret-ibn-Ômar (Cizre), 2400 m. 25 VII 1910. Nâbelek, 2338" (SAV); "Bitlis: crater of Nemrut Dag, Rough pasture, 2400 m. 11 VIII 1956. McNeill, 153" (K); "Hakkari, Sat Dağ (above Yüsekova), Valley N. of lake, Riverside, in dry hard earth, 2600 m. 30 VIII 1967. Duncan and Tait, 132" (E); "Hakkari, Kara Dag, Rocky slopes, 11500 ft. 16 VIII 1954. Davis, 24453" (E); "Hakkari, Cilo Da., 10 km W. of Cilo Tepe, 3140 m. Davis, 24144" (E).

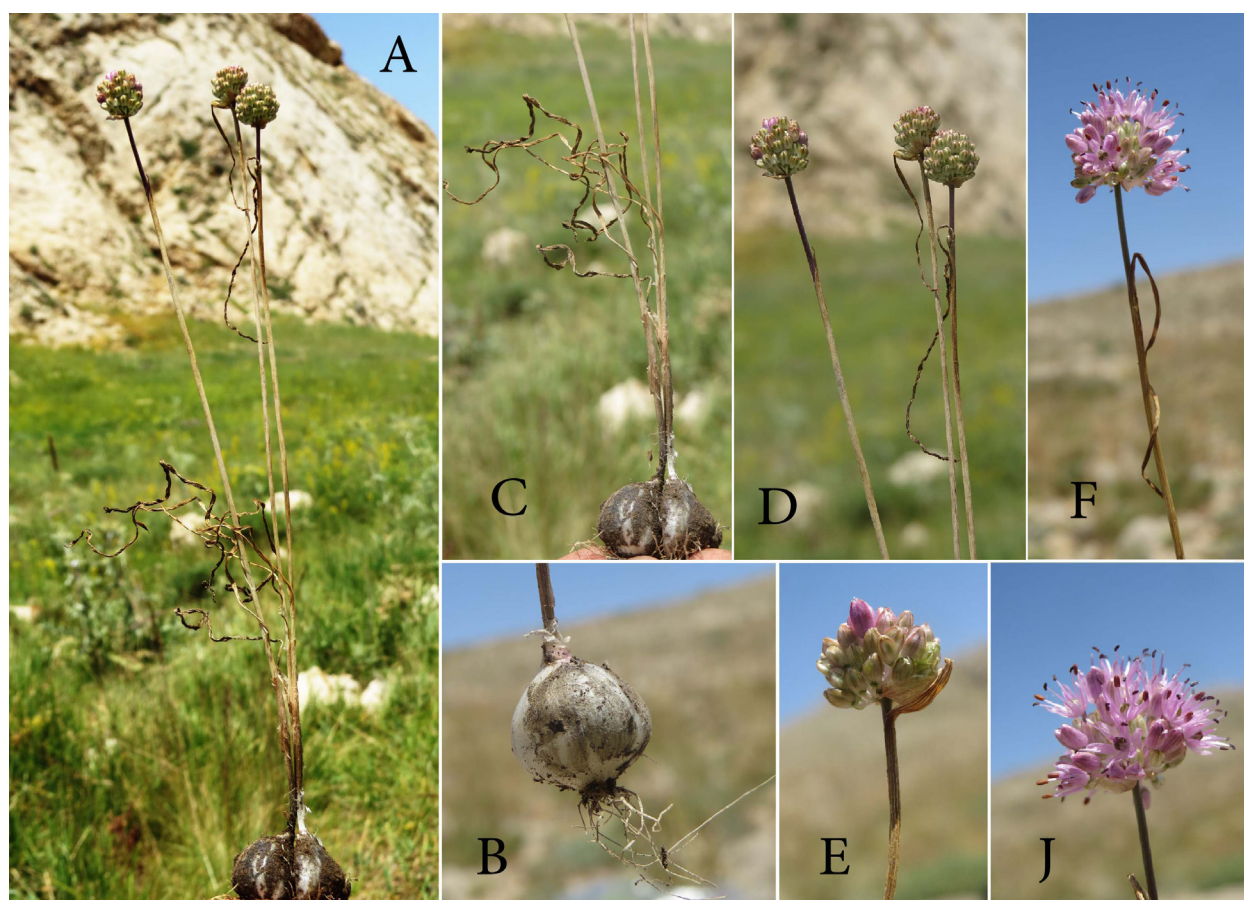


Fig. 1. *Allium anacoleum*: A – habit; B – bulb; C – lower leaves; D, F – upper leaves; E, J – inflorescence (Photo by M. Bidarlord).

Iraq: "Saramadiyah. 13 VIII 1961. R. Wheeler Haines, 2058" (E); "Valley above Ari, 2000 m. 10 VIII 1947. Gillett, 9715" (K).

Phenology: Flowering in late July – August; fruiting in August – September.

Distribution and habitat in Iran: *Allium anacoleum* is newly recorded from the northwestern Iran, specifically the Talesh Mountains. It grows in subalpine to alpine rocky crevices and mountainous steppes at altitudes of 2700–2850 meters. The species is predominantly found on snow-bed slopes of Agh-Dagh Mountain, often co-occurring with *Rosa pulverulenta* Guss. ex Nyman, *Lamium album* L., *Festuca valesiaca* Schleich. ex Gaudin, *Galium nabelekii* Ehrend. et Schön.-Tem., *Helichrysum psychrophilum* Boiss., *Tanacetum kotschyi* (Boiss.) Grierson, and *Sesleria phleoides* Steven ex Roem. et Schult.

Discussion

Allium anacoleum was first described from western Kurdistan (Turkey) by Handel-Mazzetti in 1914 and has since been regarded as a rare, narrowly localized species of the Anatolian highlands (Handel-Mazzetti, 1914; Boissier, 1875; Fritsch, Friesen, 2002). Its taxonomic placement has remained stable, with its narrow filiform leaves, small campanulate flowers, and loose hemispherical umbels distinguishing it from related taxa (Brullo et al., 2019; Jang et al., 2024).

Section *Longivaginata* belongs to subgenus *Allium*, and they are known for their long leaf sheaths extending below the inflorescence. Other characteristics of the species of sect. *Longivaginata* is flowering and fruiting time, which is late summer and early autumn.

Previously, sect. *Longivaginata* comprised three accepted species *A. arlgirdense*, *A. longivaginatum*, *A. autumniflorum* in Iran (Amini Rad, 2022). Although *A. petri* F. O. Khass. et R. M. Fritsch, *A. jaegeri* R. M. Fritsch, and *A. dolichovaginatum* R. M. Fritsch have been reported from Iran, but recently the first two species have been considered as synonyms of *A. longivaginatum* and the third species is considered synonym of *A. autumniflorum* (Amini Rad, 2022). Our record from the Agh-Dagh Protected Area marks the first confirmed occurrence of *A. anacoleum* in Iran, extending its known distribution eastward into the Talesh Mountains. Thus, with this report, the number of species in this section in Iran increases to four species.

As shown in Fig. 4, the species of this section have a limited distribution in the three countries of Iran, Iraq, and Turkey. This suggests a broader Irano-Anatolian range, consistent with the genus' evolutionary center spanning the Mediterranean to Central Asia (Friesen et al., 2006; Li et al., 2010). The species' preference for subalpine rocky slopes at high elevations mirrors its Turkish habitats and highlights the floristic continuity of these mountains (Rix, 2004; Zarei et al., 2020).

The Irano-Turanian region, especially northwest Iran, is a hotspot for *Allium* diversity and endemism, shaped by complex topography and climate (Wendelbo, 1971; Oroji et al., 2019; Sharma et al., 2024). The discovery of *A. anacoleum* in this area underscores the need for further botanical surveys and may prompt new insights into the phylogeography and conservation of high-mountain *Allium* species.

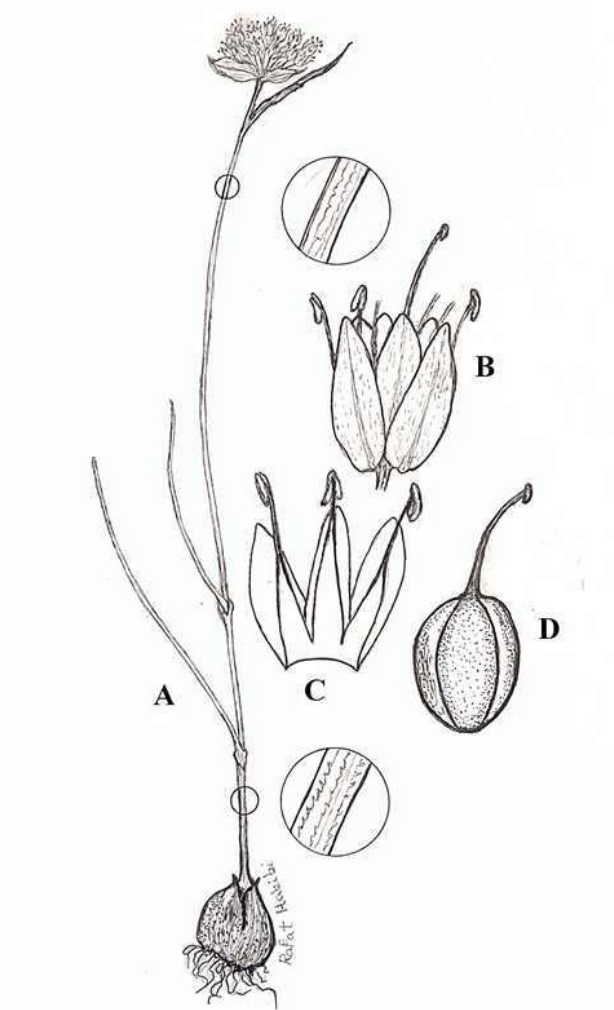


Fig. 2. *Allium anacoleum*: A – habit; B – flower (×10); C – tepals and filaments (×10); D – capsule (×12) (Drawing by R. Habibi).



Fig. 3. *Allium anacoleum* herbarium specimen (112032-TARI).

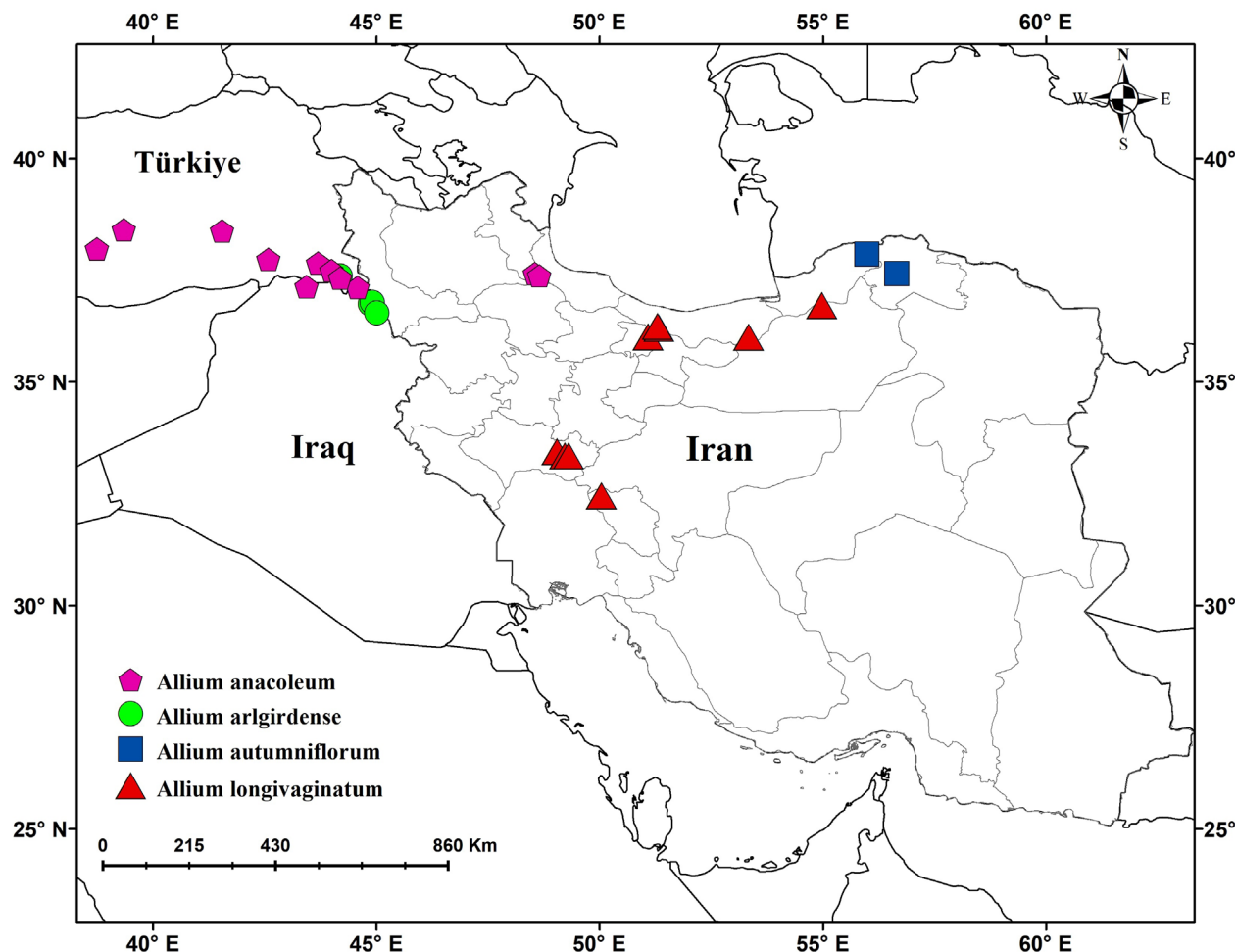


Fig. 4. Distribution map of the species of *Allium* sect. *Longivaginata*: ● – *A. arlgirdense*; ■ – *A. autumniflorum*; ▲ – *A. longivaginatum*; ◆ – *A. anacoleum*.

Identification key to the Iranian species of *Allium* sect. *Longivaginata*

1. Filaments exserted and longer than tepals *A. anacoleum*
 + Filaments shorter than or equal to tepals or rarely slightly exserted 2
2. Plants up to 5 cm high. Leaf twisted; sheaths densely papillose or puberulent in upper half
 *A. arlgirdense*
 + Plants 15 to 50 cm high. Leaf not or slightly twisted; sheaths smooth and glabrous 3
3. Inner filaments with thickened and blunt appendages along the distal margins of the dilatated basal part *A. longivaginatum*
 + Inner filaments triangular, without appendages and denticulation *A. autumniflorum*

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