

# PHYTON

## ANNALES REI BOTANICAE

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VOL. 50, FASC. 1

PAG. 1–144

6. 8. 2010

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Phyton (Horn, Austria)	Vol. 50	Fasc. 1	1–26	6. 8. 2010
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### New Species and New Records of *Allium* L. (*Alliaceae*) from Iran

By

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With 15 Figures

Received February 17, 2010

Key words: *Allium* subg. *Allium*, *Allium* subg. *Melanocrommyum*. – Description of new species, distribution, taxonomy. – Iran, Southwest Asia.

#### Summary

FRITSCH R. M. & MAROOFI H. 2010. New species and new records of *Allium* L. (*Alliaceae*) from Iran. – *Phyton* (Horn, Austria) 50 (1): 1–26, with 15 figures.

*Allium turcomanicum* REGEL, *A. egorovae* M. V. AGABABIAN & OGANESIAN, and *A. shatakiense* RECH. f. known from adjacent countries were newly recorded for the Iranian territory, and actual data for *A. szovitsii* REGEL were presented. These records were based on herbarium specimens housed in Vienna (W) and Tehran (TARI). Other *Allium* plants rather recently collected in Iran turned out to belong to hitherto not recognized taxa and were described as new species. *A. najafdaricum* R. M. FRITSCH, *A. jaegeri* R. M. FRITSCH, and *A. chlorotepalum* R. M. FRITSCH & M. JAEGER were stu-

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died as living plants under cultivation, and *A. mozaffarianii* MAROOFI & R. M. FRITSCH from wild growing plants and herbarium specimens. These species were completely described, their taxonomic relations were discussed, and their distribution in Iran shown on maps.

### Zusammenfassung

FRITSCH R. M. & MAROOFI H. 2010. New species and new records of *Allium* L. (*Alliaceae*) from Iran. [Neue Arten und Erstnachweise für *Allium* L. (*Alliaceae*) aus dem Iran]. – *Phyton* (Horn, Austria) 50 (1): 1–26, mit 15 Abbildungen.

Über das Vorkommen von *Allium turcomanicum* REGEL, *A. egorovae* M. V. AGABABIAN & OGANESIAN und *A. shatakiense* RECH. f. im Iran wird erstmals berichtet, und für *A. szovitsii* REGEL werden konkrete Angaben genannt. Iranische Belege dieser in den Nachbarländern vorkommenden Arten befinden sich in den Herbarien von Wien (W) und Teheran (TARI). Andere in letzter Zeit im Iran gesammelte *Allium*-Pflanzen konnten bisher bekannten Taxa nicht zugeordnet werden und wurden als neue Arten beschrieben: *A. najafdaricum* R. M. FRITSCH, *A. jaegeri* R. M. FRITSCH und *A. chlorotepalum* R. M. FRITSCH & M. JAEGER anhand von kultivierten Exemplaren; bei *A. mozaffarianii* MAROOFI & R. M. FRITSCH dienten Wildpflanzen und Herbarexemplare als Grundlage. Die Merkmale aller genannten Taxa wurden ausführlich beschrieben, ihre taxonomischen Beziehungen diskutiert, und die bekannten Vorkommen auf Karten dargestellt.

### 1. Introduction

WENDELBO 1971: 4 stated as first paragraph of his *Allium* treatment “The number of *Allium* species within the “Flora iranica”-area is likely to be considerably increased in the future. Several more Caucasian species may be found in NW. Persia and additional Central Asiatic species may occur in NE Afghanistan. Several sheets of undetermined plants seen during work with the genus, may represent species new to science.” These words seemed rather far-fetched in view of no less than 75 species mentioned by him to occur in Iran. Although this number increased only to 88 till the end of 2006 (FRITSCH & al. 2007), recent research activities, focusing mainly on living plants in nature and under cultivation, contributed rather many *Allium* species and subspecies as new records and new taxa from Iranian territory. The relevant publications and taxa were shortly reviewed by FRITSCH & ABBASI 2009 who listed finally altogether 114 species and subspecies occurring in Iran. Further floristic and taxonomic investigations undertaken in 2009 detected some more hitherto not named and described taxa. Several of them will be presented in this paper thus raising the number of Iranian *Allium* species to 121.

### 2. Material and Methods

Among the specimens present in the herbaria of the Iranian Research Institute of Plant Protection, Tehran (IRAN), Research Institute of Forests and Rangelands, Tehran (TARI), Tehran University (TUH), Museum of Natural History, Vienna (W),

Research Center of Agricultural and Natural Resources of Kurdistan, Sanandaj (acronymed here HKS), several specimens turned out to belong to species hitherto not recorded for Iran, or were found to differ remarkably from other specimens assigned to the same species. These voucher specimens are cited and discussed below. New taxa were described, based on morphological analyses from living plants studied during field-work in different parts of Iran, and also based on specimens under cultivation at the Iranian Research Institute of Plant Protection, Tehran. These descriptions were completed using photographs and other documented data.

### 3. Results and Discussion

#### 3.1. New Records for the Flora of Iran

##### 3.1.1. Subg. *Allium*

##### 3.1.1.1. Sect. *Allium*

*Allium turcomanicum* REGEL in Trudy Imp. S.-Peterburgsk. Bot. Sada 10: 305 (1887).

Typus: "In Turcomania ad fluvium Murgab inter Kalaburun et Abdul-lachan ad meridiem versus a Merw", leg. A. REGEL (LE).

Vouchers from Iran: Prov. Khorassan; in declivibus argilloso-calc. prope Shorlugh, 45 km a Sarakhs austro-occidentem versus, 800 m, 26.5.1977, leg. RECH. f. no. 55732 (W); in collibus 15 km a bifurcatione viae Mashhad – Sarakhs versus Salehabad, 700–900 m, 26.5.1977, leg. RECH. f. no. 55765 (W; Fig. 1).

Distribution: Turkmenistan, NW and NE Afghanistan, Tajikistan, southern Uzbekistan, northeastern edge of Iran (Fig. 3).

Ecology: Stony slopes, clayey or sandy soils.

Description (MATHEW 1996: 155): Bulbs ovoid, 1–1.5 cm in diameter, outer tunics reticulate-fibrous, reddish to brown, the few bulblets large, elongate, yellow, smooth, glossy. Scape 30–100 cm long, smooth, for 1/3–1/2 covered by glabrous leaf sheaths. Leaves 4–5, much shorter than scape, 2–6 mm wide, semi-cylindrical, fistulous, smooth. Spathe 1-valved, ovate with narrow beak, shorter than the inflorescence, soon caducous. Inflorescence spherical, 3–5.5 cm in diameter, many-flowered,  $\pm$  dense. Pedicels 12–30 mm long, of unequal length, bracteolate. Flowers urceolate-campanulate, white or pale purple-pink, median vein green or purplish. Tepals 5–6 mm long, cucullate near the tip, acute and apiculate, smooth, keeled, outer tepals narrowly ovate, cymbiform, inner ones elliptic to narrowly oblong. Filaments somewhat longer than tepals, purplish-violet, near base connate and united with the tepals, margin basally ciliate, outer filaments subulate above the broadened base, inner filaments tricuspidate, basally scarcely wider than the tepals, median cusp equal or slightly longer than the lateral cusps and as long as the broadly ovate or suborbicular base, lateral cusps shorter than or about equal to the tepals. Anthers dark violet.

Style exerted at anthesis, c. 3 mm long. Capsule subglobose or obovoid, 3.5 mm long, valves suborbicular, transversely rugose.

Typical for this species are its narrow tepals and very widely expanded inner filaments with their basal part wider than the adjacent tepal being ovate to almost orbicular in outline (MATHEW 1996). The Iranian vouchers were collected about 180 km W of the type location (Fig. 2) and represent *A. turcomanicum* in the strict sense. WENDELBO 1971 (records for Afghan territory only) and VVEDENSKY & KOVALEVSKAYA 1971 accepted *A. turcomanicum* in a wider sense. Plants from the SW Hissar mountain range in Uzbekistan and Tajikistan differ by elliptic outer tepals, white tepals and filaments, and lateral cusps of inner filaments long exerted. They grow often on saline soil and probably represent another taxon.

### 3.1.1.2. Sect. *Reticulatobulbosa* KAMELIN

*Allium szovitsii* REGEL in Trudy Imp. S.-Peterburgsk. Bot. Sada 3, 2: 171 (1875). – *A. strictum* SCHRAD. var. *anodon* BOISS., Fl. Or. 5: 247 (1882).

Typus: Azerbaijan, Karabagh. Inter saxa in summo cacumine montis Kirs. 18. 9.1829 leg. SZOVITS no. 608 (Holotype and isotypes LE).

Vouchers from Iran: Prov. West Azerb., Kuh Kani Ziarat N Habashi Bala prope Qotur, 2300–3000 m, 18.7.1974 leg. W. RECHINGER & RENZ no. 49635 (W); prov. Ardabil, Shahbil, Kuh-e Sabalan, N rocky slope, grassy & damp soil, 2800 m, 24.7.1974 leg. FOROUGHİ & ASSADI (TARI 13841, W) (Figs. 2, 3).

Distribution: Georgia, Armenia, Azerbaijan, Turkey, N Iraq ?, N Iran (Fig. 3).

Ecology: Mountain slopes and meadows of median and upper montane belt.

Description: Bulbs attached to a rhizome, narrowly conical to cylindrical, 7–10 (15) mm in diameter, outer tunics brown, fibrous-reticulate. Scape 15–50 cm long. Leaves 2–5, flat, 2–4 mm wide, narrowly linear with a rounded tip. Spathe as long as or somewhat shorter than inflorescence, 2-valved, whitish-scarious, persistent. Inflorescence 1.5–2 (3) cm in diameter, many-flowered, globose or rarely semiglobose. Pedicels 3–5 mm long. Flowers ovate-campanulate. Tepals pink or lilac, rarely white, glossy, elliptical, naviculate, (4) 5–6 mm long, tip rounded or subacute, inner tepals sometimes hooded and 1 mm longer than outer ones, median vein slightly keeled, purple. Filaments subulate, basally only united with the tepals, 2–4 mm longer than tepals, outer filaments sometimes slightly longer than the somewhat broader inner ones, pink. Anthers purple. Style 3–5 mm long, exerted, stigma undivided. Ovary ovate-tripartite, about 2 mm in diameter, green.

At first *A. szovitsii* was only listed as a name by GHAREMAN & ATTAR 1999 among the species occurring in Iran. The vouchers seen in W confirm



Fig. 1. Voucher of *Allium turcomanicum* (W).

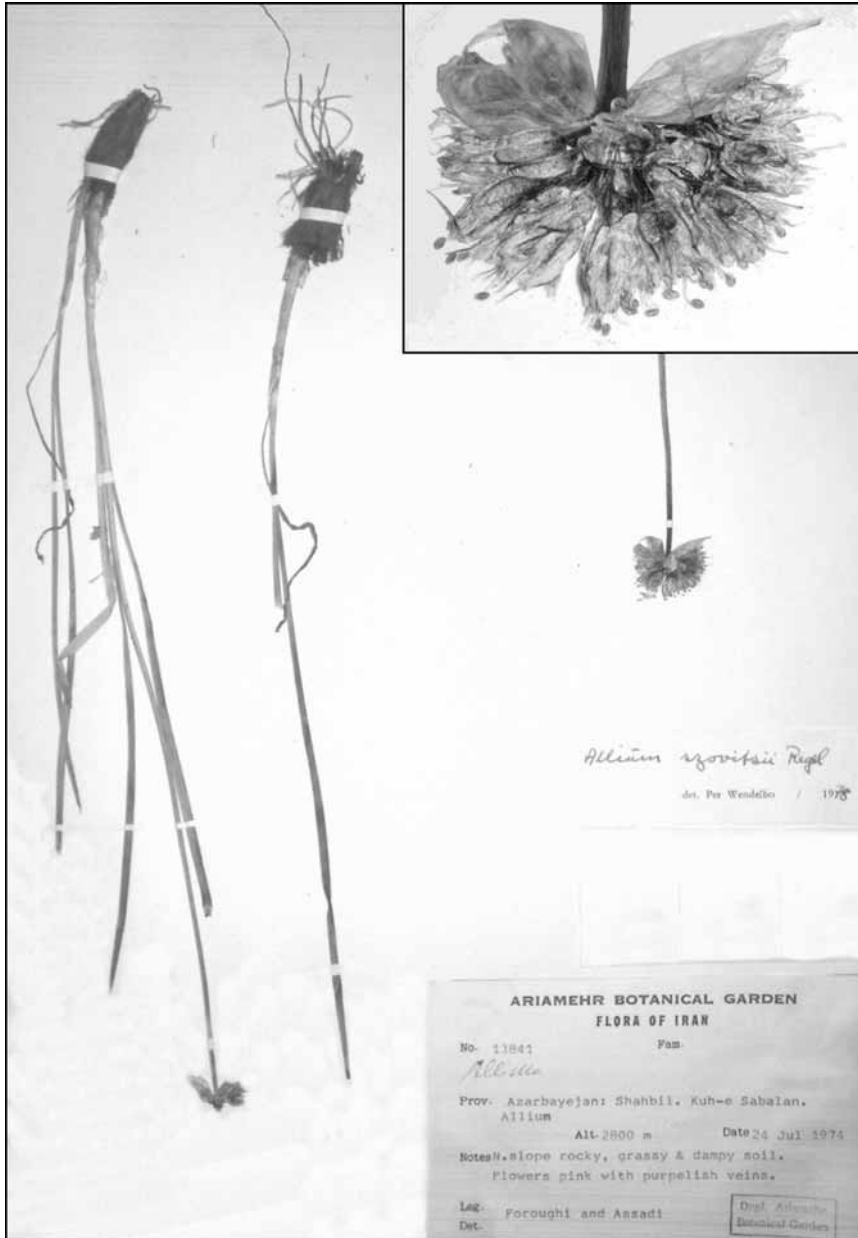


Fig. 2. Voucher of *Allium szovitsii* (W). Inset: Inflorescence enlarged.

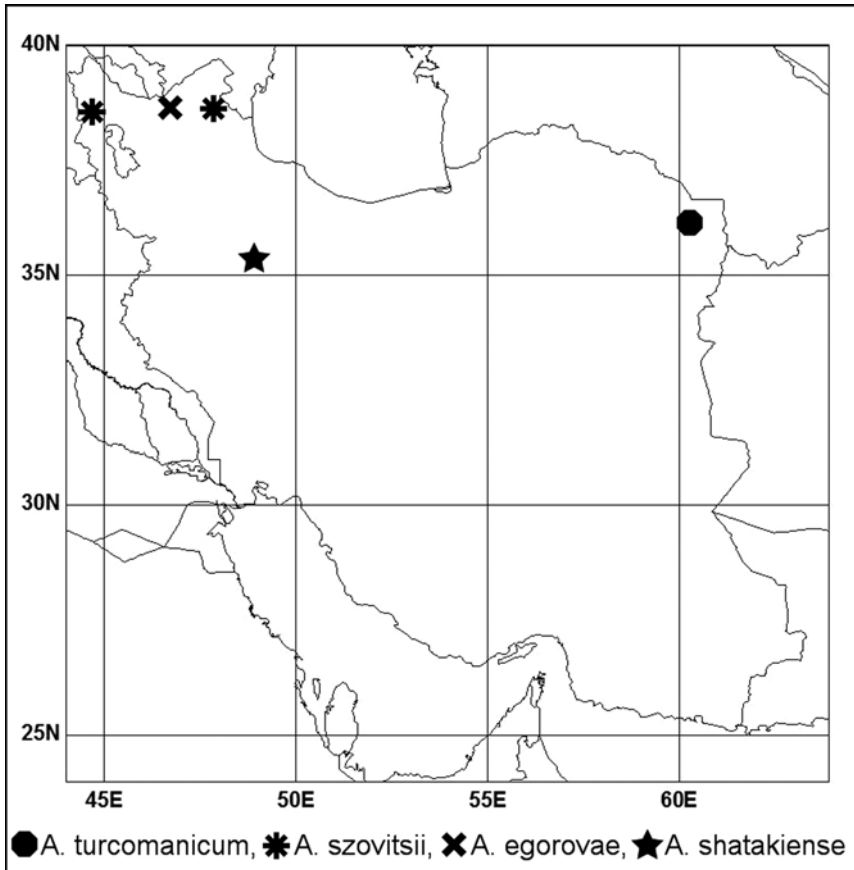


Fig. 3. Distribution map of newly recorded *Allium* species in Iran.

this record, whereas KOLLMANN 1984 erroneously assigned the type location in Azerbaijan to Iranian territory. The occurrence in Iraq (KOLLMANN 1984) remains unclear because *A. szovitsii* was not mentioned by WENDELBO 1985. This species grows only at higher altitudes (see also FRIESEN & ÖZHATAY 1998) and is easily recognized by the rhizomatous habit, reticulate-fibrous bulb tunics, narrow leaves, and a small umbel of more or less lilac, ovate-campanulate flowers with exserted filaments. *A. pseudotricatum* ALBOV is related to *A. szovitsii* differing by somewhat longer tepals and filaments basally widened and united, at least the inner ones bearing two long lateral teeth. The latter species was collected in the Caucasus, Transcaucasia, and eastern Turkey (Dogu Karadeniz Daglari; FRIESEN & ÖZHATAY 1998), occurrence in NW Iran seems possible.

3.1.2. Subg. *Melanocrommyum*3.1.2.1. Sect. *Acanthoprason* WENDELBO, *Allium derderianum* Alliance

*Allium egorovae* M. V. AGABABIAN & OGANESIAN in Willdenowia 30 (2000) 95, figs. 1, 4; OGANESIAN & M. V. AGABABIAN, Flora Armenii 10 (2001) 298, 345, tab. 110.

Typus: Azerbaijan, Nakhichevan: Vyshe s. Aravsya, bassejn verkhnego pritoka Alindzha-chaj. Raznotrav'e, 1700–2200 m, 28. VI. 1963, leg. MULK-IDZHANIAN, ERE 81409 (holotype ERE, Isotypes B and ERE 81410, 81416).

Vouchers from Iran: Prov. East Azarbaijan, Arasbaran protected region. Western part of Makidi, c. 2300 m, 08.6.1976, leg. ASSADI & MASSOUMI “common in this altitude” (TARI 20228 p. p. maj.); between Kharil and Makiki, S exposed rocky stony slope, c. 2000 m, 29.5.1977, leg. ASSADI & VOSUGHI (TARI 24865); Kalan mountain on the W side of gaurd station, 2470–2550 m, 11.7.1991, leg. JAMZAD, ZEHZAD, TAHERI & IZADPANA (TARI 70245); Doghoron mountain, 2250 m, 12.6.2008, leg. MAROOFI & KAREGAR (HKS 8480) (Fig. 4); Arasbaran to Ahar 7 km to Barzid village, 1800 m, 13.7.1991, leg. ZEHZAD, JAMZAD, TAHERI & IZADPANA (TARI 70664); western parts of Munguglu secure zone in Marakan protected area near Jolfa, 1279 m, 38°50.533'N, 45°26.521'E, 8 Apr. 2009 leg. H. NAFISI (voucher and photo in Tarbiat Moallem University of Tehran).

Distribution: Southern Transcaucasia: Nakhichevan, Armenia, southern Zangezur mountain range, northern Iran (Fig. 3).

Ecology: Median and upper montane belt, herbaceous, stony, and rubble slopes.

Description: Bulbs spherical or ovate, 1.5–3 cm in diameter, tunics strong papery, inner tunics white, outer tunics grey or brown. Scape straight or often flexuous, robust, glabrous or somewhat finely papillous, 7–20 cm long, 1.5–4 mm in diam. Leaves (2) 3 (4), plane, narrowly or linear-lanceolate, recurved, gradually narrowed in the hooded tip, nearly glabrous to somewhat finely papillose, margin narrow, white, smooth or slightly rough, cartilaginous, somewhat undulate, (10) 15–30 (40) cm long and 8–30 mm broad. Spathe divided in 2–4 valves, persistent, membranous. Inflorescence broad-fasciculate or semi-globose, in the fruiting stage ± globose, many-flowered, dense, 4–5 cm in diam. Pedicels of nearly equal lengths, 12–25 mm long, somewhat thickened, purple. Anthesis in May, capsules May to June. Flowers widely funnel-shaped, star-like. Tepals elliptic or linear-lanceolate with obtuse rounded or emarginated tip, base c. 1 mm long united also with the filaments, (6) 8–10 mm long; dirty-white or pink, the violet- or pinkish-purple median vein ends before the tip. Tepals after anthesis inflexed or deflexed and somewhat thickened with convolute margins. Filaments 1/2–2/3 as long as tepals, narrowly triangular or triangular-lanceolate, deflexed, fleshy, basal 1.5 mm long connate, inner filaments 1.2–1.5 times wider and somewhat longer than the outer ones, (3)



4–5 mm long; base white, above purplish-violet. Anthers 1–1.5 mm long, purplish-violet. Ovary 1.5–2 mm long, green. Style 1.5–3 mm long, not exerted; white or pink. Stigma dot-like. Capsule shorter than tepals, ovate to pear-shaped, 5–6 mm long, green or ocher with emarginate valves. Seeds 1.5–3 mm long, 1–2.5 mm wide,  $\pm$  kidney-shaped, depressed-globular, black, finely tuberculate.

Morphologically most similar is *A. derderianum*. This species has the same general appearance but occurs only in the Alborz mountain range. It differs by narrower, undulate leaves, narrowly triangular or lanceolate, acute tepals which are straight and prickly in the dry state, mostly a smaller inflorescence composed of less flowers, and pear-shaped capsules with cordate valves rounded at the tip. The closest molecular relatives are *A. akaka* s. str., *A. shelkovnikovii*, and *A. materculae* s. str. (FRITSCH & al. 2010).

### 3.1.2.2. Sect. *Melanocrommyum* WEBB & BERTHEL., *Allium asclepiadeum* Alliance

*Allium shatakiense* RECH. f. in Ann. Naturh. Mus. Wien 49: 280, 1939, f. 7 a, b.

Typus: Türkei: Kurdistan, Darnis Ashagi nördl. von Shatak, 2300 m ü. M., leg. FRÖDIN No. 240 (Holotype W).

Voucher from Iran: Prov. Kurdistan, Dasht-e Zarghe, on road from Hamadan ca. 40 km E Sanandaj, in fields, 11.5.1975, leg. WENDELBO & ASSADI (TARI 16904, W) (Fig. 5).

Distribution: Turkey: East Anatolia; adjacent Iraq, northwestern Iran (Fig. 3).

Ecology: Quercus shrubs, mountain steppes, grassy slopes.

Description: Bulbs ovate, ca. 1–2 cm in diam., outer tunics black, inner ones whitish, papery. Scape  $\pm$  flexuous, glabrous, 15–25 (45) cm long, c. 3 mm in diam., fresh green or purple flushed. Leaves 2–4 (7), linear-lanceolate, smooth, undulate, 10–15 cm long, 0.5–2 cm broad. Spathe membranous, whitish, 2-valved, valves ovate, 1–2.5 cm long. Inflorescence fasciculate to semi-globose, dense, many-flowered, c. 2.5–4 cm in diam. Pedicels thread-like, 12–16 mm long, after anthesis up to 25 mm, angular, smooth. Anthesis in June. Flowers funnel-shaped to campanulate. Tepals very narrowly lanceolate, acuminate, lax, finally reflexed and contorted, 7–9 mm long, 1–1.4 mm wide; lilac to purple, median vein keeled. Filaments 1/2 as long as the tepals, adnate to the tepals and connate for c. 1 mm near the base, thickish, dark purple, pale when dry. Anthers 1 mm long, ovate, purplish. Ovary ovate, green. Capsule subglobose c. 5 mm broad, with suborbicular valves, pale brown. Seeds not seen.

This only moderately tall species is well characterized by the long, narrow and acute tepals and relative short filaments, both of purplish

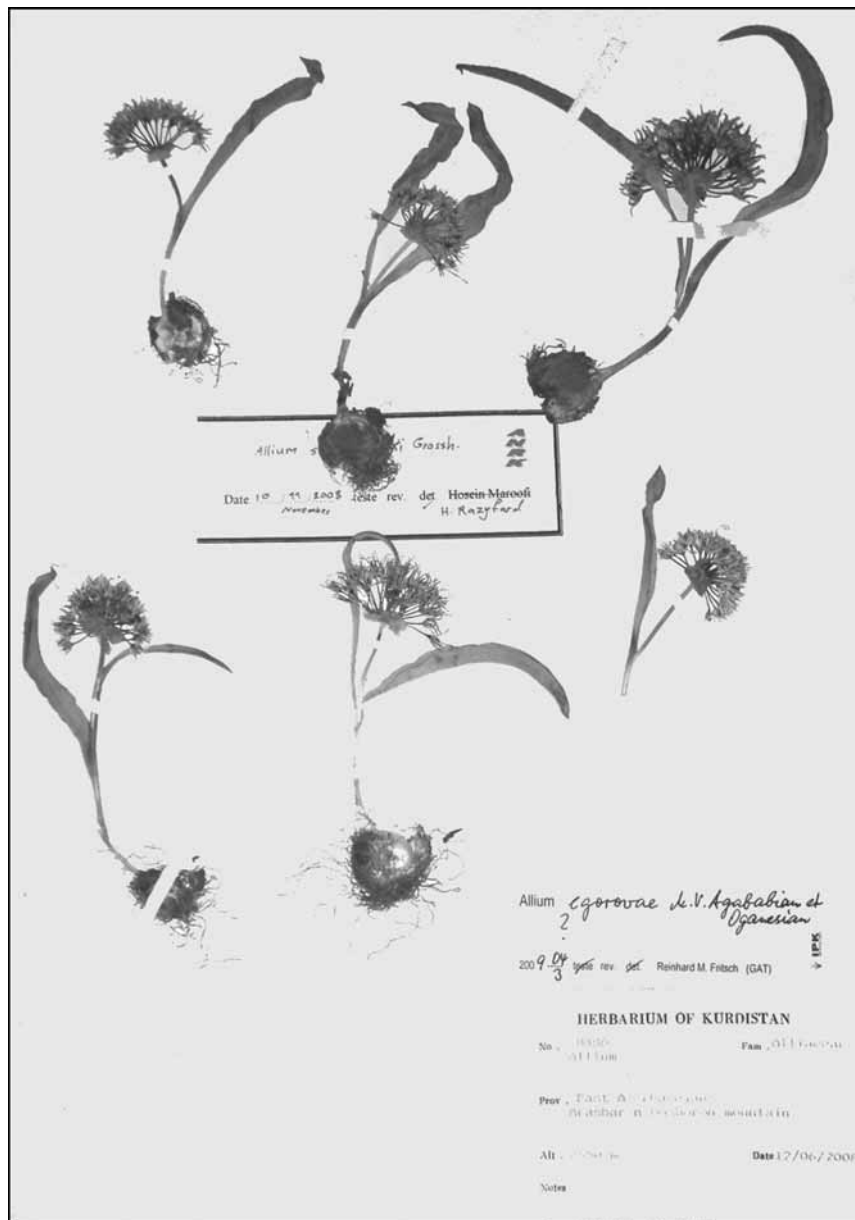


Fig. 4. Voucher of *Allium egorovae* (HKS).



Fig. 5. Voucher of *Allium shatakense* (TARI).

color. The Iranian vouchers represent rather strong plants perhaps because they grew on a field.

This species is known from several places in eastern Turkey (type location S of Lake Van) and was also reported from northernmost Iraq near the Turkish border (WENDELBO 1985). The Iranian vouchers were collected in more than 300 km distance from the SE edge of Turkish territory. Thus *A. shatakiense* may perhaps be found at other places of the provinces Kurdistan and W Azerbaijan as well.

### 3.2. New Species

#### 3.2.1. Subg. *Allium*

##### 3.2.1.1. Sect. *Caerulea* (OMELCZUK) F. O. KHASS.

###### *Allium najafdaricum* R. M. FRITSCH, **species nova**

Typus: Ex cultis in horto Gaterslebensis No. TAX 6721 leg. 16.6.2009 (GAT; Fig. 6) [bulbs from Iran: Prov. Tehran, Alborz mountain range c. 50 km W Firuzkuh, slopes south of the village Najafdar near the road from Firuzkuh to Polur; 35°46'48" N, 52°17' E, 2600–2700 m, 25.4.2008, leg. M. ABBASI & R. M. FRITSCH no. 1253].

Diagnosis: Differt ab *Allio capitellato* bulbis majoribus, scapis laevibus (non costatis), tepalis apiculatis (non obtusis) nervis medianis viridibus (non sordide violaceis) atque filamentis albidis (non violaceis), et ab *A. schergiano* foliis non filiformibus, inflorescentiis laxioribus (non compactis), floribus late (non anguste) campanulatis, tepalis majoribus apiculatis (non obtusis), filamentis 1/3 tepalis longioribus (non sublongioribus) et filamentis interioribus basi dilatatis (non e basi subulatis).

Distribution: Iran, Alborz mountain range, known only from the type location (Fig. 11).

Ecology: Stony montane slopes, near limestone rubble strips on shallow soil.

Description: Bulbs large, (1) 2–3 cm in diam., depressed-globose, with thin lengthwise splitting tunics. Scape 30–50 cm long, straight, 2–3 mm in diameter, smooth, green, up to 1/3 covered by glabrous, whitish, brown ribbed sheathes (Fig. 7B). Leaves 3, cylindrical to semi-cylindrical, smooth, 10–25 cm long, 3–5 mm in diam., glaucous (Fig. 7C). Spathe divided in 2–3 ovate-triangular, shortly acuminate valves, shorter than pedicels. Inflorescence spherical, 3–4 cm in diameter, very dense (Fig. 7A). Pedicels thin, wiry, 8–12 mm long, white, basally with narrow small bracteoles. Anthesis in June. Flowers broadly campanulate star-like. Tepals oblong, spoon-shaped, the inner tepals somewhat broader and longer, apiculate, the outer tepals somewhat naviculate and near tip with purplish stripes, after anthesis connivent and more lengthwise folded than crumpled, greenish-white with broad green (near base disappearing) median

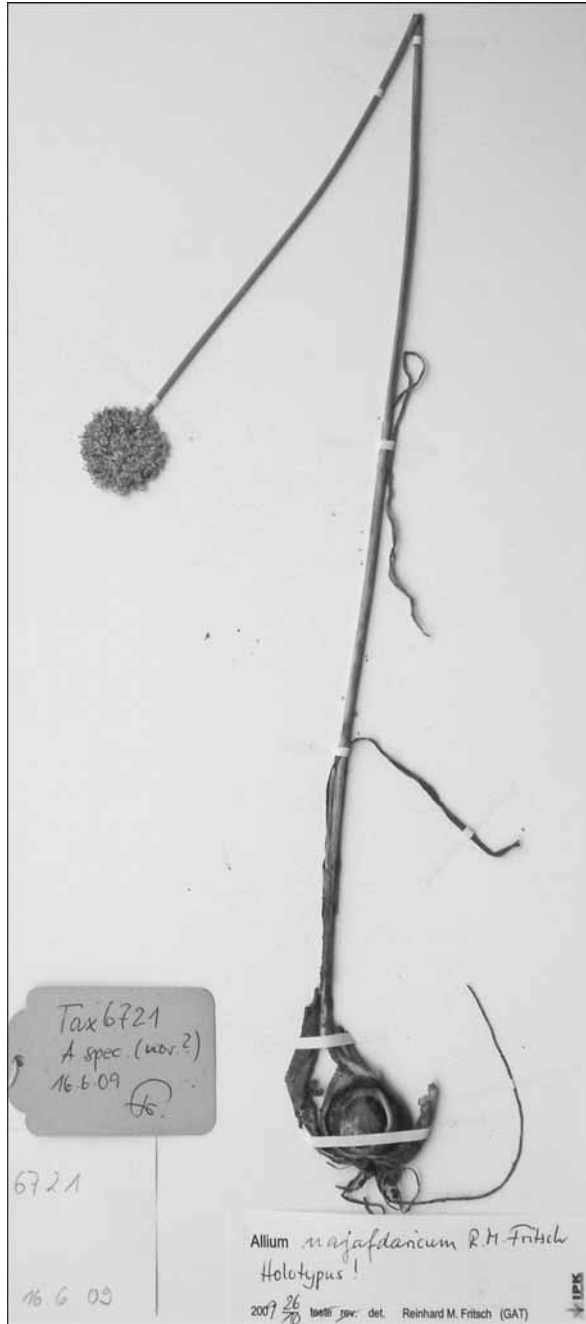


Fig. 6. Holotype of *Allium najafdaricum* (GAT).

vein, 3–4.5 mm long and 1–1.3 mm wide. Filaments 1/3 (finally 1/2) longer than tepals, basally shortly connate and the inner filaments triangular widened, above subulate, white. Anthers oblong, 1–1.5 mm long and up to 0.8 mm wide, golden yellow. Pollen light yellow. Ovary spherical, not stipitate, surface finely uneven, about 2 mm long and in diameter, dull greenish with green patches along the sutures, nectary mounds in a large pocket opening with a transversal slit near base of ovary. Style narrowly conical, 2–4 mm long, whitish. Stigma slightly capitate. Capsule rounded trihedral, parchment-like, somewhat glossy, yellowish brown, about 4 mm long and in diameter. Seeds comma-shaped, black, somewhat glossy.

This new species is difficult to affiliate if elder literature is used. Most characters fit best to sect. *Scorodon* as accepted by WENDELBO 1971. Therein *A. najafdaricum* keys out as *A. capitellatum* but is described as a larger plant with large depressed-globose (not ovate) bulbs, greyish (not black) bulb tunics, smooth (not costate) scapes, much thicker leaves, acuminate (not obtuse) tepals with green (not dirty violet) median vein, and white (not violet) filaments not obtusely toothed near the base. The key of KOLLMANN 1984 leads to Group E and *A. schergianum* BOISS. from Syria and SE Anatolia, inserted under sect. *Codonoprasum*. This species is apparently closer related. It differs from *A. najafdaricum* only by filiform leaves, a more condensed flower head, narrowly campanulate flowers, smaller, not acuminate tepals, and subulate filaments slightly longer than tepals. Both species share short, not beaked, spathe valves and differ in many other characters from sect. *Codonoprasum* as commonly accepted. As discussed in FRITSCH & al. 2007, affiliation to sect. *Caerulea* seems to fit much better.

3.2.1.2. Sect. *Longivaginata* (KAMELIN) F. O. KHASS., R. M. FRITSCH & N. FRIESEN

*Allium jaegeri* R. M. FRITSCH, **species nova**.

Typus: Cultivated in the garden of M. JAEGER, coll. 2008, bulbs collected in Iran, prov. Chaharmahali Bakhtiari, hills near Chelgert, c. 2630 m, 32°29' N, 50°06' E, 27.04.2005, leg. M. JAEGER & al. no. JZZ 05-82. (holotype GAT; Fig. 9)

Diagnosis: Differt ab *A. petri* et ceteris speciebus sectionis *Brevispatha* tepalis patentibus angustioribus, filamentis interioribus basi transverso-elliptico dilatatis, et ovariis conoideis laevibus nitidis.

Distribution: Iran: prov. Chaharmahali Bakhtiari, only known yet from the type location (Fig. 11).

Ecology: Dry grassy top of a hill.

Description: Bulbs ovate to suborbicular, c. 1 cm in diameter, 1–1.2 cm long, tunics membranous, dark grayish brown. Scape nearly straight, somewhat flexuous or ascendent (Fig. 10A), terete, smooth, 15–

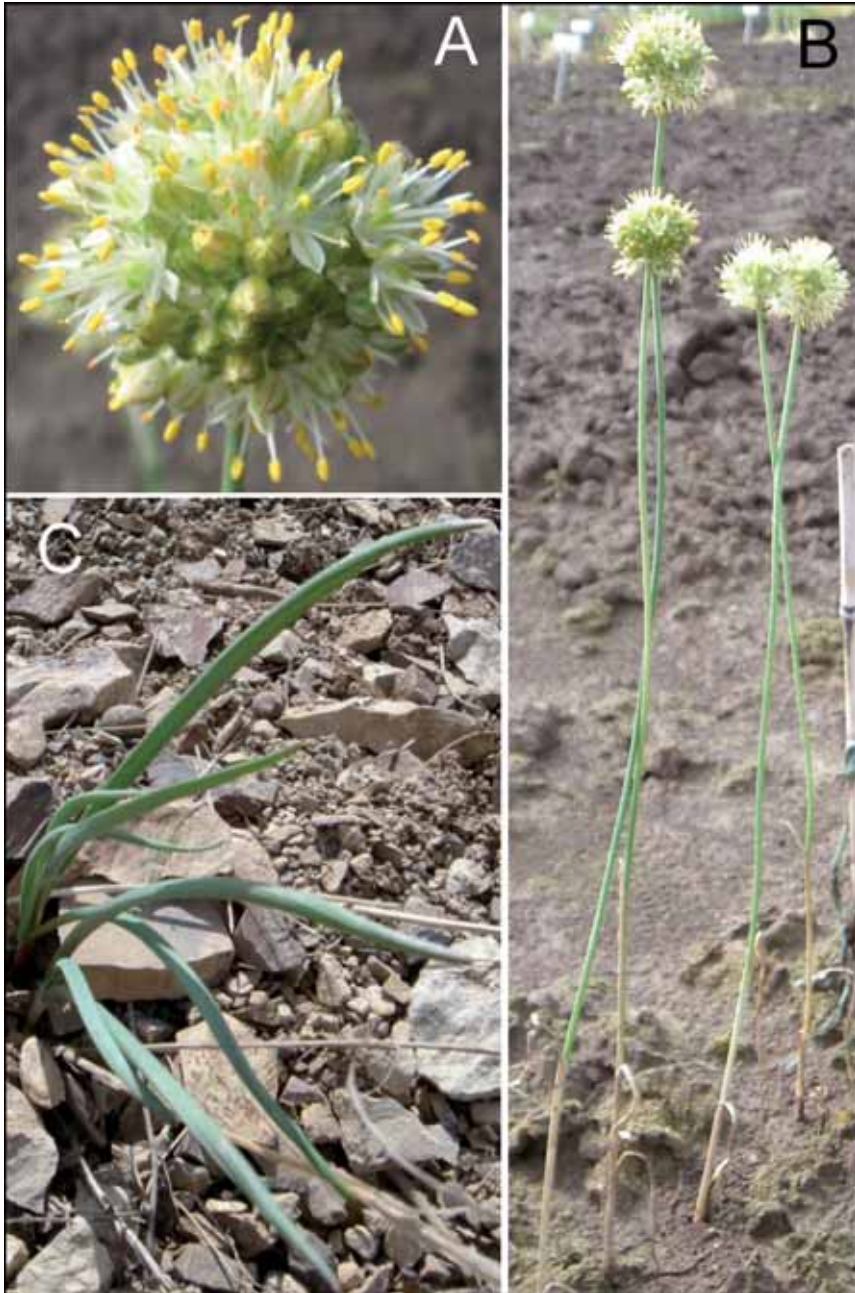


Fig. 7. *Allium najafdaricum*. A: Inflorescence and B: Flowering plants cultivated at Gatersleben; C: Plant growing at the type location (slopes S of village Najafdar, prov. Tehran).

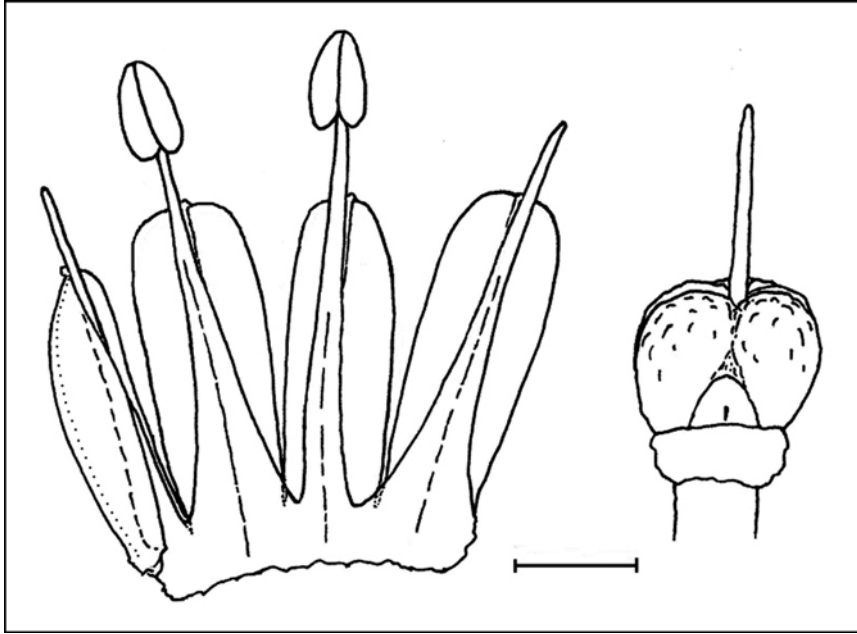


Fig. 8. *Allium najafdaricum*: Tepals, filaments with anthers, and ovary with style, scale bar = 1 mm.

20 cm long, 1.5–2 (3) mm in diameter, for about 7/8 covered by smooth leaf sheaths. Leaves 2–3 (4), blades  $\pm$  cylindrical, fistulous, slightly recurved, 5–15 cm long and in the middle 3–4 mm thick, vividly green, gradually tapering to the acute tip. Spathe apparently caducous. Anthesis in July – August. Inflorescence fasciculate, loose, few (not more than 20) flowers (Fig. 10B), 3–4 cm in diameter. Pedicels slightly incurved, thick, stiff, c. 10–15 mm long, yellowish-green, brown to purplish flushed. Flowers star-like. Tepals patent, later somewhat recurved, slightly concave, tip obtuse and acuminate (Fig. 10C), greenish-yellow with a broad brown flushed median stripe and a narrow greenish-brown median vein, c. 3 mm long, outer tepals triangular-lanceolate, c. 1 mm wide, inner tepals long-ovate, c. 1.5 mm wide, after anthesis tepals crumpled, yellowish-brown. Filaments basally c. 0.3 mm long connate, greenish-yellow, inner filaments 4 mm long, basal 1/3 strongly (wider than tepals) widened and with a fleshy rounded tooth at both sides (Fig. 10C), upper 2/3 subulate, purplish, outer filaments subulate, initially 3–3.5 mm long, purplish, deflexed, later straight, 4–5 mm long, paler. Anthers ovate, yellow, 1 mm long. Pollen sulphur-yellow. Ovary subconical-globose with sunken tip, with 6 furrows, smooth, glossy, 1.5–2 mm long and in diameter, greenish, areas between the sutures strongly purple flushed (giving the impression of longitudinal stripes). Style in-



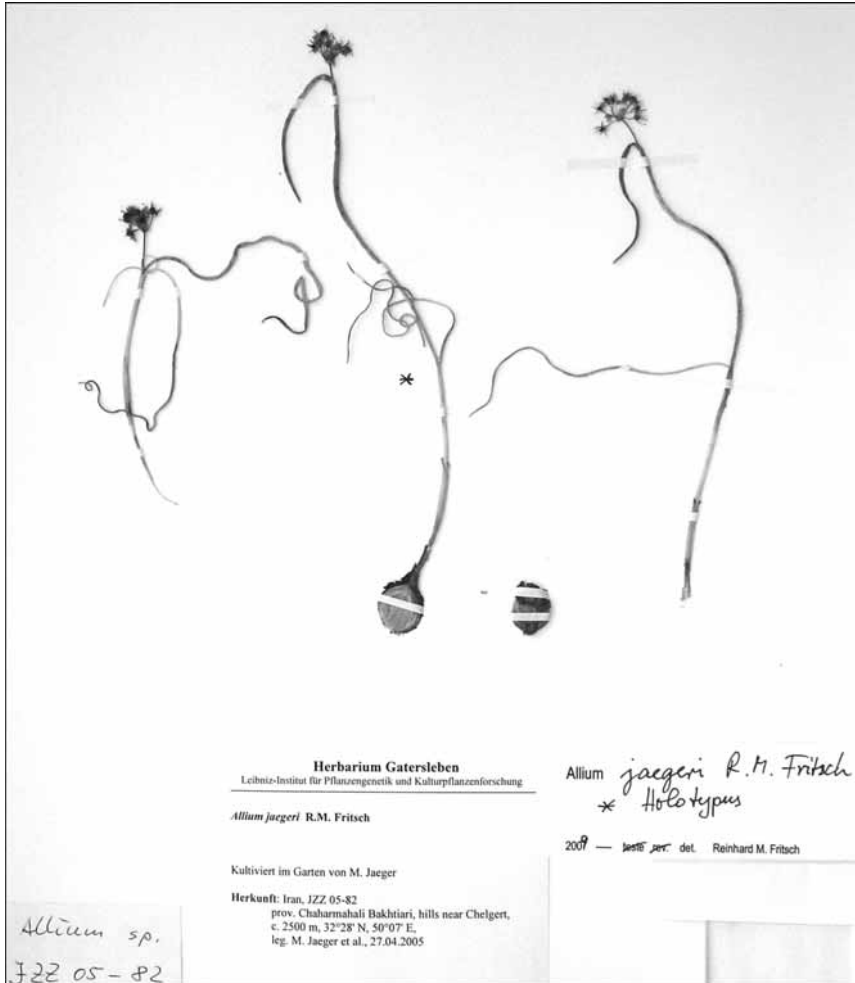


Fig. 9. Type sheet of *Allium jaegeri* (GAT).

initially 1–2 mm long, finally up to 5 mm and thread-like, greenish with purplish flush. Stigma subcapitate, greenish. Capsule and seeds not seen.

This species shows several characters well known from members of sect. *Longivaginata*, like leaf sheathes covering the scape nearly to the umbel, tepals with a brown median stripe, and the widely opened mouths of nectary tubes. However, the patent, rather narrow tepals with an intensely colored median stripe resemble those of *A. aroides* VVED. and *A. verticillatum* REGEL belonging to subg. *Melanocrommyum*. Conspicuous species-specific characters of *A. jaegeri* are the special shape of inner filaments and the subconical, smooth, and glossy ovaries. Cushion-like

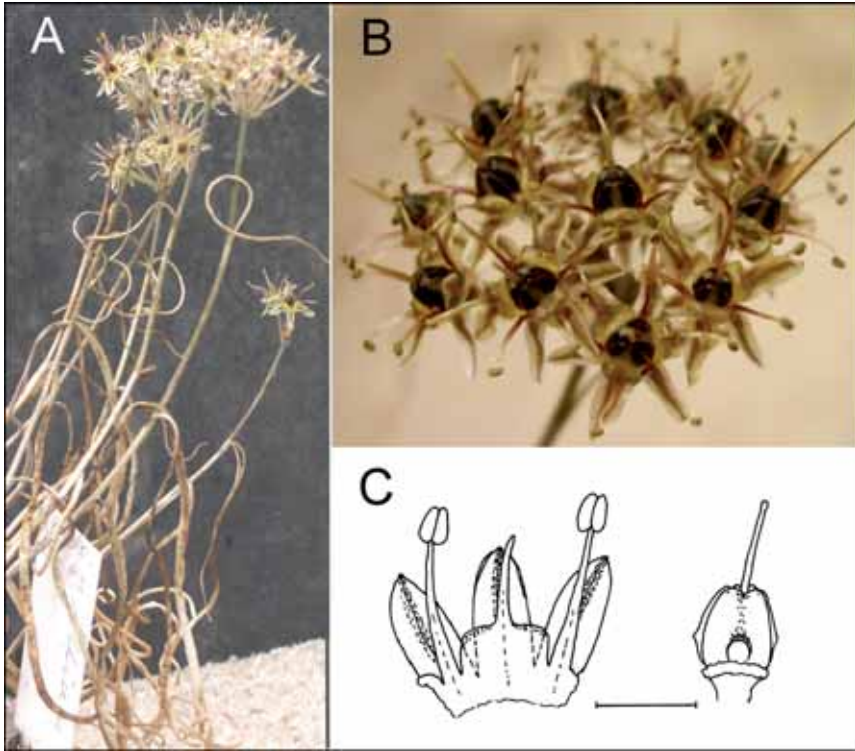


Fig. 10. *Allium jaegeri*, cultivated plants. A: Flowering plants; B: Inflorescence (photos courtesy of M. JAEGER); C: Tepals, filaments with anthers, and ovary with style, scale bar = 2 mm.

swellings along the distal margins of the dilatated basal part of filaments are present, but do not much resemble the identical structures of the related *A. petri* F. O. KHASS. & R. M. FRITSCH. In general, the plants of *A. jaegeri* look rather special. Unfortunately, the cultivated plants died prior to collecting of material for molecular investigations. A recollection of the peculiar species would be essential to elucidate the true relationships.

### 3.2.2. Subg. *Melanocrommyum* (WEBB & BERTHEL.) ROY

#### 3.2.2.1. Sect. *Acanthoprason* WENDELBO, *Allium minutiflorum* Alliance

##### *Allium chlorotepalum* R. M. FRITSCH & M. JAEGER, **species nova**

Typus: Cultivated in the IPK taxonomic reference collection no. TAX 6694 leg. 19.05.2009 (holotype GAT; Fig. 12); bulbs from Iran, province Esfahan, S to SW directed slope of Mt. Dalun massif E of village Analujeh, below the first small pass; loamy rubble of limestone and on terraces,

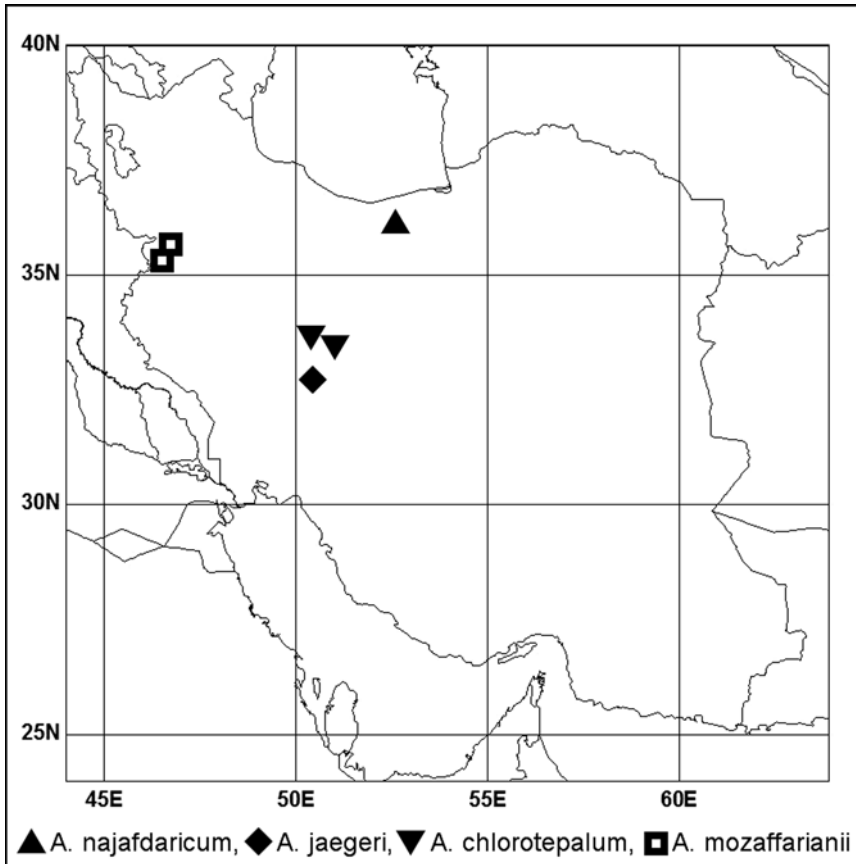


Fig. 11. Distribution map of the newly described *Allium* species in Iran.

32°55'12" N, 50°33'50" E, 2700 m, 09.04.2008, leg. M. ABBASI & R. M. FRITSCH no. 1217.

Diagnosis: Differt ab *Allio minutifloro* foliis latioribus sulcatis (non lanceolatis aequatis), tepalis duplo longioribus, filamentis incurvatis basi late triangularibus conspicue cupuliformibus connatis (non anguste triangularibus strictis basi breve occultis connatis).

Distribution: Iran, northwestern edge of prov. Esfahan (Fig. 11).

Ecology: Rock terraces and rubble areas of dry stony and rocky slopes.

Other vouchers from Iran: Prov. Esfahan, Esfahan to Daran. Ghahis protected area. 2500 m, NOWROOZI 343 leg. 20.5.1981 (TARI); living plants in the private collection of M. JAEGER, a) bulbs from Iran, prov. Esfahan, Kuh-e Daran above village Analujeh, JZZ 05-84; b) unterhalb der Felsen

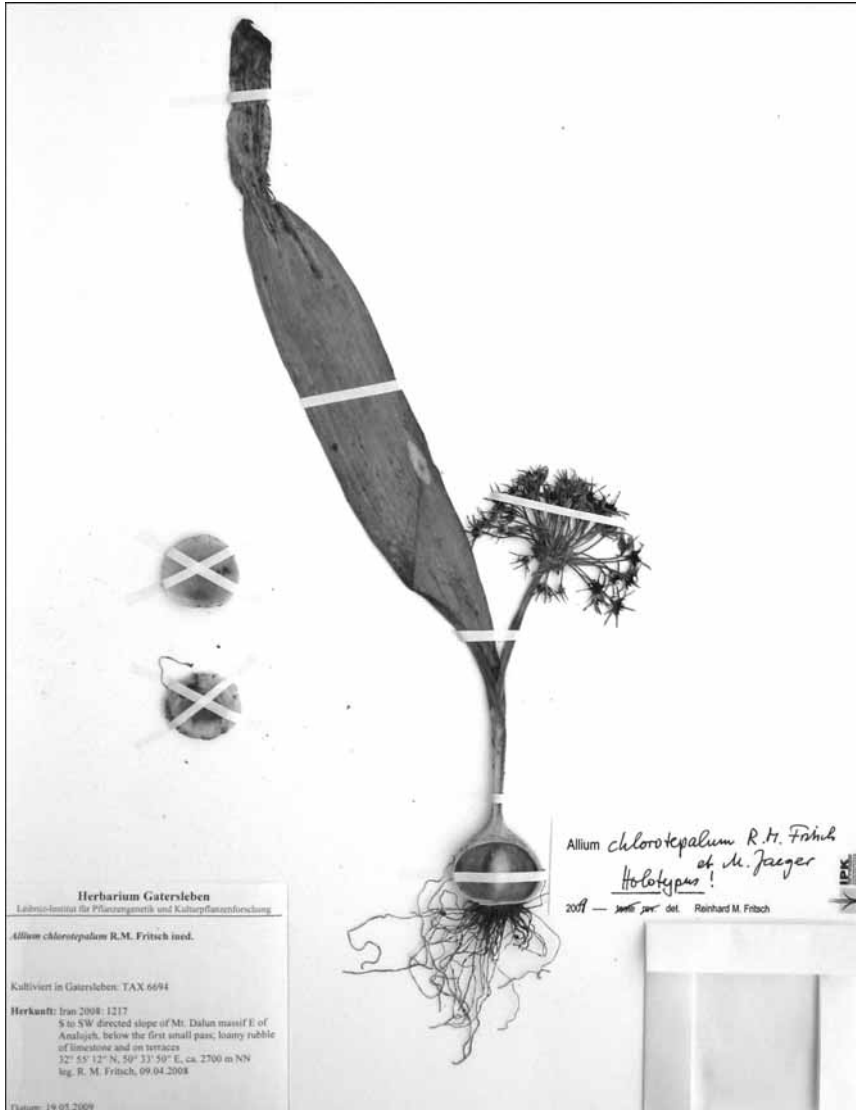


Fig. 12. *Allium chlorotepalum*. Type specimen (GAT).

im steilen Schotterhang, JLMS 02-103, 32°55'07" N, 50°33'57" E; living plants in the IPK taxonomic reference collection no. TAX 6697, bulbs from Iran, prov. Esfahan, S to SW directed slope of Mt. Dalun massif E of village Analujeh, above the first small pass; limestone rubble below second crest and deeper on E slope, 32°55'23" N, 50°33'30" E, 3000 m, 09.04.2008, leg. M. ABBASI & R. M. FRITSCH No. 1221.

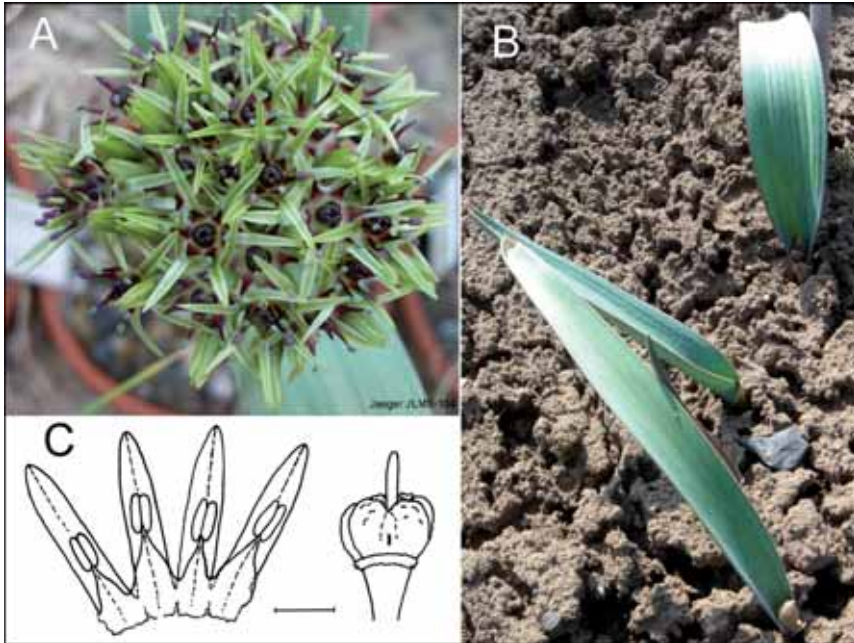


Fig. 13. *Allium chlorotepalum*. A: Inflorescence of a cultivated plant (courtesy M. JAEGER), B: Leaves of plants cultivated at Gatersleben; C: Tepals, filaments with anthers, and ovary with style, scale bar = 2 mm.

Description: Bulbs depressed-globose, 2–3 cm in diameter and 1.5–2 cm high, outer tunics greyish-brown, thickish but easily decomposing. Scape 5–10 cm long above soil, flexuous, terete, conical (4–5 mm wide below inflorescence, 2.5–4 mm wide near soil). Leaves 1–2, long-ovate to lanceolate, gradually recurved and tapering into a short hooded tip, thickish, slightly canaliculate, upper side grooved (Fig. 13B), lower side finely ribbed, green with glaucous bloom, margin initially purplish, later white, near base somewhat brown flushed. Spathe without beak, shorter than pedicels, splitting into 2–3 broadly ovate valves, yellowish-brown with darker veins. Inflorescence broadly fasciculate, dense, finally 4–5 cm in diameter. Pedicels straight, stiff, thickish, green to brown. Anthesis in May. Flowers flat star-like (Fig. 13A). Tepals linear-lanceolate with obtuse tip, plicate, patent, somewhat recurved, 6–7 (8?) mm long, c. 1.5 mm wide, green to purplish-green with wide green median vein, after anthesis brown to pale red, convolute with thickened median vein, warped, not prickly. Filaments triangular (Fig. 13C), c. 2–3 mm long, basally ring-like united, spreading and slightly incurved forming a separate cup (Fig. 13A), tip blackish-purple, towards base paler and base of annulus whitish. Anthers purple to violet, ovate, c. 1 mm long. Pollen yellowish or greenish. Ovary

depressed tripartite turbinate, c. 2 mm long and 2–3 mm in diam., with coarse epidermal cells, nearly smooth, silk-like glossy, above blackish-purple, basally green, mouth of nectary small, slit-like. Style 2–3 mm long,  $\pm$  cylindrical, deep purple. Stigma dot-like, whitish. Capsule and seeds not seen.

This new species belongs to a rather large group of species sharing short scapes and bluish-green, wide, recurved leaves longer than the scape. However, these species display different flower characters and were partly affiliated to sect. *Acanthoprason*, others to sect. *Melanocrommyum*. Molecular markers (ITS sequences, FRITSCH & al. 2010) support affiliation of *A. chlorotepalum* to sect. *Acanthoprason*, but with unclear relations. Plants from the type location form a well supported subclade of the *A. graveolens* subgroup, but the other voucher (NOWROOZI 343) was inserted in the *A. austroiranicum* subgroup. However, beside the finally incrassate median veins of tepals, most flower characters of *A. chlorotepalum* are not similar to any other species of both mentioned subgroups. Most similar is *A. minutiflorum* REGEL which differs only by lanceolate even leaves, much shorter tepals, and narrower, straight, triangular filaments positioned around the ovary as common. Therefore we follow the morphological similarity and assign *A. chlorotepalum* to the *A. minutiflorum* group. Further molecular analyses based on more and better material would be essential to verify or correct this affiliation.

#### 3.2.2.2. Sect. *Melanocrommyum* WEBB & BERTHEL., *Allium asclepiadeum* Alliance

*Allium mozaffarianii* MAROOFI & R. M. FRITSCH, **species nova**

Holotype: Iran. prov. Kurdistan, 30 km from Marivan to Paveh (Tangeh Dezli), limestone gorge; 1330–1400m, leg. 30.5.1978, RUNEMARK & MOZAFFARIAN (TARI no. 29352) (Fig. 14).

Diagnosis: Differt ab *Allio chrysanthero* inflorescentiis fasciculatis diffusis (non semiglobosis regularibus) floribus omnibus luteis (non centralibus eis purpurascensibus), filamentis viridibus (non aureis) et tepalibus triangularibus (non linearibus vel anguste lanceolatis).

Distribution: Iran: Prov. Kurdistan, known only from one region near the border of Iraq (Fig. 11). Occurrence in adjacent Iraqi territory seems probable.

Ecology: Soft slopes, open forests of *Quercus* spp. in the montane belt.

Other vouchers from Iran: Maryvan to Paveh, Darbandezli pass, 1230 m, 10.6.2007, leg. MAROOFI & KAREGAR (HKS no. 8234, 3 sheets); Maryvan, Darband Dezli, 1300 m, 16.5.2008, leg. MAROOFI & RASTEGAR (HKS no. 8684, 3 sheets).



Fig. 14. Holotype of *Allium mozaffarianii* (TARI), inset: detail of inflorescence.

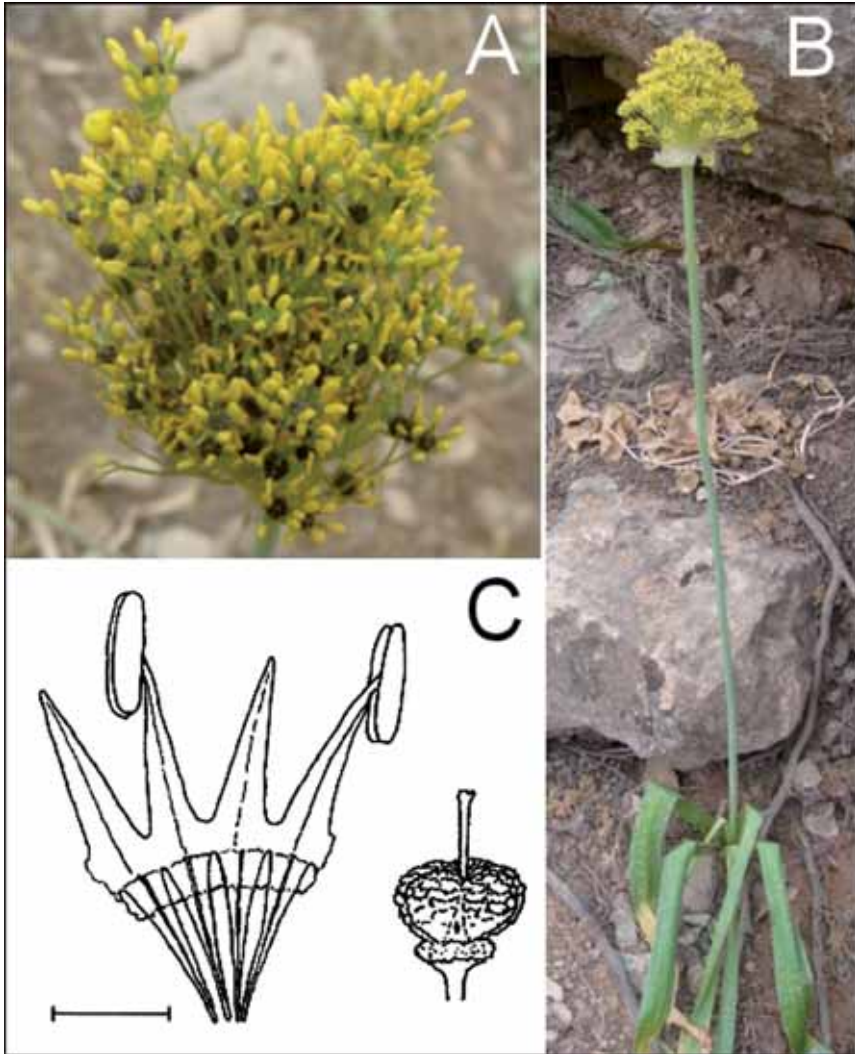


Fig. 15. *Allium mozaffarianii*. A: Inflorescence, B: Plant in anthesis (Darbandezli pass, Kurdistan); C: Filaments with anthers, reflexed tepals, and ovary with style, scale bar = 2 mm.



Description: Bulbs ovate to globular, outer tunics grayish-blackish, base slightly splitting, inner tunics ivory, papery. Scape 60–80 (100) cm long, cylindrical, straight (Fig. 15B), smooth, dull yellowish green. Leaves up to 8, lorate to lanceolate 30–40 cm long and 10–30 mm wide, canaliculate, margin toothed, green. Spathe split into 2–3, broadly triangular-ovate, obliquely reflexed parts. Inflorescence fasciculate, later sub-ovate, finally semi-globose, very dense, many-flowered, 5 cm in diameter, up to 7 cm long. Pedicels straight, stiff, very thin, yellowish-green, unequal in length (the latest opening flowers own the longest). Anthesis May. Flowers broadly funnel-shaped, star-like. Tepals spreading, soon reflexed (Fig. 15C) and irregularly curled, tender, triangular, c. 3 mm long, basally 0.7–0.8 mm wide, greenish, with a very narrow green median vein. Filaments triangular-subulate, fleshy, slightly oblique, basally united in a ring (Fig. 15C), inner ones basally slightly wider than outer ones, green, c. 4 mm long. Anthers elongated, c. 2.5 mm long, bright yellow (Fig. 15A). Pollen yellow. Ovary depressed-globose, triangular, c. 2 mm in diameter, in anthesis blackish, later green, glossy, surface with wave-like shallow depressions and elevations. Style c. 1.5 mm long, yellow-greenish. Stigma dot-like. Capsule sub-spherical, 6–7 mm in diameter. Seeds not seen.

This new taxon is very closely related to *A. chrysantherum* but it is commonly a much larger plant possessing a fasciculate, more or less diffuse inflorescence due to pedicels of unequal length (Fig. 15A), flowers truly yellow throughout, narrowly lanceolate tepals, and green filaments. The original description of *A. chrysantherum* mentioned a globose umbel 3.4–4 cm in diameter, narrowly linear, white tepals, and compared this species with *A. cyrilli*. Isotypes seen in JE were laid into press prior to anthesis, and therefore the inflorescences look indeed globular. They show tepals narrowed from a triangular base into a narrowly-lanceolate upper part. Living plants seen in Kew Gardens had semi- to subglobular inflorescences, nearly equal pedicels, and mostly greenish-yellow flowers beside a group of central flowers being purplish flushed. Such central purple flowers could also be seen in some herbarium specimens of *A. chrysantherum* which had yellow filaments. The latter species occupies dry steppes and rangelands.

#### 4. Acknowledgments

We are very indebted to Prof. Dr. M. ABBASI (Iranian Research Institute of Plant Protection, Tehran) for organizing and taking part in the field-work, supplying working facilities in the herbarium, as well as management and scientific supervision of the living *Allium* collection in Tehran. We thank also Prof. Dr. A. A. MAASSOUMI for working facilities, great hospitality, and other substantial support during a study visit at the Research Institute of Forest and Rangelands in Tehran. The senior author would like especially to thank Mr. M. JAEGER (Giessen) for comprehensive and precise

information on the *Allium* plants in his collection, supply of photographs, and donation of herbarium specimens.

Funding of research missions to Iran, creating and maintaining of a living *Allium* collection in Tehran by VolkswagenStiftung (Hannover, Germany), as well as funding of a study visit at the herbarium in Vienna by Deutsche Forschungsgemeinschaft (Fr-1044/2-1), are gratefully acknowledged.

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