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New taxa, new combinations, and taxonomic remarks on *Allium* L. from Fergan depression, Middle Asia^{*}

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Abstract: *Allium haneltii* KHASSANOV et R. M. FRITSCH (sect. *Brevidentia*), *A. spathulatum* KHASSANOV et R.M. FRITSCH (sect. *Allium* s.lat.), *A. kuramense* KHASSANOV et FRIESEN (sect. *Reticulato-bulbosa*), and *A. taeniopetalum* M. POPOV et VVED. subsp. *turakulovii* R.M. FRITSCH et KHASSANOV (sect. *Acmopetala*) were newly described. Section *Brevidentia* KHASS. et YENG. was revised, and *A. taeniopetalum* was regarded as the single species of subsect. *Stellata* KHASS. et R.M. FRITSCH with three subspecies. The necessary nomenclatorial combinations were made.

Introduction

The mountain chains around the Fergan depression were already known for rare and poorly understood *Allium* taxa (*A. aflatunense* B. FEDTSCH., *A. gulczense* O. FEDTSCH., and *A. alaicum* VVED.) when VVEDENSKY reviewed the genus for Flora USSR (1935). Later on the *Allium* taxa of the Fergan area were only marginally treated in the national floras of Uzbekistan (VVEDENSKY 1941), Kirgizstan (NIKITINA 1962), and Tajikistan (VVEDENSKY 1963) due to complicated political borderlines of those republics, and very few species were added (*A. mogoltavicum* VVED. and *A. viridiflorum* POBED.). Only in 1971 the mountains around the Fergan depression became more prominently known for peculiar *Allium* taxa with apparently very restricted distributions when VVEDENSKY (1971) described five more species from there: *A. confragosum*, *A. dodecadontum*, *A. litvinovii*, *A. schachimardanicum* and *A. taciturnum*. Most of these species were only once or twice collected and were described from that very poor herbarium material.

In more recent time it was found that *A. gulczense* is conspecific with the earlier described *A. backhousianum* REGEL (FRITSCH 1990), and still more new species became known, *A. pangasicum*, *A. rudolfii*, and *A. chodshabakirganicum* by TURAKULOV (TURAKULOV 1986, GAFFAROV & TURAKULOV 1991) and *A. zergericum* (KHASSANOV & FRITSCH 1994). These plants were studied during floristic field work of Tadjik and Uzbek botanical institutions. In the 1990s these activities were supported and accompanied by members of the Gatersleben *Allium* research group with the aim of including hitherto insufficiently known taxa within current research. Some results of these joint investigations will be presented in this paper.

^{*} Dedicated to the memory of Teshabaj Adylovich Adylov (1920-1998) from Tashkent, one of the most prominent Uzbek plant taxonomists.

Results and discussion

1. Sect. *Brevidentia* KHASSANOV et YENGALYCHEVA emend. KHASSANOV

Typus: *A. brevidens* VVED.

A m e n d a t e d d e s c r i p t i o n : Ovarium globosum purpureum, ostia nectariis sacculiformia. Filamenta violacea, simplicia vel denticulata.

This section was separated and described only recently (KHASSANOV 1996) and can additionally be characterized by a pocket-like mouth of the excretory canals of the nectaries as well as by spherical purple ovaries (fig. 2). A similar but not identical shape of ovary and nectary mouths can be found in the alliance of *A. pallasii* SCHRENK which strongly differs in other characters. The newly described *A. haneltii* occurring in Western Tien Shan is geographically widely separated from its closest relatives, *A. miserabile* WENDELBO and *A. circumflexum* WENDELBO, sharing with them simple inner filaments and coriaceous outer bulb tunics. *Allium turcomanicum* REGEL from southern Pamir-Alaj has similar perianth and filaments, but was placed into sect. *Costulatae* KHASS. et YENG. according to its triangular ovary (KHASSANOV et al. 1997). *Allium hedgeri* WENDELBO from North Afghanistan, which is very closely related to *A. brevidentiforme* VVED. from southern Pamir-Alaj, was misplaced in sect. *Allium* by WENDELBO (1971) and MATHEW (1996).

Several characters vary within section *Brevidentia*: the outer bulb tunics from coriaceous to reticulate-fibrous, the bulblets can bear a keel or not, the inner filaments from simple to 3- and 5-cuspidate, the bases of filaments from ciliate to glabrous. Thus, these characters cannot be used as diagnostic ones at the sectional level. Sect. *Brevidentia* is one more example among different subgenera of *Allium* that taxa from western Tien Shan – Pamir-Alaj area show chorological and phyletic relationships to those from Hindu Kush – Himalaya area

Allium haneltii KHASSANOV et R. M. FRITSCH spec. nova

Bulbus solitarius ovatus 10-15 mm altus, 5-10 mm latus, tunicis griseis coriaceis. Bulbillae paucae triangularia carinata. Caulis teres glaber striatus 10-20 cm altus, usque ad medium foliis glabris vaginae involutus. Folia in numero 2-3, 1-2 mm lata fistulosa semiteretia glabra. Spatha multividiva recurvata persistens, pedicellis pluries breviora. Umbella capsulifera hemisphaerica. Pedicelli subaequilongi 7-10 mm longi, bracteolati. Perigonium campanulatum albido-roseum violaceo-nervosum, tepala acuta 2-3 mm longa oblonga concava. Filamenta violacea tepalis sublongiora usque quartario longiora, basi inter se et cum perigonio connata glabra edenticulata simplicia. Antherae violaceae exsertae. Capsula laevis valvis 3-4 mm longis.

Ab *A. brevidens* VVED., *A. micranthum* WENDELBO et *A. circumflexum* WENDELBO filamentis edenticulatis glabris et bulbilli triangulari carinati differt.

Ab *A. miserabile* WENDELBO perigonii phyllis acutis differt.

Habitat in montium Kuramense (Asia Media, Tien Shan occidentalis). Species in honorem Dr. habil. Peter Hanelt Gaterslebensis denominata est.

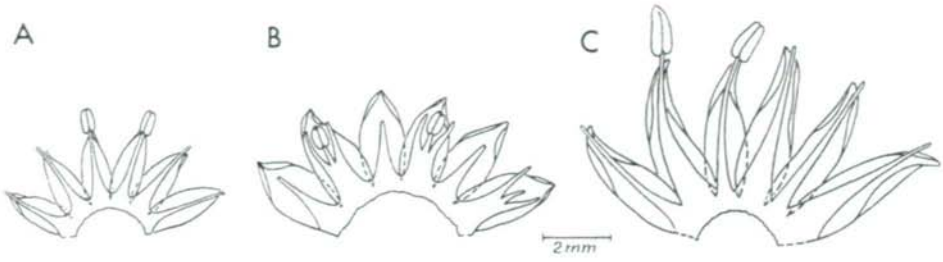


Fig. 1: Filaments and perigon of A - *Allium haneltii*, B - *A. spathulatum*, and C - *A. kuramense*.

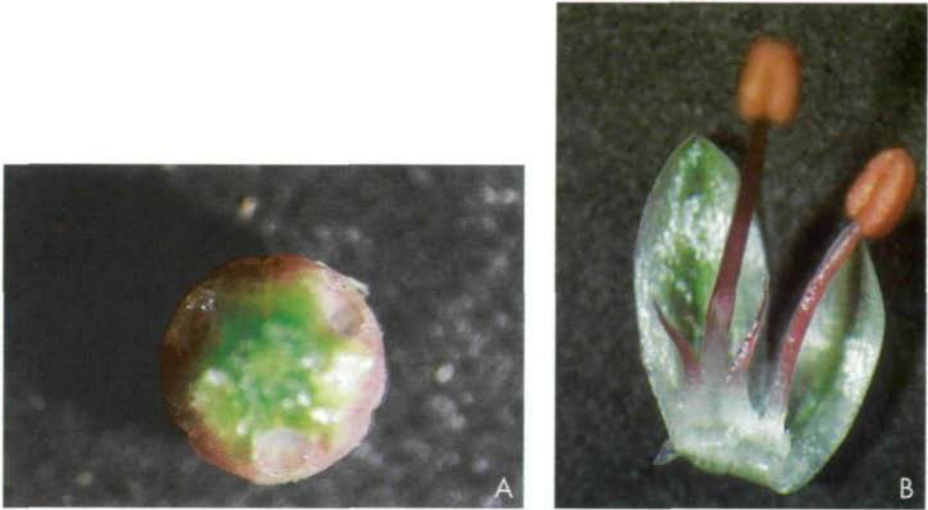


Fig. 2: *Allium brevidens*. A - Basal part of the purple ovary with pocket-like mounds of the nectary tubes, B - inner (left) and outer (right) filaments and tepals.

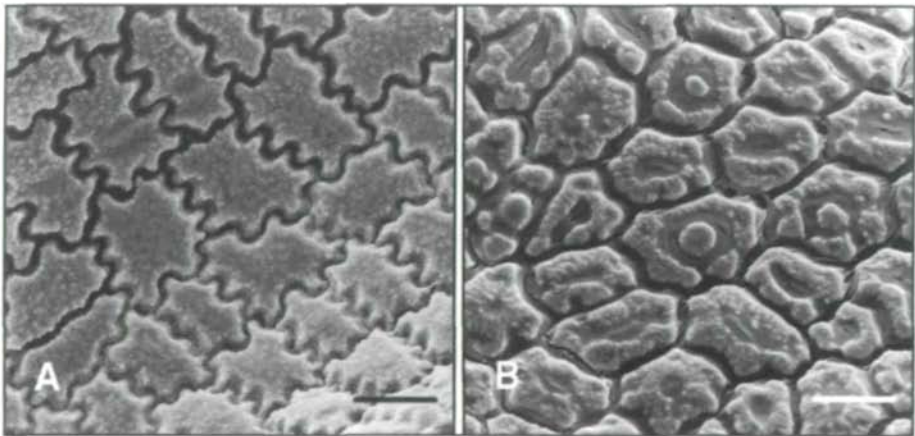


Fig. 3: Seed testa sculptures of A - *Allium haneltii*, B - *Allium spathulatum*. Bar = 30µm.

Typus: Tien Shan Occidentalis, montes Kuramensis, prope pagum Charkesar, h=900 m, 30.05.1997 KHASSANOV et R. FRITSCH No. 1637 (TASH, Iso-Typus GAT).

On morphological reasons (fig. 1A), this species clearly belongs to sect. *Brevidentia* like WENDELBO's Afghan species *A. miserabile*, *A. micranthum*, *A. ionandrum*, and *A. circumflexum*. All these species share an identical shape of flowers and ovaries as well as nectarial canals mounding in large pockets. The bulblets of *A. haneltii* are really exceptional for this section and strongly resemble those of *A. ferganicum* VVED. of sect. *Multicaulea* KHASS.

The seed testa shows a granulate general sculpturation (fig. 3A, KRUSE & ADLER) which is a symplesiomorphy in *Allium* mainly known from some primitive taxa of subg. *Rhizirideum*. Partly the outer tangential walls are even, partly a concave ring-like structure is developed. The last mentioned structure is common in the genus. The combination of coarsely undulated anticlinal walls (U-type undulation, see KRUSE 1994) with a very narrow anticlinal field is a commonly found synapomorphy typical for the sect. *Allium* s.lat. and subg. *Melanocrommyum*. Contrary to the specialised testa patterns of *A. brevidens* showing omega-undulated anticlinal walls (sub *A. brevidentiforme*, KRUSE 1994), *A. haneltii* displays plesiomorphous as well as apomorphous testa characters.

sect. *Brevidentia*. Revised key for determination

- 1 Inner filaments simple, triangular-subulate.....2
- Inner filaments 3(-5)-cuspidate, the lateral sterile cusps shorter than the median anther-bearing cusp3
- 2 Tepals acute, bulblets keeled..... *A. haneltii* KHASS. et R.M. FRITSCH
- Tepals obtuse, bulblets without keel*A. miserabile* WENDELBO
- 3 Outer filaments with two obtuse teeth at the base*A. hedgei* WENDELBO
- Outer filaments simple4
- 4 Filaments ciliate at the base, bracteoles present5
- Filaments glabrous, bracteoles absent6
- 5 Bulblets with subcrystalline tunics, anther-bearing cusp \pm as long as the expanded basal lamina and as lateral cusps*A. brevidentiforme* VVED.
- Bulblets with reticulate-fibrous tunics, anther-bearing cusp 1,5-2 times as long as basal lamina and as lateral cusps*A. brevidens* VVED.
- 6 Outer tunics reticulate-fibrous, perianth urceolato-campanulate, whitish
.....*A. ionandrum* WENDELBO
- Outer tunics coriaceous, perianth purple or violet.....7
- 7 Bulbs numerous, tepals elliptic-ovate, inner filaments with 3 cusps.....
.....*A. circumflexum* WENDELBO
- Bulb solitary, tepals lanceolate, inner filaments with (3)-5 cusps *A. micranthum* WENDELBO

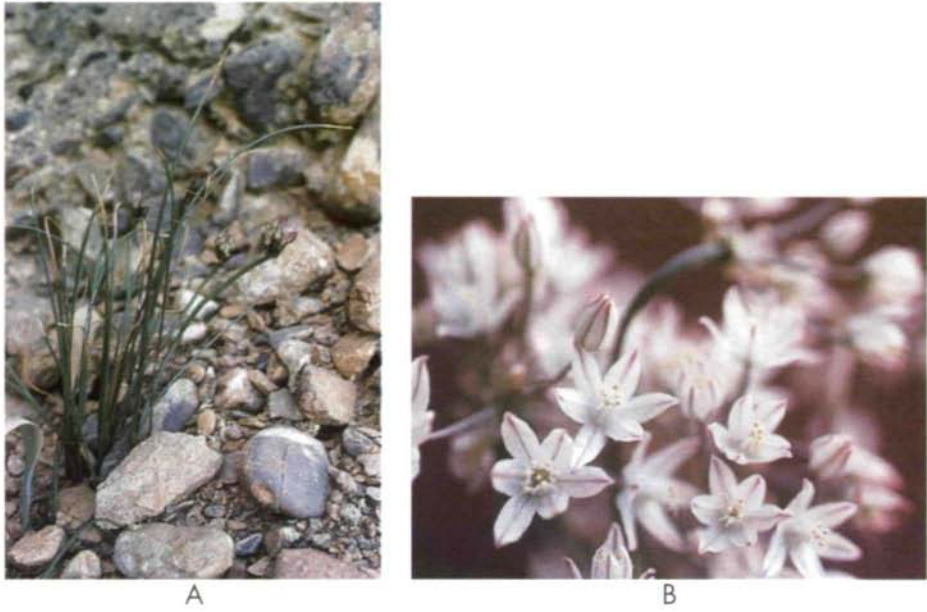


Fig. 4: *Allium spathulatum*. Plants of the type collection A - before anthesis, B - during anthesis.

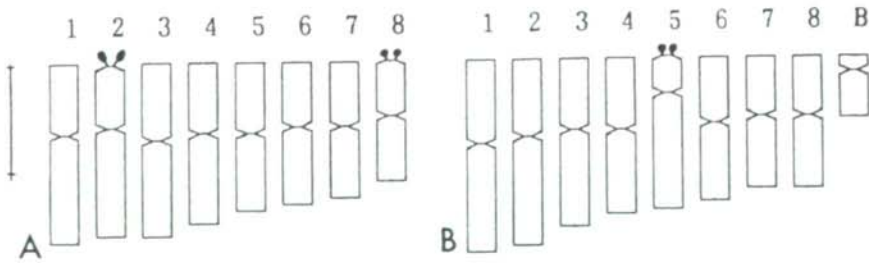


Fig. 5: Ideograms of A - *A. spathulatum* and B - *A. kuramense* (haploid chromosome sets, $n=8$). Bar = 5 μm .

2. Sect. *Allium* s.lat.

Allium spathulatum KHASSANOV et R. M. FRITSCH spec. nova

Bulbus 5-10 mm diametro, ovoideus; tunicae papyraceae, cinerae, nervis parallelis distantibus. Bulbilli nulli. Scapus unicus rarus bini 10-20 cm longus. Folia in numero 2-3, quam scapus longiora, fistulosa glabra. Spatha acuminata, bivalvis persistens. Spathuli numero 2-4. Umbella hemisphaerica laxa; pedicelli subaequilongi 1-2 cm longi. Perigonium campanulatum albido-roseum, purpureo-nervosum; tepala 4-5 mm longa, anguste elliptico - oblonga, acuta. Filamenta tepalis breviora vel subaequilonga, albida, basi eciliata connata et tepalis adnata; exteriora triangulari - subulata, interiora latiora tricuspidata, cuspidate antheriferum dimidium baseos latae et dimidium longitudinis cuspidum lateralium aequans. Antherae flavae. Stylus inclusus. Capsulae valvae ca 4 mm longae, orbicularis.

Species affinitate incerta.

Habitat in abruptis conglomeratorum montes Chatkalensis (Asia Media, Tien Shan Occidentalis).

Typus: Tien Shan occidentalis, montes Chatkalensis, prope pagum Arkit, h=950 m, 29.05.1997 Khassanov et R. Fritsch No. 1634 (TASH, isotypus GAT).

This unique taxon (fig. 4) is exceptional by the numerous spathules within the inflorescence in addition to one large spatha and by the papyraceous bulb tunics and missing bulblets. Its bulbs look like those of *A. pallasii* (sect. *Scorodon* s.l.). Bulbs of this shape have never been mentioned before in sect. *Allium* s.l. The shape of filaments (fig. 3) is similar to *A. ferganicum* VVED. of sect. *Multicaulea*. The tricuspidate inner filaments have side cusps two times as long as the middle cusp and a very broad basis (fig. 1B). These are typical characters of sect. *Allium* s.lat. Judging from morphological characters, this species clearly belongs to that section but occupies a distinctly separate position.

The seed testa (fig. 3B, KRUSE & ADLER) shows a verrucate pattern and a convex dissected ring with a central depression. These characters are known from many different taxonomic groups. However, the anticlinal walls are straight without any undulation, and an anticlinal field is missing. Straight anticlinal walls characterise unspecialised seed testa types often found in subg. *Rhizirideum* (KRUSE 1994). They are another symplesiomorphy in the genus *Allium* and underline that *A. spathulatum* displays several rather primitive characters.

The chromosome complement consists of 7 metacentric and one submetacentric (SAT) chromosomes (fig. 5A, table 1). The SAT-chromosomes bear the satellites distally on the short arm. They belong to the less specialised *Cepa* type of VED BRAT (1965) which was not found among Mediterranean species of sect. *Allium* s.l. neither by PASTOR (1982) nor by TZANOUDAKIS (1985) and other authors. However, such SAT-chromosomes are well known from many taxa of sect. *Scorodon* and of subg. *Rhizirideum* (VAKHTINA & KUDRYASHOVA 1977, PASTOR 1982, FRIESEN 1988). Karyologically, *A. spathulatum* does not appear as specialised as most other members of sect. *Allium*.

Table 1: Chromosome measures to fig. 5 (standard errors at 5% level)

<i>A. spathulatum</i> (6 plates)				<i>A. kuramense</i> (16 plates)			
chromosome	whole length μm	short arm %	satellite length μm	chromosome	whole length μm	short arm %	satellite length μm
1	8.42 \pm 0.74	38.5 \pm 0.6		1	8.89 \pm 0.34	42.2 \pm 0.7	
2	7.88 \pm 0.73	34.1 \pm 3.0	0.59 \pm 1.0	2	8.54 \pm 1.04	40.5 \pm 1.0	
3	7.96 \pm 0.73	44.6 \pm 2.3		3	7.94 \pm 0.28	42.4 \pm 1.0	
4	7.41 \pm 0.81	44.7 \pm 1.0		4	7.12 \pm 0.27	46.6 \pm 0.9	
5	7.11 \pm 0.83	47.5 \pm 1.3		5	6.84 \pm 0.17	20.6 \pm 0.5	0.22 \pm 0.5
6	6.66 \pm 0.85	47.1 \pm 1.1		6	6.55 \pm 0.07	47.1 \pm 0.4	
7	6.18 \pm 0.87	48.5 \pm 0.6		7	6.16 \pm 0.13	45.2 \pm 0.9	
8	5.53 \pm 0.98	43.5 \pm 2.1	0.33 \pm 1.0	8	5.82 \pm 0.10	45.3 \pm 1.2	
				B	2.87 \pm 0.49	25.9 \pm 1.2	

3. sect. *Reticulata-bulbosa* KAMELIN***Allium kuramense* KHASSANOV et FRIESEN spec. nova**

Bulbi gregari conico-cylindrici 5-10 mm crassi, 2-3 cm alti, rhizomati brevi insidentes, tunicis brunneis vel rufescenti-brunneis reticulato-fibrosis tecti. Caules graciles, laeves 20-30 cm alti, basi vaginis foliorum glabris involuti. Folia in numero 2-3, angustissime linearia ca. 1-3 mm lata, videtur subplana carnosula, glaucescentia, laevia, caulibus paullo usque duplo breviora. Spatha scariosa rostrata quam umbella sesqui breviora. Umbella capsulifera, hemisphaerica, pluriflora. Pedicelli aequilongi, rosei, sesquiple usque bis longiores perigonio, basi bracteolati. Perigonii anguste campanulati phylla roseo-purpurea nervo intensiore violaceo percursa, 4-5 mm longa, delicata, acuta, interiori sublongiora, lanceolato-linearia, apice recurvata. Filamenta simplicia, quintario usque quartario longiora perigonio, basi inter se et cum perigonio connata, rosea, interiora quam exteriora triplo latiora. Ovarium ovatum, purpureum. Stylus longe exsertus. Capsula globosa perigonio vix brevior.

Habitat in fissuris rupium in montibus Kuramensis (Tien Shan occidentalis, Asia Media).

Ab *A. gracillimum* VVED. perigonii phyllis lanceolato-linearibus et filamentis interioribus quam exterioribus duplo brevioribus differt.

Typus: Montes Kuramensis, in fissuris rupium prope pagum Charkesar, h=900 m, 30.05.1997, KHASSANOV et R. FRITSCH No. 1636 (TASH, isotypus GAT).

On first glance, this species is extremely similar to *A. pallasii* (sect. *Scorodon*, subg. *Allium*) in general habit by its dense heads of pink flowers with exserted filaments (fig. 1C, fig. 6). Though, taxonomically it belongs to subg. *Rhizirideum* sect. *Reticulato-bulbosa* showing close relations to the South Siberian - Mogolian species, *A. ubsicolum* REGEL (cold desert of lake Ubs-nuur high mountain depression), by the shape of filaments and tepals. However, the karyotype of the new taxon (fig. 5B, table 1) is more similar to another South Siberian - Mongolian species of the same section, *A. eduardii*

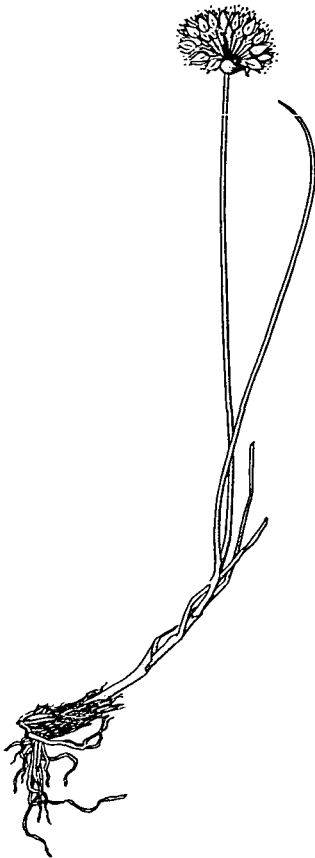


Fig. 6: Habitus of *Allium kuramense*.

STEARNS. Both share the presence of only one satellite chromosome pair although most species of sect. *Reticulata-bulbosa* have two satellite chromosome pairs in the haploid karyotype (FRIESEN 1988). *Allium kuramense* is adapted to very dry conditions, too. It differs remarkably from both of the other species of sect. *Reticulata-bulbosa*, *A. gracillimum* VVED. and *A. oreoprasoides* VVED., known from neighbouring parts of the Fergan depression.

4. sect. *Acmopetala* R.M. FRITSCH subsect. *Stellata* KHASS. et R.M. FRITSCH

The taxa of this oligotypic group are morphologically well characterised by a laxer inflorescence composed of comparatively few but larger flowers with linear-sublanceolate, stiff and canaliculate, initially stellate and later reflexed tepals with an incrassate midvein (fig. 7). Therefore these plants occupy a somewhat isolated position within sect. *Acmopetala*. Morphologically their inflorescences resemble those of sect. *Megaloprason* WENDELBO s.str. However, number and structure of the leaves as well as the rather flattened (not

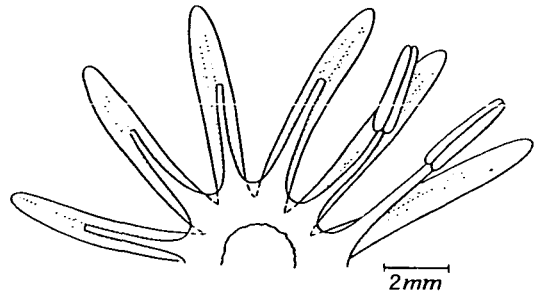


Fig. 7: Filaments and perigon of *Allium taeniopetalum* subsp. *turakulovii* at begin of anthesis.



Fig. 8: *Allium taeniopetalum*. A and B - subspec. *turakulovii*, plants of the type collection at anthesis; C - inflorescence of subspec. *mogoltavicum* from Bashkyzylsai.

drop-shaped) seeds with very prominent and sharp edges agree only with sect. *Acmopetala*. Most species of subsect. *Acmopetala*, which show also a loose inflorescence and linear-sublanceolate but still narrower tepals with a less prominent midvein, are the next closest relatives.

A conspicuous difference of the tepal length between the first opened and the last opened flowers in one inflorescence is characteristic for all taxa of subsect. *Stellata*. This special feature remained undetected until recently because it becomes only visible when living plants can be studied during the entire flowering period. It is commonly not detectable on herbarium specimens, and caused some taxonomical confusion in the past. *Allium mogoltavicum* has been described by VVEDENSKY (1946) using herbarium specimens which probably were given into the press in the last anthesis stage and were slightly pressed only (isotypes and paratypes seen in TASH). Therefore VVEDENSKY described the tepals erroneously as only 5-6 mm long. Using this measure, one cannot correctly determine either living plants or well pressed herbarium specimens of *A. mogoltavicum* if they were prepared in the early stage of flowering. This misleading tepal length was repeated in the "Key for Middle Asian Plants" (VVEDENSKY 1971) and is to be corrected into "tepals 8-12 mm long". Under cultivation, well manured plants developed the first flowers with 14-15 mm long tepals.

Investigation of living plants from the type locations and of additional accessions of *A. taeniopetalum* VVED., *A. mogoltavicum* VVED., and of *A. baschkyzylsaicum* KRASSOVSKAJA in nature as well as under cultivation in Tashkent and Gatersleben resulted in the conclusion, that they differ morphologically only by their flower colour although they show different ecological adaptations and areas of distribution. They represent only a single species with three subspecies:

***Allium taeniopetalum* M. POPOV et VVED. ex VVED.**

Byull. Sredneaz. gozud. Univ. 19 (1934): 130.

subspec. *taeniopetalum*

subspec. *mogoltavicum* (VVED.) R. M. FRITSCH et KHASSANOV, comb. nov.

Basionym: *Allium mogoltavicum* VVED. - Bot. mat. gerb. bot. inst. Akad. Nauk SSSR 9 (1946): 240.

Allium baschkyzylsaicum KRASSOVSKAJA - Bot. mat. gerb. Inst. Bot. Akad. Nauk Uzb. SSR 20 (1982): 15, syn. nov. (fig. 8c).

subspec. *turakulovii* R. M. FRITSCH et KHASSANOV, subspec. nova

Planta perenne. Bulbus (applanato-)ovatus, 8-20 mm in longitudine et diametro, tunicis fragilibus, longitudinaliter fissuratis, albescentis deinde nigrescentis. Scapus strictus, fusiformis, laevissimus, 3-6 mm diametro, 35-60 cm longus, viridis, impolitus, basi rubro-suffusus. Folia in numero 1-2, (15)25-35 cm longa, 8-18 mm lata, angustelanceolata, oblique declinata usque recurvata, crassiuscula, subcanaliculata, supra sub-sulcata, infra non profunde late - costata, sensim cuspidata, apice subcucullatis, margine basi scabris, superne sublaevis et rubescenibus, cinereo-viridia, basi rubro-suffusa. Spatha papyracea, late-ovata longe acuminata, indivisa, flaveo-brunnea. Inflorescentia

initio semiglobosa deinde subovata, mediocre multiflora, laxa, 5-12 cm diametro, ultima usque 14 cm longa. Pedicelli crassiusculi, rigidi, stricti, initio spadicei, deinde virides, politi. Flores stellato-crateriformes, subodorati. Tepala lineari-sublanceolata, canaliculata, obtusiuscula, apice subinflexa, initio stricta, 7-10 mm longa, 1.3-1.7 mm lata, flava, interdum roseo-subsuffusa, post anthesin decurvata irregulare vel subspiraliter contorta, brunnescentia, nervus crassiusculus, plus minusque latus, viridis. Filamenta tepalis initio breviora, in anthesi aequilonga, post anthesin sublongiora, subulata, basi ovaliter dilatata et connata, flaveola, basi subroseo-suffusa. Antherae elongatae, 2-2.5 mm longae 0.8 mm latae, flaveolae deinde violaceo-suffusae. Ovarium brevissime stipitatum, ovatum, verrucosum, 3-3.5 mm longum, 2,5-3 mm diametro, cinereo-viride, sericeum. Stylus elongato-conicus, 5-6 mm longus, albescens, deinde e basi violascens. Stigma indivisa albescentia.

Differt ab subspec. *mogoltavicum* tepalis flavis, in saxosis calcareis aprico-calidis crescit. Habitat in saxosis calcareis montibus Turkestanicus (Pamir-Alaj occidentalis, Asia media).

Species in honorem Prof. Dr. Isakul Turakulov Khodzhtentensis denominata est.

Typus: Ex culturae in horto Gaterslebenensis, No. TAX 5068/96, leg. 11. VI. 1996.

[ex Kirgizstan: Turkestan-Gebirge, Berge ca. 1 km oberhalb Dargun, Kalkfelsflur, ca. 1800 m NN, coll. R. FRITSCH et K. PISTRICK 1994 No. 1235A]

Allium taeniopetalum. Key for determination of the subspecies

- 1 Flowers dark purple, or pink with a yellowish flush, habitat in the shadow of shrubs among rocks, or on shady, north-facing rocks2
- Flowers pale yellow to somewhat reddish tinged, habitat in dry and warm limestone slopes of central Turkestan ridgesubspec. *turakulovii*
- 2 Flowers purple to dark purple, habitat in broader fissures of rocks below shrubs or on north-facing narrow rock terraces of northwestern Turkestan ridge subspec. *taeniopetalum*
- Flowers pink with a yellowish flush, habitat below shrubs and on north-facing, shady rocks in Mogoltau massif, in western part of Kuram ridge, and in western Chatkal ridge ...
.....subspec. *mogoltavicum*.

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