

## Four new species of *Allium* (Alliaceae) from Iran

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Four species of *Allium* from northwest Iran are described as new: *Allium alamutense* Razyfard, Zarre & R.M. Fritsch, *A. kurdistanicum* Maroofi & R.M. Fritsch, *A. subakaka* Razyfard & Zarre, and *A. mahneshanense* Razyfard, Zarre & R.M. Fritsch. A detailed description for each species, a table including the diagnostic morphological characters useful in separating these species from their relatives, images of type material and illustrations of flower parts as well as distribution maps are provided.

*Allium* is probably one of the largest genera of the petaloid monocotyledons, including approximately 850 species worldwide and 114 species in Iran (Friesen *et al.* 2006, Fritsch & Abbasi 2008). According to the recent classification performed by Friesen *et al.* (2006) and Fritsch *et al.* (2009), seven subgenera and 32 sections of *Allium* occur naturally in Iran. *Allium* subg. *Melanocrommyum* is one of the largest subgenera in the genus and consists of at least 160 species worldwide (Fritsch *et al.* 2009). Additional species described after *Flora Iranica* (Wendelbo 1971) by Kamelin and Seisums (1996), Seisums (2000), Fritsch *et al.* (2002), Mashayekhi *et al.* (2005), Fritsch *et al.* (2007), Fritsch and Abbasi (2008), Neshati *et al.* (2009), Fritsch and Maroofi (2010) and in this study, raised the number of Iranian species in this subgenus to 57.

The section *Acanthoprason* is perhaps taxonomically the most problematic section of this subgenus. Although the members of the sec-

tion are well-characterized by: (1) sharing short scapes usually bearing many-flowered (more than 30 flowers) inflorescences not much above the ground level, (2) possessing leaves longer than the scapes as well as pedicels of more or less equal size, (3) pink or purple tepals developing a rigid median nerve after anthesis, and (4) through their alpine and subalpine habitats (Wendelbo 1971), unclear delimitation of some taxa along with high variation of morphological characters in other species remain problematic. Indeed, Wendelbo (1971) explicitly characterized this section as “one of the most difficult groups”. Several taxonomic problems could finally be solved by careful study and comparison of living plants, because the dried herbarium specimens do not show some morphological features necessary for identification. Recognition of some more species and subspecies, designation of epitypes and lectotypes, and a new key for determination presented by Fritsch and Abbasi

(2008) and Fritsch *et al.* (2009) considerably enhanced dealing with the Iranian members of the section *Acanthoprason*.

Based on our new collections from different parts of Iran, we describe here four new species clearly belonging to sect. *Acanthoprason*. They could not be determined with the key of Fritsch and Abbasi (2008) and they did not fit the description of any species known in this section. The plant material for this study was collected in different regions of Iran. The plants were studied after collecting and more in detail as herbarium specimens. Holotypes of the new taxa are deposited in Tehran University Herbarium (TUH), the Herbarium of Research Institute of Forests and Rangelands in Tehran (TARI), the Herbarium of Research Center of Agricultural and Natural Resources of Kurdistan in Sanandaj (acronym used HKS), and Traditional Medicine and Materia Medica Research Center Herbarium, Shaheed Beheshti University of Medical Science in Tehran (MPH). The new species were identified based on detailed examination of all samples deposited in the Iranian herbaria in the framework of preparing the *Allium* account for the “Farsi Flora of Iran”.

***Allium alamutense*** Razyfard, Zarre & R.M. Fritsch, *sp. nova* (Figs. 1 and 2)

*Differt ab A. derderiano tepalis lanceolatis (non plus minusque triangularibus), ab A. shelkovnikovii foliis undulatis (non strictis) tepalis saturate coloratis (non albescensibus), et ab ambobus speciebus filamentis basi (non superne) infuscatis.*

TYPE: Iran. Prov. Qazvin, Qazvin, Alamut mountains, a few kilometers before Moalem Kalayieh, near Ovan Lake, 1700 m, 36°31'N, 50°28'E, 19.V.2009 Salmaki & Razyfard 34349 (holotype TUH).

Bulbs ovate-globose, 15–23 mm diam. Outer tunics blackish-brown, splitting. Leaves in pair (sometimes single), pale yellow-green, 10–13 cm long and 1–1.5 cm wide, lanceolate to falcate-undulate, thick and fleshy, upper part ± flat, with a hooded tip in dry state, lower side slightly sulcate, flushed purple from tip towards middle after anthesis; margin finely toothed (sometimes

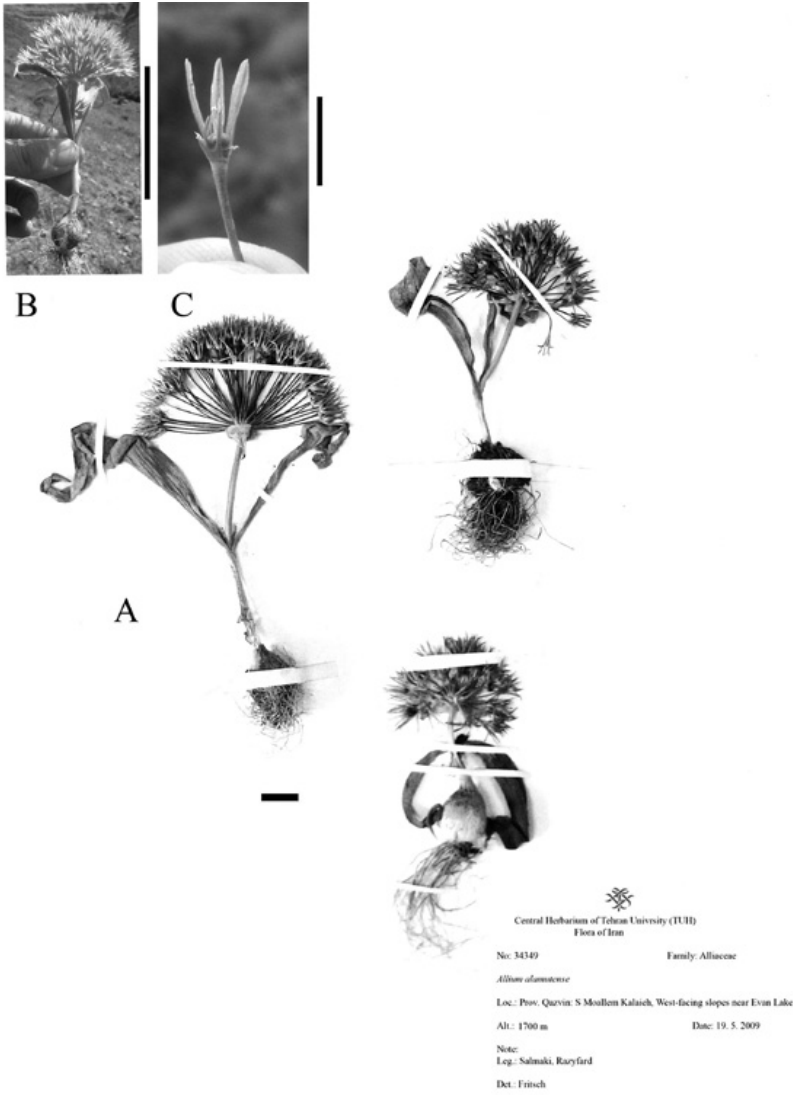
smooth), white. Scape cylindrical, ± flexuous, smooth (sulcate in dry state), 2–5 cm long above soil, ca. 3 mm diam. Spath membranous, splitting in 2 or 3 segments, whitish with brown nerves. Inflorescence semi-globose, loose, 2–4 cm diam. Pedicels straight, thin, up to 15 mm long, light green. Flowers campanulate. Tepals lanceolate, 8–10 mm long and up to 2 mm wide in middle, pink to lilac, with a darker midvein. Filaments fleshy, nearly half as long as tepals, pink throughout and darker at base, triangular, basally 1.5 mm connate to each other and adnate to tepals. Anthers ca. 1 mm long, yellowish. Ovary light green, obovate, 2–3 mm long and 2–3 mm diam.; style ca. 2 mm long; stigma undivided. Capsule with three furrows, ca. 4 mm long and 4–5 mm diam., yellowish-brown. Seeds one per locule, depressed-ovate, 1–2 mm long, ca. 2 mm wide and ca. 1 mm thick, black. Flowering in May, fruiting in June.

DISTRIBUTION AND HABITAT: Only known from the type location, growing on stony slopes with slightly moist soils in N Iran, north to the city of Qazvin.

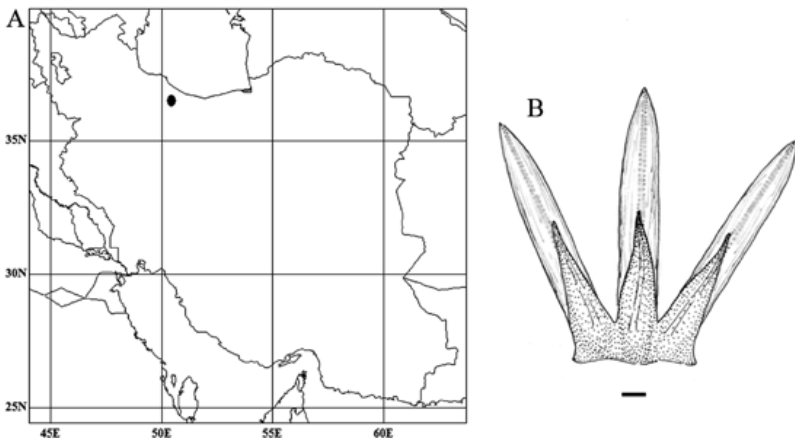
At first glance, the species is most similar to *Allium derderianum* and *A. shelkovnikovii* because of its small size and narrow leaves. It differs from *A. derderianum* by the darker and lanceolate (not triangular) tepals, and filaments darker at base (not darker at tip), but both taxa share undulate leaves. *Allium shelkovnikovii* differs from *A. alamutense* by its straight leaves, whitish tepals, sublinear outer tepals, and purple to red-brown tips of filaments. Molecular markers (ITS sequences of nuclear rDNA) of the type specimen of *A. alamutense* confirmed a position very close to *A. derderianum* (as “*A. sp. 9*”, Fritsch *et al.* 2009).

***Allium kurdistanicum*** Maroofi & R.M. Fritsch, *sp. nova* (Figs. 3 and 4)

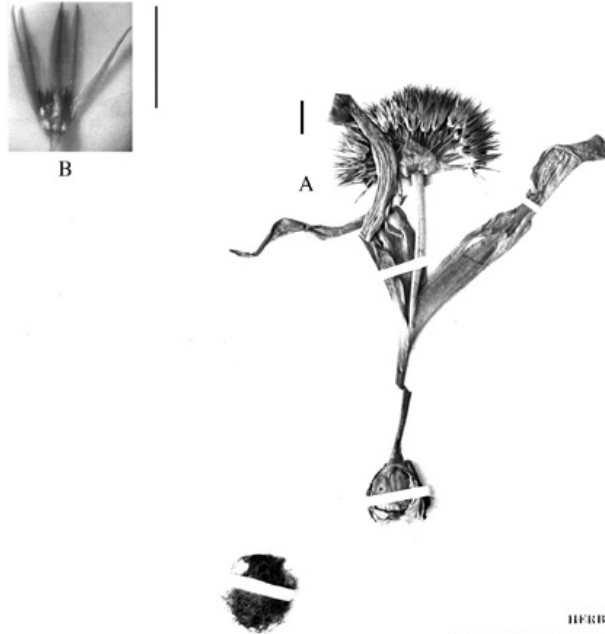
*Differt ab A. haemanthoidi foliis multo angustioribus, inflorescentiis semi-globosis (non fasciculatis) et filamentis longioribus, ab Allio zagrico foliis brevioribus angustioribus impolitibus (non nitidis) et inflorescentiis minoribus, et ab ambobus speciebus tepalis brevioribus et strictis (non recurvatis).*



**Fig. 1.** *Allium alamutense*. — **A:** Holotype (scale bar = 1 cm). — **B:** General habit in living state (scale bar = 10 cm). — **C:** A flower in closer view (scale bar = 1 cm).



**Fig. 2.** *Allium alamutense*. — **A:** Distribution map. — **B:** Tepals and filaments (scale bar = 1 mm).



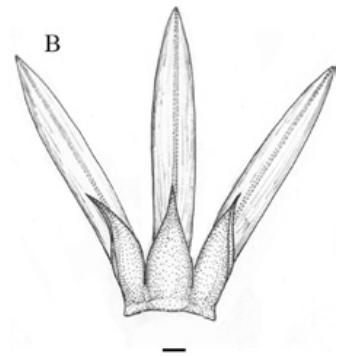
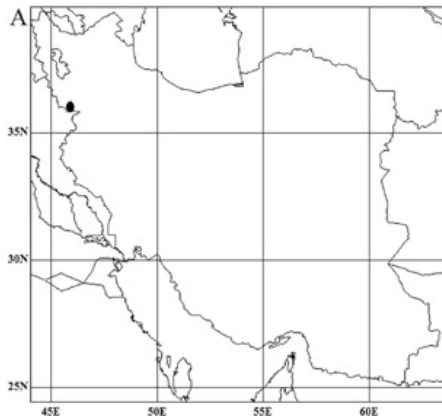
**Fig. 3.** *Allium kurdistanicum*. — **A:** Holotype (scale bar = 1 cm). — **B:** A flower in closer view (scale bar = 1 cm).

HERBARIUM OF  
RESEARCH SECTION OF FORESTS AND RANGELANDS  
BAKHTARAN - IRAN

Sc. Name: *Allium* (Liliaceae)  
Varnae Name:  
Locality: Kurdistan, 15 km. N.E. of Banah,  
Gardaneh Khan.  
Date: 1.6.1989 Alt. 2450 No. 2432  
Not Range Land.

Soil: Lithosols

Collector: Fattahia Tavakoli & Hatami Det.



**Fig. 4.** *Allium kurdistanicum*. — **A:** Distribution map. — **B:** Tepals and filaments (scale bar = 1 mm).

TYPE: Iran. Prov. Kurdistan, Baneh, Gardaneh Khan, 15 km NE Baneh, 2450 m, 36°02'N, 45°56'E, 1.VI.1989 *Fattahi, Tavakoli & Hatami* 2432 (holotype TARI). — PARATYPE: Iran. Prov. Kurdistan, Marivan, Dalani mountain, 2000 m, 16.IV.2001 *Hooshidari* 8863 (HKS).

Bulbs ovate-spherical, 2–5 cm diam., 20–45

mm long, outer tunics blackish-brown, irregularly splitting. Leaves three, one usually larger than others, 7–17 cm long and 1–2 cm wide, pale yellow-green, narrowly lanceolate-undulate, thick and fleshy; with a mucro about 2 mm long at apex, upper and lower parts slightly sul-

cate; margin finely toothed (sometimes smooth), purple. Scape conical-cylindrical, straight or  $\pm$  flexuous, smooth, 2–5 cm long above soil, ca. 3 mm diam., widest below inflorescence. Spath membranous, splitting not completely to base in 2–3 segments, whitish with brown nerves. Inflorescence semi-globose, dense, many-flowered (50 or more), 5–6 cm diam., Pedicels straight, of equal  $\pm$  length, up to 25 mm long, lilac. Flowers campanulate (star-like in fruiting state). Tepals lanceolate-triangular, acute at tip, 11–13 mm long and up to 2 mm wide in middle, pink to lilac, median vein darker, becoming stiff after anthesis. Filaments fleshy, nearly one third as long as tepals, lilac throughout and darker at tip, from ovate base triangular, 1.5 mm connate to each other and adnate to tepals. Anthers ca. 2 mm long, yellowish. Ovary light green, obovate, 2–3 mm long and 2–3 mm diam.; style ca. 3 mm long; stigma undivided. Capsule with three furrows, ca. 4 mm long and 5 mm diam., yellowish-brown. Seeds one per locule, depressed-obovate, ca. 2–3 mm long, ca. 2 mm wide and ca. 1 mm thick, flattened, elliptic in outline, black. Flowering and fruiting in May–June.

**DISTRIBUTION:** Known only from the type location near the Iraqi border. Occurrence in Iraq seems very probable.

Morphologically *A. kurdistanicum* belongs to a group of species treated by Wendelbo (1971) under the name of *A. haemanthoides*. Recently Fritsch and Abbasi (2008) split this alliance in several species. *Allium kurdistanicum* differs from *A. haemanthoides s. stricto* by the much narrower leaves, semi-globose (not fasciculate) inflorescences, shorter and straight (not recurved) tepals, and relatively longer filaments. *Allium zagricum* has similar flowers as *A. kurdistanicum* but the former differs by the much larger and wider, glossy leaves, larger inflorescences, and recurved tepals. Recent molecular investigations placed the new species (Fritsch et al. 2009, as “*A. sp. 10*”) slightly separate among accessions of *A. austroiranicum* from Kurdistan and *A. ubipetrense*. Because the filament tips are darker than the base and the leaves are rather narrow, *A. kurdistanicum* should also be a member of the *A. derderianum* alliance proposed by Fritsch et al. (2009).

***Allium mahneshanense*** Razyfard, Zarre & R.M. Fritsch, *sp. nova* (Figs. 5 and 6)

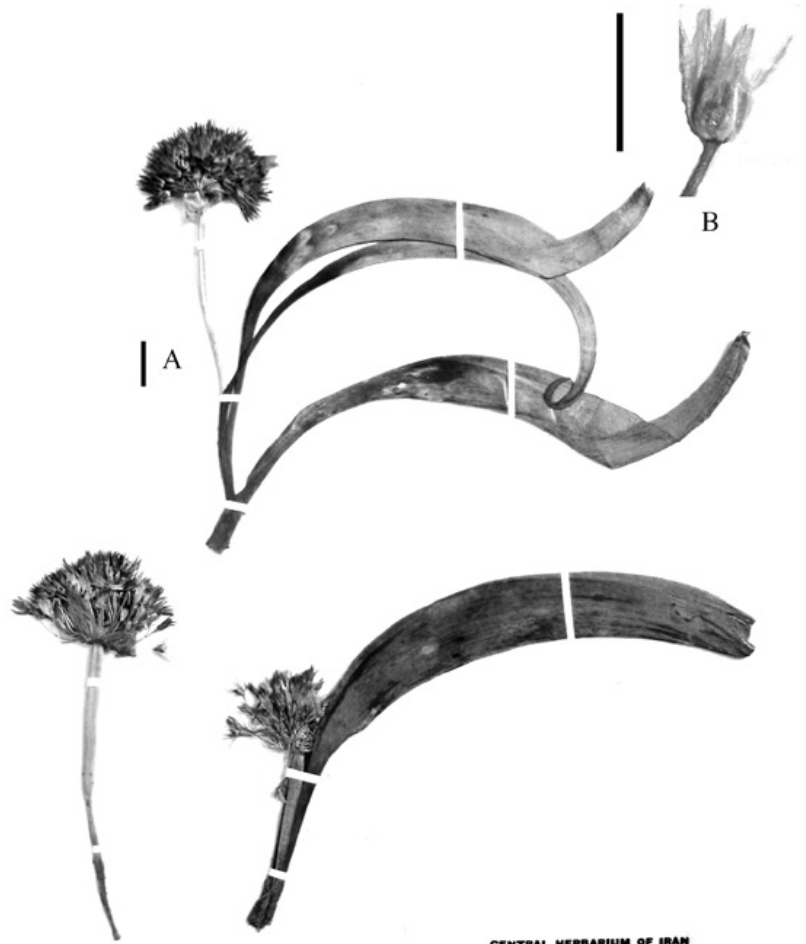
*Differt ab A. akakae foliis angustioribus falcatis (non strictis), tepalis purpureis (non albis vel roseis) et filamentis subulatis (non dilatatis), et ab A. austroiranico tepalis brevioribus elliptico-oblongis purpureis (non lanceolato-triangularibus roseo-lilacinis).*

**TYPE:** Iran. Prov. Zanjan, Mahneshan, Anguran village, Belgheis Mountains, 2700–2900 m, 36°45'N, 47°40'E, 25.IV.1987 Maassoumi 64855 (holotype TARI).

Bulbs ovate-globose, 15–25 mm diam., outer tunics black, coriaceous, and irregularly splitting. Leaves three, one usually larger than others, light green, 15–18 cm long and 2–5 cm wide, falcate-elliptic, thick and fleshy, hooded at apex, upper and lower parts slightly sulcate; margin finely toothed especially at leaf base, greenish-white. Scape conical-cylindrical, straight or  $\pm$  flexuous, smooth, 0–2 cm long above soil, ca. 3–4 mm diam., widest below inflorescence. Spath membranous, splitting into 2 or 3 segments, whitish with brown nerves. Inflorescence semi-globose, dense, many-flowered (50 or more flowers), 3–4 cm diam. Pedicels straight,  $\pm$  of equal length up to 20 mm long, brown. Flowers campanulate (star-like in fruiting state). Tepals elliptic-oblong, obtuse at tip, 6–7 mm long and up to 2 mm wide in middle,  $\pm$  purple, median vein darker, becoming stiff after anthesis. Filaments fleshy, nearly half as long as tepals, pink throughout and darker at tip, triangular, basally 1.5 mm connate to each other and adnate by 1 mm to tepals. Anthers ca. 1 mm long, yellowish. Ovary light brown, spherical, 3 mm long and 3 mm diam.; style 2 mm long; stigma undivided. Capsule and seeds not seen. Flowering and fruiting in April–May.

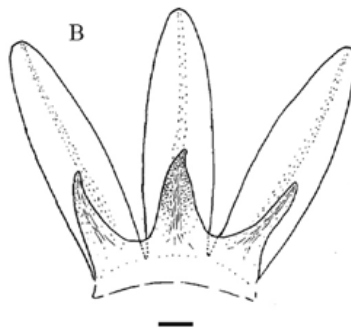
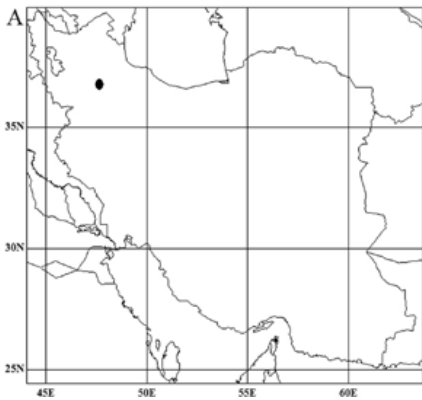
**DISTRIBUTION:** Known only from the type location near the city of Mahneshan, eastern Zanjan province.

At first glance, this species is most similar to *A. akaka*, which is characterized by the broader and often shorter and not falcate leaves, white or pink flowers, and broad (not subulate) filaments. *Allium mahneshanense* shares rather broad leaves and darker filament tips with



**Fig. 5.** *Allium mahneshanense*. — **A:** Holotype (scale bar = 1 cm). — **B:** A flower in closer view (scale bar = 1 cm).

CENTRAL HERBARIUM OF IRAN  
 No. 64855 Fam. Liliaceae  
 Allium  
 Prov. Zanjan: Mahneshan, Anguran, Boizheis Mts.  
 Alt. 2700-2900 m Date 25.4.1987  
 Note  
 Leg. Maassoumi  
 Allium ? akaka S.G. Gmelin ex Schrad. et Schult.f.  
 with purple flowers  
 2009 © 1987 Rep. det. Richard M. Fernald (USA)



**Fig. 6.** *Allium mahneshanense*. — **A:** Distribution map. — **B:** Tepals and filaments (scale bar = 1 mm).

*A. austroiranicum*, but differs by the shorter, elliptic-oblong, and purple tepals. Morphologically it belongs to the *A. austroiranicum* alliance, but according to molecular markers of the type specimen, *A. mahneshanense* was placed jointly with *A. graveolens* and *A. ubipetrense* accessions in a weakly supported subclade in sect. *Acanthoprason* (Fritsch et al. 2009, as *A. aff. akaka*) far from *A. akaka s. stricto*.

***Allium subakaka* Razyfard & Zarre, sp. nova** (Fig. 7 and 8)

*Differt ab A. akakae s. str. foliis late-ellipticis purpureo-marginatis (non longe-ellipticis albo-marginatis), tepalis angustioribus (non ellipticis), filamentis longioribus subulatis superne infuscatis liberis basi longiore connatis (non triangularis usque ovatis pallide coloratis inter se marginis contingentibus basi breve connatis).*

TYPE: Iran. Prov. West Azarbaijan, west of Uromieh, Targevar valley, west of Solak, 2000 m, 23.V.1976 *Runkmark & Foroughi* 19746 (holotype TARI). — PARATYPES: Iran. Prov. West Azarbaijan, Piranshahr, Dalanpar mountains, 2800–3600 m, 3.VI.2004 *Solyman Hariri* 6913 (HKS); prov. West Azarbaijan, Siah Chashmeh to Kelisa Kandi, Khan Goli region, 2450 m, 39°12'N, 44°07'E, 23.VI.2005 *H. Moazzeni & A. Ghorbani* 1110 (Herbarium of Traditional Medicine and Materia Medica Research Center: TMRC).

Bulbs ovate-spherical, 20–25 mm diam., 20–25 mm long, outer tunics blackish, irregularly splitting. Leaves two, one usually larger and broader, pale yellow-green, 7–9.5 cm long and 2.5–5 cm wide, oblong to elliptic, thick and fleshy, upper and lower parts ± sulcate; margin finely toothed, white to purple, hooded at apex or sometimes obtuse. Scape cylindrical, straight or ± flexuous, smooth, 3–4 cm long above soil, ca. 3 mm diam. (widest below inflorescence). Spath membranous, splitting incompletely to base into 2–3 segments, whitish with brown nerves. Inflorescence semi-globose, dense, many-flowered (70 or more), 4–5 cm diam., Pedicels straight, ± of equal length up to 20 mm long, lilac. Flowers campanulate. Tepals narrowly oblong, obtuse at tip, 8–9 mm long and up to 1.5 mm wide in middle, pink to lilac, median vein darker and becoming stiff after anthesis. Filaments

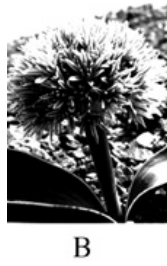
fleshy, nearly two thirds as long as tepals, with a remarkably darker tip, triangular, inner filament bases wider than outer ones, 2 mm connate to each other and 1 mm adnate to tepals. Anthers ca. 1.5 mm long, yellowish. Ovary light green, obovate, 2–4 mm long and 3–4 mm diam.; style up to 3 mm long; stigma undivided. Capsule with three furrows, ca. 4 mm long and 5 mm diam., yellowish-brown. Seeds one per locule, depressed-obovate, 2–3 mm long, ca. 2 mm wide and 1 mm thick, flattened, elliptic in outline, black. Flowering and fruiting in June–July, whereas most species of section *Acanthoprason* are flowering in May–June.

DISTRIBUTION: The species grows naturally in northwestern Iran, occurrence in eastern Turkey and northeastern Iraq is expected.

As Fritsch (2008) analyzed, rather different plants named *A. akaka* and *A. akaka* subsp. *akaka*, respectively, were reported to occur in Turkey (Kollmann 1984), Iraq (Wendelbo 1985), and different parts of northern Iran (Wendelbo 1971). Therefore, recently an epitype was designated (Fritsch & Abbasi 2008) for the *A. akaka s. stricto* morphotype, which occurs mainly in the provinces Ardebil and Gilan. *Allium subakaka* represents the morphotype hitherto incorrectly named *A. akaka*, distributed in the northwestern corner of Iran and very probably in the adjacent parts of Turkey and Iraq. It can be distinguished from *A. akaka s. stricto* by having broadly-elliptic (*vs.* narrowly elliptic) leaves with purple (*vs.* white) margins, narrower (*vs.* elliptic) tepals, subulate stamens with a dark colored tip and the basal connate filament parts distinctly longer than the upper parts adnate to the tepals (*vs.* stamens mono-colored, triangular to ovate touching one another at the margins). Easily visible are also the relatively longer filaments of *A. subakaka* (2/3 of tepal length, whereas only 1/3 in *A. akaka*). For other differences *see* Table 1.

### Acknowledgements

We are deeply grateful to Mr. H. Moazzeni for his helps during collection trips in different areas of Iran. Taxonomic treatment of the genus *Allium* in Iran was supported by the Research Council, University of Tehran, as well as “Alexander von Humboldt Stiftung”, Germany, through grants to the corresponding author.



Shahrood Beheshti University of Medical Sciences  
 Traditional Medicine and Materia Medica  
 Research Center Herbarium

No 1110 Date 23/06/2005

Family Alliaceae

Scientific name *Allium*

Local name

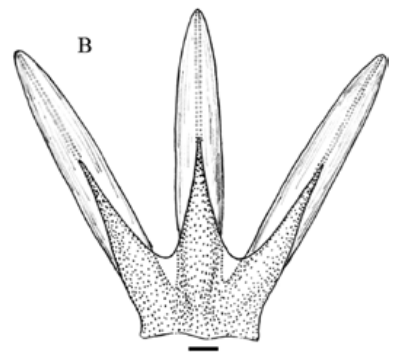
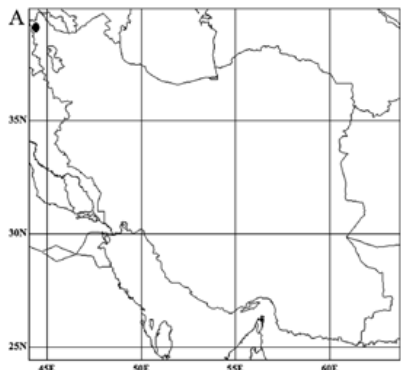
Locality W Azarbaijan, Chaldoran to Kefisakandi,  
 Khangali region N 39 12 749 E 44  
 07 737

Altitude 2450m

Collectors A. Ghorbani

Determiner

**Fig. 7.** *Allium subakaka*.  
 — **A:** After H. Moazzeni &  
 A. Ghorbani 1110 (scale  
 bar = 1 cm). — **B:** General  
 habit in living state.



**Fig. 8.** *Allium subakaka*.  
 — **A:** Distribution map. —  
**B:** Tepals and filaments  
 (scale bar = 1 mm).



Table 1. Diagnostic features of five closely related species within *Allium* sect. *Acanthoprason*.

Characters	<i>A. akaka</i>	<i>A. shelkovnikovii</i>	<i>A. alamutense</i>	<i>A. kurdistanicum</i>	<i>A. mahreshanense</i>	<i>A. subakaka</i>
Leaf shape	lanceolate-elliptic	linear	lanceolate (undulate)	narrowly lanceolate	elliptic-falcate	broadly oblong to elliptic
Leaf length (cm)	10–16	10–13	10–14	7–17	15–18	7–9
Leaf length/scape length	2.3	2.1	3.3	2.5–3.5	7–9	2
Leaf-margin color	white	white	white	purple	white	white to purple
Pedicels length (cm)	2–3	<1	1.5	1–2.5	1.5–2	2–2.5
Number of flowers per infl.	40–50	40	30	40–50	50–60	70
Tepal color	white or pink	white	pink	pink to lilac	lilac to purple	lilac to pink
Median-vein color	green or purple	purple	purple	dark lilac	dark purple	purple
Length of tepals/width of tepals	3.5–4	3.5–4	4–5	6.5	3–3.5	5
Filament length (mm)	2–2.5	3	2	3.5–4	3	5–6
Filament-tip color	whitish to pink	purple	pink	dark lilac	purple	dark pink
Filament base color	whitish or pink	white	purple	lilac	purple	pink
Inner/outer filament width	1.2	1.2	1.5	1.5	± 1.5	± 1.5
Connate-filament base length (mm)	1	1	1	1.5	1	2
Anther length (mm)	1–1.3	1–1.5	1	2	1	1.5
Length of stamens/length of tepals	0.35	0.3–0.4	0.33–0.5	0.33	0.4–0.5	0.6–0.7
Capsule length (mm)	5–7	4	4	4	(unknown)	4
Style length (mm)	2–3	1–4	2	3	2	2–3

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