

**A Preliminary Review of *Allium* subg.  
*Melanocrommyum* in Central Asia**

by Reinhard M. Fritsch

Leibniz-Institut für Pflanzengenetik und  
Kulturpflanzenforschung Gatersleben (IPK)

2016

© IPK Gatersleben - Reinhard M. Fritsch All rights reserved

<http://www.ipk-gatersleben.de/>

## Table of Contents

<b>Foreword</b>	5
<b>General Introduction</b>	7
incl. Conspectus of <i>Allium</i> subg. <i>Melanocrommyum</i> in Central Asia	14
<b>Key for determination of species and subspecies</b>	18
<b>Taxonomy</b>	41
<b><i>Allium</i> subg. <i>Porphyroprason</i> sect. <i>Porphyroprason</i></b>	41
(1) <i>Allium oreophilum</i>	41
<b><i>Allium</i> subg. <i>Melanocrommyum</i></b>	44
1. sect. <i>Longibidentata</i>	44
(2) <i>Allium fetisowii</i>	44
(3) <i>Allium chychkanense</i>	47
2. sect. <i>Decipientia</i>	49
(4) <i>Allium robustum</i>	49
(5) <i>Allium tulipifolium</i> var. <i>subscabrum</i>	51
(6) <i>Allium viridulum</i> Ledeb.	53
3. sect. <i>Regeloprason</i> 3.1 subsect. <i>Regeloprason</i>	55
(7) <i>Allium regelii</i>	55
(8) <i>Allium victoris</i>	60
3.2 subsect. <i>Diffusoumbellata</i>	62
(9) <i>Allium cupuliferum</i> subsp. <i>cupuliferum</i>	60
(10) <i>Allium cupulif.</i> subsp. <i>nuratavicum</i>	62
(11) <i>Allium balkhanicum</i>	63
(12) <i>Allium iliense</i>	65
(13) <i>Allium isakulii</i>	66
(14) <i>Allium subkopetdagense</i>	69
3.3 subsect. <i>Odoratae</i>	70
(15) <i>Allium darwasicum</i>	70
(16) <i>Allium chodsha-bakirganicum</i>	74
(17) <i>Allium hissaricum</i>	75
(18) <i>Allium intradarvazicum</i>	78
(19) <i>Allium lipskyanum</i>	80
(20) <i>Allium pseudowinklerianum</i>	82
(21) <i>Allium sochense</i>	84
(22) <i>Allium winklerianum</i>	85
4. sect. <i>Asteroprason</i> 4.1 subsect. <i>Asteroprason</i>	87
(23) <i>Allium helicophyllum</i>	87
(24) <i>Allium monophyllum</i>	89
4.2 subsect. <i>Cristophiana</i>	91
(25) <i>Allium cristophii</i> subsp. <i>cristophii</i>	92
(26) <i>Allium cristophii</i> subsp. <i>golestanicum</i>	95
5. sect. <i>Stellata</i>	97
(27) <i>Allium taeniopetalum</i> subsp. <i>taeniopet.</i>	97
(28) <i>Allium taeniopet.</i> subsp. <i>mogoltavicum</i>	99
(29) <i>Allium taeniopet.</i> subsp. <i>turakulovii</i>	102
6. sect. <i>Megaloprason</i> s. str. 6.1 subsect. <i>Megaloprason</i>	104
(30) <i>Allium rosenbachianum</i>	104
(31) <i>Allium insufficiens</i>	106
(32) <i>Allium kwakense</i>	109
(33) <i>Allium schugnanicum</i>	111
6.2 subsect. <i>Humilicognata</i>	112
(34) <i>Allium brachyscapum</i>	112
6.3 subsect. <i>Keratoprason</i>	114
(35) <i>Allium sarawschanicum</i>	114
6.4 subsect. <i>Spiralitunicata</i>	118
(36) <i>Allium suworowii</i>	118
7. sect. <i>Miniprason</i>	121
(37) <i>Allium karataviense</i> subsp. <i>karatav.</i>	121
(38) <i>Allium karataviense</i> subsp. <i>henrikii</i>	125
8. sect. <i>Acmopetala</i> 8.1 subsect. <i>Acmopetala</i>	126
(39) <i>Allium backhousianum</i>	126
(40) <i>Allium aflatunense</i>	129
(41) <i>Allium alaicum</i>	132
(42) <i>Allium arkitense</i>	133
(43) <i>Allium bekeczalicum</i>	135
(44) <i>Allium dasyphyllum</i>	135
(45) <i>Allium kurdaicum</i>	137
(46) <i>Allium pangasicum</i>	138
(47) <i>Allium schachimardanicum</i>	139
(48) <i>Allium vvedenskyanum</i>	141
(49) <i>Allium zergericum</i>	143

8.2	subset. <i>Albidiflora</i>	144		
	(50) <i>Allium saposchnikovii</i>	144		
8.3	subset. <i>Durovaginata</i>	147		
	(51) <i>Allium costatovaginatatum</i>	147	(52) <i>Allium dodecadontum</i>	149
	(53) <i>Allium severtzovioides</i>	151	(54) <i>Allium tokaliense</i>	154
8.4	subset. <i>Inornatae</i>	155		
	(55) <i>Allium sewerzowii</i>	155	(56) <i>Allium tashkenticum</i>	158
8.5	subset. <i>Pharmakoprason</i>	160		
	(57) <i>Allium tschimganicum</i>	160		
9. A.	sect. <i>Verticillata</i>	163		
	(58) <i>Allium verticillatum</i>	163	(59) <i>Allium viridiflorum</i>	166
10	sect. <i>Compactoprason</i>			
	10.1	subset. <i>Erectopetala</i>		
	(60) <i>Allium giganteum</i>	168	(61) <i>Allium isfairamicum</i>	172
	(62) <i>Allium macleanii</i>	172	(63) <i>Allium trautvetterianum</i>	175
	10.2	subset. <i>Komaroviana</i>		
	(64) <i>Allium komarowii</i>	177		
	10.3	subset. <i>Spiralopetala</i>		
	(65) <i>Allium majus</i>	180		
11.	sect. <i>Procerallium</i>			
	11.1	subset. <i>Elatae</i>		
	(66) <i>Allium stipitatum</i>	182	(67) <i>Allium altissimum</i>	187
	11.2	subset. <i>Costatae</i>		
	(68) <i>Allium jesdianum</i> subsp. <i>angustitepalum</i>	190		190
	(69) <i>Allium rosenorum</i>	193		
12.	sect. <i>Aroidea</i>	196		
	(70) <i>Allium aroides</i>	196		
13.	sect. <i>Acaule</i>	199		
	(71) <i>Allium hexaceras</i>	199		
14.	sect. <i>Popovia</i>	200		
	(72) <i>Allium gypsaceum</i>	200		
15.	sect. <i>Thaumasoprason</i>	203		
	(73) <i>Allium khozratense</i>	203		
16. A.	sect. <i>Kaloprason</i>			
	16.1	subset. <i>Kaloprason</i>		204
	(74) <i>Allium caspium</i> subsp. <i>caspium</i>	204	(75) <i>Allium caspium</i> subsp. <i>baissunense</i>	207
	(76) <i>Allium bucharicum</i>	209		
	16.2	subset. <i>Ligulifolia</i>		
	(77) <i>Allium alexeianum</i>	211	(78) <i>Allium decoratum</i>	214
	(79) <i>Allium nevskianum</i>	215	(80) <i>Allium protensum</i>	217
17.	sect. <i>Brevicaule</i>	220		
	(81) <i>Allium sergii</i>	220	(82) <i>Allium chitralicum</i>	222
	(83) <i>Allium eugenii</i>	225		
	<b>References</b>			227
	<b>Appendix 1: Compilation of herbarium vouchers collected in Central Asia</b>			240
	<b>Karyological appendix 2: Additional chromosome data of some species of <i>Allium</i> subg. <i>Melanocrommyum</i> and <i>A. oreophilum</i> from the Gatersleben collection</b>			271
	<b>General Index</b>			278

## Foreword

*Allium* is an extremely variable and taxonomically very complicated genus comprising currently more than 900 accepted species (and more than 1100 synonymous names at specific and infraspecific levels; Kew World Checklist 2016) affiliated to 15 subgenera, about 85 sections, and more than 30 groups below sectional level (Friesen & al. 2006; Fritsch & al. 2010; Khassanov & al. 2011; Khassanov & al. 2013; Huang & al. 2014). The great number of variable characters was already traditionally exploited for taxonomic reasons, and in the 20th century anatomical, karyological, chemical, phenological characters and finally molecular markers were additionally investigated and complemented the knowledge available for taxonomic decisions. When the taxonomic working group in Gatersleben started *Allium* research in 1980, rather every continental and regional revision applied another classification. Especially the cultivated species were included in different groups and at differing infrageneric levels. Thus the investigations in Gatersleben tried to exploit all the above mentioned character classes to approach to a natural classification. The plants investigated were taken from the living *Allium* genebank collection and a research collection newly created from the material (mostly seed) exchanged among international botanical gardens and research institutions. Soon it became visible that the material available was often not directly suitable for serious research: The plants of many accessions looked very similar but were received under different names, and on the other hand many identically named accessions looked different or could not be re-determined to identical names using the available taxonomic literature. Thus it seemed necessary to visit areas rich in *Allium* species, in order to study the indigenous species, and to transfer reliably named material to Gatersleben for further and broader research. The political conditions in eastern Germany (GDR) canalized the interest to the Central Asian Soviet republics that belong to the main centre of *Allium* diversity, because the cooperation between the Soviet and GDR's Academies of Sciences enabled visits of these republics in the frame of the existing research cooperation. Thus the Botanical Institute in Dushanbe could be visited repeatedly, later also identical institutions in Tashkent and Alma-Ata in order to conduct basal research in *Allium* taxonomy. This cooperation survived the end of Soviet Union only for a short period, when in the early to mid-1990ies joint research missions could be organized by Tajik, Kazakh, and mainly by Uzbek partners. Then it was easy to visit several of the now independent states during one trip. The taxonomic results were published in several papers (Hanelt & al. 1989, 1992; Fritsch 1988; Hanelt, Hammer & Knüpffer 1992; Druselmann 1992; Khassanov & Fritsch 1994; Kruse 1984, 1986, 1988, 1994; Ohri & al. 1998; and many publications summarized in Fritsch 1996b and 2001). Subsequently only single joint activities were possible. Another active period of joint scientific research was opened by a scientific research project on indigenous *Allium* species used by the local people in Turkmenistan, Tajikistan and Uzbekistan that was funded by VolkswagenStiftung (Hannover, Germany) for the years 2002 - 2006. During this research project several joint research missions could be undertaken, partly in formerly not visited areas. The materials studied and collected served to create national living *Allium* collections in these countries, and partly also to support taxonomic *Allium* research in Gatersleben. This project resulted in many publications, some of them solely devoted to taxonomy (Fritsch & Keusgen 2006; Jedelska & al. 2005, 2005a; Keusgen & Fritsch 2008; Keusgen & al. 2006) and the application of molecular markers (Friesen & al. 1997, 2006; Fritsch & al. 2010; Fritsch 2012; Gurushidze 2008; Gurushidze & al. 2007, 2008, 2010, 2012).

Taxonomic *Allium* research in Gatersleben lasted over decades, and is coming now to the finish simply because neither *Allium* plants nor taxonomists own the everlasting life. Successive peers set the focus to other objects, and one can foresee that only a small part of the still existing living Taxonomic *Allium* Reference Collection will survive the next decade.

The focus of my personal research activities was set to subgenus *Melanocrommyum* already in the 1980ies. It is the second largest *Allium* group with currently more than 160 accepted species and subspecies that are morphologically extremely divers, and correspondingly the taxonomy is very complica-

ted and not yet completely worked out (Fritsch & al. 2010; Fritsch & Abbasi 2013). Not only the results of my own *Allium* research are still awaiting final complementation (especially several character groups of the ovaries should be mentioned here), also the specific characters of most rare and recently newly described species are still incompletely known.

Nevertheless, time is ripe to summarize up the many observations and taxonomic conclusions on Central Asian species of *Allium* subg. *Melanocrommyum* by presenting a review even though a certain part of the data was already communicated in other context. Though necessarily incomplete because several taxa could not be studied repeatedly and some even not once from living plants, this preliminary review may perhaps be welcome as contemporary introduction into the many biological aspects connected with taxonomy of *Allium* subg. *Melanocrommyum* in the Central Asian countries. It also gives an opportunity to introduce, describe, and figure more than 40 species and subspecies of subg. *Melanocrommyum* newly described from or newly recorded for the Central Asian states after 1963 till today. Also the *Allium* classification was completely modernized in several consecutive steps during that period, and the Central Asian botanists shall become acquainted with the most recent version.

Secondly, currently available *Allium* treatments of Central Asian states possess only historical importance today. The last available national revision containing complete descriptions (Vvedensky 1963) is more than 50 years old and presented necessarily only species known from Tajikistan at that time. The last available key for determination (Vvedensky & Kovalevskaya 1971) covers the territory of all Central Asian republics, but did not present descriptions (except for some diagnoses in Latin, a language understood only by few scientists in that area). Additionally, this key still applied a today completely outdated classification and incorrect nomenclature. Later the "Key of Turkmen plants" (Kamelin in Nikitin & Gel'dikhanov 1988) introduced the at that time modern classification of Kamelin (1973) and presented at least plant height and a few figures (of doubtful quality), but again many incorrectly written names. Recently published reviews of some small *Allium* sections (Khassanov & al. 2011, 2013, Khassanov & Esankulov 2015) presented keys and used correct names but did not describe the taxa; thus they made the need for complete and modern revisions still more sensible.

No doubt that now it's high time to make the progress of decades available to the scientific community. This preliminary review intends to fill the above mentioned main gaps for the Central Asian states, and may perhaps inspire the botanists there to complete modern inventories of natural resources, and to work out comprehensive modern floras for their countries or even for the whole Central Asian region - many details are awaiting further improvements, and a certain number of locally distributed *Allium* taxa are still awaiting discovery ...

This booklet is dedicated to all botanists who introduced me to the *Allium* diversity in Central Asia, at first place Tamara F. Kochkareva (formerly Dushanbe), Furkat O. Khassanov (Tashkent), and Igor G. Levichev (St. Petersburg), and to the many colleagues who supported me during stays in these countries, especially Ozodbek A. Ashurmetov (formerly Tashkent), Mukharram R. Rasulova (formerly Dushanbe), Isa O. Baitulin (Almaty), Hikmat Hisoriev (Dushanbe), Rina Kamenetsky (formerly Alma-Ata), Imomnazar Kudratov (Dushanbe), Jumamurad Kurbanov (Ashgabat), Parvina A. Kurbonova (Dushanbe), Georgy A. Lazkov (Bishkek), Ivan I. Saitsev (Tashkent), E. P. Zhogoleva (formerly Dushanbe), and many local botanists, car drivers and other staff of the travel teams. I would like also to thank Janis Ruksans (Pargaujas, Latvia) and Arnis Seisums (Salaspils, Latvia) for supplying me with living plants of rare taxa, and for their kind permissions to study plants in their living collections. I am also especially thankful to Nikolai Friesen (Osnabrück) for the skilful translation of the key for determination into Russian. Last but not least I would like to thank the IPK Gatersleben (and its predecessor institution) for long-lasting excellent working facilities and maintenance of the living *Allium* collections.

Gatersleben, 02 Dec., 2016

## General introduction

### 1. Preliminary notes

Plants of bulbous *Allium* groups like the subgenera *Allium* and *Melanocrommyum* own the great disadvantage to lose many specific character states when the plants are pressed and dried for herbarium storage. Additionally they may develop artificial characters in the press because the drying process lasts much longer than in many other plants groups. George Don (1827), an early monographer of *Allium*, put this problem into the words "The genus *Allium* can only be studied satisfactorily from living specimens, for, in herbaria, the species of this genus, like other liliaceous plants, are seldom found to retain their characters, so as to be recognized with certainty". Therefore it was the main objective of the present revision to study all taxa if somehow possible from living plants in their natural habitat (focused as far as possible to plants from the type locations) as well as under cultivation. This kind of work was executed during research missions in Tajikistan (1984, 1986, 1987, 1988, 1990, 1991, 1997, 2003 - 2006), Uzbekistan (1988, 1990, 1992 - 1995, 1997, 1998, 2001, 2003, 2005, 2006), Kazakhstan (1990, 1993, 1994), Kirgizstan (1992, 1994, 1997, 1998), and Turkmenistan (1995, 2002). Concurrent missions into Iran (1994, 2004 - 2012), Turkey (1995), Georgia (2002, 2004 - 2006), and Armenia (2002, 2010) allowed to broaden the knowledge about widely distributed and related species. The missions undertaken 2003 - 2006 were in detail reported by Fritsch (2008b). The minor part of the material of Central Asian offspring cultivated and studied in the Gatersleben collections was collected by colleagues or was received via the material exchange from other botanical gardens and research institutions. It is estimated that about 700 accessions of subg. *Melanocrommyum* could be studied in Central Asia. Because not all continued growth after replanting, altogether about 500 accessions could be studied and definitely determined in Gatersleben.

The classification follows the proposal of Fritsch & al. (2010). The presentation of the species and subspecies starts with information about nomenclature and distribution followed by detailed descriptions and color plates if photos were available. Figures of ovaries, filaments with anthers, and tepals were also given for most species to enable comparison with soaked flowers from herbarium vouchers. The sequence of described characters begins with the subterranean organs followed by scapes and leaves, inflorescences, flower parts, and ends up with capsules and seeds. Next paragraphs will deal with karyological data, a list of living accessions studied of that taxon, biological data, and economic traits as far as information could be traced. Final parts are taxonomic remarks including molecular data, and etymology of the epithet and synonyms.

The locations on the labels of type vouchers were cited in the original language but, if necessary, transliterated into Latin letters. Texts other than in English were translated by the author.

Current names of the main geographical units were used in the paragraph on distribution, but in many other cases geographic names were cited as found and only transliterated. Additionally, deciphering of hand-written labels was often difficult and may have caused errors, as well as misprints cannot be excluded when the data were noted. Currently available maps of the independent Central Asian states show in many cases different names for identical geographic items and names remarkably differing orthographically among the different languages and the "official" names of Soviet and still earlier time. Historical names were used because of the practical reason that the author felt unable to memorize all the many historical and modern name variants. This practice does not intend somehow to neglect the newly established names which reflect the cultural originality of the different nations. New names will become generally applied also in the scientific practice as soon as the majority of vouchers will show them.

Because the Russian term "khrebet" is used for mountain ridges of very different dimensions, a certain (but not absolute) graduation is applied using "(mountain) range" for large, "ridge" for medium large, "massif" for smaller mountain agglomerates, and "mountains [Mts.]" for small ones. Because many geographic items could not be verified on the maps available, this graduation may contain errors.

The acronyms for herbaria follow the former "Index Herbariorum" volumes now available via Internet (<http://sweetgum.nybg.org/ih/>). IPK is used as acronym for the Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben, TKW for the thousand-kernel-weight. TAX precedent to numbers refer to accessions of the Taxonomic *Allium* Reference Collection of IPK (presented via [www.ipk-gatersleben.de/databases/genetic\\_resources/allium](http://www.ipk-gatersleben.de/databases/genetic_resources/allium) ). In the descriptions, alternative data and different sources of these data are separated by a slash / .

## 2. Geography and ecology

Members of this subgenus are naturally distributed from the Canary Islands to northwestern India (Kashmir), with a northern limit of distribution from Portugal and Spain, North of the Alps, Balkan Peninsula and Crimea to SW Siberia and western China, and a southern limit along the northwestern and northern coastal regions of Africa to northern Egypt, the Arabian Peninsula and Pakistan, with the centre of diversity in Asia Minor, Southwest Asia, and Central Asia.

Members of subg. *Melanocrommyum* occur in different ecological habitats from sea level to the alpine belt. Nevertheless, the majority are typical xerophilous and heliophilous plants and grow in dry steppes, semideserts or even sandy and gravelly deserts and on rocky and stony slopes of arid mountains. Dry shrubs and forests, open semi-humid park-like associations, humid forests, meadows, and shady gorges are more rarely inhabited. Data on ecological preferences were concluded from own observations or were adapted from other authors sharing the same circumscription of species. Most herbarium labels do not present such information. Affiliation to plant-geographic elements as proposed for several species in some literature was not adopted.

## 3. Morphological characters<sup>1</sup>

Generally the shape of mature bulbs is described, though often it can only be concluded from the bulb tunics of herbarium vouchers (the storage cataphylls shrivel irregularly during drying). The shape of immature bulbs is mostly ovate, and small renewal bulbs are flat and often bent in a shield-shaped way. The taxonomic value of bulb numbers (of daughter bulbs as well as small renewal bulbs) is a controversial issue because it is probably strongly influenced by growing conditions. Structure and the color of the bulb tunics are taxonomically important but are simultaneously influenced by the growing conditions. Many species may develop thick shell-like tunics composed of many layers at undisturbed, dry places, but bear only thin tunics when cultivated under humid conditions. Herbarium specimens often lack outer tunics because they remained in the soil glued to surrounding clods of earth. In those cases only the whitish to yellowish inner bulb tunics remain visible that possess an uncertain taxonomic value.

As far as known and observed during plant collecting, the roots of all species share the same general shape and functionality (growing out in autumn and dying during or after anthesis next summer). Differences in root color (known to occur in other *Allium* groups) were neither observed nor reported hitherto. Contractile roots (moving the bulbs, especially of seedlings, deeper into the soil) were observed in many species, they should be a common feature.

Shape, dimension, and growth form of the scape are important taxonomic characters, as well as structure, color, and gloss or dullness of the surface. Presence or absence of ribs must be observed by means of fresh scapes, because dry scapes are always hollow and ribbed, but size and density of these ribs depend on the drying process when the cortex tissue shrivels, and irregular, rib-like structures on the outer side of the sclerenchyma cylinder of the scape become visible (Fritsch 1993).

Commonly one scape develops per mature bulb. In certain years, under cultivation two or three scapes

---

<sup>1</sup> The mode of morphological variation was more detailed outlined in Fritsch (2012)



may arise from one bulb. In those cases one or two side sprouts, which normally develop into renewal bulbs in the next year, start to develop a normal scape with full inflorescence parallel to the main sprout. However, the leaf sequence (see next paragraph) of these extra sprouts is commonly incomplete: The storage cataphylls and one, several, or all foliage leaves may be reduced (unpublished observation of J. Kruse).

The leaf sequence begins with one or two extremely thickened storage organs (cataphylls) occupying the main volume of the bulb (and therefore not visible above the soil). Next leaves are 1-2 elongated cataphylls without laminae enclosing the developing leaf bud. Their aerial part is included in the descriptions under the term "sheathy prophyll". Later these "sheath leaves" are merely visible as tender remains enclosing the underground leaf parts of flowering specimens. Therefore they are often ignored, but were observed to possess group- and species-specific length, consistence, and color. Herbarium specimens rarely show these sheath leaves with the exception of members of subsect. *Durovaginata*.

The number of foliage leaves per mature bulb is a species-specific character ranging between 1-2 and 10-15. Special features of the basal subterranean sheath part were rarely observed, contrary to the well known huge amount of morphological diversity of the supraterranean leaf lamina that possess eminent taxonomic value. Also the shape of the lamina's apical area may present species-specific characters but must be analyzed when the laminae are still incompletely developed. After the anthesis started, the commonly hooded apex may be difficult to recognize because it is often already dry and crumpled.

The spathe is a  $\pm$  shortly beaked leafy organ that encloses and protects the inflorescence prior to spreading of buds. In members of subg. *Melanocrommyum* it is neither shed as a whole, nor ruptured to pieces, but splits longitudinally (often not completely to the base) into valves. Though some authors regard lengths of the beaks as well as consistence (most often membrane-like scariosus), number, shape and color of the valves as species-specific characters, we observed these features to vary among different populations of the identical species of subg. *Melanocrommyum* and to depend on ecological and actual weather conditions. Therefore their taxonomic value is lower than in other *Allium* groups.

The development of inflorescences before anthesis also shows some group- and species-specific characters, but shape, dimensions, density, and number of flowers are regarded to be much more important, even though they are also influenced by the growing conditions, age, and ontogenetic stage of the plants. Only *A. regelii* may regularly bear two to five superposed inflorescence parts per scape lifted by short scape pieces; every inflorescence part is basally enclosed by an extra spathe. Under unfavorable conditions (after strong frosty nights when the developing inflorescence was already exposed to frost), many species may develop single superposed inflorescences commonly very poor in flowers, or extra bulbs among pedicels. Dry inflorescences of some species drop down from the scape after seed ripening or roll over the soil (other do so jointly with the adhering upper part of scape) blown by the wind ("tumbleweeds"), but most often they remain upright till autumn and distribute the seeds mainly autochorically and semachorically. The receptacle may become inflated after anthesis when it is covered by inflated pedicel bases, but such cases were not regularly observed and it is not clear, whether such inflated receptacles are species-specific characters.

The pedicels are ebracteolate (the receptacle does not bear bracteoles) in subg. *Melanocrommyum*, and their lengths (relative and absolute), shape, direction, consistence, surface, and color pattern constitute characters of taxonomic value. Pedicel characters are also influenced by the ontogenetic development and ecological conditions.

Many characters of the generally hexamerous flowers are highly important for taxonomic reasons, though the great majority of all flower-based characters and character states can only exactly be studied on living plants. Often several plants in somewhat differing stages of ontogenetic development are necessary for getting informed about all developmental phases, or plants must be re-studied after a few days. Conservation of flowers in 70% ethanol warrant a good preservation of three-dimensional features over many years and even decades, but all colors are fading away during the first days. Also an

extremely careful and quick preparation of herbarium specimens conserves three-dimensional shapes only occasionally, but colors can remain visible over a few decades. However, after a century and more scarcely any difference in color tones remains detectable, and all plant parts will have turned to brown. Such "unicolor" herbarium vouchers may arise in much shorter time when the drying process was slowed down because the drying paper was not changed often enough. Also specimens attacked by mould fungi when already in the press may lose colors completely during the drying process. Two-dimensional characters of dried flowers can be revived by cooking them in water and carefully re-shaping the soft tissue (best to be done in a drop of water on a glass slide). However, shriveled tepals and filaments surrounding ripe capsules cannot be brought back into their true shape by cooking; the shriveling process of vascular bundles once finished is not reversible.

The general shape of flowers occupies the eminent place among taxonomic characters in *Allium*. Extremely diverse variants of star-like, campanulate to funnel-shaped, or rarely more or less triangular flowers, with the outer tepals more spreading than the inner ones, occur in Central Asian species. Also the scent of flowers, that can be strong (and not always appreciable), may be worth of special recognition. This character is however influenced by the air temperature during the observation.

Color, dimensions, position, texture and shape of the tepals are widely used taxonomic characters, even though they often change remarkably during the course of anthesis of a single flower. Since the mode of these changes is also variable, it also owns taxonomic value. Several details are important, too; especially evenness of the whole tepals, structure of the surface, shape of apex, margins, and base, dimensions of the connate bases and/or the part adnate to filaments, characters of the median vein, and in some special cases also other details.

The filaments show no less diversity than the tepals in the following characters: position and direction, general (two-dimensional as well as three-dimensional) shape, and the shape of the basal part, relative and absolute length, lengths of the basal connate sector commonly also adnate to the tepals, presence and location of tooth-like appendages (an important character in many *Allium* groups and also present among members of subg. *Melanocrommyum*), as well as the color of the filaments in general and of different parts.

The anthers are much less variable in their shape, dimensions and color but may present usable taxonomic characters in some cases. The pollen shows only differing color even under a hand lens, though study under the microscope allows to detect many variable features. However, the knowledge of these microscopic characters, especially the amount of intraspecific variation, is still incomplete.

The ovary is composed of three connate carpels with internal septal nectaries at the place of sutures. This composed character causes three longitudinal furrows along the suture, and three more furrows run along the median veins of the carpels. The shape of the ovaries is taxonomically important, especially the presence of a stalk-like narrowed base ("stipitate ovaries") or a pronounced central depression on the apex around the style. Although color and dimension change during the course of anthesis, they may deliver valuable information as well. Radially or obliquely outwards directed outgrowths ("hornlets") on the apex of ovaries are species-specific characters if well expressed. On the other hand, shallow bulges are a most common structure on the apex that may become more pronounced during the drying process of herbarium specimens; then these differences are unimportant. The surface may be smooth, or coarse in very different degrees of expression. Unfortunately, this character is also influenced by the ontogenetic stage and is often difficult to recognize on herbarium specimens. It has taxonomic importance but hitherto details of the differences are merely incompletely known.

The internal nectaries excrete through tubes mounding opposite the inner filaments where pocket- or funnel-like outlets can easily be seen, sometimes even in dried flowers without soaking. However, small mounds are often not larger than the surrounding cells, and are difficult to see even under the dissecting microscope. Sometimes small nectar drops indicate the position of the mounds if fresh ovaries can be analyzed. Shape and horizontal position of the mounds are taxonomically important characters. These features, like dimension of nectaries and excretory tubes as well as other anatomical characters of the

ovaries, are still incompletely known and should be the target of comprehensive studies in the future. The number of ovules per locule ranges from 2 to 24 in subg. *Melanocrommyum*, but this number varies among locules and among flowers; also here broadly based and statistically secured investigations would be necessary.

The gynobasic style shows variation of shape, length, diameter, and color, features that also change during the course of anthesis. The most often punctiform stigma appears often slightly capitate in full anthesis, but may also be shortly tripartite in a few species. It is commonly uncolored even when the style has a dark color.

The ovary develops into a loculicidal dry capsule opening along the dorsal furrow of the locules building three concave valves. Therefore shape and surface structure of the capsules can be deduced from these characters of the ovaries, but not as a shapely magnification because the shape of the valves changes in the process of drying and opening, and the surface often develops raised wrinkles when drying out. Nevertheless, color and evenness of the capsule surface as well as the mode of opening present important characters.

The seed shape is very variable showing group-specific character combinations but is also influenced by external conditions. Seed dimensions depend on the dimensions of the developing capsules, especially the space available in the locules, and the number of seeds developing per locule. Shape, dimensions (also expressed by the thousand-kernel-weight TKW), and surface sculptures visible under a hand-lens may vary remarkably in one species, but taxonomically relevant differences will probably be found when large seed samples harvested in different years can be compared. The seed color in subg. *Melanocrommyum* is most often dull black but may be slightly lustrous, what is common in other subgenera.

Contrary to this morphological variation, the principal shape and sculpturing of seed testa cells investigated under a scanning electron microscope are rather uniform (with rare exceptions in *A. aroides* and *A. verticillatum*) and were in detail discussed by Fritsch & al. (2006). These characters were not studied yet in all species of subg. *Melanocrommyum*, and the detection of more specific character combinations seems possible.

#### 4. Karyological data

The base number of chromosomes  $x = 8$  dominates, but  $x = 9$  is a specific character of *A. karataviense*, and  $x = 10$  was found in sect. *Decipientia*. Most species are diploids, also tetraploids are not rare (as far as studied), but higher ploidy levels (especially when found in plants from botanical collections) need verification. Extensive karyotyping and chromosome measurements based on many chromosome plates seem necessary to detect possible species- or section-specific karyotypes (Fritsch & Astanova 1998).

#### 5. Life form and annual cycle

All species of subg. *Melanocrommyum* are perennial bulb geophytes with an ephemeroïdal growth rhythm presenting assimilating (supraterranean) organs only from leaf sprouting in February - March to the withering of leaves before or during the anthesis in April to June. Later in May to July the capsules and seeds are completed from the reserves of the scape without functioning roots and leaves. Leaf differentiation of the sprout of the following year and inflorescence differentiation continues during the summer dormancy over a period of 4-6 months, and most species need later again several weeks of cool temperatures to induce a complete development of the flower scape and of the inflorescence to anthesis (Kamenetsky & Rabinowich 2002). Growth of roots starts only after the summer dormancy when the soil is moistened, but very few species are even able to extend dormancy till next autumn when autumn, winter, and spring are too dry. Therefore bulbs and especially roots will not earlier start sprouting when the plants were dug out of soil prior to anthesis. On the other hand, the root meristems

of many species decrease when bulbs are stored under dry conditions till mid-winter. As far as investigated, seeds need a long period with low temperatures to induce germination (Specht & Keller 1997). During the juvenile stage, which lasts several years, the apical meristem produces only leaves, and the leaf form changes gradually from the thread-like cotyledon to the species-specific final form and leaf number. Contractile roots move the young bulbs deeper into the soil in every year.

## 6. Chemical characters

Fructose-based polysaccharides, gluco-fructanes and other carbohydrates (but no starch!), flavonoids, alkaloids, saponins, several vitamins, and phenolic compounds seem to be present in species of all *Allium* groups. They contribute to special qualities of *Allium* plants dominated by different cysteine sulfoxides that disintegrate enzymatically into strong-smelling and hot-tasting sulfur compounds when cells are destroyed in any way. Contrary to cultivated taxa like garlic, common onion, and other regionally or locally important onions, many members of subg. *Melanocrommyum* contain low to very low concentrations of cysteine sulfoxides (commonly methiin, and isoalliin, more rarely they also contain alliin and propiin). These plants are nearly odorless. However, some strong-smelling species contain other cysteine sulfoxides like marasmin and pyridine cysteine sulfoxide (Kusterer & Keusgen 2009; Kusterer & al. 2009, 2011) probably important for special medical properties. There are strong indications that the concentrations of all these compounds change from one species to another (Fritsch & Keusgen 2006; Keusgen & al. 2008) and may possess chemotaxonomic importance.

Recent investigations presented evidence for antibiotic activity in some species of sect. *Melanocrommyum* against bacteria, yeast, and pathogenic fungi, and reported high radical scavenger activity (higher than that found in garlic!) for species containing a dithiodipyrrole cysteine sulfoxide (Keusgen & al. 2006; Jedelská & Keusgen 2008).

Many recent chemical research activities resulted in an accumulating knowledge on *Allium* species collected in the wild by local people for medical use or for dishes highly esteemed for their tonic properties. Although chemical data show still many gaps, they implicate to be widely exploited for medical and taxonomic application in the future. Therefore more intense continuation of ethnobotanical as well as chemical research activities seem essential. Further search for species applied by local people and study of the chemical compounds responsible for the observed effect should be initiated.

## 7. Molecular marker applications

The first molecular studies devoted to subg. *Melanocrommyum* applied genomic in situ hybridization (GISH), random amplified polymorphic DNA (RAPD) markers, and polymerase chain reaction amplified restriction fragments (PCR-RFLP) of noncoding regions of chloroplast DNA in order to trace intra-subgeneric phylogenetic relations (discussed in Fritsch & al. 2010). The results differed in many details of infra-subgeneric relations and hypothesized a high level of interspecific gene flow within subg. *Melanocrommyum*. Later comprehensive sequence analysis of the nuclear ITS (Internal Transcribed Spacer) region detected that most large sections were non-natural conglomerates of distantly related subunits. This phylogenetic structure was confirmed by sequences of the *trnL-trnF* region of chloroplast DNA (Gurushidze & al. 2010). Thus a more detailed classification was proposed by Fritsch & al. (2010) that much better reflects the natural relationships within subg. *Melanocrommyum*. This classification is applied here, though the phylogenetic relationship of all infra-subgeneric groups could not completely be resolved yet (Fritsch & Abbasi 2013). As soon as a more suitable molecular marker system will be available, a re-evaluation of a broad taxonomic sampling will be essential, if possible with the addition of hitherto missing or poorly represented species.

Recent comprehensive investigations of Gurushidze & al. (2012) showed significant differences in DNA content among phylogenetic clades of subg. *Melanocrommyum*, while closely related taxa showed highly similar genome size values. Estimations of ancestral genome sizes revealed lineages with incre-

asing as well as decreasing DNA content. DNA contents of Central Asian members of subg. *Melanocrommyum* are only partly known. Furthermore a confirmation of the elder values would be highly welcome in order to get a realistic estimation of the taxonomic value of this character.

## 8. Phylogenesis

The genus *Allium* belongs to a large number of taxonomic groups that did not leave paleobotanical remains. Thus their basal phylogenetic lineages cannot be directly deduced from paleobotanical finds, but some more or less generally accepted principles can be applied. Li & al. (2010) indicated, that the primary evolution may have happened in the old Central Asian mountain systems of Tianshan and Alai, but the ancestor of the *Allium* subgenera *Porphyroprason*, *Vvedenskya* (Kamelin) R.M. Fritsch, and *Melanocrommyum* originated in eastern Asia, and later dispersed to Central Asia. The diversification and rapid speciation surely took place during the Late Tertiary. The resulting taxa expanded their ranges into other areas such as western Asia and the Mediterranean and diversified in these regions. Later other dispersal events occurred in reverse and in other directions (Hanelt & al. 1992, Li & al. 2010). Thus it can be expected that phylogenetically basal as well as advanced groups may still be present in Central Asia.

## 9. Economical importance

The application of wild plants as vegetables, spices, and medical plants depends on botanical (the availability of such plants) as well as human factors (the knowledge on efficacy, the dosage, and the way of application). A certain number of *Melanocrommyum* species own olfactory and taste qualities more or less similar to cultivated species like the common onion, garlic, rakkyo, leek, etc., all of which belong to other subgenera. Therefore it is not surprising that leaves and bulbs (rarely whole plants) of about 30 species of subg. *Melanocrommyum* were reportedly collected in the wild by local people in different Asian countries and applied as spices, vegetables, and medical plants (reviewed in Fritsch 2012, Iranian species in Abbasi & al. 2008) Also some attempts to cultivate excessively collected taxa were reported (Hanelt 2001). Cultivation should also be prospective for several much-collected Central Asian species.

Rather many *Allium* species possess a striking ornamental habit; they combine multiflowered inflorescences in different conspicuous colors and spectacular foliage. Some form dense patches with short floral stems, others grow as grand single plants or in loose groups with large flower heads on eminent scapes. Already more than 100 years ago the first members of subg. *Melanocrommyum* were introduced in European gardens. They have become popular for rock gardens, herbaceous beds and perennial borders, and even as cut flowers and for forcing. At the beginning of the 21<sup>st</sup> century, the bulbs of about 20 species and of about 30 named selections and hybrid strains belonging to subg. *Melanocrommyum* were regularly commercially offered, most of them multiplied by commercial producers of ornamental bulbs (Kamenetsky & Fritsch 2002; Fritsch 2015). Because plant enthusiasts and commercial growers of rare bulbs offer a much broader assortment of ornamental members of subg. *Melanocrommyum*, the number of cultivated ornamentals will considerably rise in the future (Fritsch 2012, 2015).

## 10. Etymology of scientific names

Names for plants and animals exist in many languages since most ancient times, but the current scientific names of organisms, the names of the categories used for classification, as well as many scientific termini go only back to the European era of Renaissance. Then the classical Greek and Latin names and terms (many Greek texts were accepted as Latin translations) were everywhere understood by educated persons having learnt words like garlic (Latin "allium" Greek "prason") and onion (Latin "cepa" Greek "krom[m]yon" Latinized "crommyum"). Many ancient scientific plant names were single words.

Because accumulating knowledge requested more differentiation, and newly detected plants often share a certain set of characters with known species, names of known plants were taken and supplemented by additions mentioning the differing characters for the new species. Hence the ancient botanists often created long sequences of words in order to describe a new taxon carefully. These "botanical phrases" were names and descriptions, but often they were unwieldy long. Later the current practice was developed that one- or two-partite names act as acronyms to descriptions delivered when a new name is published. Newly recognized *Allium* species and groups are often traditionally named by compound words applying the Latin or Latinized words for garlic or common onion even to plants only slightly similar to those plants or sharing only single olfactory characters of them. Nevertheless, the current praxis of having a name connected with a description did not delete the historical practice to express any special character in the name of a newly described taxon. Therefore the etymology of a scientific name may give a pointer to a special character accepted by the author of the first description. Also additional information on persons honored by an epithet might sometimes be appreciated.

Botanical terms may also constitute a part of scientific names. Also the botanical terminology was derived from Greek and Latin by restricting the application of classical words to science-specific senses and by creating new composite and derivative words. This process of creating new terms and scientific names continues till today. Some botanical termini like scapus (Latin "stick, shaft"), a leafless segment of the stem, and petalum (Latinized from Greek "petalon" = leaf), the single segment of the corolla, received this restricted use already in antiquity. Other termini like filamentum (derived from Latin "filum" = thread) and stemum (Latinized from Greek "stemon" = marginal pole of wickerwork), used for all kinds (also conical or flat) leafy organs bearing the anthers, were introduced in the early phase of scientific botany. The much used term tepalum, the petaloid perigon segment not differentiated into calyx and corolla, was only created in the 19<sup>th</sup> century.

## 11. Classifications

Also *Allium* classifications trace back to pre-Linnean time, but the first groups of current subg. *Melanocrommyum* were recognized only in the 19<sup>th</sup> century. Since Wendelbo (1969) the subgeneric level is generally accepted, and several contradictory classifications were proposed (for a short historical outline see Fritsch 2012). However, all of them do not reflect true phylogenetic relationships (Gurushidze & al. 2008). Therefore a more detailed classification was proposed by Fritsch & al. (2010) that is applied here. Because molecular data could not be gained for every species and a few phylogenetic positions must be regarded as preliminary, also the taxonomic affiliations presented in this review are no more than proposals at the current state of knowledge and are open for discussion as soon as more data will be available.

## 12. Conspectus of *Allium* subg. *Melanocrommyum* (Webb & Berthel.) Rouy in Central Asia

1. *A.* subg. *Melanocrommyum* **sect. Longibidentata** (R.M. Fritsch) R.M. Fritsch  
*Allium chychkanense* R.M. Fritsch, *Allium fetisowii* Regel (incl. *A. simile* Regel)
2. *A.* subg. *Melanocrommyum* **sect. Decipientia** (Omelczuk) R.M. Fritsch  
*Allium robustum* Kar. & Kir., *Allium tulipifolium* Ledeb. var. *subscabrum* Regel, *Allium viridulum* Ledeb.
3. *A.* subg. *Melanocrommyum* **sect. Regeloprason** Wendelbo
  - 3.1 *A.* sect. *Regeloprason* **subsect. Regeloprason** (Wendelbo) Kamelin  
*Allium regelii* Trautv. (incl. *A. yatei* Aitch. & Baker), *Allium victoris* Vved.
  - 3.2 *A.* sect. *Regeloprason* **subsect. Diffusoumbellata** R.M. Fritsch  
*Allium balkhanicum* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch, *Allium cupuliferum* Regel subsp. *cupuliferum*, *Allium cupuliferum* subsp. *nuratavicum* R.M. Fritsch & Beshko, *Allium iliense* Regel, *Allium isakulii* R.M. Fritsch & F.O. Khass. (incl. *A. iliense* subsp. *nuratense*)

- Kamelin), *Allium subkopetdagense* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch
- 3.3 **A. sect. *Regeloprason* subject. *Odoratae*** R.M. Fritsch  
*Allium chodsha-bakirganicum* Gaffarov & Turak., *Allium darwasicum* Regel, *Allium hissaricum* Vved., *Allium intradarvazicum* R.M. Fritsch, *Allium lipskyanum* Vved., *Allium pseudowinklerianum* R.M. Fritsch & F.O. Khass., *Allium sochense* R.M. Fritsch & U. Turakulov, *Allium winklerianum* Regel
4. **A. subg. *Melanocrommyum* sect. *Asteroprason*** R.M. Fritsch
- 4.1 **A. sect. *Asteroprason* subject. *Asteroprason*** R.M. Fritsch  
*Allium helicophyllum* Vved., *Allium monophyllum* Vved. ex Czerniak.
- 4.2 **A. sect. *Asteroprason* subject. *Cristophiana*** Tscholok.  
*Allium cristophii* Trautv. subsp. *cristophii* (incl. *A. albopilosum* C.H. Wright, *A. bodeanum* Regel, *A. walteri* Regel), *Allium cristophii* subsp. *golestanicum* R.M. Fritsch
5. **A. subg. *Melanocrommyum* sect. *Stellata*** (F.O. Khass. & R.M. Fritsch) R.M. Fritsch  
*Allium taeniopetalum* Popov & Vved. subsp. *taeniopetalum*, *Allium taeniopetalum* subsp. *mogoltavicum* (Vved.) R.M. Fritsch & F.O. Khass. (incl. *A. baschkyzylsaicum* Krassovsk.), *Allium taeniopetalum* subsp. *turakulovii* R.M. Fritsch & F.O. Khass.
6. **A. subg. *Melanocrommyum* sect. *Megaloprason*** Wendelbo s. str.
- 6.1 **A. sect. *Megaloprason* subject. *Megaloprason*** R.M. Fritsch  
*Allium insufficiens* Vved., *Allium kwakense* (R.M. Fritsch) R.M. Fritsch, *Allium rosenbachianum* Regel s. str., *Allium schugnanicum* Vved.
- 6.2 **A. sect. *Megaloprason* subject. *Humilicognata*** R.M. Fritsch  
*Allium brachyscapum* Vved.,
- 6.3 **A. sect. *Megaloprason* subject. *Keratoprason*** R.M. Fritsch  
*Allium sarawschanicum* Regel (incl. *A. pseudozeravschanicum* Popov & Vved.)
- 6.4 **A. sect. *Megaloprason* subject. *Spiralitunicata*** R.M. Fritsch  
*Allium suworowii* Regel
7. **A. subg. *Melanocrommyum* sect. *Miniprason*** R.M. Fritsch  
*Allium karataviense* Regel subsp. *karataviense*, *Allium karataviense* subsp. *henrikii* Rukšāns
8. **A. subg. *Melanocrommyum* sect. *Acmopetala*** R.M. Fritsch
- 8.1 **A. sect. *Acmopetala* subject. *Acmopetala*** R.M. Fritsch  
*Allium aflatanense* B. Fedtsch., *Allium alaicum* Vved., *Allium arkitense* R.M. Fritsch, *Allium backhousianum* Regel (incl. *A. gulczense* O. Fedtsch.), *Allium bekeczalicum* Lazkov, *Allium dasyphyllum* Vved., *Allium kurdaicum* Bajtenov, *Allium pangasicum* Turak., *Allium schachimardanicum* Vved., *Allium vvedenskyanum* Pavlov, *Allium zergericum* F.O. Khass. & R.M. Fritsch
- 8.2 **A. sect. *Acmopetala* subject. *Albidiflora*** R.M. Fritsch  
*Allium saposchnikovii* Nikitina (incl. *A. collis-magni* Kamelin)
- 8.3 **A. sect. *Acmopetala* subject. *Durovaginata*** R.M. Fritsch  
*Allium costatovaginatatum* Kamelin & Levichev (incl. *A. rudolfii* Turak.), *Allium dodecadontum* Vved., *Allium severtzovioides* R.M. Fritsch, *Allium tokaliense* Kamelin & Levichev
- 8.4 **A. sect. *Acmopetala* subject. *Inornatae*** R.M. Fritsch  
*Allium sewerzowii* Regel, *Allium tashkenticum* F.O. Khass. & R.M. Fritsch
- 8.5 **A. sect. *Acmopetala* subject. *Pharmakoprason*** R.M. Fritsch  
*Allium tschimganicum* O. Fedtsch. (incl. *A. motor* Kamelin & Levichev)
9. **A. subg. *Melanocrommyum* sect. *Verticillata*** Kamelin,  
*Allium verticillatum* Regel, *Allium viridiflorum* Pobed.
10. **A. subg. *Melanocrommyum* sect. *Compactoprason*** R.M. Fritsch
- 10.1 **A. sect. *Compactoprason* subject. *Erectopetala*** F.O. Khass.  
*Allium giganteum* Regel (incl. *A. procerum* Trautv. ex Regel), *Allium isfairamicum* O. Fedtsch., *Allium macleanii* Baker (incl. *A. elatum* Regel), *Allium trautvetterianum* Regel

- 10.2 **A. sect. *Compactoprason* subject. *Komaroviana*** F.O. Khass. & R.M. Fritsch  
*Allium komarowii* Lipsky
- 10.3 **A. sect. *Compactoprason* subject. *Spiralopetala*** F.O. Khass. & R.M. Fritsch  
*Allium majus* Vved.
11. **A. subg. *Melanocrommyum* sect. *Procerallium*** R.M. Fritsch
- 11.1 **A. sect. *Procerallium* subject. *Elatae*** R.M. Fritsch  
*Allium altissimum* Regel, *Allium stipitatum* Regel (incl. *A. hirtifolium* Boiss.)
- 11.2 **A. sect. *Procerallium* subject. *Costatae*** R.M. Fritsch  
*Allium jesdianum* subsp. *angustitepalum* (Wendelbo) F.O. Khass. & R.M. Fritsch (incl. *A. ecornutum* F.O. Khass. & I.I. Malzev), *Allium rosenorum* R.M. Fritsch (= *A. rosenbachianum* sensu Vved. & auctt.)
12. **A. subg. *Melanocrommyum* sect. *Aroidea*** F.O. Khass. & R.M. Fritsch  
*Allium aroides* Popov & Vved.
13. **A. subg. *Melanocrommyum* sect. *Acaule*** R.M. Fritsch  
*Allium hexaceras* Vved.
14. **A. subg. *Melanocrommyum* sect. *Popovia*** F.O. Khass. & R.M. Fritsch  
*Allium gypsaceum* Popov & Vved.
15. **A. subg. *Melanocrommyum* sect. *Thaumasioprason*** Wendelbo  
*Allium khozratense* R.M. Fritsch
16. **A. subg. *Melanocrommyum* sect. *Kaloprason*** K. Koch
- 16.1 **A. sect. *Kaloprason* subject. *Kaloprason*** (K. Koch) Kamelin  
*Allium bucharicum* Regel, *Allium caspium* (Pall.) M. Bieb. subsp. *caspium* (incl. *A. brahucum* Boiss.), *Allium caspium* subsp. *baissunense* (Lipsky) F.O. Khass. & R.M. Fritsch (incl. *A. rhodanthum* Vved.)
- 16.2 **A. sect. *Kaloprason* subject. *Ligulifolia*** R.M. Fritsch  
*Allium alexeianum* Regel, *Allium decoratum* Turginov & Tojibaev, *Allium nevskianum* Vved. ex Wendelbo, *Allium protensum* Wendelbo (= *A. schubertii* auctt. non Zucc.)
17. **A. subg. *Melanocrommyum* sect. *Brevicaule*** R.M. Fritsch  
*Allium chitralicum* F.T. Wang & Tang (incl. *A. badakhshanicum* Wendelbo, *A. pauli* Vved.), *Allium eugenii* Vved., *Allium sergii* Vved.

### 13. Latin nomenclatorial terms

Another relict from pre-Linnean and classical times of botany is the use of Latin words and abbreviations in the nomenclatorial descriptions which allow short formulations. Such words and abbreviations are used in the following key and in the paragraphs on nomenclature of the taxonomy chapter and will be explained below.

& al. (et aliis) - and the other (more than two) authors

(in) adnot. (in adnotationis) - in a comment (not in the main text)

ambae - both together

ante - before, prior to

auct. / auctt. (auctorum) - of several / many authors

comb. inval. (combinatio invalida) - invalid (nomenclatural) combination

cum icone - with a figure

descr. ampl. (descriptioe ampliore) - with an amplified description

descr. germ. / ross. / latin. / (descriptioe germanico / rossico / latino) - with a German / Russian /

Latin description

eds. - editors

emend. (emendato) - amplified ("improved") by ...

ex - out of (the following publication)



excl. - excluding  
hort. (hortorum / hortulanorum) - of the gardens / gardeners  
in clavi - in the key: characters are given in a key, not as formal description  
in sched. (in scheda / schedis) - on (herbarium) label(s), not formally published  
incl. (inclusive) - including  
ined. (ineditus) - unpublished  
l. c. (locus citatus) - at the [formerly] cited place (of publication)  
leg. (legit) - collected by  
nec, necque - and not, also not  
nec non - and also  
nom. altern. (nomen alternativum) - alternative name (see art. 36.2 of the Code), is valid if published prior to 1953  
nom. illeg. (nomen illegitimum) - illegitimate name  
nom. nud. (nomen nudum) - name without description ("naked name"), nomenclaturally invalid  
nom. superfl. (nomen superfluum) - superfluous name (in the nomenclatorial sense)  
non - not  
non design. (non designatus) - not designated (in the nomenclatorial sense)  
nonnull. (nonnullus, non nullus) - several  
omnes, omnia - all of them  
p. p. (pro parte) - in part, not all  
p. p. maj. / min. (pro parte majore / minore) - (referring to the) larger / smaller part  
plerumque - commonly, very often  
post - after, later than  
quoad basion. (quoad basionymum) - as to / with respect to the basionym  
quoad pl. (quoad plantam ...) - concerning plants (from ...)  
quoad typum - concerning (only) the type  
s. lat. (sensu lato / latiore) - in the wide / wider sense  
s. n. (sine numero) - without a (collection) number  
s. str. (sensu stricto) - in the strict / narrow sense  
sensu - in the sense (of ...)  
sub - under / included in ...  
sub specie - (affiliated) at species level

## Key for the determination of species and subspecies



1. Flowers narrow, campanulate or funnel-shaped; filaments 1/4-3/4 as long as tepals, above union with the tepals  $\pm$  connate; inflorescences with rarely more than 100 flowers, initially sometimes very dense but after anthesis often lax 2
- 1\* Flowers broad, very diversely shaped, filaments shorter or longer than tepals; inflorescences divers 18
2. Tepals crème or whitish, purple towards the tip, margin of inner tepals finely undulate-denticulate; inflorescences globose; pedicels and ripe capsules drop from receptacle  
(72) *Allium gypsaceum* sect. 14. *Popovia*
- 2\* Tepals  $\pm$  unicolored, margin of tepals even, flowers often with a sweetish odor like hyacinths; inflorescences fasciculate; tepals basally to 1/4-1/3 of their length connate and united with the filaments; ripe capsules not dropping  
sect. 3. *Regeloprason* 3
3. Leaves 4-7, laminae long linear-triangular, 3-8 mm broad; inflorescences always simple; flowers with heavy sweet odor, pinkish-violet (8) *Allium victoris* subsect. 3.1 *Regeloprason*
- 3\* Leaves 1-4 or 4-8, laminae narrower than 4 mm or broader than 8 mm 4
4. Leaf single (rarely 2), lamina narrowly linear, up to 3 mm broad, canaliculate, upper part often screw-like curved  
(21) *Allium sochense* subsect. 3.3 *Odoratae*
- 4\* Leaves 1-2 (3) or 4-8, laminae at least 1 cm broad, upper part flat or recurved 5
5. Pedicels prior to anthesis much (as exception slightly) longer than flowers, and elongate during and after anthesis for (2) 3-10 times, thus infructescences very loose; leaf laminae mostly thick and fleshy, patent or prostrate 11
- 5\* Pedicels elongate less than twice during and after anthesis, thus infructescences dense, broadly fastigate; flowers intensely sweet scented somewhat like hyacinths; leaf laminae straight or obliquely sideways positioned subsect. 3.3 *Odoratae* 6
6. Flowers whitish, pale yellow or yellow-green 7
- 6\* Flowers lilac to pink or purplish 8
7. Plants (15) 20-50 (80) cm high; inflorescences with more than 30 grayish-white or pale to intense yellow-green flowers, odor strong hyacinth-like (15) *Allium darwasicum*
- 7\* Plants (10) 15-25 cm high; inflorescences mostly with 15-30 narrowly campanulate, pale yellow, scarcely scented flowers  
(16) *Allium chodsha-bakiranicum*
8. Leaf laminae initially plicate, later carinate; bulb tunics strong parchment-like to leathery; flowers varying lilac to pinkish-carmine, filaments 1/2-2/3 as long as the tepals, basally for 1/5 connate  
(17) *Allium hissaricum*

## Ключ для определения видов и подвидов

1. Цветки узкие, колокольчатые или воронковидные; нити тычинок  $1/4-3/4$  длины листочков околоцветника, выше срастания с листочками околоцветника  $\pm$  сросшиеся; соцветия редко с более чем 100 цветков, вначале иногда очень густые, но после опыления часто рыхлые ..... 2
- 1\* Цветки широкие, разнообразные по форме, нити короче или длиннее листочков околоцветника; соцветия разные ..... 18
2. Листочки околоцветника кремовые или беловатые, пурпурные к кончику, края внутренних листочков околоцветника тонко волнисто-зубчатые; соцветия шаровидные; цветоножки и спелые коробочки опадающие ..... (72) *Allium gypsaceum* секц. 14. *Popovia*
- 2\* Листочки околоцветника однородно окрашенные, края внутренних листочков околоцветника ровные, цветки часто со сладковатым гиацинтовым запахом; соцветия пучковатые, листочки околоцветника у основания до  $1/4 - 1/3$  их длины сросшиеся и соединены с тычиночными нитями; спелые коробочки не опадающие ..... секц. 3. *Regeloprason* 3
3. Листья в числе 4,7, пластинки длинные линейно-треугольные, 3-8 мм шириной; соцветия всегда простые; цветы с тяжелым сладким запахом, розовато-фиолетовые ..... (8) *Allium victoris* подсекц. 3.1 *Regeloprason*
- 3\* Листья в числе 1-4 или 4-8, листовые пластинки уже 4 мм или шире, чем 8 мм ..... 4
4. Листья одиночные (редко 2), листовые пластинки узко линейные, до 3 мм шириной, желобчатые, верхняя часть часто винтообразно скрученная ..... (21) *Allium sochense* подсекц. 3.3 *Odoratae*
- 4\* Листьев 1-2 (3) или 4-8, листовые пластинки по меньшей мере 1 см шириной, верхняя часть плоская или искривленная ..... 5
5. Цветоножки до цветения (как исключение слегка) длинее цветков и удлиняются во время цветения и после в (2) 3 – 10 раз, во время плодоношения очень рыхлые; листовые пластинки обычно толстые и мясистые, торчащие или лежащие ..... 11
- 5\* Цветоножки удлиненные менее чем в два раза во время и после цветения, соплодия плотные, широко обратно-конические; цветы с интенсивно сладким душистым гиацинтовым запахом; листовые пластинки прямые или вбок наклоненные ..... подсекц. 3.3 *Odoratae* .... 6
6. Цветки беловатые, бледно-желтые или желто-зеленые ..... 7
- 6\* Цветки сиреневые до розовых или пурпурные ..... 8
7. Растения (15) 20-50 (80) см в высоту; соцветия с более чем 30 серовато-белыми или бледно до интенсивно желто-зелеными цветками с сильным гиацинтовым запахом ..... (15) *Allium darwasicum*
- 7\* Растения (10) 15-25 см в высоту; соцветия в основном с 15-30 узко колокольчатых, бледно-желтыми, слабо душистыми цветками ..... (16) *Allium chodsha-bakiranicum*
8. Листовые пластинки сначала сложенные, позже килеватые; оболочки луковиц сильно пергаментные до кожистых; цветки варьируют от сиреневого до розовато-карминного, нити тычинок на  $1/2-2/3$  короче листочков околоцветника, при основании между собой и с околоцветником до  $1/5$  сросшиеся ..... (17) *Allium hissaricum*





8\* Leaf laminae not carinate; bulb tunics papery; flowers constantly pink to purplish-pink 9

9. Leaf laminae toothed along the margins and on the ribs of lower side, 1-1.5 cm wide; scapes 15-35 cm high; filaments 1/3-1/2 as long as the tepals (22) *Allium winklerianum*

9\* Leaf laminae smooth throughout or only basally toothed, 1.5-3 cm wide; scapes 25-80 cm high; filaments less than 2/5 or more than 1/2 as long as the tepals 10

10. Scapes 25-40 cm high; leaf laminae obliquely directed, scarcely glossy; outer filaments 1/4, inner ones 1/3-2/5 as long as the tepals, ovaries ovoid and somewhat glossy

(18) *Allium intradarvazicum*

10\* Scapes 30-80 cm high, leaf laminae thick, basal part erectly positioned, silk-glossy; filaments 1/2-2/3 of tepal length; ovaries ± globose, finely tuberculate (20) *Allium pseudowinklerianum*

11. (5) Leaves 4-8; inflorescence initially very dense, infructescence finally long-ovate and very loose; tepals pinkish-carmine with darker median vein (19) *Allium lipskyanum*

11\* Leaves 1-4, inflorescence already in the bud stage loose, during anthesis fastigate to broadly subglobose, infructescence ± semiglobose 12

12. Leaves 1-2; inflorescence always simple, infructescences very loose with thin pedicels subsect. 3.2 *Diffusoumbellata* 13

12\* Leaves 2-4 (5); inflorescences often composed of superposed parts, ± umbel-like, infructescences less loose with thick pedicels; laminae narrowly lanceolate, 1-4 cm broad; flowers slightly scented, pale lilac or mauve to pinkish-carmine

(7) *Allium regelii* subsect. 3.1 *Regeloprason*

13. Inflorescences moderately loose, pedicels up to 4 times longer than the flowers 14

13\* Inflorescences very loose, pedicels more than 4 times longer than the flowers 16

14. Inflorescences fasciculate, flowers pale pinkish-yellow; leaf laminae narrowly lanceolate (11) *Allium balkhanicum*

14\* Inflorescences semi- to subglobose, flowers pink or lilac 15

15. Plants slender, scape 30-60 cm high; leaf laminae 25-45 cm long; flowers bright pink, tepals basally up to 1/4 connate; filaments only shortly connate above adnation to the tepals

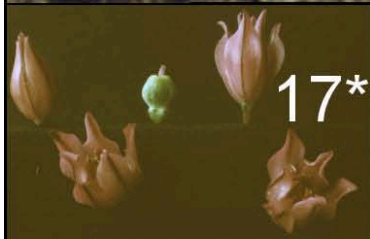
(9) *Allium cupuliferum* subsp. *cupuliferum*

15\* Plants more compact, scape 10-20 cm high; leaf laminae 10-25 cm long; flowers lilac, tepals basally for 1/3-1/4 connate; filaments long connate above adnation to the tepals

(10) *Allium cupuliferum* subsp. *nuratavicum*

- 8\* Листовые пластинки не килеватые; оболочки луковиц бумагообразные; цветки от однородно розовых до пурпурно-розовых ..... 9
9. Листовые пластинки зубчатые по краям и по ребрам с нижней стороны, 1.1,5 см шириной; стебли 15-35 см высоты; нити тычинок 1/3-1/2 длины листочков околоцветника .....(22) *Allium winklerianum*
- 9\* Листовые пластинки по краям гладкие и только у основания зубчатые, 1.5-3 см шириной; стебли 25-80 см высотой; нити тычинок на 2/5 короче или немного длиннее чем 1/2 листочков околоцветника .....10
10. Стебли 25-40 см высотой, листовые пластинки косо направленные, слабо глянцевые; наружные тычинки 1/4, внутренние 1/3-2/3 длины листочков околоцветника; завязь яйцевидная, слегка блестящая .. (18) *Allium intradarvazicum*
- 10\* Стебли 30-80 см высотой, листовые пластинки толстые, у основания вертикальные, шелковисто-гладкие; завязь шаровидная, мелкобугорчатая ... (20) *Allium pseudowinklerianum*
11. (5) Листьев 4-6; соцветие изначально сильно густое, во время плодоношения длинно-яйцевидное и рыхлое; листочки околоцветника розовато-карминные с более темно средней жилкой ..... (19) *Allium lipskyanum*
- 11\* Листьев 1-4; соцветие уже на стадии бутона рыхлое, во время цветения пучковатое до широко полушаровидного, во время плодоношения ± полушаровидное ..... 12
12. Листьев 1-2, соцветие всегда простое, во время цветения очень рыхлое с тонкими цветоножками .....подсекц. 3.2 *Diffusumbellata* 13
- 12\* Листьев 2-4 (5); соцветия часто состоят из наложенных друг на друга частей, ± зонтичного типа, во время плодоношения менее рыхлое с толстыми цветоножками; листовые пластинки узколанцетные, 1-4 см в ширину; цветы слегка душистые, бледно-сиреневые или розовато-фиолетовые до розовато-карминных .....(7) *Allium regelii* subsect. 3.1 *Regeloprason*
13. Соцветия слабо рыхлые; цветоножки до 4-х раз длиннее цветков ..... 14
- 13\* Соцветия сильно рыхлые, цветоножки более 4-х раз длиннее цветков ..... 16
14. Соцветия пучковатые; цветки бледно-розовато-желтого цвета; листовые пластинки узколанцетные ..... (11) *Allium balkhanicum*
- 14\* Соцветия полу- до почти шаровидных, цветки розовые или фиолетовые ..... 15
15. Растения тонкие, стебли 30-60 см высотой; листовые пластинки 25-45 см длиной; цветки ярко розовые, листочки околоцветника у основания до 1/4 сросшиеся; нити тычинок только коротко сросшиеся выше сращения с околоцветником .....(9) *Allium cupuliferum* subsp. *cupuliferum*
- 15\* Растения более компактные, стебли 10-20 см высотой, листовые пластинки 10-25 см длины; цветки сиреневые, листочки околоцветника у основания на 1/3-1/4 сросшиеся; нити тычинок длинно сросшиеся выше сращения с околоцветником .....(10) *Allium cupuliferum* subsp. *nuratavicum*





16. Leaf laminae narrowly lanceolate; flowers narrowly triangular-campanulate, tepals with plicate apex

(14) *Allium subkopetdagense*

16\* Leaf laminae broader, oblong-linear or linear-lanceolate 17

17. Scape 15-35 cm long; flowers narrowly campanulate, tepals linear-lanceolate, rather straight; filaments 2/5 as long as the tepals

(12) *Allium iliense*

17\* Scape 40-60 cm long; flowers triangular campanulate to urceolate, tepals with canaliculate and recurved tip, filaments 2/3 as long as the tepals

(13) *Allium isakulii*

18. (1\*) Scape above soil (1) 3-30 (as exception up to 60) cm long, straight, ascendent, or flexuous to S-shaped 19

18\* Scape 30-120 cm long (as exception 20-25 cm), straight or somewhat flexuous 41

19. Scape subcylindrical, weakest and thinnest at the tip; inflorescences loose or moderately dense 20

19\* Scape  $\pm$  obconical, thickest below inflorescence, basally narrow and weak and often only slightly lignified; inflorescences loose or dense 23

20. Scape (often S-like) flexuous, 5-15 cm long; inflorescences  $\pm$  loose; tepals ovate to elliptic, 6-13 mm long, 3-7 mm broad, obliquely upright, after anthesis incurved; leaf vernation planar

(1) *Allium oreophilum* (subg. *Porphyroprason* sect. *Porphyroprason*)

20\* Scape  $\pm$  straight, not S-like flexuous; inflorescences dense or loose, broadly fastigiate to semiglobose, after anthesis subglobose; tepals narrower than 3 mm, lanceolate, patent or claw-like inverted, after anthesis recurved,  $\pm$  crumpled or spirally contorted; leaf vernation convolute 21

21. Leaves less than 3 cm wide, lanceolate, green with glaucous bloom; apex of capsules not deeply excised; flowers flat star-like, tepals later reflexed and spirally contorted; scape 5-10 cm long, flexuous, much shorter than the leaves; inflorescences  $\pm$  hemispherical, rather dense (34) *Allium brachyscapum* sect. 6. *Megaloprason* subsect. 6.2 *Humilicognata*

21\* Leaves long-elliptic to ovate, 4-10 (15) cm wide, initially violet-bluish with purple margin, finally deep-green, longitudinally sulcate; scape flexuous; tepals narrowly linear-lanceolate, plicate; apex of capsules deeply tripartite

*Allium karataviense* sect. 7. *Miniprason* 22

22. Grows on steep rock or rubble slopes; scape (5) 10-25 cm long,  $\pm$  shorter than the leaves; tepals pinkish, brownish, or red

(37) **subsp. karataviense**

22\* Grows on rock terraces with shallow soil; scape more than 20 cm long, longer than the leaves; tepals red to purple

(38) **subsp. henrikii**

16. Листовые пластинки узко ланцетные; цветки узко треугольно-колокольчатые, листочки околоцветника со складчатой верхушкой ..... (14) *Allium subkopetdagense*
- 16\* Листовые пластинки шире, продолговато-линейные или линейно-ланцетные ..... 17
17. Стебли 15-35 см высотой, цветки узко колокольчатые, листочки околоцветника линейно-ланцетные, почти прямые; нити тычинок 2/5 длины листочков околоцветника ..... (12) *Allium iliense*
- 17\* Стебли 40-60 см высотой, цветки треугольно-колокольчатые до кувшинчатых, листочки околоцветника с желобчатым и загнутым носиком, нити тычинок 2/3 длины околоцветника ..... (13) *Allium isakulii*
18. (1\*) Стебель выше поверхности почвы (1) 3-30 (как исключение до 60) см высотой, прямой, восходящий или изогнутый до S-подобного ..... 19
- 18\* Стебель 30-120 см высотой (как исключение 20-25 см), прямой или слегка извилистый ..... 41
19. Стебель полуцилиндрический, слабый и более тонкий на верхушке, соцветие рыхлое или слабо густое ..... 20
- 19\* Стебель обратно конический, наиболее толстый под соцветием, у основания тонкий и слабый и часто слабо одревесневший; соцветие рыхлое или густое ..... 23
20. Стебли извилистые (часто S-подобные), 5-15 см высотой; соцветия ± рыхлые; листочки околоцветника яйцевидные до эллиптических, 6-13 мм длиной, 3-7 мм шириной, всегда прямые, после цветения вогнутые; расположение листов в почке всегда плоскостное .... (1) *Allium oreophilum* ..... (подрод *Porphyroprason* секц. *Porphyroprason*)
- 20\* Стебли прямые, не извилистые; соцветия рыхлые или густые, широко конические до полушаровидных, после цветения полушаровидные; листочки околоцветника уже 3-х мм, ланцетные, торчащие или как перевернутый коготь, после цветения отогнутые, ± мятые или спирально скрученные; расположены листов в почке гофрированное .... 21
21. Листья менее 3 см в ширину, ланцетные, зеленые с сизым налетом; верхушка капсул не глубоко вырезан; цветы плоские звездчатые, листочки околоцветника позже отогнутые и спирально скрученные; стебли 5-10 см высотой, извилистые, намного короче, чем листья; соцветия ± полушаровидные, довольно густые .... (34) *Allium brachyscapum* секц. 6. *Megaloprason* подсекц. 6.2 *Humilicognata*
- 21\* Листья длинно-эллиптические до яйцевидных, 4-10 (15) см шириной, изначально фиолетово-синеватые с пурпурным краем, позднее темно-зеленые, продольно бороздчатые; стебли извилистые; листочки околоцветника узко линейно-ланцетные, складчатые; верхушка коробочек глубоко трехраздельные ..... *Allium karataviense* секц. 7. *Miniprason* 22
22. Растет на крутых скалистых или щебнистых склонах; стебли (5) 10-25 см высотой, ± короче листьев; листочки околоцветника розоватые, коричневатые или красные ..... (37) *subsp. karataviense*
- 22\* Растет на горных террасах с мелкой почвой; стебли более 20 см высотой, длиннее листьев; листочки околоцветника красные до пурпурного ..... (38) *subsp. henrikii*





23. (19\*) Inflorescences mostly many-flowered; flowers flat star-like or funnel-shaped, rarely bowl-shaped, ovoid or campanulate; leaf laminae longer or shorter than the scapes that are only as exception shorter than 15 cm and stout to very stout 26

23\* Inflorescences with less than 100 bowl-shaped to cup-like flowers with  $\pm$  incurved tepals; leaf laminae up to twice longer than the 5-15 cm long, slender scape; tepals claw-like inverted or concave, after anthesis recurved and crumpled

sect. 17. *Brevicaule* 24

24. Leaf laminae 2-6 (8) mm broad, narrowly linear-triangular; inflorescences very loose, flowers pinkish, tepals with conspicuously dark median vein 25

24\* Leaf laminae linear, up to 10 (15) mm broad; inflorescences moderately loose; tepals whitish with inconspicuous median vein (82) *Allium chitralicum*

25. Leaf laminae smooth, often upper part circularly to screw-like enrolled; tepals pinkish-yellowish (81) *Allium sergii*

25\* Leaf laminae arcuately ascending and recurved to the soil, ribs and margins covered with fine, white, backwards directed hairs; tepals pinkish-greenish (83) *Allium eugenii*

26. (23\*) Pedicels are inflated at the tip; flowers flat funnel-shaped; pedicels with ripe capsules drop from the receptacle; scape slightly flexuous, 15-25 cm long

(73) *Allium khozratense* sect. 15. *Thaumasio-prason*

26\* Pedicels slightly obconical at the tip; flowers flat,  $\pm$  bowl-shaped or funnel-shaped; ripe capsules do mostly not drop 27

27. Apex of ovary with six horn-like outgrowths; leaf laminae narrowly lanceolate, 3-5 times longer than the (above soil) 1-3 cm long scape; tepals long-elliptic, straight after anthesis

(71) *Allium hexaceras* sect. 13. *Acaule*

27\* Ovary without horn-like outgrowths, scapes longer 28

28. Leaf laminae divided into long thread-like parts, much shorter than the scape; inflorescences always loose, umbel-like

sect. 9. *Verticillata* 29

28\* Leaf laminae ovate or lanceolate to linear, not lengthwise divided 30

29. Flowers bowl-shaped, tepals rose-pinkish, 2-2.5 mm broad, with broad and dark median vein (58) *Allium verticillatum*

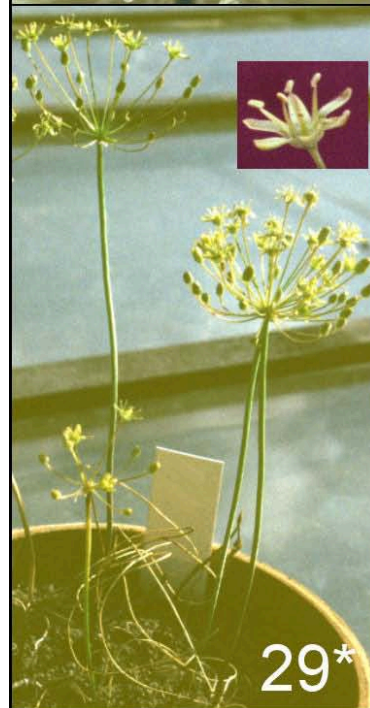
29\* Flowers flat, tepals yellow-green, 1-1.3 mm broad, near the base recurved, the apex inwards bent (59) *Allium viridiflorum*

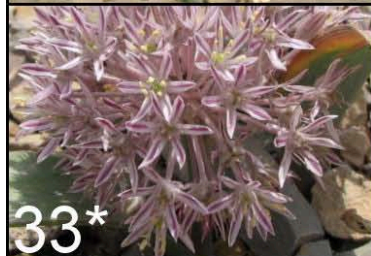
30. Leaves 1-2, laminae  $\pm$  linear, or narrowly lanceolate 33

30\* Leaves 1-3 or 4-8, mostly ovate, rarely broadly linear or lanceolate, basally canaliculate, rarely more than twice longer than the scape; scape often thicker than 8 mm below the inflorescences; tepals lingulate or long lanceolate to triangular, in the fruiting stage straight, sometimes hard and prickly 31



23. (19) Соцветия в основном многоцветковые; цветки плоско звездчатые или воронкообразные, редко чашеобразные, яйцевидные или колокольчатые; листовая пластинка длиннее или короче стебля, который только как исключение короче 15 см, толстый до очень толстого ..... 26
- 23\* Соцветия с менее чем 100 чашеобразных цветков с  $\pm$  скрученными листочками околоцветника; листовые пластинки в два раза длиннее, чем стройный стебель 5-15 см высотой; листочки околоцветника коготкового типа перевернутые или вогнутые, после цветения изогнутые и мятые ..... секц. 17. *Brevicaule* 24
24. Листовые пластинки 2-6 (8) мм шириной, узко линейно-треугольные; соцветия очень рыхлые, цветы розоватые, листочки околоцветника с явной темной средней жилкой ..... 25
- 24\* Листовые пластинки линейные, до 10 (15) мм шириной; соцветия умеренно рыхлые; листочки околоцветника беловатые с незаметной средней жилкой ..... (82) *Allium chitralicum*
25. Листовая пластинка гладкая, верхняя часть часто штопорообразно скрученная; листочки околоцветника розовато-желтоватые ..... (81) *Allium sergii*
- 25\* Листовая пластинка дугообразно восходящая и загнутая к почве, ребра и края покрыты мелкими белыми, назад направленными волосками; листочки околоцветника розовато-зеленоватые . ..... (83) *Allium eugenii*
26. (23\*) Цветоножки на кончике уплощенные; цветки плоские воронкообразные; цветоножки со спелыми коробочками опадающие; стебли слегка извилистые, высотой 15-25 см ... (73) *Allium khozratense* секц. 15. *Thaumasioprason*
- 26\* Цветоножки слегка обратноконические на кончике; цветки плоские,  $\pm$  чашеобразные или воронковидные; спелые коробочки в основном не опадают ..... 27
27. Вершина завязи с шестью роговыми выростами; листовая пластинка узколанцетная, в 3-5 раз длиннее, чем (выше почвы) 1-3 см высотой стебель; листочки околоцветника длинно-эллиптические, прямые после опыления ..... (71) *Allium hexaceras* секц. 13. *Acaule*
- 27\* Завязь без роговых выростов, стебли выше ..... 28
28. Листовые пластинки разделены на длинные нитевидные части, гораздо короче стеблей; соцветие всегда рыхлое, зонтиковидное ..... секц. 9. *Verticillata* 29
- 28\* Листовые пластинки яйцевидные или ланцетные до линейных, продольно не разделенные ..... 30
29. Цветки чашеобразные, листочки околоцветника красновато-розоватые, 2-2.5 мм шириной, с широкой и темной средней жилкой ..... (58) *Allium verticillatum*
- 29\* Цветки плоские, листочки околоцветника желто-зеленые, 1-1.3 мм шириной, у основания изогнутые, верхушки внутрь загнутые ..... (59) *Allium viridiflorum*
30. Листьев 1-2, листовая пластинка  $\pm$  линейная или узколанцетная ..... 33
- 30\* Листьев 1-3 или 4-8, в основном яйцевидные, реже широко линейные или ланцетные, у основания желобчатые, реже более чем в два раза длиннее, чем стебли; стебли часто толще, чем 8 мм ниже соцветия; листочки околоцветника языкообразные или длинно-ланцетные до треугольных, на стадии плодоношения прямые, иногда твердые и колючие . 31





31. Flowers flat star-like; tepals straight or recurved; filaments basally united forming a cup separate from the tepals; ovaries pyriform (stipitate), dull and tuberculate (rarely smooth and shiny) sect. 4. *Asteroprason* 32

31\* Flowers broadly funnel-shaped star-like,  $\pm$  ovoid, or campanulate, tepals straight or incurved; inflorescences always loose with pedicels of unequal length; ovaries turbinate or depressed-pyriform, rarely depressed-globose, smooth and dull; filaments basally  $\pm$  united but not cuplike sect. 16. *Kaloprason* 35

32. Plants compact, small; leaves only basally  $\pm$  toothed; tepals 5-7 mm long, linear-oblong, canaliculate, finally crumpled, not prickly in the fruiting stage; leaves 5-6 (8), laminae very narrowly linear-lanceolate,  $\pm$  screw-like curved, longer than the scape

(23) *Allium helicophyllum* subsect. 4.1 *Asteroprason*

32\* Stature larger; leaf laminae shorter than the scape, hairy or at least densely toothed along margins; tepals 10-15 mm long, in the fruiting stage stiff and prickly subsect. 4.2 *Cristophiana* 34

33. Leaves 1-2, lamina lengthwise folded, as long as the flexuous and narrow (4-6 mm in diameter) scape; inflorescences loose, subglobose, pedicels incurved, in anthesis unequally long; tepals concave, ovate (70) *Allium aroides* sect. 12. *Aroidea*

33\* Leaves 1 (rarely 2), laminae narrowly lanceolate, longer than the slightly bent scape, arcuately recurved to the soil; inflorescence  $\pm$  dense; tepals linear-lanceolate

(24) *Allium monophyllum* subsect. 4.1 *Asteroprason*

34. Plants slender with narrow and curved leaf laminae,  $\pm$  deep silvery-violet tepals, and purple filaments

(25) *Allium cristophii* subsp. *cristophii*

34\* Plants more stocky with broader and shorter (and often really woolly) leaves straight when growing out, silvery-brownish tepals, and maroon filaments

(26) *Allium cristophii* subsp. *golestanicum*

35. (31\*) Leaves 3-6, laminae lanceolate to linear-oblong; flowers  $\pm$  broadly funnel-shaped; ovaries depressed-globose 36

35\* Leaves 1-3; flower shape divers; ovaries depressed-pyriform or turbinate 37

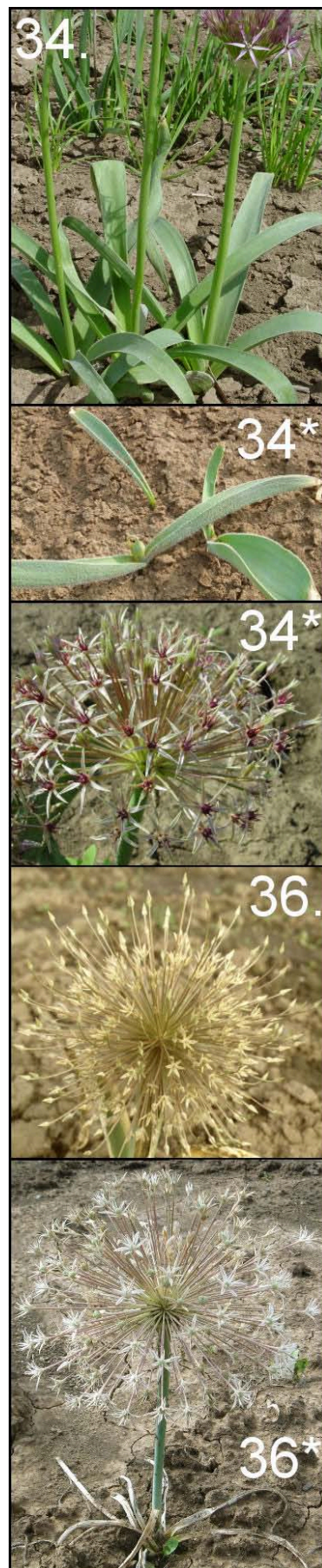
36. Leaf laminae up to 7 (10) cm broad; pedicels of the last flowers about 3-4 times longer as those of the first flowers; tepals whitish to pink or pale brown

(80) *Allium protensum* subsect. 16.2 *Ligulifolia*

36\* Leaf laminae 1-2 (3) cm broad; pedicels of the last flowers about twice longer than those of the first flowers, filaments slightly shorter than the tepals; tepals whitish to pale rose

(76) *Allium bucharicum* subsect. 16.1 *Kaloprason*

31. Цветки плоские звездчатые; листочки околоцветника прямые или отогнутые; нити тычинок у основания сросшиеся, образуя чашку отдельно от околоцветника; завязь грушевидная (на ножке), тусклая и покрыта бугорками (редко гладкая и блестящая) ..... секц. 4. *Asteroprason* 32
- 31\* Цветки широко воронкообразные звездчатые, ± яйцевидные или колокольчатые, листочки околоцветника прямые или изогнутые; соцветия всегда рыхлые с цветоножками разной длины; завязь носовидная или придавленно-грушевидная, реже придавленно-шаровидная, гладкая и тусклая; нити тычинок у основания ± сросшиеся, но не чашеобразно ..... секц. 16. *Kaloprason* 35
32. Растения компактные, маленькие; листья только у основания ± зубчатые; листочки околоцветника 5-7 мм длиной, линейно-продолговатые, желобчатые, в конце мятые, в стадии плодоношения не колючие; листьев 5-6 (8), листовые пластинки очень узко линейно-ланцетные, ± винтовато изогнутые, длиннее стебля  
..... (23) *Allium helicophyllum* подсекц. 4.1 *Asteroprason*
- 32\* Растение крупнее; листовые пластинки короче стеблей, волосатые или, по крайней мере, часто зубчатые по краям; листочки околоцветника 10-15 мм длиной, в стадии плодоношения жесткие и колючие  
..... подсекц. 4.2 *Cristophiana* 34
33. Листьев 1-2, листовая пластинка продольно сложена, длинной как извилистые и узкие (4-6 мм в диаметре) стебли; соцветия рыхлые, почти шаровидные, цветоножки изогнутые, после цветения неодинаковой длины; листочки околоцветника вогнутые, яйцевидные  
..... (70) *Allium aroides* секц. 12. *Aroidea*
- 33\* Листьев 1 (редко 2), листовая пластинка узколанцетная, длиннее, чем слегка изогнутый стебель, дугообразно отогнутые к почве; соцветие ± густое; листочки околоцветника линейно-ланцетные  
..... (24) *Allium monophyllum* подсекц. 4.1 *Asteroprason*
34. Растения стройные с узкой и изогнутой пластинкой листа, ± глубоко серебристо-фиолетовыми листочками околоцветника и с фиолетовыми тычиночными нитями  
..... (25) *Allium cristophii* subsp. *cristophii*
- 34\* Растения более приземистые с более широкими и более короткими (и часто очень пушистыми) прямыми листьями, серебристо-коричневыми листочками околоцветника и темно-бордовыми тычиночными нитями  
..... (26) *Allium cristophii* subsp. *golestanicum*
35. (31\*) Листьев 3-6, листовые пластинки ланцетовидные до линейно-продолговатых; цветки ± широко воронкообразное; завязь придавленно-шаровидная ..... 36
- 35\* Листьев 1-3; формы цветка разная; завязь придавленно-грушевидные или носоватые ..... 37
36. Листовые пластинки до 7 (10) см в ширину; цветоножки последних цветов примерно в 3-4 раза длиннее, чем у первых цветков; листочки околоцветника белые до розового или светло-коричневые  
..... (80) *Allium protensum* подсекц. 16.2 *Ligulifolia*
- 36\* Листовые пластинки 1-2 (3) см в ширину; цветоножки последних цветов примерно в два раза длиннее, чем у первых цветков, нити тычинок немного короче околоцветника; листочки околоцветника от белого до бледно-розового  
..... (76) *Allium bucharicum* подсекц. 16.1 *Kaloprason*





37. Leaf laminae narrowly oblong to broadly lanceolate, canaliculate, always green; flowers ovate or campanulate triangular; filaments about twice longer than the tepals; ovaries six-angled turbinate subsect. 16.1 *Kaloprason* 38
- 37\* Leaf laminae initially sulcate and greenish violet with purple margin, long (ob-)ovate to oblong-elliptical; flowers star-like funnel-shaped; tepals patent, after anthesis  $\pm$  convolute, crumpled or erect and prickly subsect. 16.2 *Ligulifolia* 39
38. Tepals pinkish to greenish violet; pedicels of the last flowers about 3-5 times as long as those of the first flowers; grows on sandy desert areas (74) *Allium caspium* subsp. *caspium*
- 38\* Tepals pale to whitish (on red soil also red); pedicels of the last flowers about twice as long as those of the first flowers; grows on strongly gypseous-saline slopes (75) *Allium caspium* subsp. *baissunense*
39. Leaves 9-10 cm long and c. 3-3.5 cm wide; pedicels of  $\pm$  equal length; filaments longer than the pale red tepals (78) *Allium decoratum*
- 39\* Leaves 10-35 cm long and 2.5-7 (12) cm broad; filaments shorter than the tepals 40
40. Flowers broadly funnel-shaped, tepals lanceolate, patent, dirty red or greenish-brown, in the dry state prickly by a thick stiff median vein (77) *Allium alexeianum*
- 40\* Flowers narrower funnel-shaped, tepals narrowly lanceolate, somewhat recurved, pink to purplish, in the dry state soft becoming only crumbled (79) *Allium nevskianum*
41. (18\*) Nectaries mound as a pocket-like cave slightly above the base of the ovary; scape always smooth and dull; inflorescences moderately dense; tepals concave to canaliculate, ovaries always sessile and coarse sect. 2. *Decipientia* p. p. 42
- 41\* Nectaries mound as hole, pit, or short slit near the base of the ovary; scape and inflorescences variously shaped; ovaries shortly or distinctly stipitate; tepals rarely concave-canaliculate 43
42. Scape 60-80 cm long,  $\pm$  straight; leaf laminae  $\pm$  oblong lanceolate, 1-2 cm broad and 15-20 cm long; tepals patent, later reflexed, 5-6 mm long, purplish with darker to greenish median vein; filaments purplish (4) *Allium robustum*
- 42\* Scapes 20-25 cm long, ascending to flexuous; leaf laminae narrowly linear-lanceolate, 5-10 mm broad, 10-15 cm long; tepals obliquely forward directed, later patent, 4-5 mm long, whitish-green or reddish with thin darker median vein; filaments white (6) *Allium viridulum*
43. (41\*) Scape during anthesis regularly longer than about 80 cm or shorter when basally ribbed; ovaries sometimes colored 44
- 43\* Scape not ribbed and during anthesis only exceptionally so long; ovaries during the whole anthesis green 51

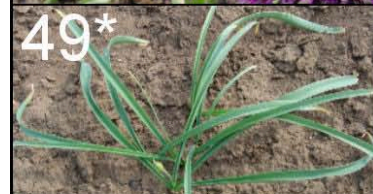
37. Листовые пластинки узко продолговатые до широко ланцетных, желобчатые, всегда зеленые; цветки яйцевидные или колокольчато треугольной формы; нити тычинок примерно в два раза длиннее листочков околоцветника, завязь шестигульная, носообразная ..... subsect. 16.1 *Kaloprason* 38
- 37\* Листовые пластинки сначала бороздчатые и зеленовато-фиолетовые с фиолетовым краем, длинные яйцевидные до продолговато-эллиптических; цветки звездчатообразные в форме воронки; листочки околоцветника прямые, после цветения гофрированные, мятые или торчащие и колючие .  
..... подсекц. 16.2 *Ligulifolia* 39
38. Листочки околоцветника розоватые до зеленовато-фиолетового; цветоножки последних цветов около 3-5 раз длиннее первых цветков; растет на песчаных пустынных районах  
..... (74) *Allium caspium subsp. caspium*
- 38\* Листочки околоцветника бледные до беловатых (на красной почве тоже красные); цветоножки последних цветков примерно вдвое длиннее, чем у первых цветков; растет на сильно гипсово-засоленных склонах  
..... (75) *Allium caspium subsp. baissunense*
39. Листья 9-10 см длиной и примерно 3-3,5 см в ширину; цветоножки ± одинаковой длины; нити тычинок длиннее бледнокрасных листочков околоцветника .... (78) *Allium decoratum*
- 39\* Листья 10-35 см длиной и 2,5-7 (12) см в ширину; нити тычинок короче листочков околоцветника ..... 40
40. Цветки широко воронковидные, листочки околоцветника ланцетные, прямые, грязно красные или зеленовато-коричневые, в сухом состоянии в районе толстой жесткой срединной жилки колючие ..... (77) *Allium alexeianum*
- 40\* Цветки узковоронковидные, листочки околоцветника узколанцетные, слегка скрученные, розовые до пурпурных, в сухом состоянии мягкие, осыпающиеся ..... (79) *Allium nevskianum*
41. (18\*) Нектарники в форме карманообразного углубления слегка нависают над основанием завязи; стебли всегда гладкие и тусклые; соцветия умеренно густые; листочки околоцветника вогнутые до канальчатых; завязи всегда сидячие и шероховатые ..... секц. 2. *Decipientia* p. p. 42
- 41\* Нектарники в форме отверстия, ямы или короткой щели у основания завязи; стебли и соцветия различной формы; завязь на короткой или отчетливой ножке; листочки околоцветника редко вогнутые и канальчатые ..... 43
42. Стебли 60-80 см высотой, ± прямые; листовые пластинки ± продолговато-ланцетные, 1-2 см шириной и 15-20 см длиной; листочки околоцветника прямые, позднее отогнутые, 5-6 мм длиной, пурпурные с более темной до зеленоватой средней жилкой; тычинки пурпурные с более темным зеленовато-средней жилкой; тычинки пурпурные ..... (4) *Allium robustum*
- 42\* Стебли 20-25 см высотой, восходящие до извилистых; листовые пластинки узко линейно-ланцетные, 5-10 мм шириной, 10-15 см длиной; листочки околоцветника косо вверх направленные, позже прямые, 4-5 мм длиной, беловато-зеленые или красноватые с тонкой темной средней жилкой; тычинки белые ..... (6) *Allium viridulum*
43. (41\*) Стебли во время цветения регулярно выше чем 80 см или короче если у основания ребристые; завязь иногда окрашена 44
- 43\* Стебель не ребристый и во время цветения только в исключительных случаях такой высокий; завязи в течении всего цветения зеленые ..... 51





44. Flowers white or crème, tepals narrowly lanceolate or triangular sect. 8. *Acmopetala* subsect. 8.1 *Acmopetala* 45
- 44\* Flowers lilac to pinkish-purple; tepals oblong to lanceolate 46
45. Tepals triangular, ± translucent white; leaf laminae oblong, 4-10 cm broad, margins above glabrous  
(39) *Allium backhousianum*
- 45\* Tepals narrowly linear, crème; leaf laminae linear-lanceolate, 2-4 cm broad, margins above coarse (49) *Allium zergericum*
46. Leaf laminae linear-lanceolate, sometimes pubescent, up to 8 (12) cm broad; scape smooth or ribbed; ripe capsules open widely and do not drop down sect. 11. *Procerallium* 48
- 46\* Leaf laminae oblong to broadly lanceolate, 3-10 cm wide, margins smooth; scape always smooth, dull  
sect. 10. *Compactoprasum* p. p. 47
47. Tepals after anthesis not reflexed; ripe capsules open with a narrow slit and drop down  
(60) *Allium giganteum* subsect. 10.1 *Erectopetala*
- 47\* Tepals after anthesis reflexed and spirally enrolled; capsules open by a wider slit and do not drop  
(65) *Allium majus* subsect. 10.3 *Spiralopetala*
48. Scape at least in its lower part lengthwise prominently ribbed, 30-80 (120) cm long; leaf laminae up to 3.5 (5) cm wide, never pubescent  
subsect. 11.2 *Costatae* 49
- 48\* Scape smooth (but ribbed when dry), (50) 80-120 (150) cm long; leaf laminae up to 8 (12) cm broad, sometimes pubescent  
subsect. 11.1 *Elatae* 50
49. Scape only basally ribbed; leaf laminae moderately canaliculate, basally for 1/3-1/2 narrower; upper part of filaments initially purely white (68) *Allium jesdianum* subsp. *angustitepalum*
- 49\* Scape completely covered by ribs; leaf laminae ± strongly canaliculate, basally scarcely narrower; upper part of filaments rose, later lilac to pinkish-carmine (69) *Allium rosenorum*
50. Scapes mostly longer than 120 cm; leaf laminae (3) 5-12 cm broad, recurved to the soil, sparsely to densely hairy, at least dentate along margins and on the veins; tepals mostly long-triangular, 8-12 mm long and 1.3-2 mm broad, lilac to pinkish-carmine, after anthesis reflexed; inner filament bases only slightly broader than bases of outer filaments  
(66) *Allium stipitatum*
- 50\* Scapes (80) to 120 cm long; leaf laminae obliquely erect, 2-6 (9) cm broad, glabrous (or at the most only sparsely toothed); tepals ± (dark) purple, the basal half sublinear, 6-8 mm long and 2-2.5 mm broad, already in full anthesis recurved; inner filament bases about 1.4-1.7 times broader than outer ones  
(67) *Allium altissimum*

44. Цветки белые или кремовые, листочки околоцветника узко ланцетные или треугольные  
..... секц. 8. *Acropetala* подсекц. 8.1 *Acropetala* 45
- 44\* Цветки сиреневые до розовато-пурпурных; листочки околоцветников удлинненные до ланцетных ..... 46
45. Листочки околоцветника треугольные, ± полупрозрачные белые; листовые пластинки продолговатые, 4-10 см в ширину, с гладкими краями ..... (39) *Allium backhousianum*
- 45\* Листочки околоцветника узколинейные, кремовые; листовые пластинки линейно-ланцетные, 2-4 см шириной, шероховатые ..... (49) *Allium zergericum*
46. Листовые пластинки линейно-ланцетные, иногда опушенные, до 8 (12) см в ширину; стебли гладкие или ребристые; спелые коробочки широко открытые и не опадающие  
..... секц. 11. *Procerallium* 48
- 46\* Листовые пластинки продолговатые до широко ланцетных, 3-10 см шириной, края гладкие; стебли всегда гладкие, матовые ..... sect. 10. *Compactoprasum* p. p. 47
47. Листочки околоцветника после цветения не отогнутые; спелые коробочки открытые с узкой щелью и опадающие  
..... (60) *Allium giganteum* подсекц. 10.1 *Erectopetala*
- 47\* Листочки околоцветника после цветения отогнутые и спирально закрученные; спелые коробочки широко открытые и не опадающие  
..... (65) *Allium majus* подсекц. 10.3 *Spiralopetala*
48. Стебли, по крайней мере, в своей нижней части в продольном направлении заметно ребристые, 30-80 (120) см высотой; листовые пластинки до 3,5 (5) см шириной, не опушенные ..... subsect. 11.2 *Costatae* 49
- 48\* Стебли гладкие (но ребристые, когда сухие), (50) 80-120 (150) см высотой; пластинки листа до 8 (12) см шириной, иногда опушенные ..... subsect. 11.1 *Elatae* 50
49. Стебли только у основания ребристые; листовые пластинки умеренно вальковатые, у основания до 1/3-1/2 более узкие; верхняя часть тычиночных нитей изначально чисто белые  
..... (68) *Allium jesdianum* subsp. *angustitepalum*
- 49\* Стебли полностью покрыты ребрами; листовые пластинки ± желобчатые, у основания едва более узкие; верхняя часть тычиночных нитей розовые, позднее фиолетовые то розовато-карминных ..... (69) *Allium rosenorum*
50. Стебли обычно выше 120 см; листовые пластинки (3) 5-12 см шириной, загнутые назад к почве, от скудно до густоволосистых, или по крайней мере зубчатыми по краям и на жилках; листочки околоцветника в основном длинно-треугольные, 8-12 мм длиной и 1.3-2 мм шириной, сиреневые до розовато-карминных, после цветения отогнутые; основания внутренних тычинок лишь немного шире, чем основания внешних тычинок ..... (66) *Allium stipitatum*
- 50\* Стебли (80) до 120 см высоты; листовые пластинки наклонно прямостоячие, 2-6 (9) см шириной, голые (или в лучшем случае лишь слабо зубчатые); листочки околоцветника ± (темно) фиолетовые, у нижней половины полулинейные, 6-8 мм длиной и 2-2,5 мм шириной, уже во мере цветения отогнутые; основания внутренних тычинок в 1,4-1,7 раза шире, чем у наружных ..... (67) *Allium altissimum*





52.



52



52\*



53.



54\*



54\*

51. (43\*) Inflorescences (sub)globose, very dense (up to 3000 flowers) with thin pedicels of unequal length, at least 5 cm in diam.; capsules depressed-globose tripartite (but often misformed with only one seed per capsule), they open with three narrow slits and finally drop down

sect. 10. *Compactoprason* subsect.10.1 *Erectopetala* 52

- 51\* Inflorescences fastigiate to globose or ovoid, moderately dense, often smaller than 10 cm in diam., also in the fruiting stage with pedicels of subequal length; capsules obconical or ovoid and do not drop down; ± widely opening 55

52. Leaf laminae vividly green, ± glossy; scape rarely longer than 80 cm; tepals lanceolate, subacute to subobtuse, 6-7.5 mm long; filaments up to 1/4 longer than the tepals (62) *Allium macleanii*

- 52\* Leaf laminae dull bluish-green; scapes shorter or longer than 80 cm 53

53. Scape commonly longer than 80 cm; leaves 4-7 (10); tepals oblong, obtuse, 5-6 mm long; filaments 1.5 times longer than the tepals (60) *Allium giganteum*

- 53\* Scape shorter than 80 cm, leaf number 2-5 54

54. Leaf laminae broadly oblong, tapering towards the base, 25 cm long, 4-5 cm broad, green; tepals lanceolate, violet; filaments c. 1/4 longer than the tepals (capsules not known)

(61) *Allium isfairamicum*

- 54\* Leaf laminae oblong-lanceolate, 30-35 cm long, (2) 3-7 (10) cm broad, dull gray-green; tepals elliptic to broadly lanceolate, glossy purple; filaments as long as the tepals; ripe capsules with pedicels drop from the receptacle (63) *Allium trautvetterianum*

55. (50\*) Leaf laminae broadly lanceolate, sulcate, violetish-green; inflorescences ± semiglobose (64) *Allium komarowii*

sect. 10. *Compactoprason* subsect. 10.2 *Komaroviana*

- 55\* Leaf laminae variously shaped, without conspicuous furrows, often glaucous but not violetish-green; inflorescences subglobose to ovoid 56

56. Leaves 1-4 (rarely up to 6); bulb tunics membranous or stronger, only slightly split into fibers and finally decomposing 58

- 56\* Leaves 3-6 (10); bulb tunics strong, ± split into fibers and elongated in a ± long neck 57

57. Scape 15-30 (60) cm long, less than 5 mm in diam.; leaf laminae very narrowly linear, narrowly canaliculate, 2-5 (7) mm broad; ovaries papillous, initially violet

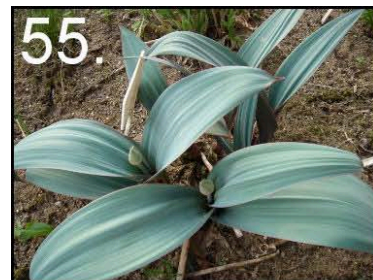
(31) *Allium insufficiens* subsect. 6.1 *Megaloprason*

- 57\* Scape 30-60 (100) cm long; leaf laminae linear-lanceolate, 2-6 cm broad; ovaries glossy, smooth with even or slightly convex epidermis cell walls, always green

(36) *Allium suworowii* subsect. 6.4 *Spiralitunicata*



51. (43\*) Соцветия (полу) шаровидные, очень густые (до 3000 цветков) с тонкими цветоножками разной длины, по меньшей мере 5 см в диаметре; коробочки прижато-шаровидные трехраздельные (но часто деформированные только с одним семенем на коробочку), открываются с тремя узкими щелями и в конце опадающие  
секц. 10. *Compactoprason* подсекц. 10.1 *Erectopetala* 52
- 51\* Соцветия пучковатые до шаровидных или яйцевидные, умеренно густые, часто меньше, чем 10 см в диаметре, и также на стадии плодоношения с цветоножками почти равной длины; коробочки обратноконические или яйцевидные и не опадающие; ± широко открывающиеся ..... 55
52. Листовые пластинки ярко-зеленые, ± глянцевые; стебли редко выше 80 см; листочки околоцветника ланцетные, полуострые до полутупых, 6-7,5 мм длиной; тычинки до 1/4 длиннее листочков околоцветника .... (62) *Allium macleanii*
- 52\* Листовые пластинки тусклые голубовато-зеленые; стебель ниже или выше 80 см ..... 53
53. Стебли обычно выше, чем 80 см; листьев 4-7 (10); листочки околоцветника продолговатые, тупые, 5-6 мм длиной; тычинки в 1,5 раза длиннее околоцветника  
..... (60) *Allium giganteum*
- 53\* Стебель ниже чем 80 см; листьев 2-5 ..... 54
54. Листовые пластинки широко продолговатые, суженные к основанию, 25 см длиной, 4-5 см шириной, зеленые; листочки околоцветника ланцетные, фиолетовые; тычинки на 1/4 длиннее листочков околоцветника (коробочки не известны) ..... (61) *Allium isfairamicum*
- 54\* Листовые пластинки продолговато-ланцетные, 30-35 см длиной, (2) 3-7 (10) см в ширину; тускло серо-зеленые; листочки околоцветника эллиптические до широко-ланцетных, пурпурно глянцевые; тычинки одинаковой длины с лепестками околоцветников, спелые коробочки с черешками опадающие ..... (63) *Allium trautvetterianum*
55. (50\*) Листовые пластинки широко ланцетные, бороздчатые, фиолетово-зеленые; соцветия ± полушаровидные  
..... (64) *Allium komarowii*  
.....секц. 10. *Compactoprason* подсекц. 10.2 *Komaroviana*
- 55\* Листовые пластинки различной формы, без заметных борозд, часто сизоватые, но не фиолетово-зеленые; соцветия полушаровидные до яйцевидных ..... 56
56. Листьев 1-4 (редко до 6); оболочки луковиц перепончатые или крепче, только слегка расщепляются на волокна и, наконец, разлагающиеся ..... 58
- 56\* Листьев 3-6 (10); оболочки луковиц крепкие, ± разделенные на волокна и вытянутые в ± длинные шлейфы ..... 57
57. Стебли 15-30 (60) см высотой, менее 5 мм в диаметре; листовые пластинки очень узко линейные, узко желобчатые, 2-5 (7) мм шириной; завязь шероховатая, изначально фиолетовая (31) *Allium insufficiens* подсекц. 6.1 *Megaloprason*
- 57\* Стебли 30-60 (100) см высотой; листовые пластинки линейно-ланцетные, 2-6 см шириной; завязь глянцевая, гладкая с ровной или слегка выпуклой стенкой клеток эпидермиса, всегда зеленая  
..... (36) *Allium suworowii* подсекц. 6.4 *Spiraliticata*





58. Leaf laminae 2-6 (10) cm broad, oblong- to linear-lanceolate, margins basally overlapping and collar-like outside bent; apex of the papillate ovary with obliquely-upwards directed and radially elongated outgrowths

(35) *Allium sarawschanicum* subsect. 6.3 *Keratoprason*

58\* Base of leaf laminae without collar-like outside bent margins; apex of ovary without prominent outgrowths 59

59. Leaf laminae ± glossy yellowish green, ± lanceolate, never hairy, basally slightly or distinctly petiole-like narrowed; inflorescences depressed-globose; flowers ± flat-starlike, capsule open widely subsect. 6.1 *Megaloprason* 60

59\* Leaf laminae dull green, often with strong glaucous bloom; inflorescences sometimes ovate; flowers cup- or bowlshaped- (rarely flat-) starlike; capsule open moderately widely 62

60. Scape 60-80 cm high; leaf blades nearly straight positioned, often screw-like twisted, basally only slightly narrowed

(32) *Allium kwakense*

60\* Scape 40-50 (80) cm long; leaf laminae initially prostrate, later obliquely sideways curved 61

61. Tepals inconspicuously silvery-pinkish; leaves basally stalk-like narrowed (30) *Allium rosenbachianum*

61\* Tepals lilac-violet; leaves without stalk-like base

(33) *Allium schugnanicum*

62. Scapes ± cylindrical (terete), widest in the basal part; inflorescences semi- to subglobose and finally longer than broad; flowers bowl-shaped star-like; tepals ± acute, median vein diverse; capsules open ± moderately widely; filament position oblique or straight 66

62\* Scapes obconical, widest below the moderately loose, depressed-globose inflorescences; flowers flat star-like; tepals obtuse with narrow median vein 63

63. Leaf laminae broadly linear-lanceolate; tepals oblong to obovate, 6-8 mm long, whitish to very pale lilac; filaments obliquely sideways directed

(5) *Allium tulipifolium* var. *subscabrum* sect. 2. *Decipientia*

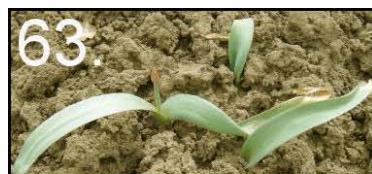
63\* Leaf laminae narrowly lanceolate; tepals narrowly linear-lanceolate, 7-12 mm long, pale yellow to carmine; filaments straight, upper half recurved sect. 5. *Stellata* 64

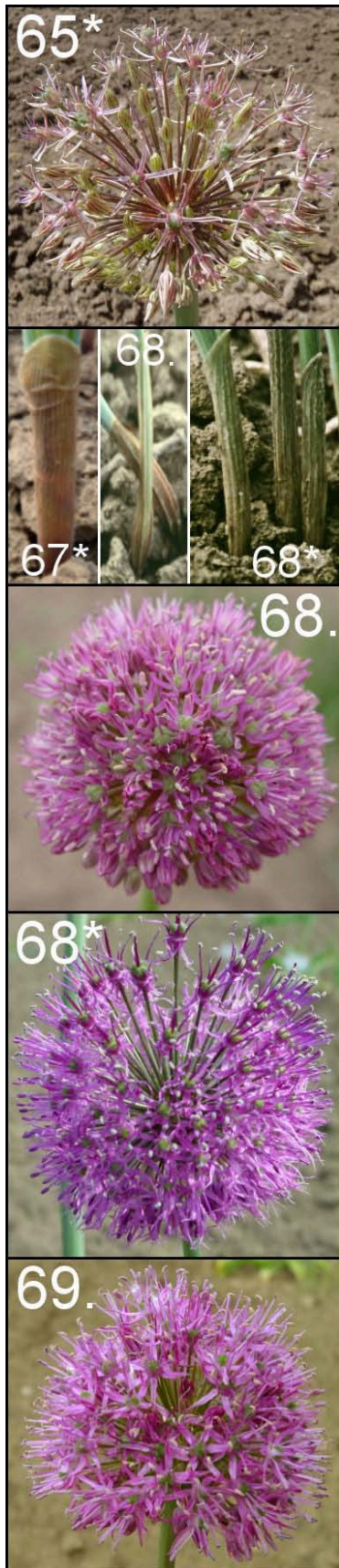
64. Flowers pinkish or deep pink to carmine with a yellowish flush; plants prefer shady places 65

64\* Flowers pale yellow or somewhat reddish tinged; filament bases ovately widened; plants prefer dry and warm limestone slopes (29) *Allium taeniopetalum* subsp. *turakulovii*

65. Flowers ± carmine; filaments basally short-triangular widened (27) *Allium taeniopetalum* subsp. *taeniopetalum*

58. Листовые пластинки 2-6 (10) см шириной, продолговато-до линейно-ланцетных, у основания края перекрываются и наружу согнутые, образуя воротник; верхушка бородавчатой завязи с вверх наклонно-направленными и радиально вытянутыми выростами  
.. (35) *Allium sarawschanicum* подсекц. 6.3 *Keratoprason*
- 58\* Основание пластинки листа без воротника; верхушка завязи без заметных выростов ..... 59
59. Листовые пластинки ± глянцевые желтовато-зеленые, ± ланцетные, никогда не волосатые, у основания слегка или отчетливо сужаются; соцветия прижато-шаровидные; цветки ± плоско-звездноподобные, коробочка широко открывающаяся ..... подсекц. 6.1 *Megaloprason* 60
- 59\* Листовые пластинки тускло-зеленые, часто с сильным сизым налетом; соцветия иногда яйцевидные; цветки чаше- или миско-образные (редко плоско) звездчатые; коробочка открывается умеренно широко ..... 62
60. Стебли 60-80 см высотой; листовые пластинки почти прямые, часто винтовато-скрученные, у основания только слегка суженные ..... (32) *Allium kwakense*
- 60\* Стебли 40-50 (80) см высотой; листовые пластинки изначально лежащие, позднее наклонно вбок изогнутые ..... 61
61. Листочки околоцветника неприметно серебристо-розовые; листья у основания черешкообразно суженные ..... (30) *Allium rosenbachianum*
- 61\* Листочки околоцветника сиренево-фиолетовые; листья у основания без черешкообразного сужения ..... (33) *Allium schugnanicum*
62. Стебли ± цилиндрические (вальковатые), самые широкие у основания; соцветия полушаровидные и в конце более длинные, чем широкие; цветки чашеобразно-звездчатые; листочки околоцветника ± острые, средняя жилка разнообразная; коробочки открываются ± умеренно широко; тычиночные нити косые или прямые ..... 66
- 62\* Стебли обратно-конические, самая широкая часть под умеренно рыхлым, прижато-шаровидным соцветием; цветки плоско-звездчатые; листочки околоцветника тупые с узкой средней жилкой ..... 63
63. Листовые пластинки широко линейно-ланцетные; листочки околоцветника продолговатые до овальных, 6-8 мм длиной, беловатые до очень бледно-сиреневые; нити тычинок наклонно вбок направленные  
(5) *Allium tulipifolium* var. *subscabrum* секц. 2. *Decipientia*
- 63\* Листовые пластинки узко ланцетные; листочки околоцветника узко линейно-ланцетные, 7-12 мм длиной, бледно-желтые до карминного; тычинки тоечашие, верхняя половина отогнутая ..... секц.5. *Stellata* 64
64. Цветки розоватые или темно-розовые до карминного с желтоватым румянцем, растения предпочитают тенистые места ..... 65
- 64\* Цветки бледно-желтые или с несколько красноватым оттенком; основания тычиночных нитей яйцевидно-расширенные; растения предпочитают сухие и теплые известняковые склоны (29) *Allium taeniopetalum* subsp. *turakulovii*
65. Цветки ± карминные, основания тычиночных нитей коротко треугольно-расширенные  
..... (27) *Allium taeniopetalum* subsp. *taeniopetalum*





- 65\* Flowers pink with a yellowish flush; filaments basally short-rectangular widened  
(28) *Allium taeniopetalum* subsp. *mogoltavicum*
66. (62) Sheathy prophyll (outermost leaf without lamina) coarse or with prominent ribs, dull, during anthesis still present  
sect. 8. *Acmopetala* subsect. 8.3 *Durovaginata* 67
- 66\* Sheathy prophyll smooth, tender, translucent or brownish, glossy, quickly decaying 70
67. Sheathy prophyll with about 10-20 broad ribs 68
- 67\* Sheathy prophyll with about 20-35 fine shallow but coarse ribs, filaments basally shortly connate and triangular widened (inner filaments often with 2 teeth) 69
68. Sheathy prophyll strong, brown with high sharp ribs; filaments somewhat longer than the 4-6 mm long tepals, bases glabrous and edentate (51) *Allium costatovaginatum*
- 68\* Sheathy prophyll more papery, pale brownish-gray with shallow ribs; filaments  $\pm$  as long as the 8-10 mm long tepals, all bases with two subobtusate, outside ciliate teeth  
(52) *Allium dodecadontum*
69. Sheathy prophyll strong papery, very scabrid, pale brown with maroon veins; tepals at the back with purple greenish median vein; filaments pinkish-purple (53) *Allium severtzovioides*
- 69\* Sheathy prophyll thin-leathery, slightly scabrid, pale; tepals with inconspicuous median vein; filaments pinkish  
(54) *Allium tokaliense*
70. (66\*) Tepals subobtusate to obtuse, 4-7 mm long, either white or inconspicuously yellowish-pinkish; median vein widest and thickest in the upper half of the tepals; scape 30-60 (90) cm long, cylindrical, smooth; leaf laminae linear-lanceolate, dull or glossy, up to 4.5 cm wide sect. 8. *Acmopetala* p. p. 71
- 70\* Tepals obtuse or acute, 6-10 mm long, of various colors and shape, median veins  $\pm$  narrow, often very thin toward the apex; scape 50-80 (120) cm long; leaf laminae never glossy, sometimes much wider than 5 cm 74
71. Tepals and filaments white or crème 72
- 71\* Tepals pale yellow-pinkish, filaments pinkish-carmine to violet  
subsect. 8.4 *Inornatae* 73
72. Scapes 30-50 (90) cm long, smooth; leaf laminae with toothed margins; tepals and filaments white  
(50) *Allium saposhnikovii* subsect. 8.2 *Albidiflora*
- 72\* Scape 15-35 (50) cm long, like the narrow leaf laminae covered with dense hairs on the ribs; tepals crème, later greenish, with green, basally fading (in herbarium brown) median veins; filaments crème  
(44) *Allium dasyphyllum* subsect. 8.1 *Acmopetala*
73. Leaf laminae linear-lanceolate, 1-2.5 cm broad; dull green with glaucous bloom, basally often maroon (55) *Allium sewerzowii*

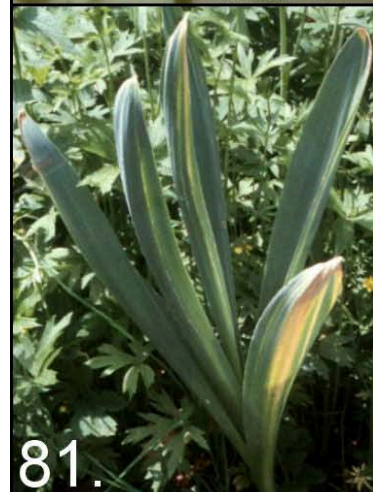
- 65\* Цветки розовые с желтоватым румянцем; нити тычинок у основания коротко прямоугольно-расширенные .....(28) *Allium taeniopetalum* subsp. *mogoltavicum*
66. (62) Вагинальный прелест (самый наружный лист без листовой пластинки) грубый или с выдающимися ребрами, тусклый, во время цветения все еще присутствует ..... секц. 8. *Acropetala* подсекц. 8.3 *Durovaginata* 67
- 66\* Вагинальный прелест гладкий, нежный, полупрозрачный или коричневатый, глянцевоый, быстро распадающийся .... 70
67. Вагинальный прелест с около 10-20 широкими ребрами 68
- 67\* Вагинальный прелест с около 20-35 мелких неглубоких, но грубых ребер; нити тычинок у основания коротко сросшиеся и треугольно расширенные (внутренние нити часто с двумя зубчиками) ..... 69
68. Вагинальный прелест грубый, коричневый с высокими острыми ребрами; тычинки немного длиннее чем 4-6 мм длинных листочков околоцветника, у основани голые и без зубцов ..... (51) *Allium costatovaginatum*
- 68\* Вагинальный прелест более бумагообразный, светло коричневато-серый с неглубокими ребрами; нити тычинок примерно одинаковы с 8-10 мм длинных листочков околоцветника, все основания с двумя полутупыми, на внешней стороне реснитчатыми зубцами ..... (52) *Allium dodecadontum*
69. Вагинальный прелест сильно бумагообразный, очень шершавый, бледно-коричневый с темно-бордовыми жилками; листочки околоцветника на спине с фиолетово-зеленоватой срединной жилкой; нити тычинок розовато-фиолетовые ..... (53) *Allium severtzovioides*
- 69\* Вагинальный прелест тонко-кожистый, слегка шершавый, бледный; листочки околоцветника с незаметной срединной жилкой; нити тычинок розовые ..... (54) *Allium tokaliense*
70. (66\*) Листочки околоцветника туповатые до тупых, 4-7 мм длиной, скорее белые или незаметно желтовато-розоватые; срединная жилка более широкая и толстая в верхней половине лепестков; стебель 30-60 (90) см высотой, цилиндрический, гладкий; листовая пластинка линейно-ланцетная, матовая или глянцевая, до 4,5 см шириной ..... секц. 8. *Acropetala* p. p. 71
- 70\* Листочки околоцветника тупые или острые, 6-10 мм длиной, различных цветов и формы, средние жилки ± узкие, часто очень тонкие к вершине; стебли 50-80 (120) см высотой, листовые пластинки никогда не глянцевые, иногда гораздо шире 5 см ..... 74
71. Листочки околоцветника и тычинки белые или кремовые 72
- 71\* Листочки околоцветника светло желто-розовые, тычинки розово-карминные до фиолетовых подсекц. 8.4 *Inornatae* 73
72. Стебли 30-50 (90) см высотой, гладкие; листовые пластинки с зубчатыми краями; листочки околоцветника и тычинки белые ..... (50) *Allium saposchnikovii* подсекц. 8.2 *Albidiflora*
- 72\* Стебли 15-35 (50) см высотой, как и узкие листовые пластинки покрыт густыми волосками на ребрах; листочки околоцветника кремовые, позже зеленоватые, с зелеными, к основанию угасающими (в гербарии коричневыми) средними жилками; тычинки кремовые ..... (44) *Allium dasyphyllum* подсекц. 8.1 *Acropetala*
73. Листовая пластинка линейно-ланцетная, 1-2.5 см шириной, матово зеленая с сизым налетом, у основания часто темно-бордовые ..... (55) *Allium sewerzowii*





- 73\* Leaf laminae oblong to linear-lanceolate, (0.8) 2-3.5 (4.5) cm broad; glossy yellowish green, initially basally with a purplish suffused lower side (56) *Allium tashkenticum*
74. (70\*) Tepals shining pink; bases of inner filaments with two or more long, never ciliate teeth sect. 1. *Longibidentata* 75
- 74\* Tepals whitish, pale violet, pink, or purplish, bases of inner filaments without or with two short, glabrous or long-ciliate teeth 76
75. Leaf laminae 15-30 (40) cm long, 0.7-2 (3) cm broad; tepals semi-reflexed, upper part incurved (2) *Allium fetisowii*
- 75\* Leaf laminae 20-25 cm long, 1.5-5 cm broad; tepals completely backwards turned (3) *Allium chychkanense*
76. Scape always smooth; leaf laminae linear-lanceolate, up to 3 cm wide, containing a red sap; inflorescences semiglobose-conical, dense, finally subconical and longer than wide; tepals obliquely patent, lanceolate-triangular and acuminate, purplish pink (57) *Allium tschimganicum* subsect. 8.5 *Pharmakoprason*
- 76\* Scape smooth or basally ribbed; leaf laminae narrow linear to broadly lanceolate, (0.5) 2-13 cm wide, sometimes hairy, only exceptionally with red sap; inflorescences finally rarely longer than wide; tepals subacute to obtuse (if long-acuminate then margins irregularly dentate), white or lilac to pink subsect. 8.1 *Acmopetala* 77 (small specimens of sect. *Procerallium* may also key out here, see 47)
77. Scape bases and leaf laminae ± densely covered by long, backwards directed hairs; scape above nearly smooth and glabrous; tepals pale violet with darker median vein (41) *Allium alaicum*
- 77\* Scapes and leaf laminae glabrous, sparsely hairy, or coarse by short teeth 78
78. Flowers whitish or crème 79
- 78\* Flowers pink to purplish 80
79. Tepals triangular, 10-15 mm long, whitish; leaf laminae oblong with smooth margins, 4-10 cm broad (39) *Allium backhousianum*
- 79\* Tepals narrowly linear, 8-9 mm long, crème; leaf laminae linear-lanceolate with coarse margins, 2-4 cm broad (49) *Allium zergericum*
80. Scape commonly 60-100 cm long, leaves 2-6 81
- 80\* Scape 30-60 cm long, with 1-2 (3) ± lanceolate or 3-5 very narrow leaves 82
81. Plants rather stout with 3-6 leaves; laminae oblong, 40-60 (70) cm long and 3-9 cm broad; tepals 9-10 mm long, basally 2-2.5 mm broad; deep pinkish-lilac to pale violet (40) *Allium aflatunense*

- 73\* Листовая пластинка продолговатая до линейно-ланцетной, (0,8) 2-3,5 (4,5) см шириной, глянцевая желто-зеленная, у основания вначале с пурпурным налетом на нижней стороне ..... (56) *Allium tashkenticum*
74. (70\*) Листочки околоцветника интенсивно блестяще розовые; основания внутренних тычинок с двумя или более длинными, но никогда не реснитчатыми зубцами ..... секц. 1. *Longibidentata* 75
- 74\* Листочки околоцветника беловатые, светло-фиолетовые, розовые или пурпурные; основания внутренних тычинок без или с двумя короткими голыми или с длинными реснитчатыми зубцами ..... 76
75. Листовая пластинка 15-30 (40) см длиной, 0,7-2 (3) см шириной; листочки околоцветника полу-отогнутые, верхняя часть вогнутая ..... (2) *Allium fetisowii*
- 75\* Листовая пластинка 20-25 см длиной, 1,5-5 см шириной; листочки околоцветника полностью назад повернутые ..... (3) *Allium chychkanense*
76. Стебли всегда гладкие; листовые пластинки линейно-ланцетные, до 3 см в ширину, содержащие красный сок; соцветия почти шаровидные-конические, густые, позднее, полуконические и длиннее, чем в ширину; листочки околоцветника косо торчащие, ланцетно-треугольные и заостренные, пурпурно-розовые  
.... (57) *Allium tschimganicum* подсекц. 8.5 *Pharmakoprason*
- 76\* Стебли гладкие или у основания ребристые; листовые пластинки узкие линейные до широко-ланцетных, (0,5) 2-13 см шириной, иногда волосатые, только в исключительных случаях с красным соком; соцветия, в конце редко длиннее, чем широкие; листочки околоцветника островатые до тупых (если длинно заостренные то края неравномерно зубчатые), белые или сиреневые до розовых ... подсекц. 8.1 *Actopetala* (мелкие виды секции *Procerallium* можно определять отсюда, смотри 47) ..... 77
77. Основание стеблей и листьев ± густо покрыты длинными, направленными назад волосками; стебли в верхней части гладкие и голые; листочки околоцветника бледно-фиолетовые с более темной средней жилкой .... (41) *Allium alaicum*
- 77\* Стебли и листовые пластинки голые, редко волосатые, или покрыты грубыми короткими зубцами ..... 78
78. Цветки беловатые или кремовые ..... 79
- 78\* Цветки розовые или пурпурные ..... 80
79. Листочки околоцветника треугольные, 10-15 мм длиной, беловатые; листовая пластинка удлинённая с гладкими краями, 4-10 см шириной ..... (39) *Allium backhousianum*
- 79\* Листочки околоцветника линейные, 8-9 мм длиной, кремовые; листовые пластинки линейно-ланцетные с грубыми краями, 2-4 см шириной ..... (49) *Allium zergericum*
80. Стебли обычно 60-100 см высотой, листьев 2-6 ..... 81
- 80\* Стебли 30-60 см высотой, с 1-2 (3) ± ланцетными или 3-5 очень узкими листьями ..... 82
81. Растения довольно крепкие с 3-6 листьями; листовые пластинки продолговатые, 40-60 (70) см в длину и 3-9 см в ширину; листочки околоцветника 9-10 мм длиной, у основания 2-2,5 мм шириной; глубоко розовато-сиреневые до бледно-фиолетового ..... (40) *Allium aflatunense*





81\* Plants rather slender with 2-3 leaves; laminae linear, flat, shorter than the scape, 1-3 cm broad; tepals linear-lanceolate, 5 mm long, pinkish-violet or dark purple (45) *Allium kurdaicum*

82. Leaves 3-5, 12-20 cm long, 2-5 mm broad, with sparsely hairy ribs; flowers flat star-like, mostly deep rose

(48) *Allium vvedenskyanum*

82\* Leaves 1-2 (3), commonly longer than 20 cm and at least 1 cm broad 83

83. Bases of inner filaments with 2 ciliate teeth; margins of tepals subciliate or dentate (46) *Allium pangasicum*

83\* Bases of all filaments without teeth; margins of tepals smooth 84

84. Filaments basally shortly connate; leaf laminae ± stiffly erect, smooth, 18-25 cm long, 2-5 cm broad; vividly green

(47) *Allium schachimardanicum*

84\* Filaments basally free; leaf laminae obliquely sideways curved, grayish green with strong glaucous bloom 85

85. Only one leaf present, lamina 25 cm long and 1.5 cm wide, linear-lanceolate, plane, glabrous; filaments basally ovate widened

(43) *Allium bekeczalicum*

85\* Leaves 1-2 (3), laminae (12) 20-40 cm long, 15-25 mm broad, margins narrowly white, densely scabrous; filaments basally shortly triangular widened (42) *Allium arkitense*

=====

81\* Растения довольно тонкие с 2-3 листьями; листовая пластинка линейная, плоская, короче стеблей, 1-3 см шириной; листочки околоцветника линейно-ланцетные, 5 мм длиной, розовато-фиолетовые или темно пурпурные

..... (45) *Allium kurdaicum*

82. Листьев 3-5, 12-20 см длиной. 2-5 мм шириной, с редко волосатыми ребрами; цветки плоско звездчатые, в основном глубоко розовые ..... (48) *Allium vvedenskyanum*

82\* Листьев 1-2 (3), обычно длинее 20-ти см и не менее 1 см шириной ..... 83

83. Основания внутренних тычинок с 2 реснитчатыми зубцами; края листочков околоцветника полуреснитчатые или зубчатые ..... (46) *Allium pangasicum*

83\* Основания всех тычинок без зубцов, края листочков околоцветника гладкие ..... 84

84. Тычинки у основания коротко сросшиеся; листовые пластинки ± натянута прямостоячие, гладкие, 18-25 см длиной, 2-5 см шириной; ярко-зеленые

..... (47) *Allium schachimardanicum*

84\* Тычинки у основания свободные; листовые пластинки косо вбок изогнутые, серовато-зеленые с сильным сизым налетом ..... 85

85. Лист одиночный, листовая пластинка 25 см длиной и 1.5 см шириной, линейно-ланцетная, плоская, голая; тычинки у основания яйцевидно расширенные

..... (43) *Allium bekeczalicum*

85\* Листьев 1-2 (3), листовая пластинка (12) 20-40 см длиной, 15-25 мм шириной, края почти белые, густо шероховатые; тычинки у основания треугольно расширенные

..... (42) *Allium arkitense*



## Taxonomy

### *Allium* subg. *Porphyroprason* (Ekberg) R.M. Fritsch

in Friesen & al., *Aliso* 22: 386 (2006). — Type species: *A. oreophilum* C.A. Meyer.

#### *A.* subg. *Porphyroprason* sect. *Porphyroprason* Ekberg

in Bot. Notiser 122: 65 (1969). — Kamelin, *Florog. analiz Srednej Azii*: 243 (1973); Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 26 (1994), omnia sub subg. *Melanocrommyum*. *Allium* sect. *Molium* series *Oreophila* Tzag. in Bot. mat. gerb. inst. bot. AN Kaz. SSR vyp. 10: 14 (1977). — Type species: *A. oreophilum* C.A. Meyer

(1) *Allium oreophilum* C.A. Mey., *Verz. Pfl. Casp. Meer.*: 37 (1831). Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 3, 2: 210 (1875); Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 10: 299, 355 (1887). Lipsky in *Trudy Imp. S.-Peterb. Bot. Sada* 18: 133 (1900). J.D. Hooker in *Curtis's Bot. Mag.* 127: t. 7756 (1901). *Vved.*, *Flora URSS* 4: 255 (1935); *Vved.*, *Flora Uzbek.* 1: 456 (1941); Nikitina & Kashtsh., *Flora Kirg. SSR* 3: 89, tabl. 12 fig. 3 (1951). Pavlov & Polyakov, *Flora Kazakhst.* 2: 186, tab. 14/3 (1958); *Vved.*, *Flora Tadzh. SSR* 2: 338 (1963). Nikitina & al., *Flora Kirg. SSR, Dopoln. vyp.* 1: 53 (1967). *Vvedensky* [& Kovalevskaya], *Opred. rast. Sredn. Azii* 2: 80 (1971), omnia incl. *A. platystemon* et *A. "ostrovskianum"*. *Wendelbo, Flora Iranica* 76: 67, tab. 6 Fig. 92 (1971). Kollmann, *Flora Turkey* 8: 126, fig. 3, map 13 (1984). Hanelt & al. in *Flora* 182: 69 (1989); Xu & Kamelin, *Flora China* 24: 200 (2000). Fritsch & Abbasi, *Taxon. review Allium subg. Melanocr.* Iran: 33, plate T1, map (2013). — *Allium oreophilum* var. *typicum* Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 10: 299, 355 (1887). *Caloscordum oreophilum* (C.A. Meyer) Banfi & Galasso in Banfi, Galasso & Soldano, *Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano*, 152 (2): 87 (Nov 2011). *Allium platystemon* Kar. & Kir. in *Bull. Soc. Imp. Naturalistes Moscou* 15: 514 (1842). Type: Altai. 1842, leg. Kar. & Kir. s. n. (lectotype LE!, design. Fritsch 1990: 506). *Allium ostrowskianum* Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 7, 2: 545 (1881), Regel in *Gartenflora* 30: 223 tab. 1089 (1881). *Allium oreophilum* var. *ostrowskianum* (Regel) Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 10: 299, 356 (1887). Type: Ex horto bot. Petropolitano 81. 5. e Turkestan occidentalis Fetisow misit [from Bot. Garden St. Petersburg, sent by Fetisow from western Turkestan] (lectotype LE!, design. Fritsch 1990: 506). — Type: Azerbaijan: E Caucasus, in petrosis alpinis Tufandagh [from Caucasus, in the alpine rock region of Tufandagh], 31.7.1830, 1500', leg. Meyer (holotype LE!).

Distribution: E Caucasus, E Anatolia ?, NE Afghanistan, N Pakistan, Central Asian mountain ranges (Uzbekistan, Kirgizstan, Tajikistan, Kazakhstan) to S Altai, Tarbagatai, Jungar Alatau, and Tian Shan mountain ranges (W Sinkiang); petrophyte of alpine and subalpine steep rock and rubble slopes.

Description: Bulbs subglobose, 1-2 cm in diam.; outer tunics thin, whitish to brownish-grey, soon decaying. Scape (often S-like) flexuous, terete, smooth; 5-15 cm long, 2-4 mm in diameter; green, at least near the base brown suffused. Leaves 1-2, laminae narrowly linear-lanceolate, steep to flat arcuately ascending with recurved upper part, thick, fleshy, shallowly canaliculate; upper side smooth or somewhat grooved, lower side with a few flat ribs; margin smooth or slightly toothed, shortly tapering into the not cucullate apex; 10-15 (20) cm long, 6-15 mm broad; green, basally red-brown suffused with glaucous bloom, at least during outgrowth violet flushed. Sheathy prophyll short, hyaline, long lasting. Vernation planar. Spathe hyaline, up to the middle divided into several suborbicular to triangular, acuminate, patent valves shorter than the pedicels; whitish to brownish with inconspicuous veins. Inflorescence broadly fastigiate to semi-globose; ± loose, 20-50-flowered; 5-6 cm in diam. Pedicels moderately thick, straight to somewhat ascending; 1-3.5 cm long; green, brown or purplish suffused. Anthesis in (May) June to July. Flowers broadly campanulate triangular. Tepals ovate to elliptic, basally free, acutish or subobtusate, dorsally slightly concave, obliquely upright positioned; after anthesis straw-like stiff and ± incurved; outer tepals 8-13 mm long, 5-7 mm broad, sometimes with 3 veins; inner tepals

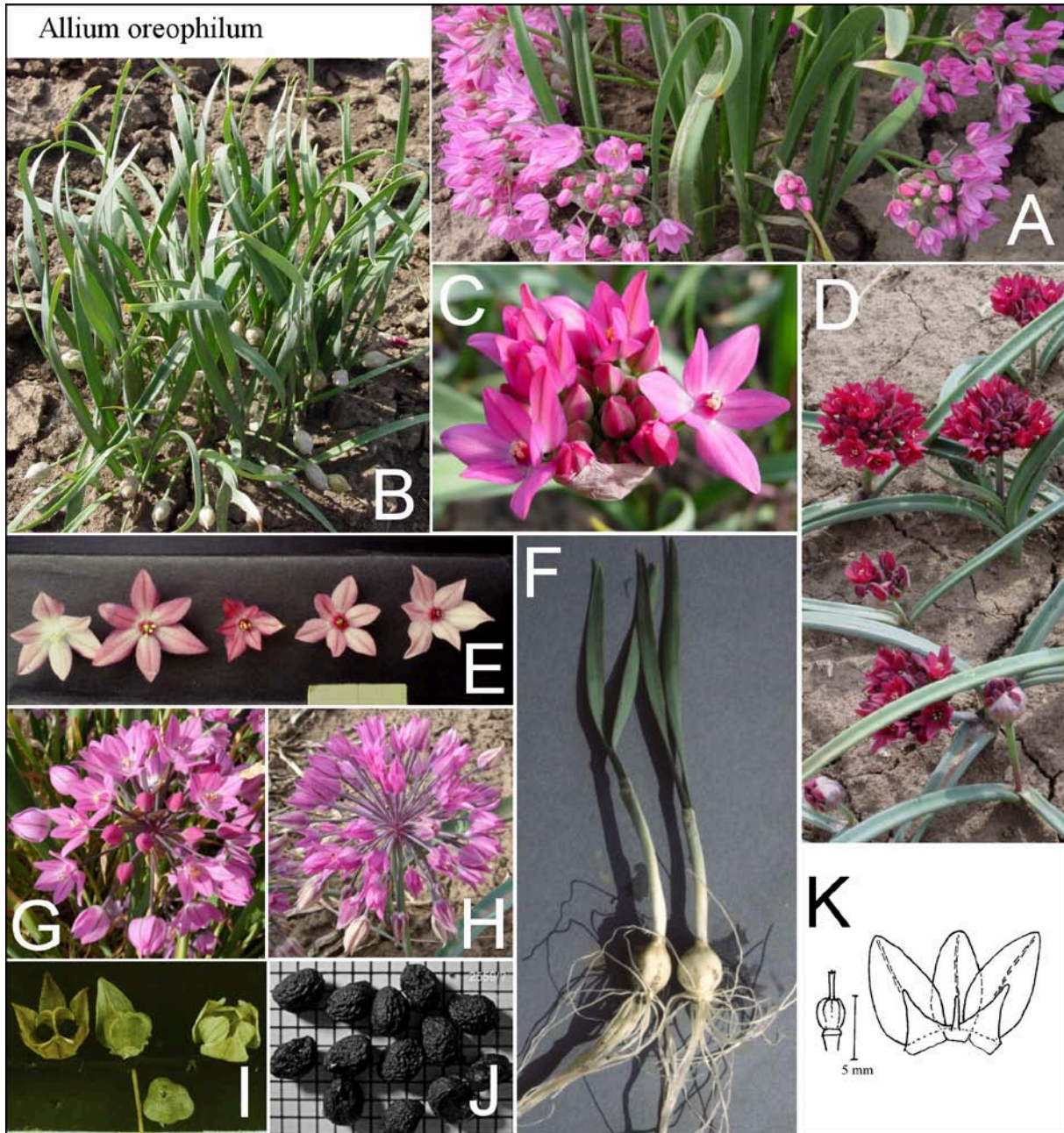


Plate (1): Cultivated plants from different countries are shown. A: Flowering plants; B: plants prior to anthesis; C: inflorescence at begin of anthesis; D: flowering plants from Tajikistan; E: diversity of shape and color of flowers of different accessions; F: vegetative plants showing sheath leaves, bulbs, and roots; G & H: inflorescences in full and late anthesis, resp.; I: capsules and dry tepals; J: seeds; K: shape of ovary, tepals and filaments of a flower prepared from herbarium (millimeter paper as background and measure scale of E & J; plate copied from Fritsch & Abbasi 2013: 34 Plate T1).

for 2 mm shorter and 2-3 mm narrower, always with one median vein; pale to deep pink or deep brownish purple, fading towards the base, vein(s) greenish-brown, narrow. Filaments 1/3-1/2 as long as the tepals, fleshy; basally connate, inner filaments broadly ovate-triangular with short narrow tip, outer filaments twice narrower and somewhat shorter; color basally like adjacent tepals but upper part much darker colored. Anthers ovoid; c. 1 mm long; yellow. Pollen yellow; 26.9 / 31-34  $\mu\text{m}$  long; 18-20  $\mu\text{m}$  broad, P/E index 1.7; brochi 0.8  $\mu\text{m}$ , muri > 0.5  $\mu\text{m}$  in diameter (Levan 1935, Thunert 1967). Ovary sessile, depressed globose, triangular or nearly hexangular with 3 rather broad and 3 very narrow furrows, 2-3.5 mm long, 2-4 mm in diam.; surface papillose; green with paler sutures. 6 / up to 9 ovules per ovary (Vvedensky 1935, 1941 / Filimonova 1970) / 3-4 ovules per locule but only 2 develop into seeds (Hanelt & al. 1989). Nectary ducts mound in triangular holes near the base of the ovary. Style subconi-

cal, slightly angled, c. 1 mm long; green to purplish. Stigma shortly tripartite; white. Capsule enclosed by the stiff dry tepals, depressed-globose or depressed-pyriform triangular, surface very finely coarse, 5–6 mm long and 6–8 mm in diam.; widely open, valves broadly heart-shaped with a shallow longitudinal furrow; brownish-yellow. Seeds 1–2 (3) per locule, ovoid; surface minutely papillous with irregularly reticulate ledges, silk-glossy black; c. 2.5 mm long, 2 mm broad and thick. TKW 6.35 / 7.29 g (Fritsch & Abbasi 2013). The periclinal walls are convex and evenly covered by small granules, the anticlinal walls show weakly to moderately S-like undulations with small amplitude (Kruse in Hanelt & al. 1989).

**Chromosomes:**  $2n = 16$  Levan 1929, Levan 1931, Levan 1935 figs. 12k, 12n (Sweden, Denmark: Botanical collections Lund and Copenhagen).  $2n = 16$  Vakhtina 1964a, 1969 (Tajikistan: Shakhristan pass, no. 331).  $2n = 16$  Dietrich 1967 (France: Botanical collection Strasbourg, also meiosis).  $2n = 16$  Elkington & al. 1976 (source not mentioned).  $2n = 16$  Badr & Elkington 1977 Figs. 6 & 7 (Netherlands: Bulb trader van Tubergen).  $2n = 16$  Jacobsen & Ownbey in Löve 1977 (Sweden: Botanical collection Uppsala).  $2n = 16$  Vosa 1977 (source not mentioned).  $2n = 14$  Pogosian 1983 fig. 15 (France: Botanical collection Liège).  $2n = 16$  Pogosian 1983 (Armenia: Mt. Kapudzhikh, Mirzoeva s. n.).  $2n = 16$  Narayan 1988 (source not mentioned, "*A. ostrowskianum*").  $2n = 16$  Ohle in Hanelt & al. 1989 Abb. 6 & 7 (Germany: Botanical collection).  $2n = 16$  Astanova 1990 (Tajikistan: Turkestan range).  $2n = 16$  Fritsch & Abbasi 2013 (see karyolog. appendix for karyotype, Tajikistan: Turkestan range, Kusavlisai TAX 2559).

**Living accessions studied:** Material without documented origin, received from botanical collections: Botanical Garden University Halle/Saale, Germany: TAX 0115; Botanical Garden Univ. Graz, Austria: TAX 0348; Botanical Garden University Karlsruhe, Germany: TAX 0705; Botanical Garden München-Nymphenburg, Germany: TAX 0738; Botanical Garden University Jena, Germany: TAX 0793, TAX 0797; Botanical Garden Technical University Aachen, Germany: TAX 0882; Main Botanical Garden Moscow, Russia: TAX 2732; home garden of P. Hanelt, Gatersleben, Germany: TAX 5393. — **Kirgizstan:** Alai range (without exact location, leg. 1989 Günther, Zündorf & Schnittler 4 & 11; GAT) TAX 2683, TAX 2690; Alai range, glacier "Abramov" (donated by O. A. Ashurmetov, Tashkent 1995; GAT) TAX 5470. **Tajikistan:** Turkestan range, Kusavlisai valley above the station (39°32' N, 68°38' E, 3200 m, 13.8.1988 Fritsch 382 GAT) TAX 2559; pass Shakhristan N Aini, gneiss slope (39°33' N, 68°33' E, 3350 m, 15.8.1988 Fritsch 399; GAT) TAX 2565; Darvaz range, gorge Viskharvi (donated by Botanical Garden Khorog; GAT) TAX 2419. **Uzbekistan:** Chatkal range, Chatkal reservation, Mt. Kysyl-Nura (3400 m, leg. I. G. Levichev, Leningrad; GAT) TAX 2789.

**Remarks:** This small species is characterized by narrowly linear leaves, a first prostrate and later ascending, thin scape, and large flowers showing a very specific broad shape of tepals. It was included in this review because of much general similarity to species of subg. *Melanocrommyum*. *Allium oreophilum* is a very variable species concerning stature of the plants, shape and color of leaf laminae, scape length, flower color and dimensions (Lipsky 1900: 133 ff., Regel 1887: 355), also under cultivation. A careful morphological comparison of plants from many different locations, including the type locations of the synonyms, and accompanied by molecular analyses, would be essential to confirm that only one variable taxon exists. According to molecular markers (ITS sequences of nuclear rDNA) this species occupies a separate position beside subg. *Melanocrommyum* and deserves also subgeneric rank (Friesen & al. 2006: 386, Fritsch & al. 2010: 171 Fig. 2 A, Gurushidze & Blattner in Fritsch & Abbasi 2013: 199 "oreo0348").

**Etymology:** The epitheta refer to the alpine distribution of this species (from Greek "loving mountains"), and to the former Imperial Russian minister M. N. v. Ostrowski.

**Biological data:** Growth form, phenology, anatomical, karyological and other characters were investigated in detail by Hanelt & al. (1989). The scape is grooved, the vascular bundles in the cortex of the scape are orbicular in cross-section (Fritsch 1993). Pistrick & al. (2001) observed the fusion of extended filament bases and shifting outwards of the originally inner stamina during ontogenetic flower development. The plants are early flowering and short-vegetating geophemeroids; bulb scales up to 2 cm thick, root system belongs to the bulbous type and is frequently ephemeral, non-branching, diffuse with up to 40 cm deep root penetration and up to 200 roots per plant; the leaf primordia of the next year's shoot develop in April to June and the inflorescences in August to October (Kamenetsky 1992). Without a longer period of low temperatures (12 weeks at 4°C are sufficient) the bulbs do even not sprout in spring (Dubouzet & al. 1992, Maeda & al. 1994). The bulbs contain several steroid sapo-

nines and cholestan glycosides (Mimaki & al. 1993). Fresh bulbs contain in total 0.03 % cysteine sulf-oxides (49 % methiin, 2 % alliin, 49 % isoalliin; Fritsch & Keusgen 2006). Reported genome sizes [pg 2C DNA] were 38.8 (Vakhtina & al. 1977), and 36.7 (Zakirova 1989). Air dry bulbs contained 22 % polysaccharids (glucofructans; Khodzhaeva & Ismailov 1979).

**Economic traits:** Flowers tested as food had a very pleasant taste and were useful as spice (de Lestrieux & de Belder-Kovacic 2000). In Europe, cultivation as ornamental especially for alpine gardens started towards the end of 19<sup>th</sup> century, also some cultivars were selected. A very polymorphous species listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991) and commercially available (de Hertog & Zimmer 1993, Fritsch 2015). Livestock does not eat this species because of its bitter taste (Kojima & Yoshida 1994).

***Allium* subg. *Melanocrommyum* (Webb & Berthel.) Rouy,**

Fl. France 12: 378 (1910). Wendelbo in Bot. Notiser 122: 27 (1969). Kamelin, Florog. analiz Srednej Azii: 240 (1973); Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 26 (1994). *Caloscordum* Herb. subg. *Melanocrommyon* (Rouy) Banfi & Galasso in Banfi, Galasso & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano, 152 (2): 87 (Nov 2011). — *Moly* Moench, Meth.: 286 (1794), type species: *Moly speciosum* Moench (= *A. magicum* L.). *Allium* sect.(?) *Moly* (Moench) Endl., Gen. Plant. 1: 147 (1836). *Allium* sect. *Molium* G. Don ex Koch, Syn. Deut. Schweizer Fl.: 714 (1837), p. p. *Canidia* Salisb., Gen. Pl.: 92 (1866), type species: *Canidia magica* (L.) Salisb. *Allium* sect. *Molium* sensu Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 298 (1887), excl. *A. ursinum* L., *A. thunbergii* Regel & *A. monanthum* Maxim. — **Type species:** *Allium nigrum* L.

1. ***A.* subg. *Melanocrommyum* sect. *Longibidentata* (R.M. Fritsch) R.M. Fritsch** in Bot. Jahrb. Syst. 127: 465 (2009). *A.* sect. *Acmopetala* subsect. *Longibidentata* R.M. Fritsch in Khassanov & Fritsch, Linzer Biol. Beiträge 26: 974 (1994). — **Type species:** *Allium fetisowii* Regel

(2) ***Allium fetisowii*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 5: 631 (1878). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 298, 355 (1887). Vved., Flora URSS 4: 263-264 (1935); Vved., Fl. Uzbek. 1: 459 (1941); Vved., Flora Tadzh. SSR 2: 349 (1963); Nikitina & Kashtsh., Flora Kirg. SSR 3: 90-93. (1951); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 51 (1967); Pavlov & Polyakov, Fl. Kazakhst. 2: 188, tab. 14/2 (1958), omnia "*fetissovii*" et p. p., incl. *A. tschimganicum* p. p. and *A. simile*; Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 (1971), p. p. maj. "*fetissovii*". Xu & Kamelin, Flora China 24: 201 (2000). — *Allium simile* Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 359 (1887), s. str. Pavlov & Polyakov, Fl. Kazakhst. 2: 188 (1958) sub *A. "fetissovii"*, non *A. simile* sensu horti Gaterslebenensis. Lectotype: Kirgizstan: Angust. Arassan. m. Alexander [Arassan gorge of Alexander Mts.], 7-9000', 7.6.1880, leg. Fetisow (LE, design. Fritsch 1990: 507). — **Lectotype:** Ex horto bot. Petropolitano 78.5 "Von Fetisow Zwiebeln aus Wernoje erhalten"[Fetisow sent the bulbs from Ver-noye] (LE, design. Fritsch 1990: 504).

**Distribution:** Kazakhstan, Kirgizstan, China: W Xinjiang: N Tianshan mountain ranges: from Karasu in the East to the Chuili mountains in the West, colline to submontane grassy and steppe slopes, not too dense shrubs, and open places.

**Description:** Bulbs depressed-globose, 1-2 (3) cm in diam., 8-15 (25) mm long; inner tunics whitish, strong, nearly parchment-like, outer tunics grey-brown to blackish, strong, longitudinally splitting, with a short neck. Scape straight, terete, strong, smooth, 40-80 cm long, 3-6 mm in diam.; green with moderate glaucous bloom, only the very base maroon flushed. Leaves 1-3 (5), laminae linear-lanceolate, obliquely arcuately ascending and recurved, the upper part later hanging down, basally U-like above shallower canaliculate, ± thickish; upper side shallowly grooved, lower side with distant flat but sharply-edged ribs; margins narrowly whitish or reddish, smooth or above finely toothed, rather shortly

tapering into the  $\pm$  hooded apex; 15-30 (40) cm long, 0.7-2 (3) cm broad; semi-glossy vividly green with glaucous bloom. Sheathy prophyll short, arcuate, tender, nearly colorless and translucent, quickly decaying. Spathe membranous, completely divided in 2-3 ovate to triangular, shortly acuminate valves, much shorter than the pedicels; buff with inconspicuous veins. Inflorescence initially  $\pm$  semi-globose later nearly conical; very dense, many-flowered; (2.5) 4-5 cm in diam. Pedicels subequally long, thin wiry, straight or the lowermost later ascending; green. Anthesis in May to June. Flowers cup-shaped starlike; with honey odor. Tepals linear-lanceolate, acute, basally flat, in the upper third canaliculate, initially patent, later reflexed and tortuous, finally incurved but not enrolled; 6-8 mm long, 1-1.5 mm

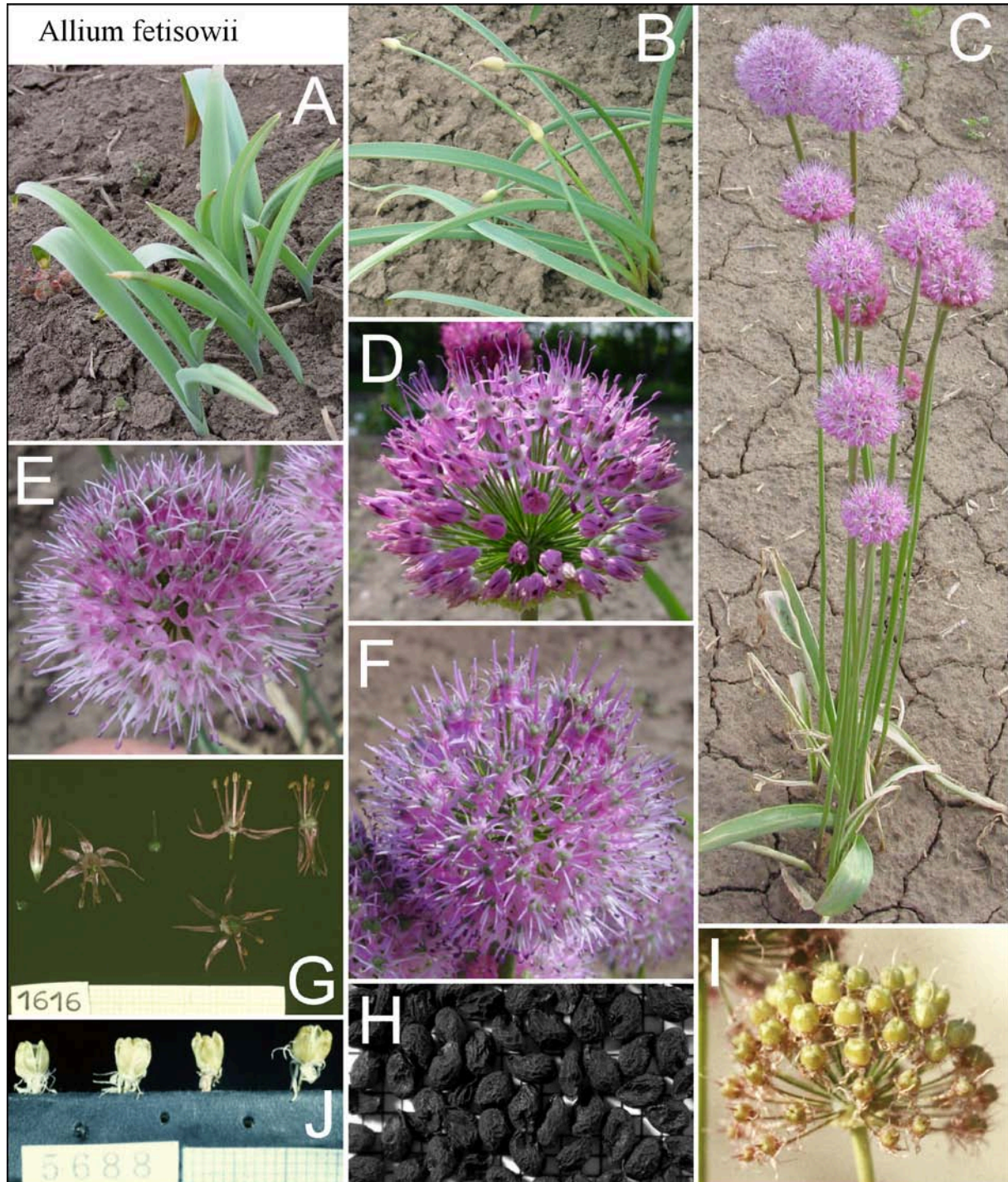


Plate (2): Cultivated plants are shown. A.: Leaves after sprouting; B: plants in shooting stage; C: flowering plants; D, E & F: inflorescences in early and full anthesis, resp.; G: comparison of flowers and flower parts in different stages of anthesis; H: seeds; I: inflorescence with developing capsules; J: ripe open capsules (millimeter paper as background and measure scale of G, H & J).

broad; shining pink with slightly darker median vein. Filaments initially shorter later as long as the tepals; basally up to 0.5 mm connate and inner filaments subquadratically widened and with 2 (rarely 4) long teeth, outer filaments subulate; pinkish-carmine fading towards the base. Anthers ovoid-oblong; 1.5-2 mm long, 1 mm broad; greyish to bluish-violet. Pollen dark yellowish-gray. Ovary shortly stipitate, depressed-globose flat triangular, 2-3 mm long and in diam.; surface flat papillous; green,  $\pm$  violet flushed. Nectary somewhat lobed, ducts mound in slits at the base of ovary below the bottom of locules (Fritsch 1992b). Up to 4 ovules per locule, 15 ovules per ovary (Filimonova 1970) / 4-6 ovules per locule. Style threadlike, finally 4-6 mm long; initially white, later violet. Stigma undivided, sometimes subcapitate; white. Capsule sessile, ovoid to sharply triangular, 4-5 mm long, 3.5-4 mm in diam., surface papillous, largely reticulate lacunose; valves ovoid, apex somewhat cartilaginous and deeply notched; dull green later buff. Seeds 1-3 per locule, long ovate; surface papillous with irregular network of raised wrinkles; 2-2.5 mm long, c. 1.5 mm broad, 1-1.5 mm thick. TKW 1.72 g (IPK, unpubl. data). The testa showed periclinal walls with a moderate number of verrucae, and transitions from Omega-like to S-like and rarely to U-like undulations of the anticlinal walls (Kruse 1988 Abb. 31; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Zakirova & Vakhtina 1974, Vakhtina & al. 1977 total length of chromosomes (Kazakhstan: Almaty, Komissarovki gorge, no. 193; river bank of Almatinka minor, no. 195; vill. Aksaj, Prilavki, no. 194; road from Alma-Ata to Chilik, no. 206).  $2n = 16$  Zakirova & Nafanailova 1990 (Kazakhstan: Talass. Alatau range, Jabagly valley, Ivashchenko s. n.).  $2n = 16$  Pogosian & Seisums 1992 (Kazakhstan: N Almaty, Kamelin & al. 543).  $2n = 16$ , 16+B IPK *Allium* reference collection ideogram (Kirgizstan: Bishkek, Paspel'dyk hills TAX 5685; Kirgiz. Alatau range, Alameddin Mts., Ysyk Ata TAX 5688).

**Living accessions studied:** **Kazakhstan:** Slopes S Kjuk-Tjube near Alma-Ata (1250 m, 11.5.1985 Hanelt 9; GAT) TAX 1616, (1200 m, 11.5.1985 Hanelt 10; GAT) TAX 1617, dry steppe near station Burundai, c. 35 km N Alma-Ata (43°21' N, 76°15' E, 700 m, 14.6.1990 Fritsch 639; GAT) TAX 2975, (43°20' N, 76°51' E, 650 m, 01.6.1993 Fritsch 945; GAT) TAX 3695, hill W railway station Chemolgan (43°23' N, 76°34' E, 18.6.1990 coll. Gusak, Fritsch 653; GAT) TAX 2982; Karatau range, Kindyktas Mts. c. 70 km N Bishkek, Kurdai pass area (43°21' N, 75°00' E, 1240 m, 31.5.1993 Fritsch 942; GAT) TAX 3693, (25.6.1993 coll. Baitulin 2; GAT) TAX 3733; Transili Alatau, Almatinka canyon (43°03' N, 76°59' E, 1500 m, 09.6.1990 Fritsch 621; GAT) TAX 2968, Kotur-Bulak valley c. 10 km E Alma-Ata above Turbaza (43°13' N, 77°06' E, 2100 m, 13.6.1990 Fritsch 631; GAT) TAX 2970, (1100 m, 13.6.1990 Fritsch 635; GAT) TAX 2972. **Kirgizstan:** Kirgiz Alatau c. 20 km E Jambul, shrubby slopes near Uch-Bulak (42°53' N, 71°35' E, 1250 m, 01.7.1994 Fritsch, Khassanov, Pistrick 1186; GAT) TAX 5052, NE slopes of Alameddin massif above spa Ysyk Ata (42°35' N, 74°54' E, 2000 m, 27.5.1997 Fritsch, Khassanov 1621; GAT) TAX 5688; Paspel'dyk hills SW Bishkek (42°45' N, 74°33' E, 1100 m, 25.5.1997 Fritsch, Khassanov 1618; GAT) TAX 5685.

**Remarks:** *Allium fetisowii*, the type species of sect. *Longibidentata*, occurs in more northern parts of the western Tianshan mountain range than the morphologically very similar *A. chychkanense*. The latter taxon differs by shorter and broader leaves and by completely backwards turned tepals (Fritsch 2012b: 246). Sometimes other taxa also possessing bidentate inner filament bases were wrongly named *A. fetisowii*, e.g. *A. severtzovioides* and *A. tschimganicum* (Vvedensky 1941: 459, Xu & Kamelin 2000). A report of *A. fetisowii* from Tajikistan: Kurama Mts., Kyzyl-Almaly-Sai (Vvedensky 1963: 349) refers probably to *A. pangasium*. On the other hand, Xu & Kamelin (2000) regard plants similar to *A. fetisowii* but with indentate filament bases as a new species that needs to be verified by study of living accessions. (It remains open whether *A. bekeczalicum* shall represent this new species because no reference was made). Detailed investigations of plants from the lectotype location of *A. simile* confirmed identity to *A. fetisowii* as already proposed by Lipsky (1900). Molecular markers (ITS sequences of nuclear rDNA) gave evidence that *A. fetisowii* belongs to the basal group of the basal grade of subg. *Melanocrommyum*, with members of sect. *Decipientia* as closer relatives, and is only very distantly related to morphologically  $\pm$  similar species of sect. *Acmopetala* that were inserted in the clusters 5 and 6 of the core clade (Fritsch & al. 2010: 167 basal grade § 3.2.1; Fritsch 2012b: 246, 247 Fig. 1; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Data from sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage 1\*) showed identical relations but with lower resolution.

**Etymology:** The epithet honors certainly the plant collector of merit in the then Russian province Turkestan, Aleksey Mikhailovich Fetisov. Around 1880 he sent large collections to the Imperial Bot. Garden St. Petersburg.

**Biological data:** Some anatomical scape characters were shown, but not discussed at species level (Fritsch 1993 Fig. 7B). The reported genome sizes [2C DNA] were 24.6 pg (Vakhtina & al. 1977), 23.2 pg (Zakirova 1989), 26.3/28.4 pg that is lower than in *A. chychkanense* (34 pg, Gurushidze & al. 2012). This species owns bactericidal activity (Sokolov 1994).

**Economic traits:** Bulbs (?) contain 13,4 % polysaccharids (glucofructans) in the air dry mass (Khodzhaeva & Ismailov 1979). The green plant parts are eaten in Tajikistan (determination uncertain; Anonymous 1985). Rarely offered as ornamental (Fritsch 2015).

**(3) *Allium chychkanense*** R.M. Fritsch in Bot. Jahrb. Syst. 127: 466, fig. 3 (2009). — *Allium simile* sensu horti Gaterslebenensis. — **Type:** Cultivated in Gatersleben no. TAX 5057, leg. 05.5.1999, plants collected in Kirgizstan, Talassischer Alatau, rechter Hang am Chychkan-Fluß ca. 15 km unterhalb des Alabel-Passes, trockene Stellen am Hang, [Talas Alatau, dry places at the right slope of Chychkan river valley c. 15 km below pass Alabel] ca. 2200 m, 42°15' N, 73°00' E, 03.7.1994 Fritsch, Pistrick & Khassanov 1206 (holotype GAT!, isotypes GAT!, TASH!).

**Distribution:** Kirgizstan: Central Tianshan mountain ranges, moderately dry montane slopes and river terraces in higher altitudes of Susamyr massif, known only from the type area.

**Description:** Bulbs depressed-globose, 8-25 mm in diameter, 8-20 mm long; inner tunics membranous, white, outer ones grey to black, disintegrating in pieces. Scape straight, terete, smooth; 40-60 cm long, 4-6 mm in diameter; green, basally purple flushed. Leaves 2-4, laminae lanceolate, obliquely directed then flat descending recurved, thickish, ± longitudinally grooved, later nearly flat; upper side with shallow ribs, lower side with flat and broad ribs; margins reddish, smooth or very finely toothed, shortly arcuately tapering in a hooded (often reddish) apex; 20-25 cm long, 1.5-5 cm broad; vividly green with glaucous bloom, basally violet flushed. Sheathy prophyll rather long, brownish, tender, quickly decaying. Spathe membranous, nearly completely divided into two shortly acuminate, ± reflexed valves; buff with brown veins. Inflorescence initially ovoid, later globose or somewhat conical; very dense, many-flowered. Pedicels thin wire-like, straight; 15-25 mm long; green, basally reddish. Anthesis in May. Flowers initially cup-shaped later reflexed-starlike. Tepals lanceolate to triangular, soon turned backwards but upper part slightly inverted, shortly acuminate with a claw-like apex; 6-8 mm long, 1.2-2 mm wide; shining pink, the greenish median vein is visible at the outer side only in the distal part. Filaments ± as long as the tepals; basally for c. 0.5 mm united and shortly triangular widened (inner filaments twice broader), above subulate, inner (and often also outer) filaments basally with a blunt, irregularly formed tooth at every side; pink, basally mostly whitish. Anthers oblong; 1.6-2 mm long, c. 1 mm wide; ± violet. Pollen yellowish gray. Ovary stipitate, globose-pyriform triangular, c. 2 mm long and in diameter; surface scabrously papillous, slightly glossy, with shallow longitudinal furrows; greenish with purplish flushed sutures. Nectary ducts mound slit-like near the base. Style conical-threadlike, 3-6 mm long; pink. Stigma undivided; rose. Capsule triangular-pyramidal, 4-5 mm long and in diameter, surface finely scrobiculate; the upper half open, valves cordate with a smaller notch at the apex; buff, slightly glossy. Seeds 1-2 per locule, long ovoid to sector-shaped; surface papillous with many longitudinal raised wrinkles, dull black; 1.5-1.8 mm long, c. 1.2 mm wide and thick. The testa showed periclinal walls with a moderate number of verrucae and transitions from Omega-like to S-like and rarely to U-like undulations of anticlinal walls (Fritsch & al. 2006 as *A. aff. fetisowii*).

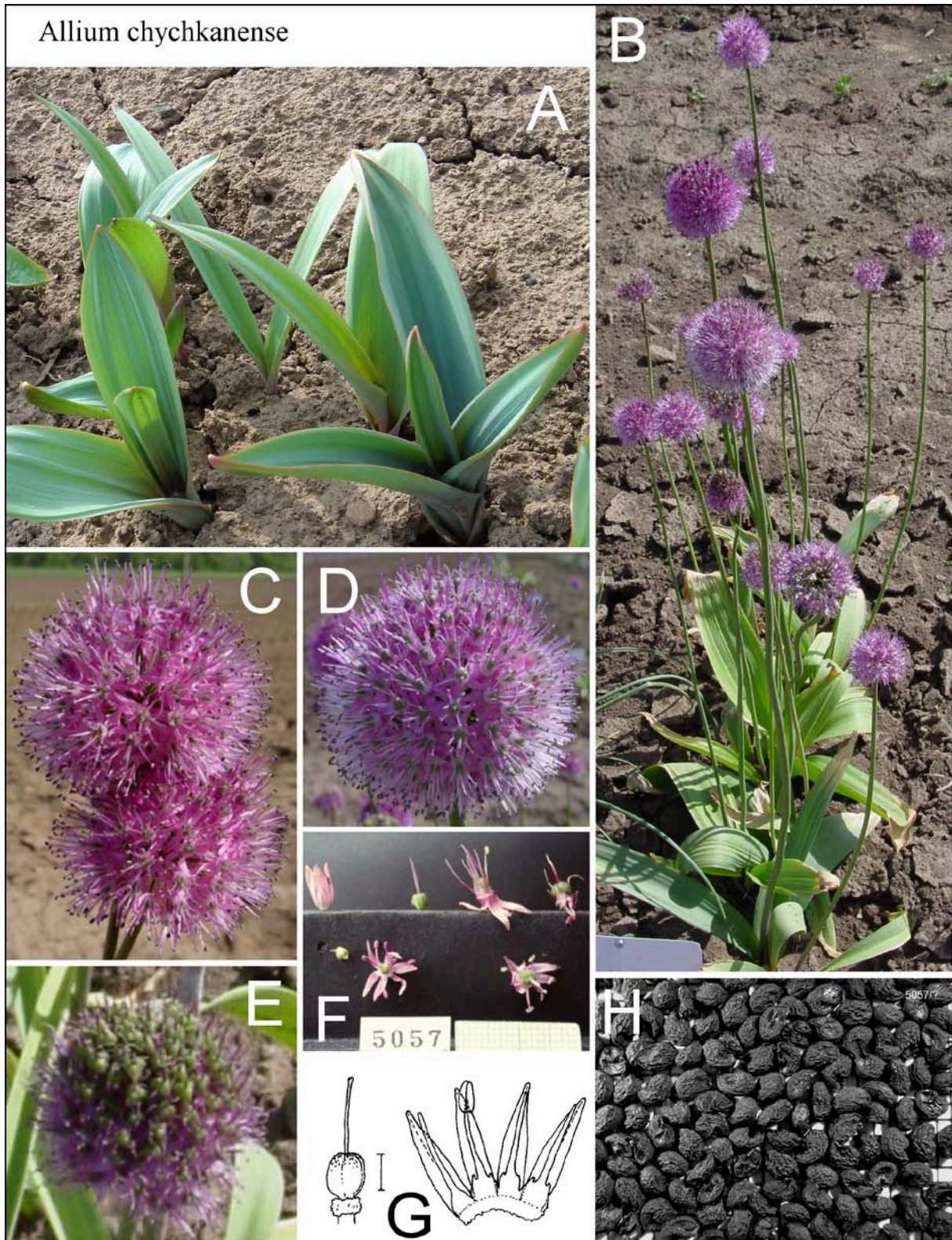


Plate (3): Cultivated plants from type location (except C and E) are shown. A: Sprouting leaves; B: flowering plants; C, D & E: inflorescences in full and late anthesis, resp.; F: comparison of flowers and flower parts in different stages of anthesis; G: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2009: 466, fig. 3 C, scale bar = 2 mm); H: seeds (millimeter paper as background and measure scale of F & H).

**Chromosomes:**  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Kirgizstan: Talassian Alatau range, Chychkan valley, TAX 5060).



Living accessions studied: Kirgizstan: Fergan range, gypseous hills beside the main road c. 10 km E Torkent (41°44' N, 73°12' E, 1150 m, 04.7.1994 Fritsch, Khassanov, Pistrick 1212; GAT) TAX 5028; Talas Alatau, Chychkan valley c. 25 km S pass Alabel (42°10' N, 72°52' E, 1750 m, 04.7.1994 Fritsch, Khassanov, Pistrick 1210; GAT) TAX 5060, right slopes along the river Chychkan c. 15 km below pass Alabel (42°15' N, 73°00' E, 2200 m, 03.7.1994 Fritsch, Khassanov, Pistrick 1206; GAT) TAX 5057.

Remarks: The plants are morphologically rather similar to *A. fetisowii* differing mainly by shorter and broader leaves, by completely backwards turned tepals, and by short and variably shaped side teeth of the inner filaments. They occur in higher altitudes than *A. fetisowii* under more humid conditions. *Allium schachimardanicum* prefers similar ecological conditions and is also morphologically similar, but does not develop side teeth of filaments. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. chychkanense* as most basal group in the basal clade next to the species of sect. *Decipientia*, and support the close relationship to *A. fetisowii* with a clear separation at species level (Fritsch & al. 2010: 167 basal grade § 3.2.1; Fritsch 2012b: 246, 247 Fig. 1; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Sequences of the plastid *trnL-trnF* region confirmed this general position and showed a more derived haplotype than *A. fetisowii* (Gurushidze & al. 2010: 836, fig. 4 lineage I).

Etymology: The epithet refers to the Chychkan valley in Talas Alatau (Kirgizstan) where the type accession was collected.

Biological data: The genome size of 34 pg 2C DNA is remarkably higher than in *A. fetisowii* 26.3/28.4 pg (Gurushidze & al. 2012).

2. *A.* subg. *Melanocrommyum* sect. ***Decipientia*** (Omelczuk) R.M. Fritsch

in Phytion (Horn, Austria) 49: 168 (2010). *A.* sect. *Melanocrommyum* s. lat. series *Decipientia* Omelczuk in Ukr. Bot. Zh. 19, 3: 71 (1962). — *A.* subg. *Melanocrommyum* sect. *Melanocrommyum* Webb & Berthel. subsect. *Melanocrommyum* group of *A. decipiens* relatives, Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 26 (1994). — Type species: *Allium decipiens* Fisch. ex Schult. & Schult. f.

(4) ***Allium robustum*** Kar. & Kir. in Bull. Soc. Imp. Natural. Moscou No. 4: 753 '853' (1841). Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 248 (1875), sub *A. atropurpureum* Waldst. & Kit.; Vved., Flora URSS 4: 265 (1935); Pavlov & Polyakov, Fl. Kazakhst. 2: 189 (1958); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 83 (1971); Xu & Kamelin, Flora China 24: 201 (2000), omnia incl. var. *alpestre*. — *Allium robustum* var. *alpestre* Kar. & Kir. in Bull. Soc. Imp. Naturalistes Moscou 15: 513 (1842). Lectotype: Kazakhstan: [Jung.] Alatau, subalpine Krautflur am Lepsa-Fluß [subalpine associations of perennials along river Lepsa], 1841, leg. Kar. & Kir. 2037 (LE, design. Fritsch 1990: 507, the lectotype label was erroneously stuck to no. 825). — Lectotype: Kazakhstan: Altai. "Wiesen der Songarisch-Kirgisischen Wüste bei den Tarbagatai-Bergen am Tscheharak-assu, 1840 [Meadows of the Jungar-Kirgiz desert nearby the Tarbagatai Mts. along Cheharak-assu], leg. Kar.[elin] 472 (LE!, isotype P, design. Fritsch 1990: 506).

Distribution: China: N Xinjiang, E Kazakhstan: Jungar Alatau and Tarbagatai ranges, (sub)montane stony and dry steppe slopes, among shrubs.

Description: Bulbs ovoid to subglobose; inner tunics papery, white, outer tunics extended in a short neck, blackish. Scape flexuous later straight, terete, smooth, dry ± ribbed; (50) 60-80 cm long, 4-6 mm in diam.; green with glaucous bloom, basally maroon flushed. Leaves 2-3, laminae oblong-lanceolate to linear, initially prostrate later obliquely directed; margins smooth, gradually tapering into the acute hooded apex; 15-20 cm long, scarcely more than 2 cm broad; green with glaucous bloom. Sheathy prophyll short, smooth, glossy, with fine veins. Spathe membranous, divided in about 2-3 shortly acuminate, reflexed valves, shorter than the pedicels; pale brownish with brown veins. Inflorescence short-conical to semi-globose; ± dense, moderately many-flowered; up to 5 cm in diam. Pedicels thickish, wiry,

straight to ascending; 1-2 cm long; silk-glossy brown to maroon. Anthesis in May to June. Flowers flat starlike. Tepals broadly lanceolate, concave, subobtuse, patent, later reflexed and tortuous but not enrolled; 5-6 mm long, outer tepals 2 mm, inner ones 2.5 mm broad; pink to purple with darker or greenish median vein. Filaments shorter to longer than the tepals; basally for c. 0.5 mm connate and lanceolate-triangularly widened (inner filaments nearly 1.5 times broader), above subulate; purplish or pinkish. Anthers oblong; c. 1.5 mm long; pale violet. Pollen yellowish gray. Ovary sessile, ± depressed-globose triangular, c. 3 mm long; surface acutish-papillous, green with purplish flush and paler sutures. The nectary ducts mound basally in pocket-like holes. Style threadlike, 3-4 mm long; purple. Stigma undivided; whitish. Capsule ovoid, surface slightly papillous; 6-8 mm long and in diam.; valves ovate. Seeds 3 / 5-6 per locule. The testa showed verrucose periclinal walls and Omega-like undulated anticlinal walls with a moderate amplitude (Fritsch & al. 2006).

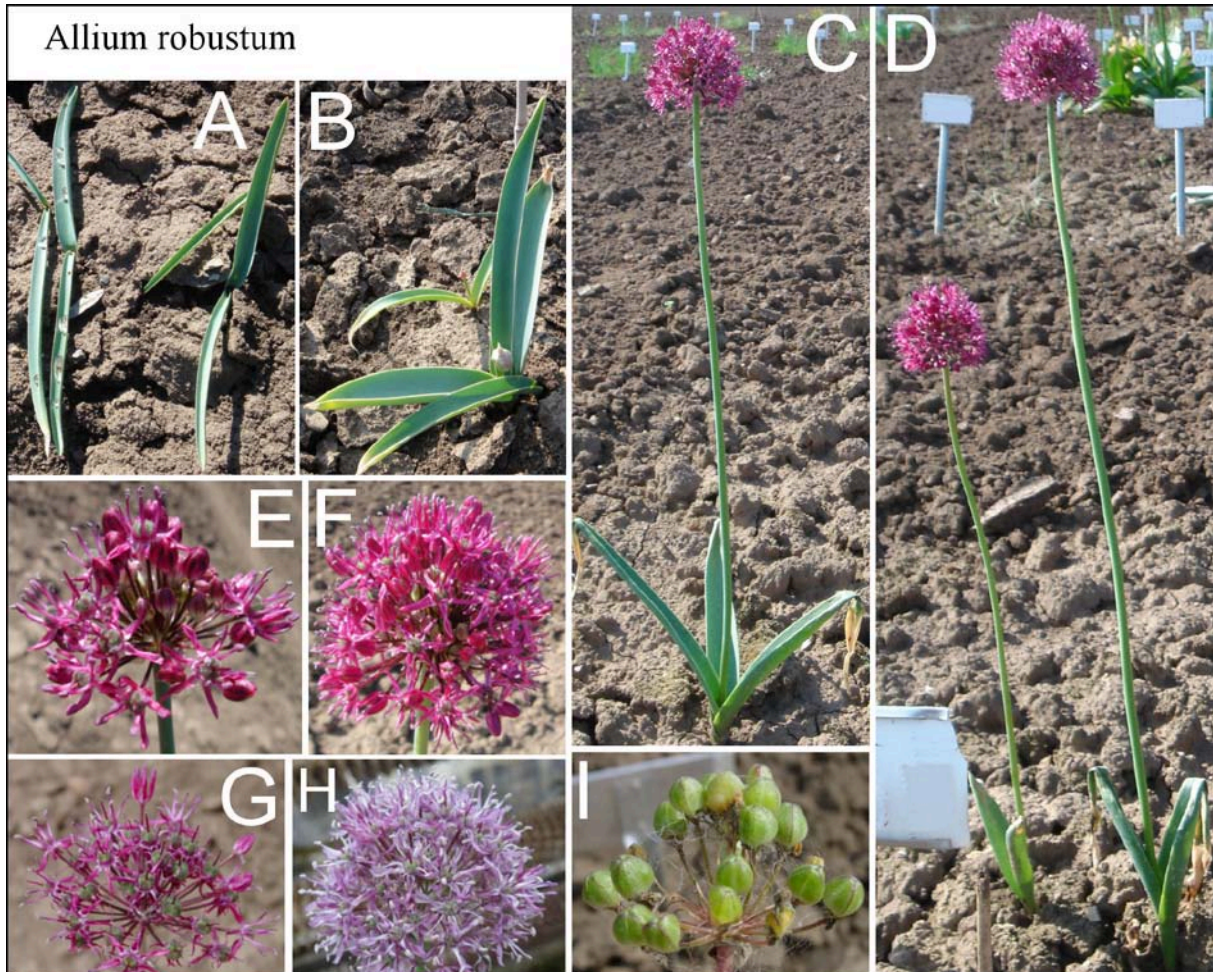


Plate (4): Cultivated plants are shown. A: Sprouting leaves; B: plants in early shooting stage; C & D: flowering plants; E, F & G: inflorescences in early, full, and late anthesis; H: inflorescence of another strain cultivated in Latvia; I: inflorescence with full-sized capsules.

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Kazakhstan: Tarbagatai range, Urdzhar canyon, Kamelin & al. 2149).

**Living accessions studied:** Kazakhstan: lowland of lake Saisan (collected by S. Smirnov, Barnaul, 47°47' N, 82°20' E, 2006 via Friesen, Osnabrück 06-31-0139-20; GAT) TAX 6565; S Altai range, Kalbin massif (collected by S. Smirnov, Barnaul, 49°02'40" N, 83°15'53" E, 450 m, June 2006 via Friesen, Osnabrück 06-31-0126-20; GAT) TAX 6599; Jungar Alatau, side gorge at Jungarian Gate near camping spot (45°42'43" N, 81°47'27" E, 04.6. 2012 Ruksans 12KZ-81B; GAT) TAX 6971.

**Remarks:** This is a rather large species formerly affiliated to the *A. nigrum* group of sect. *Melanocrommyum* and by Lipsky (1900) even included in *A. stipitatum* of sect. *Procerallium*. In the original description it was separated from *A. tulipifolium* by a more stately habit and larger and darker tepals, but some cultivated plants and many herbarium vouchers showed only slender plants of moderate height.

Cultivated plants of *A. robustum* differed from *A. tulipifolium* by somewhat narrower leaves, denser inflorescences, thicker and red (not greenish-brown) pedicels, shorter and purplish (not pale lilac) tepals, and strongly (not slightly) coarse ovaries. Unfortunately, plants from the type location could not be studied. Molecular markers presented good evidence that these and other species of sect. *Decipientia* belong to the basal grade and are only very distantly related to sect. *Melanocrommyum*. ITS sequences of nuclear rDNA showed even a well-supported sistergroup relationship of *A. robustum* to *A. zergericum* and the whole core clade, that would support recognition as monotypic section (Fritsch & al. 2010: 168 § 3.2.2; Fritsch 2012b: 246, 247 Fig. 1; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). However, reliable morphological characters separating *A. robustum* from sect. *Decipientia* were not found yet, and sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage I) support only the close relationship to *A. grande* (as *A. chelotum*), *A. viridulum*, and sect. *Longibidentata*.

Etymology: The epithet was certainly derived from the Latin word for "strong" or "hard".

Biological data: Reported genome size 32.1 pg 2C DNA (Gurushidze & al. 2012).

Economic traits: Very rarely offered as ornamental (Fritsch 2015).

(5) *Allium tulipifolium* Ledeb. var. *subscabrum* Regel in Bull. Soc. Imp. Natur. Moscou 41: 453 (1868). — Type: Kazakhstan, Ili-Niederung, auf Steppenboden bei 1000' Höhe, im Mai blühend [Ili river lowland, on steppe soil in 1000 ft. elevation, flowering in May], leg. Semenow (LE!). — *Allium tulipifolium* auct. non Ledeb., Fl. altaica 2 ([Jul-Dec]1830) 9, et in Ic. pl. fl. ross. alt. illustr. Cent. II: 13, t. 137 ([late]1830), s. str. Lectotype: Russia: "*Allium tulipaefol.* m. pr. Krasnojarsk copio [near Krasnojarsk copious]", Herb. Ledeb. 190, leg. Ledeb. (LE!, design. Fritsch 1990: 508). ?? *Allium lallemantii* Regel & Rach, Index sem. hort. bot. imp. Petrop. 1858: 24 (1858). Type: non design. *Allium decipiens* sensu Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 245 (1875), sensu Vved., Flora URSS 4: 265 (1935), sensu Pavlov & Polyakov, Fl. Kazakhst. 2: 189 tab. 14/1 (1958); sensu Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 83 (1971); sensu Xu, Flora Reip. popul. Sinicae 14: 270 (1980), omnia p. p. minore.

Distribution: Kazakhstan, north of Transili Alatau to the Balkhash – Alaköl depression, the western border is still unclear; stony slopes, steppes, salt plains, sandy places.

Description: Bulbs subglobose to ovoid, 1.5-3.5 cm in diam., 1.5-3 cm long; inner tunics yellowish-white, outer tunics brownish -gray, somewhat longitudinally fiber-like split. Scape straight or subflexuous, terete, smooth (dry finely ribbed); 35-50 (70) cm long, 4-7 (10) mm in diam.; green with slight glaucous bloom, basally reddish flushed. Leaves 1-2 (3), laminae flat, broadly linear-lanceolate, flat arcuately ascending and recurved, thick, shallowly canaliculate; upper and lower sides slightly grooved, lower side basally with fine brown ribs; margins maroon, finely to coarsely scabrous, shortly tapering into an arcuate, hooded apex; (10) 25-35 cm long, the outermost leaf (0.5) 2-5 cm broad, the inner leaves consecutively narrower; green with strong glaucous bloom; sheathy leaf part inside reddish. Sheathy prophyll very short, tender, smooth, brown, quickly decaying. Spathe membranous, completely ± divided in 2 (3) ± shortly acuminate valves, c. 1-1.5 cm long; white to buff with inconspicuous veins. Inflorescence semi-globose to subglobose; initially dense later (very) loose; moderately many-flowered; 6-8 (fruiting up to 10) cm in diam. Pedicels subequally long, thin wiry, initially nearly straight later ascending; green basally whitish, above purplish flushed. Anthesis in mid of May to begin of July. Flowers broadly bowl-shaped to flat starlike. Inner tepals oblong, outer ones obovate, obtuse, concave, patent, later reflexed with convolute margins, crumpled; 6-8 mm long, 1.5-2 mm broad; initially greenish-white later pale lilac with green to purplish median vein (broadest in the middle). Filaments 1/3 to slightly shorter than the tepals; basally for c. 0,5 mm connate and triangularly (inner filaments about 1/4 broader and more lanceolate) widened, above subulate; basally white, above lilac. Anthers oblong-

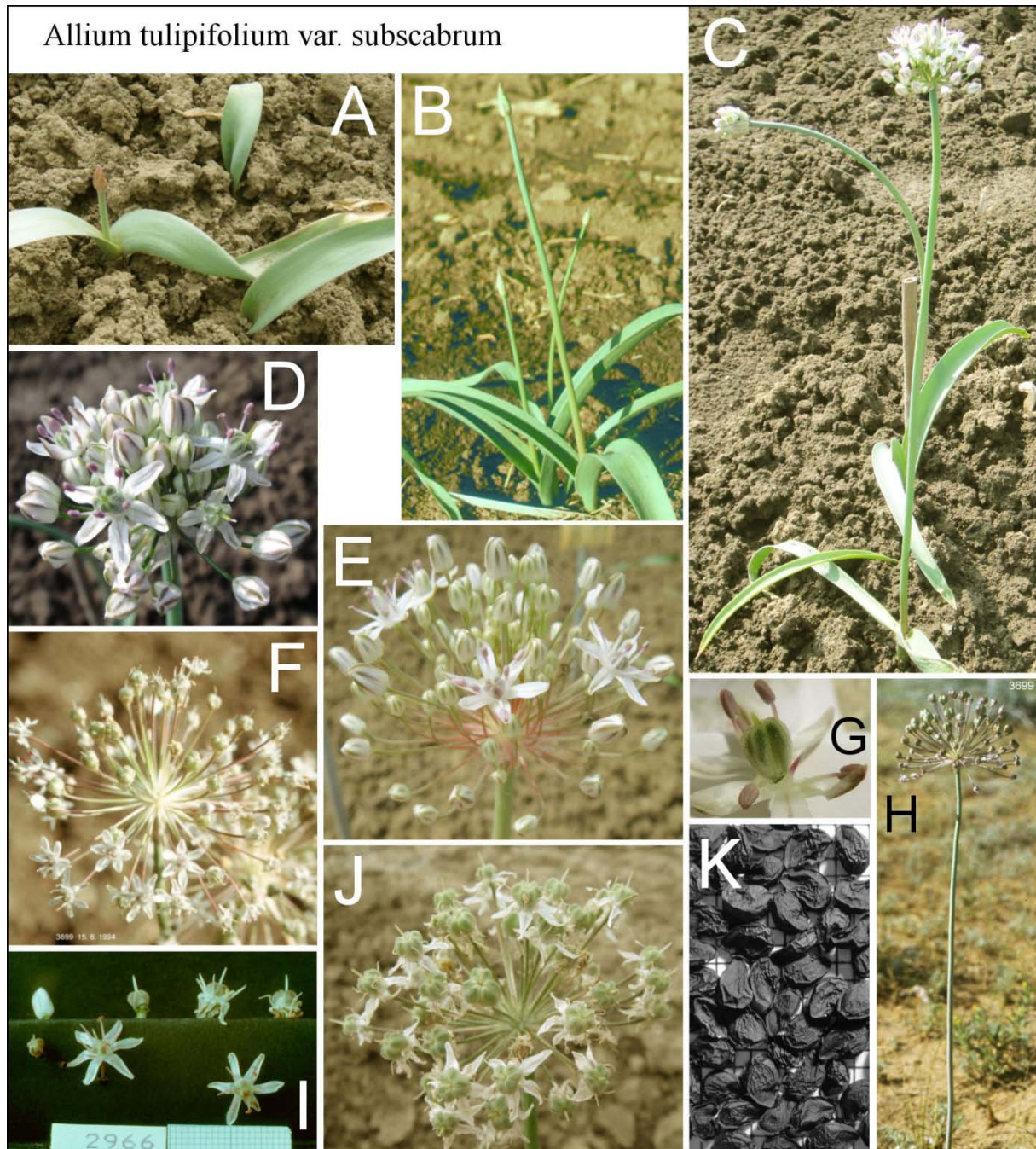


Plate (5): Cultivated plants (except H) are shown. A.: Leaves of vegetative plants and one plant in early shooting stage; B: plants in early shooting stage; C: a plant in buds and a flowering plant; D, E & F: inflorescences in early and full anthesis, resp.; G: close-up of a flower; H: plant with developing capsules near Bakanas, Kazakhstan; I: comparison of flowers and flower parts in different stages of anthesis; J: inflorescence in late anthesis; K: seeds (millimeter paper as background and measure scale of I & K).

ovoid; c. 2-2.2 mm long, 0.8-1 mm broad; lilac-brownish. Pollen yellowish gray. Ovary sessile, pear-shaped hexangular, 3-4 mm long and in diam.; surface finely acutish papillous; whitish-green with purplish flushed sutures. The nectary ducts mound dot-like on small bumps near the base of ovaries. 4-6 ovules per locule were reported (Xu & Kamelin 2000). Style narrowly conical, c. 2-4 mm long; white. Stigma undivided; white. Capsule triangular broadly ovoid to double-conical, surface coarsely papillous, up to 5 mm long and 7 mm in diam.; glossy bright green often with whitish sutures; valves broadly ovate to obcordate, above narrowly and deeply notched. Seeds 2-3 per locule, triangular crescent-shaped to flat oblong with sharp edges; surface finely papillous with mostly longitudinal raised wrinkles, silk-glossy black; 2.5-3 mm long, 1.5-2 mm broad, 1-1.5 mm thick.

**Chromosomes:**  $2n = 20$  Vakhtina 1964a, Vakhtina 1964b fig. 4, Vakhtina 1969 p. 148, Vakhtina 1974 (Kazakhstan: Kapchagaj, near Ili river, no. 430 "*A. decipiens*").  $2n = 20$  Zakirova & Vakhtina 1974 (Kazakhstan: Ilijskij, no. 4; left bank of Ili no. 185, 207, 208; Kapchagai, no. 184, 191; Taukum desert, Ajdarly, no. 186).  $n = 10$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection BIN "*A. decipiens*").  $2n = 40$  Vakhtina & Tarvis 1983 (source not mentioned).  $2n = 20$  Pogosian & Seisums 1992 (Kazakhstan: Alma-Ata area, Kapchagai, Seisums s. n. "*A. decipiens*"). (Chromosome counts of  $2n = 16$  belong very probably to *A. tulipifolium* s. str. and are excluded here.)

**Living accessions studied:** **Kazakhstan:** Taukum semidesert N Alma-Ata near Kapchagai, sandy rock slopes near Ili river (43°55' N, 77°04' E, 600 m, 08.6.1990 Fritsch 606 B; GAT) TAX 2967, semi-desert c. 60 km N Kapchagai, Ili lowland (44°03' N, 77°00' E, 500 m, 16.6.1990 Fritsch 649; GAT) TAX 2980, sand dunes in the Ili lowland ca. 20 km S Bakanas (44°45' N, 76°23' E, 400 m, 04.6.1993 Fritsch 958; GAT) TAX 3699, semi-desert near Karagach (43°56' N, 77°08' E, 650 m, 08.6.1990 Fritsch 606 A; GAT) TAX 2966, river bank of Kapchagay (43°55'21" N, 77°07'24" E, Ruksans 12KZ-042; GAT) TAX 6964; Saisan lowland, Kein Kerish hills 20 km from main road, Artemisia steppe (48°07'47" N, 84°29'39" E, Ruksans 12KZ-104; GAT) TAX 6974; collection site unknown (from *Allium* collection of Kamenetskaja in Burundai, 15.6.1990 Fritsch 647; GAT) TAX 2979.

**Remarks:** The long tradition to lump together white to pale lilac or pinkish flowering species distributed in the steppe areas around Black Sea to south Siberia under the eldest name *A. decipiens* Fisch. ex Schult. & Schult.f. (1830) goes at least back to Regel (1875: 246). Herbarium vouchers look similar indeed, but only superficially. More detailed studies restricted application of that name to plants distributed from Dnepr to Don river drainages. According to Seregin (2007), *A. decipiens* subsp. *decipiens* owns tepals 4-5 mm, subsp. *quercetorum* Seregin (5) 6 (8) mm long, whereas *A. tulipifolium* s. str. differs by shorter perianth segments, filaments almost equal to the tepals, and usually (1) 2 (-3) narrowly lanceolate to lanceolate leaves. Unfortunately, living specimens from the type area of *A. tulipifolium* (Irtysch lowland near the historical village Krasnoyarsk) could not be studied yet to verify Seregin's (2007) measures. If plants from the lower Volga river lowland also belong to *A. tulipifolium*, they own 3.5-4.5 mm long, whitish tepals with darker median vein, and filaments slightly shorter than the tepals (Sagalaev 1997). Unfortunately, it remained also unclear to which taxon plants of *A. decipiens* s.lat. occurring from Bulgaria to southern Russia (Omelczuk 1979) belong. Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) positioned samples from the semi-desert area north of Transili Alatau (as *A. tulipifolium*) in the basal grade, with *A. grande* Lipsky (= *A. chelotum* Wendelbo) as sister group and *A. decipiens* [subsp. *quercetorum* only] as more basal subgroup, and sect. *Longibidentata* as most basal group (Gurushidze & al. 2010: 836, fig. 4 lineage I; Fritsch & al. 2010: 167 basal grade § 3.2.2; Fritsch 2012b: 246-247 Fig. 1 Basal grade; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). However, no samples of the above discussed regional taxa could be analyzed, and their relationship remained unclear. Morphological, karyological ( $2n = 20$ ) and ecological features support recognition of var. *subscabrum* at species level, though it must still be proofed whether the binomina *A. lallemantii* Regel & Rach (1859) and *A. vakhtinae* Seisums (1994 as nom. nud.) refer to var. *subscabrum* and could have nomenclatural priority.

The current affiliation to sect. *Decipientia* is only provisional, because var. *subscabrum* differs by some key characters (dot-like mounds of nectary ducts, another chromosome number) from *A. decipiens* s. str.

**Etymology:** The epithet reflects most probably the finely toothed leaf margins, from Latin "slightly coarse" (the original description of *A. tulipifolium* underlined "not denticulate" leaves).

**Biological data:** The genome size [2C DNA] was reported as 40.5 pg (Vakhtina & al. 1977) and 38.2 pg (Zakirova 1989).

(6) *Allium viridulum* Ledeb., Fl. altaica 2: 20 (1830), Ic. pl. fl. Ross. alt. ill., cent. IV: t. 378 (1833). Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 86 (1875). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 285, 312 (1887). Vved., Flora URSS 4: 265 (1935); Pavlov & Polyakov, Fl. Kazakhstana 2: 189 (1958), p. p.; Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2 83 (1971), omnia sub *A. decipiens*. — Lecto-

type: Kazakhstan: Altai legi in desertis (sabulosis) salsis versus [in the (sandy) saline desert toward lake] Noor-saissan. 13.5.1826, leg. Ledeb. 485 (LE, design. Fritsch 1990: 509).

Distribution: Kazakhstan: Southern foothills of Altai range, saline lowland meadows.

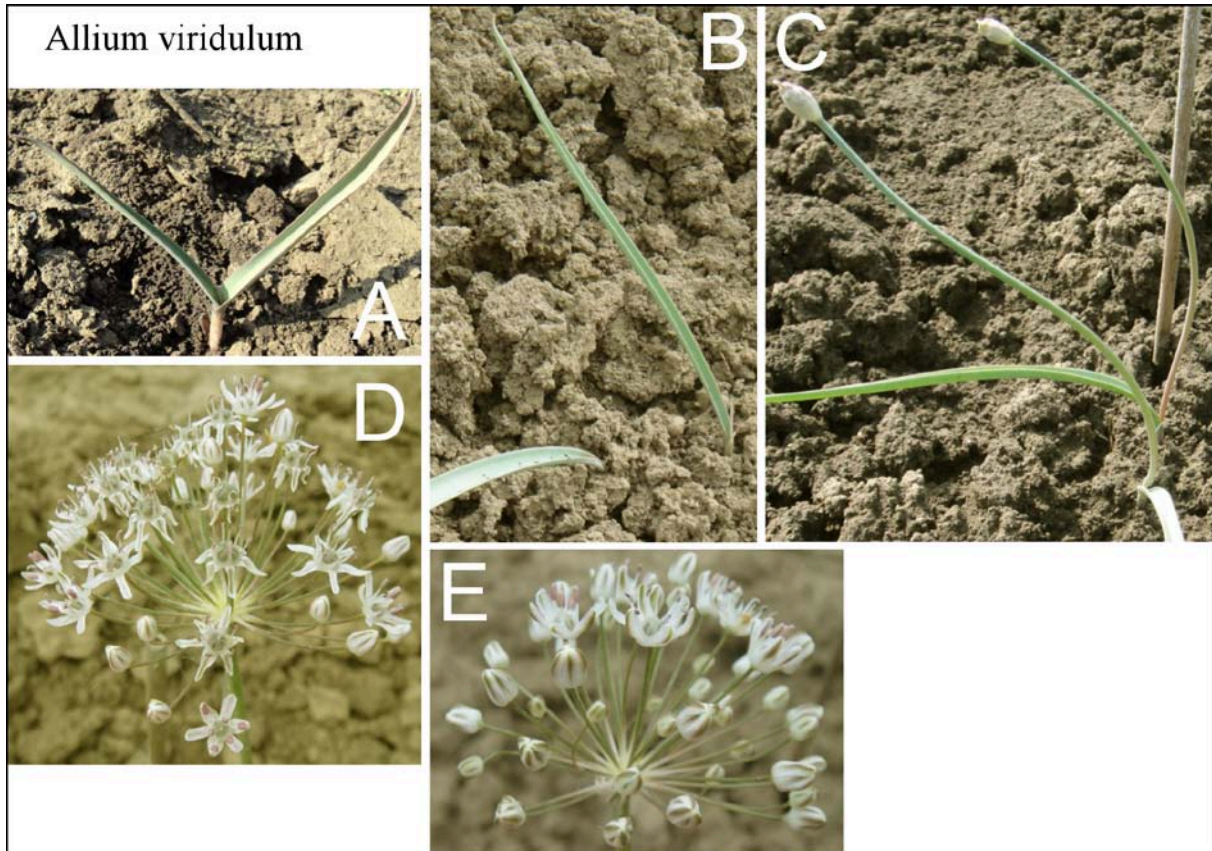


Plate (6): Cultivated plants are shown. A & B: Sprouting leaves; C: plants in the shooting stage; D & E: inflorescences in full and early anthesis, resp.

Description: Bulbs ovoid, c. 1-1.5 cm in diam.; outer tunics bright cinereous to greenish-violet, papery, sometimes accumulating to shells. Scape  $\pm$  flexuous, terete, smooth; 20-25 cm long, 2-3 mm in diam.; green with glaucous bloom, basally reddish flushed. Leaves 1-2, laminae narrowly linear-lanceolate, 10-15 cm long, 5-10 mm broad; green with some glaucous bloom. Sheathy part finely silky, smooth. Sheathy prophyll short, thin membranous, bright translucent, quickly decaying. Spathe membranous, divided in 2-3 ovate to orbiculate, reflexed valves shorter than the pedicels; with red veins. Inflorescence semi-globose to subglobose; dense, moderately many-flowered; 2-3 cm in diam. Pedicels thin wiry, ascendent, 12-20 mm long; green basally whitish. Anthesis in May. Flowers cup-shaped to flat star-like. Tepals oblong to broadly linear-lanceolate, obtuse, canaliculate, obliquely forward directed, later patent, finally reflexed and crumpled; 4-5 mm long, outer tepals about 1.5 mm, inner ones 1 mm broad; whitish-green or reddish with thin brownish green (finally blackish-purple) median vein. Filaments  $\pm$  longer than the tepals; basally for 1/4 connate and triangular widened (inner filaments for 1/3 broader), above subulate; white. Anthers oblong-ovoid; c. 1 mm long; pale violet. Pollen yellowish gray. Ovary sessile, depressed-globose; surface finely papillous; 1 ovule per locule, nectaries mound pocket-like near the base. Style thin threadlike, c. 3-5 mm long; whitish. Stigma undivided. Capsule broadly obovoid, sharply triangular, encased by the dry tepals and filaments; surface subglossy?, valves shortly triangular notched at the apex. The seed testa showed granulous periclinal walls without verrucae and Omega-like undulation with short wavelength (Fritsch & al. 2006 Fig. 18).

Chromosomes:  $2n = 16$  Dietrich 1967 pl. 1 (France: Botanical collection Strasbourg).

Living accessions studied: Kazakhstan: Saisan depression, roadside steppe near lake Sasyqkol (46°38'10" N, 80°34'04" E, Ruksans 12KZ-084; GAT) TAX 6972.

**Remarks:** This is a rather unclear taxon compared in the first description with *A. stellerianum* Willd. and regarded as most similar with *A. pallasii* Murray. The short leaves should be inflated, and small hyaline bracts should be present, therefore *A. viridulum* was affiliated by Regel (1875: 86, 1887: 285) to sect. *Schoenoprasum* Dumort., but Vvedensky (1935, 1971) included it in *A. decipiens* s.lat. Living plants similar to the lectotype and most characters of the original description had flat leaves and no bracts. Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) presented evidence that these plants belong to subg. *Melanocrommyum*. The only investigated sample was well supported inserted between the basal *A. decipiens* and the more advanced *A. grande* and *A. tulipifolium* [var. *subscabrum*] (Gurushidze & al. 2010: 836, fig. 4 lineage I; Fritsch & al. 2010: 167 Basal grade § 3.2.2; Fritsch 2012b: 246-247 Fig. 1 Basal grade; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199), and gave support that *A. viridulum* is no synonym of any of them.

**Etymology:** The epithet refers most probably to the pale green flower color mentioned in the protologue (from Latin "rather green").

### 3. *A.* subg. *Melanocrommyum* sect. *Regeloprason* Wendelbo

in Acta Horti Gothob. 28: 36 (1966) and in Bot. Notiser 122: 29 (1969). — *A.* sect. *Melanocrommyum* subsect. *Regeloprason* (Wendelbo) Kamelin, Florogen. analiz Srednej Azii: 241 (1973), s. lat. — **Type species:** *Allium regelii* Trautv.

#### 3.1 *A.* sect. *Regeloprason* subsect. *Regeloprason* (Wendelbo) Kamelin,

Florogen. analiz Srednej Azii: 241 (1973) (sub *A.* sect. *Melanocrommyum*), s. str.; Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), s. str. — **Type species:** *Allium regelii* Trautv.

(7) *Allium regelii* Trautv. in Trudy Imp. S.-Peterb. Bot. Sada 9: 275 (1884), in Trudy Imp. S.-Peterb. Bot. Sada 9: 466 (1886). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 298, 354 (1887). Vved., Flora Turkm. 1, 2: 295 (1932). Vved., Flora URSS 4: 278 (1935); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 89 (1971). Wendelbo, Flora Iranica 76: 95, tab. 10/139 a-b, tab. 22/1, tab. 23, tab. 28/3 (1971). Kamelin in Nikitin & Gel'dikhanov, Opred. rast. Turkmen.: 124, 129 (1988). Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 63, 67 plate 1 A (2000). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 184, plate T73, map (2013). *Allium cupuliferum* var. *regelii* (Trautv.) O. Kuntze in Trudy Imp. S.-Peterb. Bot. Sada 10: 242 (1887). — *Allium yatei* Aitch. & Baker in Trans. Linn. Soc., Second Ser., 3: 117 (1888). Kamelin in Nikitin & Gel'dikhanov, Opred. rast. Turkmen.: 124, 129 (1988). *Allium regelii* subsp. *yatei* (Aitch. & Baker) Kamelin & Seisums in Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), comb. inval. Syntypes: Afghanistan: Hari-rud valley, 21. & 26.4.1885 Aitchison 289, 09.5.1885 Aitchison 414 (K!)? *Allium regelii* subsp. *salangense* Kamelin & Seisums in Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), nom. nud., type (ined.): Salang pass, north side, 8000' ... leg. 5.6.1964 B. Furse 6614, ? *Allium cupuliferum* sensu Kamelin in Nikitin & Gel'dikhanov, Opred. rast. Turkmen.: 124, 129 (1988). — **Type:** Turkmenistan: (Vel in tractu Achalteke Turcomaniae vel in districtu [either in the region Akhalteke of Turkmenistan or in the region] Karabach Transcaucasiae) leg. Cristoph 4711, mis. M. N. Smirnov 1883 (holotype LE!).

**Distribution:** Turkmenistan, W and N Afghanistan, NE Iran: Kopetdag range; submontane loamy steppe slopes, colline loess and rubble slopes, lowland meadows; occurrence along the Panj river in Afghanistan is doubtful.

**Description:** Bulbs ± broadly ovoid, 1-2.5 cm in diam., 1-3 cm long; inner tunics papery, yellowish, outer tunics parchment-like, extended in a neck, longitudinally splitting (sometimes fiber-like), often accumulating to a brittle brownish to reddish shell. Scape straight or somewhat flexuous, terete, smooth; 20-70 (100) cm long, 3-8 mm in diam.; dull green, basally and above purple suffused. Leaves (1) 2-4

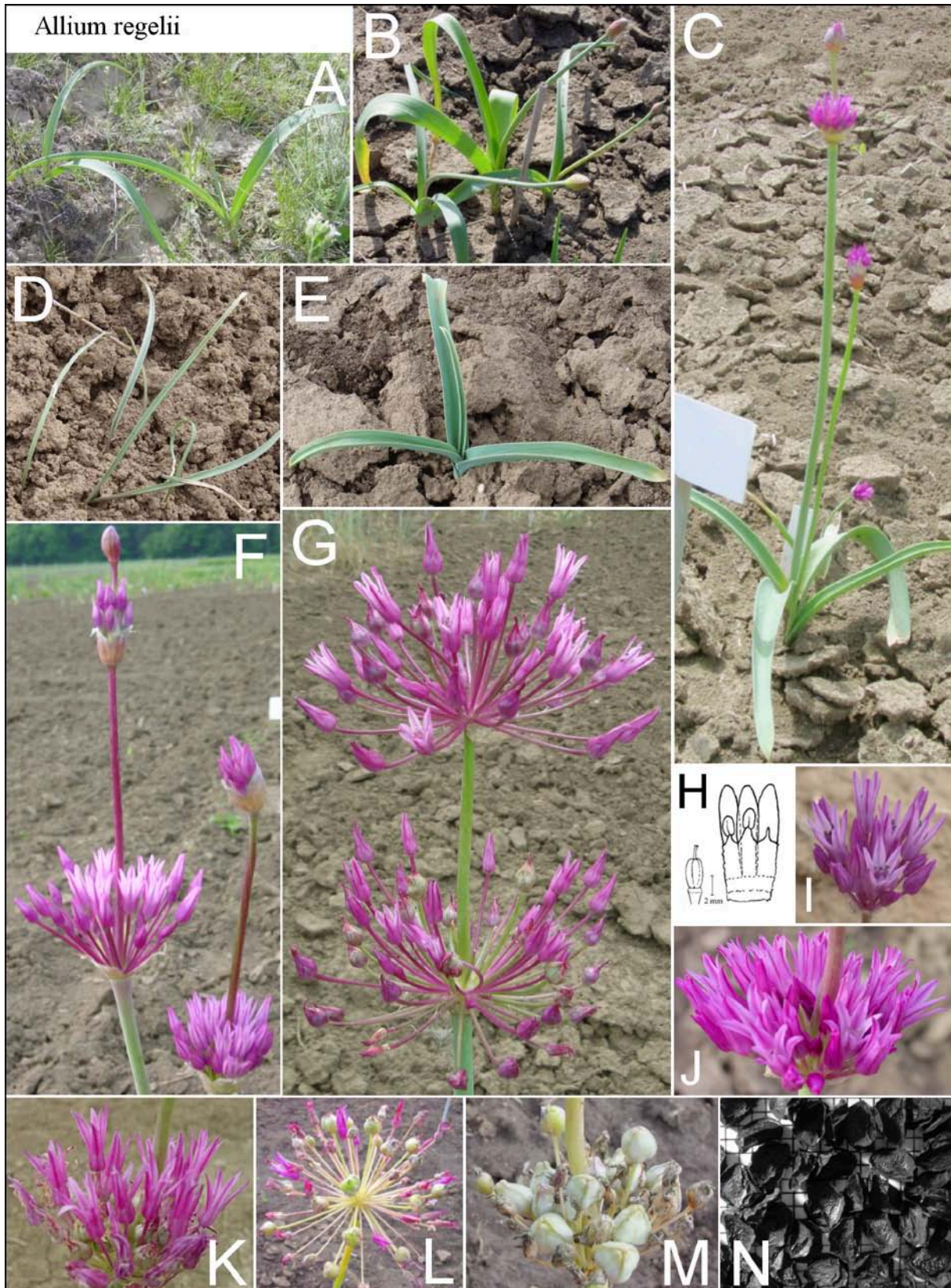


Plate (7): A & B: Plants in the shooting stage near Gaudan, Turkmenistan, and under cultivation, resp.; C: cultivated plants in early anthesis; D & E: sprouting leaves of weak and strong cultivated plants, resp., F & G: superposed inflorescences in early and late anthesis, resp.; H: shape of ovary, tepals and filaments of a flower prepared from herbarium; I: simple inflorescence of a weak cultivated plant in early anthesis; J & K: partial inflorescences in full and late anthesis, resp., L: simple inflorescence with developing capsules; M: partial inflorescence with full-sized capsules; N: seeds (millimeter paper as background; plate copied from Fritsch & Abbasi 2013: 185 Plate T73).



(5), laminae narrowly lanceolate, stiff to flat obliquely arcuately ascending, thin or fleshy, canaliculate; upper side smooth or with some furrows, lower side with few broad and shallow ribs; margins smooth or slightly ciliate, long tapering into the subacute, slightly cucullate apex; 25-40 cm long, (5) 10-40 mm broad; glaucous green, purplish suffused near the base. Sheathy prophyll short or long, membranous, smooth, bright, soon decaying. Spathe fine membranous, split into 2-3 triangular, long acuminate, patent valves; pale yellowish brown with darker veins, basal part often initially purplish suffused. Inflorescence composed of 1-3 (5) superposed partial inflorescences (separated by short partial scapes of decreasing diameter terminated by additional spathes), fasciculate later semi-globose, dense to loose; the lowest partial inflorescence bears 20-50, the uppermost 8-15 flowers. Pedicels thin to rather thick, stiff wiry, very unequally long (they elongate during anthesis for c. 2 times; last flowers with the longest pedicels, those of the lowest partial inflorescence are much longer than those of the uppermost partial inflorescence); green, purple to brown suffused below the flowers, color fading during anthesis. Anthesis in April to May (early June). Flowers narrowly campanulate to funnel-shaped. Tepals lanceolate with subobtusate apex, straight or slightly recurved, after anthesis shriveling; basally for 1/3-2/5 connate, (9) 13-17 mm long (inner tepals somewhat shorter), at the base of the free part inner tepals 2-2.5 mm broad, outer tepals up to 3 mm broad; pale lilac or mauve to pinkish-carmine with conspicuous greenish, brown or purple median vein. Filaments c. 1/2 as long as the tepals; basally for 3/4 connate, free parts of the outer filaments subulate to triangular, of the inner ones triangular to ovate, twice broader and somewhat longer; whitish. Anthers ovoid to arrowhead-shaped; c. 1.8 mm long, at the base c. 1 mm broad; violet to maroon. Pollen reddish-gray; the shape is oblate, 28 / 38-42  $\mu\text{m}$  long, 16 / 27-30  $\mu\text{m}$  broad, P/E 0.6 / 1.4, brochi c. 0.3  $\mu\text{m}$ , muri 0.3-0.5  $\mu\text{m}$ , sculptures rugulate to microrugulate and perforate, wall 0.9  $\mu\text{m}$  thick (Thunert 1967; Neshati & al. 2009). Ovary shortly stipitate, long ovoid-triangular, semi-glossy; surface very finely coarse, tip concave; green with violet flush. 8-10 (20) ovules per locule (Fritsch & Abbasi 2013) / up to 4 ovules per locule, 11 locules per ovary (Filimonova 1970) / 21 ovules per ovary (Vvedensky 1932). Nectary ducts lead in small pits at the base of the ovary. Style narrowly conical to threadlike, 1.5-5 mm long; pink to purple. Stigma very shortly tripartite; pinkish. Capsule ovoid to long-ovoid three-angled, surface  $\pm$  smooth and semi-glossy with a few irregular ledges, 6-8 mm long and 5-6 mm in diam.; yellowish brown; widely open, valves long-oval, with a broad longitudinal furrow only near the base and scarcely notched at the apex. Seeds 2-5 per locule, flat ovate with sharp edges, at least one side concave; surface papillous or glossy and reticulate lacunose, dull to silk-glossy black; 2.5-3.5 mm long, 2-2.5 mm broad, c. 1 mm thick. The periclinal walls of the testa were flat and granulous, without verrucae or with many verrucae, the anticlinal walls showed mostly Omega-like undulation with low to moderate amplitude (Kruse 1988; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a (Turkmenistan: lake Jer-Ajlanduz).  $2n = 16$  Pedersen & Wendelbo 1966 (Afghanistan: Qataghan, Mirza-Atbili pass, H&W 3554).

**Living accessions studied:** **Turkmenistan:** Central Kopetdag range, border control station Gaudan-Bajigiran c. 10 km S Ashgabat (37°48' N, 58°22' E, 595 m, 05.4.2002 Fritsch, Keusgen, Khassanov 6; GAT) TAX 5917; rocky limestone slopes c. 4 km above vill. Gjaurs E Ashgabat (37°41' N, 58°39' E, 550 m, 19.4.1995 Fritsch, Khassanov 1307; GAT) TAX 5255; W Kopetdag range, small and shallow valley c. 5 km E Parowbibi (38°57'42" N, 56°05'48" E, 200 m, 08.4.2002 Fritsch, Keusgen, Khassanov 23; GAT) TAX 5926, loess hills near the main road from Kizylarvat to Khodzhakala (38°48' N, 56°18' E, 462 m, 07.4.2002 Fritsch, Keusgen, Khassanov 17; GAT) TAX 5923, loess slopes NE town Kara-Kala (38°27' N, 56°21' E, 500 m, 23.4.1995 Fritsch, Khassanov 1345; GAT) TAX 5274, NE exposed clayey slopes in the Bami valley (38°41'36" N, 56°44'42" E, c. 300 m, 12.4.2002 Fritsch, Keusgen, Khassanov 41; GAT) TAX 5937.

**Remarks:** *Allium regelii* is the type species of sect. *Regeloprason* and subsect. *Regeloprason*. Strong specimens of this taxon are exceptional for the often multi-storey inflorescence (up to 5 superposed umbels were reported). We observed in the culture that plants collected with a simple inflorescence changed to the common shape under better conditions. There were no reports yet whether plants from populations showing solely simple inflorescences mentioned by Wendelbo (1971: 96) changed in the same manner when cultivated, and whether the morphological peculiarities described by Botschantzev

& al. (1978) for Badkhyz "*A. yatei*" are also true for Iran and Afghan plants. Also the true taxonomic state of plants with pale lilac flowers was not elucidated hitherto. Occurrence of *A. regelii* s. str. in the western Tianshan range of Kirgizstan near Chaek (Yoshida & al. 1995) seems extremely improbable. Confusion with *A. winklerianum* (herbarium specimens of both species may look extremely similar when pressed in early bud stage) that grows about 400 km apart, is also not probable. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. regelii* rather close to all investigated members of subsect. *Humilicognata* but rather distant to all other groups of sect. *Regeloprason* (Fritsch & al. 2010: 183 cluster 1 § 3.3.4; Fritsch 2012b: 247 Fig. 1 B, 248; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Sequences of the plastid *trnL-trnF* region indicated a closer relationship to *A. hissaricum*, *A. winklerianum*, and to several species of sect. *Megaloprason* s. str. (Gurushidze & al. 2010: 836, fig. 4 lineage V).

**Etymology:** Named after the distinguished German horticulturist and eminent botanist Eduard Regel (1815-1892) acting mainly in St. Petersburg (Russia). He was the author of the last monograph of the genus *Allium* (Regel 1875).

**Biological data:** Seedlings belong to the *Allium karataviense* type (Druselmann 1992). Fresh bulbs contain in total 0.35 / 0.26 % cysteine sulfoxides (77 / 74 % methiin, 23 / 15 % isoalliin, 0 / 11 % propiin; Keusgen & al. 2008 / partly as *A. yatei*). A genome size of 42.8 pg 2C DNA was reported (Gurushidze & al. 2012).

**Economic traits:** Plants are not eaten by livestock (Borovskij & al. 1940 in Vvedensky 1963), contain saponins and are prospective for medical use (Kerbabaev & Meshcheryakov 1975), but Kurbanov (2005) reported the plants to be edible. Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991). This species was already included in a list of ornamentals proposed for Turkmenistan (Androsov 1941), very rarely offered currently (Fritsch 2015).

**(8) *Allium victoris*** Vved., *Opred. rast. Srednej Azii* 2: 317 (1971). Fritsch in O.A. Ashurmetov & al. (eds.), *Pl. Life S.-W. & C. Asia*, Tashkent: 64, 67 plate 1 B (2000). — *Allium cupuliferum* sensu Vved., *Flora URSS* 4: 277 (1935), p. p. min. Lapin, *Opredel. rast. Tashk. oazisa* 1: 81 (1938). — **Type:** Kazakhstan: Tashkentskie Chuli, Alymtau, v 30 km na zapad ot zh. d. st. [30 km W of railway station] Dzhilga, 13.5.1962, leg. Adylov & Tsukervanik 187 (holotype TASH!, topotype LE!).

**Distribution:** Kazakhstan: Single hill-ridges in the desert between Tashkent and the Karatau range; saline clayey slopes of marine sediments.

**Description:** Bulbs subglobose, with few, large, smooth, pale brown side bulbs, 10-15 mm in diam.; inner tunics membranous, whitish, outer tunics papery, gray. Scape straight, terete, smooth; 50-60 (80) cm long, (3) 4-5 mm in diam.; glaucous green. Leaves 4-7, laminae long linear-triangular, canaliculate, flat arcuately recurved to the soil; margins smooth, gradually tapering into the narrow apex; 8-15 cm long, 3-8 mm broad; green with glaucous bloom. Sheathy prophyll not observed. Spathe membranous, divided in two or more, shortly beaked valves, about 1/2 as long as the pedicels. Inflorescence fasciculate; very loose, with 12-20 (30) flowers. Pedicels equally long, ± thickish wiry, ascending; 2-4 cm long; brownish-green to maroon. Anthesis in April. Flowers funnel-shaped starlike; with strong very sweet odor. Tepals linear-lanceolate with subacute, plicate apex, basally for 2/5 connate; 13-15 mm long, the base of the free part 2-2.5 mm broad; pinkish-violet with darker median vein. Filaments ± 1/2 as long as the tepals; basally for 2/3 connate, the free parts fleshy, triangularly widened (inner filaments slightly broader and longer); white. Anthers ovoid to arrowhead-shaped; c. 2 mm long; yellow with purple flush. Pollen yellowish. Ovary stipitate, shortly ovoid, 2.5-3 mm long, 2-2.5 mm in diam.; surface finely papillous; pale grayish-green. Style conical-threadlike, c. 5 mm long; white. Stigma shortly tripartite; white. Capsule triangular ovoid to double-pyramidal, surface dull with many raised wrinkles, up to 7 mm in diam. and 1 cm long; moderately widely open, valves ovoid, slightly or not notched at the apex; greenish to yellowish brown. Seeds flat ovoid to drop-shaped with sharp edges; surface

papillous with many irregular raised wrinkles, dull black; 3-4 mm long, 2.5-3.5 mm broad, c. 2-3 mm thick. The testa showed verrucose periclinal walls, and Omega-like undulation with short wavelength and low to moderate amplitude (Fritsch & al. 2006, Fig. 21).

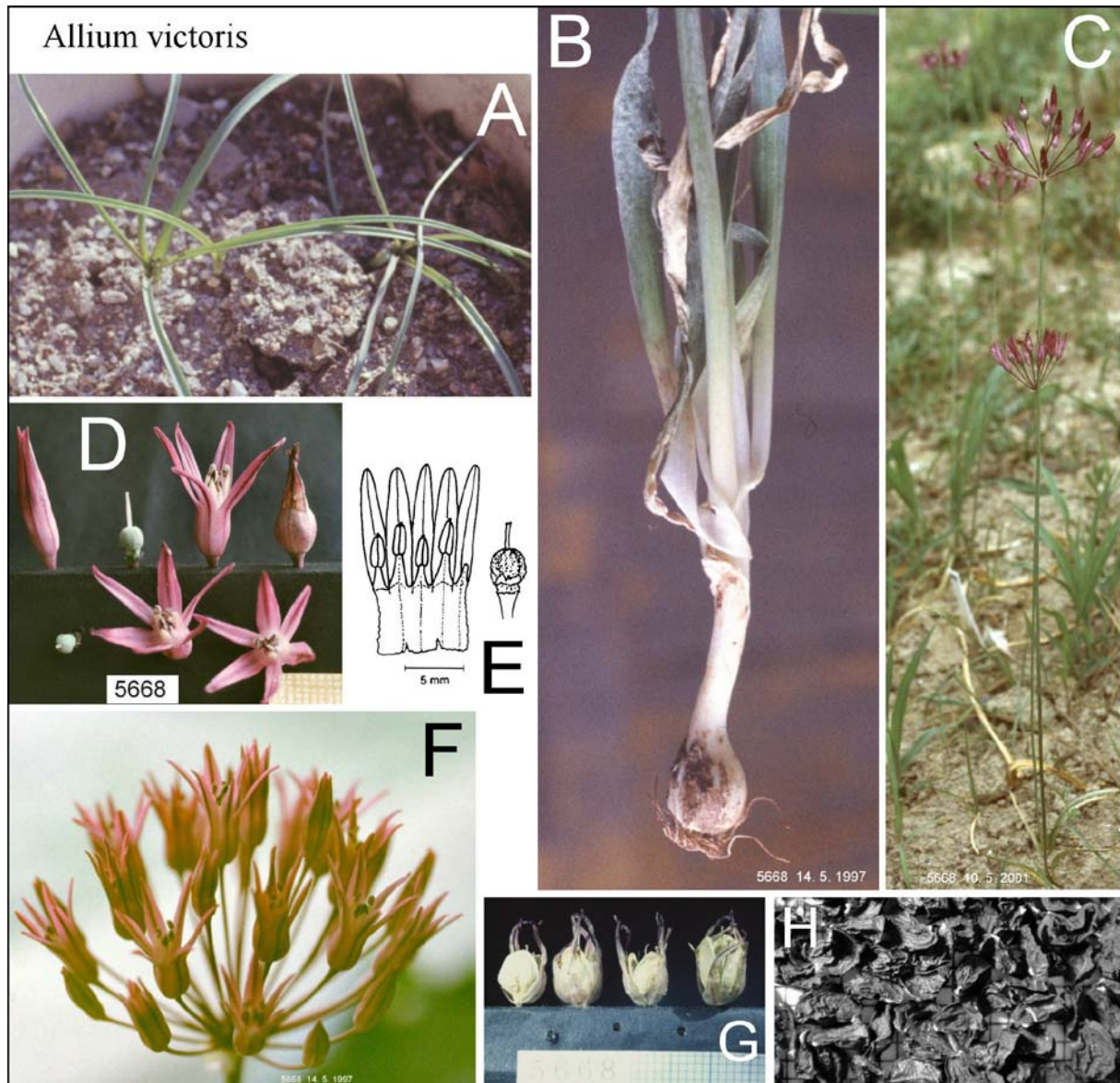


Plate (8): Plants from the type location are shown. A: Sprouting leaves of cultivated plants; B: leaves and bulb of a plant dug out at the type location; C: plants in late anthesis cultivated in Tashkent, Uzbekistan; D: comparison of flowers and flower parts in different stages of anthesis; E: shape of ovary, tepals and filaments of a flower prepared from herbarium (from Fritsch 2000: 67 plate 1, B); F: inflorescence in full anthesis; G: ripe open capsules; H: seeds (millimeter paper as background and measure scale of D, G & H).

Living accession studied: Kazakhstan: Steppe c. 60 km NE Tashkent, hill ridge Alymtau, red loamy slopes (type location, 41°45' N, 68°39' E, c. 600 m, 09.5.1997 Khassanov via Fritsch 1599; TASH GAT) TAX 5668.

Remarks: *Allium victoris* inflorescences are similar to those of *A. iliense* s. str. though the plants are slender with leaf laminae that are very narrow as those of *A. sochense*, but straight and patent. The flower characters are intermediate between *A. cupuliferum* and *A. hissaricum*, but the flowers emit a much stronger odor than these species. Samples for molecular studies were not available yet.

Etymology: The epithet honors, like *A. botschantzevii* Kamelin, the outstanding Russian botanist and botanical explorer in Central Asia, Viktor Petrovich Botschantzev (1910-1990) acting in the 1930ies to 1980ies in Tashkent and St. Petersburg (Leningrad).

3.2 A. sect. *Regeloprason* **subject. *Diffusoumbellata*** R.M. Fritsch  
in *Phyton* (Horn, Austria) 49: 201 (2010). — Type species: *Allium cupuliferum* Regel

*Allium cupuliferum* Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 3, 2: 234 (1875), Regel in *Izv. Imp. obshch. lyub. est. antr. etn.* 21, 2: t. XV f. 4, 5 (1876). Regel in *Trudy Imp. S.-Peterb. Bot. Sada* 10: 298, 354 (1887). Lipsky in *Trudy Imp. S.-Peterb. Bot. Sada* 18: 131 (1900); Vved., *Flora URSS* 4: 277 (1935); Vved., *Flora Uzbek.* 1: 466 (1941), omnia p. p.; Vved. [& Kovalevskaya], *Opred. rast. Sredn. Azii* 2: 88 (1971). Fritsch in O.A. Ashurmetov & al. (eds.), *Pl. Life S.-W. & C. Asia*, Tashkent: 64, 67 plate 1, D (2000). — Type: Uzbekistan: Saravshanskaya dolina, Dzhizhanskoe ushchel'e [Zaravshan valley, Jizman gorge], 2040-2874', 02.5.1869 leg. O. Fedtschenko (holotype LE!, isotype TASH-Fedt! with 2 labels: 02.5. and 03.5.!).

**(9) subsp. *cupuliferum***

Distribution: Uzbekistan: Aktau, Nuratau, and Malguzar massifs north of the Turkestan range, submontane rock terraces and rubble slopes.

Description: Bulbs depressed-globose, 1-3 cm long, 1-3.5 cm in diam.; inner tunics strong, whitish, outer tunics somewhat splitting, blackish. Scape straight or ± flexuous, terete, smooth, 30-60 cm long, 3-4 mm in diam.; green with maroon base. Leaves 1-2 (3), laminae (narrowly) lanceolate, arcuately ascending and reflexed, very thick, ± canaliculate; upper side with some grooves, lower side initially finely ribbed later with c. 1 mm high sharp-edged but smooth longitudinal ribs; margins narrowly maroon, near base finely toothed above mostly glabrous, shortly tapering into the short hooded apex; 25-45 cm long, 2-4.5 cm broad; dull grayish green with slight glaucous bloom. Sheathy prophyll short (reaches the soil surface), hyaline, smooth, thickish, bright, quickly decaying. Spathe membranous, completely divided in 2-3 long acuminate, 12-15 mm long valves; buff with inconspicuous veins. Inflorescence semiglobose; already loose when in buds, moderately few-flowered; 4-10 cm in diam. and 3-6 cm long. Pedicels thin, ± wiry, basal pedicels ascending, the others straight; glossy maroon. Anthesis in May. Flowers broadly campanulate to funnel-shaped. Tepals lanceolate, obtuse with canaliculate apex, obliquely positioned, later connivent, basally for 1/4 connate; outer tepals 12-15 mm long and 3.5-4 mm broad, inner tepals 10-13 mm long and 2.5-3.5 mm broad; bright pink with narrow, carmine to brownish-green median vein. Filaments 1/3-2/5 as long as the tepals; basally for 1/4 connate and for 1/2 adnate to the tepals, the free part of the inner filaments broadly triangular, of the outer ones shorter and narrowly triangular; pink to purplish with paler base. Anthers ovoid to arrowhead-shaped; 1.2-1.5 mm long, 0.8-1 mm broad; red. Pollen grayish-yellow. Ovary stipitate, subglobose, surface finely scabrous; 2-3 mm long and in diameter; glaucous brown suffused. Up to 8 ovules per locule, 24 ovules per ovary (Filimonova 1970). Style shortly conical, 1-1.5 mm long; whitish to pinkish. Stigma undivided; whitish. Capsule ± globose, encased by the dry tepals, up to 9 mm in diam.; widely open, valves broadly ovate; semi-glossy; initially grayish green, finally yellowish. Seeds 2-3 per locule, ovoid to drop-shaped, somewhat edged; surface finely papillous with dense raised wrinkles, silk-glossy black; 2.5-3.2 mm long, 2-2.3 mm broad, 1.5-2 mm thick.

Chromosomes:  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Turkestan range, Penjikent, Seisums s. n.).  $2n = 16$  Fritsch 2000 (Uzbekistan: Aktau ridge, valley Juman, type location).  $2n = 16$  IPK *Allium* reference collection ideogram (Uzbekistan: Nuratau ridge, Sentjabsai, TAX 5808, Beshko s. n.).

Living accessions studied: Uzbekistan: Malguzar ridge, NW exposed gneiss slopes E vill. Sangzor, valley of Sangzor river (40°04' N, 67°43' E, 650 m, 15.4.1995 Fritsch, Khassanov 1282; GAT) TAX 5241; Aktau ridge c. 40 km NE town Kattakurgan, Ionboshsai (40°15' N, 66°12' E, 1300 m, 20.5.1993 Fritsch, Khassanov 870; GAT) TAX 3708, slate slope near the road 2 km S Langar (40°21'54" N, 66°00'57" E, 1100 m, 31.5.2003 Fritsch, Keusgen, Khassanov 4176 (4117); GAT) TAX 6196, northern chains, granitic slopes in *Amygdalus* association (40°23' N, 66°03' E, 1300 m, 16.4.1995 Fritsch, Khassanov 1298; GAT) TAX 5247, southern chains, SE exposed slopes in the valley of Oltynsai opposite to the road (40°21' N, 66°01' E, 1100 m, 17.4.1995 Fritsch, Khassanov 1302; GAT) TAX 5250; Nuratau ridge, field station above village Uhum (40°31'30.6" N, 66°46'04.3" E, 1040 m, 05.5.2005 Fritsch, Khassanov 4199; GAT) TAX 6350, height N village Uhum (40°31'22.7" N, 66°43'50.7" E,

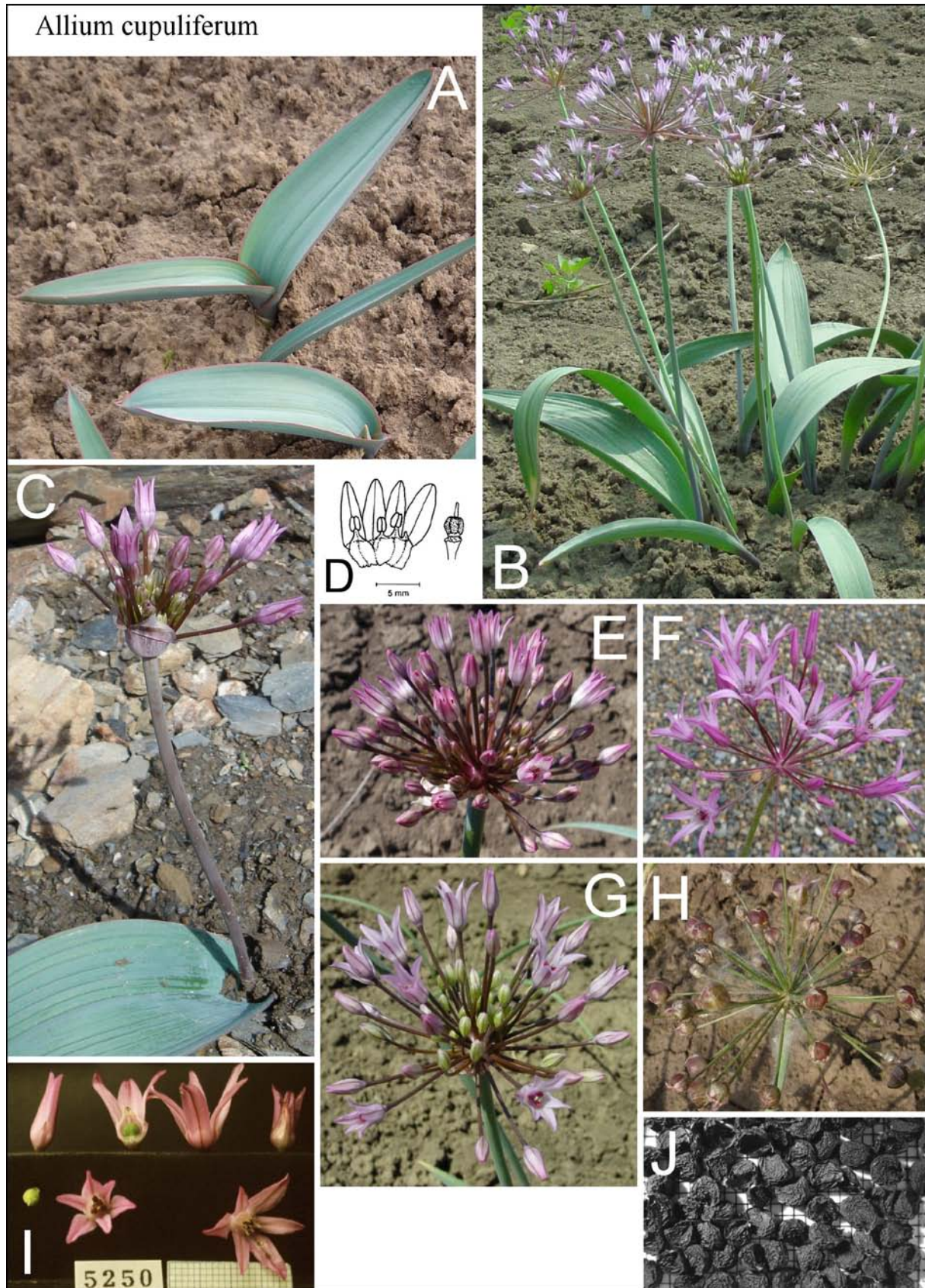


Plate (9): A: Sprouting leaves of cultivated plants; B: flowering cultivated plants; C: plant in early anthesis in Nuratau ridge, Uzbekistan; D: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, D); E, F & G: inflorescences in early and full anthesis, resp.; H: inflorescence with developing dapsules; I: comparison of flowers and flower parts in different stages of anthesis; J: seeds (millimeter paper as background and measure scale of I & J).

1660 m, 06.5.2005 Fritsch, Khassanov 4203, 4205; GAT) TAX 6354, TAX 6356, Nuratau crest region near Sentyabsai, limestone rubble slope (2000 m, 1998 coll. Beshko s.n.; GAT) TAX 5808.

**Remarks:** *Allium cupuliferum* is the type species of subsect. *Diffusoumbellata*. This ornamental species owns rather thick and broad, glaucous leaves and striking pink, straight tepals; it occurs only in the mountains north and northeast of Samarkand (Uzbekistan; Fritsch 2012b: 249). Prior to Vvedensky (1971), also *A. lipskyanum* was included in *A. cupuliferum*, despite the latter taxon differs by twice more, thin, narrower leaves, initially very short pedicels strongly elongating during and after anthesis, and occurs in the central and southwestern Hissar range in Tajikistan and Uzbekistan. The clear separation of both taxa is also underlined by molecular data: *A. cupuliferum* is moderately closely related to *A. isakulii*, *A. balkhanicum*, *A. subkopetdagense* and the members of sect. *Stellata* (Fritsch & al. 2010: 185 cluster 3 § 3.5.2; Fritsch 2012b: 249 Fig. 2 F), but *A. lipskyanum* belongs to cluster 7 and is related to other members of sect. *Regeloprason* and to most species of sect. *Compactoprason*. Sequence data of the plastid *trnL-trnF* region show a similar separation and more or less identical relatives in different groups: *A. cupuliferum* belongs to lineage VI, but *A. lipskyanum* to lineage IV (Gurushidze & al. 2010: 836, fig. 4).

The occurrence of *A. cupuliferum* in the Kugitang ridge (Kamelin in Nikitin & Gel'dikhanov, *Opredel. rast. Turkmen.*: 129, 1988) seems very doubtful, perhaps the voucher belongs to *A. regelii*.

**Etymology:** The epithet is most probably derived from the cup-like united basal part of the perigon (from Latin "cup-bearing").

**Biological data:** Reported genome size 40.8 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.22 % cysteine sulfoxides (77 % methiin, 10 % alliin, 13 % isoalliin; Keusgen & al. 2008).

**Economic traits:** The plants are not eaten by local people because of its unpleasant taste (Keusgen & Fritsch 2008). Very rarely offered as ornamental (Fritsch 2015).

**(10) *Allium cupuliferum* subsp. *nuratavicum*** R.M. Fritsch & Beshko in O.A. Ashurmetov & al. (eds.), *Pl. Life S.-W. & C. Asia*, Tashkent: 64, 67 plate 1 E (2000). — **Holotype:** Uzbekistan: khr. Nuratau, verkhov'ya Sentyabsaya, okolo vodorazdela, yugo-zapadnaya eksp. [Nuratau ridge, heights of Sentyabsai, near watershed, SW exposition] 2000 m, leg. 14.5.1995 Beshko 95082 (holotype and isotype GAT!).

**Distribution:** Uzbekistan: Highest parts of the Nuratau massif; montane rock terraces and rubble slopes.

**Description:** Bulbs depressed-globose, 2-3 cm in diam.; tunics membranous to papery, outer tunics finally blackish and shell-like many-layered, disintegrating. Scape flexuous, terete, smooth; 10-20 cm long, 5-6 mm in diam.; green with glaucous bloom. Leaves 1-2, laminae lanceolate to ovate-lanceolate, arcuately prostrate, thick; upper side smooth or with a few grooves, lower side finely ribbed; margins basally subscabrous and enrolled, above glabrescent, shortly tapering into the hooded apex; 10-25 cm long, 3-6 cm broad; initially violet suffused with purple margin, later gray-green with glaucous bloom. Sheathy prophyll short, brownish to whitish, quickly decaying. Spathe divided in 2 suborbicular, reflexed valves; buff with inconspicuous veins. Inflorescence initially semi-globose later globose; loose, moderately many-flowered; 5-12 cm in diam. Pedicels unequally long, thin wiry, straight or basal pedicels slightly ascending; initially 2-3, finally up to 6 cm long; glossy carmine to brown. Anthesis in May. Flowers narrowly triangular campanulate to funnel-shaped. Tepals lanceolate, obtuse, obliquely forward directed, later irregularly convolute and crumpled, connivent, basally for 1/3 (inner tepals) to 1/4 (outer ones) connate; outer tepals 10-12 mm long and 3-3.5 mm broad, inner tepals 8-11 mm long and c. 2.5 mm broad; bright pinkish-lilac fading toward the base, with a narrow, distinct, maroon to greenish brown median vein. Filaments 1/2 as long as the tepals; the basal 2/3 connate, the free part very shortly triangular (inner filaments longer and broader) widened; whitish with pink to violet apex. Anthers oblong; c. 1.5 mm long and 0.8 mm broad; reddish. Pollen pale yellow. Ovary shortly stipitate, triangularly depressed-globose, c. 3 mm long and in diam.; surface finely papillous; silk-glossy vividly green. Style conical-threadlike, 2-3 mm long; bright pink to violet. Stigma undivided; whitish. Capsule and seeds not seen.

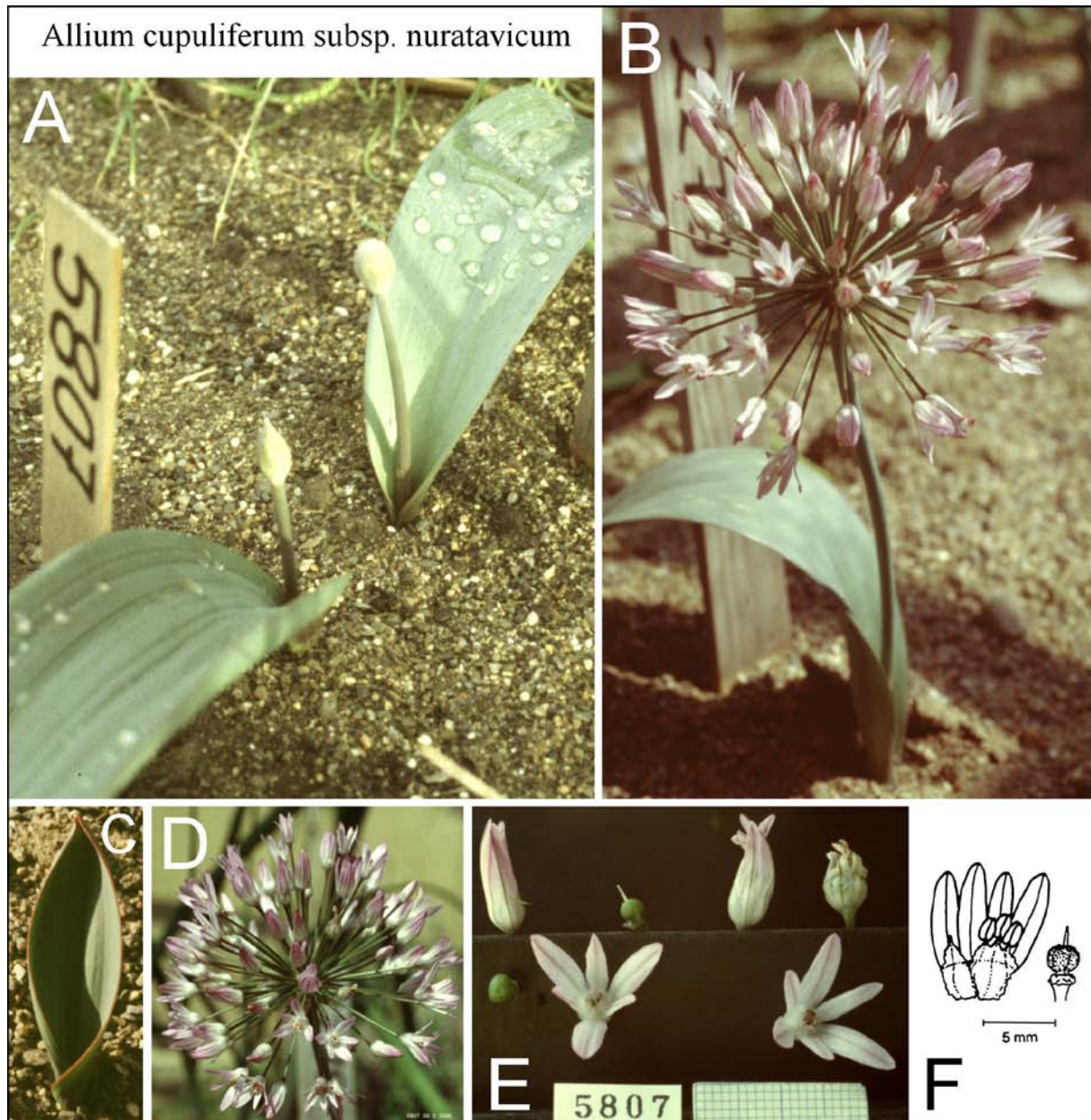


Plate (10): Cultivated plants from the type location are shown. A: Shooting plants; B: flowering plant; C: sprouting leaf; D: inflorescence in full anthesis; E: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as measure scale); F: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, E).

Living accessions studied: Uzbekistan: Nuratau ridge, Mt. Khajatbashi, S exposed limestone rubble slope (2100 m, 1998 Beshko s. n.; GAT) TAX 5807.

Remarks: Plants from Mt. Khyatbashi showed the typical character states (more compact and smaller growth, shorter leaves with a finely ribbed lower side, denser inflorescences, lilac flowers and longer united tepals than subsp. *cupuliferum*) also under cultivation in Gatersleben. Extraction of DNA for molecular analyses failed.

Etymology: The subspecific epithet was derived from the Nuratau ridge in SW Uzbekistan where the type was collected.

(11) *Allium balkhanicum* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch in *Phyton* (Horn, Austria) 49: 186 (2010). *Allium isakulii* R.M. Fritsch & F.O. Khass. subsp. *balkhanicum* R.M. Fritsch & F.O. Khass. in O.A. Ashurmetov & al. (eds.), *Pl. Life S.-W. & C. Asia*, Tashkent: 65, plate 1 H (2000). —

*Allium iliense* sensu Vved., Flora Turkm. 1 2: 295 (1932); Vved., Flora URSS 4: 278 (1935); Kamelin in Nikitin & Gel'dikhanov, Opred. rast. Turkmen.: 124, 129 (1988); et auct. quoad pl. Turkmen., omnia p. p. — Type: Ex culturae in horto Gaterslebensis no. TAX 5264/97 leg. 29.5.1997 (ex Turkmenistan: Großer Balkhan, *Artemisia*-Steppe ca. 10 km NO Dzhebel [cultivated in Gatersleben ... from Great Balkhan massif, *Artemisia* steppe c. 10 km NE Jebel], ca. 450 m, 39°42' N, 54°28' E, 20.4.1995 Fritsch & Khassanov 1322, holotype and isotype GAT!).

Distribution: Turkmenistan: Great Balkhan massif and its foothills, *Artemisia* associations of steppe slopes on limestone.

Description: Bulbs ovoid, 15-25 mm long, 10-18 mm in diameter; outer tunics strong, somewhat longitudinally split, finally black. Scape straight to flexuous, terete, smooth, (15) 20-25 cm long, below 2-4 mm, near tip 2-2.5 (3) mm in diameter; green, mainly the basal part purplish suffused. Leaves 1-2, narrowly lanceolate, flat-arcuately recurved to the soil, thick, near base canaliculate above shallower canaliculate; upper side smooth, lower side finely and densely ribbed; margins white, finely toothed, towards the apex nearly smooth, gradually tapering into the long hooded apex; (15) 20-30 cm long, 8-20 mm broad; green, glaucous. Sheathy prophyll tender, early decaying. Spathe membranous, completely divided in 2 oval, ± long acuminate, 0.5-1 cm long valves; buff, veins reddish. Inflorescence fastigiate; very loose, 20-40 flowered; 4-10 cm in diam., up to 6 cm long. Pedicels unequally long, thin wiry, straight or slightly ascending; up to 6 cm long; glossy reddish later green. Anthesis in mid to end of April. Flowers narrowly campanulate. Tepals narrowly lanceolate with obtuse apex, the basal 1/5-1/4 connate, in anthesis recurved, later straight and slightly crumpled; 12-16 mm long, 2-3 mm broad; rose, later pink, median vein of inner tepals narrowly lanceolate, of outer tepals much broader in the middle, green to maroon. Filaments 1/4-1/3 as long as the tepals; basally connate and triangular (the inner filaments longer) widened; white. Anthers ovoid, mucronate; c. 1.5 mm long; reddish, later brown. Pollen yellowish. Ovary ovoid, stipitate, without angles and furrows, 3 mm long, 2 mm in diam.; surface finely

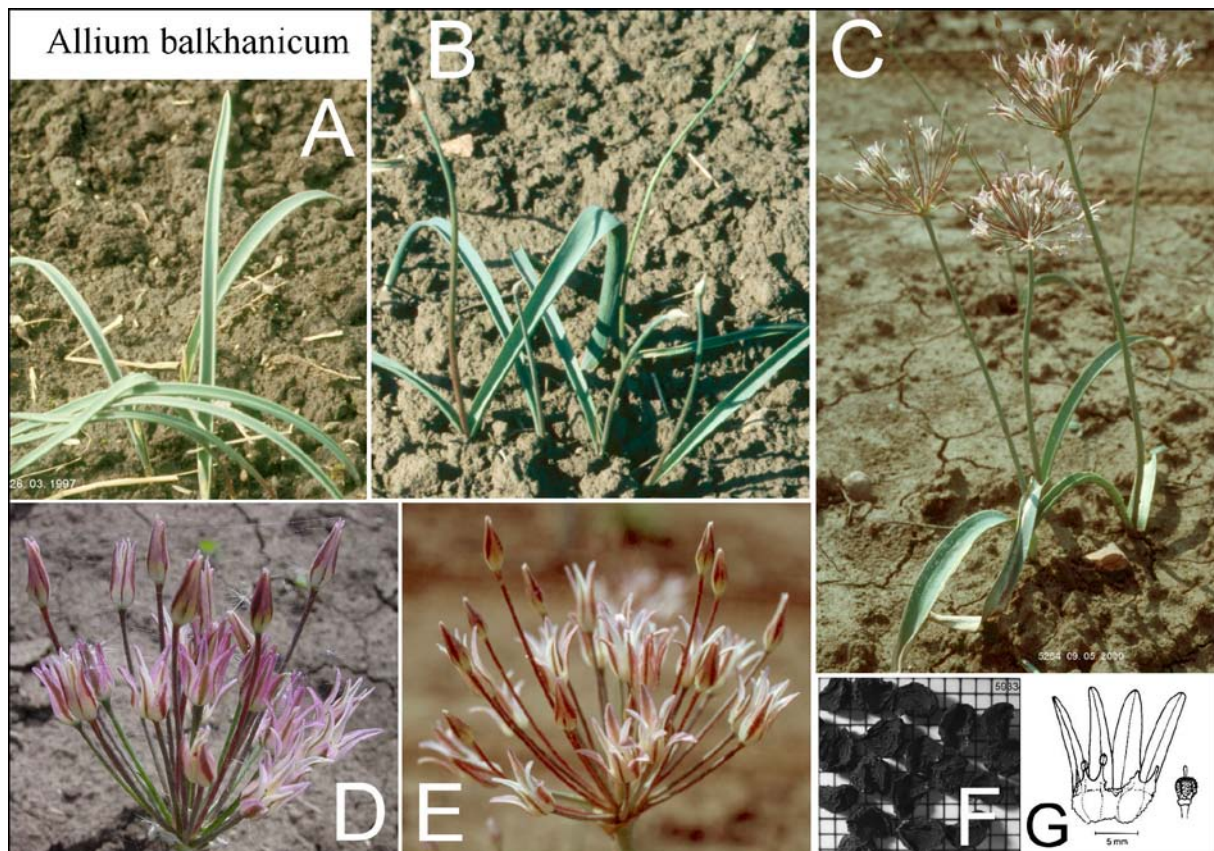


Plate (11): A & B: Shooting cultivated plants; C: flowering cultivated plants; D & E: inflorescences of cultivated plants in full anthesis; F: seeds (millimeter paper as background); G: shape of ovary, tepals, and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, H).



scabrous; pale green. Style short conical, c. 1 mm long; whitish. Stigma  $\pm$  undivided; whitish. Capsule broadly triangular depressed-globose, c. 4 mm long and in diam.; widely open, valves suborbicular, surface with raised wrinkles; buff. Seeds 1-2 per locule, flat ovate to semi-circular, sides often concave; surface densely reticulate with raised wrinkles, dull black; 2.5-3 mm long, 2 mm broad, 1.5 mm thick.

Living accessions studied: Turkmenistan: Great Balkhan massif, Artemisia steppe c. 10 km NE Dzhebel (39°42' N, 54°28' E, 450 m, 20.4.1995 Fritsch, Khassanov 1322; GAT) TAX 5264, spring Nazar Ekerem at N slopes of Great Balkhan (39°37'42" N, 54°22'15" E, c. 300 m, 09.4.2002 Fritsch, Keusgen, Khassanov 31; GAT) TAX 5931; foothills of Great Balkhan massif S spring Nazar Ekerem (39°38' N, 54°22'30" E, 515 m, 10.04.2002 Fritsch, Keusgen, Khassanov 33, 34; GAT) TAX 5932, TAX 5933.

Remarks: This species is easily discernible from other smaller taxa of sect. *Regeloprason* in Central Asia by the poor-flowered, more fastigate than umbel-like and moderately loose inflorescence with crème-pinkish flowers; the general appearance is most similar with *A. iliense* s. str. Molecular markers (ITS sequences of nuclear rDNA) support a moderately close relationship to *A. iliense* s. str. and *A. isakulii*, and less close relations to *A. subkopetdagense* and *A. cupuliferum* (Fritsch & al. 2010: 186, cluster 3 § 3.5.3; Fritsch 2012b: 249 Fig. 2 H; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region show a lower resolution; here *A. balkhanicum* shares the identical haplotype with *A. cupuliferum*, and the species of the sects. *Kaloprason*, *Stellata*, and *Megaloprason* s. str. (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

Etymology: The epithet refers to the Great Balkhan ridge at the northern margin of which the type location is located.

Biological data: The genome size of 40.8 pg 2C DNA is similar to *A. subkopetdagense* (41.4 pg; Gurushidze & al. 2012).

(12) *Allium iliense* Regel in Bull. Soc. Imp. Natur. Moscou 41 II: 452 (1868), Regel in Izv. Imp. obshch. lyub. est. antr. etn. 21, 2: t. XV f. 9, 10 (1876), sensu stricto. Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 236 (1875); Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 299, 357 (1887). Vved., Flora URSS 4: 278 (1935), p. p. min. Nikitina & Kashtsh., Flora Kirg. SSR 3: 95-96 (1951); Nikitina & al., Flora Kirg. SSR, Dopln. vyp. 1: 53 (1967). Pavlov & Polyakov, Fl. Kazakhst. 2: 193 (1958). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 89 (1971), p. p. min. Wendelbo, Flora Iranica 76: 94, tab. 10/137 (1971), p. p. Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 64, 67 plate 1 F (2000). — Non *Allium iliense* sensu Vved., Flora Turkm. 1, 2: 295 (1932), sensu Kamelin in Nikitin & Gel'dikhanov, Opred. rast. Turkmen.: 124, 129 (1988); Vved., Flora URSS 4: 278 (1935), p. p. maj., Vved., Flora Uzbek. 1: 466 (1941), Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 89 (1971), p. p. maj. — Type: Kazakhstan: "No. 90 *Allium iliense* Rgl. Ili-Niederung, auf Sandboden [Ili river lowland, sandy soil], 1000 F., Mai 24 1857, leg. Semenow" (holotype LE). The type citation by Wendelbo 1971: 94 "... Semenow 1085" used erroneously the number of Regel's enumeration "Plantae Semenovianae" instead of the collection number.

Distribution: Kazakhstan: East of Chu-Ili mountains to lake Balkhash, Tarbagatai range?; oversanded rock slopes and plateaus in the semi-desert.

Description: Bulbs ovoid to subglobose, 1.5-2.5 cm in diam. and long; inner tunics papery, white, outer tunics finally brownish-violet, many-layered, near base and above longitudinally splitting. Scape straight, terete, smooth; 15-35 cm long, 2.5-3 mm in diam.; green with maroon flush (?). Leaves 1-2, laminae oblong-linear, flat arcuately ascending and recurved to the soil, rather flat; upper side nearly smooth, lower side with some toothed ribs; margins  $\pm$  undulate, hyaline, finely toothed; c. 10-25 cm long, up to 4 cm broad; green with glaucous bloom. Spathe membranous, divided in 1-2 lanceolate, shortly acuminate valves, much shorter than the pedicels; buff. Inflorescence fasciculate or  $\pm$  semi-globose; very loose, with 6-30 (50) flowers. Pedicels unequally long, ascending; 2-10 (14) cm long. Anthesis in May. Flowers narrowly campanulate. Tepals linear-lanceolate, thickish, long tapering into the obtuse apex, basally for 1/4-1/3 connate, rather straight, later the margins convolute; 10-15 mm

long, base of free part 2-3 mm broad; pinkish-carmine with purple or dirty-green median vein. Filaments 2/5 as long as the tepals; basally for 4/5-5/6 connate, the free part broadly lanceolate, of the inner filaments broader and much longer. Anthers ovoid; c. 2.5 mm long. Ovary stipitate, ovoid to subglobose; surface finely papillous. Up to 9 ovules per locule, 22 ovules per ovary (Filimonova 1970). Style shortly cylindrical, c. 1 mm long. Stigma slightly tripartite. Capsule subglobose, 4-6 mm in diam.; widely open. Seeds 3-5 per locule?, ovoid to drop-shaped; surface papillous with densely reticulate, raised wrinkles, dull black; 2-2.5 mm long, 1.5-2 mm broad, 1-1.5 mm thick. The testa showed verrucose periclinal walls and mostly Omega-like undulation of anticlinal walls with low to moderate amplitude and short wavelength (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Zakirova & Vakhtina 1974, Vakhtina & al. 1977 total length of chromosomes (Kazakhstan: Ili valley, Kapchagai, no. 189, type location ?); Taukum desert, vill. Ajdarly, no. 188).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Kazakhstan: Ili valley near Kapchagai TAX 3724, type location).

**Remarks:** *Allium iliense* is the oldest name for members of sect. *Regeloprason* sharing very loose, large, and umbel-like inflorescences rolling over the soil in the fruiting state blown by the wind ("tumbleweeds"). Thus up to Kamelin (1980) this epithet was also used for several recently separated taxa of more southern distribution. This author mentioned also long-flowered plants growing in the NW Karatau range and the river lowland of Sarysu that need further investigation of their taxonomic state. The description presented here refers to very few plants studied at the type location. These plants died in Gatersleben prior to making flower scapes again. Molecular markers (ITS sequences of nuclear rDNA) supported the mentioned splitting of *A. iliense* s. latiss. (as far as samples were available), with *A. isakulii* as the closest relative, and *A. balkhanicum*, *A. subkopetdagense*, and the Iranian *A. cathodicarpum* Wendelbo as less close relatives (Fritsch & al. 2010: 186 cluster 3 § 3.5.3). Two more samples from the Fergan depression added later turned out to represent well separated and distantly related (but hitherto undescribed) new taxa (ady16760 and isak13Fer; Fritsch 2012b: 249, 250 Fig. 3 G and H; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). These analyses are still incomplete because of the low number of samples per taxon; addition of more material would be essential.

**Etymology:** The epithet refers probably to the Ili river lowland where the type specimen was collected.

**Biological data:** Reported genome size: 35.7 pg 2C DNA (Vakhtina & al. 1977), 33.8 pg (Zakirova 1989). Regel (1875) pointed out that some flowers may have rudimentary outer filaments that may appear as tooth-like appendices at the margins of the inner filament bases. A few later developing flowers bear solely male organs and are topping shorter pedicels than normal flowers.

(13) *Allium isakulii* R.M. Fritsch & F.O. Khass. in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 65, 67 Plate 1G (2000). — *Allium iliense* subsp. *nuratense* Kamelin in Bot. Zh. 65: 1463 (1980), s. str., quoad typum. *Allium isakulii* subsp. *nuratense* (Kamelin) R.M. Fritsch & F.O. Khass. in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 65 (2000), nom. superfl. Type: Uzbekistan, montes Nuratavici, jugum Bachiltau prope pagum [Nuratau ridge, Bakhiltau Mts. near village] Nurata, 900 m, 8.5.1978, leg. Botschantzev, Litvinova, Sumerin 1124 (holotype LE!). *Allium iliense* sensu Vved., Flora URSS 4: 278 (1935); Vved., Flora Uzbek. 1: 466 (1941); Vved., Flora Tadzh. SSR 2: 361 (1963), Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 89 (1971), omnia p. p. — **Type:** Tajikistan: [Expedition to Mogoltau massif, valley Boj-Bogush-Ata], leg. 09.5.1924, M. Popov & Vvedensky 566 (holotype TASH!, isotype LE).

**Distribution:** Uzbekistan, Kirgizstan?, Tajikistan: Mogoltau and Nuratau ridges; colline to submontane, steep limestone rock and rubble slopes; plants in the Fergan depression area belong most probably to another taxon.

**Description:** Bulbs subglobose, c. 2 cm in diam.; tunics parchment-like, inner ones whitish, outer tunics grayish-black, longitudinally splitting. Scape straight, terete, smooth; 40-60 cm long, 4-5 mm in diam.; green with strong glaucous bloom. Leaves 1-2, laminae broadly linear-lanceolate, thick, initially obliquely directed, later recurved, very shallowly canaliculate; upper side smooth with few groo-

ves, lower side with narrow shallow ribs; margins initially purple later white, subglabrous, very shortly arcuately tapering into the scarcely hooded apex; 15-25 cm long, 2-4 cm broad; green with strong glaucous bloom. Spathe membranous, divided in 1-2 very short, acuminate, subreflexed valves; brownish. Inflorescence fasciculate to semi-globose; very loose, rather poor-flowered, buds open very gradually; 8-15 cm in diam. Pedicels unequally long, strong wiry, basally thickened,  $\pm$  ascending c. 4-7 cm long; silk-glossy greenish-brown paler towards the base. Anthesis in June (to July). Flowers triangular campanulate to urceolate. Tepals lanceolate, acuminate, straight, arcuately connivent with recurved apex, basally for 1/3 connate, 10-12 mm long, base of the free part 3-3.5 mm broad; pinkish-carmine with greenish median vein. Filaments about 2/3 as long as the tepals; for 2/3 connate, free part of the inner filaments broadly rectangular, suddenly subulate, of the outer filaments for 1/3 narrower, long triangular; purplish. Anthers ovoid?; violet. Pollen yellow. Ovary sessile,  $\pm$  ellipsoid, 3-4 mm long, c. 3 mm in diam.; surface papillous; green with darker suturs. Style shortly cylindrical, 1-2 mm long, not protruding; pinkish. Stigma slightly capitate; whitish. Capsule  $\pm$  globose, surface scabrous, 6-8 mm in diam.; moderately widely open, valves suborbicular, scarcely notched at the apex; greenish-brownish. Seeds

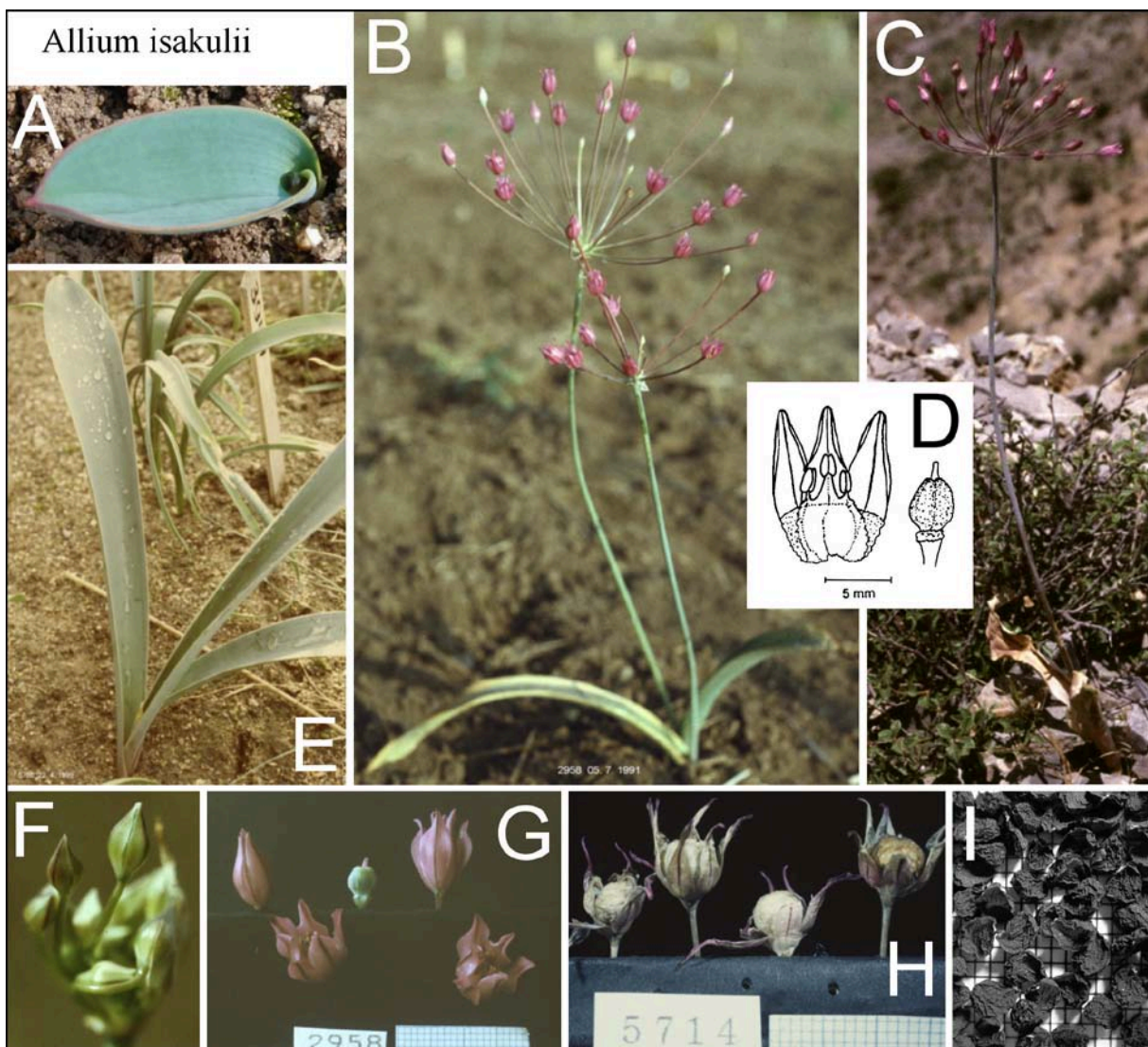


Plate (13): A: Sprouting leaf; B: cultivated plant in full anthesis; C: plant in late anthesis in Mogoltau massif, Tajikistan; D: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, G); E: cultivated plant in early shooting stage; F: inflorescence in the budding stage; G: comparison of flowers and flower parts in different stages of anthesis; H: ripe capsules; I: seeds (millimeter paper as background and measure scale of G, H & I).

3-6 per locule, flat and broadly drop-shaped; surface papillous with a rather dense network of raised wrinkles, dull black; c. 2.5 mm long, c. 2 mm broad, 1.5 mm thick. The testa showed verrucose periclinal walls and mostly Omega-like undulation of anticlinal walls (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Vakhtina "1985" in Agapova & al. 1990 (Uzbekistan: Kojtash Mts., Suljuki-saj, Botschantzev 590 "A. *nuratense*").  $2n = 16$  Astanova 1990 (Tajikistan: Mogoltau massif "A. *iliense*").

Living accessions studied: Tajikistan: W Tianshan range, Mogoltau massif, SE exposed limestone slopes in valley Ptavsai (40°17' N, 69°26' E, 1100 m, 31.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 574; 950 m, 01.6.1997 Fritsch, Khassanov 1649; GAT) TAX 2958, TAX 5714, unknown place in Spa massif (unknown collector, 40°17' N, 69°27' E, 1000 m, 20.5.1998 via Fritsch 1666; GAT) TAX 5786.

Remarks: Kamelin (1980) started the division of the "conglomerate species" *A. iliense* s. lat. into more natural taxa by creating subsp. *nuratense* as "a morphotype clearly separable by an own area of distribution and related to *A. cathodicarpum* Wendelbo" and affiliated these taxa to sect. *Acanthoprason* Wendelbo. Seisums (1994: 28) agreed to this affiliation by creating [sect. *Kaloprason*] subsect. *Iliensia* Kamelin & Seisums, a never validly described group, for *A. iliense* and *A. cathodicarpum*. Unfortunately, several herbarium vouchers determined by Kamelin as subsp. *nuratense* belong to *A. cupuliferum* s. str. (e.g. Tsukervannik 419 from Nuratau was even marked as "typical specimen" by Kamelin himself). Thus subsp. *nuratense* is an unclear taxon, and an independent solution for the new taxon also involved had to be found.

Important key characters of *A. isakulii* are the broad leaves (that are fleshy like in many related taxa) and the fleshy, undulate but straightly directed tepals. Unfortunately, the fleshy character disappears in the drying process, and is no longer visible neither on herbarium vouchers nor on the tepals surrounding the capsules. Typical *A. iliense* differs by not fleshy and not undulate flowers and narrower leaves, and is represented by smaller plants growing in sandy semi-desert habitats. The inflorescence of *A. isakulii* is rather similar to *A. subkopetdagense* but the latter species owns much narrower leaves, not undulate tepals, and is growing on fine limestone rubble slopes on foothills of the Kopetdag range. *Allium balkhanicum* has again a remarkably smaller stature, and differs also by narrow leaves and denser, fasciculate-semiglobose, poorer-flowered inflorescences of pale rose-crème flowers. Molecular studies of ITS sequences of nuclear rDNA underlined the close relationship of *A. isakulii* to *A. iliense*, with *A. cupuliferum* as the most basal relative and sect. *Stellata* as sister subgroup. *Allium balkhanicum* and *A. subkopetdagense* / *A. cathodicarpum* are more distant relatives. All these taxa were far away positioned from sect. *Kaloprason*. However, only very few samples could be studied (Fritsch & al. 2010: 186 cluster 3 § 3.5.3; Fritsch 2012b: 249 Fig. 2 H; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201); addition of more samples would be essential. Sequences of the plastid *trnL-trnF* region were not studied yet.

Taxonomically unclear remained broad-leaved plants rarely collected in the limestone rock areas surrounding the Fergan depression in Uzbekistan and Kirgizstan. In recent years two very small populations of living plants could be detected by Tashkent botanists at different places in the Fergan depression. Vouchers sent to IPK were molecularly studied (samples isak13Fer and adyl6760; Fritsch 2012b: 249 position H; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201), and both turned out to differ from typical *A. isakulii*. Morphologically similar plants occurred formerly also in S Uzbekistan in the area of the Sherabad river drainage, but became extinct by over-collecting for consumption of the plants by men (information obtained from local peasants during fieldwork in 2003). All these plants might belong to taxa different from *A. isakulii*; perhaps a decision on their taxonomic state will be possible after detailed study in the near future.

Etymology: The epithet honors the excellent contemporary Tajik botanist Isakul Turakulov acting in Khujand who recognized the remarkable differences of *A. isakulii* to typical *A. iliense*.

Economic traits: The green plant parts are eaten in Tajikistan (as *A. iliense*, Anonymous 1985). Not offered as ornamental, because this name was wrongly used (Fritsch 2015).

(14) *Allium subkopetdagense* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch in *Phyton* (Horn, Austria) 49: 186 (2010). Fritsch & Abbasi, *Taxon. review Allium subg. Melanocr.* Iran: 189, plate T75, map (2013). *Allium isakulii* subsp. *subkopetdagense* R.M. Fritsch & F.O. Khass. in O.A. Ashurmetov & al. (eds.), *Pl. Life S.-W. & C. Asia*, Tashkent: 65, plate 1 I (2000). — ? *Allium cupuliferum* sensu Kamelin in Nikitin & Gel'dikhanov, *Opredel. rast. Turkmen.*: 129 (1988). *Allium iliense* sensu Vved., *Flora Turkm.* 1, 2: 295 (1932); Vved., *Flora URSS* 4: 278 (1935), omnia p. p., sensu Wendelbo, *Flora Iranica* 76: 94 (1971), p. p.; Kamelin in Nikitin & Gel'dikhanov, *Opred. rast. Turkmen.*: 124, 129 (1988), et auct. p. p., quoad pl. Kopetdag. — Type: Ex culturae in horto Gaterslebenensis no. TAX 5278/96, leg. 22.7. 1996 (ex Turkmenistan: Zentraler Kopetdag ca. 5 km S der Ortschaft Chuli, Kalkschotterhänge bei [cultivated in Gatersleben ... c. 5 km S village Chuli, limestone rubble slopes at] ca. 800 m, 38°29' N, 056°22' E, 25.4.1995 Fritsch & Khassanov 1366, holotype GAT!).

Distribution: Turkmenistan: C Kopetdag range; submontane limestone rubble slopes and rock terraces, presence on Iranian territory is very probable.

Description: Bulbs depressed-globose, (1.2) 2-3 cm in diam., (1.5) 2-2.5 cm long; outer tunics membranous, finally gray-brown and decomposing. Scape slightly flexuous, terete, smooth, (18) 30-40 cm long, above 3-4, basally up to 6 mm in diam.; green with strong glaucous bloom, basally reddish flushed. Leaves 1-2, narrowly lanceolate, flat ascending-recurved; ± thick, basally strongly, above slightly canaliculate; upper side smooth or with single furrows, lower side with broad and shallow ribs; mar-

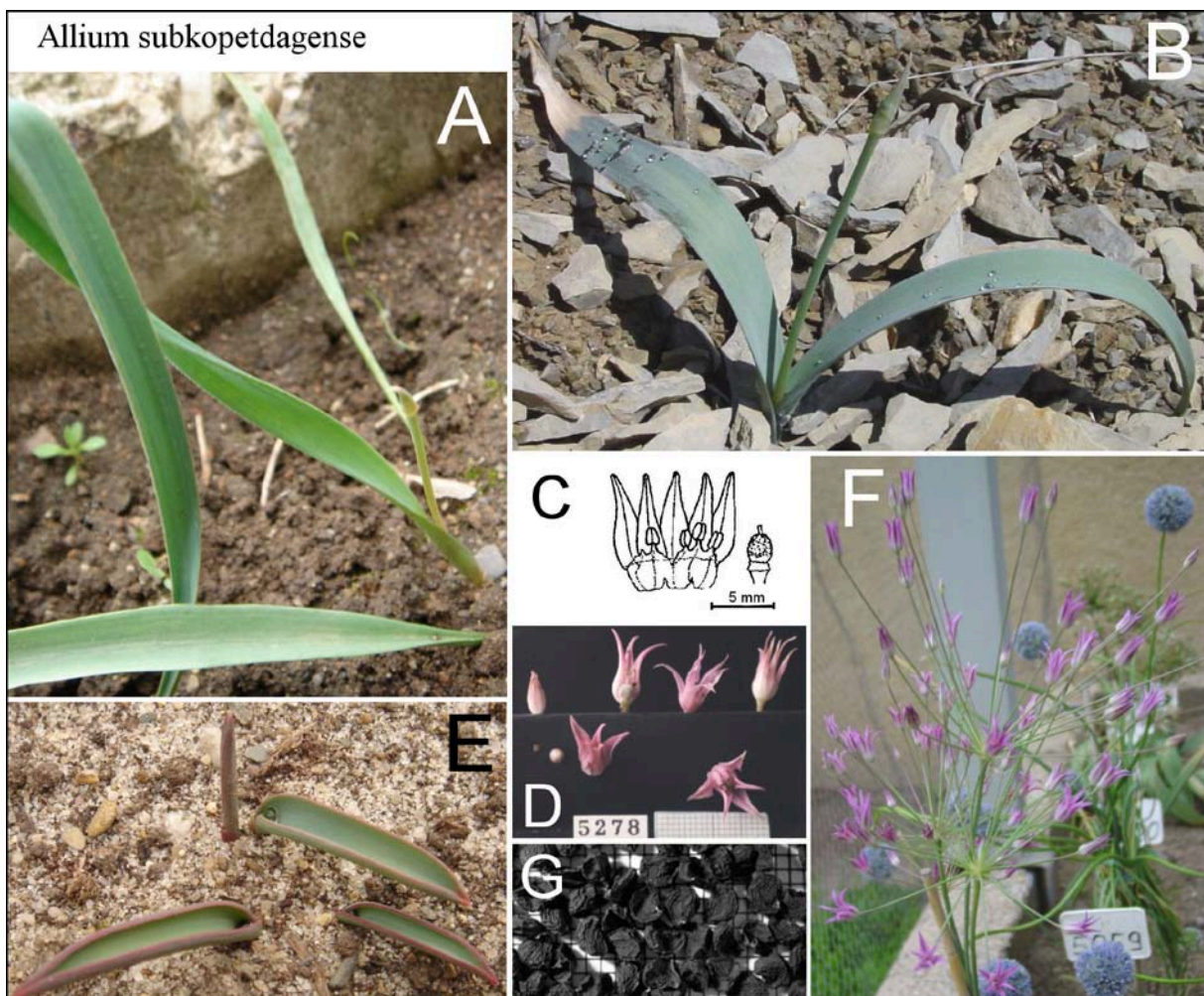


Plate (14): A & B: Plants in the shooting stage in cultivation and in the Chuli valley, Turkmenistan, resp.; C: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, I); D: comparison of flowers and flower parts in different stages of anthesis; E: sprouting leaves of cultivated plants; F: inflorescences of cultivated plants in anthesis; G: seeds (millimeter paper as background and measure scale D & G; plate copied from Fritsch & Abbasi 2013: 190 Plate T75).

gins basally toothed, above glabrescent, initially narrowly red-brown, ± shortly tapering into the hooded apex; 12-25 (35) cm long, 5-20 mm broad; deep green with glaucous bloom. Sheathy prophyll thin, ± strong, with silky sheen. Spathe thin membranous, undivided or split into 2 ovate, long-acute valves, ± completely reflexed; buff with narrow, inconspicuous veins. Inflorescence broadly fasciculate, finally subglobose; very loose, rather few-flowered; (5) 10-15 cm in diam. Pedicels thin wire-like, somewhat ascending; dull brownish-green. Anthesis in June. Flowers narrowly campanulate. Tepals lanceolate-triangular, basally straight and for 3-4 mm connate, the free parts recurved, acute with plicate apex; 12-15 mm long, base of the free part 3-4 mm broad; deep pink to pinkish-carmine, paler towards the base, with narrow, brown-green to carmine median vein. Filaments 2/5 as long as the tepals, for 3/4 adnate to the tepals; above c. 3 mm connate, free part broadly triangular, above shortly subulate; pale pink. Anthers ovoid; c. 2 mm long, 1.5 mm broad; initially violet. Pollen grayish yellow. Ovary very shortly stipitate, subglobose with three narrow furrows, 2-3 mm long and in diam.; surface finely coarse; pale green with violet patches; 14 ovules were reported (Vvedensky 1932). Style narrowly conical, 2-3 mm long; white to finally pink. Stigma undivided, finally subcapitate; pinkish. Capsule globose, encased by the remains of the tepals and filaments, 4-5 mm long and in diam.; widely opening, valves suborbicular. Seeds 1-2 per locule, flat drop- to comma-shaped; surface finely rugose with irregular ledges, dull black; 2.3-3 mm long, 1.5-2 mm broad und thick.

Chromosomes:  $2n = 16$  Fritsch 2000 (Turkmenistan: Central Kopetdag range, Chuli, type location).

Living accessions studied: Turkmenistan: W Kopetdag range, Nokhur valley not far from main road (38°30' N, 57°05' E, 500 m, 06.4.2002 Fritsch, Keusgen, Khassanov 9; GAT) TAX 5919; Central Kopetdag range, upper valley of Chuli above the spring area (37°57' N, 58°01' E, 700-850 m, 14.4.2002 Fritsch, Keusgen, Khassanov 46; ASH), E exposed limestone rubble slope (37°55' N, 58°00' E, 900 m, 19.4.1995 Fritsch & Khassanov 1317; GAT) TAX 5259, 5 km S vill. Chuli (38°00' N, 58°01' E, 800 m, 25.4.1995 Fritsch & Khassanov 1366; GAT) TAX 5278.

Remarks: *Allium subkopetdagense* is similar to *A. cupuliferum* but is distinguished by narrower and thinner leaves, a looser inflorescence, and by backwards bent, plicate tepal tips. *Allium balkhanicum* differs by a fasciculate inflorescence and paler, more yellow flowers. According to molecular markers (ITS sequences of nuclear rDNA), the Iranian *A. cathodicarpum* is the closest genetic relative. *Allium iliense*, *A. isakulii* and *A. balkhanicum* are more distantly related with sect. *Stellata* as sister subgroup, and *A. cupuliferum* occupies the basal position of this group (Fritsch & al. 2010: 186 cluster 3 § 3.5.3; Fritsch 2012b: 249 Fig. 2 H; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region show a lower resolution; here *A. subkopetdagense* owns a haplotype derived from *A. balkhanicum* and *A. cupuliferum*, and the species of the sects. *Kaloprason*, *Stellata*, and *Megaloprason* s. str. as closer relatives (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

Etymology: The epithet refers to the occurrence on foothills of the Kopetdag range (from Latin "sub~" = not completely, below).

Biological data: Genome size 41.4 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.14 % cysteine sulfoxides (50 % methiin, 50 % isoalliin; Keusgen & al. 2008).

3.3 A. sect. *Regeloprason* **subject. *Odoratae*** R.M. Fritsch  
in Linzer Biol. Beitr. 26: 983 (1994). — Type species: *Allium darwasicum* Regel

(15) *Allium darwasicum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 659, tab. VII ("VI") fig. a-e (1884), Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 298, 354 (1887). Vved., Flora URSS 4: 276 (1935); Vved., Flora Tadzh. SSR 2: 359 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 88 (1971) omnia "*darwasicum*"; Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 66, 67 plate 1 J (2000). — Lectotype: Tajikistan: In montibus Kuh-Frush inter vallem Niab et Kulab, in

*Chanato Darwas Bucharae orientalis* [Kuh-Frush Mts. between the rivers Niab and Kulyab, khanate Darvaz, eastern Bokhara], 10000-11000' alt., VI.1883, leg. A. Regel (LE, design. Fritsch 1990: 503).

Distribution: Uzbekistan?, Tajikistan, N Afghanistan: Hissar to Darvaz to Hindu Kush mountain ranges; submontane to montane rock terraces, steep rocky and rubble slopes.

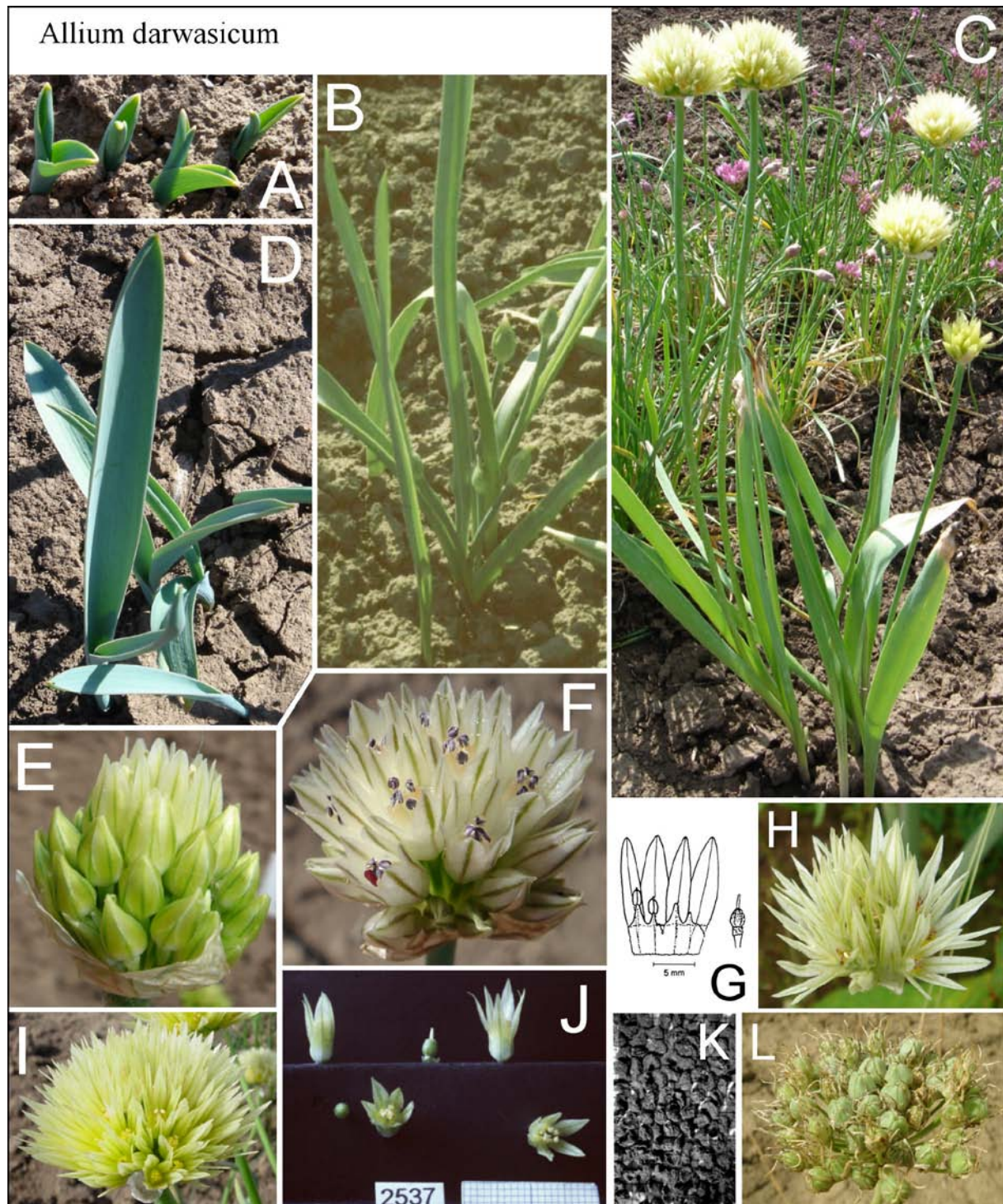


Plate (15): A & D: Leaves of cultivated plants in early and later stages of sprouting, resp.; B: cultivated plants in shooting stage; C: cultivated plants with greenish-yellow flowers in full anthesis; E & I: inflorescences with greenish-yellow flowers in early and full anthesis, resp.; F: inflorescence with whitish flowers in full anthesis; G: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, J); H: inflorescence with creme flowers in late anthesis in Darvaz range, Tajikistan; J: comparison of whitish flowers and flower parts in different stages of anthesis; K: seeds; L: inflorescence with full-sized capsules (millimeter paper as background and measure scale of J & K).

**Description:** Bulbs subglobose, 10-25 mm in diam., rarely with side bulblets; inner tunics partly thin membranous, partly parchment-like, whitish, glossy, outer tunics finally blackish-brown and disintegrating. Scape sometimes 2 (Regel 1887: up to 4), mostly  $\pm$  flexuous, terete, smooth; 15-50 cm long, 3-6 (8) mm in diam.; green with glaucous bloom, often basal part (rarely up to 3/4) brown flushed. Leaves 1-2 (3), laminae linear-lanceolate, straight or  $\pm$  recurved; basally U-like canaliculate, sometimes with overlapping margins, thick, upper part more shallowly canaliculate to flat, thinner, apex mostly drooping; upper side smooth, lower side with toothed ribs; margins finely to coarsely toothed, sometimes cartilaginous and reddish, short arcuately tapering into the hooded apex; (10) 25-40 (60) cm long, (8) 12-20 (30) mm broad; dull green with strong glaucous bloom, basally sometimes purple flushed. Sheathy prophyll short to long, thin, smooth to finely scabrous with raised darker veins; purplish brown to greenish, quickly decaying. Spathe membranous, undivided or divided in 2 triangular valves, as long as the pedicels; whitish to pale brown with brown veins. Inflorescence fasciculate to semiglobose, strong plants finally subglobose; very dense,  $\pm$  many-flowered; 3-5 cm in diam. and 2-3 cm long. Pedicels equally long, thickish-conical clubshaped below the flower, straight or somewhat ascending; c. 8-12 (15) mm long; glossy deep green. Anthesis in May to June (July). Flowers campanulate to funnel-shaped; with sweet odor. Tepals narrowly linear-lanceolate, acutish, basally for 1/10-1/4 connate, later margins convolute; 10-12 (14) mm long, 2-3 mm broad; grayish white, pale or intense yellow-green with  $\pm$  broad, greenish or brownish median vein. Filaments about 1/2 as long as the tepals; basally for 1/4-3/5 connate, free parts below long triangular above conical, of the inner filaments twice longer than of the outer filaments; whitish to yellowish with brownish apex. Anthers shortly ovoid, apex mucronate; c. 1.5 mm long; dark purple or greenish yellow. Pollen grayish yellow. Ovary stipitate, ovate, 2-2.5 mm long, c. 2 mm in diam.; surface slightly scabrous. Up to 10 ovules per locule, 28 ovules per ovary (Filimonova 1970) / 9 ovules per locule (Hanelt 1992 Fig. 1). Nectary ducts mound near the base of ovary below the bottom of locules (Fritsch 1992b). Style threadlike, c. 2.5 mm long; white. Stigma slightly thickened, rarely sub-tripartite; white. Capsule not stalked, ovoid, (5) 6-8 mm in diam. and long, surface  $\pm$  semi-glossy; valves broadly ovate, scarcely notched at the apex. Seeds 1-3 per locule,  $\pm$  flat ovoid to semi-circular; surface finely scabrous, with small and undulate raised wrinkles, (semi-)glossy black; c. 2.5 mm long, 1.8-2.2 mm broad, 1.5-1.8 mm thick; TKW 3.64 / 3.68 / 4.32 g (IPK, unpubl. data). The testa showed verrucose periclinal walls with many verrucae and U-like or mostly Omega-like undulation of anticlinal walls with short wavelength (Kruse 1988, Abb. 35 & 36; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Mensinkai 1939, (Great Britain: Botanical collections).  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 (Tajikistan: Hissar range, Anzob pass, no. 760).  $2n = 16$  Ved Brat 1965a (Italy: Botanical collection Villa Taranto).  $2n = 16$  Vakhtina 1985 (Tajikistan: Faizabad, no. 680).  $2n = 16$  Narayan 1988 (source not mentioned).  $2n = 16$  Astanova 1990 (Tajikistan: Peter I. range, Gardani-Kaatar, Zaprjagaev 1224).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Varzob valley, Siana gorge TAX 1339, Childukhtarom gorge TAX 2260, TAX 2261, Maikhura gorge TAX 2263, Darvaz range, Khoburabot pass TAX 2412).  $2n = 16$  Gurushidze & al. 2010, 2012 (Tajikistan: Darvaz range, Khojidaara TAX 6138).  $2n = 16$  Gurushidze & al. 2012 (Tajikistan: Khozratishoh range, Sarimarguzor TAX 6134).

**Living accessions studied:** **Tajikistan:** Hissar range, drainage of Varzob river, side valley (1850 m, 15.5.1985 Hanelt 19; GAT) TAX 1625, Varzob valley (38°55' N, 68°49' E, 1600 m, 19.5.1987 Fritsch 172; GAT) TAX 2268, Siana valley (38°58' N, 68°44' E, 1760 m, 21.6.1984 Fritsch T49; GAT) TAX 1339, (1750 m, 15.5.1985 Hanelt 18; GAT) TAX 1624, Kondara valley (38°49' N, 68°46' E, 1700 m, 1988 Fritsch 158; GAT) TAX 2577, Childukhtarom valley (38°49' N, 68°53' E, 1800 m, 17.5.1987 Fritsch 163 a, b; GAT) TAX 2260, TAX 2261, Maikhura valley (39°03' N, 68°44' E, 2000 m, 19.5.1987 Fritsch 165; GAT) TAX 2263, slopes at Kuk-Tepa, E vill. Siddi (39°03' N, 68°54' E, 2500 m, 11.7.1991 Fritsch, Kudratov 660; GAT) TAX 3229; Vakhsh range, Kugitek Mts., Joli-Tun pass SE Khovaling (38°21' N, 70°03' E, 1700 m, 04.8.1988 Fritsch 328; GAT) TAX 2537, slopes W town Khovaling, former vill. Sebi-Such (38°30' N, 70°03' E, 2000 m, 06.8.1988 Fritsch 346; GAT) TAX 2546, N slopes of Kugitek Mts. along river Obi-Masar (38°27' N, 70°04' E, 1850 m, 03.8.1988 Fritsch 305; GAT) TAX 2532; Darvaz range, pass Khobu-Rabat (3200 m, 1987 via Botanic Garden Khorog s. n.; GAT) TAX 2412, loess terrace 1.5 km W vill. Khojidaara (37°59'09.1" N, 70°11'42.2" E, 1200 m, 27.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6073; GAT) TAX 6164, E exposed grassy slopes above vill. Khojidaara (37°59'05.2" N, 70°10'51.4" E, 1420 m, 27.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6074; GAT) TAX 6138, W slopes of Kugi Frush (type location) in N exposition (38°04'31" N, 70°13'31.8" E, 1300 m, 28.4.2003



Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6081; GAT), under shrubs (38°04'26.8" N, 70°13'46" E, 1380 m, 28.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6082; GAT) TAX 6144, S vill. Sagirdasht, Darai mob (38°37'33.6" N, 70°40'07.4" E, 2720 m, 11.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6193; GAT) TAX 6431; Khozratishoh range, slopes E vill. Sarimarguzor, right side of Dughova river above Sari Marguzori Bolo (37°47'55.6" N, 70°14'11" E, 1600 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6067; GAT) TAX 6134; Peter I. range, terraces along Obikhingou river near vill. Layroni Pojon (38°53'25.7" N, 70°55'42.5" E, 2000 m, 25.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6238; GAT) TAX 6553, terraces above Obikhingou river near village Kal"a (38°52'33.8" N, 71°05'38.9" E, 2150 m, 25.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6242; GAT) TAX 6557.

**Remarks:** *Allium darwasicum*, the type species of subsect. *Odoratae*, is a variable species widely distributed in the mountains of Tajikistan. In the Hissar range, the plants have grayish-white flowers and ± violet anthers, but plants with yellowish-green flowers and yellow anthers occur in the more southern located Vakhsh massif up to Afghan areas East of Panj river. Plants from the type location and other sites near Panj river showed slightly yellowish-green flowers of more or less intermediate color and yellow or pale violet anthers. Plant height (15-50 cm) and leaf width (10-30 mm) showed a similar mode of variation in all investigated populations, and the other characters were identical. Therefore all flower variants belong to the same species. In the molecular analysis of ITS sequences of nuclear rDNA, all color forms of *A. darwasicum* constitute jointly with *A. intradarvazicum* one subgroup that is closely related to the species of sect. *Megaloprason* s. strictiss. The more distant relations to sect. *Acmopetala*, *A. karataviense*, and a heterogeneous group comprising *A. balkhanicum*, *A. subkopetdagense*, *A. iliense*, *A. isakulii*, *A. cupuliferum*, *A. verticillatum* and sect. *Stellata* were not resolved (Fritsch & al. 2010: 188 cluster 4 § 3.6.2; Fritsch 2012b: 252 Fig. 4 P, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Unexpected was the position of a few accessions of *A. darwasicum* from Darvaz range inserted among members of sect. *Compactoprason* (Fritsch & al. 2010: 194 cluster 7 § 3.9.4; Fritsch 2012b: 252 Fig. 4 T; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). They represent a cryptic species as analyzed by Gurushidze & al. (2008). Sequence data of the plastid *trnL-trnF* region belonged to three different haplotypes and confirmed the closer relations to the species and sections discussed above with much lower resolution, but not to sect. *Compactoprason* (Gurushidze & al. 2010: 836, fig. 4 lineage V).

In the series Herb. Fl. URSS under no. 5522 not *A. darwasicum* but *A. sarawschanicum* and *A. rosenorum* (perhaps also *A. kwakense*) were distributed at least in some cases.

**Etymology:** The epithet refers most probably to the historical administrative unit of Darvaz khanate (Tajik spelling "Dorvoz") in E Tajikistan where the type was collected. The name of the identically named mountain range has the Tajik meaning "one can find ways through".

**Biological data:** Miralibekov (1982) counted 152 [31-314] seeds per inflorescence under cultivation; the infrutescences were 2.3 cm broad and 2.7 cm long, 21 flowers (85.7 % with ovaries) resulted in 125 seeds (Miralibekov 1984). Anatomical characters of the scape: cortex cells are radially extended, outer vascular bundles are narrow, outer margin of sclerenchyma shows double ribs (Fritsch 1993 Fig. 7D). Different genome sizes [2C DNA] were reported: 17.7 pg (Jones & Rees 1968), and 33.9 / 37.6 pg (Gurushidze & al. 2012). Fresh bulbs contained in total 0.03 / 1.52 % cysteine sulfoxides (? / 74 % methiin, ? / 0 % alliin, ? / 26 % isoalliin, ? / 0 % propiin; Keusgen & al. 2008), dry leaves contained in total 0.15 % cysteine sulfoxides with methiin dominating (Jedelska & al. 2004). Radical scavenger activity is low (Jedelska & al. 2004). Plants in the bud stage contained 12.75 % protein, 2.38 % fat, 33.47 % cellulose, 40.19 % "BEV", and 11.21 % salts (Anonymus 1983b).

**Economic traits:** Leaves are eaten by grazing livestock (Anonymus 1983b). Plants are mixed with other greens and eaten as tonic vegetable after the winter time in Afghanistan (local Dari name 'band-e-jamia', Keusgen unpubl.). Rarely offered as ornamental (Fritsch 2015).

(16) *Allium chodsha-bakirganicum* Gaffarov & Turak. in Uzbek. Biol. Zhurn. No. 2: 69 (1991). Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 66, 67 plate 1 K (2000). — ? *Allium hissaricum* var. *albinoticum* auct., in sched., nom. nud. (p. p.?) — Type: Kirgizstan: Declivia borealia jugi Turkestanici, sistema fl. Chodsha-bakirgan (Lajljak), in viciniis pagi [N slopes of Turkestan range, drainage of Khoja-Bakirgan (Laylyak) river near village] Baul, 1850-1900 m s.m., 9.6. 1986, leg. Gaffarov (holotype and isotype TASH).

Distribution: Kirgizstan: Central Turkestan range, montane stony-rubble slopes, hitherto only known from the type location.

Description: Bulbs globose, 5-10 mm in diameter; tunics papery, grey. Scape slightly flexuous, terete, smooth (only in dry state costate); 15-25 (30) cm long, 2.5-4 mm in diameter; green. Leaves 1-2, laminae linear or narrowly linear-lanceolate; upper side  $\pm$  smooth, lower side with finely toothed ribs; margins toothed; much shorter than the scape, 2-5 mm wide. Spathe thin membranous,  $\pm$  completely divided in two shortly acuminate valves; brownish with darker veins. Inflorescence narrowly to broadly fasciculate; very dense, 15-30-flowered. Pedicels  $\pm$  equally long, thickish, ascending; 5-7 mm long; silk-glossy yellow-green. Anthesis in mid of June. Flowers narrowly funnel-shaped. Tepals narrowly lanceolate,  $\pm$  straight, the basal third connate, the upper parts long tapering into the obtuse apex, later crumpled; (9) 11-15 mm long, inner tepals c. 1.5 mm, outer tepals c. 2.5 mm broad; pale yellow with a narrow, greenish-yellow (toward the base brownish) median vein. Filaments about 1/2 as long as the tepals; basally for 1/2-3/4 connate, the free parts (of the inner filaments broader and longer) triangular; pale yellow with green median veins. Anthers ovoid; mucronate, c. 1.5 mm long and 0.8 mm broad; orange. Pollen sulfur-yellow. Ovary shortly stipitate, triangular club-shaped, c. 2 mm long and 1.5 mm

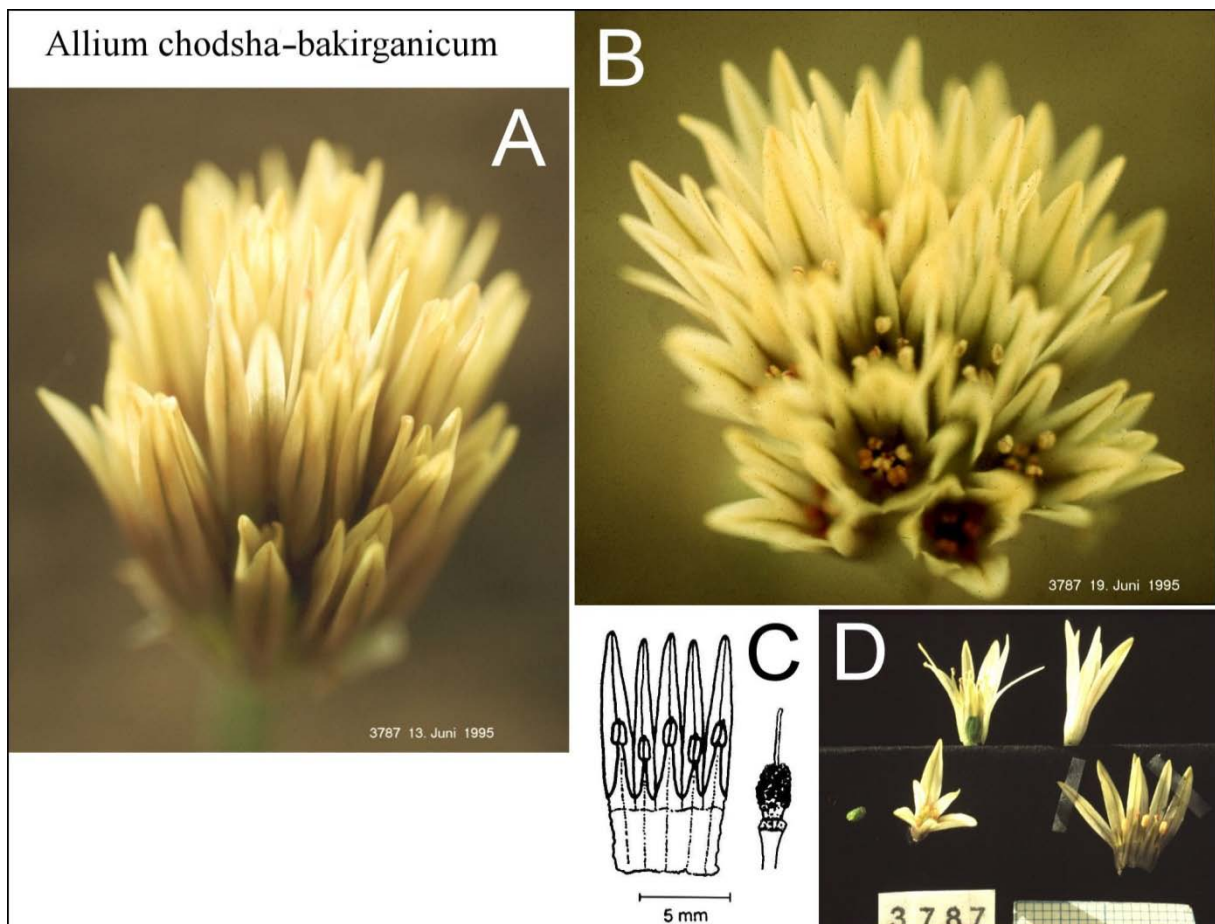


Plate (16): Cultivated plants from the type location are shown. A & B: Inflorescences in early and full anthesis; C: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1, K); D: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as measure scale).

in diam.; surface scabrously papillous; green with paler sutures. Style shortly conical, 1.5-4 mm long; whitish, later greenish. Stigma undivided; whitish. Capsule broadly ovoid, c. 5 mm in diameter. Seeds not seen.

Chromosomes:  $2n = 16$  Astanova in Fritsch 2000 (Kirgizstan: Turkestan range, Khoja-bakirgan river valley, Gaffarov no. 671, type location).  $2n = 16$  Fritsch unpubl. (Kirgizstan: Turkestan range, Khoja-bakirgan river valley, TAX 3787, type location).

Living accessions studied: Kirgizstan: N slopes of Turkestan range, drainage of Khoja-bakirgan (Lajljak) in the vicinity of vill. Baul (type location, 1850 m, 14.6.1993 via Khassanov s. n.; GAT) TAX 3787.

Remarks: Though *A. chodsha-bakirganicum* was compared with *A. darwasicum* in the original description, it is a much smaller species differing not only by yellow flowers but also by narrower leaf laminae and fewer flowers. Small herbarium specimens of *A. darwasicum* are difficult to separate if the flower color faded (Fritsch 2000), and some vouchers may indeed represent *A. chodsha-bakirganicum*. Molecular data (ITS sequences of nuclear rDNA) supported a direct relationship to *A. lipskyanum* (despite the inflorescences of *A. chodsha-bakirganicum* do not expand during and after anthesis) with unresolved closer relations to most members of sect. *Compactoprason*, *A. darwasicum* p. p., *A. hissaricum* p. p., and *A. winklerianum* s. str. (Fritsch & al. 2010: 194 cluster 7 § 3.9.4; Fritsch 2012b: 252, 253, Fig. 4 R; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202).

Etymology: The epithet refers most probably to the valley of Khoja-Bakirgan river in the Kirgiz part of the Turkestan range where the type was collected.

(17) *Allium hissaricum* Vved., Flora Tadzh. SSR 2: 358, 425, t. 59, fig. 4, 5 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 88 (1971). Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 66, 67 plate 1L (2000). — *Allium winklerianum* sensu Vved., Flora URSS 4: 276-277 (1935), p. p. min. ? *Allium hissaricum* subsp. *cisdarwasicum* Kamelin & Seisums ex Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 27 (1994), nom. nud., type (ined.): Tajikistan, Vodorazdel rr. Yakhsu i Obi-Surkh mezhdu razv. kishl. Simdedara i mazarom Tajtuta Darvazskij otr. [watershed between the rivers Yakhsu and Obi-Surkh between the ruins of village Simdedara and mazar Taytuta, spurs of Darvaz range], 12.6.1981 leg. Darvaz group? 876 det. Kamelin (LE photo! 2 sheets). — Type: Tajikistan: Declivitas orientalis fl. [eastern slopes of river] Semiganch adversus pag. [opposite of village] Dara, ... in schistoso-lapidosus [stony rubble slope] 1750 m, 17.6.1934, leg. Koroleva & Nikitin 114 (holotype LE!).

Distribution: Tajikistan: Hissar range to Vakhsh range; dry loamy or stony, submontane to montane grass slopes.

Description: Bulbs ovoid to broadly ovoid, rarely with flat side bulbs, 7-10 (15) mm long and in diameter; inner tunics yellowish, outer tunics brownish to blackish- or reddish-gray, parchment-like to leathery, longitudinally splitting, near base and apex fibrous, extended into a short neck. Scape straight to flexuous, terete, smooth; 20-40 (60) cm long, 2-4 (6) mm in diam.; green with slight glaucous bloom, basally often maroon flushed. Leaves 1-2, laminae narrowly linear-lanceolate, steep obliquely ascending and later arcuately recurved, upper part often hanging down, initially plicate, basally narrowly and upper part shallower canaliculate, thin; upper side slightly grooved, often with a central furrow, lower side with broad, mostly shallow, toothed ribs; margins densely toothed, long tapering into the hooded apex; 10-25 (40) cm long, 5-15 (25) mm broad; vividly green,  $\pm$  semi-glossy with  $\pm$  dense glaucous bloom. Sheathy prophyll thin, translucent, with inconspicuous veins, quickly decaying. Spathe thin membranous, divided in mostly 2 triangular acuminate valves, initially as long as the pedicels, later shorter; whitish with inconspicuous veins. Inflorescence fastigiate, rarely nearly semi-globose; dense, moderately many-flowered; 3-4.5 mm in diam., 3 cm long. Pedicels equally long, thin wiry, ascending; finally 12-15 mm long; glossy green. Anthesis in May to July. Flowers narrowly campanulate. Tepals oblong or lanceolate, long triangular acuminate with obtuse apex, basally for 1/4-1/6 connate, nearly straight,

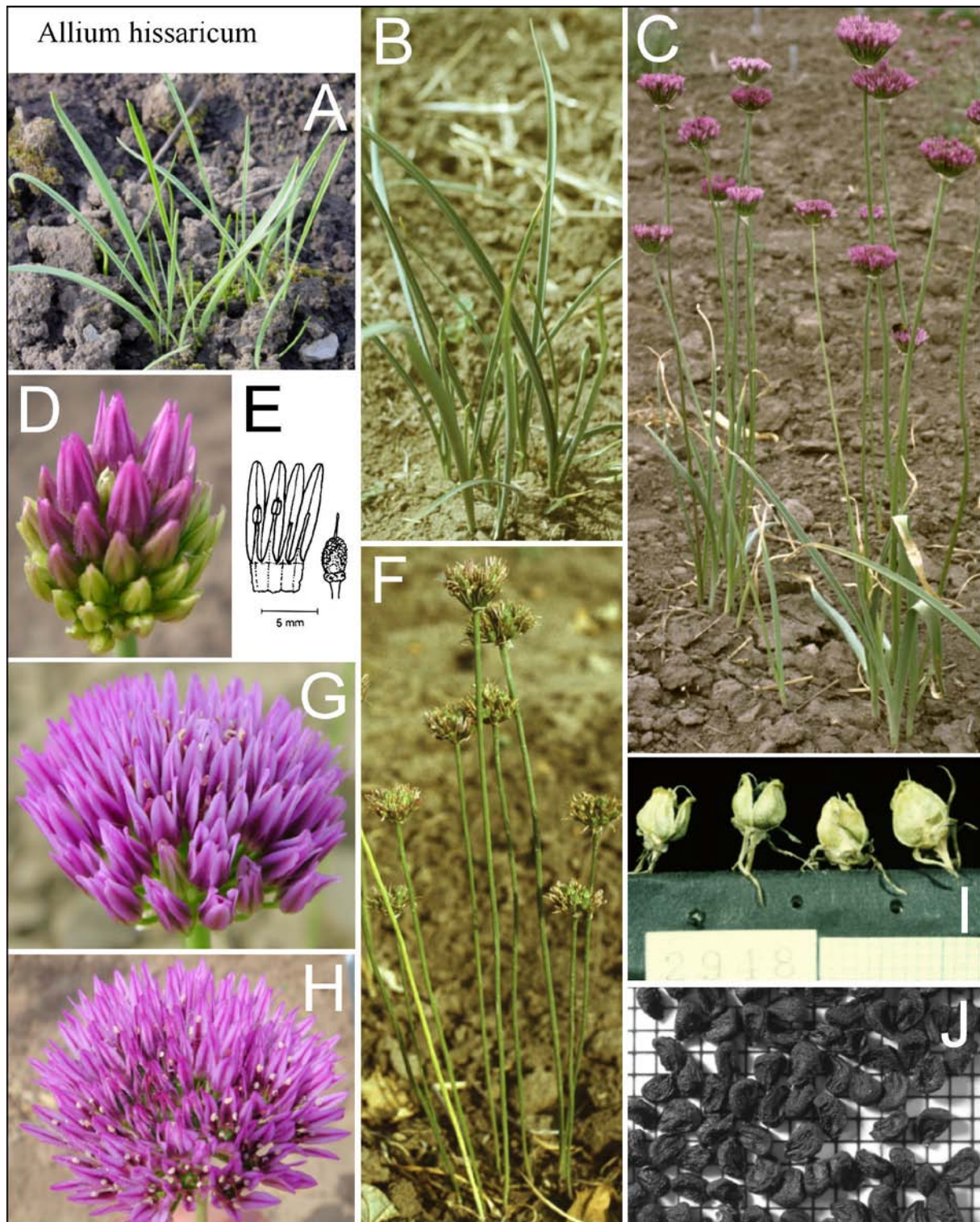


Plate (17): A: Sprouting leaves of cultivated plants; B: sprouting cultivated plants; C: cultivated plants in full anthesis; D: inflorescence prior to start of anthesis; E: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1 L); F: cultivated plants with developing capsules; G & H: inflorescence in full and late anthesis, resp.; I: ripe open capsules; J: seeds (millimeter paper as background and measure scale of I & J).

the free parts later convolute and often the tips stuck together, finally tortuous and irregularly directed; 7-10 mm long, 1.5-2 mm broad, outer tepals slightly broader; pinkish-violet, basally greenish, with brownish-green median vein. Filaments 1/2-2/3 as long as the tepals; basally for 1/5 connate and widened (inner filaments twice broader, long triangular, and slightly longer), above subulate; pinkish to violet. Anthers ovoid to shortly arrowhead-shaped; 1-1.2 mm long, c. 0.8 mm broad; violet. Pollen yellow.

wish gray. Ovary sessile, ovoid; surface moderately papillous; green. Up to 9 ovules per locule, 23 ovules per ovary (Filimonova 1970). The nectaries mound in small slits below a bulge somewhat above the base of ovary. Style threadlike, short; initially whitish. Stigma undivided, sometimes very shortly tripartite; whitish. Capsule conical-triangular, 5-7 mm long, 4.5-6 mm in diam., the upper-third with broad longitudinal furrows, surface with pimples and bumps; moderately widely open, valves ovate-triangular, above cartilaginous, not or only slightly notched; buff. Seeds 2-3 (6) per locule, triangular to drop-shaped; surface shallowly papillous, coarsely reticulate lacunose, dull black; 1.7-2 mm long, 1-1.5 mm broad, 0.8-1.5 mm thick. The testa showed verrucose periclinal walls and mostly Omega-like undulation of anticlinal walls with low to moderate amplitude and short wavelength (Kruse 1986 Abb. 40; Fritsch & al. 2006).

**Chromosomes:** 2n = 16 Vakhtina 1964a, Vakhtina 1969 (Tajikistan: Hissar range, Anzob pass, no. 762). 2n = 16 Vakhtina 1985 (Tajikistan: Hissar range, Varzob gorge, no. 730). 2n = 16 Astanova 1990 (Tajikistan: Hissar range). 2n = 16 Ohri & al. 1998 (Tajikistan: Hissar range, Varzob valley, Semiganch gorge TAX 2947, type location). 2n = 16 Fritsch & Astanova 1998 Table 2 (Tajikistan: Vakhsh range, Kyzylsu valley TAX 3129).

**Living accessions studied:** **Tajikistan:** Hissar range, drainage of Varzob river, Kondara valley, S exposed slopes beside the path from Kondara station to Kwak (38°49' N, 68°46' E, 1500 m, 25.4.1986 Fritsch T127; GAT) TAX 1895, Ojug valley NE Dushanbe, terrace on a rubble slope (38°47' N, 68°50' E, 1180 m, 06.5.1984 Fritsch 63; GAT) TAX 1333, Semiganch valley c. 30 km NE Dushanbe, rock slopes SW to SE vill. Dara (38°41' N, 69°00' E, 1980 m, 24.5.1990 Fritsch, Kudratov, Pistrick 507 A, 1850 m 507 B; GAT) TAX 2947, TAX 2948; top of Gazimajlik ridge, around Mt. Mundytau (Munda) (38°01' N, 68°28' E, 2180 m, 13.5.1990 Fritsch, Kudratov, Pistrick 455; GAT) TAX 2935, W slopes of Gazimajlik ridge, place Obodkan, c. 10 km NW vill. Ganjino (38°02' N, 68°34' E, 1330 m, 12.5.1990 Fritsch, Kudratov, Pistrick 441; GAT) TAX 2932; Sebiston W region of Vakhsh range, slopes above vill. Teguzak, in Rosa thicket (38°17'29.3" N, 69°15'04.4" E, 1500-1700 m, 06.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6106; GAT) TAX 6157, Vakhsh range, along the path on the crest between the valleys Heishdara and Kyzylsu (38°23' N, 69°43' E, 21.7.1991 Fritsch 683; GAT) TAX 3129.

**Remarks:** *Allium hissaricum* was the first taxon still separated by Vvedensky himself out of the species conglomerate named *A. winklerianum* up to 'Flora Uzbekistana' (Vvedensky 1941). Its plants are much slender than those of true *A. winklerianum*, and are characterized by strong, ± leathery bulb tunics, initially plicate leaf laminae, and much shorter united filament bases. The color of the very sweet smelling flowers varies from pale pink to deep carmine-violet in most populations. According to molecular markers (ITS sequences of nuclear rDNA), it is inserted as subgroup among members of sect. *Compactoprason* like *A. winklerianum* s. str. and *A. darvasicum* p. p. (see there) with the closest relationship to *A. macleanii* (Fritsch & al. 2010: 194 cluster 7 § 3.9.4; Fritsch 2012b: 252 Fig. 4 T, 254; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Another marker (sequences of the plastid *trnL-trnF* region) confirmed this relationship only partly (Gurushidze & al. 2010: 836, fig. 4 lineage IV), other haplotypes of *A. hissaricum* belonged to lineage V, like *A. winklerianum* s. str. and *A. darvasicum* p. p.

Already more than 20 years ago, subsp. *cisdarvasicum* was accepted by Seisums (1994) but not validly described yet. The type could not be studied, but a photo showed plants with the stature of *A. hissaricum* but with hairy leaves. This is an hitherto unknown character in sect. *Regeloprason*. Comparison of living plants would be essential.

**Etymology:** The epithet refers rather certainly to the Hissar mountain range in Tajikistan where the type was collected.

**Biological data:** Seed germinate very well at 5 °C, but very bad at more than 10 °C (Specht & Keller 1997). The genome size of 29.4 pg 2C DNA was reported by Ohri & al. (1998). Fresh bulbs contain in total 0.09 % cysteine sulfoxides (only methiin; Keusgen & al. 2008), leaves 0.05 % cysteine sulfoxides (Jedelska & al. 2004). The radical scavenger activity was at moderate level (Jedelska & al. 2004).

**Economic traits:** In Central Tajikistan the leaves are eaten (Saidov 1986, 2001), but only the medical use was later confirmed, local name 'sir' (Keusgen & al. 2004, 2006). Very rarely offered as ornamental (Fritsch 2015).

(18) *Allium intradarvazicum* R.M. Fritsch in Bot. Jahrb. Syst. 127: 461, fig. 1 (2009). — *Allium winklerianum* auct., p. p. — Type: Cultivated in Gatersleben no. TAX 6452, leg. 14.5.2007; bulbs collected in Tajikistan, Darvaz range, Khumbov canyon, canyon Ganjurak opposite to village Gshun, N exposed loamy slope among shrubs and perennials; 2560 - 2950 m, 38°38'01.8" N, 70°52'06.2" E, 23.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6219 (holotype GAT!).

Distribution: Tajikistan: Darvaz range, only known yet from submontane river banks in the Khumbov valley.

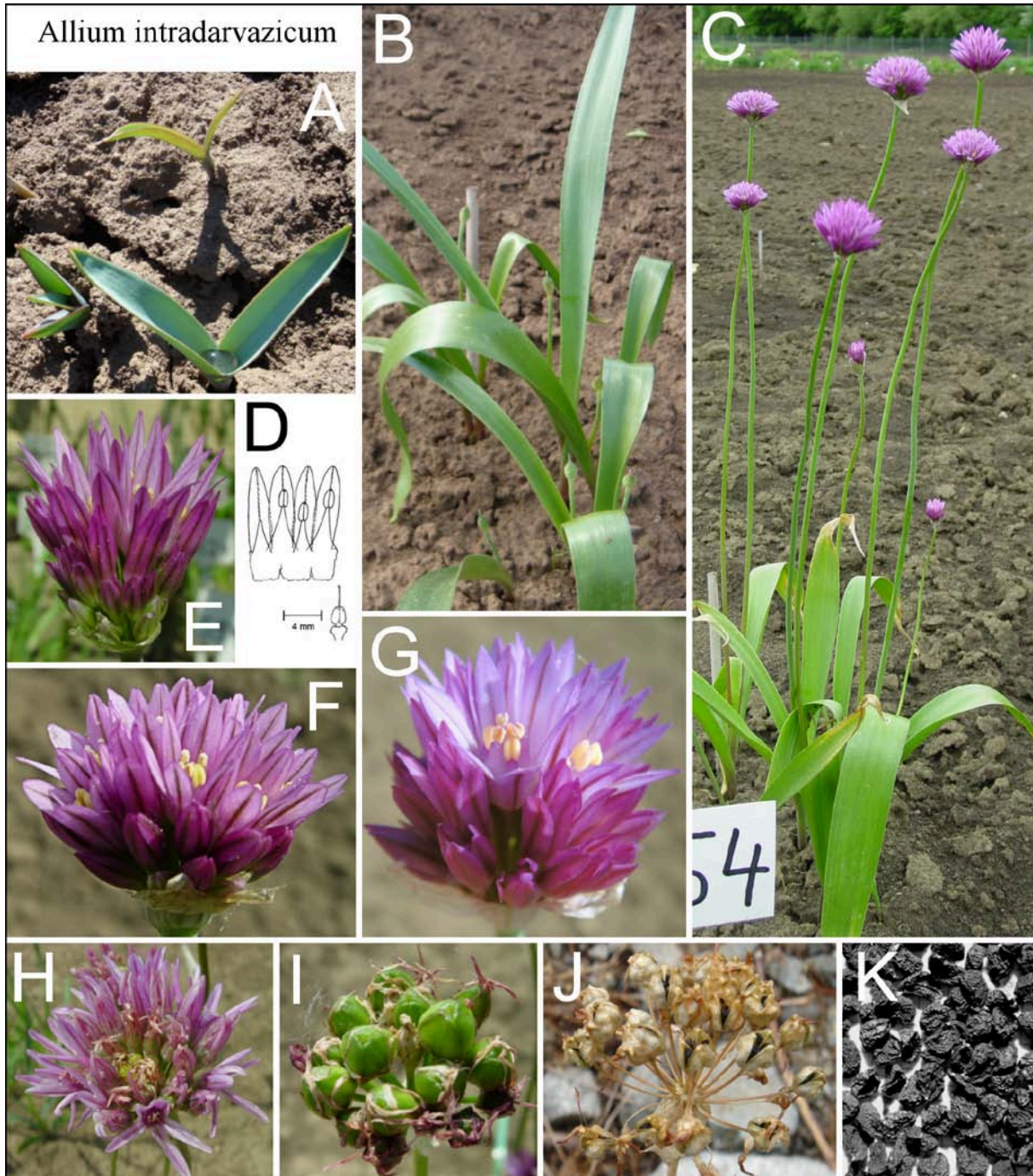


Plate (18): Cultivated plants (except J) from the type location are shown. A: Sprouting leaves; B: shooting plants; C: plants in early to full anthesis; D: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2009: 462, fig. 1 D); E, F, G & H: inflorescences in early, full, and late anthesis, resp.; I: inflorescence with developing capsules; J: infructescence in Khumbov canyon, Tajikistan; K: seeds (millimeter paper as background).

**Description:** Bulbs depressed-globose, rarely more than 2 cm wide; outer tunics papery, grayish brown. Scape slightly flexuous, terete to conical, smooth; (15) 25–40 cm high, 4–5 mm in diam.; vividly green with strong glaucous bloom, near base brown flushed. Leaves 1–2, laminae narrowly lanceolate with a linear medium part, lower part  $\pm$  canaliculate, upper part even, strictly upright, later upper part hanging down, very thin; upper side smooth or with fine grooves, lower side with dense fine ribs; margins basally finely toothed above glabrescent, gradually tapering into the hooded apex; 35–60 cm long, 1–3 (4.5) cm wide; vividly green and brown flushed near base, scarcely glossy because of glaucous bloom. Sheathy prophyll delicately membranous, short, maroon with thin brown veins, soon decaying. Spathe membranous, completely divided in 2 widely ovate-triangular valves more or less adpressed to the pedicels; buff with brown veins. Inflorescence initially ovoid-fasciculate later widely fasciculate; very dense, moderately many-flowered; (1.5) 2–4 cm in diameter. Pedicels subequally long, thickish, wiry, nearly straight; 6–8 (10) mm long; green with brownish flush. Anthesis in May. Flowers narrowly funnel-shaped; with nice sweet odor. Tepals lanceolate, obliquely forward directed and slightly recurved, arcuately tapering into the obtuse plicate apex, basally for up to 1/3 connate, the free part broadly lanceolate, outer tepals narrower and initially somewhat shorter; c. 12 (free part 7–8) mm long, inner tepals 2 mm, outer ones 3 mm wide; pinkish-carmine with narrow green median vein. Filaments about 1/2 as long as the tepals; basally for 1/2 connate, free part of outer filaments 1/3 as long as the free part of tepals, shortly subulate, fleshy, free part of inner filaments 2/5–3/5 as long as the free part of tepals and  $\pm$  triangular; basally darker carmine colored than the upper part. Anthers arrowhead-shaped, mucronate; c. 1.5 mm long and 0.8 mm broad; yellow. Pollen bright yellow. Ovary stipitate, ovoid, 3 mm long and nearly 2 mm in diam.; surface of the upper part shallowly papillous, lower part  $\pm$  smooth; green (sutures brighter), somewhat glossy. Nectary ducts mound in very small holes near the very base of ovary. Style conical-threadlike, 1–3 mm long; basally whitish above pinkish-carmine. Stigma very shortly incrassate; whitish. Capsule triangularly globose, valves with irregular ribs and bumps, c. 6–7 mm long and in diameter; moderately widely open by narrow clefts. Seeds 2–4 (6) per locule; ovoid to comma-shaped with often concave sides; surface  $\pm$  densely reticulate lacunose, dull black; 2–2.5 mm long, c. 1.5–2 mm wide and thick.

**Chromosomes:**  $2n = 16$  Gurushidze & al. 2010, 2012 (Tajikistan: Darvaz range, Khumbov gorge TAX 6452, Ganjurak gorge TAX 6454).

**Living accessions studied:** Tajikistan: Darvaz region, Darvaz range, Khumbov canyon, above the third bridge, Regi Ravon (38°37'24.1" N, 70°51'48.7" E, 2100 m, 22.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6216; GAT) TAX 6450, canyon Ganjurak opposite to village Gshun (38°38'01.8" N, 70°52'06.2" E, 2560–2950 m, 23.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6219; GAT) TAX 6452, village Gshun, small canyon Osiobdara (38°29'24.1" N, 70°51'20.1" E, 2700 m, 24.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6221; GAT) TAX 6454.

**Remarks:** This species is the most recent segregate species from *A. winklerianum* s. lat. differing by a scape of double length, obliquely directed, much broader, smooth, and semi-glossy leaves, as well as rotundate-triangular and nearly smooth ovaries. It was surprising to find these plants only less than 20 km apart from pass Khobu-Rabot, the type location of *A. winklerianum*. Though similar in plant height to *A. pseudowinklerianum*, the latter species is characterized by thick, erectly standing, glossy leaf blades, and spherical, finely tuberculate ovaries, and occurs in the Fergan ridge. Molecular studies (ITS sequences of nuclear rDNA) supported the separation of these taxa. *Allium intradarvazicum* shows the closest relationship to *A. darwasicum* s. str., and is less closely related to sect. *Megaloprason* in the strictest sense (Fritsch & al. 2010: 188 cluster 4 § 3.6.2; Fritsch 2012b: 252 Fig. 4, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201), whereas *A. pseudowinklerianum* is located in cluster 1, and *A. winklerianum* in cluster 7. Sequences of the plastid *trnL-trnF* region showed *A. winklerianum* to own the more basal haplotype, *A. darwasicum* a somewhat derived, and *A. intradarvazicum* a more derived haplotype (Gurushidze & al. 2010: 836, fig. 4 lineage V).

**Etymology:** The epithet reflects the occurrence in a river drainage inside of the Darvaz (in Tajik "Dorvoz") mountain range in Tajikistan (from Latin "inside of Darvaz"; see also explanation under *A. darwasicum* above).

**Biological data:** The genome size of 37.9 pg 2C DNA is much larger than those of *A. winklerianum* (32.9 pg, Gurushidze & al. 2012).

(19) *Allium lipskyanum* Vved., Opred. rast. Srednej Azii 2: 317 (1971). Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 64, 67 plate 1 C (2000). — *Allium winklerianum* sensu Vved., Flora URSS 4: 277 (1935), in adnot.; Vved., Flora Uzbek. 1: 465 (1941); Vved., Flora Tadzh. SSR 2: 360 (1963), omnia p. p. min. *Allium cupuliferum* sensu Vved., Flora Uzbek. 1: 466 (1941), p. p., et auctt. — **Type:** Uzbekistan: Gissarskiy khrebet. Bass. r. Tupolang. Dolina r. Chash. Po doroge v verkhov'ya saya Obi-shur. [Hissar range, drainage of river Tupolang, valley of river Chash, along the way to the height of the gorge Obi-Shur], 20.6.1948, leg. Pyataeva 605 (holotype TASH!, paratype: [the same location] Pyataeva 568 TASH, topotype LE!).

**Distribution:** Tajikistan, Uzbekistan: Central and SW Hissar mountain ranges; montane rock terraces, loamy and grass slopes with not too shallow soil.

**Description:** Bulbs broadly ovate, 15-25 mm long and in diam.; inner tunics yellowish buff, outer tunics grayish brown to blackish, strong papery, longitudinally splitting or disintegrating, extended in a short, often fibrous neck. Scape straight or ± flexuous, terete, smooth; 30-50 (80) cm long, 4-8 mm in diam.; green with glaucous bloom. Leaves (2) 4-8, laminae linear-lanceolate, obliquely ascending later the upper part hanging down, basally ± thick above thin, basally U-like canaliculate above shallower; upper side ± smooth, lower side with fine, basally ± scabrous ribs; margins whitish or brownish, finely and densely toothed, glabrescent toward the long triangularly tapering, scarcely hooded apex; 25-60 cm long, (0.3) 1-4 cm broad; vividly green with glaucous bloom. Sheathy prophyll up to 2 cm long, rather strong and persistent; yellowish or greenish with green veins. Spathe membranous, finally completely divided in 2 broad-ovate to triangular valves; pale to buff with darker veins. Inflorescence initially (narrowly) fasciculate to ovoid; very dense, initially 3.5-6 cm in diam., later the centre strongly elongated and looser, finally long-ovoid, very loose. Pedicels unequally long, ascending, wiry, edged; initially about 1 cm, later in the center up to 4 cm long; glossy green, basally reddish. Anthesis in May to June. Flowers narrowly campanulate later funnel-shaped. Tepals ± narrowly lanceolate, acutish, somewhat plicate, basally for 1/4-1/3 connate, obliquely forward directed, later first longitudinally convolute and then irregularly crumpled; 10-12 (14) mm long, outer tepals 3 mm, inner ones 2 mm broad; pink to violet with a narrow, darker or greenish median vein. Filaments 1/2-3/4 as long as the tepals; basally for 1/2 connate, free part triangularly (inner filaments longer and twice broader) widened; violet, basally paler. Anthers ovoid; 1.5-2 mm long, c. 1 mm broad; yellow. Pollen whitish gray. Ovary shortly stipitate, triangular, shortly double pyramidal up to subglobose; 2.5-3.5 mm long and in diam.; surface shallowly papillous; green. Nectary ducts mound near the base of the ovary below the bottom of locules (Fritsch 1992b as *A. cupuliferum* and *A. winklerianum*). Style conical-threadlike, 2-3 mm long; white, later violet. Stigma undivided; whitish. Capsule globose, 5-6 mm long and in diam.; valves suborbicular narrowly and shallowly notched at the apex. Seeds 2-3 (4) per locule, triangular to drop-shaped; surface papillous with dense, shallowly raised wrinkles, dull black; 2.5-3 mm long, 1.5-2 mm broad, 1.5-1.8 mm thick. The testa showed verrucose periclinal walls with prominent verrucae and strong Omega-like undulation with low to moderate amplitude and short wavelength (Fritsch & al. 2006, Fig. 20).

**Chromosomes:** 2n = 16 Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Khilaliktai Mts. TAX 3116, TAX 3118). 2n = 16 Ohri & al. 1998 (Tajikistan: Botanical collection Dushanbe TAX 1384). 2n = 16 Gurushidze & al. 2012 (Uzbekistan: W Hissar range, Tupalang valley, vill. Zevar TAX 5076, TAX 5077 ("5078")). 2n = 15? IPK *Allium* reference collection ideogram (Uzbekistan: W Hissar range, Tupalang valley, vill. Zevar TAX 5075).

**Living accessions studied:** **Tajikistan:** Hissar range, Chilaliktai massif, NW exposed slopes above vill. Sangichob (38°44' N, 68°28' E, 2200 m, 15.7.1991 Fritsch 666, 668; GAT) TAX 3116, TAX 3118; drainage of Varzob river, Varzob valley c. 50 km NE Dushanbe (38°55' N, 68°49' E, 1600 m, 19.5. 1987 Fritsch 171b; GAT) TAX 2287; collection site unknown (from Botanic Garden Acad. Dushanbe 1984, no. 675; GAT) TAX 1384. **Uzbekistan:** W Hissar range, drainage of Tupolang river, Divlog valley E vill. Zevar (38°44' N, 67°57' E, 2350 m, 16.7.1994 Fritsch, Khassanov, Pistrick 1257, 1258, 1267; GAT) TAX 5075, TAX 5076, TAX 5077.



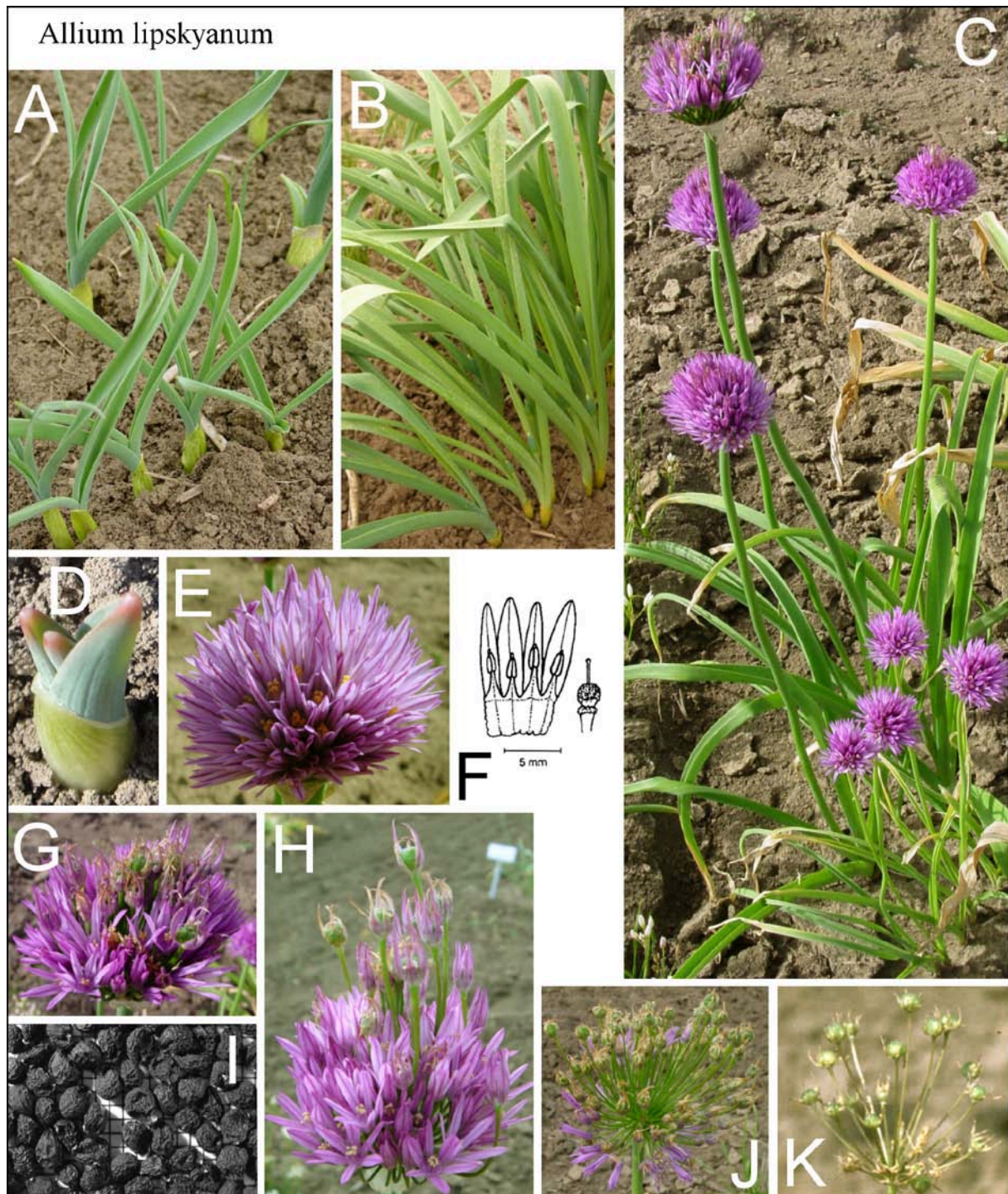


Plate (19): Cultivated plants are shown. A & D: Sprouting leaves in medium and very early developmental stages, resp.; B: plants in the early shooting stage; C: plants in different stages of anthesis; F: shape of ovary, tepals and filaments of a flower prepared from herbarium (copied from Fritsch 2000: 67 plate 1 C); E, G, H & J: inflorescences in full and different later phases of anthesis, resp.; I: seeds (millimeter paper as background); K: inflorescence with developing capsules.

**Remarks:** Very characteristic for *A. lipskyanum* are pedicels elongating during anthesis: they are shorter than the tepals at begin of anthesis, and 4-5 times longer when the anthesis has ended. Therefore meager, two-leaved plants are difficult to separate from *A. winklerianum* when pressed at begin of anthesis. Strong plants of *A. lipskyanum* differ strongly by the higher leaf number and at anthesis by the enlarging inflorescence from *A. winklerianum*, and *A. cupuliferum* has thick and oblong leaf laminae as well as pedicels elongating already during bud development. Lumping of *A. lipskyanum* with *A. cupuliferum*, as proposed by some authors, completely ignores remarkable differences in leaf, inflorescence, and

flower morphology, as well as the results of molecular studies. Molecular markers (ITS sequences of nuclear rDNA) underline a moderately close genetic relationship to most species of sect. *Compactoprason* and to *A. darwasicum* p. p., *A. hissaricum*, and *A. winklerianum* that belong to in details unresolved sister subgroups (Fritsch & al. 2010: 192 cluster 7 § 3.9.1; Fritsch 2012b: 252 Fig. 4, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). The only accession of *A. chodsha-bakirganicum* as direct sister group may be an effect of long-branch attraction (see p. 166). Sequences of the plastid *trnL-trnF* region showed a lower resolution (Gurushidze & al. 2010: 836, fig. 4 lineage IV) and positioned *A. lipskyanum* jointly with the mentioned members of the sects. *Regeloprason* and *Compactoprason* plus many species of sect. *Procerallium* in the same lineage.

**Etymology:** The epithet honors the eminent Russian Botanist Vladimir Ippolytovich Lipsky (1863-1937), one of the great botanical explorers of Central Asia in the late 19th and early 20th centuries.

**Biological data:** Seed germination was very good at 5 °C, but very bad at 10 °C and more (Specht & Keller 1997). Different genome sizes were reported: 30.9 pg 2C DNA (Ohri & al. 1998), and 33.6 pg (Gurushidze & al. 2012).

**Economic traits:** Very rarely offered as ornamental (Fritsch 2015).

**(20) *Allium pseudowinklerianum*** R.M. Fritsch & F.O. Khass. in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 66, 67 plate 1 N (2000). — *Allium winklerianum* sensu Vved., Flora URSS 4: 276-277 tab. 16 fig. 3, 3a (1935) p. p. min.; sensu Nikitina & Kashtsh., Flora Kirg. SSR 3: 95 (1951), Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 53 (1967), et auct. p. p., quoad pl. Fergan. — **Type:** Kirgizstan: SW Fergan range, drainage of Zargersaj, near [vill.] Zarger on the way to Kum-bel, lower N exposed slopes, ca. 1350 m, 15.5.1990 leg. Gazybaev 195 (holotype TASH!, isotype GAT!).

**Distribution:** Kirgizstan: Fergan range and adjacent part of Alai range; montane stony slopes among perennials, shrubs, and deciduous trees.

**Description:** Bulbs depressed-globose, commonly without bulbils, up to 3 cm long and 4 cm in diam.; tunics membranous, inner ones whitish, outer tunics gray, papery, later disintegrating. Scape straight, terete, smooth; 30-80 cm long, 4-6 mm in diam.; green with glaucous bloom, basally shortly purplish suffused. Leaves 1-2 (3), laminae narrowly lanceolate, straight, basally thick and broadly canaliculate, upper part thin and flat, drooping; upper side ± smooth, lower side broadly ribbed; margins glabrous or basally toothed, ± long tapering into the short, slightly hooded apex; 30-45 (60) cm long, (1) 1.5-3 (4) cm broad; silk-glossy green with glaucous bloom, basally often maroon flushed. Sheathy prophyll long, finely membranous, maroon, decaying before anthesis. Spathe membranous, completely divided in 2-3 triangular valves; brownish with darker veins. Inflorescence initially fastigiate, later nearly semi-globose; dense, many-flowered; up to 7 cm in diam. Pedicels subequally long, thickish wiry, ascending; initially less than 1 cm, later up to 2 cm long; silk-glossy greenish-brown, basally purplish suffused. Anthesis in May to June. Flowers narrowly campanulate later narrowly funnel-shaped. Tepals linear-lanceolate, subobtuse, straight, somewhat plicate, later crumpled and margins enrolled; 6-8 mm long, c. 2 mm broad; violet, basally greenish, median vein more greenish, less conspicuous. Filaments 1/2-2/3 as long as the tepals; basally for 2/5 connate (inner filaments twice broader), free part narrowly triangular; violet, somewhat fading towards the base. Anthers ± oblong or ovoid to arrowhead-shaped; 1.5-2 mm long, 1 mm broad; reddish later yellow. Pollen grayish-yellow. Ovary long triangular-globose; surface finely papillous; green with brighter sutures. The nectary ducts mound funnel-shaped near the base of ovary below the bottom of locules (Fritsch 1992b as *A. winklerianum*). Style ± threadlike, 1-4 mm long; whitish. Stigma slightly divided; white. Capsule initially encased by the dry tepals, narrowly triangular-globose, surface finely papillous, silk-glossy, 5-8 mm long and in diam.; moderately widely open, valves cordate, slightly notched at the apex; buff. Seeds flat ovate to drop-shaped, surface papillous and coarsely reticulate lacunose; 1.8-2.3 mm long, 1.5-2 mm broad, c. 1 mm thick. The testa

showed verrucose periclinal walls and mostly Omega-like undulation of anticlinal walls with low to moderate amplitude and short wavelength (Fritsch & al. 2006).

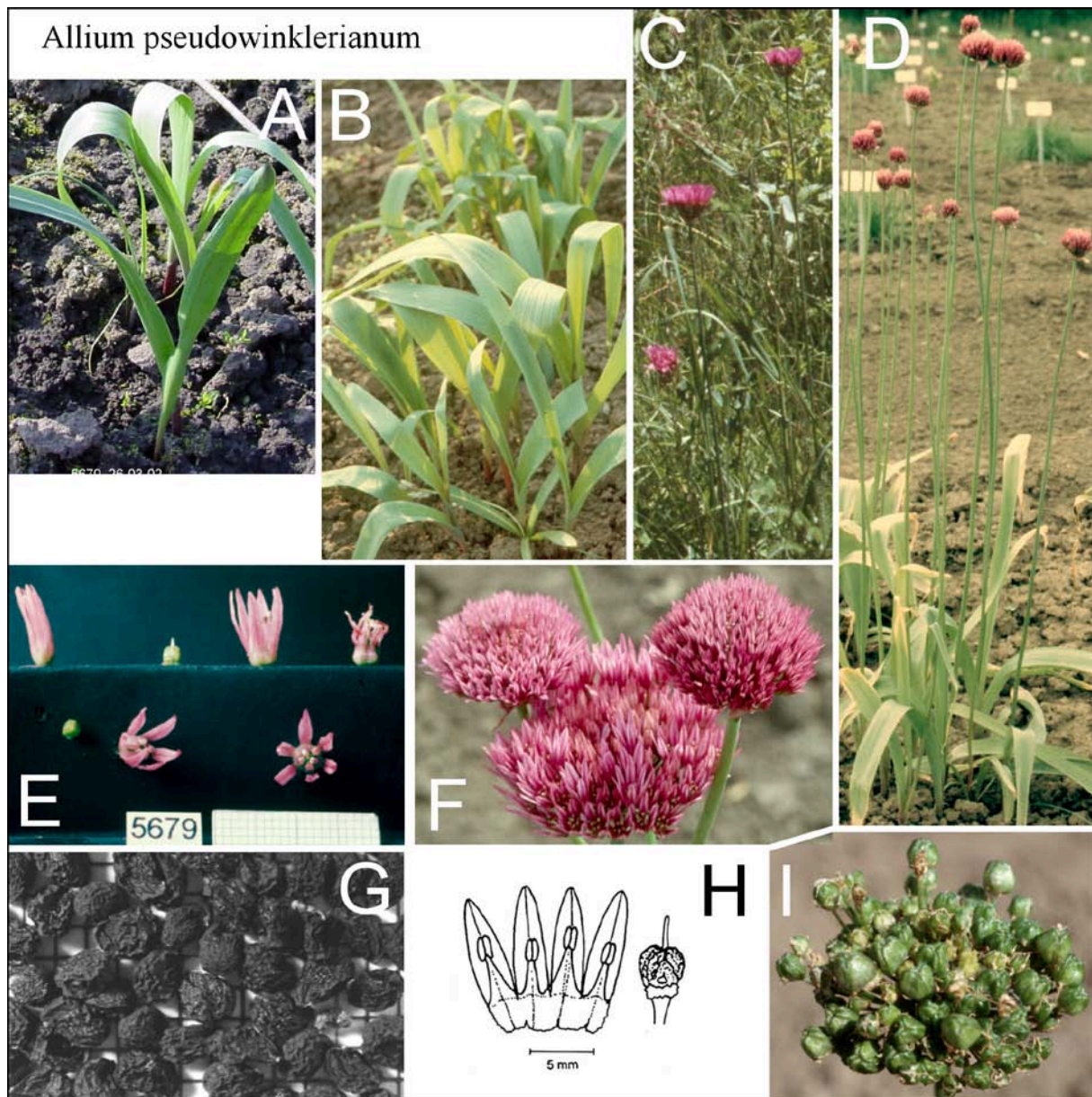


Plate (20): A: Cultivated plants in early shooting stage; B: sprouted leaves of cultivated plants; C: flowering plants near Zarger river, Kirgizstan; D: cultivated plants in early to full anthesis; E: comparison of flowers and flower parts in different stages of anthesis; F: inflorescences of cultivated plants; G: seeds; H: shape of ovary, tepals and filaments of a flower prepared from herbarium (from Fritsch 2000: 67 plate 1 N); I: inflorescence with developing capsules (millimeter paper as background and measure scale of E & G).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 fig. 3/3, Vakhtina & al. 1977 total length of chromosomes (Kirgizstan: foothills of Fergan range, no. 336 "*A. winklerianum*").  $2n = 16$  Fritsch 2000 (Kirgizstan: SW Fergan range, Zargersaj, type location).

**Living accessions studied:** **Kirgizstan:** Fergan range, valley of Zargersai river 40 km N Uzgen (1200 m, 03.6.2002 Khassanov 4093; TASH), herb-rich slopes along river Zarger c. 30 km NE Uzgen (40°57' N, 73°32' E, 1450 m, 20.5.1997 Fritsch & Khassanov 1611; GAT) TAX 5679, walnut forest in the drainage of Zarger river (donated by Khassanov, 40°55' N, 73°30' E, 05.6.1990 Fritsch 601; GAT) TAX 2991.

**Remarks:** Also this species was formerly subsumed under *A. winklerianum* but differs strongly by larger (broader and longer), smooth (also along the margin), and thick leaf laminae, a longer scape, the pink to carmine or violet tepals with a greenish or dark median vein are basally shorter connate, and the anthers are reddish not yellow. The intense sweet flower odor and the stature of *A. pseudowinkleri-*

*anum* are similar to *A. hissanicum*, but the latter species has narrower leaves with densely dentate margins, smaller inflorescences, narrower flowers, violet anthers, and ovate, coarsely tuberculate ovaries. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. pseudowinklerianum* in a small subgroup nested in sect. *Melanocrommyum* with one accession of *A. hissanicum* and *A. sochense* as closest relatives (Fritsch & al. 2010: 177 cluster 1 § 3.3.4; Gurushidze & Blattner in Fritsch & Abbasi 2013: 200). A third sample preliminarily determined as *A. pseudowinklerianum* was later added but became nested in the Alai-Fergan geographic clade of sect. *Acmopetala* ("9713pswi" Fritsch 2012b: 252 Fig. 4 Q, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). If this separate position can be confirmed by additional samples and the plants are morphologically separable, it could well be a separate taxon. In any case, the very distant position of *A. winklerianum* s. str. in cluster 7 (as well as in lineage V according to sequences of the plastid *trnL-trnF* region; Gurushidze & al. 2010: 836, fig. 4) supports the taxonomic separation of *A. pseudowinklerianum*.

**Etymology:** The epithet reflects a certain morphological similarity to *Allium winklerianum* (from Greek "pseudo~ = resembling but not equaling").

**Economic traits:** Very rarely offered as ornamental (Fritsch 2015).

**(21) *Allium sochense*** R.M. Fritsch & U. Turakulov in Stapfia 80: 387 (2002). — **Type:** [Kirgizstan] Alajskij khrebet, bass. reki Soch, g. Sandal, uroch. Terak-Mazar, kam.-shchebn. sklony v poyase termofil'nykh archevnikov i shiblyaka ["Monti Alajici, sistema fluvii Sochensis, in decliviis schistoso-lapidosis monti Sandal, in regione Juniperi" Alai range, drainage of Sokh river, stony rubble slopes of Mt. Sandal in the belt of thermophilous Juniperus societies and shiblyak], 26.6.1994 leg. I. Turakulov (holotype TASH!, isotype GAT!).

**Distribution:** Kirgizstan: Alai mountain range; open steppe slopes in the *Elytrigia-Artemisia* association. Only known from the type location.

**Description:** Bulbs ovoid-globose, 6-12 mm in diam., with firm paper-like, blackish tunics. Scape straight or flexuous, terete, smooth, distantly ribbed when dry; 20-35 cm long, c. 2.5 mm in diam. Leaf 1 (rarely 2), narrowly linear, canaliculate, obliquely erect, upper part hanging down and often spirally curved; upper surface apparently smooth, lower surface with a few prominent, finely toothed ribs; margins dentate; 10-15 cm long, 1-2.5 mm wide; probably dull green with glaucous bloom. Spathe membranous, divided in 2 valves; brownish with darker veins. Inflorescence fasciculate, finally semi-globose; few-flowered; 2-3 cm in diam. Pedicels subequally long, straight; 5-8 mm long; shiny brownish-green. Anthesis in May to June (?). Flowers narrowly campanulate. Free part of the outer tepals narrowly oblong and almost 1.5 times broader than that of the lanceolate inner tepals, subobtusate, basally connate for about 1/3; 8-10 (11) mm long; pinkish-violet with darker median vein. Filaments about 3/5 as long as the tepals; basally for c. 1/2 connate, free part of the inner filaments triangular widened, c. 3 mm long, that of the outer filaments subulate 2 mm long with slightly widened base. Anthers ovoid to arrowhead-shaped; c. 1.5 mm long; yellow. Ovary sessile, ovoid, three-edged, c. 3 mm long and 2 mm wide; surface finely papillous; nectary ducts mound in small pores. Style elongated but not exceeding tepals. Stigma undivided. Capsule ovoid. Seeds not seen.

**Remarks:** The thread-like narrow leaves of this species are an unique feature in sect. *Regeloprason*. Otherwise *A. sochense* is most similar to small specimens of *A. winklerianum* which differ by much broader leaf blades and subglobose capsules, and to *A. chodsha-bakirganicum* that has yellow flowers and narrow outer tepals. Unfortunately, this new species could not be studied in the living stage, and nothing is known about its variability. However, molecular markers (ITS sequences of nuclear rDNA, Fritsch & al. 2010: 177 Cluster 1 § 3.3.4; Gurushidze & Blattner in Fritsch & Abbasi 2013: 200) did not confirm any relationship to *A. winklerianum*. The only available sample (isotype specimen) was basally positioned to *A. pseudowinklerianum* and *A. hissanicum* p. p. that form a small group of sect.

*Regeloprason* species nested within sect. *Melanocrommyum* s. str. Additional samples would be essential to verify this position.

**Etymology:** The epithet refers to the Sokh river area in the Alai mountain range, where the type was collected.

(22) *Allium winklerianum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 661 (1884), Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 298, 354 incl. adnot. p. 355 (1887). Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 131 (1900) sub *A. cupuliferum*, p. p. Vved., Flora URSS 4: 276-277 tab. 16 fig. 3, 3a (1935) p. p. min.; Vved., Flora Uzbek. 1: 465 (1941); Vved., Flora Tadzh. SSR 2: 360 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 88 (1971), omnia p. p. Wendelbo, Flora Iranica 76: 93, tab. 10/136 (1971). Fritsch in O.A. Ashurmetov & al. (eds.), Pl. Life S.-W. & C. Asia, Tashkent: 66, 67 plate 1 M (2000). — non *Allium winklerianum* sensu Nikitina & Kashtsh., Flora Kirg. SSR 3: 95 (1951), Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 53 (1967). ? sensu Xu & Kamelin, Flora China 24: 201 (2000). — **Lectotype:** Ex horto bot. Petropolitano 84. 6. E. Turkest. Sem. mis. [from Bot. Garden St. Petersburg ... seeds sent from Turkestan by] Dr. A. Regel (LE, design. Fritsch 1990: 509).

**Distribution:** Uzbekistan, Tajikistan, NE Afghanistan; ? Fergan depression, Alai to Hissar and Darvaz ranges, prov. Badakhshan; montane to subalpine stony and shallow-soil slopes and shrub associations. Occurrence in China (W Xinjiang, drainage of Ili river) and Kirgizstan remains very doubtful.

**Description:** Bulbs subglobose, 7-20 mm in diam., 8-15 mm long; inner tunics whitish, outer tunics blackish, papery, finally disintegrating. Scape flexuous to straight, terete, smooth; 15-35 (60) cm long, 2-5 mm in diam.; green with glaucous bloom, basally brownish suffused. Leaves 1-2 (3), laminae linear to narrowly linear-lanceolate, obliquely directed,  $\pm$  thin, broadly to shallowly canaliculate; upper side  $\pm$  smooth, lower side coarsely ribbed; margins basally coarsely scabrous, above finely scabrous,  $\pm$  shortly tapering into the scarcely hooded apex; 20-30 cm long, (0.5) 1-1.5 (2.5) cm broad; dull green with glaucous bloom. Sheathy prophyll short, thin, quickly decaying. Spathe membranous, completely divided in 2 broadly ovate to triangular valves, often reflexed; buff with inconspicuous or reddish veins. Inflorescence fasciculate to semi-globose (in buds and in fruiting stage nearly globose); dense, moderately many-flowered; (1.5) 2-3 cm in diam. Pedicels equally long, thick wiry, stiff; green with brownish to violet flush. Anthesis in (end of May) June to July. Flowers  $\pm$  narrowly campanulate to funnel-shaped; with nice odor. Tepals narrowly lanceolate, long acuminate with subacute, mostly plicate apex, obliquely forward directed, later crumpled and straight to irregularly directed, basally for 1/4 connate; (8) 11-14 (17) mm long, base of the free part of the outer tepals up to 2.5 (3) mm broad, of the inner tepals narrower and shorter; pink to purplish with darker or green median vein. Filaments 1/3-1/2 as long as the tepals; for c. 3/5 connate (overtopping the ovary); the free part broadly triangular (inner filaments for 1.5-2 times broader and slightly longer), above subulate;  $\pm$  deep pink. Anthers ovoid to subglobose, mucronate; 1.5-1.8 mm long, 8.8-1 mm broad; yellow. Pollen grayish yellow. Ovary shortly stipitate, ovoid to subglobose, 2.5-3 mm long and 2-2.5 mm in diam.; surface finely papillous; silk-glossy green. Up to 9 ovules per locule, 20 ovules per ovary (Filimonova 1970) / 8-10 ovules in 2 rows per locule (Hanelt 1992) / 4 and more ovules (Xu & Kamelin 2000). Mounds of nectary ducts are not concave ?. Style conical-threadlike, 1-2 mm long; whitish. Stigma undivided; whitish. Capsule broadly ovoid to subglobose, surface with a fine network of raised wrinkles, 6-7 mm long, c. 5 mm in diam.; valves ovate; buff. Seeds 1-2 per locule, flat drop-shaped to semicircular; surface rounded papillous, with an irregular pattern of raised wrinkles, silk-glossy black; 2-3 mm long, 1.5-2 mm broad, 1.2-2 mm thick. The testa showed verrucose periclinal walls and mostly Omega-like undulation of anticlinal walls (Kruse 1994, Abb. 26; Fritsch & al. 2006).

**Chromosomes:**  $2n = 32$  Ved Brat 1965a (Denmark: Botanical collection Copenhagen).  $2n = 16$  Pedersen & Wendelbo 1966 (Afghanistan: Parvan, Panjshir valley, Chimar, H&W 5378).  $2n = 16$  Jacobsen & Ownbey in Löve 1977 (USA: New Jersey, Burlington Co., Pearce s. n.).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, upper Varzob gorge TAX 2550; Zaravshan range, Fan Mts. TAX 3137).

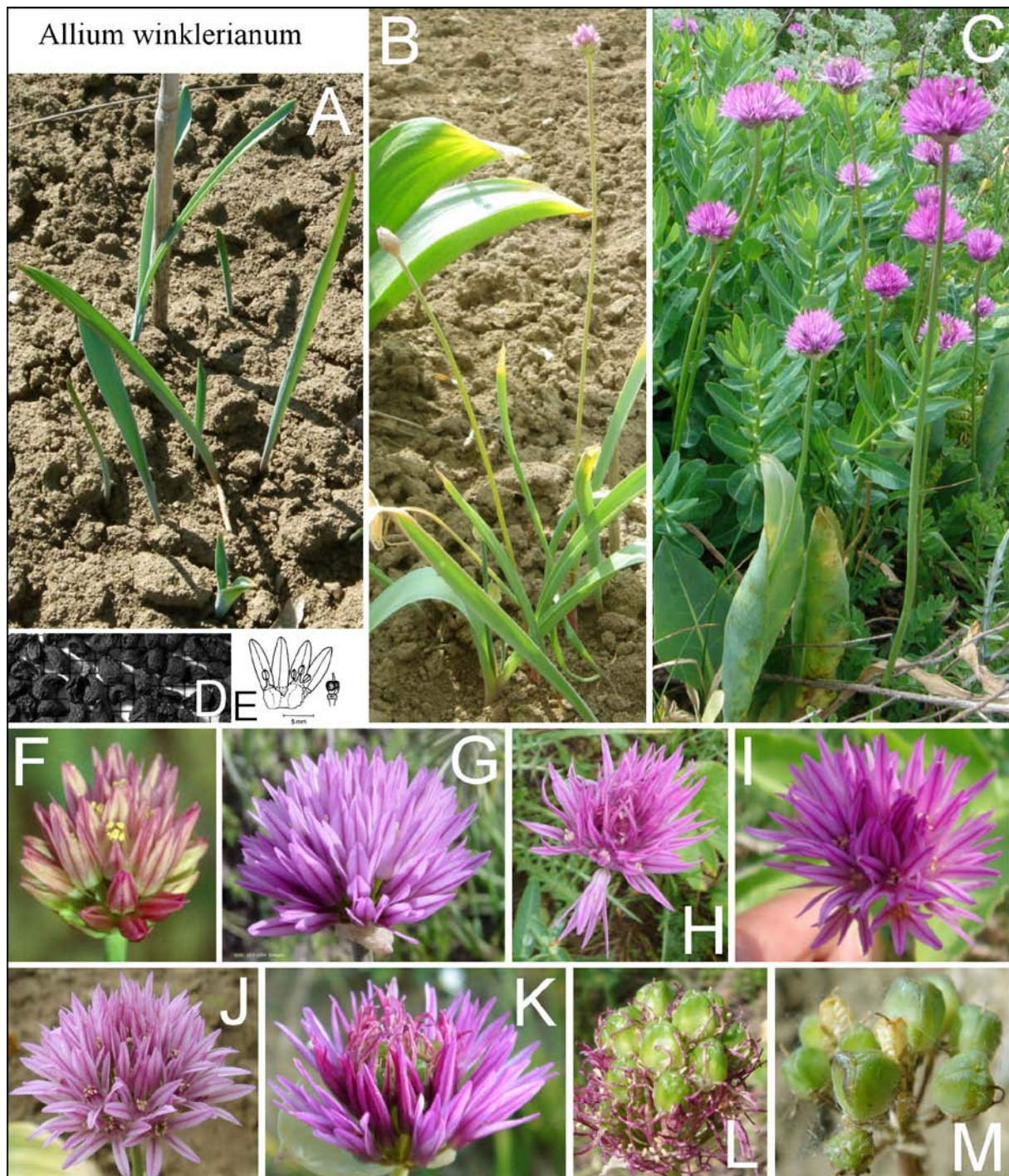


Plate (22): A: Sprouting leaves of cultivated plants; B: cultivated plants in late shooting stage; C: flowering plants in Mionadu, Tajikistan; D: seeds (millimeter paper as background); E: shape of ovary, tepals and filaments of a flower prepared from herbarium (from Fritsch 2000: 67 plate 1 M); F & G: inflorescences in early anthesis; H, I & J: inflorescences in full anthesis; K: inflorescence in late anthesis; L: inflorescences with developing capsules; M: full-sized capsules (H & M at type location, I, J, K & L in Mionadu).

Living accessions studied: Tajikistan: Central Hissar range, drainage of Varzob river, station Kuk-Tepa E vill. Siddi, tall forbs association (39°03' N, 68°54' E, 2700 m, 10.8.1988 Fritsch 351; GAT) TAX 2550; N slope of Hissar range, drainage of lake Iskanderkul 2 km W vill. Saritag, left side of Karakul river, Tagoiipista (39°03' 22.2" N, 68°16'04.6" E, 3370 m, 25.6.2004 Fritsch, Hisoriev, Keusgen 6145; GAT) TAX 6292, highest part of Mura valley, tributary of Iskander-darya (39°00' N, 68°17' E, 2700 m, 29.7.1991 Fritsch 698; GAT) TAX 3137; Darvaz range, near the way to Khoburobot about 1 km N pass (type location, 38°38'12.7" N, 70°42'46" E, 3165 m, 11.7.2005 Fritsch, Hisoriev, Keusgen, Kudratov 6196; GAT) TAX 6434, Obikhingou valley, place Zaki Khir-

sdara, slopes above village Mionadu (38°49'09.5" N, 70°54'28.3" E, 2700-2800m, 29.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6254; GAT) TAX 6564.

**Remarks:** *Allium winklerianum* can superficially be regarded as pink-flowering counterpart of *A. darwasicum*. Both species share thin and relatively narrow leaves with coarse margins, thin but strong scapes, and dense, relatively small inflorescences. Irrespective of striking differences in stature, leaf characters, and form as well as color of tepals, over decades plants from different parts of Tianshan and Pamir-Alai mountain ranges were all put to this name. Study of living plants from the type location confirmed, that *A. winklerianum* has 8-15 mm wide, coarse leaves, rose-pinkish to pinkish-purple flowers, and 11-15 mm long and 2.5-3 mm wide tepals. Plants occurring in different parts of the Hissar range differ mainly by somewhat shorter and broader tepals. Molecular markers (ITS sequences of nuclear rDNA) confirmed the taxonomic independence of the taxa recently split off. True *A. winklerianum* occupied a rather strange position beside *A. macleanii*, with other species of sect. *Compactoprason*, *A. hissaricum* p. p., and *A. darwasicum* p. p. as closer relatives, and *A. lipskyanum* as unresolved, less closely related subgroup (Fritsch & al. 2010: 194 cluster 7 § 3.9.4; Fritsch 2012b: 252 Fig. 4 T, 254 ; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage V) supported the close relationship to *A. darwasicum* and *A. hissaricum*, but members of sect. *Megaloprason* and not of sect. *Compactoprason* were closely related, and *A. regelii* instead of *A. lipskyanum*.

**Etymology:** The epithet honors the Russian botanist (of Baltic-German offspring) Constantin (Konstantin) Georg Alexander Winkler (1848-1900) acting in St. Petersburg who had an outstanding part in the scientific edition of Asian plant collections.

**Biological data:** The seedlings belong to the *Allium karataviense* type (Druselmann 1992). The genome size is 32.9 pg 2C DNA (Gurushidze & al. 2012). Bulb extract inhibited growth of some (mainly Gram-positive) bacteria species and showed a very high radical scavenger activity (Jedelská & Keusgen 2008). Fresh bulbs contained in total 0.02 % / 0.06 % cysteine sulfoxides (only methiin), inflorescences contain in total 0.28 / 0.19 % cysteine sulfoxides (only methiin), leaves contain in total 1.40 % cysteine sulfoxides (12 % methiin, 88 % isoalliin; Keusgen & al. 2008, at least 2 strains). Dithiodipyrrole that causes the red color of wounded tissue, is present and was closer investigated by Vogt & al. (2008).

4. *A.* subg. *Melanocrommyum* sect. *Asteroprason* R.M. Fritsch  
in *Phyton* (Horn, Austria) 49: 184 (2010). — Type species: *Allium elburzense* Wendelbo

4.1 *A.* sect. *Asteroprason* **subject.** *Asteroprason* R.M. Fritsch  
in *Phyton* (Horn, Austria) 49: 184 (2010). — Type species: *Allium elburzense* Wendelbo

(23) *Allium helicophyllum* Vved. [Flora Turkm. 1, 2: 287 (1932), nom. nud. in adnot.] in *Byull. Sredne-az. gosud. Univ.* 19: 127 (1934); Vved., *Flora URSS* 4: 256-257 (1935); Vvedensky [& Kovalevskaya], *Opred. rast. Sredn. Azii* 2: 80 (1971). Wendelbo, *Flora Iranica* 76: 91, tab. 9/132, tab. 28/1 (1971). Kamelin in Nikitin & Gel'dikhanov, *Opredel. rast. Turkmen.*: 125, 127 (1988). Fritsch & Abbasi, *Taxon. review Allium subg. Melanocr.* Iran: 117, plate T46, map (2013). — Type: Turkmenistan: Kopetdag, cult. in Hort. bot. turkmen. [cultivated in the Turkmen Bot. Garden] 31.5.1931 leg. Androsov (holotype TASH! isotype ASH?). Paratype: Zapadnyj Kopetdag. Okr. gor. Kara-kala. Pestrotsvetnye kholmy na pravom beregu r. [W Kopetdag range, near town Kara-Kala, pestrotsvet hills at right banks of river] Sumbar. 13.6.1931 leg. Vvedensky (TASH? not seen).

**Distribution:** Turkmenistan, Iran: Kopetdag range, submontane to montane rubble slopes, rock outcrops, semidesert plains.

**Description:** Bulbs ovoid to globose, 1.5-2 cm long and in diameter; inner tunics whitish, outer tunics blackish, papery,  $\pm$  prolonged into a neck, sometimes accumulating into a shell. Scape  $\pm$  straight, obconical, smooth; 10-20 cm long, basally 4-6 mm, above up to 10 mm in diam.; dull green. Leaves (3) 5-6 (8), laminae narrowly linear-lanceolate or long-triangular, spirally enrolled (in humid years only the uppermost part), thick, canaliculate; upper side smooth, lower side finely ribbed or nearly smooth; margins sparsely toothed to ciliate in the basal part, long tapering into the scarcely hooded apex; 20-30

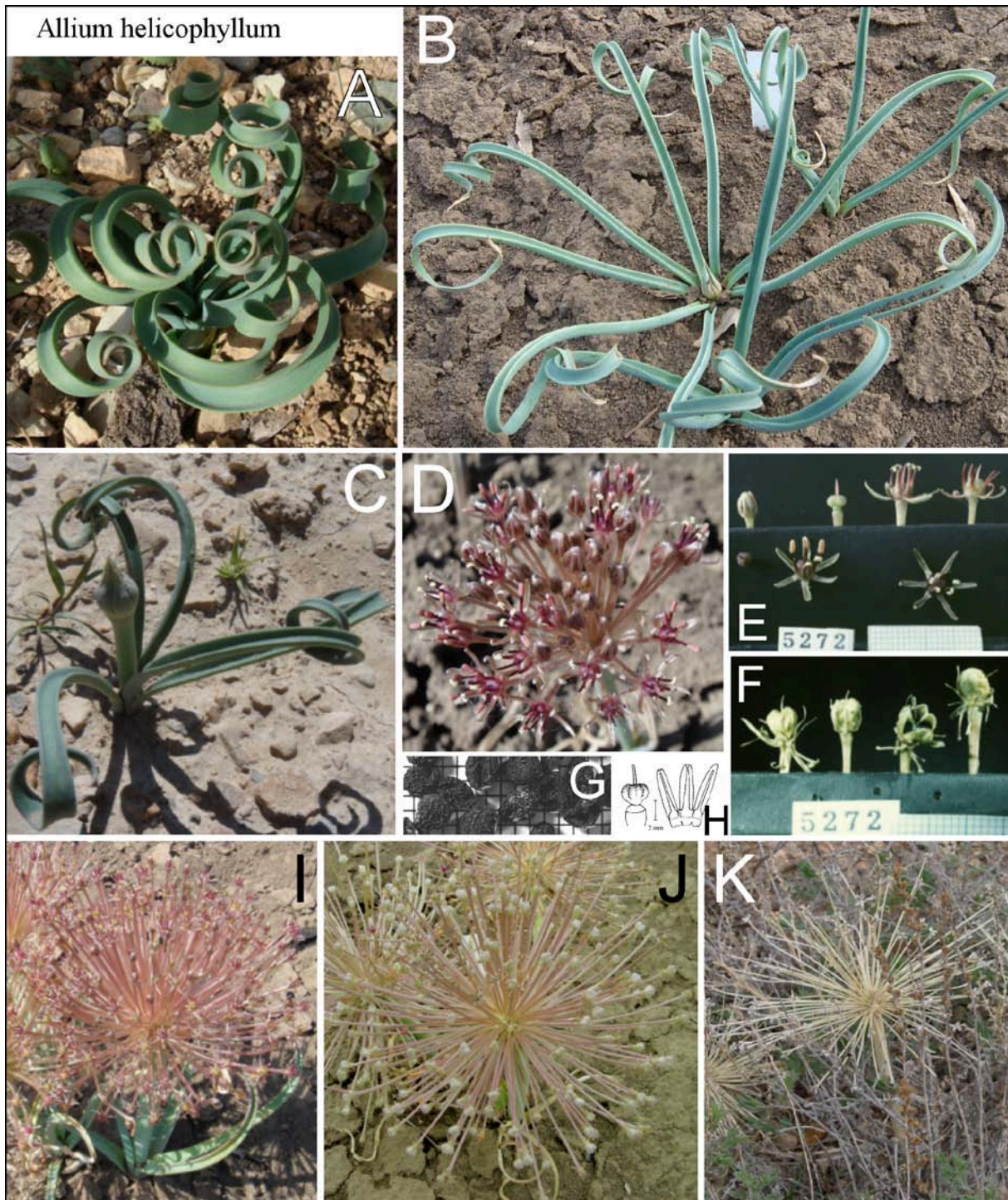


Plate (23): A.: Leaves of a cultivated plant in a very dry spring; B.: Leaves and young scape of a cultivated plant in normal spring; C: plant in the shooting stage near Ashkhaneh, Iran; D: inflorescence in early anthesis; E: comparison of flowers and flower parts in different stages of anthesis; F: ripe capsules; G: seeds; H: shape of ovary, tepals and filaments of a flower prepared from herbarium; I, J & K: plants in late anthesis, with full-sized capsules, and with open capsules, resp. (millimeter paper as background and measure scale of E, F & G; plate copied from Fritsch & Abbasi 2013: 118 Plate T46).



cm long, (3) 5-10 (15) mm broad (the innermost leaves are the narrowest); dull grayish green with glaucous bloom. Sheathy prophyll membranous, bright to translucent, silk-like glossy, quickly decaying. Spathe thin membranous, completely divided into 2-4 shortly triangular, acute valves; hyaline brownish with darker veins. Inflorescence initially  $\pm$  broadly fasciculate, later semi-globose and finally subglobose; moderately loose, many-flowered; 8-15 cm in diam. Pedicels unequally long, stiff wire-like, thickish and near apex obconical, ascending, glossy; brownish green to purplish. Anthesis in May to June. Flowers flat starlike. Tepals linear-oblong, canaliculate, obtuse with claw-like reflexed apex, patent, after anthesis subreflexed, convolute and crumpled; 5-7 mm long, c. 1 mm broad; pale pinkish-brownish, median vein very broad (up to 4/5 of tepal width), dark green to purple. Filaments slightly shorter than the tepals; basally shortly connate and short-triangular broadened (inner filaments c. 1.5 times wider and sometimes with 2 short-triangular side teeth), above subulate, fleshy; deep purple or violet, fading towards the base. Anthers oblong; 2 mm long, 0.8 mm wide; orange to violet. Pollen pale yellow; the shape is oblate, E 26  $\mu$ m, P 17  $\mu$ m, P/E 0.6, sculpture striate, wall 0.9  $\mu$ m thick (Neshati & al. 2009). Ovary very shortly stipitate, depressed-globose triangular with 3 narrow and 3 broader furrows, apex concave, 2.5-3 mm long, 3-3.5 mm in diameter; surface finely papillous; green, initially  $\pm$  violet flushed. 2-3 ovules per locule / 6-7 ovules per ovary were counted (Fritsch & Abbasi 2013 / Vvedensky 1935). Nectary ducts lead in short slits near the base of the ovary. Style narrowly conical, 3-5 mm long;  $\pm$  violet finally whitish. Stigma undivided; whitish. Capsule  $\pm$  broadly obovate, tripartite at the apex, ca. 4-5 mm in diam.; moderately widely open; valves suborbicular with deeply notched apex; buff. Seeds 1-2 per locule; flat ovate to drop-shaped, somewhat edged; surface finely papillous and densely and finely reticulate lacunose, dull black; 2.5-3 mm long, 2-2.3 mm broad, 1.5-2 mm thick. The testa showed verrucose periclinal walls, the anticlinal walls transitions from U- to Omega-like undulation with moderate wavelength (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Pogosian 1983 (Iran: Gorgan to Almehr).  $2n = 16$  Fritsch & Abbasi 2013 (karyotype see karyolog. appendix, Turkmenistan: Kyzyl-Arvat, TAX 5272).

**Living accessions studied:** Turkmenistan: Kopetdag range, NE exposed clayey slopes in the Bami valley (38°41' 36" N, 56°44'42" E, c. 300 m, 12.4.2002 Fritsch, Keusgen, Khassanov 43; GAT) TAX 5938; W Kopetdag range, limestone slopes c. 8 km S Kyzyl-Arvat along the road to Kara-Kala (38°43' N, 56°16' E, 450 m, 22.4.1995 Fritsch & Khassanov 1338; GAT) TAX 5272.

**Remarks:** This species shows  $\pm$  screw-like winding, canaliculate leaves are much larger than in *A. sergii*. The large but loose inflorescence with small flowers, small soft tepals curled in the dry state, and brown to purple filaments are other specific characters. The plants are rather inconspicuous in anthesis and are often only recognized when the pale-yellow infrutescences are blown through the semi-desert by the wind ("tumble-weeds"). Molecular markers (ITS sequences of nuclear rDNA) strongly support affiliation to sect. *Asteroprason* where it forms a well separated subgroup (Fritsch & al. 2010: 183 cluster 2 § 3.4.4; Fritsch 2012b: 247 Fig. 1 D, 248; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199), but sequences of the plastid *trnL-trnF* region indicate a larger distance to most species of this section and closer relations to sect. *Megaloprason* s. str., *A. kuhshorkhense* R.M. Fritsch & Joharchi, and a few taxa of sect. *Regeloprason* (Gurushidze & al. 2010: 836 lineage V).

**Etymology:** The epithet refers certainly to the  $\pm$  enrolled (at least in the upper part) leaf laminae (from Greek "spiral-shaped leaf").

**Biological data:** Seedlings belong to the *Allium karataviense* type (Druselmann 1992). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1).

**(24) *Allium monophyllum*** Vved. ex Czerniak. in Repert. Spec. Nov. Regni Veg. 27: 266 (1930), descr. germ., in Izv. glavn. bot. sada SSSR 29: 135 (1930), descr. ross.; Vved., Flora Turkm. 1, 2: 290 (1932), descr. ross., in Byull. Sredneaz. gosud. Univ. 19: 128 (1934), descr. latin. ampl.; Vved., Flora URSS 4: 259, tab. 15 fig. 3, 3a (1935); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971).

Wendelbo, Flora Iranica 76: 72, tab. 7/94 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 127 (1988). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 122, plate T48, map (2013). — Type: Turkmenistan: Tsentral'nyj Kopetdag, gora Chapan, verkhov'ya ushel'ya Ion-dere, kamenistyje uchastki u lednika (Central Kopetdag range, Mt. Chapan, height of the Ion-dere gorge, stony places near the glacier) 20.7.1928, leg. Jarmolenko & Gontscharov 1152 (lectotype LE!, design. Vvedensky 1934, see Fritsch 1990: 505).

Distribution: Iran, Turkmenistan: Kopetdag range; montane to perhaps subalpine stony and rubble slopes and rock terraces.

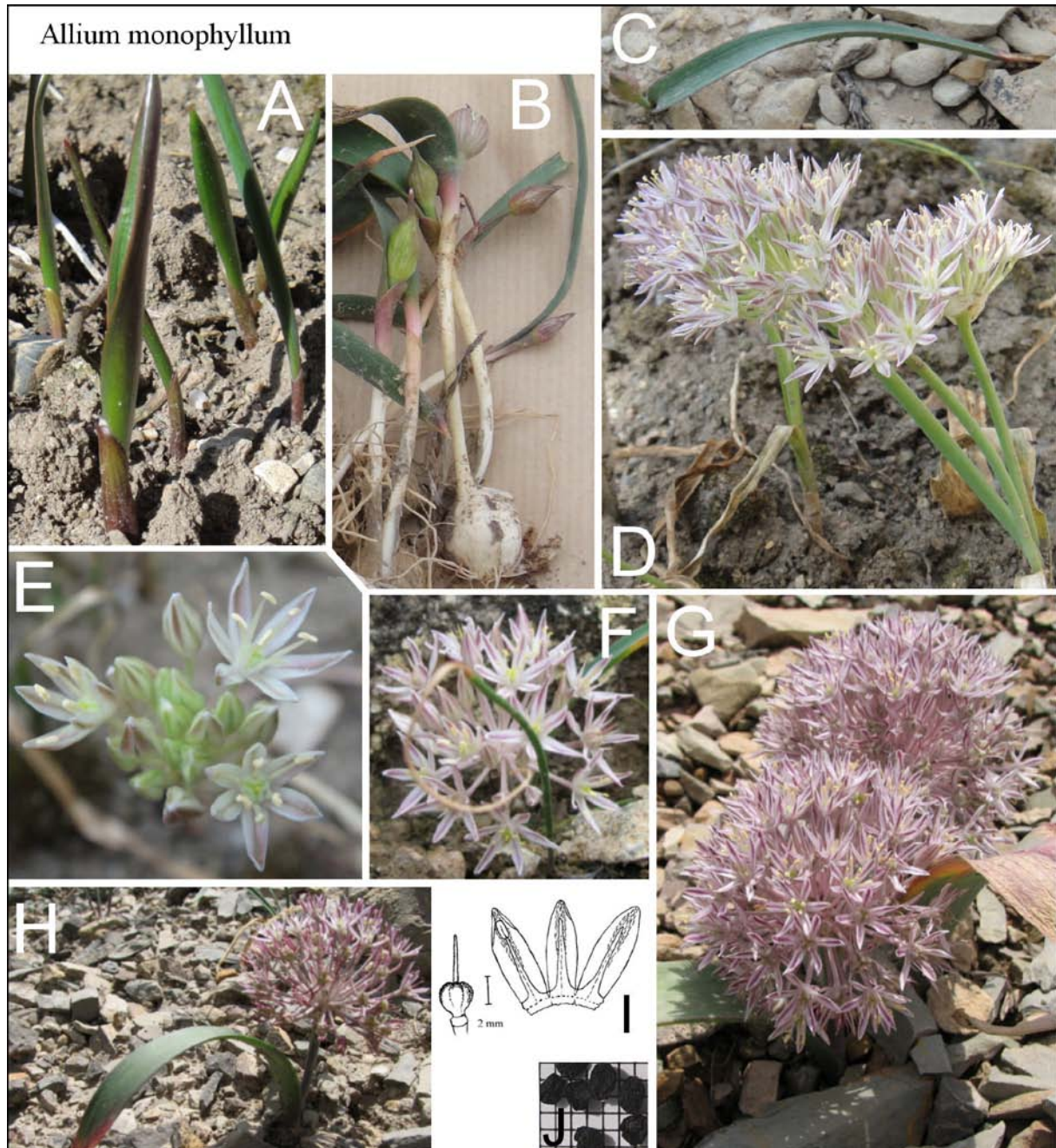


Plate (24): A: Leaves of cultivated plants during sprouting; B & C: plants in the shooting stage collected near Mareshk, Iran; D: flowering cultivated plants; E & F: inflorescences in early anthesis; G: flowering plants in Hezar Masjed massif, Iran; H: plant in late anthesis in Hezar Masjed massif; I: shape of ovary, tepals and filaments of a flower prepared from herbarium; J: seeds (millimeter paper as background; photos F - H courtesy of H. Razifard; plate copied from Fritsch & Abbasi 2013: 123 Plate T48, modified.)

**Description:** Bulbs ovoid to globose, 8-25 mm in diam., outer tunics brownish-blackish, thin, disintegrating, rarely accumulating in a thin shell. Scape slightly bent, terete, ± obconical, smooth; aerial part 2-8 cm long, 3-4 (5) mm in diam.; green, brownish near the soil. Leaves single (rarely 2), laminae linear-lanceolate, initially straight, later arcuately recurved to the soil or prostrate, thick, shallowly canaliculate; upper side with broad shallow ribs, lower side finely and densely ribbed; margins purplish, smooth or sparsely ciliate, ± gradually tapering into the cucullate sometimes ± spirally enrolled apex; 6-15 cm long, 4-10 mm broad; soft dark green, ± glossy, basally purplish flushed. Sheathy prophyll short, purplish, thickish, decaying prior to anthesis. Spathe membranous, divided into 2-3 ovate to suborbicular, shortly acuminate valves; pale with inconspicuous, brown veins. Inflorescence semi-globose, ± dense, moderately many-flowered; 3-5 cm in diameter. Pedicels ± unequally long, thickish, stiff, straight or slightly ascending; pale green, purple suffused. Anthesis in June to July (August). Flowers flat funnel-shaped starlike. Tepals linear-lanceolate, plicate towards the subobtusate apex, basally nearly free, obliquely patent, after anthesis subconvolute, contorted, and color darker; 5-7 mm long, 1-1.2 mm broad; rose to pink, median vein purple, narrowly lanceolate, broadest in the upper one-third. Filaments 2/3-3/4 as long as the tepals, subulate; basally shortly triangularly widened (inner filaments nearly twice wider) and shortly connate; white to rose. Anthers oblong; c. 1.5 mm long; yellow. Pollen yellow. Ovary substipitate, depressed globose triangular with 3 wider and 3 narrow furrows, 2-3 mm long and in diam.; surface rounded papillous; nectary ducts lead in dot-like holes near the very base. 6-8 ovules per ovary were reported (Vvedensky 1932). Style conical to threadlike, 2-4 mm long; yellow ± purplish suffused. Stigma undivided; yellowish. Capsule sessile, depressed-globose triangular, surface moderately scabrous, reticulate lacunose, 4-5 mm long, 5-6 mm in diam.; valves suborbicular, apex shortly and broadly notched. Seeds 1-2 per locule, ovoid to drop-shaped; surface coarsely reticulate lacunose, dull black; 1.5-2 mm long, c. 1.5 mm broad and thick.

**Chromosomes:**  $2n = 64$  Kurita 1956 (Great Britain: Botanical collection Edinburgh).

**Remarks:** *Allium monophyllum*, the smallest species of sect. *Asteroprason*, is somewhat smaller than *A. hexaceras* (sect. *Popovia*) and remarkably shorter than the species of sect. *Brevicaule*. *Allium monophyllum* differs in many flower characters from the other mentioned species that are much slender plants with narrower leaves and often smaller inflorescences (solely *A. chitralicum* has leaves similar to *A. monophyllum* and scapes of 15-20 cm length). The only available sample for molecular studies (ITS sequences of nuclear rDNA, Gurushidze & Blattner in Fritsch & Abbasi 2013: 199) was most basally positioned in sect. *Asteroprason* confirming the inclusion in that section proposed by Fritsch & al. (2010: 184). SSR analysis of another Iranian sample confirmed inclusion in sect. *Asteroprason* (Akhanian & al. 2015). Unfortunately, only living plants from Iran territory (see Fritsch & Abbasi 2013: 121) could be studied, but the plants from the type location on Mt. Chapan in Turkmenistan are apparently still smaller (Czerniakovska 1930) and own slightly shorter tepals becoming stiff after anthesis (Vvedensky 1934). The morphological identity of Turkmen and Iranian plants was underlined by Czerniakovska (1930), but the genetic identity could not be verified yet.

**Etymology:** The epithet refers to the mostly solitary leaf of this species (from Greek "single leaf").

**Biological data:** Contains larger amounts of dimethyldisulfid, methyl-n-propyldisulfid and di-n-propyldisulfid like members of sect. *Cepa* (Bernhard 1970).

**Economic traits:** Local name 'pioseke harz', not used in Iran by man but sheep like it (unpubl. results 2012).

#### 4.2 A. sect. *Asteroprason* **subsect. *Cristophiana*** Tscholok.

in Zam. sist. geogr. rast. Tbilisi 31: 52 (1975), sub sect. *Acanthoprason*. — *A. sect. Acanthoprason* subsect. *Acanthoprason* (Wendelbo) Kamelin group of *A. cristophii* relatives, Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 28 (1994), p. p. min. — **Type species:** *Allium cristophii* Trautv.

*Allium cristophii* Trautv. in Trudy Imp. S.-Peterb. Bot. Sada 9: 268 (1884) [nom. & orth. cons., Fritsch in Taxon 48: 577-579 (1999); Brummitt in Taxon 50: 561 (2001)]. Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 299, 357, t. VII f. 1, 1a, 1b (1887). Vved., Flora Turkm. 1, 2: 288 (1932). Vved., Flora URSS 4: 261 (1935). Wendelbo, Flora Iranica 76: 75, tab. 7/102, tab. 26/1 (1971). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971), Kamelin in Nikitin & Gel'dikhanov, Opre del. rast. Turkmen.: 123, 128 (1988), sub *A. bodeanum* Regel, omnia "*christophii*". Kollmann, Flora Turkey 8: 196, fig. 9/19 (1984). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 126, plate T50, map (2013). *Caloscordum cristophii* (Trautv.) Banfi & Galasso, in Banfi, Galasso & Soldano, Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano, 152 (2): 87 (Nov 2011). — *Allium bodeanum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 238 (1875), nom. rej. [Brummitt in Taxon 50: 561 (2001)], s. str. quoad typum. Vved., Flora Turkm. 1, 2: 289 (1932). Vved., Flora URSS 4: 261 (1935). Type: Persien [without place and date] leg. Bode (LE!). *Allium walteri* Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 299, 357, t. VII fig. 3, 3a (1887). Vved., Flora Turkm. 1, 2: 289 (1932), sub *A. bodeanum*. Type: Turkmenistan, Wand der Karanki ('Karange')dagh Schlucht, über [wall of the Karangedagh gorge, above] 5000', 25.5.1887, leg. Walter (LE!). *Allium albopilosum* C.H. Wright in Gard. Chron. third ser., 1903 (2) [No. 864]: 34, tab. opp. p. 40 (1903). Lectotype: "*Allium albopilosum* C.H. Wright in Gard. Chron. XXXIV p. 34, with fig. 138-02. Ellis. Hort. Kew. 9 June 1903. Figured for Bot. Mag. 7982". (K, bar-coded K000464557; design. Fritsch & al. 2010: 202). — Type: Turkmenistan: Achalteke ('Dubium est utrum in Turcomania australis (Achalteke) anne in Karabach specie haec a Cristoph reperta sit' It is doubtful whether this species was collected in W Turkmenistan or Karabakh) leg. Cristoph 7511, mis. 1883 M. N. Smirnov (holotype LE!).

**(25) subsp. *cristophii***

Distribution: Turkmenistan, NW Iran: Koppe Dagh / Kopetdag range; colline to submontane steppe slopes, along the margins of shrub areas, stony slopes with shallow soil. Occurrence in C Anatolia (Turkey, Erciyas Da.) needs verification.

Description: Bulbs depressed-globose, 2-5 cm in diam.; inner tunics membranous, yellowish, outer tunics papery, dissolving into fibers; bright gray, finally blackish-brown and disintegrating. Scape straight or slightly bent, smooth, terete, ± obconical; (10) 20-60 cm long, (3) 5-12 mm in diam.; green with glaucous bloom. Leaves 2-7 (11; depending on the bulb weight: Zimmer & al. 1985), laminae linear-lanceolate, arcuately ascending, sometimes falcate, finally above lax and drooping, thin, canaliculate; upper side with narrow and shallow furrows and rarely hairy, lower side with flat, broad and often hairy ribs; margin rarely toothed more often with short or long hairs, arcuately tapering into the cucullate apex; 15-30 (45) cm long, 1-3 (5) cm broad; green with strong glaucous bloom. Sheathy prophyll thin hyaline, soon decaying. Spathe membranous, completely divided in 2-3 (5) ovate often acuminate, finally reflexed valves; pale brown with darker veins. Inflorescence fastigiate to semiglobose, finally subglobose; many-flowered, loose; 8-18 cm in diam., in the fruiting stage also more than 25 cm in diameter and inflorescence dropping from the scape. Pedicels initially subequally finally unequally long, rather thin, stiff and elastic, straight or somewhat ascending; glossy brown to red-brown. Anthesis in April to May. Flowers flat starlike. Tepals narrowly triangular-lanceolate, somewhat plicate, gradually tapering into the subacute apex, basally very shortly connate, patent, slightly recurved, after anthesis stiff with convolute margins and thick vein, prickly; 10-15 (20) mm long, near the base (1.5) 2-3 mm broad; pale silvery lilac to metallic purplish-blue, median vein green with purple margin, outside thicker. Filaments 2/5-2/3 as long as the tepals; basally very shortly connate and shortly triangular widened (inner filaments somewhat broader), above subulate-triangular, straight later recurved; purple. Anthers linear-oblong; 2-2.5 mm long; pinkish-violet. Pollen grayish-yellow; shape oblate to peroblate, 27.5-35.5 µm long, 17-19.5 µm wide, sculptures microrugulate to rugulate, simple perforate, perforations 0.12 µm in diam., wall 0.8 µm thick (Levan 1935; Namin & al. 2009; Neshati & al. 2009). Ovary shortly stipitate, depressed globose to ovoid, with 3 broad and 3 narrow furrows, surface finely papillous; green, initially violet flushed. Up to 6 ovules per locule / 10 ovules per ovary were reported (Filimonova 1970 / Vvedensky 1932, also as *A. bodeanum*). Nectary ducts lead into small holes near the base of the ovary

below the bottom of the locules (Fritsch 1992b). Style threadlike, 3-6 mm long; violet with whitish base, later whitish. Stigma undivided; pink to whitish. Capsule broad-conically triangular, surface coarse, 6-8 (10) mm in diameter, 6-8 mm long; greenish yellow to dark brown;  $\pm$  widely opening, valves broadly elliptic, notched at the apex, with a broad longitudinal furrow. Seeds 2-3 (6) per locule, flat ovate with sharp edges; surface reticulate lacunose, at the back with more ledges, silk-glossy black; 3-3.5 mm long, 2.5-3 mm broad, 2-2.5 mm thick; TKW 6.06 / 6.61 / 6.81 g (Fritsch & Abbasi 2013). The testa showed verrucose periclinal walls, and the anticlinal walls transitions from S-like to U-like undulation with short wavelengths (Kruse 1986, Fritsch & al. 2006).

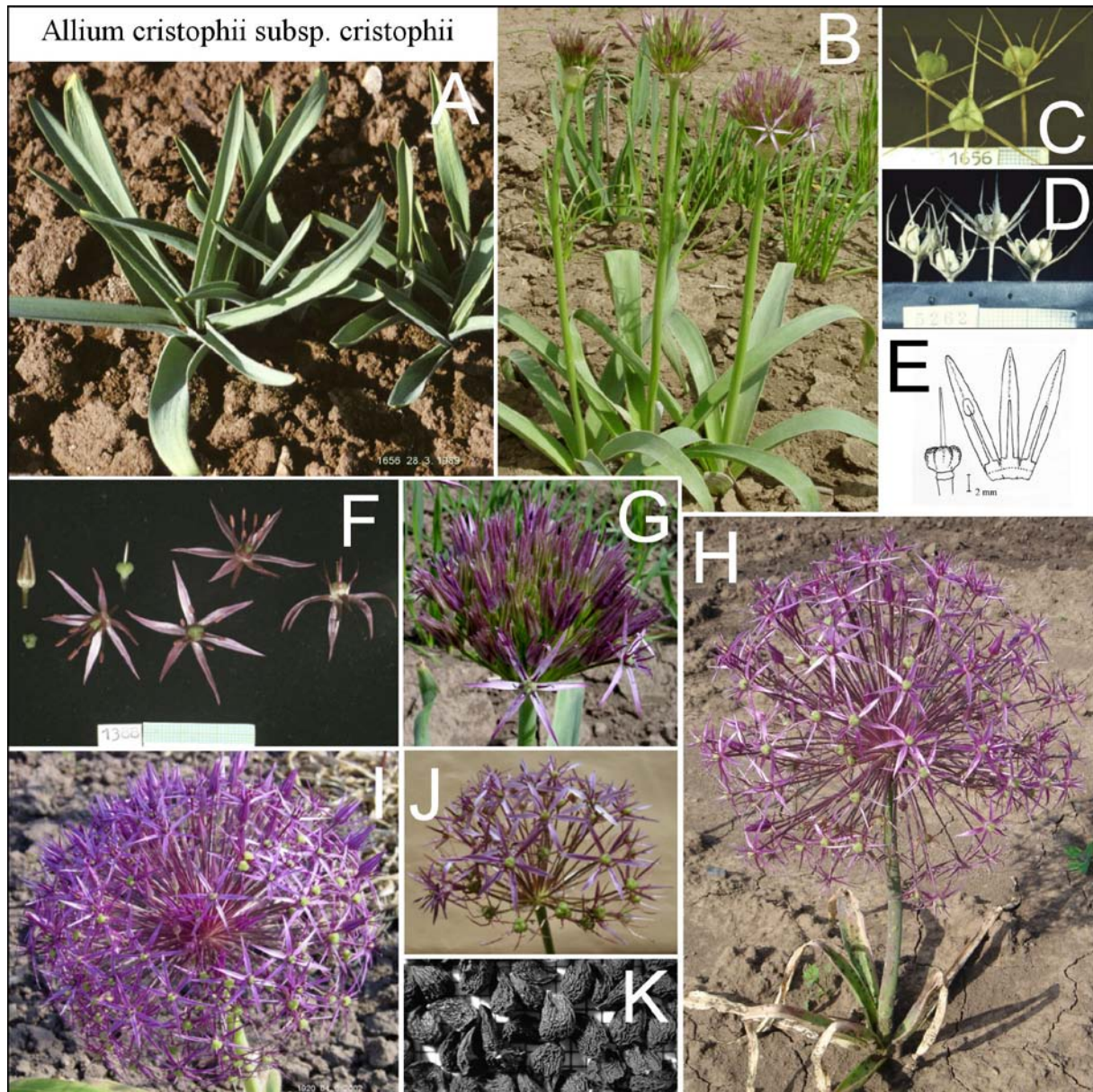


Plate (25): Cultivated plants are shown. A: sprouting leaves; B: plants prior to anthesis and in early anthesis, resp.; C: full-sized capsules; D: ripe capsules; E: shape of ovary, tepals and filaments of a flower prepared from herbarium; F: comparison of flowers and flower parts in different stages of anthesis; G: inflorescence in early anthesis; H: flowering plant; I & J: inflorescences in full and in late anthesis, resp.; K: seeds (millimeter paper as background and measure scale in C, D, F & K; plate copied from Fritsch & Abbasi 2013: 127 Plate T50).

**Chromosomes:**  $2n = 16$  Levan 1935 (Netherlands: Bulb trader van Tubergen "*A. albopilosum*").  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 fig. 3/1 (Turkmenistan: Kopetdag range, no. 493).  $2n = 16$  Pedersen & Wendelbo 1966 (Iran: Mazandaran, Haraz valley, W 1597).  $2n = 16$  Dietrich 1967 (France: Botanical collection Strasbourg "*A. albopilosum*").  $2n = 16$  Zakirova & Vakhtina 1974 (Turkmenistan: Kopetdag range, no. 26).  $n=8$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection BIN).  $2n = 16$  Vosa 1977 (source not mentioned, "*A. albopilosum*").  $2n = 16$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen).  $2n = 16$  Ohri & al. 1998 (Hungary: Botanical collection Budapest, TAX 2005).

2n = 16 Astanova in Fritsch & Abbasi 2013 (Tajikistan: Botanical collection Dushanbe). 2n = 16 IPK *Allium* reference collection ideogram (Great Britain: Botanical collection Manchester, TAX 1920).

Living accessions studied: Turkmenistan: Central Kopetdag range, W exposed limestone slopes c. 3 km S vill. Gjaurs, c. 20 km SE Ashgabat (37°42' N, 58°39' E, 500 m, 18.4.1995 Fritsch, Khassanov 1305; GAT) TAX 5253, vill. Chuli c. 30 km W Ashgabat (37°57' N, 57°59' E, 700 m, 20.4.1995 Fritsch & Khassanov 1320; GAT) TAX 5262, (37°58' N, 58°01' E, c. 700 m, 03.4.2002 Fritsch, Keusgen, Khassanov 4; GAT); W Kopetdag range, special place Kumyshdash (38°21' N, 56°58' E, 1600-1700 m, 06.4.2002 Fritsch, Keusgen, Khassanov 11; GAT), limestone slopes NE town Kara-Kala (38°29' N, 65°22' E, 800 m, 23.4.1995 Fritsch & Khassanov 1363; GAT) TAX 5277.

Remarks: *Allium cristophii*, the type species of subsect. *Cristophiana*, is an extremely polymorphous taxon especially concerning shape and density of indumentums of leaf laminae, length and diameter of scapes, dimension and density of inflorescences, as well as shape and color of tepals. The oldest available binomen is *A. bodeanum*, but this name was variably applied: by Regel (1875) to plants with small flowers and only toothed leaf margins, by Kamelin (in Nikitin & Gel'dikhanov 1988) to stocky plants growing on the heights of Kopetdag range, and by Wendelbo (1977) to the pale flowering variant of *A. elburzense* Wendelbo from Iran. This confusion was finally solved by rejecting the name *A. bodeanum* against *A. cristophii* (with conserved orthography, Brummitt 2001), a name much used in horticulture. An exact type location of *A. cristophii* is not traceable (the historical region "Akhhalteke" stretches along the northern foothills of Kopetdag mountain range in Turkmenistan at least from Baharden to Kaachka), where several accessions of slender plants with narrow and curved leaf laminae and ± deep silvery-violet tepals could be collected and compared under cultivation with more stocky plants having straight and broad leaf laminae and pale silvery-brown tepals collected in higher elevations. Thus two morphologically well recognizable subspecies are present. It remained unclear whether small and stocky plants from very high elevations (*A. walteri*) are only montane variants of subsp. *cristophii* or represent another taxon. A few herbarium vouchers (bearing only leaf remains and bleached flowers) imply that also at least another tall and probably red-flowered taxon could exist in the northeastern corner of Iran territory (informally named "*masjedense*" in the key of Fritsch & Abbasi 2013: 16) that could also occur on adjacent Turkmen territory. Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) presented strong evidence that *A. cristophii* is neither a member of sect. *Acanthoprason* nor of sect. *Kaloprason*, but of sect. *Asteroprason* (Fritsch & al. 2010: 183 cluster 2 § 3.4.4; Fritsch 2012b: 247 Fig. 1 D, 248; Gurushidze & al. 2010: 836, fig. 4 lineage V). Recent addition of more samples implies that subsp. *golestanicum* could be more basal and subsp. *cristophii* more advanced (Gurushidze & Blattner in Fritsch & Abbasi 2013: 199).

Etymology: Three epithets honor botanists of the 19th century that collected the type specimens: Dr. Cristoph was a physician and collected mainly insects but also plants when travelling in the Caucasus, North Iran, Transcaspia, and the Amur region, Dr. Walter accompanied G.F. Radde during research missions in Transcaucasia and Turkmenistan, and baron K.K. Bode undertook scientific research missions in Iran when he was Prime Secretary of the Russian embassy in Iran. The epithet *albopilosum* refers to the long white hairs often present on the leaf laminae (from Latin "hairy with distinct white long ascending hairs").

Biological data: The seedlings belong to the *Allium karataviense* type (Druselmann 1992). The growth form is characterized by one lateral shoot arising in the axil of the uppermost leaf (Kruse 1992). Some anatomical scape characters were shown, but not discussed at species level (Fritsch 1993 Fig. 7C). Anatomical characters of the scape: "elliptic" in cross section, 7.15 mm in diameter, 2 rows of vascular bundles, 9 vascular bundles in the peripheral layer, 4 layers of "thick walled parenchyma", largest vascular bundles 0.13 mm in diameter (Namin & al. 2009b). Details of temperature regimes influencing time and ability to flower as well as some parameters of roots, leaves, scapes, and inflorescences were studied by Aoba (1967) in Ellis & al. (1985, as *A. albopilosum*); Zimmer & al. (1985); Zimmer & Weckeck (1989); Dubouzet & al. (1992); Maeda & al. (1994). Seeds germinate only at 5-9 °C, even a short period of 13 °C causes inhibition (Zimmer & al. 1985; Ellis & al. 1985; Specht & Keller 1997). The bulbs contain

different steroid saponins and cholestan glycosids (Mimaki & al. 1993). Contains larger amounts of dimethyldisulfid, methyl-n-propyldisulfid and di-n-propyldisulfid like members of sect. *Cepa* (Bernhard 1970). Fresh bulbs contain in total 0.2 % cysteine sulfoxides (83 % methiin, 2 % alliin, 15 % propiin; Keusgen & al. 2008). Bulb extract inhibited growth of some (mainly Gram-positive) bacteria species and showed a moderate radical scavenger activity (Jedelská & Keusgen 2008). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1). Different genome sizes [2C DNA] were reported: 44.5 pg (Vakhtina & al. 1977), 42.0 pg (Zakirova 1989), 24.1 pg (Labani & Elkington 1987), 48.7 pg (Ohri & al. 1998; Gurushidze & al. 2012).

**Economic traits:** The species was tested as food; it is inedible with very unpleasant taste (de Lestrieux & de Belder-Kovacic 2000). In Turkmenistan it is used as repellent for mice, rats, and cockroaches (Kurbanov 2005). Much cultivated in Europe (even in the St. Petersburg area of Russia) as ornamental for flower beds and borders and for the spectacular dry infrutescences used for florist's decorations; introduced in the first decade of the 20th century by the Dutch bulb grower van Tubergen under the synonym *A. albopilosum*; still often traded under the incorrect name *A. christophii*. It is commercially available still today (De Hertog & Zimmer 1993, Fritsch 2015) and was listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991). Androsov (1941) recommended this species as ornamental for Turkmenistan. It was involved in crosses resulting in hybrid cultivars and is one parent of 'Globemaster' but not of 'Globus' (Friesen & al. 1997, Fritsch 2015).

**(26) *Allium cristophii* Trautv. subsp. *golestanicum* R.M. Fritsch in Fritsch & Abbasi, Taxon. Review *Allium* subg. *Melanocr.* Iran: 130, plate T51, map (2013). — *Allium cristophii* Trautv. sensu Wendelbo, Flora Iranica 76: 75, tab. 7/102, tab. 26/1 (1971). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 299, 357, t. VII f. 1, 1a, 1b (1887); Vved., Flora Turkm. 1, 2: 288 (1932); Vved., Flora URSS 4: 261 (1935); Vved. [ & Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971), sub *A. bodeanum*; Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 128 (1988), omnia p. p. — **Type:** Iran: Vers Bojnurd 160 km de Shahpasand, 1120-1300 m, 22.5.1976 Termeh & Matin (holotype 331-IRAN!).**

**Distribution:** Turkmenistan, NE Iran: Koppe Dagh range, submontane grassy and rocky slopes at elevations above 1000 up to 1800 m.

**Description:** Bulbs broadly ovoid, 1.5-4 cm broad, 2-4 cm long; outer tunics grayish brown, parchment-like, longitudinally splitting, sometimes accumulating to a thick but brittle shell. Scape ± straight, terete, smooth; 20-40 (70) cm long, basally 4-8, above up to 12 mm in diam.; dull green. Leaves 2-3 (4), laminae broadly lanceolate, straight when growing out later recurved, canaliculate, ± thick; upper side ± smooth, lower side ribbed, both sides and margins densely covered by long hairs (sometimes indumentum is sparse); short-arcuately tapering into the cucullate apex; 15-40 cm long, 3-5 (8) cm wide; green, very glaucous. Sheathy prophyll moderately long, thickish, pale to deep brown, soon decaying. Spathe membranous, divided into 1-2 broadly ovate to nearly triangular, acuminate, patent to subreflexed valves; pale brown with darker veins. Inflorescence fasciculate, later semi-globose; loose to moderately dense, moderately many-flowered; 5-8 cm long, finally 12-18 (25) cm in diam. Pedicels initially of subequal length, those of the latest flowers much longer, thin wiry, stiff, ± straight; pale greenish to brown, purple flushed. Anthesis in (April) May to June. Flowers flat starlike, after anthesis moderately funnel-shaped. Tepals long lanceolate-triangular, canaliculate, somewhat plicate, gradually tapering into the subobtuse apex, patent, slightly recurved, basally very shortly connate, after anthesis stiff with convolute margins and thick vein, prickly; 12-20 mm long, 2-3 mm broad; silvery-brownish to buff; median vein broad, green to brown. Filaments 2/5-2/3 as long as the tepals; subulate with shortly connate and short-triangular widened base; maroon, whitish near the very base. Anthers linear-oblong; c. 2 mm long and 0.8 mm broad; pale violet to maroon. Pollen yellowish gray. Ovary does not differ from the typical subspecies. The nectary ducts lead in small slits near the very base of the ovary. Style narrowly conical, 3-4 mm long; carmine. Stigma undivided, dot-like; white. Capsule sessile, depressed-globose, triangular, surface reticulate lacunose with some stronger irregular ledges, 4-8 mm long and

5-8 mm in diam.; greenish to ochre; valves broad-elliptic with a longitudinal furrow and a shallow notch at the apex. Seeds 1-2 per locule;  $\pm$  flat ovoid; surface coarsely reticulate lacunose, dull black; 2.5-3 mm long, c. 2 mm broad, 1.5-2 mm thick.

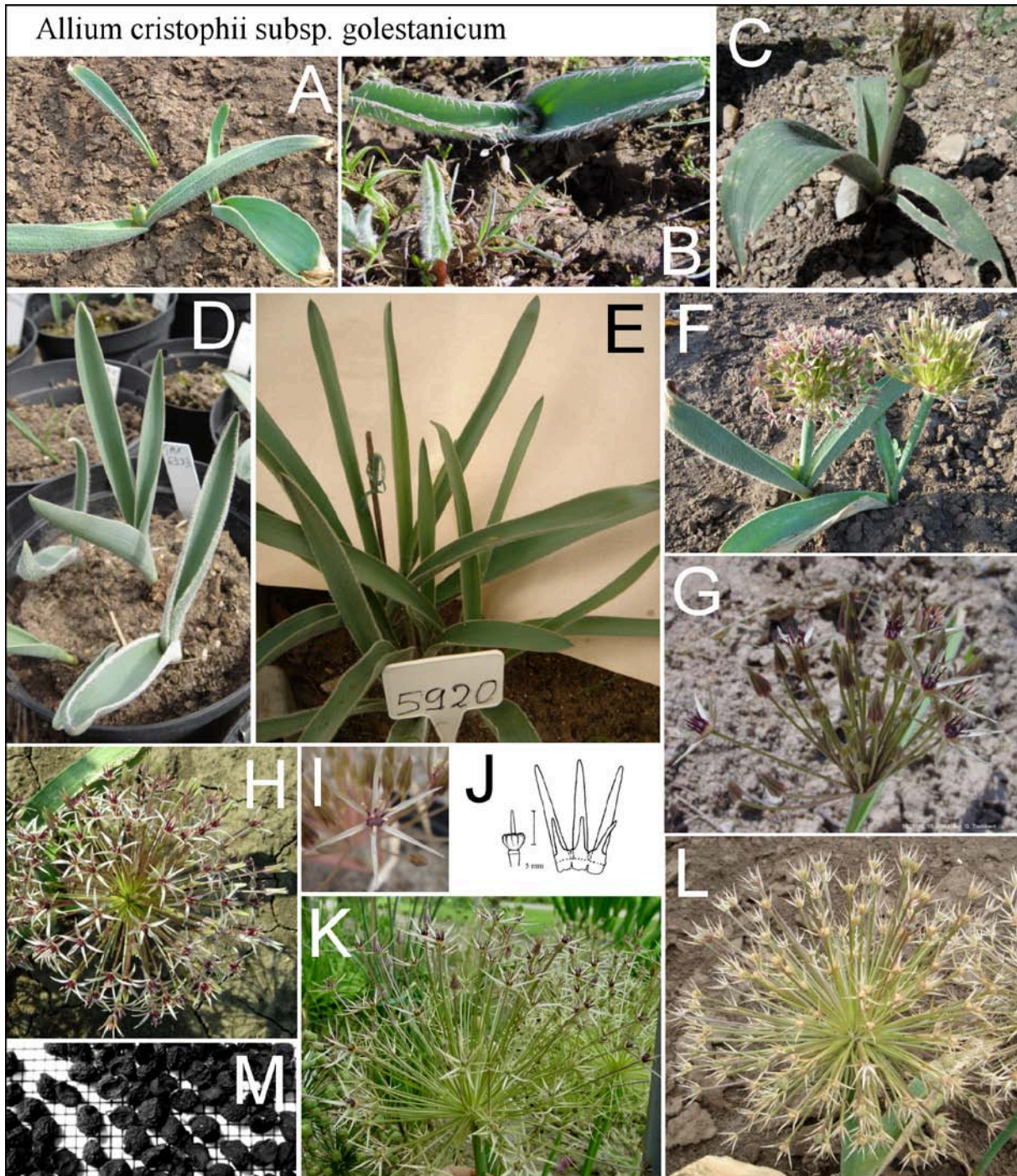


Plate (26): A, D & E: Leaves of cultivated plants in different developmental stages; B: sprouting leaves in Kumyshdash, Turkmenistan; C: cultivated plant in the shooting stage; F: cultivated plants at the begin of anthesis; G: inflorescence at the begin of anthesis (cultivated in Tashkent, Uzbekistan); H, K & L: inflorescences in full, late, and after anthesis, resp.; I: close-up of a flower; J: shape of ovary, tepals and filaments of a flower prepared from herbarium; M: seeds (millimeter paper as background; plate copied from Fritsch & Abbasi 2013: 131 Plate T51).

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Turkmenistan: Kopetdag range, Mt. Dushak, Seisums s. n., "*A. bo-deanum*").

**Living accessions studied:** **Turkmenistan:** W Kopetdag range, special place Kumyshdash; subalpine meadows with single *Juniperus turkestanica* trees (38°21' N, 56°58' E, 1600 m, 06.4.2002 Fritsch, Keusgen, Khassanov 11; GAT) TAX 5920.



**Remarks:** Important key characters of subsp. *golestanicum* are 20–40 cm long scapes, broader and shorter (and often really woolly) leaves straight when growing out, silvery-brownish tepals, and maroon filaments (a detailed discussions see under the typical subspecies). Living plants are well separable from typical *A. cristophii* as well as from stocky plants growing in the montane belt. The color photo of *A. cristophii* in "Flora Iranica" (Wendelbo 1971: Tab. 26/1) depicts subsp. *golestanicum*. Molecular markers do not differ from that of the typical subspecies, they were already discussed there. Plants with longer and narrower leaves and often intensely violet tepals dominate along the northern slopes of Kopetdag range (Turkmen "Akhhalteke" area), whereas plants with broader and shorter (and often really woolly) leaves and silvery-brownish tepals occur most often in the central and northern (Iranian) parts of this mountain range. *Allium cristophii* is very polymorphous depending on the ecological conditions. A more detailed study of this variation seems essential.

**Etymology:** The epithet refers to the Golestan reservation in northern Iran where the plants are widely distributed.

**Biological data:** The plants are tumble-weeds: The scape is decomposing at the base in the fruiting stage, and the infrutescences tumble away blown by the wind. Genome size 46 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.33 % cysteine sulfoxides (71 % methiin, 3 % alliin, 26 % isoalliin, Keusgen & al. 2008). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1 as *A. cristophii*).

5. *A.* subg. *Melanocrommyum* sect. *Stellata* (F.O. Khass. & R.M. Fritsch) R.M. Fritsch in *Phyton* (Horn, Austria) 49: 187 (2010). — *A.* sect. *Acmopetala* subsect. *Stellata* F.O. Khass. & R.M. Fritsch in *Linzer Biol. Beitr.* 26: 976 (1994). — **Type species:** *Allium taeniopetalum* Popov & Vved.

*Allium taeniopetalum* Popov & Vved. in *Byull. Sredneaz. gosud. Univ.* 19: 130 (1934). Vved., *Flora URSS* 4: 269–270 (1935). Vved., *Flora Uzbek.* 1: 461 (1941); Vved., *Flora Tadzh. SSR* 2: 351 (1963). Vved. [& Kovalevskaya], *Opred. rast. Sredn. Azii* 2: 85 (1971). Fritsch & Khassanov in *Linzer Biol. Beitr.* 30: 290 (1998)]. — **Type:** Uzbekistan: Bukharskiya vpadeniya. Gory bliz st. zh. dor. [Bokhara lowland. Mountains near the railway station] Zerabulak; 30.4.1912 leg. Androsov (holotype & isotype LE!).

### (27) subsp. *taeniopetalum*

**Distribution:** Uzbekistan, Tajikistan: Turkestan range, Kurk-Tau massif; locally moister places on montane stony and rocky slopes and rock terraces, among rocks.

**Description:** Bulbs subglobose, 1–2 cm in diam. Scape ± straight, terete, somewhat fusiform, smooth (coarsely ribbed when dry); 30–60 (80) cm long, (4) 8–12 mm in diam.; green with glaucous bloom, ± maroon suffused. Leaves 2–3 (4), laminae narrowly-lanceolate, obliquely arcuately ascending and recurved to the soil, thickish, basally narrowly canaliculate above shallower; upper side grooved, lower side finely ribbed; margins mostly reddish, scabrous, gradually tapering into the slightly hooded apex; 25–45 cm long, (1) 2–6 cm broad; dull vividly green, basally sometimes the ribs reddish flushed. Sheathy prophyll long, fine silky, smooth, greenish translucent, quickly decaying. Spathe thin membranous, nearly completely divided in 2 or more long acuminate valves; whitish-translucent with brownish veins. Inflorescence initially semi-globose later globose to ovoid; rather loose, with (15) 45–90 (120) flowers; initially c. 3 cm finally c. 8 cm in diam. and 10 cm long. Pedicels subequally long, thick, very strong, upper pedicels straight, lower ones ascending; silk-glossy green, in full anthesis often maroon. Anthesis in end of May to June. Flowers flat starlike. Tepals narrowly linear to sublanceolate, subobtusate with slightly plicate and claw-shaped apex, patent, later reflexed, ± convolute and somewhat tortuous; 7–8 (first flowers up to 12) mm long, basally 1.2–1.8 mm broad; deep pink to carmine with ± narrow, greenish-brown median vein. Filaments ± as long as the tepals, basally for ± 1 mm connate and triangular widened (inner filaments c. 1.5 times broader), above subulate; pink to carmine, fading towards

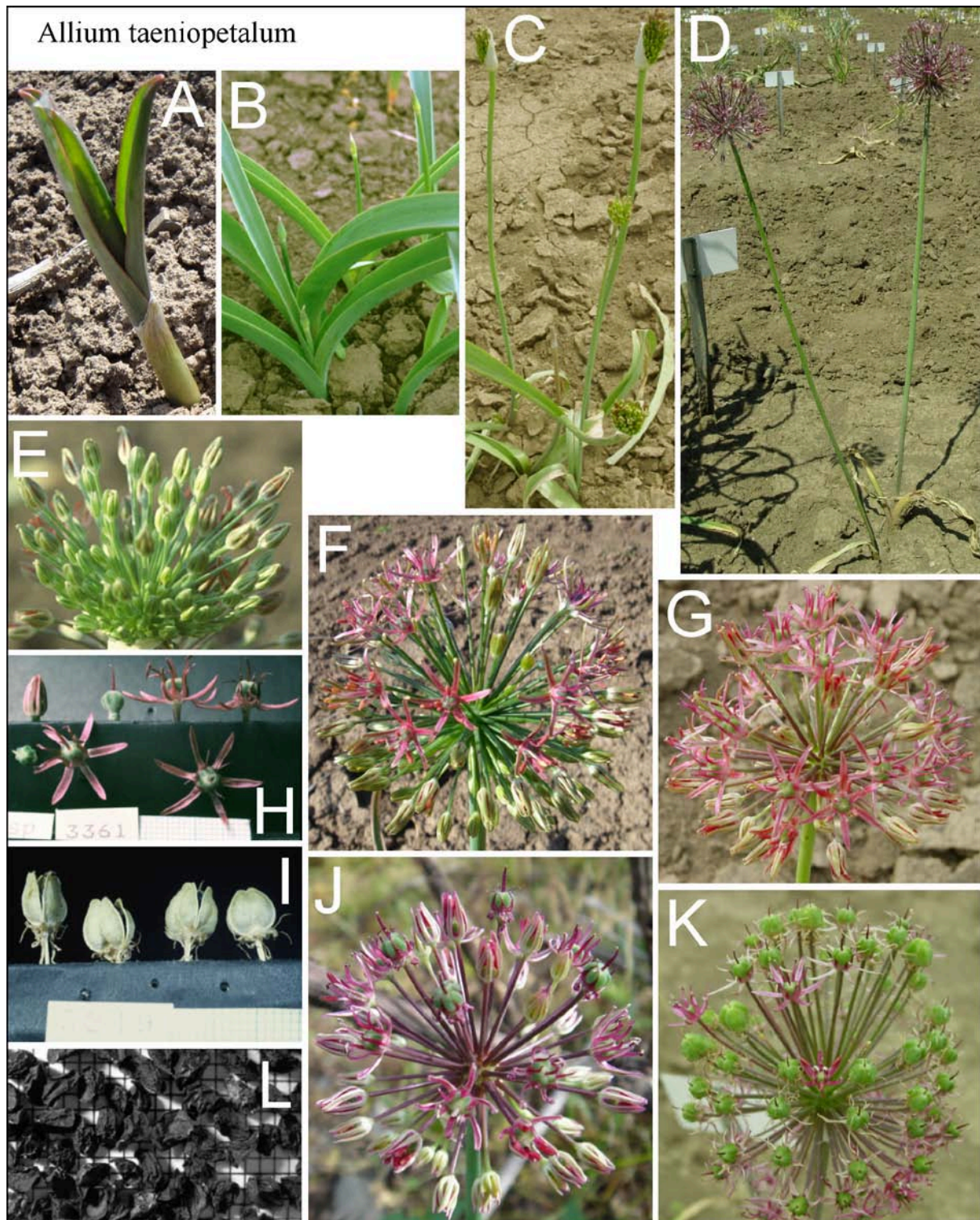


Plate (27): Cultivated plants (except J) are shown. A: Sprouting leaves; B & C: plants in the early and late shooting stage, resp.; D: plants in full anthesis; E: inflorescence with buds; F & G: inflorescences in early anthesis; H: comparison of flowers and flower parts in different stages of anthesis; I: ripe open capsules; J: inflorescence in full anthesis in Nuratu ridge, Uzbekistan; K: inflorescence in late anthesis; L: seeds (millimeter paper as background and measure scale of H, I & L).

base. Anthers oblong; 3 mm long and 1 mm broad, surface large-celled; violet. Pollen gray. Ovary stipitate, globose to nearly hexangular, 3-4 mm long and in diam.; surface acutish papillous; gray-green. Up to 5 ovules per locule, 15 ovules per ovary (Filimonova 1970). Nectaries mound in small oval to triangular holes at the bottom of ovary. Style conical-threadlike, 3-5 mm long; whitish later carmine. Stigma undivided; whitish. Capsule ovoid-triangular, surface with rather few raised wrinkles, 7-8 mm long

and 5-6 mm in diam.; narrowly open, valves long cordate mostly deeply notched; ± dull buff. Seeds 2-4 per locule, triangularly semicircular to drop-shaped with sharp edges; surface papillous with irregularly reticulate raised wrinkles, silk-glossy black; 2-2.5 mm long, c. 1.5 mm broad, 1-1.2 mm thick. The testa showed transitions from Omega-like to S-like and rarely to U-like undulated anticlinal walls and verrucate periclinal walls with a moderate number of verrucae (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 148, Vakhtina & al. 1977 total length of chromosomes (Uzbekistan: Nuratau ridge, no. 84).  $2n = 16+B$  Fritsch & Astanova 1998 Table 2 (Uzbekistan: Malguzar ridge, Jizzakh TAX 3361).

**Living accessions studied:** Uzbekistan: Turkestan range, Zomin valley below the highest sanatorium (39°40'40.2" N, 68°29'03.9" E, 1650 m, 04.6.2006 Fritsch & Khassanov 4246; GAT). TAX 6531; Malguzar ridge, rocks "Tamerlanskie vorota" c. 5 km S Jizakh, right side of Sangzar valley (40°04' N, 67°40' E, 500 m, 23.5.1992 Fritsch & Khassanov 784; GAT) TAX 3361; Aktau ridge, steep side valley of S slope in NE exposition (40°21' N, 66°02' E, 1300 m, 16.4.1995 Fritsch & Khassanov 1292; GAT) TAX 5244; N chain, granitic slope, *Amygdalus* association (40°23' N, 66°03' E, 1400 m, 16.4.1995 Fritsch & Khassanov 1300; GAT) TAX 5249, near the road to Chuja (40°23'31.3" N, 66°00'48.6" E, 1300 m, 01.6.2003 Fritsch, Keusgen, Khassanov 4178; TASH); Pistalitau Mts., middle section of western part 25 km E vill. Yangikishlok (40°20'55" N, 67°33'14.6" E, 500 m, 02.6.2003 Fritsch, Keusgen, Khassanov 4180 (4121); GAT) TAX 6198; Nuratau ridge, valley Gordara, c. 5 km E village Old Farish (40°31'00" N, 66°54'54.1" E, 740 m, 06.5.2005 Fritsch & Khassanov 4207; GAT) TAX 6358.

**Remarks:** *Allium taeniopetalum* is the only species of sect. *Stellata*. The distribution area stretches from the mountains east of Tashkent via the Mogoltau massif and the northern spurs of Turkestan range to mountains east of Bokhara. The typical subspecies is characterized by deep pink to purplish tepals and occupies the westernmost part of this area. The molecular relationships will in detail be discussed under subsp. *mogoltavicum*. Both molecular markers showed a remarkable diversity among the investigated samples of subsp. *taeniopetalum* (Gurushidze & al. 2010: 836, fig. 4 lineage VI; Fritsch & al. 2010: 173 Fig. 2C; Fritsch 2012b: 249 Fig. 2 group G; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Perhaps here the molecular diversity mirrors different ecological preferences.

**Etymology:** The epithet is most probably derived from the ± linear shape of the tepals (from Greek "with linear tepals").

**Biological data:** Good germination at 5 °C, but no germination above 10 °C (Specht & Keller 1997). The genome size of 31.3 pg 2C DNA is similar to subsp. *mogoltavicum* (30.6 pg) Gurushidze & al. (2012). Fresh bulbs contain in total 0.02 % cysteine sulfoxides (53 % methiin, 47 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008).

**Economic traits:** The leaves are eaten as vegetable in Tajikistan, local name 'model' (Saidov 1986).

**(28) *Allium taeniopetalum* subsp. *mogoltavicum*** (Vved.) R.M. Fritsch & F.O. Khass. in Linzer Biol. Beitr. 30: 290 (1998). *Allium mogoltavicum* Vved. in Bot. mat. gerb. bot. inst. Akad. Nauk SSSR 9, 4-12: 240 (1946). Vved., Flora Tadzh. SSR 2: 347 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 (1971). — *Allium baschkyzylsaicum* Krassovsk. in Bot. Mat. Gerb. Inst. Bot. Akad. Nauk Uzb. SSR 20: 15 (1982). Type: Uzbekistan: Zapadnyj Tyan-Shan, levij sklon r. Bash-Kyzyl-saya, otrog Alchazar [W Tianshan range, left slope of Bashkyzylksai, spur of Alchazar]; 1300 m, 30.5.1978, leg. Krassovskaja 26 (holotype LE!, isotype LE, TASH!; topotype LE, TASH). — **Type:** Tajikistan: Zapadnyj Tyan-Shan. Gory Mogol-tau, ushchhel'e na V. ot ushchel'ya [W Tianshan range, Mogoltau massif, gorge E of gorge] Mamran-Saj; 4.5.1927, leg. Granitov 350 (holotype & isotype TASH!).

**Distribution:** Uzbekistan, Kirgizstan, Tajikistan: W Tianshan range, Mogoltau and ridges of W Chatkal range, montane N-exposed rocky and stony slopes, among shrubs and under trees.

**Description:** Bulbs depressed-globose, (1) 1.5-3 (4) cm in diam., 1-2.5 cm long; tunics whitish, thin membranous, finally blackish and strongly disintegrating. Scape ± flexuous, ± terete, initially thicker below inflorescence later fusiform, smooth; 25-60 cm long, basally 3-6 mm, in the middle 5-10 mm, above 4-8 mm in diam.; green with glaucous bloom, basally often purple suffused. Leaves (1) 2-3 (6!),

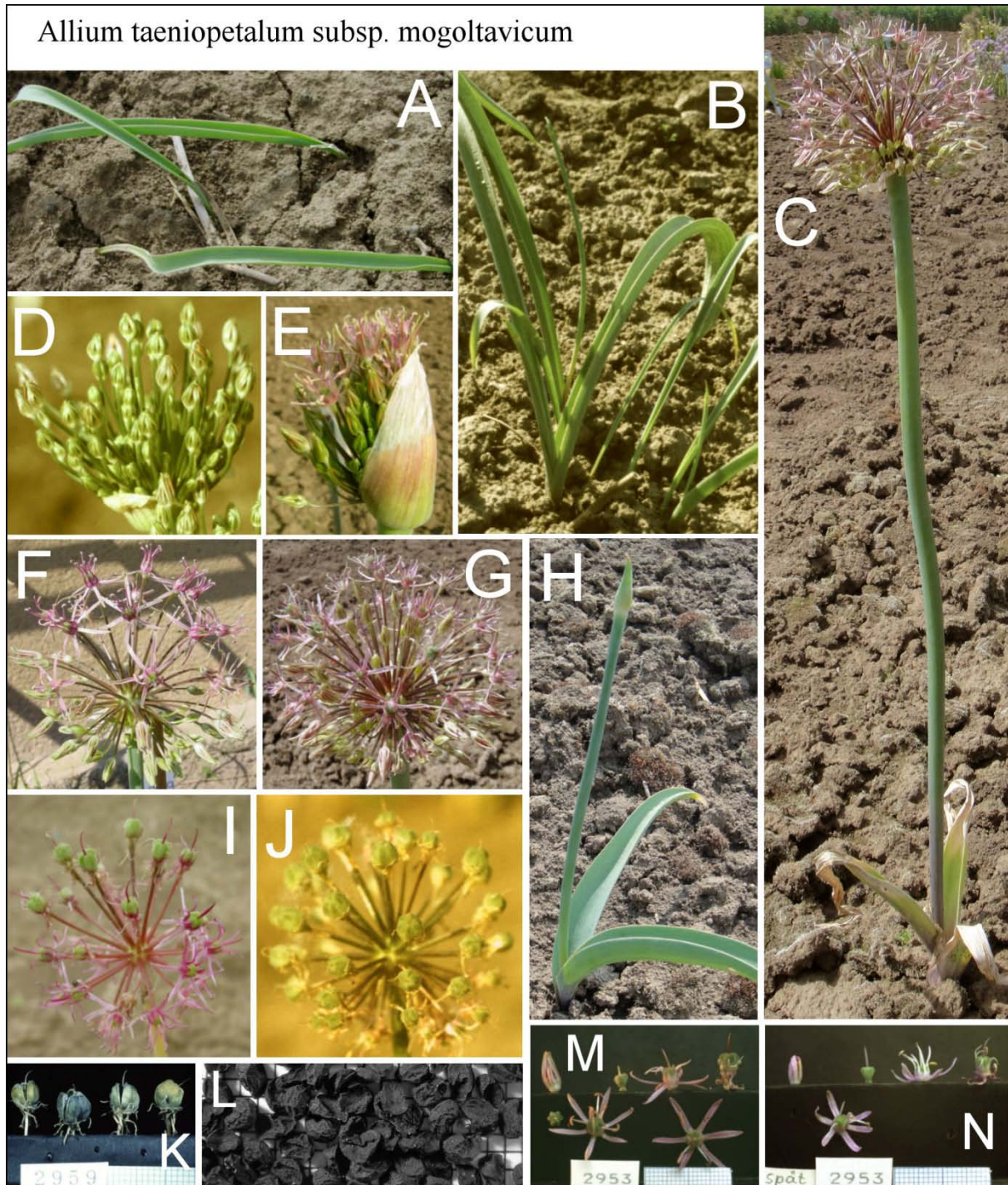


Plate (28): Cultivated plants are shown. A: Sprouting leaves; B & H: shooting plants; C: flowering plant; D: inflorescence in buds; E & F: inflorescences in early anthesis; G: inflorescence in full anthesis; I & J: inflorescences in late anthesis; K: ripe open capsules; L: seeds; M & N: comparisons of flowers and flower parts in different stages of anthesis, M first flowers, N late flowers of the identical inflorescence (millimeter paper as background and measure scale of K, L, M & N).

laminae linear-lanceolate, flat to stiff arcuately ascending, upper part often hanging down, basally deeply above shallowly canaliculate; upper side smooth, lower side with broad and shallow (often maroon) ribs fading towards the apex; margins narrow white or maroon, basally loosely toothed above glabrous, long tapering into the hooded apex; 15-25 (50) cm long, 0.6-2 (7) cm broad; green with glaucous bloom, silk-glossy, basally purplish suffused. Sheathy prophyll long, strong, with cross wrinkles, white, rather quickly decaying. Spathe membranous, completely divided into 2 oblong-ovate, long acuminate valves, shorter than the pedicels; whitish with inconspicuous veins. Inflorescence semi-globose to globose

(fruiting subovoid); rather loose, with (15) 30-60 (130) flowers; 5-9 cm in diam. Pedicels subequally long, thickish wiry, slightly descending; 1-3 (fruiting up to 6) cm long; brownish-green with silky gloss. Anthesis in April to June. Flowers flat starlike. Tepals linear-lanceolate, subobtuse or acutish, canalliculate with incurved apex, initially patent, later reflexed and irregularly contorted and slightly enrolled; in the first flowers c. 10 (up to 14!) mm long and 1.8 mm broad, in the last flowers only 5-7 mm long and c. 1 mm broad; ± rose-pinkish with darker median vein that is fading towards the apex. Filaments ± as long as the tepals; basally for nearly 1 mm connate and subrectangularly (outer filaments up to 1.5 times broader) widened, the subulate upper part reclinate; pink fading toward the apex. Anthers oblong; 2 mm long, 0.8 mm broad; pale brownish-violet. Pollen grayish yellow. Ovary distinctly stipitate, ovoid-conical nearly hexangular, up to 5 mm long and in diam.; surface acutish papillous. Style conical-threadlike, 3-7 mm long; whitish to rose, finally ± violet. Stigma undivided; whitish. Capsule ovoid to globose triangular, surface coarse with wrinkles, 4-6 mm long and in diam.; valves ovate, notched at the apex; dull buff. Seeds (1) 2-3 per locule, semi-circular with concave sides and many-edged back; surface finely papillous and sharply reticulate-lacunose, dull black; 2-2.5 mm long, 1.5-1.8 mm broad, c. 1.5 mm thick. The testa showed transitions from Omega-like to S-like and rarely to U-like undulated anticlinal walls and verrucate periclinal walls with a moderate number of verrucae (Fritsch & al. 2006).

Chromosomes:  $2n = 16+B$  IPK Allium reference collection ideogram (Uzbekistan: Chatkal range, Bashkizylsai TAX 5721, type location of *A. bashkizylsaicum*).  $2n = 16$  Astanova 1990 (Tajikistan: Mogoltau massif, type location; correction in litt.).

Living accessions studied: Uzbekistan: Kurama ridge, Angren valley 4 km below Irtashsaj (41°07'30.7" N, 70°21'35.7" E, 1200 m, 22.5.2003 Fritsch, Keusgen, Khassanov 4126 (4067); GAT) TAX 6169; Chatkal range, valley Aksakata, 30 km NE town Chirchik (1370 m, 25.8.2001 Fritsch & Gemeinholzer 1876; 41°21'38.1" N, 69°55'31.6" E, 1250 m, 10.5.2005 Fritsch & Khassanov 4220; GAT) TAX 5910, TAX 6372, N exposed stony-shrubby slopes in Bashkizylsai valley c. 7 km SE vill. Nevich (41°41' N, 69°50' E, 1300 m, 03.6.1997 Fritsch & Khassanov 1658; GAT) TAX 5721. Tajikistan: Kurama ridge, strongly grazed *Juniperus* slope in the valley Chelata shortly below the pass (40°38' N, 69°35' E, 1700 m, 29.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 557 A, B; GAT) TAX 2953, TAX 2954; Mogoltau massif, crest of valley Ptavsaj in Spa massif c. 17 km W Leninabad (40°47' N, 69°26' E, 1100 m, 31.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 575 A, B; GAT) TAX 2959, TAX 2960.

Remarks: All subspecies of *A. taeniopetalum* show a remarkable shift of flower dimensions: the first flowers in the inflorescences are much larger than late blooming ones. This fact was apparently not recognized by Vvedensky who published a much too short tepal length for *A. mogoltavicum*. Type and isotype represent specimens most probably laid into the press in early anthesis. They were only slightly pressed, and thus they continued anthesis in the press and developed capsules. The tepals of the first flowers became strongly contorted and enrolled, their true length cannot be estimated with certainty. Vvedensky probably analyzed the late blooming flowers only. Subsp. *mogoltavicum* differs mainly by rose to pink tepals from the other subspecies. Also *A. bashkizylsaicum* shares this flower color. Plants in the Bashkizylsai valley possessed indeed only one leaf when studied and collected there, but after replanting into the Gatersleben collection the identical specimens developed two or three leaves in the next years and showed also no other differences to topotypical plants of subsp. *mogoltavicum*. Molecular markers (ITS sequences of nuclear rDNA) displayed a remarkable diversity inside *A. taeniopetalum*. Most basal is a sample from Turkestan range sister to subsp. *mogoltavicum*, more advanced is subsp. *turakulovii*, and the Aktau samples of subsp. *taeniopetalum* are most advanced. The general position supports a close relationship of this species to the *A. cupuliferum* and *A. balkhanicum* alliances of sect. *Regeloprason*, less close to *A. verticillatum*, and a moderately close but unresolved relationship to several other sections (Fritsch & al. 2010: 186, cluster 3 § 3.5.4.; Fritsch 2012b: 249 Fig. 2 G, 250; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Another molecular marker (sequences of the plastid *trnL-trnF* region, Gurushidze & al. 2010: 836, fig. 4 lineage VI) did also not resolve the closer relationships, because *A. taeniopetalum* shared identical haplotypes with members of several sections.

**Etymology:** The subspecific epithet refers certainly to the Mogoltau ridge W Khujand (Tajikistan) where the type was collected.

**Biological data:** The genome size was 30.6 pg 2C DNA (Gurushidze & al. 2012).

**Economic traits:** The green plant parts are eaten in Tajikistan (Anonymous 1985). Very rarely offered as ornamental (Fritsch 2015).

**(29) *Allium taeniopetalum* subsp. *turakulovii*** R.M. Fritsch & F.O. Khass. in Linzer Biol. Beitr. 30: 290, 843 (1998). — **Type:** Ex culturae in horto Gaterslebensis No. TAX 5068/96, leg. 11.6.1996. (Ex Kirgizstan: Turkestan-Gebirge, Berge ca. 1 km oberhalb Dargun, Kalkfelsflur [cultivated in Gatersleben ... mountains c. 1 km above [village] Dargun, limestone rock area], ca. 1800 m, 39°59' N, 069°57' E, 10.7.1994 Fritsch & Pistrick 1235A; holotype GAT!).

**Distribution:** Tajikistan ?, Kirgizstan: central Turkestan range, montane dry rocky slopes and rock terraces, only known yet from the type location.

**Description:** Bulbs depressed-globose to ovoid, 8-20 mm in diam. and long; inner tunics finely membranous, longitudinally splitting, whitish, outer tunics blackish, somewhat fibrous, finally disintegrating. Scape slightly flexuous, terete, initially  $\pm$  obconical later subfusiform, smooth; 35-60 cm long, 3-6 mm in diam.; dull green with glaucous bloom, basally somewhat purplish flushed. Leaves 1-2 (3); laminae narrowly lanceolate, obliquely (later arcuately) ascending and recurved, thickish, broadly to flat canaliculate; upper side finely grooved, lower side ribbed; margins narrowly reddish to whitish, basally scabrous, glabrescent toward the gradually tapering, scarcely hooded apex; (15) 25-35 cm long, (0.6) 1-2 cm broad; dull gray-green with slight glaucous bloom, basally slightly maroon flushed. Sheathy prophyll quickly decaying. Spathe papery, completely divided in broadly ovate, long acuminate valves; brownish with  $\pm$  slightly darker veins. Inflorescence semi-globose to globose finally subovoid; rather loose, (15) 30-80-flowered; 5-12 cm in diam., finally up to 14 cm long. Pedicels subequally long, thickish, stiff, straight; glossy, initially maroon later green. Anthesis in begin of June. Flowers bowl-shaped later flat starlike; with fine flower odor. Tepals linear-lanceolate, canaliculate with shortly acuminate, slightly claw-like apex, patent, later subreflexed and tortuous or somewhat spirally enrolled; 7-10 mm long, 1.3-1.7 mm broad; as buds yellowish-green, then pale yellow often slightly reddish flushed, after anthesis brown, with broad, green, outside more conspicuous median vein. Filaments  $\pm$  as long as the tepals; basally for c. 0.8-1.3 mm connate and ovately widened, above subulate; crème, basally often rose flushed. Anthers oblong; 2-2.5 mm long and c. 0.8 mm broad; yellow with purplish flush. Pollen yellowish. Ovary stipitate, ovoid, 3-3.5 mm long, 2.5-3 mm in diam.; surface moderately papillous; silky-glossy gray-green. Style narrowly conical, 5-6 mm long; whitish, finally purplish flushed near base. Stigma undivided; whitish. Capsule triangular obovoid, surface coarse with a variable pattern of raised wrinkles, 6-7 mm long and 5-6 mm in diam.; narrowly open, valves narrowly notched at the apex; buff. Seeds 3-4 per locule, flat triangular to drop-shaped with sharp edges and often one concave side; surface finely papillous with an irregular pattern of raised wrinkles, silk-glossy black; 2-2.5 mm long, 1.5-1.8 mm broad, c. 1 mm thick. The testa showed transitions from Omega-like to S-like and rarely to U-like undulated anticlinal walls, and verrucate periclinal walls with a moderate number of verrucae (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Kirgizstan: Turkestan range, Dargun TAX 5068, type location).

**Living accessions studied:** **Kirgizstan:** Turkestan range, mountains c. 1 km above vill. Dargun, limestone rock slope (39°59' N, 69°57' E, 1800 m, 10.7.1994 Fritsch, Khassanov, Pistrick 1235 A; GAT) TAX 5068, grassy N exposed slope (39°59' N, 69°57' E, 1750 m, 10.7.1994 Fritsch, Khassanov, Pistrick 1235 B; GAT) TAX 5067.

**Remarks:** This subspecies is mainly characterized by pale yellow to somewhat reddish tinged tepals and a separate area of distribution on dry and warm limestone slopes of the central Turkestan range. The molecular relationships (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region)

were already in detail discussed under subsp. *mogoltavicum*. The only investigated (type) sample is positioned between the other subspecies supporting a certain taxonomic distance (Gurushidze & al. 2010: 836, fig. 4 lineage VI; Fritsch & al. 2010: 186 cluster 3 § 3.5.4; Fritsch 2012b: 249 Fig. 2 G, 250; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201).

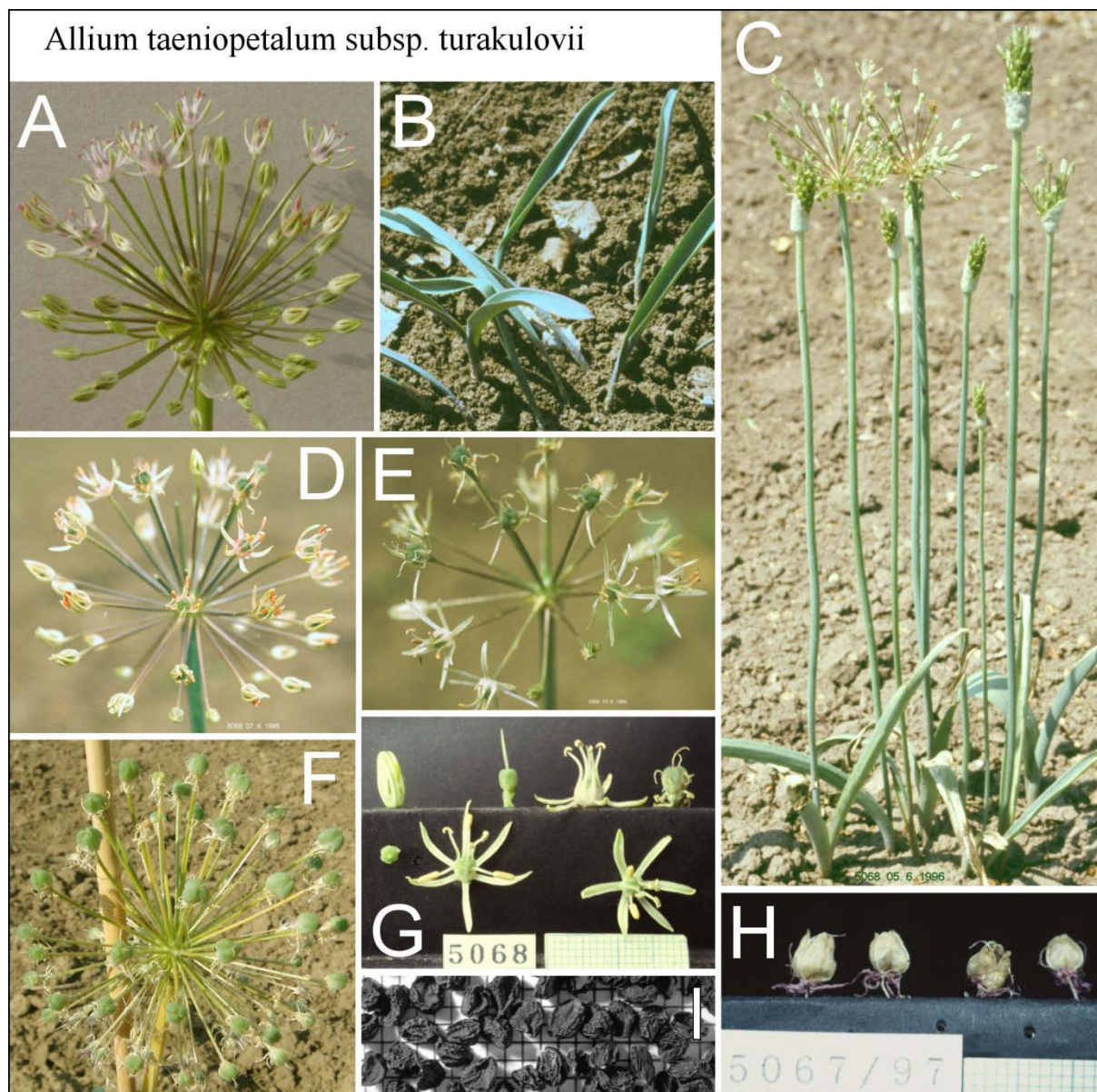


Plate (29): Cultivated plants are shown. A: Inflorescence in early anthesis; B: sprouting leaves; C: plants in buds and in early anthesis; D & E: inflorescences in late anthesis; F: inflorescence with developing capsules; G: comparison of flowers and flower parts in different stages of anthesis; H: ripe open capsules; I: seeds (millimeter paper as background and measure scale of G, H & I).

**Etymology:** The epithet honors the excellent contemporary Tajik botanist Isakul Turakulov acting in Khujand who detected this species and presented plants at the type location.

6. *A.* subg. *Melanocrommyum* sect. *Megaloprason* Wendelbo

in Bot. Notiser 122: 28 (1969), s. str. — *A.* sect. *Melanocrommyum* subsect. *Melanocrommyum* sensu Kamelin, Florogen. Analiz Srednej Azii: 241 (1973), p. p. *A.* sect. *Kaloprason* subsect. *Megaloprason* (Wendelbo) Kamelin & Seisums in Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), comb. inval., p. p. — Type species: *Allium rosenbachianum* Regel

6.1 *A.* sect. *Megaloprason* subsect. *Megaloprason* R.M. Fritsch  
in Candollea 48: 421 (1993). — Type species: *Allium rosenbachianum* Regel

(30) *Allium rosenbachianum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 8, 1: 664 (1883 publ. 1884), sensu stricto, non auct., Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887), sensu stricto. Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 143 (1900), p. p.?, sub *A. jesdianum* Boiss. & Buhse. Vved., Flora URSS 4: 270 (1935); Vved., Flora Tadzh. SSR 2: 351 (1963); Vved. [ & Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971), omnia p. p. min. — Non *Allium rosenbachianum* hort., necque sensu Vved., Flora Uzbek. 1: 462 (1941), necque sensu Wendelbo, Flora Iranica 76: 83 (1971), et auct. nonnull. — Type: Tajikistan: In Bucharae orientalis in chanato Baldschuan ad ripam dextram fluvii [E Bokhara region, in khanate Baljuan on the right bank of river] Kysil-su 4-5000', leg. A. Regel (holotype LE!, see Fritsch 1990: 507).

Distribution: Tajikistan, N Afghanistan: Vakhsh to Darvaz ranges and the mountains E Panj river; col-line to submontane, not too dry steppe or rocky slopes, also among trees and shrubs.

Description: Bulbs ovoid to depressed-globose, 1.5-6 cm in diam., 1.5-4 cm long; inner tunics ± papery, white to yellowish, outer tunics somewhat longitudinally splitting, grayish, finally blackish and disintegrating. Scape ± straight, terete, smooth; (25) 40-80 cm long, 5-12 (15) mm in diam.; glossy green with slight glaucous bloom, sometimes spotted, basally often maroon flushed. Leaves 2-4 (5), laminae broadly lanceolate, later basally stalk-like tapering, initially prostrate later arcuately ascending above recurved, basally narrowly, above shallowly canaliculate; upper side smooth or with a few grooves, lower side broadly ribbed; margins narrowly white, basally with fine and soft teeth, above glabrescent, gradually tapering into the short, scarcely hooded apex; 14-30 (45) cm long, (0.8) 2-5 (9) cm broad; glossy yellow-green. Sheathy prophyll short, membranous, smooth and strong, bright and translucent, quickly decaying. Spathe membranous, completely divided in 2-3 ovate, long acuminate valves; brownish with slightly darker veins. Inflorescence semi-globose to globose; ± dense, many-flowered; 8-12 cm in diam. Pedicels subequally long, thickish wiry, nearly straight; glossy green later brown-green with violet base. Anthesis in mid of May to June. Flowers bowl-shaped starlike. Tepals narrowly lanceolate to triangular, long acuminate, the subobtuse apex plicate, initially claw-like incurved, patent, later reflexed and crumpled; 6-7 (9) mm long, basally 1.2-1.5 (1.8) mm broad; silvery-pink with brown-green median vein. Filaments 2/3-3/4 as long as the tepals; basally for up to 0.5 mm connate and short-triangular widened (inner filaments up to 1.5 times broader), above subulate; carmine fading towards the whitish apex. Anthers oblong; 2-2.5 mm long, nearly 1 mm broad; ± deep pink. Pollen grayish-yellow. Ovary shortly stipitate, depressed-globose hexangular, 2-3 mm in diam. and long; surface coarsely papillous; green or with purplish flush. Nectary ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b also as *A. schuganicum*). Style conical-threadlike, 3-6 mm long; whitish finally pinkish-violet. Stigma undivided; whitish. Capsule ± flat triangular obpyramidal, surface coarsely corrugated, up to 6 mm in diam. and 5 mm long; widely open, valves broadly ovate, narrowly and deeply notched at the apex; silk-glossy buff. Seeds often only 1-2 per locule, depressed ovate-globose, slightly edged; surface finely papillous with dense raised wrinkles, dull black; 2-2.5 mm long, 1.8-2.3 mm broad, 1.5-2 mm thick. TKW 3.54 g (IPK, unpubl. data). The testa showed verrucose periclinal walls, and anticlinal walls with U- like and Omega-like undulations and high amplitudes (Fritsch & al. 2006).



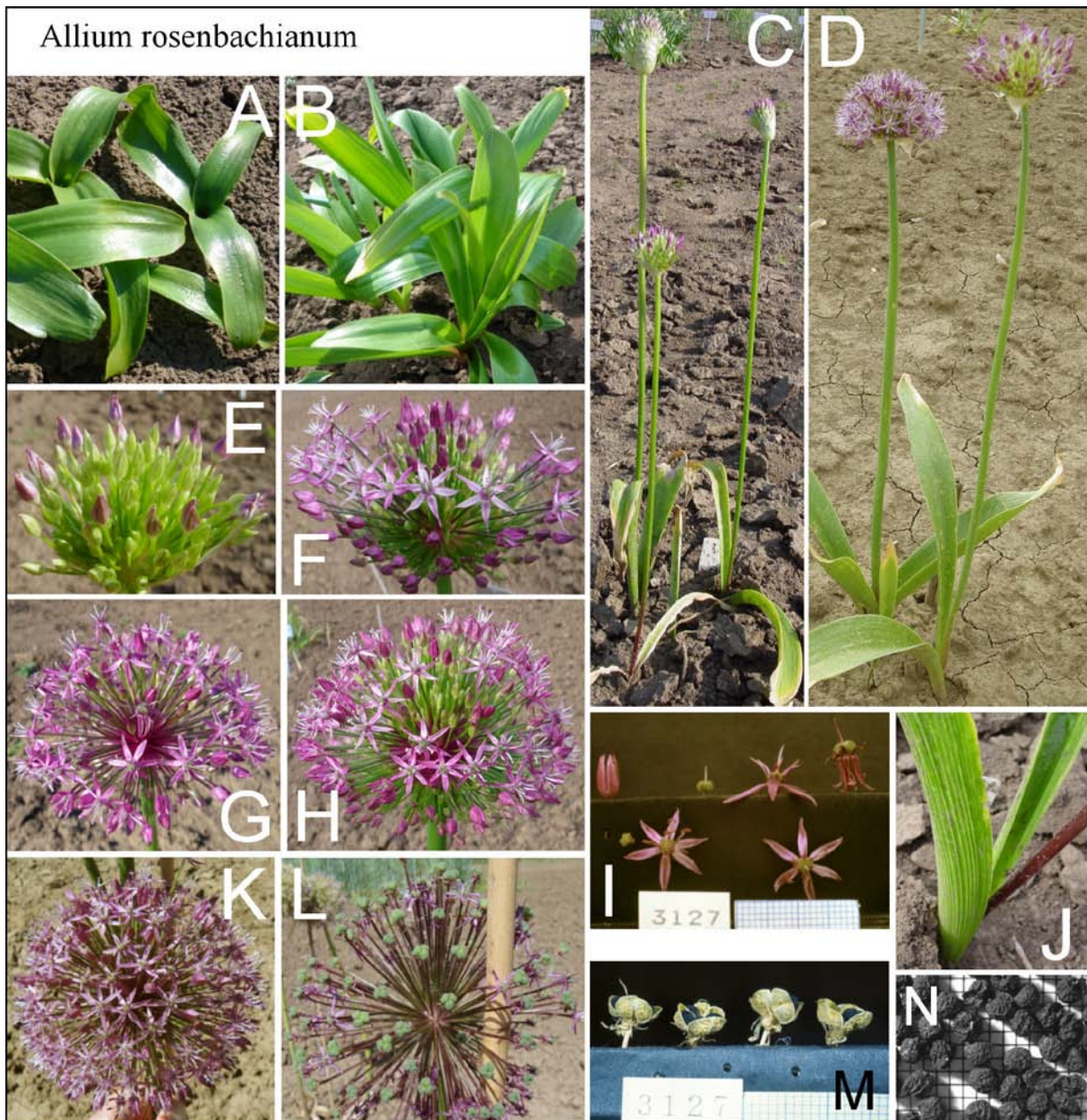


Plate (30): Cultivated plants are shown. A & B: Sprouting leaves in the earlier and later phase, resp.; C: plants in late shooting stage; D: flowering plants in early anthesis; E: inflorescence in buds; F - H: inflorescences in different stages of early anthesis; I: comparison of flowers and flower parts in different stages of anthesis; J: ribbed lower side of leaf base and unribbed basal part of scape; K & L: inflorescences in full and late anthesis; M: ripe open capsules; N: seeds (millimeter paper as background and measure scale of I, M & N).

**Chromosomes:**  $2n = 16$  Ohri & al. 1998 (Tajikistan: Vakhsh range, Baljuan TAX 3124).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Netherlands: Botanical collection Amsterdam, from Afghanistan TAX 2606).  $n = 5?$  IPK *Allium* reference collection ideogram (Tajikistan: Vakhsh range, Baljuan TAX 3126).

**Living accessions studied:** **Tajikistan:** Vakhsh range, E Darai Odamkhur, rocky place between big stones (37°21' 59" N, 69°12'42,5" E, 1090 m, 21.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6043; GAT) TAX 6120, top region of Khoja Mumin, place Archazor (37°43'42" N, 69°38'44" E, 1300 m, 23.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6050; GAT) TAX 6123, slopes E vill. Sarimarguzor, right side of Dughova river above Sari Marguzori Bolo (37°47'30.5" N, 70°14'15.3" E, 1600 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6065; GAT) TAX 6132, Khojidara, slopes of Surkheyo, N exposed slope along the soy to vill. Mionatuk (26.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6072; GAT) TAX 6137, (37°58'58.3" N, 70°10'28.7" E, 1600 m, 27.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6078; GAT) TAX 6140, drainage of Yakhsu river (38°27' N, 70°11' E, 1300 m, 04.8.1988 Fritsch 339; GAT) TAX 2544, shady slope in Heishdara valley c. 6 km above vill. Baljuan (38°22' N, 69°42' E, 1000 m, 18.7.1991 Fritsch 675; GAT) TAX

3124, left side valley of Heishdara valley, (1250 m, 19.7.1991 Fritsch 677 A, B; GAT) TAX 3126, TAX 3127.

**Remarks:** *Allium rosenbachianum* is the type species of section and subsection *Megaloprason*. According to the original description and the type specimen, this species has smooth scapes and rather broad, lanceolate leaves tapering into the basal part. But already Regel (it is improbable that the labels in LE were merged) used the name *A. rosenbachianum* for plants characterized by much narrower, ribbed leaf laminae and strongly ribbed scapes. Lipsky (1900) and finally also Vvedensky (1935, 1941, 1963, 1971) accepted not the original description and the type as representatives of *A. rosenbachianum*, but those plants regarded as *A. rosenbachianum* by Regel. This use of the wrong name was further broadcasted when the wrong taxon was introduced as perennial ornamental in the first decades of 20th century. Wendelbo (1971) made even *A. angustitepalum* Wendelbo (1958) from Afghanistan a synonym of *A. rosenbachianum*. The correct use of these names was resurrected by Khassanov & Fritsch (1994) only. Molecular markers presented convincing evidence to separate these taxa. ITS sequences of nuclear rDNA positioned *A. rosenbachianum* s. str. in an excellently separated subgroup jointly with *A. kwakense* and the *A. darwasicum* alliance of sect. *Regeloprason*, with unresolved distant relations to several sections (Fritsch & al. 2010: 187 cluster 4 § 3.6.1; Fritsch 2012b: 251, 252 Fig. 4 O; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). The above mentioned species formerly lumped with *A. rosenbachianum* were positioned in cluster 7 (Fritsch & al. 2010: 197, 198 §§ 3.9.9, 3.9.11; Fritsch 2012b: 256 ff. Fig. 4 Z1-Z4; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Also sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage V versus lineage VI) corroborated this clear separation. Because sect. *Megaloprason* was typified by *A. rosenbachianum*, it became restricted to less species than before, and other species were separated as new section *Procerallium*. We must conclude that the very similar inflorescence and flower characters in the sections *Megaloprason* and *Procerallium* are an example of parallel evolution. The leaf shape is moderately similar to *A. sarawschanicum*, and both species were apparently merged in some literature.

A sheet in LE "Ex horto bot. Petroplitano 84.6 teste Rgl., A. Rgl. Baldschuan" was labeled as lectotype by Seisums (dated 1992, unpublished) but cannot serve as lectotype because it was collected only after the publication of the description.

**Etymology:** The epithet honors the former prefect of the historical Russian province Turkestan, N. O. von Rosenbach.

**Biological data:** The genome size [2C DNA] was reported as 47.2 pg (Ohri & al. 1998) and 41.3 pg (Gurushidze & al. 2012). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1). Dry leaves contain in total 0.04 % methiin (Jedelska & al. 2004), fresh bulbs contain in total 0.04 % cysteine sulfoxides (Keusgen & al. 2008). The radical scavenger activity was moderately low (Jedelska & al. 2004).

**Economic traits:** Local name 'gushi buzak'. Fresh and dried leaves represent the vegetable part of the national Tajik soup dish 'atolla' which is much esteemed as appetizer and general tonic in Tajikistan and Afghanistan (Keusgen & al. 2006, Keusgen unpubl.). Very rarely offered as ornamental, also cultivars were selected, but most often merged with other species (Fritsch 2015).

**(31) *Allium insufficiens*** Vved. in Byull. sredneaz. gosud. Univ. 19: 129 (1934). Vved., Flora URSS 4: 264-265 (1935). Vved., Flora Tadzh. SSR 2: 343 tab. LX, 1; 346 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 83 (1971). — **Type:** Tajikistan: Kurgan-Tjube, 21.4.1906, leg. Roshevits 345 (holotype LE).

**Distribution:** S Tajikistan and N Afghanistan; submontane dry stony limestone or loess slopes and *Pistacia* associations.

**Description:** Bulbs depressed-globose, 8-15 (20) mm in diam., with reddish roots; tunics parchment-like, inner ones yellowish-white, outer tunics yellowish-grey later blackish, longitudinally fibrous or splitting, sometimes extended in a short neck. Scape ± flexuous, terete, smooth; 15-30 (60) cm long, above 2-4 (5) mm, below 3-6 mm in diam.; green with glaucous bloom, sometimes brown near base. Leaves 3-6 (10), laminae very narrowly linear, narrowly canaliculate; upper side smooth, lower side distinctly ribbed; margins initially white, ciliate or glabrous, apex not hooded; 15-25 (30) cm long, (1) 2-5 (7) mm

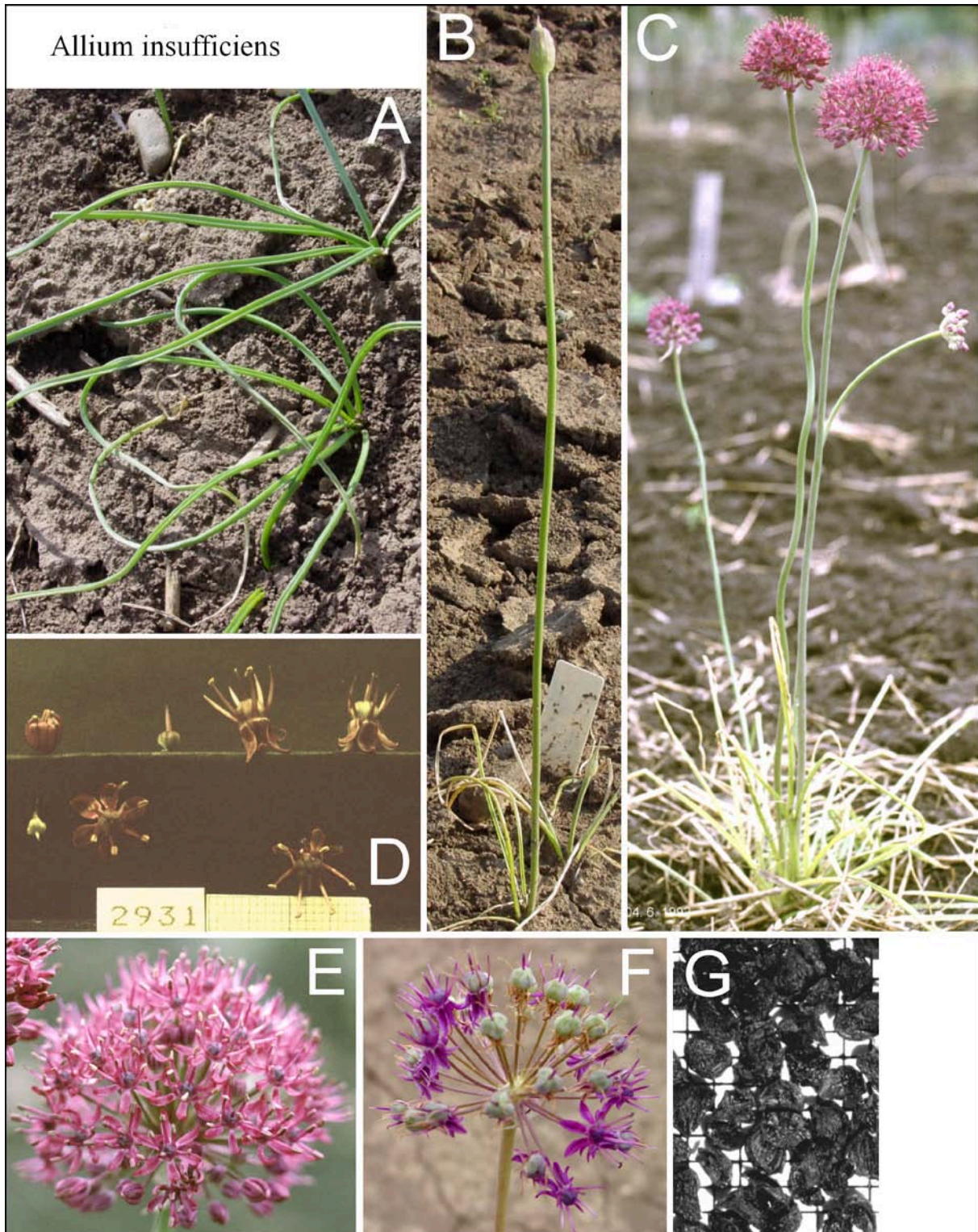


Plate (31): Cultivated plants are shown. A: Completely developed leaves; B: plants in the shooting stage; C: plants in different phases of anthesis; D: comparison of flowers and flower parts in different stages of anthesis; E & F: inflorescences in full and late anthesis; G: seeds (millimeter paper as background and measure scale of D & G).

broad. Sheathy prophyll very short, hyaline silky, smooth, quickly decaying. Spathe hyaline membranous, divided into 2-3 shortly mucronate valves, half as long as the pedicels; buff, with distant veins. Inflorescence initially fasciculate later semiglobose; dense, moderately many-flowered; 25-35 mm in diam. Pedicels equally long, thin wiry with conically thickened base, slightly ascending, 8-15 mm long; semi-glossy brownish-green. Anthesis in April to May. Flowers bowl-shaped starlike; honey-scented. Tepals oblong to ovate, spoon-like concave, obtuse with incurved apex, obliquely directed to patent, later reflexed and slightly enrolled or crumpled; 4-5 mm long, 1.5-2 mm broad; pinkish-purple to violet, with greenish-brown median vein. Filaments  $\pm$  as long as the tepals, subfleshy; basally c. 0.5 mm connate and triangularly (inner filaments slightly broader) widened, above subulate; violet, basally paler to whitish. Anthers ovoid-oblong; 1.5-2 mm long, 0.8-1 mm broad; violet. Pollen grayish yellow. Ovary shortly stipitate, depressed-globose hexangular, 2-3 mm long, 3-4 mm in diam.; surface shallowly papillous; initially violet, later green. Up to 24 ovules per locule, 70 ovules per ovary (Filimonova 1970). Style  $\pm$  conical-threadlike, 3-6 mm long;  $\pm$  violet. Stigma undivided; white. Capsule broadly triangular-globose, sessile, 5-6 mm long, 5-7 mm in diam.; valves suborbicular, very shallowly notched at the apex. Seeds flat triangular to drop-shaped with  $\pm$  sharp edges; surface finely papillous,  $\pm$  densely and irregularly reticulate lacunose, silk-glossy black; c. 2 mm long, 1.5 mm broad, 1-1.2 mm thick. The testa showed verrucose periclinal walls with a moderate number of verrucae and S-like undulated anticlinal walls (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Astanova 1990 (Tajikistan: Gazimailik ridge, Aруктау massif).  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Tabakchi massif, Seisums s. n.).

**Living accessions studied:** **Tajikistan:** Panj Karatau ridge, loess terraces S Darai Odamkhur (37°22'49.9" N, 69°12'43.4" E, 964 m, 21.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6042; GAT) TAX 6119; W slopes of Gazimailik ridge, *Pistacia* association c. 5 km N vill. Ganjino (38°00' N, 68°36' E, 1250 m, 11.5.1990 Fritsch, Kudratov, Pistrick 440; GAT) TAX 2931.

**Remarks:** This is a rarely collected species characterized by very narrow leaf laminae, a moderate scape length, and a rather dense inflorescence of moderately small, purplish flowers. The general appearance is rather similar to some members of sect. *Acmopetala* where it was formerly affiliated, but tepal and ovary characters fit equally well to sect. *Megaloprason*. Like *A. vvedenskyanum* and *A. victoris*, *A. insufficiens* is often keyed out beside *A. verticillatum* for the very narrow leaves, though the 1-3 leaf laminae of *A. verticillatum* are divided into several parallel, thread-like parts, but the other species own a higher number of separate leaves with narrow laminae. These narrow-leafed taxa are easily separable by inflorescence and flower characters: *A. victoris* owns a loose umbel and funnel-shaped, heavily sweet-scenting, purple flowers, and the other species a dense inflorescence and honey-scenting flowers, *A. vvedenskyanum* has pink flowers with linear-triangular tepals, and *A. insufficiens* purplish flowers with oblong, concave tepals. Molecular markers (ITS sequences of nuclear rDNA) positioned the only investigated accession of *A. insufficiens* in cluster 4 closest to *A. kwakense*, with a less close but not resolved relationship to the other species of sect. *Megaloprason* s. str., *A. darwasicum* s. str., and *A. intradarvazicum* (Fritsch & al. 2010: 187 cluster 4 § 3.6.1; Fritsch 2012b: 251, 252 Fig. 4 N; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Addition of more samples would be essential to proof the closer relationship to *A. kwakense*; *A. insufficiens* could also represent an own subgroup. Sequences of the plastid *trnL-trnF* region confirmed this position but with a lower resolution: *A. insufficiens* clustered with the above mentioned species but also with a few species of other sections (Gurushidze & al. 2010: 836, fig. 4 lineage V).

**Etymology:** The epithet is most probably derived from the Latin meaning "non-satisfyingly [known]".

**Biological data:** Fresh bulbs contain in total 0.01 % cysteine sulfoxides (Keusgen & al. 2008).

(32) *Allium kwakense* (R.M. Fritsch) R.M. Fritsch in Phytion (Horn, Austria) 49: 187 (2010). *Allium rosenbachianum* Regel subsp. *kwakense* R.M. Fritsch in Candollea 48: 419, fig. 1 (1993). — Type: Tajikistan: Hissar-Gebirge nördl. Dushanbe, Kondara-Tal, lehmiger Hang nahe der Kwak-Hütte [Hissar range N Dushanbe, Kondara valley, loamy slope near the hut Kwak], ca. 1830 m, 16.5.1987 leg. Fritsch & Ivanov 131/86 (holotype GAT!, isotype TAD!).

Distribution: Tajikistan: from middle part of Hissar range to the Khozratishoh range, montane mountain slopes with shrubs and along the margins of broad-leafed forests.

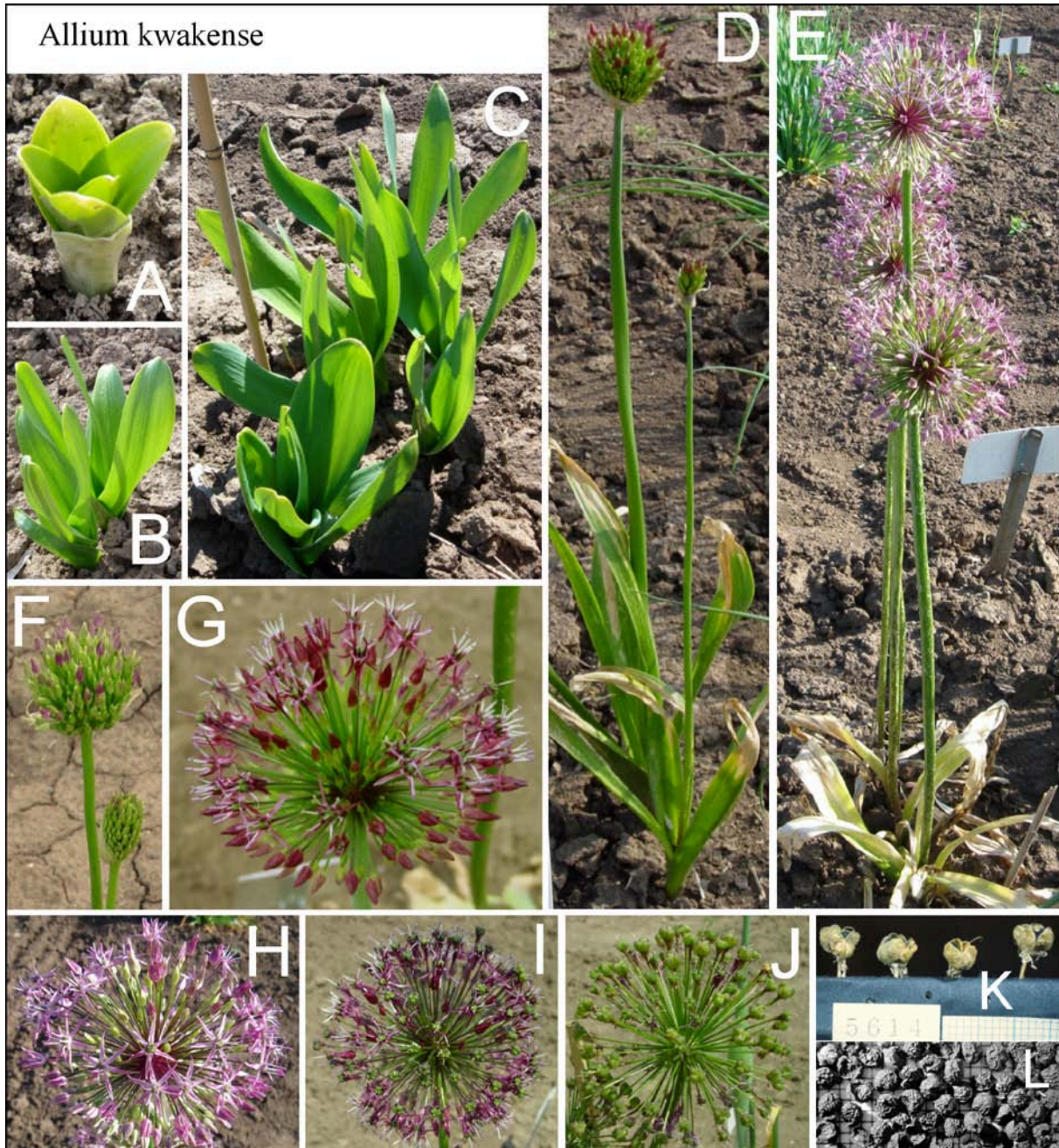


Plate (32): Cultivated plants are shown. A, B & C: Sprouting leaves in different developmental stages; D: plants prior to anthesis; E: plants in full anthesis; F: inflorescences in buds; G, H & I: inflorescences in early, full, and late anthesis, resp.; J: inflorescence with developing capsules; K: ripe open capsules; L: seeds (millimeter paper as background and measure scale of K & L).

Description: Bulbs depressed-globose, up to 3 cm in diameter; outer tunics papery, grayish-brown. Scape straight, terete, smooth, 30-80 cm long, 4-10 mm in diameter; green with glaucous bloom, (initially only basally) purplish suffused. Leaves 2-3 (5), laminae linear-lanceolate, straight, often screw-like twisted, basally with overlapping margins, above nearly flat and near apex with a broad central

channel, thick; upper side smooth, lower side diffusely ribbed; margins basally with fine teeth or cilia, above glabrescent to smooth, in the uppermost part slightly longitudinally recurved, short-arcuately tapering into the hooded apex; 20-40 (50) cm long, (1.5) 3-6 (8) cm broad; yellowish to vividly green with slight glaucous bloom, upper side dull to subglossy, lower side more glossy. Sheathy prophyll  $\pm$  long, membranous but strong, colorless, quickly decaying. Spathe membranous, divided in 1-2 ovate or triangular, long acuminate valves; buff with inconspicuous veins. Inflorescence initially depressed-globose later globose; loose, many-flowered; up to 12 cm in diam. Pedicels subequally long (last flowers with shorter pedicels), moderately thick, wiry; glossy initially green with purple base, later  $\pm$  maroon. Anthesis in May to June. Flowers flat starlike. Tepals linear-triangular or narrowly lanceolate with subacute slightly incurved apex, canaliculate to plicate, initially patent later completely reflexed; 7-10 (12) mm long, c. 2 mm broad; silvery pinkish to carmine with greenish-brown median vein. Filaments  $\pm$  as long as the tepals; basally for c. 0.8 mm connate, above subulate; pink to carmine, basally darker. Anthers oblong; 2-2.5 mm long, c. 1 mm broad; pink to violet. Pollen yellowish gray. Ovary shortly stipitate, shortly pear-shaped nearly hexangular, apex with 6 flat radially directed bulges, 2-3 mm long, 3-4 mm in diam.; surface humpy papillous; semi-glossy vividly green. Nectary ducts mound in a slit slightly above the base of ovary. Style threadlike, 2-5 mm long; initially white later pink. Stigma undivided; white. Capsule triangular double pyramidal, surface partly bumpy and scabrous, 7-8 mm in diam., 6-7 mm long; widely open, valves broadly ovate, deeply notched at the apex; silk-glossy buff. Seeds 3-4 per locule; flat ovoid to subglobose, slightly edged; surface with dense raised wrinkles, dull black; 2-2.5 mm long, 2-2.3 mm broad, 1.5-2 mm thick. The testa showed verrucose periclinal walls, and U-like or Omega-like undulated anticlinal walls (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Vakhtina 1985 (Tajikistan: Hissar range, Kondara gorge, Vakhtina 694 "*A. komarowii*").  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Khozratishoh range TAX 2545).  $2n = 16$  IPK *Allium* reference collection ideogram (Tajikistan: Hissar range, Kondara gorge TAX 1899, type location).

**Living accessions studied:** **Tajikistan:** Central Hissar range, drainage of Varzob river, Kondara valley c. 50 km N Dushanbe, N exposed slope (type location, 38°49' N, 68°46' E, 1620 m, 25.4.1986 Fritsch, Ivanov T131; GAT) TAX 1899, drainage of Sorbho river, Ramit reservation (38°45' N, 69°19' E, 1300 m, 17.4.1986 Fritsch T71; GAT) TAX 1870; Vakhsh range, Sebiston W region, slopes above Teguzak village (38°17'28.1" N, 69°15'02.4" E, 1500-1700 m, 06.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6107; GAT) TAX 6159; Vakhsh range, slopes W Khovaling, near former vill. Sebi-Sukh (38°30' N, 70°03' E, 1900 m, 06.8.1988 Fritsch 347 & 349; 2000 m, 345; GAT) TAX 2545, TAX 2547, TAX 2548, N slopes of Kugitek massif along river Obi-Masar (38°27' N, 70°04' E, 2200 m, 03.8.1988 Fritsch 310; GAT) TAX 2535, drainage of Yakh-Su river, valley Obi-Pitau-Du (38°27' N, 70°11' E, 1400 m, 04.8.1988 Fritsch 337; GAT) TAX 2541. Darvaz range, Obikhingou valley, N exposed slope above village Khoিদara (38°42'24" N, 70°33'11" E, 1775-1960 m, 26.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6228; GAT) TAX 6461, Khoিদarai bolo (38°42'28" N, 70°33'03" E, 1950 m, 26.7.2005 Fritsch, Hisoriev, Keusgen, Kudratov 6232; GAT) TAX 6597; Peter I. range, Obikhingou valley, in a small valley below vill. Lyangar (38°54'22" N, 71°01'35" E, 2000 m, 29.6.2006 Fritsch 2371; GAT) TAX 6570; collection site unknown (from Botanic Garden Acad. Dushanbe 1984, no. 675; GAT) TAX 5614.

**Remarks:** Several taxa of sect. *Procerallium* and *A. rosenbachianum* / *A. kwakense* of sect. *Megaloprason* s. str. own morphologically variable flower parts and inflorescences that cover a similar range of variation. Therefore herbarium specimens without leaves or plants with capsules can rarely be determined with certainty. Though the tepals of *A. kwakense* are mostly darker, the shape of flowers and inflorescences is  $\pm$  similar to that of *A. rosenbachianum*, *A. rosenorum*, and even small specimens of *A. stipitatum*. Living plants of *A. kwakense* differ by erect, sublinear and longitudinally twisted leaves from *A. rosenbachianum* that shows subpatent, recurved, lanceolate (with narrowed base) and not twisted leaves. These both species differ by smooth,  $\pm$  glossy and vividly green leaves from *A. stipitatum* that owns broader, subpatent, and dull glaucous leaf laminae. *Allium rosenorum* shows narrow, more linear than lanceolate and dull leaves and strongly ribbed scapes, whereas the scapes of the other three species discussed above are smooth in the living state. Molecular markers (ITS sequences of nuclear rDNA) underlined very different position of both sections in the dendrograms (sect. *Megaloprason* in cluster 4 / positions N & O, sect. *Procerallium* in cluster 7 / positions Z1 - Z4; Fritsch & al. 2010: 187 § 3.6.1 / 197 §§ 3.9.9 - 3.9.11; Fritsch 2012b: 252 / 256; Gurushidze & Blattner in Fritsch & Abbasi

2013: 201 / 202). Also the sequences of the plastid *trnL-trnF* region belonged to different lineages (Gurushidze & al. 2010: 836, fig. 4 lineage V against IV & VI). ITS sequences showed a clear genetic separation of *A. rosenbachianum* s. str. from *A. kwakense* contradicting the far-reaching morphological similarity. Both taxa belong to one cluster but to different subclusters, with *A. darwasicum* p. p. and *A. intradarvazicum* as third subcluster with unresolved relationship (Fritsch & al. 2010: 187 cluster 4 § 3.6.1; Fritsch 2012b: 251, 252 Fig. 4 N & O; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region showed a low resolution with different haplotypes of *A. kwakense* and *A. rosenbachianum* in two subgroups of lineage V (Gurushidze & al. 2010: 836, fig. 4).

**Etymology:** The epithet refers to the location Kwak in the upper part of the Kondara valley (Varzob river drainage in Hissar range, Tajikistan) where formerly a research station was acting.

**Biological data:** The genome size of 47.6 pg 2C DNA is much larger than in *A. rosenbachianum* s. str. (41.3 pg; Gurushidze & al. 2012). Seed storage proteins were analyzed by Maass (1992 Fig. 1, Fig. 5, "rosb"). Fresh bulbs contain in total 0.05 %, leaves 0.08 % cysteine sulfoxides (only methiin; Keusgen & al. 2008).

**Economic traits:** Peasants in the Kugitek ridge (Khozratishoh range, Tajikistan) denied any use of the plants, but in the Hissar range the leaves are collected for consumption, with a similar use as *A. rosenbachianum* s. str. (Keusgen & al. 2006). Very rarely offered as ornamental (Fritsch 2015).

(33) *Allium schugnanicum* Vved. in Bot. mat. gerb. Bot. inst. Akad. Nauk SSSR 9, 4-12: 242 (1946). Vved., Flora Tadzh. SSR 2: 352 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971). — **Type:** Tajikistan: Shugnanskij rajon, bliz k. Gordzhak, podvergnuvshaya oresheniyu shchebnistaya myatlikogo polynnaya polupustynya po zapadnym sklonam k r. Pyandzh [Shugnan region, near village Gorjak, irrigated gravelly Mentha-Artemisia semidesert on the slopes toward Panj river] 05.6.1935, leg. Ovczinnikov & Afanasjev 196 (holotype LE!, isotypes TASH, TAD).

**Distribution:** Tajikistan, N Afghanistan: Western Pamir mountain ranges, side valleys of upper Panj river, montane rocky-stony and loamy slopes in the shadow of rocks.

**Description:** Bulbs subglobose, 1.5-2 cm in diam.; outer tunics nearly parchment-like, cinereous. Scape ± straight, terete, basally slightly ribbed, above slightly papillous; 25-55 cm long, rather thin; green. Leaves 2-3, laminae linear-oblongate, tapering towards the base, flat ascending-recurved, basally broadly canaliculate; margins with fine long teeth, arcuately tapering into the short, hooded apex; 15-

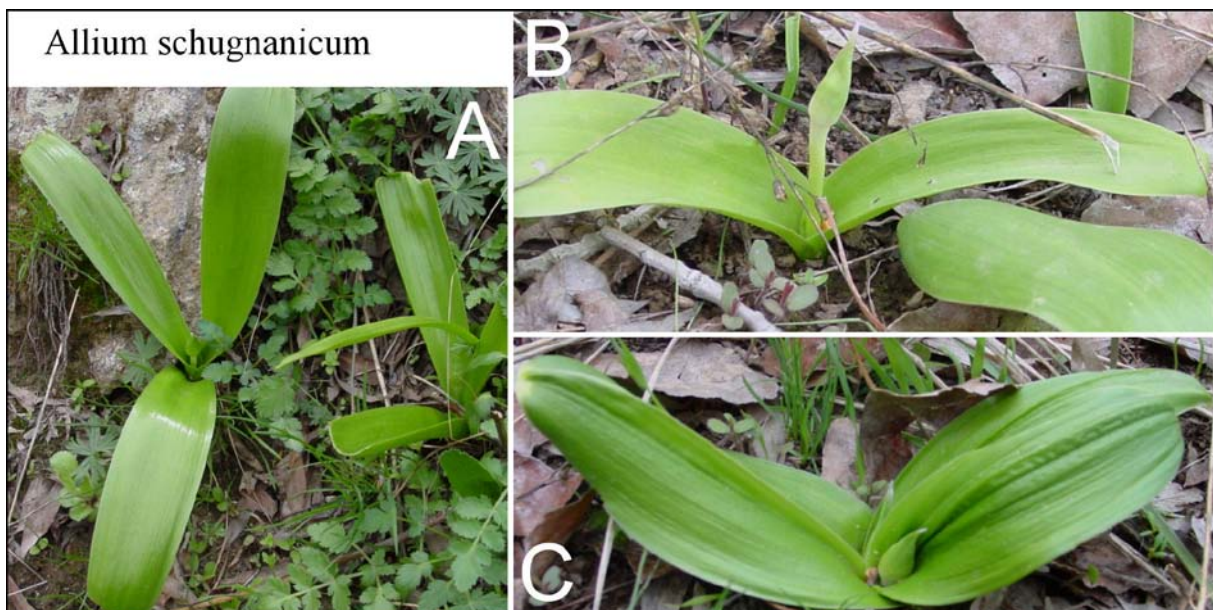


Plate (33): A, B & C: Wild plants in the early shooting stage at the type location in Tajikistan.

25 cm long, (0.8) 2-3 cm broad; glossy yellowish green. Sheathy prophyll not observed. Spathe membranous, shortly beaked, about half as long as the pedicels. Inflorescence semi-globose to globose; ± dense, many-flowered; up to 5 cm in diam. Pedicels subequally long, thin wiry; up to 2 cm long. Anthesis in June. Flowers bowl-shaped starlike. Tepals long linear-lanceolate to triangular, long acuminate with initially claw-like apex, patent, later reflexed and tortuous; 6-8 mm long, basally 1.2-1.5 mm broad; dull pinkish-lilac to violet, the darker median vein disappears towards the apex. Filaments 3/4-5/6 as long as the tepals; basally ± 0.5 mm connate and triangular widened (inner filaments up to 1.5 times broader), above subulate; pale pinkish-lilac. Anthers oblong; 1.8 mm long, 0.8 mm broad; pinkish-lilac to violet. Pollen yellowish-gray. Ovary shortly stipitate, depressed-globose triangular, 2 mm long, 3 mm in diam.; surface papillous with reticulate raised wrinkles; green. Style threadlike, 2-4 mm long; white later pinkish. Stigma undivided; whitish. Capsule subglobose (?); valves deep and narrowly notched at the apex. Seeds not seen.

**Chromosomes:**  $2n = 16$  Astanova 1984 (Tajikistan: Shugnan range, Shakh-Dara gorge, Zaprjagaev 566).  $2n = 16$  Astanova 1990 (Tajikistan: W Pamir mountain area, Tuston-Dara gorge, Zaprjagaev 3668).  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Khozratishoh range, vill. Iol, Seisums s. n.).

**Living accessions studied:** Tajikistan: W Pamir region, Ishkashim massif, gorge Gojak, N exposed stony slope (type location, 37°24'10.3" N, 71°29'49.3" E, 2200 m, 02.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6094; GAT) TAX 6151.

**Remarks:** The morphological characters studied on herbarium specimens fall into the variability of *A. rosenbachianum* s. str. Unfortunately, plants at the type location of *A. schugnanicum* were in early shooting stage when studied, and the collected bulbs grew very badly in Gatersleben and died in the second year of cultivation. Therefore a detailed comparison of living plants was not possible hitherto. Molecular investigations (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) positioned this sample directly beside *A. rosenbachianum* s. str. (Gurushidze & al. 2010: 836, fig. 4 lineage V; Fritsch & al. 2010: 187 cluster 4 § 3.6.1; Fritsch 2012b: 252 Fig. 4 O; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Analyses of additional samples would be necessary in order to decide whether *A. schugnanicum* is merely a montane variant of *A. rosenbachianum* s. str.

**Etymology:** The epithet refers most probably to the Shugnan geographical region along the upper Panj river and not to the Shugnan mountain range, because the type location is located at the foothills of Ishkashim range.

**Biological data:** Kasach (1975) reported the timing of annual developmental phases and detailed morphological data of leaves, scape, inflorescence, and flower parts. Miralibekov (1982) reported a mean of 86 [47-127] seeds per inflorescence under cultivation, and the infrutescence as 6.4 cm broad, 7.4 cm long, with 59 flowers (84.75 % with ovaries) that resulted in 113 seeds (Miralibekov 1984). Fresh bulbs contain in total 0.08 % cysteine sulfoxides (Keusgen & al. 2008). The radical scavenger activity is low (Jedelska & al. 2004).

**Economic traits:** Inflorescences are used for decoration in Gorshak (Keusgen & Fritsch 2008).

6.2 *A. sect. Megaloprason* **subject. *Humilicognata*** R.M. Fritsch  
in Phyton (Horn, Austria) 49: 183 (2010). — **Type species:** *Allium brachyscapum* Vved.

(34) *Allium brachyscapum* Vved., Flora Turkm. 1, 2: 291, f. 104 (1932), descr. ross., in Byull. Sredneazgosud. Univ. 19: 129 (1934), descr. latin. Vved., Flora URSS 4: 261-262 (1935). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971). Wendelbo, Flora Iranica 76: 81, tab. 8/114 (1971), p. p. maj. Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 125, 128 (1988). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 145, plate T57, map (2013). — **Type:** Turkmenistan: Kopetdag, Sulyuklyu, po shchebnisto glinistomu sklonu [on a gravelly-clayey slope], 20.5.1923, leg. Androssov (lectotype no. 118720 and isotypes TASH!, design. Khassanov & Fritsch 1994: 983).



**Distribution:** Turkmenistan, NE Iran: Kopetdag range; montane stony and rubble slopes.

**Description:** Bulbs ovoid to globose, 0.8-1.5 cm in diameter; outer tunics papery, grey to purplish, disintegrating. Scape flexuous, terete, smooth; 5-10 cm long, 3-4.5 mm in diam.; green with strong reddish flush. Leaves 1 (2), laminae lanceolate, flat arcuately prostrate, undulate or upper part screw-like enrolled, thick, only near the very base canaliculate, above flat; upper side grooved, lower side with broad ribs; margins red,  $\pm$  toothed but base and tip often smooth, shortly tapering into the hooded apex; 10-15 (25) cm long, 8-30 mm wide; dull green with glaucous bloom, lower side often more yellowish green and lucid. Sheathy prophyll hyaline, soon decaying. Spathe membranous, divided in 3 broadly triangular valves  $\frac{1}{2}$  as long as the pedicels, finally patent or reflexed; buff with darker nerves. Inflorescence broadly fastigiate to semi-globose; moderately dense, many-flowered; 4-6 cm in diameter. Pedicels subequally long, thick, straight, stiff wiry; (12) 15-20 mm long; glossy brown to purple. Anthesis in May. Flowers flat bowl-shaped starlike. Tepals lanceolate with subobtuse,  $\pm$  incurved apex, often  $\pm$  convolute, patent, basally for c. 1 mm connate, after anthesis reflexed,  $\pm$  crumpled and spirally

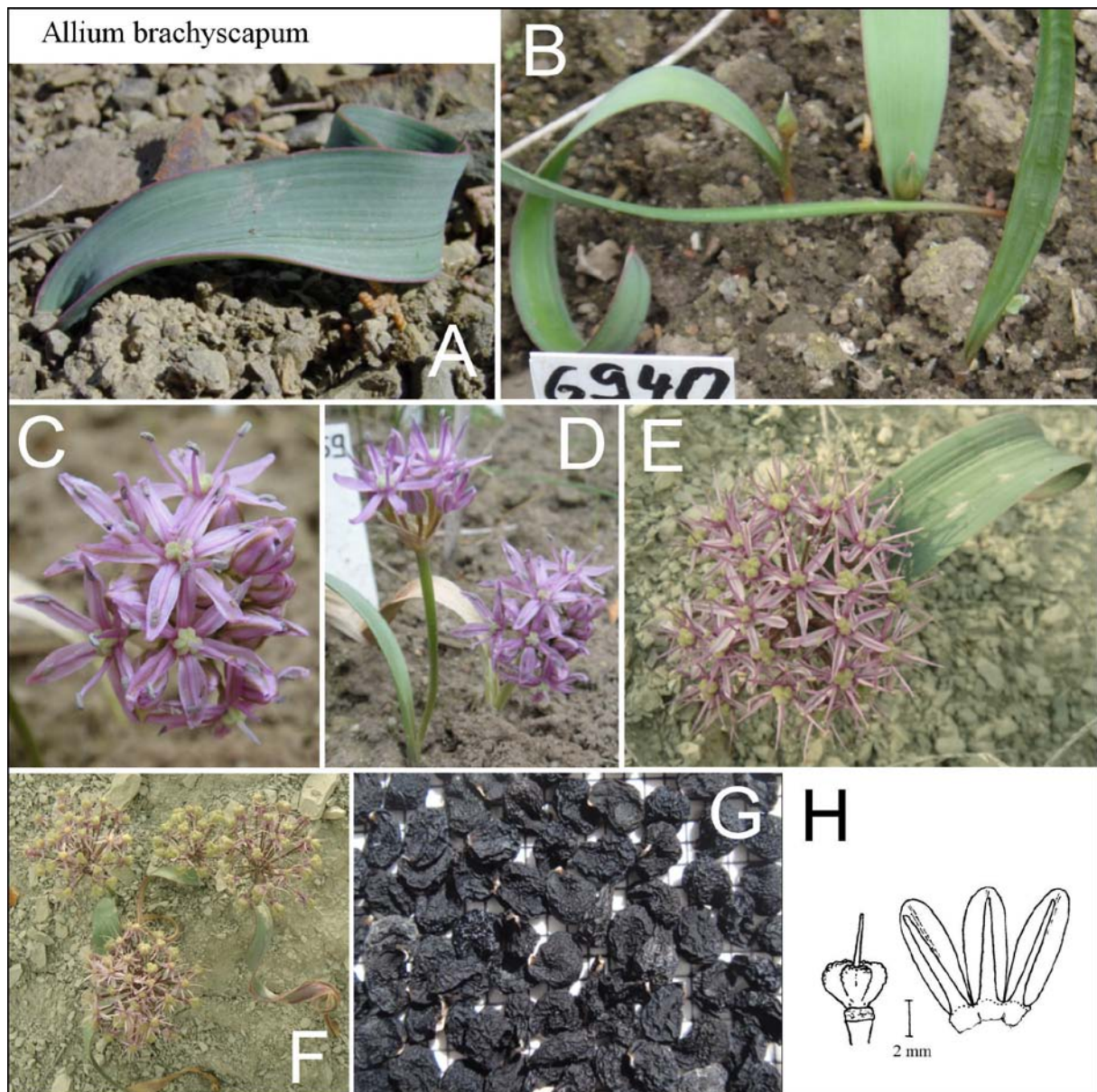


Plate (34): A & B: Sprouting leaves and scapes of cultivated plants; C & D: inflorescence and cultivated plants in early anthesis, resp.; E & F: plants in late anthesis and after anthesis, resp., between Bojnurd and Gifan (Iran); G: seeds (millimeter paper as background); H: shape of ovary, tepals and filaments of a flower prepared from herbarium (plate copied from Fritsch & Abbasi 2013: 197 Plate T57).

enrolled; 5-7 (10) mm long, (1.5) 2-3 mm broad; pinkish-carmine with narrow green median vein fading towards the apex. Filaments as long as the tepals or by 1/4 longer; basally for about 0.5 mm connate and triangularly widened (inner tepals 1.5 times wider), above subulate, obliquely directed; pinkish-carmine with darker base. Anthers oblong; 1.5-2 mm long; pinkish-yellow. Pollen grayish-yellow. Ovary shortly stipitate, depressed-globose with 3 wide and 3 narrow furrows; surface strongly acutish papillose; 2.5-3 mm in diam., 2-2.5 mm long; pale green. Nectary ducts mound in dot-like pores near the base of the ovary. 3-4 ovules per locule are present. Style narrowly conical to threadlike, 4-8 mm long; rose, finally pink-purplish. Stigma undivided; whitish. Capsule somewhat depressed-globose triangular, 4 mm long and 5 mm in diam., with 11 ovules (Vvedensky 1932); widely open, valves broadly elliptic with a broad longitudinal furrow and shortly notched at the apex. Seeds 1-2 (3) per locule, drop-like comma-shaped, one side often with a sunken area near the hilum; surface densely reticulate lacunose, dull black; c. 3 mm long, 2.5 mm broad, 1-2 mm thick.

Chromosomes:  $2n = 16$  Pogosian & Seisums 1992 (Turkmenistan: Kopetdag range, Arvaz gorge, Seisums s. n.).

Living accessions studied: Turkmenistan: Kopetdag range, special place Kumyshdash (38°20'30" N, 56°56'30" E, 1650-1700 m, 06.4.2002 Fritsch, Keusgen, Khassanov 14; GAT) TAX 5922.

Remarks: *Allium brachyscapum* is the type species of subsect. *Humilicognata*. As far as known yet, this taxon has the shortest scapes among all members of subsect. *Humilicognata* commonly shorter than 5 cm above the soil. Additional key characters are pink tepals, pink filaments darker in the basal part, and strongly furrowed leaves spirally enrolled towards the apex. Vouchers of this species from outside the Kopetdag range mentioned by Wendelbo (1971) belong to *A. assadii* Seisums and *A. esfahanicum* R.M. Fritsch. Molecular markers (ITS sequences of nuclear rDNA) support a very close genetic relationship to the Iranian species *A. scotostemon* Wendelbo and *A. assadii* as well as to *A. esfahanicum* and *A. kopsedorum* R.M. Fritsch (Fritsch & al. 2010: 183, cluster 2 § 3.4.3; Fritsch 2012b: 247 Fig. 1 B; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Sequences of the plastid *trnL-trnF* region support a less close relationship to *A. scotostemon* (the other above mentioned species were not investigated) and present additional evidence that the subsections *Humilicognata*, *Megaloprason* s. str., and *Spiralitunicata* are closely related, but less closely to sect. *Asteroprason* and to some members of sect. *Regeloprason* (Gurushidze & al. 2010: 836 fig. 4 lineage V).

Etymology: The epithet refers to the characteristic short scape of this species (mixture of Greek and Latin word elements).

Biological data: Fresh bulbs contain in total 0.44 % cysteine sulfoxides (96 % methiin, 4 % propiin; Keusgen & al. 2008).

6.3 A. sect. *Megaloprason* **subsect. *Keratoprason*** R.M. Fritsch  
in Phytion (Horn, Austria) 49: 195 (2010). — Type species: *Allium sarawschanicum* Regel

(35) *Allium sarawschanicum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 244 (1875), Regel in Izv. Imp. obshch. lyub. estestv. antr. etn. 21, 2: t. XVII f. 1-4 (1876). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 358 (1887). — Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 136 (1900). Vved., Flora Turkm. 1, 2: 293 (1932) "*zeravschanicum*" p. p.; Vved., Flora URSS 4: 273 (1935) "*seravschanicum*"; Vved., Flora Uzbek. 1: 463 (1941) "*zeravschanicum*"; Vved., Flora Tadzh. SSR 2: 353 (1963) "*seravschanicum*"; Vved. [ & Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971) "*seravschanicum*". Wendelbo, Flora Iranica 76: 87, tab. 9/125 (1971). Seisums in Latv. Zinatnu Akad. Vēstis B No. 4: 79 (1992). Fritsch in Nordic J. Bot. 16: 13 (1996). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 152, plate T61, map (2013). — *Allium pseudozeravschanicum* Popov & Vved., Flora Turkm. 1, 2: 293 (1932), in adnot. Vved., Flora URSS 4: 273 (1935) "*pseudoseravschanicum*"; Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Lectotype: Turkmenistan, Zakasp. obl. Krasnovod. u., Karakalin. pristavstvo, Sev. skl. g. [Transcaspian region, Krasnovodsk district,

Karakala police area, northern slopes of Mt.] Syunt, 8.5.1912, leg. Lipsky 3318 (LE! design. Fritsch 1990: 506). — **Type:** Uzbekistan: Zaravshanskaya dolina, gore Aksai [Zaravshan valley, Mt. Aksai] 2700-7000', 15.5.1869, leg. O. Fedtschenko (holotype LE!, isotype TASH-Fedt!).

**Distribution:** NE Iran, N Afghanistan, Turkmenistan, Uzbekistan, Tajikistan: mesophyt of submontane stony or rocky slopes, among shrubs, or in the shadow of trees and rocks.

**Description:** Bulbs depressed-globose, 1.3-3 cm long and 2-4 cm in diameter; outer tunics whitish or grey, ± papery, longitudinally striate but not splitting, only slightly extended in a neck. Scape straight, terete, smooth; 18-50 (80) cm long, 3-6 (10) mm in diam.; dull green, often basally brownish suffused. Leaves (1) 2-3 (5), laminae narrowly oblong-lanceolate to linear-lanceolate, near the soil margins collar-like overlapping, somewhat higher deep canaliculate soon becoming flat, stiff obliquely directed but upper part drooping, basally thick, upper part thin; laminae initially strongly plicate, later upper and lower side with broad flat and sometimes coarse ribs; margins only in the lower part rather loosely toothed or shortly ciliate, glabrescent above, gradually tapering into the short, subcucullate apex; (15) 25-40 (60) cm long, (0.7) 2-6 (10) cm broad; vividly to deep green with glaucous bloom, near the base often brownish suffused. Sheathy prophyll thin, rather short, yellowish brown, finely coarse, soon decaying. Spathe membranous, ± completely divided in 2-3 ovate, long acuminate, finally reflexed valves; buff with brown veins. Inflorescence depressed-globose to subglobose; moderately dense, many-flowered; 6-10 (12) cm in diameter. Pedicels subequally long, straight, wiry, stiff; glossy greenish brown to maroon with purple base. Anthesis in May to June. Flowers bowl-shaped starlike. Tepals linear-lanceolate, incurved, canaliculate, subacute, basally free, patent, during the course of anthesis reflexed and spirally enrolled; 5-8 mm long, c. 1.5 mm broad; pinkish carmine with narrow greenish-brown median vein conspicuous at the dorsal side. Filaments 2/3-4/5 as long as the tepals, straight, in the middle outwards bent; basally connate for 0.5-1 mm and very shortly broadened; inner filaments basally with 2 often very short side teeth, above subulate; initially white with pinkish-carmine base, later pinkish-carmine throughout. Anthers oblong; 1.5-2.5 mm long, c. 1 mm broad; deep pink. Pollen pale yellow; the shape is oblate to peroblate, 30 µm long, 17 µm broad, P/E index 0.6, sculptures rugulate to micro-rugulate, wall 1 µm thick (Neshati & al. 2009). Ovary stipitate, depressed globose hexasulcate, apex concave surrounded by 6 radially-backwards directed, ± sharp bulges, 2-3 mm long, 3-4 mm in diameter; surface densely covered by acute tubercles, pale to vividly green. Up to 4 ovules per locule, 10 per ovary (Filimonova 1970). Nectary ducts lead in pores at the base of ovary below the bottom of locules (Fritsch 1992b). Style narrowly conical, 2-5 mm long; whitish finally pink. Stigma dot-shaped; whitish. Capsule short pyriform-tripartite with a concave apex and 3 broad and deep and 3 broad and shallow furrows separated by longitudinal ledges, surface rather coarse, 4-6 mm long and in diameter, widely open; valves transversally obovate with a broad and deep longitudinal furrow and shortly notched at the apex; yellowish brown. Seeds 1-2 per locule, depressed ovoid to subglobose; surface papillous with coarsely reticulate raised wrinkles, somewhat glossy black; c. 3 mm long, 2.5 mm broad, 2 mm thick. TKW 3.37 / 3.68 g (Fritsch & Abbasi 2013). The testa showed verrucose periclinal walls, and a variable undulation of the anticlinal walls showing transitions from S-like to U-like and to Omega-like forms with moderate to short wavelengths and low amplitudes (Kruse 1994; Fritsch & al. 2006).

**Chromosomes:** 2n = 16 Vakhtina 1964a, Vakhtina & al. 1977 total length of chromosomes (Uzbekistan or Tajikistan: Zaravshan range). 2n = 16 Pedersen & Wendelbo 1966 (Afghanistan: Mairana, H&W 3781). 2n = 16 Zakirova & Vakhtina 1974 (Tajikistan: Hissar range, Kondara gorge, no. 121). 2n = 16 Astanova 1990 (Tajikistan: Gazimailik ridge). 2n = 16 Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Varzob valley, Kondara gorge TAX 1323, TAX 1888, Ojuk gorge TAX 1326, Khorongon gorge TAX 1909, Gazimailik ridge, Ganjino TAX 2276).

**Living accessions studied:** **Uzbekistan:** W Hissar range, village Kaltakul, 8 km along the road to the valley Kirg-alma (38°49'00.1" N, 67°07'53.1" E, 1900 m, 29.5.2003 Fritsch, Keusgen, Khassanov 4172 (4113); GAT) TAX 6192; Zaravshan range S Samarkand, slope N pass Takhta-Karachacha above vill. Amankutan (type location, 39°19' N, 66°56' E, 1700 m, 20.5.1993 Fritsch & Khassanov 869; GAT) TAX 3673. **Tajikistan:** Central Hissar range, drainage of Varzob river, Kondara valley (38°38'21.7" N, 68°43'01.2" E, 1250-1600 m, 07.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6114; TAD), (1300 m, 19.6.1984 Fritsch T21; GAT) TAX 1323, always under trees and shrubs (38°49' N, 68°48' E, 1390 m, 23.4.1986 Fritsch T120a & b; GAT) TAX 1888, TAX 1889, under

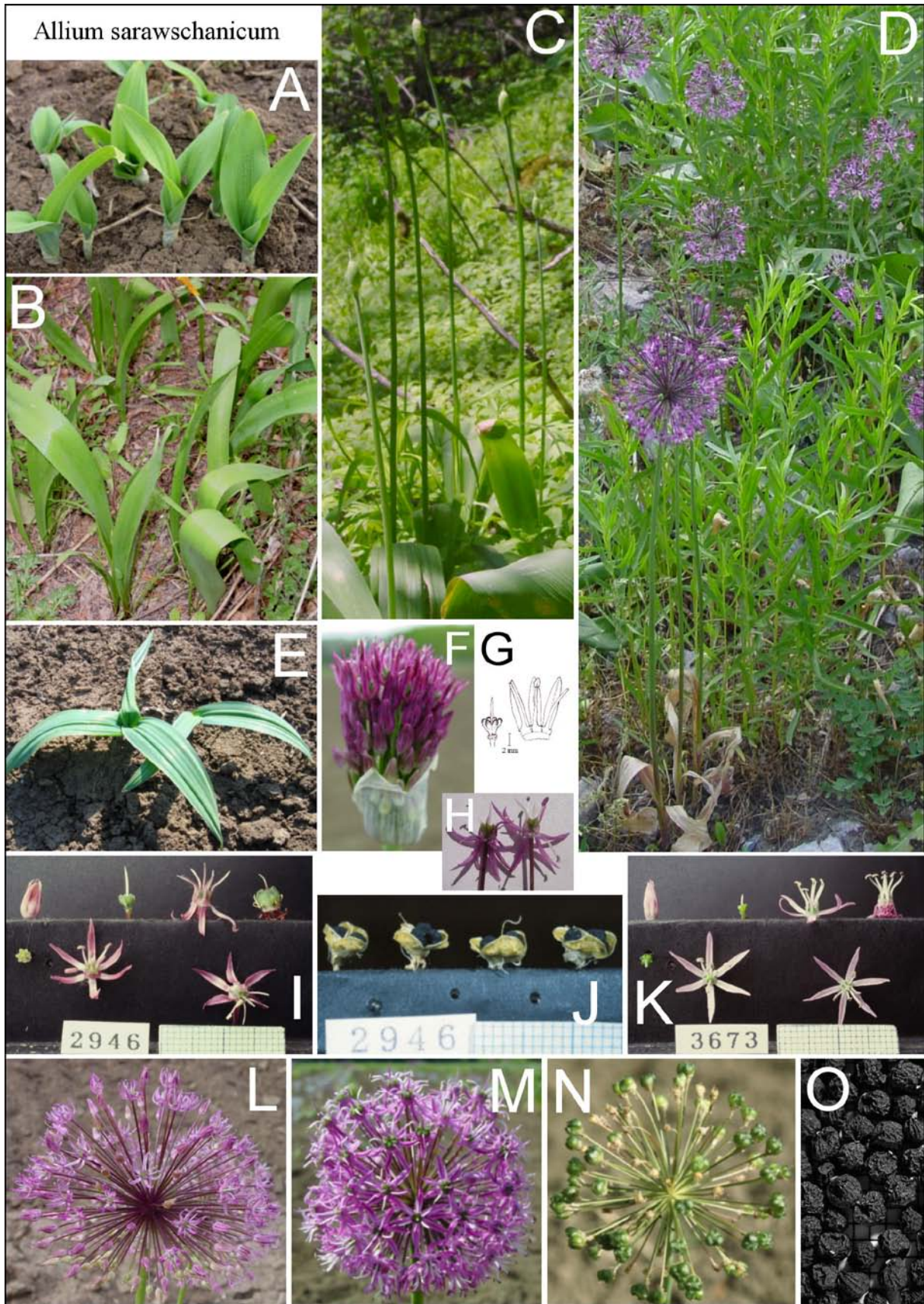


Plate (35): A: Sprouting leaves of cultivated plants; B: plants in the early shooting stage in the Golestan reservation, Iran; C: plants in the late shooting stage near Dushanbe, Tajikistan; D: flowering plants in the Shing valley, Tajikistan; E: developing leaves of cultivated plants from Ojug valley, Tajikistan; F, L & M: inflorescences in buds, in early anthesis and in full anthesis, resp.; G: shape of ovary, tepals and filaments of a flower prepared from herbarium; H: close-up of dissected flowers; I & K: comparison of flowers and flower parts in different

*Juniperus zeravschanica* tree near the path to location Kwak (38°49' N, 68°46' E, 1700 m, 25.4.1986 Fritsch T128; GAT) TAX 1896; drainage of Jirinod creek opposite Kondara station (38°49' N, 68°46' E, 1500 m, 18.5. 1987 Fritsch 162; GAT) TAX 2250; Khorongon valley N Dushanbe, in loose *Acer* forest (38°42' N, 68°53' E, 1940 m, 27.4.1986 Fritsch T-146; GAT) TAX 1910, rubble strip between rock outcrops (38°42' N, 68°53' E, 1960 m, 27.4. 1986 Fritsch T145; GAT) TAX 1909; Ojug valley NE Dushanbe, shady rock terrace (38°47' N, 68° 50' E, 1140 m, 23.6.1984 Fritsch T62; GAT) TAX 1326; Semiganch valley c. 30 km NE Dushanbe, rock slopes SE – SW of vill. Dara (38°41' N, 69°00' E, 1550 m, 24.5.1990 Fritsch, Kudratov, Pistrick 506; GAT) TAX 2946; Ramit gorge near Javros ENE Dushanbe (16.5.1985 Hanelt 20; GAT) TAX 1626; Zaravshan range, W side of the end of 7th lake (39°06'42.4" N, 67°50'38.3" E, 2500-2650 m, 28.6.2004 Fritsch, Hisoriev, Keusgen 6159; GAT) TAX 6304, valley of river Obi-borik about 3 km above village Obi-borik (39°12'38.2" N, 67°43'12.6" E, 1750 m, 30.6.2004 Fritsch, Hisoriev, Keusgen 6170; GAT) TAX 6314; Gazimailik ridge, near vill. Ganjino, N exposed slope under Pistacia (37°59' N, 68°34' E, 1330 m, 23.5.1987 Fritsch 185; GAT) TAX 2276, chain before Gazimailik ridge, terraces of a SE exposed dolomitic ? cliff (37°57' N, 68°31' E, 1320 m, 15.5.1990 Fritsch, Kudratov, Pistrick 468; GAT) TAX 2939.

**Remarks:** *Allium sarawschanicum*, the only species of subsect. *Keratoprason*, is a rather polymorphous species with a wide area of distribution from northern Iran up to Tajikistan. The existence of two infra-specific molecular groups might reflect this diversity, but both these groups comprise accessions from different regions (Fritsch & al. 2010). Thus the below cited molecular markers deny recognition of *A. pseudozeravschanicum* as proposed by Seisums (1992) or of other infraspecific taxa. The plants of *A. sarawschanicum* own a general stature like members of subsect. *Costatae* but differ by broader linear-lanceolate leaf laminae with collar-like bent and overlapping margins near the base. Plants of *A. rosenbachianum* s. str., albeit commonly smaller and without outgrowths at the tip of ovaries, are also similar in the shape of leaf laminae (but without the above mentioned collar-like base), as well as in inflorescence and tepal characters. Molecular markers (ITS sequences of nuclear rDNA and sequences of the plastid *trnL-trnF* region) proved a large genetic distance to subsect. *Costatae* and sect. *Megaloprason* s. str. (Fritsch & al. 2010: 194 cluster 7 § 3.9.6; Fritsch 2012b: 254-255 Fig. 5 V; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201) where *A. sarawschanicum* was formerly affiliated. Solely *trnL-trnF* sequences showed closer relations to *A. jesdianum* incl. subsp. *angustitepalum* (Gurushidze & al. 2010: 835 fig. 4 lineage VI).

There are several species in subg. *Melanocrommyum* bearing six oblique-upwards directed and radially elongated outgrowths on the apex of the ovaries. Those of *A. sarawschanicum* are more pronounced and radially longer than the (not really) "horn-like" ones of *A. hexaceras*.

**Etymology:** The epithet refers probably to the Zaravshan valley or to the Zaravshan mountain range in Uzbekistan where the type location is situated.

**Biological data:** Very good seed germination occurred at 5 °C, but very bad above 10 °C (Specht & Keller 1997). Cultivation trials including morphological parameters correlated to stages of development and agrotechnical measures were reported by Inamov (1971). Reported genome sizes [2C DNA] were 37.4 pg (Vakhtina & al. 1977), 35.4 pg (Zakirova 1989), 34.2 pg (Hissar) / 36.2 pg (Iran) (Gurushidze & al. 2012). Detailed analysis of seed storage proteins showed more similarity to *A. rosenbachianum* than to other tall species (Maass 1992, Fig. 5 "sara"). Fresh bulbs contained in total 0.03 / 0.04 % cysteine sulfoxides (62 / ? % methiin, 37 / ? % alliin, 2 / ? % isoalliin; Fritsch & Keusgen 2006; Keusgen & al. 2008).

**Economic traits:** Used as ornamental, medicinal plant, and vegetable species (Inamov 1971). Local name 'model', the leaves are eaten in Tajikistan (Saidov 1986, Sokolov 1994, Saidov 2001). Use as spice (Kochkareva & Chukavina 1985) could not be confirmed, merging with the similar leaves of *A. rosenbachianum* s. str. is assumed (Keusgen & al. 2005). Local name 'evoj pijoz', belongs to the most important edible species in the Uzbek mountains (Khassanov 2008). In Uzbekistan used against skin disea-

---

stages of anthesis (I from Semiganch valley, Tajikistan, K from type location, Uzbekistan); J: ripe open capsules; N: inflorescence with full-sized capsules; O: seeds (millimeter paper as background and measure scale of I, J, K & O; plate copied from Fritsch & Abbasi 2013: 153 Plate T61, modified).

ses, owns bactericidal and fungicidal activities (Sokolov 1994). Offered as ornamental, is also a parent of named hybrids and registered cultivars (Fritsch 2015).

6.4 A. sect. *Megaloprason* **subject. *Spiralitunicata*** R.M. Fritsch

in Linzer Biol. Beitr. 26: 975 (1994, sub sect. *Acmopetala*). — A. sect. *Melanocrommyum* subject. *Melanocrommyum* group of *A. aschersonianum* relatives, Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 26 (1994), p. p. — Type species: *Allium suworowii* Regel

**(36) *Allium suworowii*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 7: 546 (1881), Regel in Gartenflora 30: 356 t. 1062 f. 4-5 (1881); Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887). Baker in Curtis's Bot. Mag. 114: t. 6994 (1888). Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 139 (1900), sub *A. sewerzowii*. Vved., Flora Turkm. 1, 2: 293 (1932); Vved., Flora URSS 4: 266 (1935); Lapin, Opredel. rast. Tashk. oazisa 1: 81 (1938); Vved., Flora Uzbek. 1: 460, tabl. 65 fig. 2 (1941); Nikitina & Kashtsh., Flora Kirg. SSR 3: 93 (1951); Pavlov & Polyakov, Fl. Kazakhst. 2: 190 (1958); Vved., Flora Tadzh. SSR 2: 348 (1963); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 52 (1967); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971); Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 125, 128 (1988), omnia "*suworovii*". Wendelbo, Flora Iranica 76: 82, tab. 8/116 (1971). — *Allium nobile* Regel in Gartenflora 36: 369 (1887), in adnot. Type non design. — Type: Uzbekistan: In deserto kirghisico prope pagum [in the Kirgiz desert near village] Uralsk, leg. A. Regel (LE?, not traced, see Fritsch 1990: 508); Neotype: "Ex horto bot. Petropolitano [from Bot. Garden St. Petersburg] 82.5 *Allium Suworowi* Rgl. Fl. turkest.", second label "Lectotype 1992 A. Seisums" (LE; design. Fritsch & al. 2010).

Distribution: Tajikistan, Uzbekistan, Kazakhstan, Kirgizstan, Turkmenistan, NW Afghanistan: Western Tianshan to western Pamir-Alai mountain ranges, Badghyz; colline to montane steppe slopes, also shallow-soil stony and loess slopes, ruderal places and weedy in fields.

Description: Bulbs depressed-globose, rarely with side bulblets, 2-5 cm in diam., up to 4 cm long; tunics strong, ± glossy, yellow-brown, old gray, longitudinally splitting, extended in a long neck of spirally twisted fibers. Scape straight to subflexuous, terete, strong, smooth; 30-60 (100) cm long, 8-12 mm in diam.; green with glaucous bloom. Leaves 3-6 (10), laminae linear-lanceolate, obliquely arcuately ascending and recurved to the soil, later ± flaccid, basally thickish and U-like canaliculate, above thinner and shallowly canaliculate; upper side smooth, lower side with broad, above sometimes toothed ribs; margins often whitish or reddish, variably toothed, gradually tapering into the hooded apex; 20-35 (55) cm long, (1.5) 2-6 cm broad; grayish green with strong glaucous bloom; during sprouting with strong unpleasant odor, during anthesis often with light odor only. Sheathy leaf base glossy yellow. Sheathy prophyll bright green, very short, ± strong, smooth, thickish. Spathe membranous, divided in 2-3 (4) broadly ovate-triangular, long cuspidate, often many-pointed valves c. 25 mm long; pale brownish with greenish to maroon veins. Inflorescence fasciculate to semi-globose, fruiting nearly globose; moderately to very dense, many-flowered; up to 10 cm in diam., 5-6 cm long. Pedicels ± unequally long, thin wiry, ± straight; initially 1.5-3, fruiting up to 4 cm long; glossy, initially brown with red base, later brownish green. Anthesis in May to June. Flowers bowl-shaped to flat starlike. Tepals linear-lanceolate, concave, patent to slightly forward directed, shortly acuminate, later reflexed and curled; (4) 6-7 mm long, 2-3 mm broad; lilac to deep pinkish-violet, the darker or greenish, narrow median vein is inconspicuous inside. Filaments ± as long as the tepals; basally long triangular widened (inner filaments 1.5 times broader), above subulate; pinkish-carmine. Anthers oblong; c. 2 mm long and 1.2 mm broad; pinkish- to grayish-violet. Pollen yellowish-gray; length 30 μm (Levan 1935). Ovary long stipitate, triangular depressed-globose, 2-3 mm long, 3-4 mm in diam.; surface even or with shallow bulges, very glossy; vividly green with darker sutures. Up to 8 ovules per locule, 20 ovules per ovary (Filimonova 1970) / 7-8 ovules per locule (Hanelt 1992). Nectary somewhat lobed, the ducts mound at the

base of the ovary below the bottom of locules (Fritsch 1992b) in a pore on a small hump. Style conical-threadlike, 3-7 mm long;  $\pm$  bright violet. Stigma undivided; pink to purplish. Capsule broadly triangular-

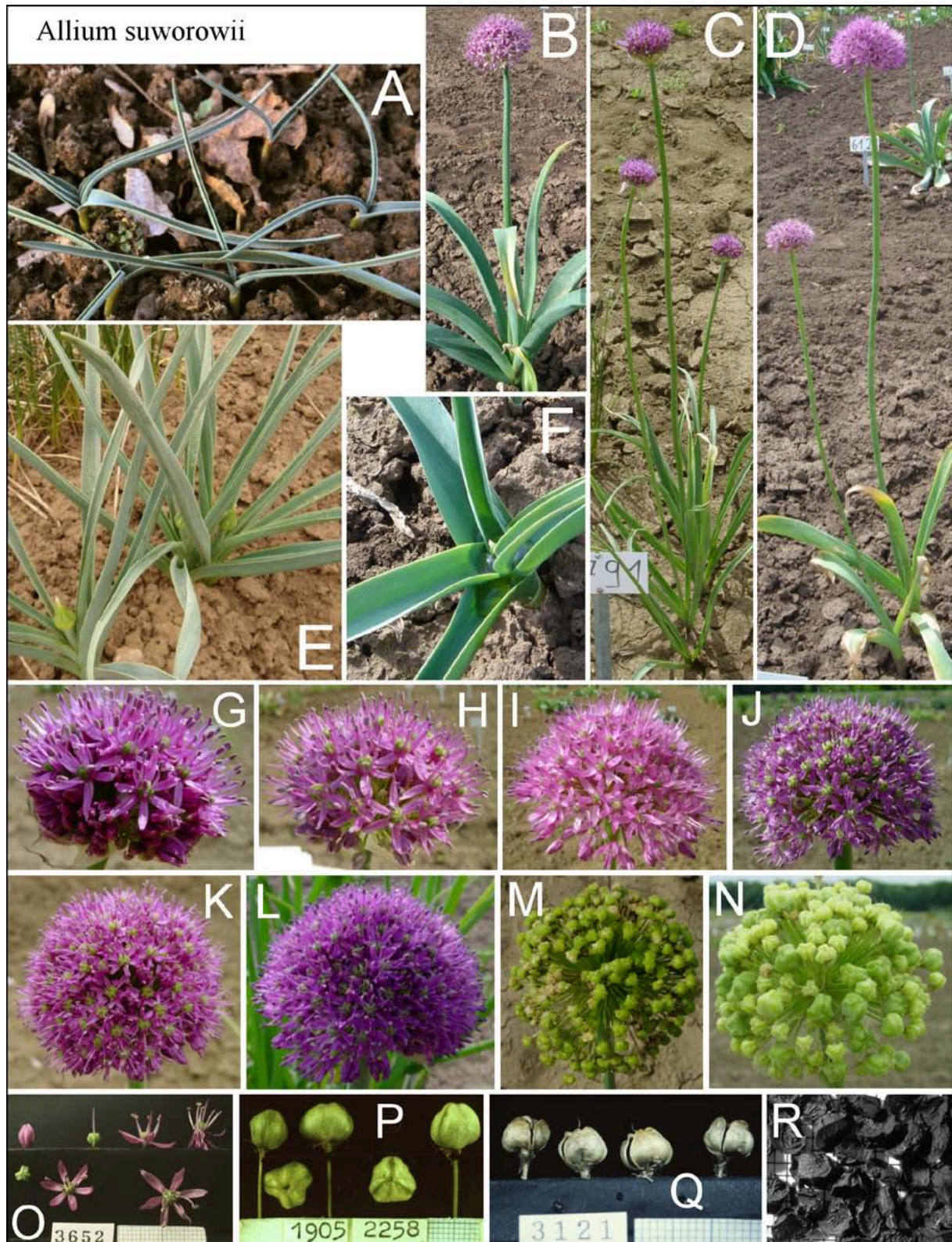


Plate (36): Cultivated plants are shown. A: Sprouting leaves; B: flowering plant from Kulyab area, Tajikistan; C: plants from Khojamushkent, Uzbekistan, in early anthesis; D: flowering plants from Mionatuk, Tajikistan; E: plants from Khojamushkent in early shooting stage; F: plant from Kulyab in early shooting stage; G, H & I: inflorescences in early anthesis; J, K & L: inflorescences in full anthesis; M & N: inflorescences with developing capsules; O: comparison of flowers and flower parts in different stages of anthesis; P: full-sized capsules; Q: ripe open capsules; R: seeds (millimeter paper as background and measure scale of O, P, Q & R).

globose, sessile, surface with some humps,  $\pm$  glossy, 7-9 mm long, 8-12 mm in diam.; whitish-green; moderately widely open, valves shortly triangular, scarcely notched at the apex, with rather dense raised wrinkles; dull buff to brown. Seeds 2-3 (7) per locule, flat ovate to semicircular with strong sharp edges and longitudinal raised wrinkles; surface finely papillous, dull black; 2.5-3.5 mm long, 3 mm broad, 1.5-2 mm thick. TKW 3.50 / 3.79 / 4.88 g (IPK, unpubl. data). The testa showed Omega-like undulated anticlinal walls with moderate or small wavelengths and high amplitudes. The periclinal walls were verrucate with a moderate number of verrucae (Kruse 1994; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Levan 1931, Levan 1935 fig. 16j (Denmark: Botanical collection Copenhagen).  $2n = 32$  Ved Brat 1965a (Italy: Botanical collection Villa Taranto).  $2n = 16$  Vakhtina 1969, Vakhtina & al. 1977 whole length of chromosomes (Uzbekistan: SW Hissar range, Baisun, no. 142).  $2n = 16$  Astanova 1990 (Tajikistan: Gazimajlik ridge).  $2n = 16$  Pogossian & Seisums 1992 (Tajikistan: Hissar range, Varzob valley, Kondara gorge, Seisums s. n.).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Ramit TAX 1871, TAX 2258, Varzob valley, Kondara gorge TAX 1905).

**Living accessions studied:** **Kazakhstan:** Foothills of W Tianshan ranges, tree strip beside the main road Tashkent – Chimkent c. 5 km S Karatag (41°49' N, 69°24' E, 600, 14.5.1993 Fritsch 817; GAT) TAX 3657; Kindyktas Mts., tree strip beside the main road Alma Ata – Bishpek c. 10 km W Georgievka (43°08' N, 74°38' E, 650 m, 12.5.1993 Fritsch 804; GAT) TAX 3652, Kur dai pass area, slopes (1986 from Botanic Garden Acad. Alma-Ata s. n.; GAT) TAX 2725. **Uzbekistan:** Turkestan range, Zomin valley, village Duoba (39°45'36.6" N, 68°24'41" E, 1150 m, 04.6.2006 Fritsch & Khassanov 4247; GAT) TAX 6532; West Hissar range, Sangardag river (38°32'08.4" N, 67°33'52.8" E, 1111 m, 17.5.2009 Keusgen & Khassanov 4287; GAT) TAX 6742; foothills of Turkestan range near vill. Khojamushkent c. 180 km S Tashkent, grassy slopes (39°52'30" N, 68°41'30" E, 1000 m, 21.5.1998 Fritsch 1671; GAT) TAX 5791; relicts of *Allium* collection in Bot. Garden Tashkent (24.6.1988 Fritsch 242; GAT) TAX 2519. **Tajikistan:** Muminabad region, collection place not recorded (from Bot. Garden Kulyab, donated by the director 24.4.2003 via Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6055; GAT) TAX 6127; Khozratishoh range, slopes between sandstone rocks above vill. Khojidara (37°59' 01.3" N, 70°10'47.2" E, 1640 m, 27.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6076; TAD), (37°58'57.1" N, 70°10'25.1" E, 1650 m, 27.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6079; GAT) TAX 6141, main road prior to vill. Jakhchipun, slopes along the way (37°55'48.6" N, 70°15'38.2" E, 1180 m, 29.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6083; GAT) TAX 6145; Hissar range, drainage of Varzob river, Kondara valley (38°48'41.3" N, 68°48'27.6" E, 1350 m, 07.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6112; GAT) TAX 6161, beside the path from Kondara station to location Kwak, loamy slope (38°49' N, 68°49' E, 1300 m, 26.4.1986 Fritsch T141; GAT) TAX 1905; Ramit reservation, left side valley of Kholmon river (38°45' N, 69°18' E, 1220 m, 14.5.1987 Fritsch 157; GAT) TAX 2258, tributary of Kafirnigan (1300 m, 17.4.1986 Fritsch T73; GAT) TAX 1871; Gazimailik ridge, grazed slopes beside spring Khojabekhib (38°04' N, 68°30' E, 2000 m, 14.5.1990 Fritsch, Kudratov, Pistrick 460; GAT) TAX 2937, W slopes of Gazimailik ridge, place Obodkan, c. 10 km NW vill. Ganjino, loamy terraces (38°02' N, 68°34' E, 1600 m, 12.5.1990 Fritsch, Kudratov, Pistrick 453; GAT) TAX 2934; Vakhsh range, drainage of Kyzylsu river, valley Heishdara ca. 6 km above vill. Baljuan (38°22' N, 69°42' E, 1000 m, 18.7.1991 Fritsch 672; GAT) TAX 3121; Turkestan range near Ura-Tyube (39°57' N, 69°00' E, 15.5.1993 Khassanov s. n.; GAT) TAX 3788; foothills of Kurama ridge S vill. Kochkarli, field margins (40°40' N, 69°25' E, 28.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 553; GAT) TAX 2950.

**Remarks:** *Allium suworowii*, the type species of subsect. *Spiraliticata*, is distinguished by thread-like disintegrating and curling into a long neck, yellowish-brown outer bulb tunics, narrowly lanceolate to nearly linear, glaucous leaf blades (that are after sprouting  $\pm$  horizontally positioned, and very unpleasantly smelling), and completely smooth, like polished, glossy ovaries though the flower color may vary from lilac to pink and purple. The unpleasant odor of the whole plant is not rarely also perceptible from not too old herbarium specimens. According to molecular data (ITS sequences of nuclear rDNA), the samples form a well separated clade with many subgroups (Fritsch & al. 2010: 182 cluster 2 § 3.4.1; Fritsch 2012b: 247-248 Fig. 1 A; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Despite of often high bootstrap values, the subgroups are not correlated to morphology or geography, and separation of formal infraspecific groups would not be justified. Other molecular markers (sequences of the plastid *trnL-trnF* region; Gurushidze & al. 2010: 836, fig. 4 lineage V) supported the diversity; three haplotypes were recognized. A slightly higher general similarity to members of sect. *Acropetala* was the reason to affiliate *A. suworowii* there (Khassanov & Fritsch 1994), but the molecular dendrograms support affiliation to sect. *Megaloprason* s. str.



**Etymology:** The epithet honors the at that time inspector of the medical organization in the Russian province Turkestan, J. P. von Suworow, who supported the research missions of Albert Regel.

**Biological data:** Germination at 5°C was very good, but failed at temperatures above 10°C (Specht & Keller 1997). Khodzhaeva & Ismailov (1979) reported 34 % polysaccharids (glucofructans) in the air dry mass of bulbs, the subterranean parts contained altogether 64 % glucose, fructose, saccharose, oligosaccharids and glucofructans; the inflorescence steroids, the seeds fructose, glucose und stachyose (Sokolov 1994). A genome size of 37.6 pg 2C DNA was reported (Gurushidze & al. 2012). Dry leaves contained in total 0.05 % isoalliin (Jedelska & al. 2004), fresh bulbs in total 0.05 % cysteine sulfoxides (12 % methiin, 2 % alliin, 86% isoalliin) / 0.06 %, 0.36 % (Fritsch & Keusgen 2006, Keusgen & al. 2008), fresh bulbs of different Tajik strains contained in total 0.46 / 0.054 / 0.41 / 1.81 % cysteine sulfoxides (74 / 7 / 35 / 63 % methiin, no alliin, 93 / 65 / 11 / 37 % isoalliin, no propiin), leaves (strain 4) contained in total 0.06 % cysteine sulfoxides (only methiin, Keusgen & al. 2008). The seed storage proteins were compared with other species by Maass (1992, Fig. 5 "suwo"). Vollerner & al. (1988a, b) reported the structure of ansurogenins A & B from *A. suworowii*.

**Economic traits:** The whole plant, local name 'bobuna', or fresh and dry parts are used for the local dish 'atolla' (Keusgen & Fritsch 2008). Developing bulbs are pickled (like *A. stipitatum*) in Tajikistan (Sumnevich 1942, Vvedensky 1963, Anonymous 1985, Saidov 2001), and were so much collected that this species became rare, cultivation was promised (Yunusov 1985). Also in the Uzbek mountains, the pickled bulbs were named 'anzur pijož' and became a favorite 'titbit' in the 20th century. This species was also collected in large amounts and became really rare. Nowadays this species is no longer endangered (Khassanov 2008). The pickled bulbs are used against early stages of tuberculosis and other problems of respiratory tract (Sakhobiddinov 1948, Vvedensky 1963, Khalmatov 1964) and internal diseases (Sokolov 1994). This species was generally mentioned as medical plant (Dadoboeva 1972, Khassanov & Umarov 1989, Sokolov 1994). Local name 'piozi anzur', decocts of flowers and seeds are medically applied in Central Tajikistan (Keusgen & al. 2006). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991), but rarely offered today (Fritsch 2015).

7. *A.* subg. *Melanocrommyum* sect. *Miniprason* R.M. Fritsch, in Hanelt & al. (eds.), genus *Allium*: 74 (1992), emend. R.M. Fritsch in Linzer Biol. Beitr. 26: 968 (1994). — *A.* sect. *Kaloprason* subsect. *Megaloprason*, group of *A. karataviense* relatives, Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 27 (1994), p. p. — **Type species:** *Allium karataviense* Regel

*Allium karataviense* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 243 (1875), Regel in Izv. Imp. obshch. lyub. est., antr. etn. 21, 2: t. XVI f. 1-3 (1876), Regel in Gartenflora 27: 162 t. 941 (1878). Baker in Curtis's Bot. Mag. 105: t. 6451 (1879). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 358 (1887). Vved., Flora URSS 4: 262 (1935); Vved., Flora Uzbek. 1: 459 (1941). Nikitina & Kashtsh., Flora Kirg. SSR 3: 90, tabl. 14 fig 2 "1" (1951). Pavlov & Polyakov, Fl. Kazakhst. 2: 188 (1958). Vved., Flora Tadzh. SSR 2: 346 (1963). Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 50 (1967). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 125, 128 (1988). — ? *Allium cabulicum* Baker in Curtis's Bot. Mag. 119: t. 7294 (1893). Type: "*Allium cabulicum*, Baker (type) Ex hort. reg. Kew No. 150 Tulipa species Aitchison Afghani. Rec... at Kew no. 33.85. *Allium cabulicum* Baker Bot. Mag. 24. 92." (holotype K! K000464363 bar-coded). ? *Allium singulifolium* Rech.f. in Repert. Spec. Nov. Regni Veg. 47: 51 (1939). Type: Griechenland: Samos, Berg Prophet Elias bei [Mt. Prophet Elias near] Vathy, ex horto Vienn., not seen). *Allium karataviense* var. *granitovii* Priszter in Acta bot. Acad. Sci. Hung. 21: 379, f. 1 (1975 publ. 1976). Type: Tien-Shan occidentalis, territorio protectionis naturae Tschatkalskiy Zapovednik dicto [W Tianshan range, Chatkal nature reservation], 2000-2300 m.s.m., leg. I. Isépy 5.5.1971, (BPU now BP?,

not seen). — Lectotype: Kazakhstan: Im Kokanischen [Kokand region] Karatau, Mai, leg. Sewerzow (LE, design. Fritsch 1990: 505).

**(37) subsp. *karataviense***

Distribution: Kazakhstan, Tajikistan, Uzbekistan, Kirgizstan, Turkmenistan?, Afghanistan?: W Tianshan mountain ranges from Syrdarya-Karatau and Chu-Ili mountains to Darvaz and Alai ranges, Kugitang ridge?, Hindu-Kush range?; montane steep rock and rubble slopes and rock terraces; often but not exclusively on limestone.

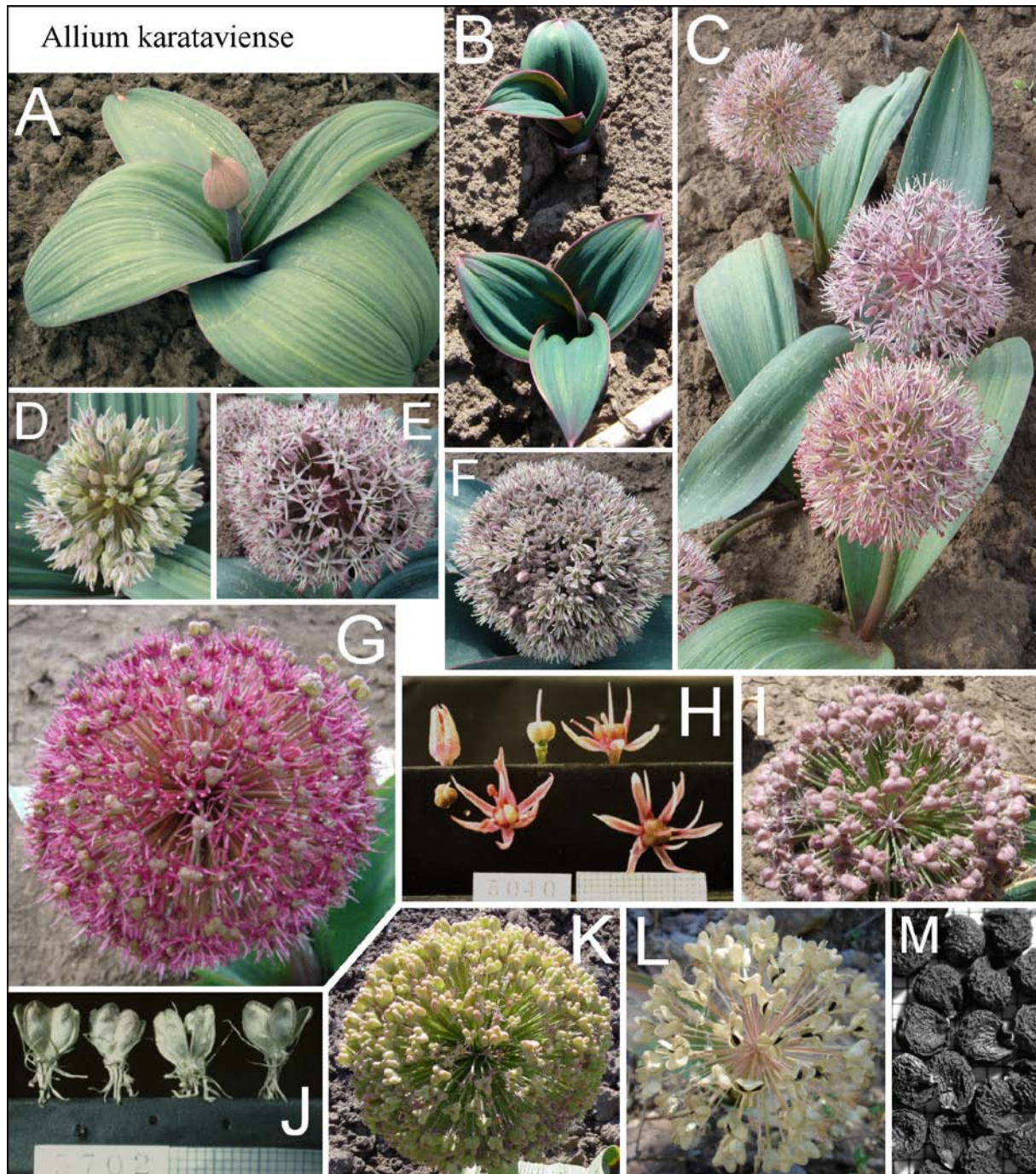


Plate (37): Cultivated plants (except L) are shown. A: Shooting plant; B: sprouting leaves; C: plants with flesh-colored flowers in full anthesis; D, E & F: inflorescences with flesh-colored flowers in early, full, and late anthesis, resp.; G: inflorescence with purplish flowers in late anthesis; H: comparison of purplish flowers and flower parts in different stages of anthesis; I & K: inflorescences with developing capsules; J: ripe open capsules; L: infructescence with open capsules in Chatkal range, Uzbekistan; M: seeds (millimeter paper as background and measure scale of H, J & M).

**Description:** Bulbs depressed-globose, up to 5 cm in diam.; inner tunics silk-glossy whitish, parchment-like strong, outer tunics reddish-blackish or grayish, papery, somewhat longitudinal splitting, extended in a short neck. Scape ± flexuous, terete or flattened, conical with broader base, smooth, in the dry state sometimes breaking along many cross grooves; (5) 10-25 (fruiting up to 40) cm long, 4-10 (15) mm in diam.; green with glaucous bloom, often ± red to purple flushed. Leaves 1-3 (4), laminae elliptic to long ovate (innermost ones more lanceolate), flat arcuately ascending and recurved, thickish, flat; upper side mostly with many longitudinal grooves, lower side with many ribs; margins smooth, narrowly purple or white, short or long tapering into the hooded apex; 10-25 (40) cm long, (1.5) 4-15 cm broad; initially violet later deep green with strong glaucous bloom, near base lower side often purplish flushed. Sheathy prophyll very short, thick, strong, smooth; maroon to greenish. Spathe membranous, completely divided in 2-3 ovate or triangular, undivided or double-tipped valves; white or reddish with darker veins. Inflorescence ± subglobose, finally globose; moderately dense (red-flowering variants looser), many-flowered; 5-10 (15) cm in diam., in the fruiting stage larger. Pedicels subequally long, straight, thick wiry; green with reddish base, initially reddish flushed, red-flowering variants purplish-green. Anthesis in April to May (begin of June). Flowers cup-shaped to bowl-shaped starlike. Tepals narrowly linear-lanceolate, navicular incurved with claw-like but ± obtuse apex, basally free, obliquely directed, later incurved, finally reflexed, longitudinally convolute and ± crumpled; 5-8 (10) mm long, basally 2-2.5 mm broad; whitish, crème, rose, lilac-purple to deep purple, median vein darker to maroon, often basally and outside greenish, not thickened. Filaments slightly longer than the tepals, basally for c. 1 mm connate and triangularly widened (inner filaments somewhat broader), above subulate, somewhat fleshy; white, or crème to reddish (red flowers basally purplish) fading towards the apex. Anthers ovoid; 1.5-2 mm long, 0.8-1 mm broad; yellow, orange or violet. Pollen gray-yellow; 28.5 µm long (Levan 1932, 1935). Ovary stipitate, triangular to pear-shaped, 3-4 mm long and in diam.; surface acutish papillous, green, brown to red flushed. The nectary ducts mound in vertical slits near the base. Up to 5 ovules per locule, 14 ovules per ovary (Filimonova 1970) / only 2 ovules per locule (Hanelt 1992). Style conical-threadlike, finally 5-7 mm long; yellowish-green to reddish. Stigma undivided; whitish. Capsule long triangular-conical, broadest above the middle and up to 3 mm deep incised at the center of the apex, surface papillous and reticulately lacunose, near base the funnel-shaped sunken mounds of nectaries are visible, 8-10 mm long and in diam.; valves deeply cordate; dull reddish-greenish, dry buff. Seeds 2 per locule; flat drop-shaped; surface finely papillous with dense irregular ledges, dull black; 3-5.5 mm long, 2.5-4 mm broad, c. 2 mm thick. TKW 6.93 / 7.83 g (IPK, unpubl. data). The testa showed verrucose periclinal walls and Omega-like undulation of the anticlinal walls with low to moderate amplitude (Kruse 1994; Fritsch & al. 2006).

**Chromosomes:**  $2n = 18$  Levan 1929 (" $2n = 16$ "), Levan 1931 (" $2n = 16$ "), Levan 1932, Levan 1935 (Sweden: Botanical collection Lund).  $2n = 18$  Telezynski in Tischler 1931 (source not mentioned).  $2n = 18$  Vakhtina 1964a Uzbekistan: Tashkent area, Karshantau ridge, s. n.).  $2n = 18$  Pedersen & Wendelbo 1966 (Sweden: Botanical collection Stockholm).  $2n = 18$  Dietrich 1967 (France: Botanical collection Strasbourg).  $2n = 18$  Jones & Rees 1968 Fig. 3 (source not mentioned).  $2n = 18$  Vakhtina 1969 p. 148 (Kazakhstan: Karatau range, no. 382).  $2n = 18$  Zakirova & Vakhtina 1974 (Uzbekistan?: Zaravshan range, s. n.; Tajikistan: Darvaz range, Sangeu, no. 112).  $n = 9$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection BIN).  $2n = 18$  Jacobsen & Ownbey in Löve 1977 (Sweden: Botanical collection Uppsala).  $2n = 18$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen).  $2n = 18$  Astanova 1990 (Tajikistan: Kurama ridge " $2n = 16$ "; corrected in litt.).  $2n = 18$  Zakirova & Nafanailova 1990 (Kazakhstan: Talas Alatau range, Mashad gorge, Ivashchenko s. n.)  $2n = 18$  Pogosian & Seisums 1992 (Kazakhstan: Karatau range, watershed of rivers Bugun and Sasi-kazen, Kamelin & al. 233; Sajasu gorge, Kamelin & al. 351).  $2n = 17, 18+0-1B$  Fritsch (see karyolog. appendix, Germany: Botanical collection Gatersleben TAX 2323, Botanical collection Halle TAX 4141; Uzbekistan: Chatkal range, Yangiabad TAX 2989, Chimgan massif, Charvak TAX 5040; Kirgizstan: Kirgiz Alatau range, pass Tyuesashu, TAX 5690).

**Living accessions studied:** **Kazakhstan:** Karatau range, Kantagy valley c. 15 km N town Kentau, mostly S exposed limestone slopes (43°39' N, 68°38' E, 750 m, 24.5.1993 Fritsch 878; GAT) TAX 3676, c. 25 km NE town Kentau, limestone rubble slopes in valley Ikonzu (43°35' N, 68°47' E, 650 m, 25.5.1993 Fritsch 892; GAT) TAX 3678, c. 25 km W town Sholakkorgan, hill ridge Kara-arpa in the valley Arpa-uzen (43°49' N, 68°47' E, 1000 m, 26.5.1993 Fritsch 912; GAT) TAX 3682, ca. 80 km SE town Chajan, N slopes of Mt. Ulken-Tura c. 3 km above vill. Karatas (42°51' N, 69°52' E, 900 m, 29.5.1993 Fritsch 932; GAT) TAX 3689, Kindyktas massif, pass Kujuk c. 30 km SW town Jambul c. 2 km W of main road Chimkent - Jambul (42°45' N, 70°56' E, 1050 m, 30.5.1993

Fritsch 938; GAT) TAX 3691; Mashat Mts., rubble slopes (1986 from Botanic Garden Acad. Alma-Ata s. n.; GAT) TAX 2727; unknown place (from Botanic Garden VILR Moscow catalogue 1981 no. 1337; GAT) TAX 0366. Kirgizstan: Chatkal range, slopes in Sarychilek valley NE vill. Arkit (41°50' N, 71°58' E, 1200 m, 29.5.1997 Fritsch & Khassanov 1635; GAT) TAX 5702; Kirgiz Alatau range, rubble slope along the main road below pass Tyuesashu (42°30' N, 73°21' E, 1550 m, 28.5.1997 Fritsch & Khassanov 1623; GAT) TAX 5690. Uzbekistan: Ugam range, Nauvalisaj, 3 km above the road (41°44'28.1" N, 70°04'38.7" E, 1030 m, 24.5.2003 Fritsch, Keusgen, Khassanov 4139 (4080); GAT) TAX 6175; Chatkal range, N village Chetsuv (41°12' N, 70°15' E, 2100 m, 20.5.2001 Fritsch & Hoffmann 1770; GAT) TAX 5888, (41°07'02.6" N, 70°14'18.9" E, 1700 - 2300 m, 04.6.2003 Fritsch, Keusgen, Khassanov 4193; GAT), above village Sukok c. 50 km E Tashkent (41°14'48.5" N, 69°49'33.3" E, 1400 m, 09.5.2005 Fritsch & Khassanov 4215; GAT) TAX 6366, Chilchenboa massif near Jangiabad N town Angren (41°10' N, 70°08' E, 1700 m, 06.6.1990 Fritsch & Khassanov 596; GAT) TAX 2989, Chimgan massif, porphyry slopes in the valley Karamazar c. 2.5 km S town Charvak (41°36' N, 69°55' E, 800 m, 28.6.1994 Fritsch, Khassanov, Pistrick 1167; GAT) TAX 5040; Kurama ridge, granitic slopes beside the road S pass Kamchik (41°04' N, 70°34' E, 2100 m, 29.5.1998 Fritsch 1674; GAT) TAX 5793; Pskem ridge, Aksarsai near village Nanay (41°42'07.7" N, 70°08'01.9" E, 1050 m, 06.6.2006 Fritsch & Khassanov 4248; GAT) TAX 6533; collection place unknown, from the *Allium* collection of Khassanov in Tashkent (1998 no. 59/1996; GAT) TAX 5770. Tajikistan: Khozratishoh range, slopes E village Sarimarguzor, right side of Dughova river above Sari Marguzori Bolo (37°47'55.6" N, 70°14'11" E, 1650 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6066; GAT) TAX 6133, along the way from Dashti Sardolyak and Kuffo (38°03'20.6" N, 70°22'29.4" E, 1000 m, 30.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6087; GAT) TAX 6147; Mogoltau massif, SE exposed limestone slopes in the valley Ptavsai, Spa massif (40°17' N, 69°26' E, 1000 m, 01.6.1997 Fritsch & Khassanov 1648; GAT) TAX 5713, unknown place in Spa massif (unknown collector, 40°47' N, 69°27' E, 1000 m, 20.5.1988 Fritsch 1666; GAT) TAX 5963; Turkestan range, Isfara valley near vill. Vorukh, from the *Allium* collection of Khassanov in Tashkent (39°51' N, 70°40' E, 01.6.1998 via Fritsch 1685; GAT) TAX 5803; Darvaz range, canyon Zigar (1987 from Botanic Garden Khorog s. n.; GAT) TAX 2414.

Remarks: *Allium karataviense*, the only species of sect. *Miniprason*, is a morphologically very plastic species. Under shady conditions grow slender plants with often only one long and narrow leaf, a longer scape, and a looser inflorescence composed of fewer flowers, but on very dry and hot places scape and leaves are often very short, and also the flower number per inflorescence may be low. A permanently one-leafed population was described as var. *granitovii*. On the other hand, very large plants with up to four long and broad leaves, a long scape, and dense, many-flowered inflorescences are often met with on deep rich soil and under cultivation. However, the flower color is not much influenced by the growth conditions though it is slightly paler at shady places. Purplish flowering plants occur apparently only in the Chatkal and Kurama ridges (but not in Mogoltau massif) of the western Tianshan mountain range. In herbaria, *A. karataviense* is not rarely merged with *A. alexeianum* and species of sect. *Acanthoprason* if the after anthesis tortuous, reflexed, and never stiff and prickly tepals and the ± deeply incised apex of young capsules were not properly recognized. Unfortunately, *A. karataviense* shares approximately broadly-lanceolate or long-ovate, longitudinally grooved, initially bluish-violet with distinct red margins and later green and strongly glaucous leaves with several species of the sections *Acanthoprason*, *Compactoprason*, and *Kaloprason*. Thus these leaf features do not indicate taxonomic relationship. Living plants from Kugitang ridge and from the Kabul area in Afghanistan (where *A. cabulicum* was cultivated for food) could not be studied yet, but the latter place is very probable no outpost of the natural area of distribution. The type of *A. cabulicum* might possibly represent a weak plant of *A. karataviense* (though the tepals are much stronger reflexed), but the next known places of natural occurrence in Tajikistan are about 500 km away. Another voucher of *A. cabulicum* is even a mixture of *A. mirum* Wendelbo and *A. stipitatum* (Wendelbo 1966). Thus this taxon remains unclear; the detailed study of living plants is urgently necessary. Contrary to the remarkable diversity of morphological characters and genome size, ITS sequences of nuclear rDNA are rather uniform. Beside two morphologically inconspicuous accessions from the Tajik bank of Panj river that represent a basal subgroup, all other accessions belong to one well supported subgroup. They are the closest molecular relatives of the western Tianshan geographical clade of sect. *Acmopetala* and *A. motor*. The more distant relationship to the members of sects. *Megaloprason* s. str., *Regeloprason* p. p., *Stellata*, and *Verticillata* is not resolved (Fritsch & al. 2010: 188 cluster 5 § 3.7.1; Fritsch 2012b: 250 Fig. 3 I; Gurushidze & Blattner

in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage III) belonged also to only three haplotypes and showed the same relationships.

**Etymology:** The epithet refers certainly to the [Syrdarya-]Karatau range in Kazakhstan where the type was collected.

**Biological data:** The bulbs are up to 10 cm deep located in the soil, the roots are annual, up to 62 cm long and 37 cm deep (Bajtulin & Kamenetskaya 1983). The plants are early flowering and short-vegetating geophemeroids, with bulb scales up to 2 cm thick, a bulbous type root system that is frequently ephemeroidal, nonbranching, diffuse with up to 40 cm deep root penetration and up to 200 roots per plant; the leaf primordia of the next year's shoot develop in April to June and the inflorescences in August to October (Kamenetsky 1992 Fig. 1c, Kamenetsky 1996, Kamenetsky & Japárova 1997). Germination period after stratification at 0-3 °C of 2 years stored seed is shorter than of 1 year stored seed, at 20 °C no germination occurred (literature source lost). The seedlings belong to the *Allium karataviense* type (Druselmann 1992). The bulbs contain different saccharids, glucofructans, pectic substances, hemicelluloses, different steroids; the inflorescences different karataviosids and lipids (Sokolov 1994). The bulbs were regarded as poisonous caused by a high saponine contents (Pavlov & Polyakov 1958). The structures of several compounds were investigated by Vollerner & al. (1978: karataviosid A, 1980: karataviosid C, 1983: karataviosid B, 1983b: karatavigenin C, 1984: karataviosid E and F). Different genome sizes [2C DNA] were reported: 24 pg (Labani & Elkington 1987), 28.2 pg (Vakhtina & al. 1977), 26.7 pg (Zakirova 1989), 45.4 pg (Jones & Rees 1968), and 42.7 pg (Gurushidze & al. 2012). Plants of some strains contain dithiodipyrrole (Gurushidze 2008), and the radical scavenger activity was moderately high (Jedelska & al. 2004). Bulbs contain in total 0.3 % cysteine sulfoxides (45 % methiin, 55 % propiin; Jedelska & al. 2004), and the leaves 0.39 % cysteine sulfoxides (45 % methiin, 55 % propiin; Keusgen & al. 2008). Gorovits & al. (1973) reported the structure of karatavigenin as 3-O-benzoat alliogenin, Khristulas & al. (1974) the structure of the 3-O-β-D-glycopyranosid karatavigenin, and Dejneco (1981) the presence of fatty acids.

**Economic traits:** The hot tasting leaves, rarely bulbs, are eaten (Khassanov & Umarov 1989, Umarov 1992). Use of leaves as vegetable for traditional dishes, and as stuffing of pastries was confirmed (Keusgen & al. 2004, Khassanov 2008, as 'matalluk' Keusgen & Fritsch 2008). Local name 'chuchka piyoz', belongs to the most important edible species in the Uzbek mountains, but used by individual families only (Khassanov 2008). Cultivated as field crop in the Kabul area of Afghanistan for the edible bulbs (Baker 1893 as *A. cabulicum*). Flowers were tested as food but had rather unpleasant taste and were inedible (de Lestrieux & de Belder-Kovacic 2000). Is used as medical plant for quicker healing of wounds (Dadoboeva 1972, Sokolov 1994) and is applied in the folk's medicine against lung diseases and shortness of breath (Sakhobiddinov 1948, as 'chychka-kulak', 'luk karatavskij', Khalmatov 1964). Cooked bulbs are used against light diseases, the alcoholic extract of supraterranean parts shows antibacterial activity (Sokolov 1994). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991) and in Fritsch (2015). In Europe cultivated as ornamental for rock gardens since the 1880ies; today commercially available as ornamental (De Hertog & Zimmer 1993, Fritsch 2015) with several cultivars differing mainly by flower color, also hybrids with other species exist (Friesen & al. 1997, Fritsch 2015).

**(38) *Allium karataviense* subsp. *henrikii*** Rukšāns, Buried Treasures: 362, plate 95 (2007). — *Allium karataviense* subsp. *henrikii* Rukšāns, nom. ineff. publ. & nom. nud., Janis Ruksans Bulb Nursery [printed Catalogue] Late summer/autumn 2006: 8, no. 49 (2006). — **Type:** Uzbekistan, western end of the Karzhantau range, Camel Mount near Tashkent at Tovaksai, stony slopes, Rukšāns & Seisums 1996-2-5, ARJA 9678 ex culturae in horto [cultivated in the garden of] Janis Rukšāns (holotype GB, not seen).

**Distribution:** Uzbekistan: Chatkal mountain range, rock terraces covered by a thin layer of soil, known only from the type location E Tashkent.

Description: Scape flexuous, terete, smooth; 20-40 cm long; greenish-brown. Leaves 2, laminae ovate, arcuately ascending and recurved to the soil; shorter than the scape and narrower than in the typical subspecies; green with strong glaucous bloom. Inflorescence subglobose; loose; up to 25 cm in diam. Pedicels subequally long, thickish, straight; semi-glossy brown-green. Anthesis in May to June. Flowers are apparently identical to the red form of the typical subspecies. Tepals red to purple. Filaments like in the typical subspecies.

Remarks: The description was deduced from photos and remarks presented in catalogues of Rukšāns. Most characteristic is the more than 20 cm long scape longer than the leaves, whereas the typical subspecies owns commonly scapes shorter than the leaves. Also the habitats are different: subsp. *henrikii* grows on flat positions, covered by a thin layer of soil, but subsp. *karataviense* among stones on scree and rocky slopes (Rukšāns in litt.). Molecular markers (ITS sequences of nuclear rDNA) confirmed this subspecies to belong to the main group of *A. karataviense* (Fritsch 2012b: 250 Fig. 3 I; Gurushi-dze & Blattner in Fritsch & Abbasi 2013: 201), but this result is indifferent in regard to the taxonomic value of subsp. *henrikii*.

Etymology: The subspecific epithet honors the outstanding contemporary Swedish botanist Henrik Zetterlund from Gothenburg.

Economic traits: Sometimes offered as ornamental cultivar 'Red Globe' (Fritsch 2015).

8. *A.* subg. *Melanocrommyum* sect. *Acmopetala* R.M. Fritsch, in Hanelt & al. (eds.), genus *Allium*: 74 (1992). — *A.* sect. *Melanocrommyum* subsect. *Jaxartoprason* Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 26 (1994), nom. inval., p. p. — Type species: *Allium backhousianum* Regel

8.1 *A.* sect. *Acmopetala* subsect. *Acmopetala* R.M. Fritsch in Linzer Biol. Beitr. 26: 969 (1994). — *A.* subg. *Melanocrommyum* sect. *Melanocrommyum* subsect. *Melanocrommyum* sensu Kamelin, informal group "sphere of *A. gultschense* relatives", Florog. analiz Srednej Azii: 242 (1973), p. p. — Type species: *Allium backhousianum* Regel

(39) *Allium backhousianum* Regel in Gartenflora 34: 213, tab. p. 215 (1885), Regel in Trudy Imp. S.-Peterb. Bot. Sada 9, 2: 598 (1886).— *Allium gulczense* [B. Fedtsch. ex] O. Fedtsch. in Progress. Sadov. Ogorodn. No. 36: 332 ([09. IX.]1906), descr. ross. without type, B. Fedtsch. in Bot. Zh. [izd. Otd. Bot. Imp. S.-Peterb. obshch. Estestv.] (St. Peterburg) 1, 6: 194 (1907). *Allium "gultschense"* Vved., Flora URSS 4: 268 (1935); Nikitina & Kashtsh., Flora Kirg. SSR 3: 94 (1951); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 50 (1967); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971). Type (?syntypes): Kirgizstan: Montes Alaici: inter Kisyl-Kurgan et Gulcha et inter lacum Kaplan-kul and trajectum [Alai range, between Kisyl-kurgan and Gulcha, and between lake Kaplankul and crossing] Taka, VIII. 1901 et VIII. 1904, leg. O.A. & B.A. Fedtsch. (not found in TASH); a voucher "Mezhdu Gul'shej i Sufi-Kurganym, syuda ... lukovitsy [between Gulcha and Sufikurgan, bulbs came from there] 28.6.1901 leg. O.A. & B.A. Fedtsch. in LE represents probably authentic material and was labeled as "type" by Seisums (in sched., only photo seen). — Type: Ex horti petrop. 85.5 (solely one leaf on the sheet, LE!). Lectotype = epitype: The figure in Gartenflora 34: tab. p. 215 (1885), designated as lectotype by Fritsch (1990: 502-503), designated here as epitype.

Distribution: Kirgizstan, Uzbekistan: Alai mountain range, montane semi-dry slopes with some shrubs, walnut forests.

Description: Bulbs depressed globose, up to 6 cm in diam. and 4 cm long; inner tunics whitish, finely membranaceous, outer tunics pale brown to buff, strong like cardboard, later disintegrating and blackish. Scape straight, terete, glabrous, smooth, 60-120 (150) cm long, near base 1-1.5 (2) cm, above 6-10 mm thick; dull green with waxy bloom, near base maroon suffused. Leaves 3-5, laminae oblong, flat

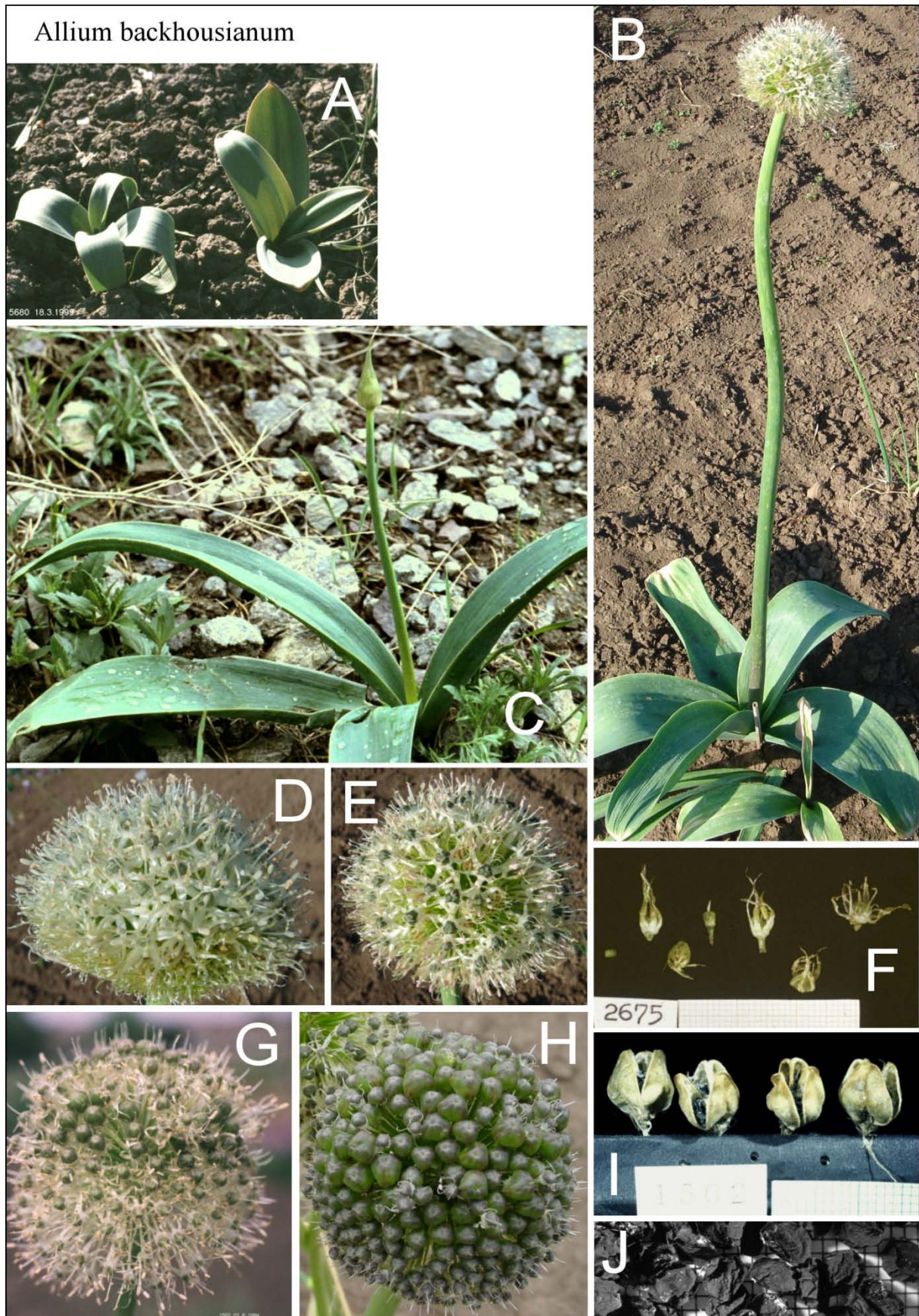


Plate (39): A: Sprouting cultivated plants; B: flowering cultivated plant; C: shooting plant near Tashkura, Kirgizstan; D, E & G: inflorescence in early, full, and late anthesis; F: comparison of flowers and flower parts in different stages of anthesis; H: inflorescence with developing capsules; I: ripe open capsules; J: seeds (millimeter paper as background and measure scale of F, I & J).

recurved, basally strongly above shallowly canaliculate, rather thick; upper side smooth or slightly grooved, lower side with broad shallow ribs; margins narrowly white to purplish, near base scabrous, above glabrous, arcuately tapering in the hooded apex; (15) 25-40 (60) cm long, 3.5-8 (12) cm broad; dull vividly green with waxy bloom, basally  $\pm$  purplish suffused especially on the veins. Sheathy prophyll short, thickish, smooth, pale brownish with scarcely darker nerves; quickly decaying. Spathe membranous, completely divided in 2-3 ovate to long-acuminate valves, as long as the pedicels; pale ochre, veins greenish or brown. Inflorescence initially  $\pm$  ovoid, later subglobose then depressed-globose; very dense and many-flowered; with capsules up to 13 cm in diameter. Pedicels equally long, thickish, strong wiry; initially very short, later up to 3 cm long; semi-glossy yellowish basally greenish. Anthesis in end of May to mid of June. Flowers initially cup-shaped starlike, later irregular. Tepals very narrowly triangular, basally first recurved and soon incurved tapering into a narrow, slightly canaliculate and curled apex, very tender, later completely reflexed; 10-15 (20) mm long, basally 1.5-2 mm broad; milky white, the narrow, greenish median vein better visible at the back side and near the base. Filaments 3/4-4/5 as long as the tepals; basally for c. 1 mm connate and quadratically widened (or all filaments with 2 short teeth) and with longitudinal ledges, above subulate; white. Anthers  $\pm$  oblong; 2.5 mm long, c. 1 mm broad; initially pale reddish-orange, later yellow. Pollen grayish to yellow. Ovary  $\pm$  stipitate, depressed globose triangular, 2-3 mm long, 2.5-3.5 (4) mm in diam.; surface semi-glossy, finely papillose; initially grayish to brownish green, later maroon. Up to 5 ovules per locule, 15 locules per ovary (Filimonova 1970) / 7-8 ovules per locule (Hanelt 1992). Style conical-threadlike, initially 2, later 4 mm long; whitish. Stigma undivided; white. Capsule double conical triangular, surface very finely tuberculate, semi-glossy, up to 12 mm long and 10 mm in diam.; ripe moderately widely open, valves ovate, slightly notched at the apex, surface with raised wrinkles, pale greenish-brown. Seeds 3-5 per locule, flat-drop-shaped, with concave sides and some irregular fields separated by sharp edges; surface papillous, silk-glossy black; 3.5-4 mm long, 2.5-3 mm broad, (the back) 1.5-2 mm thick; TKW 3.83 / 4.32 / 5.00 g (IPK, unpubl. data). The testa showed verrucate periclinal walls with a moderate number of verrucae, and Omega-like undulated anticlinal walls with short wavelengths and rather high amplitudes (Kruse 1994, Abb. 25; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 147, Vakhtina & al. 1977 total length of chromosomes (Kirgizstan: Alai range, Gulcha, no. 208, type location of *A. gulczense* "*A. gultschense*").  $2n = 16$  Pogosian & Seisums 1992 (Kirgizstan: Alai range, Seisums s. n.).  $2n = 16$  Ohri & al. 1998 (Hungary, Tajikistan: Botanical collections Budapest TAX 0616, and Khorog TAX 1502).

**Living accessions studied:** Kirgizstan: Fergan range, slopes along the river Zerger c. 30 km NE Uzgen (40°57' N, 73°32' E, 1450 m, 20.5.1997 Fritsch & Khassanov 1612; GAT) TAX 5680, Zergersaj river, 40 km N Uzgen (1200 m, 03.6.2002 Khassanov 4092; TASH GAT); rock slopes along the road between Aral and Naukat (40°19' N, 72°38' E, 1200 m, 15.5.1992 Fritsch, Khassanov 754; GAT) TAX 3348; Alai range, without exact collection place (1989 Günther, Zündorf, Schnittler 1 & 2; GAT) TAX 2680, TAX 2681; S part of pass Chigirchik along the road from Osh to Gul'cha below vill. Tashkura (40°15' N, 73°23' E, 2000 m, 14.5.1992 Fritsch & Khassanov 735; GAT) TAX 3337.

**Remarks:** *Allium backhousianum* is the type species of section and subsection *Acmopetala*. This species is easily to recognize by long and narrowly triangular, whitish tepals that are reflexed with curled tips in anthesis, and basally widened and connate filaments shorter than the tepals (Fritsch 2012b: 253). The striking general appearance similar to *A. stipitatum*, *A. altissimum*, and *A. giganteum* was already mentioned in the original description, but the offspring assumed there from Himalaya was as wrong as in the case of *A. giganteum*. This geographic error and Regel's none too exact description of tepal shape were perhaps the main reasons that Olga and Boris Fedtschenko described this species again as *A. gulczense*. Unfortunately, the only known original herbarium sheet of *A. backhousianum* contains only one broad glaucous leaf lamina that is insufficient for a doubtless identification of this species, because such a leaf shape is known from several species of *A.* subg. *Melanocrommyum*. Therefore, the detailed figure accompanying the description of *A. backhousianum* was designated as lectotype and is designated here as epitype. A search for original vouchers of *A. gulczense* in the Fedtschenko herbarium in Tashkent (TASH) failed. Vvedensky and other botanists used the incorrect spelling "*gultschense*" in-



stead of "*gulczense*", but the reason for doing so could not be traced. In the molecular dendrograms (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region), *A. backhousianum* belongs to the Alai-Fergan clade of sect. *Acmopetala* and is closely related to *A. aflatunense* s. str., *A. alaicum*, and *A. arkitense* (see the detailed discussion under *A. arkitense*). It shares also the identical *trnL-trnF* haplotypes with *A. aflatunense* s.str. and *A. dodecadontum* (Gurushidze & al. 2010: 836, Fig. 4 lineage III).

**Etymology:** The epithet honors the historical British bulb grower company James Backhouse & Son (York) that sent the first bulb of this species to the Imperial Botanical Garden St. Petersburg.

**Biological data:** Seed germination is better at 5 °C than at temperatures above 10 °C (Specht & Keller 1997). The genome size was reported as 37.8 / 40.6 pg 2C DNA (Ohri & al. 1998) and 44.3 pg 2C DNA (Gurushidze & al. 2012). Miralibekov (1982, as *A. gulczense*) counted 680 [304-1956] seeds per inflorescence under cultivation; the infrutescences were 7.2 cm broad, 6.3 cm long, had 236 flowers (86 % with ovaries) that resulted in 827 seeds (Miralibekov 1984).

**Economic traits:** Rarely offered as ornamental (Fritsch 2015).

**(40) *Allium aflatunense*** B. Fedtsch. in Bull. Herb. Boiss. Ser. 2, 4: 917, pl. 7 post p. 956 (1904), B. Fedtsch. ex O. Fedtsch. in Vestnik Imp. Ross. Obshch. Sadovodstva No. 11-12: 510 (1904), descr. ross., s. str. Vved., Flora URSS 4: 269-270 (1935). ? Pavlov & Polyakov, Fl. Kazakhst. 2: 191 (1958). Nikitina & Kashtsh., Flora Kirg. SSR 3: 94 (1951). Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 52 (1967), p. p.?. Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971). — Non *Allium aflatunense* hortulanorum. **Lectotype:** Ol'gino, cult. 1904 (Lukovitsy is Turkestan [bulbs from Turkestan], 1902 Aflatun) leg. Fedtschenko (LE!), design. Fritsch 1990: 502).

**Distribution:** Uzbekistan, Kirgizstan: Fergan depression and adjacent mountain ranges perhaps to Talas Alatau; the borderline in the North (till Kazakhstan?) and West (really up to Nuratau massif?) remained unclear. Submontane to montane (subalpine?) steppe slopes and broad-leaved forests.

**Description:** Bulbs ovoid (Ruksans!) to subglobose, 3-7 (10) cm in diameter, 4-8 cm long; tunics yellowish to brown, parchment-like, later blackish and disintegrating. Scape straight, terete, smooth; 60-120 cm long, 6-15 (20) mm in diam.; dull green, with light glaucous bloom, basally ± purplish flushed. Leaves 3-6, laminae broadly oblong-lanceolate, rather stiff and straight, near base very thick and canaliculate, upper part thinner, nearly flat, and finally somewhat drooping; glabrous, upper side smooth or later with narrow fine grooves, the lower side with broad and flat ribs; margin near base scabrous above smooth, narrowly whitish, shortly arcuately tapering into the hooded apex; 40-60 (70) cm long, the inner laminae narrower but not shorter, the outer laminae 3-9 cm broad; dark green with strong glaucous bloom, basally maroon flushed. Sheathy prophyll maroon, smooth, strong, short, thick, not persistent. Spathe membranous, completely divided into 2-3(4) ovate, long acuminate valves, mostly shorter than the pedicels; brownish with inconspicuous veins. Inflorescence initially semiglobose finally ± ovoid; very dense, many-flowered; 6-12 cm in diam. Pedicels subequally long, thin wiry, straight; sub-glossy yellowish-brown to maroon with ± red base. Anthesis in May, earlier than *A. stipitatum*. Flowers bowl-shaped to flat starlike. Tepals ovate-lanceolate, concave, with subacute plicate tip, patent, later recurved and crumbled; 9-10 mm long, basally 2-2.5 mm broad; deep pinkish-lilac to pale violet with darker or greenish, slightly keel-like median vein. Filaments initially as long later longer than the tepals; basally for c. 0.5 mm connate and outer filaments slightly, inner filaments broadly triangular widened, sometimes two-toothed, above subulate; basally whitish, above pinkish violet. Anthers linear-oblong; 2-3 mm long, c. 1 mm broad; pale violet. Pollen pale yellowish gray. Ovary stipitate, depressed globose-triangular, c. 3 mm long and 2.5-3 mm in diam.; surface finely but sharply papillous with smooth stalk; green; nectary ducts mound in a slit near the base of ovary. Up to 7 ovules per locule, 19 ovules per ovary (Filimonova 1970). Style conical to thread-like, 4-8 mm long; pale to deep violet. Stigma undivided; white to violet. Capsule blunt double pyramidal with subconcave (near base subconvex) sides,

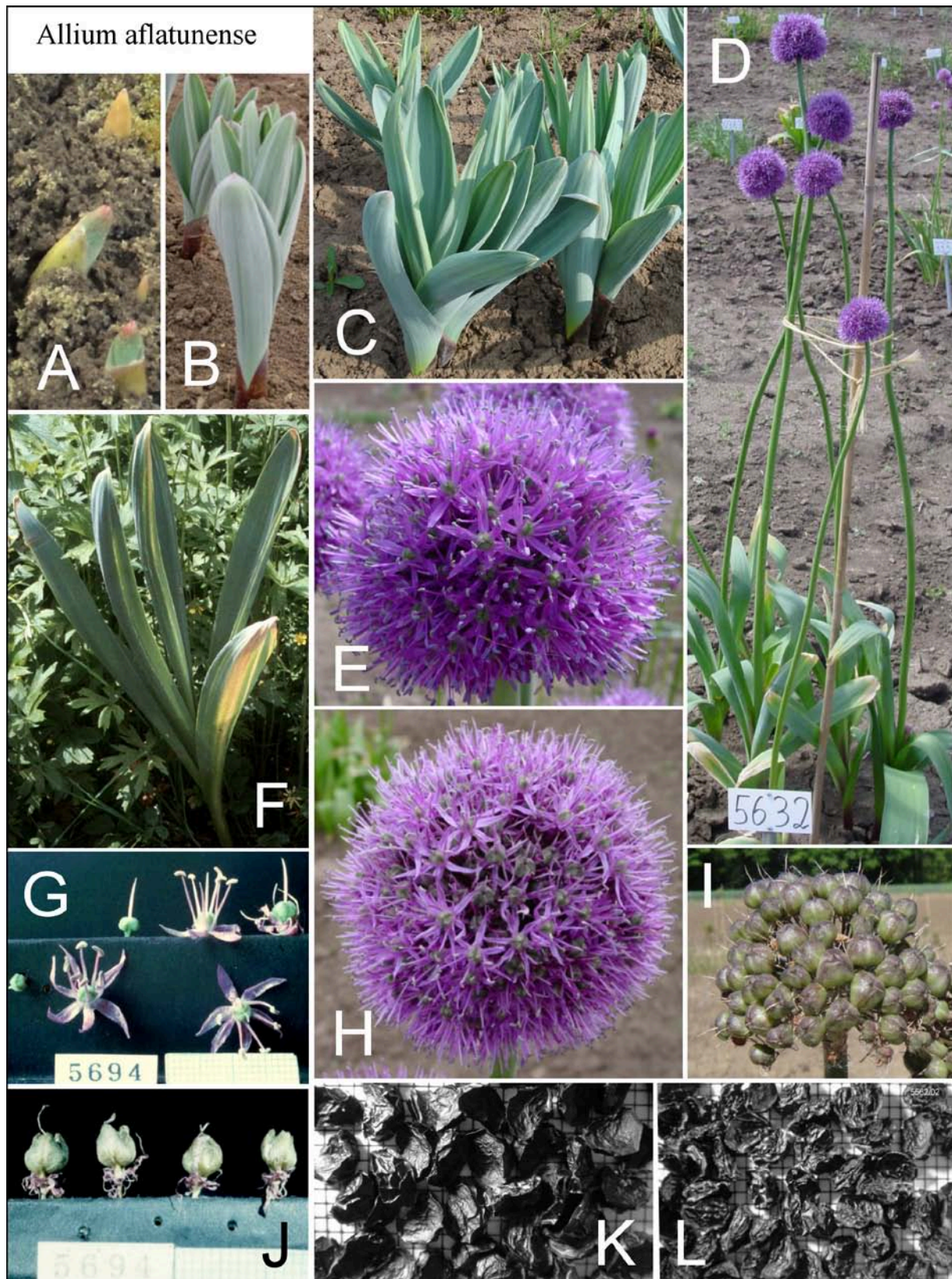


Plate (40): A - C: Sprouting leaves of cultivated plants; D: flowering cultivated plants; E & H: inflorescences in full and late anthesis, resp.; F: vegetative plant in Sarychilek valley, Kirgizstan; G: comparison of flowers and flower parts in different stages of anthesis ; I: inflorescence with full-sized capsules; J: ripe open capsules; K & L: seeds (millimeter paper as background and measure scale of G, J, K, L).

up to 10 mm in diam., 6-8 mm long, in the dry state smaller; widely open, valves suborbicular, surface densely reticulate lacunose; somewhat glossy, initially green or violet flushed, finally yellowish-brown.

Seeds 2-3(4) per locule, broadly ovate with rather sharp edges; surface finely reticulate lacunose, dull black; 3-3.5 mm long, 2.5-3 mm broad, 2-2.5 mm thick; TKW 6.3 g (IPK, unpubl. data). The testa showed strongly verrucate periclinal walls and transitions from S-like to Omega-like undulated anticlinal walls with moderate to short wavelengths (Fritsch & al. 2006 Fig. 11).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a (Uzbekistan: Nuratau ridge).  $2n = 16$  Vakhtina 1969 p. 148 (Kirgizstan?: Tianshan range, Baubashata Mts., no. 362).  $2n = 16$  Zakirova & Vakhtina 1974 (source not mentioned).  $n = 8$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection BIN)  $2n = 16$  Komissarov & Tarasova 1979 p. 189 (Russia: Botanical collection VIR k-2056).  $2n = 16$  Pogosian & Seisums 1992 (Kirgizstan: Chatkal range, lake Sary-Chelek, Seisums s. n.).  $2n = 16$  Ohri & al. 1998 (Russia: Botanical collection BIN, TAX 1211).

**Living accessions studied:** **Kirgizstan:** Central Tianshan range, valley Kokomeren forest community (2400 m, leg. S. Zonshtain s. n. via Khassanov; GAT) TAX 5632; Chatkal range, Sarychilek valley, slopes NE vill. Arkit (41°50' N, 71°58' E, 1300 m, 29.5.1997 Fritsch 1627; GAT) TAX 5694. **Kazakhstan:** Collection site unknown, from the *Allium* collection of Kamenetskaya, Burundai near Alma-Ata (15.6.1990 via Fritsch 641; GAT) TAX 2977. Determination unsure: **Turkmenistan:** Kopetdag, Chuli c. 30 km W Ashgabat (37°58' N, 58°01' E, c. 700 m, 03.4.2002 Fritsch, Keusgen, Khassanov 5; ASH GAT) TAX 5916. **Kazakhstan:** Karatau range, Kindyktas Mts., pass Kurdai, slopes (1986 via Botanic Garden Acad. Alma-Ata s. n.; GAT) TAX 2726, western border of pass area (43°21' N, 75°00' E, 800 m, 31.5.1993 Fritsch 941; GAT) TAX 3692.

**Remarks:** Though similar to *A. stipitatum* in general appearance, *A. aflatunense* differs by a generally stouter stature, lower scapes, basally coarse and above smooth leaf margins, an earlier anthesis, a much denser umbel, and broader tepals (Fritsch 2008: 69; Fritsch 2012b: 253, Fig. 46). However, molecular data (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) deny any genetic relationship to sect. *Procerallium* but support close genetic relations to the Alai-Fergan clade of sect. *Acmopetala* (Fritsch & al. 2010: 174 cluster 6 § 3.8.1.; Gurushidze & al. 2010: 836, lineage III; Fritsch 2012b: 252-253 Fig. 4 Q). Unfortunately, tall forms of *A. stipitatum* having ± smooth leaves, very long scapes, and starting anthesis about 3 weeks later than typical *A. stipitatum* were also distributed under the name *A. aflatunense* by the bulb trade and from European Botanical gardens. They do not differ molecularly from typical *A. stipitatum* (Fritsch 2012b: 257, Fig. 6 position Z2 "af\_st"). *Allium aflatunense* cultivars as sold by bulb growers and garden shops turned out to belong to *A. hollandicum* R.M. Fritsch, a species closely related to NW Iranian members of sect. *Procerallium* (Fritsch & al. 2010: 197 cluster 7 § 3.9.10; Fritsch & Abbasi 2013: 160, 202).

**Etymology:** The epithet is most probably derived from the collection site of the type plants, the pass Aflatun of the Chatkal mountain range (Kirgizstan). Derivation from the Greek language meaning "without odor" seems much less probable.

**Biological data:** Seeds germinate very well at temperature of 5 °C but badly over 10 °C (Specht & Keller 1997), also Nikolaeva & al. (1985) recommended 5 °C or 10 °C as condition for good germination. The subterranean plant parts contain 36 % glucose, fructose, saccharose, oligosaccharides, and glucofructans (Khodzhaeva & Ismailov 1979), the supraterranean parts flavonoids and phenolcarbon acids and their compounds (Sokolov 1994). Bulbs reach up to 200 g weight, the plants develop often 2 daughter bulbs per year; basally the laminae may compose a short pseudo-stem (Yur'eva & Kokoreva 1992). The genome size of three accessions was 44 pg 2C DNA identical to that of *A. stipitatum* s. str. (Gurushidze & al. 2012). Fresh bulbs contain in total 0.61 % cysteine sulfoxides (90 % methiin, 10 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008).

**Economic traits:** The bulbs are eaten as vegetable and also used for making glue (Sokolov 1994); they contain 36 % polysaccharids in the air dry mass (Khodzhaeva & Ismailov 1979, see Dejneco 1985). Much mentioned as ornamental in Europe, but most traded strains belong to *A. hollandicum* or *A. stipitatum*, only very rarely the true species is sold (Fritsch 2015). Local name "anzur pijoz". Belongs to the most important edible species in the Uzbek mountains (Khassanov 2008). Unripe, still developing bulbs are eaten as vegetable (Khassanov & Umarov 1989, Sokolov 1994).

(41) *Allium alaicum* Vved. in Byull. sredneaz. gozud. univ. 19: 130 (1934). Vved., Flora URSS 4: 267, tab. 15 fig. 1, 1a (1935). Nikitina & Kashtsh., Flora Kirg. SSR 3: 93-94 (1951); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 51 (1967). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 (1971). — Non *Allium alaicum* sensu Pavlov & Polyakov, Fl. Kazakhst. 2: 190, tab. 14/8 (1958). — Type: Kirgizstan: prov. Fergana, distr. Osch, pr. [near] Gulcza, 01.6.1900, leg. W. Tranzschel s. n. (holotype BM!, topotype LE!; lectotypification by Fritsch 1990: 502 is invalid, see Khassanov & Fritsch 1994: 983).

Distribution: Kirgizstan, Uzbekistan?; northern foothills of Alai mountain range, lower montane dry grassy slopes, among shrubs.

Description: Bulbs ovoid to globose, 10-15 mm in diam.; tunics blackish-grey, papery, longitudinally splitting, extending in a short neck. Scape straight, terete, basal part shallowly ribbed and bearing some long, backwards directed hairs, above nearly smooth and glabrous; 30-70 cm long, c. 5-6 mm in diam.; green. Leaves (1) 2, laminae linear-lanceolate, arcuately ascending and recurved to the soil; upper and lower side  $\pm$  densely covered with long backwards directed hairs; gradually tapering into the apex; 15-

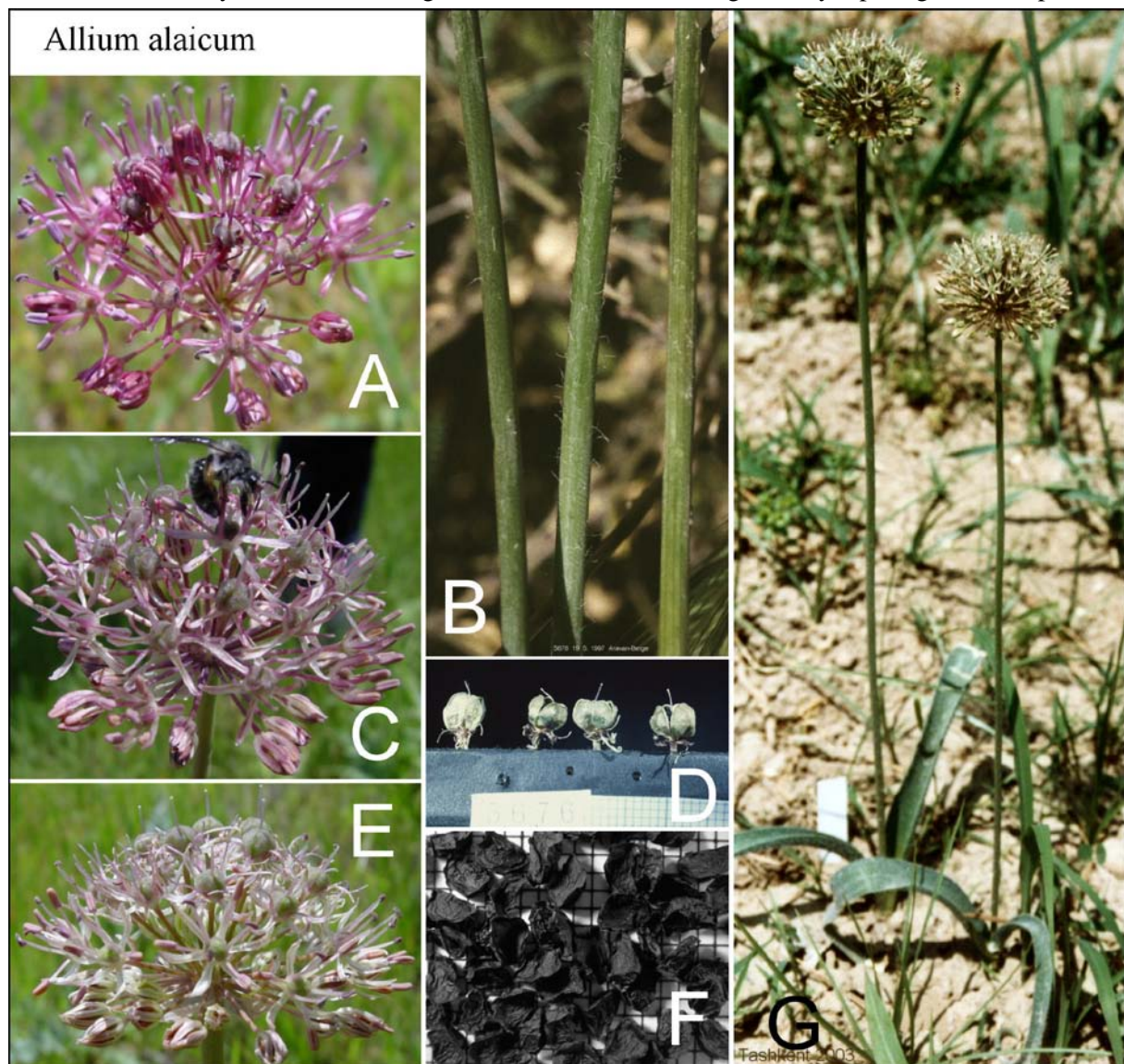


Plate (41): A, C & E: Inflorescences in anthesis; B: indumentum of scapes; D: ripe open capsules; F: seeds; G: flowering cultivated plants in Tashkent, Uzbekistan (millimeter paper as background and measure scale of D & F).

30 cm long, 5-20 mm broad; deep green. Sheathy prophyll short, membranous, green to brownish, quickly decaying. Spathe membranous, divided in 2-3 broadly triangular, very shortly tipped valves, patent, about as half as long as the pedicels; pale brownish with  $\pm$  purplish veins. Anthesis in May. Inflorescence broadly fasciculate to semi-globose rarely subglobose; rather loose, few- to many-flowered; 4-6 cm in

diameter. Pedicels equally long, straight, coarse; c. 15-20 mm long; greenish-brown. Flowers bowl-shaped starlike. Tepals linear-lanceolate, obtuse, patent, after anthesis reflexed and curled; 6 mm long, c. 1 mm broad; rose to pale violet with darker median vein. Filaments often somewhat longer than the tepals, straight; only at the very base connate, basally shortly widened (inner filaments much broader), above subulate; pale to deep pink. Anthers oblong; ca. 2 mm long and 0.8 mm in diam.; yellow with violet flush. Pollen yellowish gray. Ovary substipitate, depressed globose triangular, c. 2 mm long and in diameter; surface finely papillous, grayish green with deep green sutures; many ovules per locule. Style conical-filiform, up to 7 mm long; white, finally somewhat pinkish. Stigma undivided; white. Capsule ovoid-globose to depressed-globose, surface densely papillous, c. 3-5 mm long and 4 mm in diameter; green with purplish flush, ripe brownish? Seeds 1-2 per locule, flat triangular to drop-shaped; surface with a moderately prominent, irregularly reticulate network of raised wrinkles; 2.5-3 mm long, 1.7-2.3 mm broad and c. 1 mm thick. The testa showed generally verrucate periclinal walls with a moderate number of verrucae and Omega-like undulated anticlinal walls combining short wavelengths with rather high amplitudes (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Fritsch (see karyolog. appendix, TAX 5676, Kirgizstan: Aravan).

Living accessions studied: Kirgizstan/Uzbekistan: Alai range, Aravan mountains between Osh and Aravan (40° 31'44" N, 72°34'31" E, 1150 m, 19.5.1997 Fritsch & Khassanov 1607, re-visited 21.5.2003 Fritsch, Keusgen, Khassanov 4125; GAT TASH) TAX 5676.

Remarks: The stature of this species is somewhat similar to small plants of *A. jesdianum* subsp. *angustitepalum*, but it differs by having only 1 or 2 leaves, a moderately dense indumentum of long and often curled hairs at leaves and the basal part of the scape, and by an only ± semi-globose inflorescence with fewer flowers bearing narrower, pale pinkish-violet tepals. Molecular data (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) supports another relationship as sister group of *A. backhousianum* of the Alai-Fergan clade of sect. *Acmopetala* with a close genetic relationship to *A. af-latunese* s. str. and *A. arkitense*, and not to the alliances of *A. jesdianum* or *A. stipitatum* that belong to sect. *Procerallium* (Fritsch & al. 2010: 174 cluster 6 § 3.8.1; Gurushidze & al. 2010: 836 lineage III; Fritsch 2012b: 253, Fig. 4 Q).

Etymology: The epithet refers most probably to the Alai mountain range where the type plants were collected.

Biological data: Bulb extract showed a very high radical scavenger activity (Jedelska & al. 2004, Jedelská & Keusgen 2008). Fresh bulbs contain in total 0.12 % cysteine sulfoxides (87 % methiin, 13 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008).

Economic traits: Ornamental plant listed in the "International Checklist ..." of the Royal General Bulb-growers Association (1991), but very rarely offered by bulb growers (Fritsch 2015). Fodder plant for sheep and goats (Keusgen & Fritsch 2008).

(42) *Allium arkitense* R.M. Fritsch in Stapfia 80: 385, plate 2A, 2B (2002). — Type: Ex culturae in horto Gaterslebensis no. TAX 5692, leg. 12.5.2000 (Ex Kirgizstan: Chatkal-Gebirge, Sarychilek-Tal bei Arkit, krautreiche SO-exponierte Hänge (cultivated in Gatersleben ... Chatkal range, valley Sarychilek near village Arkit, SE exposed slopes with many perennials) ca. 1300 - 1500 m NN, coll. 28.5.1997 Fritsch 1625; holotype GAT!).

Distribution: Kirgizstan: Chatkal range, submontane grassy-shrubby slopes. Known only from the type location.

Description: Bulbs ± depressed-ovoid, 15-20 mm long, 12-20 mm in diam.; outer tunics strong papery, whitish, later brownish-black and disintegrating. Scape straight, terete, smooth; 40-60 (90) cm long, 4-6 mm in diam.; dull green. Leaves 1-2 (3), linear-lanceolate, rather straight to obliquely sideways curved, broadly canaliculate, thickish; upper side smooth, lower side with broad narrow ribs; margins narrowly white, densely scabrous, suddenly tapering in a strongly hooded apex; (12) 20-40 cm long, 15-

25 mm broad; grayish green with strong glaucous bloom. Sheathy prophyll greenish, smooth, quickly decaying. Spathe membranous, divided in two ovate, gradually acuminate, patent valves, 1/3 shorter than the pedicels; brownish with darker veins. Inflorescence initially semi-globose later depressed-globose; rather dense, moderately many-flowered; 4-7 cm in diameter. Pedicels subequally long, straight, wiry; glossy brownish-green. Anthesis in May. Flowers bowl-shaped starlike. Tepals narrowly lanceolate-triangular with obtuse apex, canaliculate, initially patent later somewhat recurved; 5-6 mm long and c. 1 mm wide; pinkish-carmine with inconspicuous median vein. Filaments somewhat longer than the tepals; basally free and shortly triangularly widened, above subulate; pinkish-carmine with whitish base. Anthers oblong; c. 2 mm long, 0.8 mm broad; grayish-violet. Pollen yellowish gray. Ovary shortly stalked, slightly depressed-globose, triangular, 2.5-3 mm long and 2-3 mm in diameter; surface papillose; dull green with violet flush. Style narrowly conical, 4-6 mm long; whitish to pinkish-carmine. Stigma undivided and not thickened; whitish. Capsule broadly spindle-shaped, 3-4 mm long and in diameter. Seeds flat triangularly drop-shaped; surface finely rugose with irregular network of sharp ledges, silk-glossy black; 3-3.5 mm long, 1.8-2.5 mm broad, c. 1.5 mm thick. The testa showed verrucate periclinal walls with a moderate number of verrucae, the Omega-like undulated anticlinal walls combined short wavelengths with rather high amplitudes (Fritsch & al. 2006).

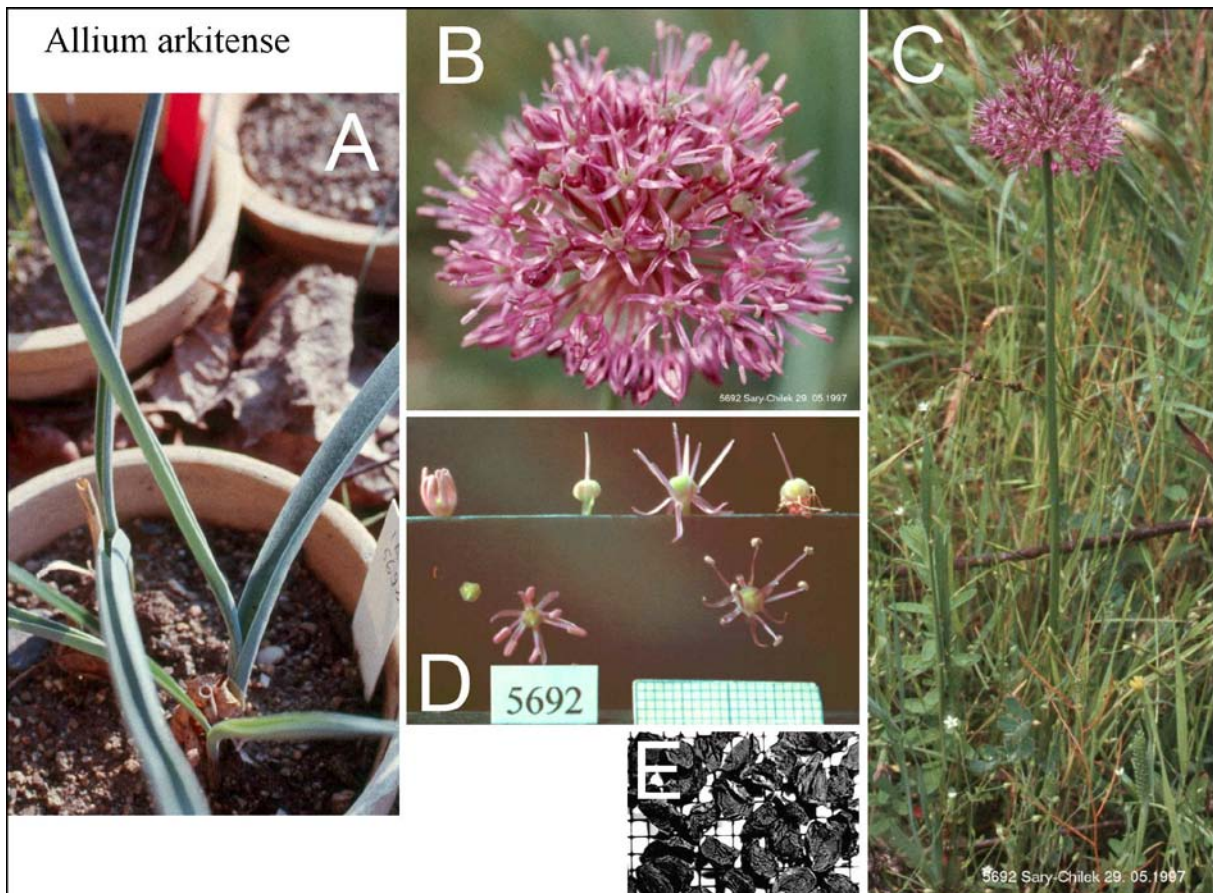


Plate (42): A: Sprouting leaves of cultivated plants; B: inflorescence in full anthesis; C: flowering plants at the type location near Sary-Chilek, Kirgizstan; D: comparison of flowers and flower parts in different stages of anthesis; E: seeds (millimeter paper as background and measure scale of D & E; B & C copied from Fritsch & al. 2002: 385, plate 2A, 2B).

Living accessions studied: Kirgizstan: Chatkal range, Sarychilek valley NE vill. Arkit (type location, 41°50' N, 71°58' E, 1400 m, 13.5.1997 Fritsch & Khassanov 1625; GAT) TAX 5692.

**Remarks:** This species differs from *A. alaicum* by glabrous leaves and scapes and purplish flowers, and from *A. zergericum* by the shorter scape and a different flower color. These three species form a group of moderately tall but slender species known from the mountains east of the Fergan depression. They share rather narrow, glaucous leaves, narrowly lanceolate, relatively long tepals, and semi-globose to

depressed-globose, rather dense inflorescences. They are only known from very restricted areas, and more studies about their variability as well as their relations to other taxa would be highly welcome. According to molecular data (ITS sequences of nuclear rDNA), *A. alaicum*, *A. arkitense* and *A. aflatunense* s. str. belong to the Alai-Fergan clade of sect. *Acmopetala*. They are the sister group of *A. backhousianum* (Fritsch & al. 2010: 191 cluster 6 § 3.8.1; Fritsch 2012b: 252-253 Fig. 4 Q; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201) with *A. dodecadontum* and *A. schachimardanicum* as less close relatives. The relationship to the western Tianshan clade of sect. *Acmopetala*, that form another clade with *A. karataviense* as basal member (Fritsch & al. 2010: §§ 3.7.3, 3.7.4, 3.7.5; Fritsch 2012b: 250 Fig. 3 I-M; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201), is not resolved.

**Etymology:** The epithet refers to the village Arkit in the Chatkal mountain range in Kirgizstan located near the type location.

**(43) *Allium bekeczalicum*** Lazkov in Bot. Zhurn. (Moscow & Leningrad) 93 (8): 1272, tabl. I, II, III (2008). — **Type:** Ex cultis in horto botanico Academiae Nationalis Scientiarum Kirghisicae enatis, 19.5.2006 leg. G.A. Lazkov (E bulbus a G.A. Lazkov in Jugum Ferganicum angustis fl. [cultivated in the Bot. Garden of the National Academy of Sciences of Kirgizstan ... from bulbs collected by G.A. Lazkov in the Fergan range, gorge of river] Bekeczal, 09.6.2005 lectis (holotype LE, isotype FRU; not seen).

**Distribution:** Kirgizstan: Fergan range, gorge of Bekechal river, only known from the type location.

**Description:** Bulbs solitary, ovoid, 1.5 cm wide; tunics papery, grey. Scape ribbed; 40-60 cm high, near base 3 mm in diam. and covered by leaf sheathes. Leaves single, linear-lanceolate; plane, glabrous; 25 cm long, 1.5 cm wide. Spathe scarious, shortly rostrate, half as long as the pedicels. Inflorescence subglobose, dense, multiflorous. Pedicels glabrous; 0.8-1.2 cm long. Anthesis in May. Flowers starlike. Tepals linear-lanceolate, after anthesis crumpled and reflexed; 6.5 mm long; pinkish-violet with green median vein. Filaments as long as the tepals; basally not united and ovate (inner filaments 1.5-2 times wider than outer ones), subulate above, without teeth. Ovary on 1 mm long stalk; surface scabrous; with many ovules.

**Remarks:** According to the original description, *A. bekeczalicum* differs from *A. fetisowii* by the single leaf and filaments without basal teeth, and from *A. schachimardanicum* by filaments basally not united and without teeth. Material of this species was not available for morphological and molecular analyses hitherto. It should molecularly be tested whether this taxon is related to *A. fetisowii*, then it would belong to sect. *Longibidentata*, or alternatively to the Alai-Fergan clade of sect. *Acmopetala*. In the latter case *A. bekeczalicum* could be merely an one-leafed variant of *A. arkitense*.

**Etymology:** The epithet refers most probably to the type location in the gorge of river Bekechal in the Fergan range in Kirgizstan.

**(44) *Allium dasyphyllum*** Vved. in Byull. Sredneaz. Univ. 9, pril.: 6 (1925). Vved., Flora URSS 4: 264 (1935). Nikitina & Kashtsh., Flora Kirg. SSR 3: 93 (1951); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 51 (1967). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 83 (1971). — ? *Allium alaicum* sensu Pavlov & Polyakov, Fl. Kazakhst. 2: 190, tab. 14/8 (1958). — **Lectotype:** Kazakhstan: [Herbarium Florae Asiae Mediae ... 57. *Allium dasyphyllum* Vved. sp. n.] Prov. Syr-Darja, distr. Aulie-ata, Montes Alexandri in tesquis subalpinis saxosis prope Utsch-bulak [Alexander Mts., in subalpine stony steppe near Uch-Bulak]; 8.7.1924, leg. Mokeeva & Popov (the very right plant, TASH!; designated by Fritsch & al. 2010: 203, isolectotype B!).

**Distribution:** Kirgizstan, Kazakhstan: W Tianshan mountain ranges: submontane rocky and stony slopes of the western foothills of Kirgiz Alatau; perhaps also on clayey semi-desert soils in SW Karatau range.

**Description:** Bulbs ovoid to subglobose, 1-2 cm long, 7-13 mm in diam.; inner tunics finely papery,

white, outer tunics strong papery, grey, finally disintegrating and blackish. Scape straight or flexuous, terete, basally with distinct and hairy ribs or with  $\pm$  backwards directed papillae, above subglabrous and smooth; 15-35 (50) cm long, above 3 mm, basally 4-5 mm in diam.; grayish green. Leaves 1-3, laminae narrowly linear-lanceolate, longitudinally folded, thick; upper side with 6-8 ribs and  $\pm$  densely covered by long, backwards directed papillae and fine hairs, lower side with narrow long-haired ribs; margins densely ciliate, long tapering into the hooded apex; 12-18 cm long, 4-8 mm broad; green with glaucous bloom. Sheathy prophyll very short, scabrous; green. Spathe membranous,  $\pm$  completely divided in very shortly acuminate valves, much shorter than the pedicels; buff with darker veins. Inflorescence initially subglobose later  $\pm$  flat semi-globose; dense later looser, moderately many-flowered; up to 5 cm in diam. and 4 cm long. Pedicels subequally long,  $\pm$  thin wiry, straight; dull green. Anthesis in mid of June. Flowers cup-shaped starlike. Tepals linear-oblong, the subobtuse apex claw-like and concave, patent and incurved, later reflexed and tortuous; c. 5 mm long, 1.2 mm broad; crème, later greenish, with green, basally fading (in herbarium brown) median vein. Filaments 1/4-1/3 longer than the tepals; basally for c. 0.3 mm connate, outer filaments long triangular and inner filaments shortly rectangular widened or with two obtuse teeth, above subulate; crème. Anthers oblong; 1.7-2 mm long and 0.8-1 mm broad; brown. Pollen pale greenish-yellow. Ovary shortly stipitate,  $\pm$  depressed-globose triangular, 1.5-2 mm long, 2-3 mm in diam.; surface finely acutish papillous; grayish green, sutures reddish flushed; 3-4 ovules per locule. Style conical-threadlike, 3-6 mm long, longer than the filaments; crème, finally reddish. Stigma undivided; whitish. Capsule depressed-globose tripartite; valves suborbiculate with notched apex. Seeds flat triangular to semi-circular with  $\pm$  sharp edges; surface papillous, one side concave, the other side with reticulate raised wrinkles, silk-glossy black; c. 2.5 mm long, 1.5 mm broad and thick. The testa showed verrucate periclinal walls with a moderate number of verrucae, and Omega-like undulated anticlinal walls with moderate wavelengths and low amplitudes (Fritsch & al. 2006).

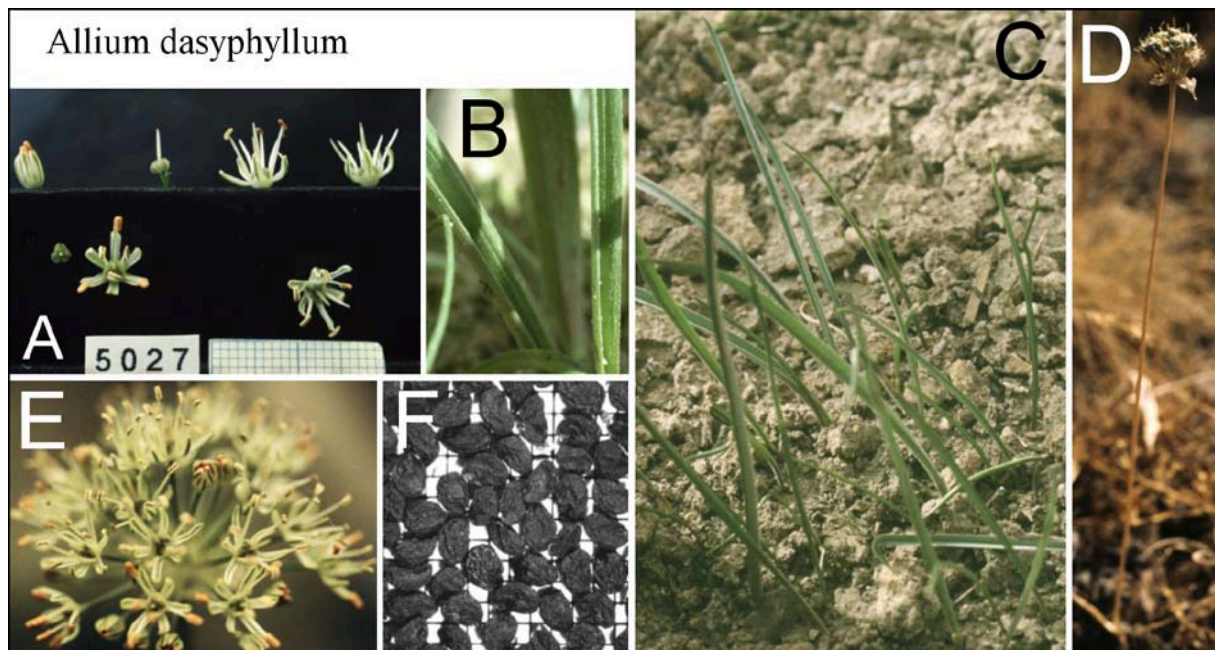


Plate (44): Cultivated plants (except D) from the type location. A: comparison of flowers and flower parts in different stages of anthesis; B: leaf parts showing the short-hairy indumentum; C: sprouting leaves; D: scape and inflorescence with full-sized capsules in Uch-Bulak, Kirgizstan; E: inflorescence in full anthesis; F: seeds (millimeter paper as background and measure scale of A & F).

**Chromosomes:**  $2n = 16+0-1B$  Pogosian & Seisums 1992 (Kirgizstan: W Kirgiz. Alatau range, Kara-archa, Kamelin & al. 432).  $2n = 16$  Fritsch unpublished (Kirgizstan: Kirgiz. Alatau range, Uch-Bulak TAX 5027, type location).

**Living accessions studied:** Kirgizstan: N slopes of Kirgiz Alatau range c. 20 km E Jambul, S exposed slopes near Uch-Bulak (type location, 42°53' N, 71°35' E, 1350 m, 01.7.1994 Fritsch, Khassanov, Pistrick 1187; GAT) TAX 5027.



**Remarks:** *Allium dasyphyllum* is a rather inconspicuous and moderately small species characterized by a densely ribbed and densely hairy scape, narrow hairy leaves, and yellowish flowers. Molecular markers (ITS sequences of nuclear rDNA) did not confirm any relationship to *A. fetisowii* as proposed in the original description and by Kamelin (1976a), but jointly with *A. vvedenskyanum* it constitutes a well separated subgroup with unresolved closer relationship to *A. tschimganicum*, the western Tianshan geographical clade of sect. *Acmopetala*, and *A. karataviense* as basal group. Perhaps *A. dasyphyllum* and *A. vvedenskyanum* represent one or two extra subsection(s) if addition of more material will confirm this position (Fritsch & al. 2010: 189 cluster 5 § 3.7.3; Fritsch 2012b: 250, 251 Fig. 3 J; Gushidze & Blattner in Fritsch & Abbasi 2013: 201).

Hitherto *Allium dasyphyllum* was only collected at the type location. Occurrence in the southwestern Karatau range (though assumed by Pavlov & Polyakov [1958] to be *A. alaicum*) seems possible but no vouchers could be seen (see below).

**Etymology:** The epithet refers most probably to the hairy leaves and scapes of this species (from Greek "with hairy leaf").

**Biological data:** Fresh bulbs contain in total 0.003 % cysteine sulfoxides (only methiin; Fritsch & Keusen 2006).

**Economic traits:** Bulbs are extremely rich in saponins with poisonous effect to livestock (as *A. alaicum*, taxonomic identity remained unclear; Pavlov & Polyakov 1958: 191; Tabl. 14 fig. 8 may indeed represent *A. alaicum* and not the voucher "sent to Alma-Ata"). Very rarely offered as inconspicuous ornamental (Fritsch 2015).

**(45) *Allium kurdaicum*** Bajtenov in Izv. NAN Resp. Kazakhstana, Ser. biol. No. 6: 81 (1996?, Kew recd. Sept. 1997). — **Type:** Tian-Schan septentrionale, Zailijskii Alatau, montes Kurdai, locus [northern Tianshan range, Transili Alatau, Kurdai Mts., place] Uriukti, 02.6.1981 leg. M. Bajtenov (holotype AA?, not seen).

**Distribution:** Kazakhstan: NW Tianshan mountain range, submontane slopes of Kurdai mountains with shallow soil. Only known from the type location.

**Description:** Bulbs single, globose, 1.5-2.5 cm thick; tunics papery, gray. Scape 80-100 cm long, thickened, near the base covered by leaf sheathes. Leaves 2-3, laminae linear, flat; shorter than the scape, 1-3 cm broad. Spathe half as long as the inflorescence. Inflorescence globose; dense, many-flowered. Pedicels equally long; 3-5 times longer than the tepals; violet. Flowers starlike. Tepals linear-lanceolate, finally flaccid / reflexed; 5 mm long; pinkish-violet or dark purple with darker median vein. Filaments as long as the tepals; basally connate with the tepals and slightly higher among themselves, from triangular base (inner filaments 1.5-2 times broader) gradually narrowed. Style exerted. Capsule shortly stipitate, obovate-globose. Seeds broadly ovate; in the upper part lacunose-grooved, black; 2 mm long.

**Remarks:** A very uncertain species: No taxonomic affiliation was given, no figures accompanied the description, Latin and Russian descriptions differ in several characters, and the type specimen was not available for loan. According to the description, it differs from *A. sewerzowii* by stipitate, obovoid-rotundate capsules and (not further specified) seed characters. It could be related to *A. sewerzowii*, but the presence of above-soil leaf sheathes nurses the guess that *A. kurdaicum* might alternatively belong to subg. *Allium*.

**Etymology:** The epithet refers most probably to the Kurdai mountains (W end of Zaili mountain range in Kazakhstan) where the type was collected.

(46) *Allium pangasicum* Turak. in Dokl. Akad. nauk Tadzh. SSR 29, 3: 181 (1986). Fritsch, Flora Tadzh. SSR 10: 499 (1991). — *Allium dodecadontum* sensu R.M. Fritsch, Flora Tadzh. SSR 10: 499 (1991). — Type: N Tajikistan, Kuraminskij khrebet, verkhov'ya saya Zardvod, levij pritok Pangaz-saya, pod kustarnikami [Kurama ridge, heights of Zardvodsai, left tributary of Pangazsai, under shrubs]; 2010 m, 09.6.1984, leg. I. Turakulov (holotype TAD!, isotype TASH!).

Distribution: Tajikistan, Kirgizstan: W Tianshan mountain range, Kurama ridge up to its union with Chatkal range (Lazkov & Turdumatova 2010), montane shrub associations and in the shadow of rocks.

Description: Bulbs ovoid to depressed-globose with flat, pale yellowish-brown side-bulbs, 8-15 mm long, 7-15 (25) mm in diam.; outer tunics papery, grayish-yellow, old blackish with prominent veins. Scape ± straight, terete, basally slightly ribbed above smooth; 30-45 (65) cm long, 4-7 mm in diam.; green, base (rarely also tip) maroon suffused. Leaves (1) 2-3, laminae linear-lanceolate, ± stiff ascending with descending upper part, flat canaliculate, ± thickish; upper side smooth, lower side with broad ribs, margin very narrowly reddish, basally toothed, glabrescent in the upper part, quickly tapering into the hooded apex; (10) 14-18 (30) cm long, (3) 8-18 (25) mm broad; dark green with ± strong glaucous

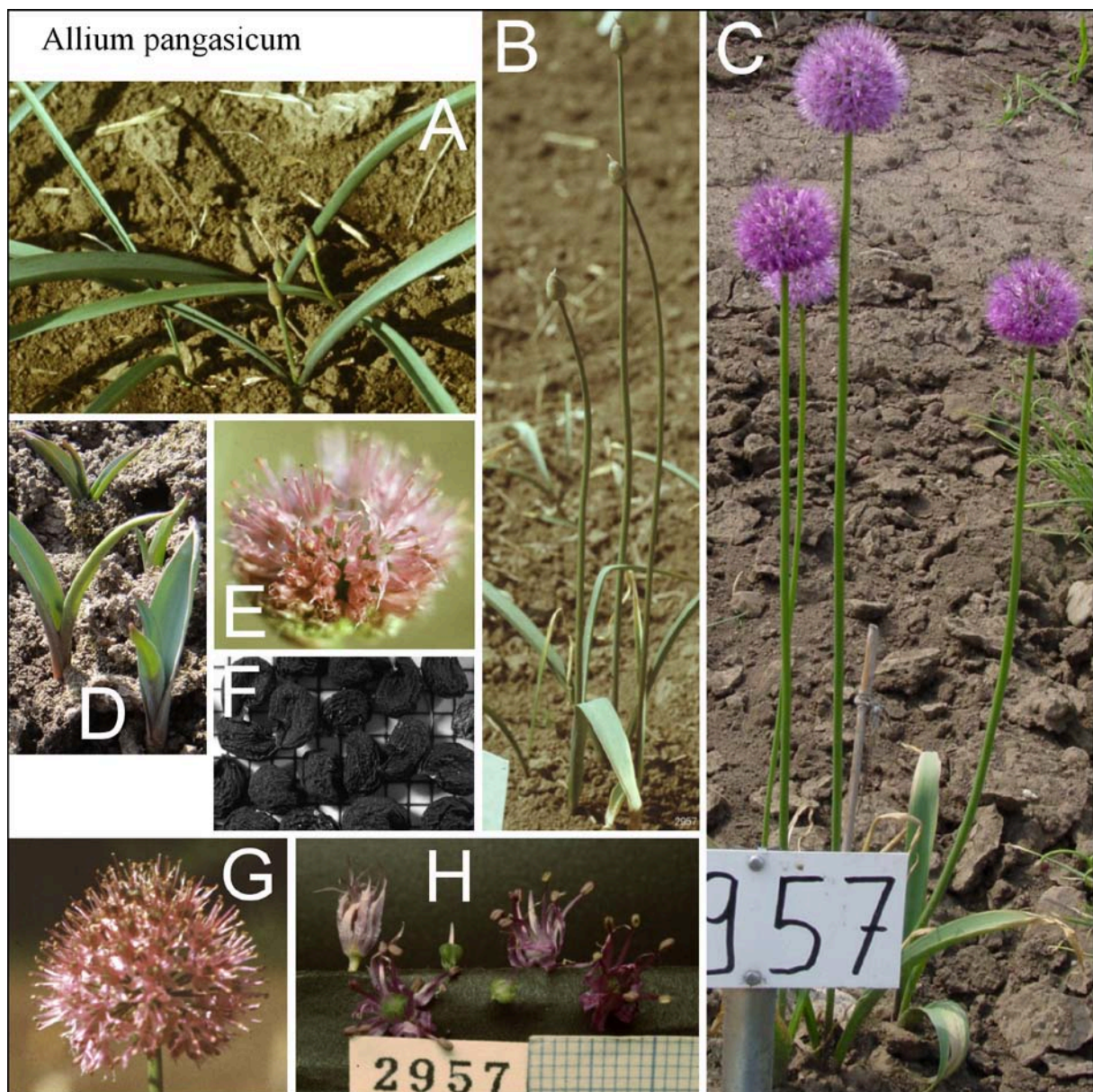


Plate (46): Cultivated plants are shown. A & B: Plants in early and late shooting stage, resp.; C: flowering plants; D: sprouting leaves; E & G: inflorescences in early and late anthesis, resp.; F: seeds; H: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as background and measure scale of F & H).

bloom, basally the lower side with maroon ribs. Sheathy prophyll short, membranous, red or translucent, only visible during sprouting. Spathe membranous, divided in mostly 2 ovate-triangular, long cuspidate valves, shorter than the pedicels; brownish with darker veins. Inflorescence initially (and in the fruiting stage) semi-globose, later subglobose; dense, many-flowered; 3-5 cm in diam., up to 3 cm long. Pedicels subequally long (central pedicels are finally the longest), thickish, wiry; up to 2 cm long; glossy green, below the flower purplish flushed. Anthesis in May. Flowers bowl-shaped starlike. Tepals  $\pm$  ovate-lanceolate, arcuately ascending, margins in the middle somewhat toothed, long acuminate, later reflexed and enrolled; 7-9 mm long, basally 1.5-2 mm broad; bright pinkish-violet, the inconspicuous median vein fades towards the tip. Filaments initially slightly shorter finally slightly longer than the tepals; basally free, outer filaments subulate, inner filaments basally widened and with 2 triangular to threadlike, ciliate, along the margin toothed teeth; initially only basally, later completely violet flushed. Anthers ovoid-oblong; c. 1.5 mm long, 1 mm broad; grayish-violet. Pollen yellowish-gray. Ovary stipitate, triangular clubshaped, 2.5-3.5 mm long, 2-3 mm in diam.; surface finely papillous with bumps near the apex; semi-glossy gray-green. 2 ovules per locule. Style conical-threadlike, (3) 4-7 mm long; whitish later violet. Stigma undivided; whitish. Capsule triangular depressed-globose, subsessile, surface scabrously papillous with many cross wrinkles, 4-5 mm long, 5-6 mm in diam.; valves broadly ovate-cordate with deeply notched apex. Seeds 2-3 per locule, flat drop-shaped; surface finely papillous with longitudinal, raised wrinkles, silk-glossy black; 2.5-3 mm long, c. 1.5 mm broad, 1.2-1.5 mm thick. The testa showed periclinal walls with a moderate number of verrucae and Omega-like undulated anticlinal walls (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Astanova 1990 (Tajikistan: Kurama ridge).

Living accessions studied: Tajikistan: Kurama ridge, valley of Oshoba creek above vill. Shivar (40°45' N, 70°26' E, 1900 m, 30.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 566; GAT) TAX 2957.

Remarks: This taxon looks similar to *A. tschimganicum* and *A. dodecadontum* and occupies an intermediate position between them having short (but brown) sheathy prophylls and only the inner filament bases with teeth like the first mentioned species, but the filament teeth are ciliate like in *A. dodecadontum*. However, the only accessions cultivated in Gatersleben had not subciliate but sparsely long-dentate tepal margins. Investigation of more accessions would be essential to verify the key characters and the taxonomic affiliation using molecular markers.

Etymology: The epithet refers certainly to the Pangaz river valley (Kurama ridge in Tajikistan) closely located to the type location.

Biological data: Seed germination at 5°C was much better than at temperatures above 10°C (Specht & Keller 1997).

Economic traits: The green plant parts are eaten in Tajikistan (the report as "*A. fetissovi*" belongs most probably to this species; Anonymous 1985).

**(47) *Allium schachimardanicum*** Vved., *Opred. rast. Srednej Azii* 2: 84, 317 (1971). — *Allium "fetissovi"* sensu Vved., *Flora URSS* 4: 263 (1935), p. p. min. quoad pl. Alaic. — Type: Kirgizstan: Alajskij khr[ebet], bass[ein] reki Shakhimardan, ushch[e'l'e] Mashalang, v teni skal [Alai range, drainage of Shakhimardan river, gorge Mashalang, in the shadow of rocks]. 10.6.1968, leg. Khalkusiev (holotype TASH!).

Distribution: Uzbekistan, Kirgizstan: Alai mountain range, submontane to montane stony slopes and rock terraces with shallow soil.

Description: Bulbs ovoid to globose, 10-15 mm in diam. and long; inner tunics finely membranous, yellowish, outer tunics strong, finally grayish black and disintegrating. Scape  $\pm$  flexuous finally straight, terete, smooth; 30-40 (50) cm long, 2.5-4 mm in diam.; glossy green, basally maroon flushed. Leaves 1-2 (3), lanceolate like tulip-leaves, stiff arcuately ascending and recurved to the soil, basally canalicate above  $\pm$  flat, thickish; upper side smooth, lower side shallowly ribbed; margins smooth, initially

purplish, shortly tapering into the hooded apex; 18-25 cm long, 2-5 cm broad; vividly green, basally maroon flushed. Sheathy prophyll short, quickly decaying. Spathe membranous, nearly completely divided in 3 long acuminate valves; pale brown with maroon veins. Inflorescence initially semi-globose later  $\pm$  broadly conical (broader than long); dense, many-flowered; up to 3 cm in diam. Pedicels equally long, thin wiry; 1-1.5 (2) cm long; glossy brown-green. Anthesis in May to June. Flowers cup-shaped star-like. Tepals narrowly triangular-lanceolate, very long and sharply acuminate, margins slightly serrate, initially patent and shortly incurved, finally completely reflexed and flaccid but scarcely tortuous; 6-9 (10) mm long, basally 1.2-1.5 mm broad (inner tepals slightly broader); pinkish-lilac, the darker median vein fading towards the apex. Filaments slightly longer than the tepals; basally very shortly connate and long-triangular widened (inner filaments 2-3 times broader), above subulate; pink, paler towards the base. Anthers oblong; 1.2 mm long and 0.6-0.8 mm broad; yellowish violet. Pollen yellowish-gray. Ovary stipitate, triangular club-shaped, 2-2.5 mm long, up to 3 mm broad; surface acutish papillous; gray-green, violet flushed. Nectary ducts mound in a round hole at the base of ovary. Style conical-threadlike, 5-7 mm long; whitish finally pinkish-lilac. Stigma undivided; whitish. Capsule broadly ovoid triangular, surface with fine raised wrinkles, c. 5 mm long and in diam.; narrowly open, valves broadly elliptic, with a broad longitudinal furrow; buff. Seeds 2 per locule, flat triangular to drop-shaped with sometimes sharp edges; surface papillous, densely and irregularly reticulate lacunose, silk-glossy black; 2-3 mm long, 1.5-1.8 mm broad, 1.2-1.5 mm thick. The testa showed S-like undulated periclinal walls and verrucate anticlinal walls with a moderate number of verrucae (Fritsch & al. 2006).

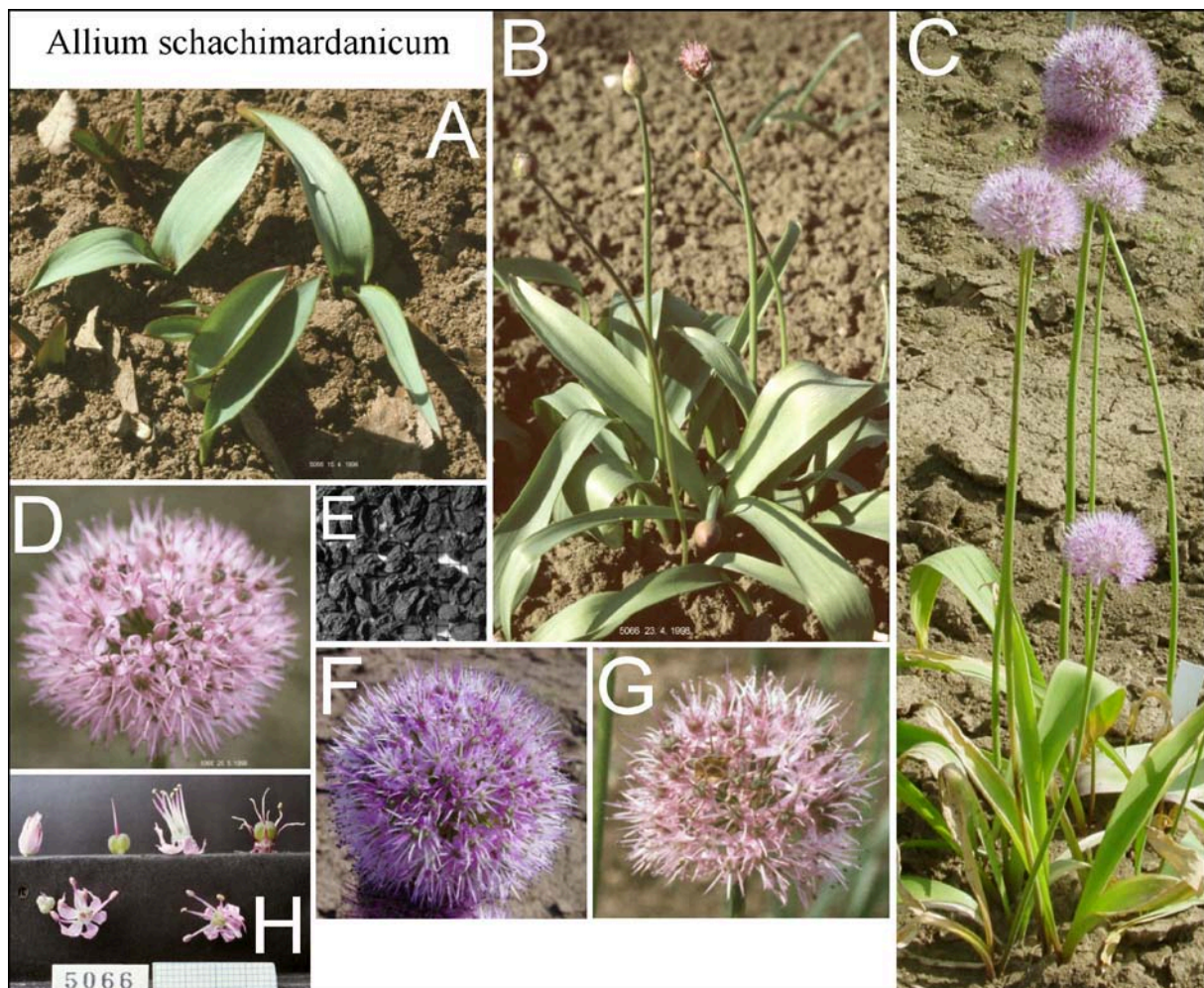


Plate (47): Cultivated plants are shown. A: Sprouting leaves; B: plant in the shooting stage; C: plants in anthesis; D, F & G: inflorescences in early and late anthesis; E: seeds; H: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as background and measure scale of E & H).

**Chromosomes:**  $2n = 16$  Fritsch (see karyolog. appendix, Uzbekistan: Alai range, between Jordan und Mashalang valley, type location ?, TAX 5066).

Living accessions studied: Uzbekistan: Alai range, Aksu river valley between vill. Jordan and Mashalang, rock clefts and terraces (39°58' N, 71°43' E, 2100 m, 08.7.1994 Fritsch, Khassanov, Pistrick 1233; GAT) TAX 5066.

Remarks: Though the general habit of *A. schachimardanicum* is similar to the species of sect. *Longibidentata*, this species owns quickly decaying and smooth sheathy prophylls, ± stiff erectly positioned leaf laminae, broader leaves, and glabrous filament bases without teeth. These characters agree with the affiliation to sect. *Acmopetala*. Concordantly, the only molecularly investigated sample was positioned as well supported basal subgroup of the Alai-Fergan geographical clade of sect. *Acmopetala* (ITS sequences of nuclear rDNA, Fritsch & al. 2010: 191 cluster 6 § 3.8.1; Fritsch 2012b: 252-253 Fig. 4 Q; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). But sequences of the plastid *trnL-trnF* region indicated a close relationship to several species of sect. *Melanocrommyum* s. str. (Gurushidze & al. 2010: 836, fig. 4 lineage I)! These strongly diverging molecular positions should be confirmed by additional accessions prior to drawing taxonomic conclusions. Nevertheless, if we recognize the morphological similarity to the species of sect. *Longibidentata*, *A. schachimardanicum* is another example that different evolutionary lineages seem to have converged on similar phenotypes.

Etymology: The epithet refers most probably to the town or the river valley Shakhimardan in the Alai mountain range in Kirgizstan and Uzbekistan.

Biological data: Genome size was 33.9 pg 2C DNA, like *A. chychkanense* (34 mg) and larger than *A. fetisowii* (26.3 pg, Gurushidze & al. 2012). The plants contain dithiodipyrrole that causes a orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1).

**(48) *Allium vvedenskyanum*** Pavlov in Vestn. AN Kaz. SSR 1: 27 (1949). Pavlov & Polyakov, Fl. Kazakhst. 2: 187, tab. 14/10 (1958); Vved. [ & Kovalevskaya], Opred. rast. Sredn. Azii 2: 83 (1971). — Lectotype: [Kazakhstan:] *Allium vvedenskyanum* N. Pavl. sp. n., Kaz. SSR Almaatinsk. obl., sukhaya step bliz st. Otar [region Alma-Ata, dry steppe near station Otar] 2.6.1940, leg. & det. N.V. Pavlov 583 (MW!; design. Fritsch & al. 2010).

Distribution: Kazakhstan, Kirgizstan: Western Tianshan mountain ranges, Zaili Alatau range, Aktau ridge, Chu-Ili mountains, Kirgiz Alatau range; colline to submontane, dry steppe slopes of foothills transitional to semi-desert ridges.

Description: Bulbs ovoid, 1-1.5 cm in diam., up to 2 cm long; inner tunics papery, whitish, outer tunics brown, subcoriaceous, smooth, somewhat longitudinally splitting, extended in a distinct neck. Scape ± flexuous, terete, smooth; 30-40 cm long, 4-6 mm in diam.; dull green. Leaves 3-5, very narrowly linear-triangular, canaliculate, stiff obliquely directed; upper side smooth or with some scarcely hairy ribs, lower side with dense, narrow, shortly hairy ribs (2-3 central ribs are most prominent); margins densely short-hairy or with long teeth, gradually tapering into the plicate and slightly hooded apex; 12-20 cm long, 2-5 mm broad; vividly green with glaucous bloom. Sheathy prophyll rather long, smooth, whitish with green veins. Spathe membranous, often divided in 2 broadly ovate, shortly acuminate valves; whitish with ± brown veins. Inflorescence ± semi-globose; dense, many-flowered; up to 4 cm in diam. and 2.5 cm long. Pedicels equally long, thin wiry, somewhat ascending; 1.5-2 cm long; pale to deep pink. Anthesis in end of May to June. Flowers bowl-shaped to flat starlike. Tepals linear-triangular, with subobtusate, claw-like recurved apex, patent or slightly obliquely directed, later reflexed; 4-5 mm long, outer tepals 1-1.2 mm broad, inner ones slightly broader; bright pink to lilac or whitish-violet, the narrow brown-green median vein is inside and outside towards base scarcely visible. Filaments slightly shorter than the tepals; basally for c. 0.5 mm connate and triangularly widened (inner filaments slightly or up to twice broader), above subulate; pink, fading towards the base. Anthers oblong to ovoid; 1.6-1.8 mm long, c. 0.8 mm broad; gray-violet. Pollen gray-yellow. Ovary sessile, triangular depressed-globose, up to 2 mm long and 2.5 in diam.; surface finely papillous; silk-glossy gray-green, maroon along the sutures. Up to 4 ovules per locule, 9 ovules per ovary (Filimonova 1970). The nectary ducts mound basally in large pores. Style conical-threadlike, 2-4 mm long; rose. Stigma undivided; whitish. Capsule triangular ovoid, surface silk-glossy papillous, 5 mm long, c. 4 mm in diam.; rather narrowly

open, valves  $\pm$  ovate. Seeds 1-2 per locule, triangularly comma-shaped to semicircular with sharp edges; surface with a finely reticulate pattern of raised wrinkles, silk-glossy black; 2-2.5 mm long, c. 1.5 mm broad, c. 1.2 mm thick. The testa showed Omega-like undulated anticlinal walls, and verrucate periclinal walls with a moderate number of verrucae (Fritsch & al. 2006).

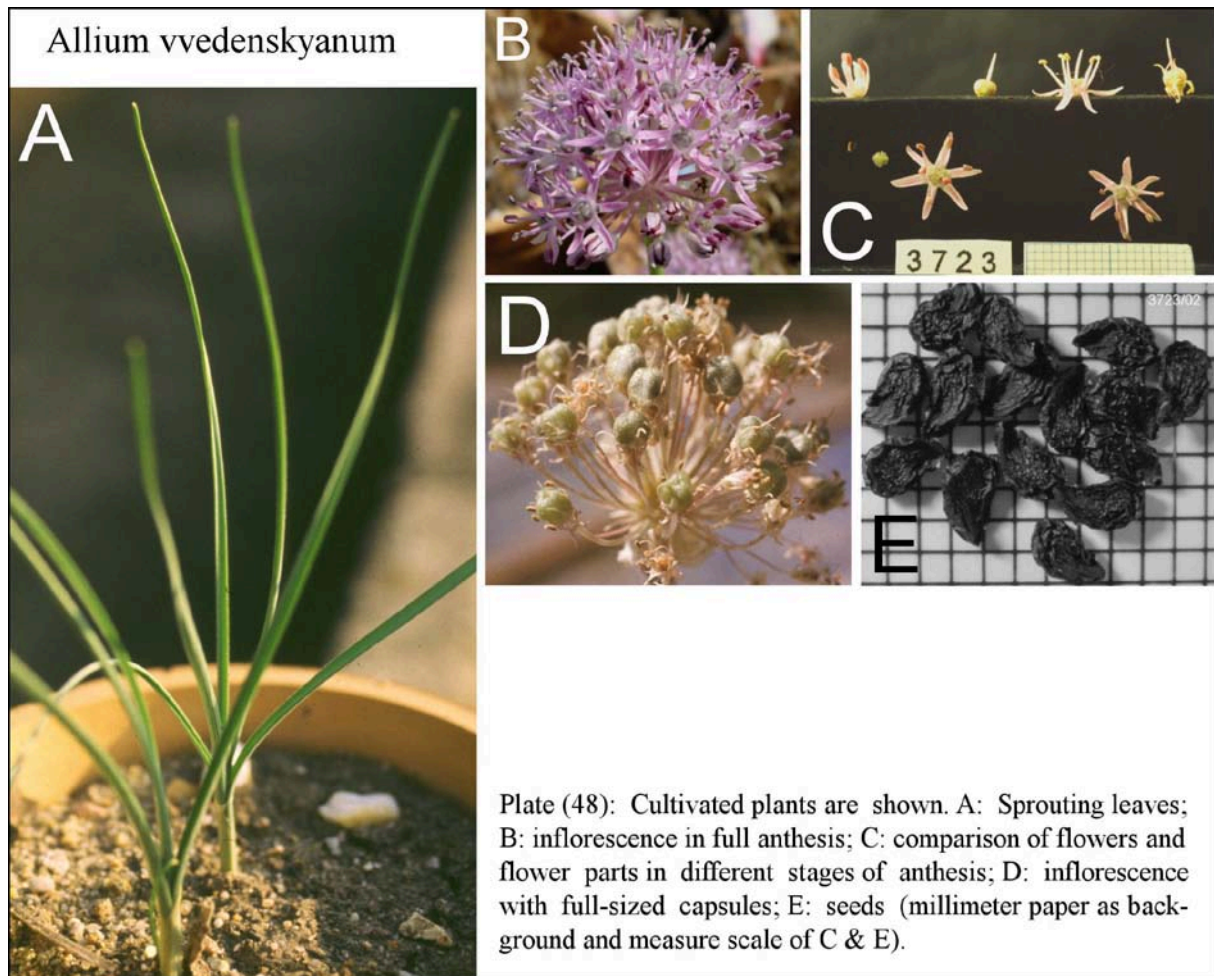


Plate (48): Cultivated plants are shown. A: Sprouting leaves; B: inflorescence in full anthesis; C: comparison of flowers and flower parts in different stages of anthesis; D: inflorescence with full-sized capsules; E: seeds (millimeter paper as background and measure scale of C & E).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a (Kazakhstan: Chu-Ili Mts.).  $2n = 16$  Pogosian & Seisums 1992 (Kazakhstan: Chu-Ili Mts., Otar, Seisums s. n., type location).  $2n = 16$  IPK *Allium* reference collection ideogram (Kazakhstan: Kindyktas Mts., Kurdai pass TAX 3723).

**Living accessions studied:** Kazakhstan: Kindyktas Mts. c. 70 km N Bishkek, Kurdai pass area, grassy E exposed slopes (43°21' N, 75°00' E, 1240 m, 31.5.1993 Fritsch 943; GAT) TAX 3723.

**Remarks:** This species owns a rather slender habit and is characterized by sparsely hairy, very narrow leaves, a small and rather dense inflorescence, and flat star-like, most often deep rose flowers. Though often handled in keys for determination jointly with narrow-leaved species like *A. insufficiens*, *A. victoris* (and even *A. verticillatum*), only the leaf shape is similar but inflorescence and flower characters differ remarkably. *Allium insufficiens* plants are generally smaller and have purple flowers with spoon-like concave tepals, *A. victoris* owns loose inflorescences with purplish, funnel-shaped flowers of sweet odor, and *A. verticillatum* has no narrow leaves but laminae longitudinally divided into many threadlike lobes, and also loose inflorescences but with bowl-shaped starlike, pinkish flowers with a conspicuous, broad median vein. Molecular markers (ITS sequences of nuclear rDNA) confirmed affiliation to sect. *Acmopetala*, where the only studied sample formed a small subgroup with *A. dasyphyllum* as sister. This subgroup had an unresolved closer relationship to subsect. *Pharmakoprason*, and to the western Tianshan geographical clade of sect. *Acmopetala* (Fritsch & al. 2010: 189 cluster 5 § 3.7.3; Fritsch 2012b: 250-251 Fig. 3 J; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Also sequences of the plastid *trnL-trnF* region confirmed close relationship to that geographical clade (Gurushidze & al.

2010: 836, fig. 4 lineage III). Analysis of more accessions seems essential prior to accept this separate subgroup.

**Etymology:** The epithet honors the great Russian botanist, outstanding botanical explorer in Central Asia, and author and editor of merit of many regional floras and revisions Aleksei Ivanovich Vvedensky (1898-1972) acting in Tashkent.

**Biological data:** The bulbs are about 6 cm deep positioned in the soil, 35-40 unbranched roots penetrate the soil up to 15 cm deep (Kamenetskaya 1987). The genome size is 33.4 pg 2C DNA (Gurushidze & al. 2012).

**(49) *Allium zergericum*** F.O. Khass. & R.M. Fritsch in Linzer Biol. Beitr. 26: 969, fig. 7 (1994). —

**Type:** Kirgizstan: Ex horto instituto botanici Tashkent, leg. 19 majo 1992. Bulbis ex regione fluvii Zerger (dexter influxio Jassy, montes Ferganenses) misit anno [from garden of Bot. Institute Tashkent, leg. 19.5.1992. Bulbs from Zerger river area (right tributary of Jassy river, Fergan range) were sent in] 1990 (holotype TASH!, isotype GAT!).

**Distribution:** Kirgizstan: Southern slopes of the Fergan range E Jalalabad; montane steppe meadows and shrub associations in northern exposition; only known from the type area.

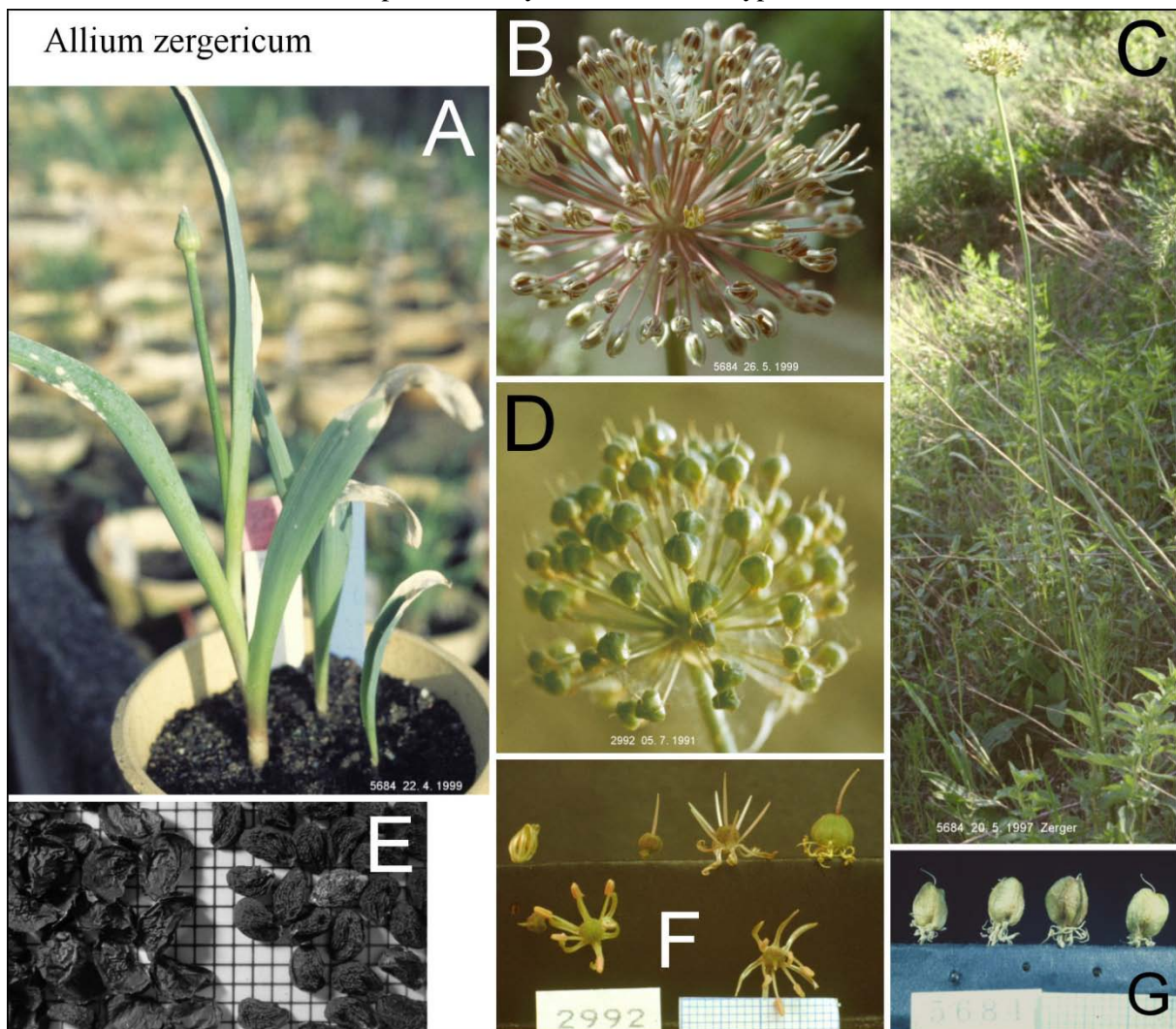


Plate (49): A: Cultivated plants in the shooting stage; B: inflorescence in early anthesis; C: flowering plant in Zerger valley, Kirgizstan; D: inflorescence with developing capsules; E: seeds; F: comparison of flowers and flower parts in different stages of anthesis; G: ripe capsules (millimeter paper as background and measure scale of E, F & G).

**Description:** Bulbs depressed-globose, 1.5-3 cm in diam. Scape straight, terete, smooth; up to 1 m long, below 8 mm, above 5 mm in diam.; green with glaucous bloom. Leaves 1-3, laminae linear-lanceolate, obliquely ascending, thickish, deeply to moderately canaliculate; upper side with some grooves, lower side with some broad ribs; margins basally ciliate, above scabrous, shortly tapering into the spoon-like hooded apex; 20-65 cm long, 2-4 cm broad; green with glaucous bloom. Sheathy prophyll up to 1 cm long, thin membranous, whitish, during budding stage decaying. Spathe membranous, divided in 2-3 broadly ovate, acuminate valves; brownish with darker veins. Inflorescence initially fasciculate later semi-globose to subglobose;  $\pm$  loose, many-flowered; up to 9 cm in diam. and 7 cm long. Pedicels subequally long, thin wiry, straight or somewhat ascending; finally up to 5 cm long; green with strong maroon flush, basally paler. Anthesis in end of May to June. Flowers bowl-shaped starlike. Tepals narrowly linear to long triangular, the subobtuse apex claw-like incurved, patent, soon reflexed, convolute and tortuous; 8-9 mm long, 1-1.3 mm broad; crème (sometimes dirty-violet flushed) with a narrow brown median vein. Filaments  $\pm$  as long as the tepals; finally for 1/4 longer, basally not connate and inner filaments quadratically widened (slightly broader than outer ones) or with 2 small side tooth, above subulate; whitish to light rose. Anthers oblong to ovoid; 1.5-2 mm long, 0.8 mm broad; yellowish grey with pinkish flush. Pollen yellowish gray. Ovary stipitate, depressed-globose to obtuse-conical; surface finely papillous; dull green with brownish flush. Style conical-threadlike, 3-7 mm long; whitish to rose. Stigma undivided; whitish. Capsule conical-triangular, surface silk-glossy papillous, 6-8 mm long, up to 10 mm in diam.; valves ovate, notched at the apex; greenish to buff. Seeds flat triangular semicircular to drop-shaped with sharp edges; surface finely papillous and reticulate lacunose by raised wrinkles, silk-glossy black; c. 3 mm long, c. 2 mm broad and 1.5 mm thick. The testa showed transitions from Omega-like to S-like and rarely to U-like undulated anticlinal walls, short wavelengths are combined with rather low amplitudes. The periclinal walls were generally verrucate with a moderate number of verrucae (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Kirgizstan: Fergan range, Zerger valley type location TAX 2992).

**Living accessions studied:** Kirgizstan: Fergan range, drainage of Zerger river, walnut forest (donated by Khassanov, 40°55' N, 73°30' E, 05.6.1990 via Fritsch & Pistrick 602; GAT) TAX 2992, NE exposed loamy slope in the Zerger valley c. 25 km NE Uzgen (40°56' N, 73°32' E, 1400 m, 20.5.1997 Fritsch & Khassanov 1616; GAT) TAX 5684.

**Remarks:** The habit of *A. zergericum* is similar to *A. alaicum*, but the leaves are glabrous, the tepals are longer, and the filament bases are nearly quadratic. Very peculiar is the whitish-crème tepal color, but otherwise the plants are also similar to *A. arkitense* and belong morphologically to sect. *Acmopetala*. However, molecular markers (ITS sequences of nuclear rDNA) put the only studied sample intermediate between the basal grade and the large core clade of subg. *Melanocrommyum* (Fritsch & al. 2010: 168 Basal grade § 3.2.2; Fritsch 2012b: 247-248 Fig. 1; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Investigation of more material seems essential to verify this special position.

**Etymology:** The epithet refers to the Zerger (Zarger) river region in the W foothills of Fergan range (Kirgizstan) where the bulbs of the types were collected.

8.2 A. sect. *Acmopetala* **subject. *Albidiflora*** R.M. Fritsch  
in Linzer Biol. Beitr. 26: 970 (1994). — **Type species:** *Allium saposchnikovii* Nikitina

(50) *Allium saposchnikovii* Nikitina, Flora Kirg. SSR 10: 375 (1962), Nikitina & al., Flora Kirg. SSR Dopoln. vyp. 1: 50-51 "*saposchnikovii*", t. 2 (1967). — *Allium collis-magni* Kamelin in Byull. Mosk. ob-va izpyt. prir., n. s. 81: 138 (1976). Type: Kazakhstan: Syrdar'inskij Karatau, gory Ulkun-Burul bliz g. Dzhambul, alt. 1138 m, na vershine [Syrdarya-Karatau, Ulkun-Burul Mts. near town Jambul, elev. 1138 m, on the top], 10.6.1974, leg. Kamelin 1243 (LE!). — **Lectotype:** [Kirgizstan:] "Kirgizskij khrebet, predgor'ya nad Chon-Arykam lesoposadki Akademii, 1 Iyunya [Kirgiz Alatau, foothills above Chon-Aryk forest plantings of academy, 01 June] 1956 leg. E. Nikitina", second label "Lecto-Type



26.5.1997 Reinhard M. Fritsch" (FRU! design. Fritsch & al. 2010: 206; isolectotypes FRU!, LE!, topotypes FRU!, LE!).

Distribution: Kirgizstan, Kazakhstan: W Tianshan mountain ranges, Karatau to Kirgiz Alatau ranges; montane grassy to shrubby steppe slopes.

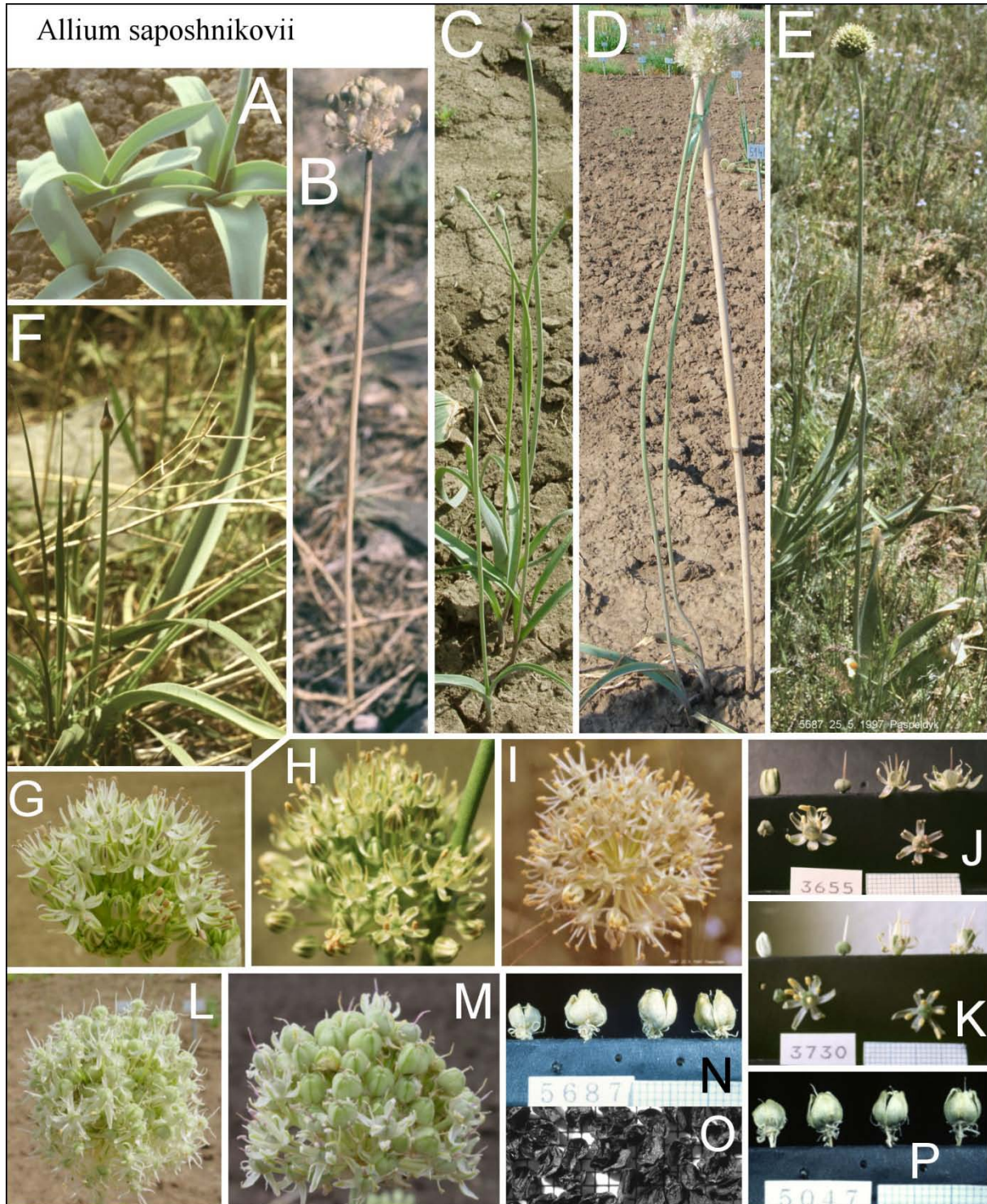


Plate (50): A: Shape of leaves; B: plant with ripe capsules at Ulken-Burul, Kazakhstan; C: cultivated plants in the shooting stage; D: cultivated flowering plants; E: flowering plant at the type location Paspeldyk, Kirgizstan; F: shooting plant near Sholakkorgan, Kazakhstan; G - I: inflorescences in early to full anthesis, resp.; J & K: comparison of flowers and flower parts in different stages of anthesis; L & M: inflorescences in late anthesis; N: ripe open capsules from type location; O: seeds; P: ripe open capsules from Ulken-Burul (millimeter paper as background and measure scale of J, K, N, O & P).

**Description:** Bulbs depressed-ovoid, 1-3.5 cm in diam.; tunics  $\pm$  papery, white to gray or reddish, finally blackish, slightly longitudinally splitting and finally disintegrating. Scape flexuous, terete, cylindrical to somewhat spindle-shaped, smooth; 30-50 (90) cm long, 4-10 mm in diam.; green with glaucous bloom, only initially maroon suffused near the base. Leaves 2-5 (6), laminae narrowly to broadly lanceolate, slightly twisted, stiff arcuately ascending and recurved to the soil, thick, near the base strongly canaliculate, above nearly flat; upper side  $\pm$  smooth, lower side with flat ribs or some grooves; margins narrowly white, near base densely toothed becoming subglabrous above, long tapering into the short and hooded apex; (10) 30-45 cm long, 1-3 cm broad; dull dark-green with strong glaucous bloom, basally somewhat reddish flushed. Sheathy prophyll rather long, thin but strong, nearly smooth, brownish, quickly decaying. Spathe  $\pm$  strong membranous, completely divided in 2-3 short acuminate valves, shorter or as long as the pedicels; white to yellowish with inconspicuous or brownish veins. Inflorescence semi-globose to globose; very dense, many-flowered; 3-5 cm in diam., 2-4 cm long. Pedicels subequally long,  $\pm$  thickish wiry, smooth; 1-4 cm long; silk-glossy green to pinkish. Anthesis in May to June. Flowers bowl-shaped starlike. Tepals obovate or broadly lanceolate, spoon-shaped concave with hooded, subobtusate apex, patent, later subreflexed and margins enrolled; (4) 6-7 mm long, inner tepals 1.5-2.5 mm, outer tepals up to 3 mm broad; white, later greenish to bright rose, the green or maroon, narrowly lanceolate median vein is conspicuously broad and thick above. Filaments about as long as the tepals; basally very shortly connate and the inner filaments strongly triangular widened or with 2 small, shoulder-like teeth, above subulate, outer filaments subulate; (greenish) white. Anthers oblong; 2.5-3 mm long, c. 1.2 mm broad; yellow or pinkish-violet. Pollen grayish yellow to ochre. Ovary stipitate, depressed-globose triangular, 3 mm long, 4-5 mm in diam.; surface finely acutish papillose; gray-green with darker sutures. Style long conical to threadlike, 3-6 mm long; initially white later bright violet. Stigma undivided; whitish. Capsule broad ovoid-triangular, surface coarsely papillose, 6-8 mm long and in diam.;  $\pm$  narrowly open, valves obovate, scarcely notched at the apex; greenish finally buff. Seeds 2-3 (4) per locule, flat triangular to crescent-shaped with sharp edges; surface papillose with an irregular pattern of raised wrinkles, silk-glossy black; 3-3.5 mm long, c. 1.5 mm broad and thick. The testa showed verrucose periclinal walls with a moderate number of verrucae and S-like or Omega-like undulated anticlinal walls with moderate wavelengths and high amplitudes (Fritsch & al. 2006, *A. saposhnikovii* from type location and type of *A. collis-magni*).

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Kirgizstan: Bishkek, Paspel'dyk hills Seisums s. n., type location).  $2n = 16$  IPK *Allium* reference collection ideogram (Kazakhstan: Karatau range, W Sholakkorgan TAX 3683).  $2n = 32$  Fritsch karyotype (see karyolog. appendix, Kazakhstan: Karatau range, Mt. Ulken-Burul TAX 5047).  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Kirgizstan: Bishkek, Paspel'dyk hills, type location TAX 5687).

**Living accessions studied:** Kirgizstan: Spurs of Kirgiz Alatau range, Paspel'dyk hill ridge SW Bishkek (type location, 42°45' N, 74°33' E, 1100 m, 25.5.1997 Fritsch & Khassanov 1619; GAT) TAX 5686, slopes with tall forbs (1180 m, 25.5.1997 Fritsch & Khassanov 1620; GAT) TAX 5687. Kazakhstan: Karatau range, top region of Mt. Ulken-Burul S Jambul (42°54' N, 71°06' E, 800 m, 30.6.1994 Fritsch, Khassanov, Pistrick 1177; GAT) TAX 5047, TAX 5396, SW slopes of Mt. Ulkun-Burul, loose association of perennials (42°53' N, 71°06' E, 700 m, 13.5.1993 Fritsch 808 & 811 A; GAT) TAX 3655, TAX 6276; valley Arpa-uzen c. 25 km W town Sholakkorgan, N exposed shrubby slopes (43°49' N, 68°46' E, 1600 m, 27.5.1993 Fritsch 917 A, B, & C; GAT) TAX 3683, TAX 3729, TAX 3730.

**Remarks:** *Allium saposhnikovii* is the only species of subsect. *Albidiflora*. Plants studied at the type location had a stately habit and rather broad leaves, but those from a more western location near Jambul were smaller, had narrower leaves, and often pale violet, not yellow, anthers. The other characters of inflorescences and flowers were identical. Molecular markers (ITS sequences of nuclear rDNA and sequences of the plastid *trnL-trnF* region) positioned this species in the western Tianshan geographical clade of sect. *Acmopetala* (Gurushidze & al. 2010: 836, fig. 4 lineage II; Fritsch & al. 2010: 190 cluster 5 § 3.7.5; Fritsch 2012b: 250 Fig. 3 M, 251; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Unexpectedly, the sample from the type location occupied a well supported basal position, and the other samples shared a more advanced position with other species. Addition of more samples would be

essential to verify these positions. Alternatively, the plants from Jambul area could be a white-flowering form of *A. sewerzowii* only.

A type voucher mentioned in the original description ("predgor'ya Kirg. Ala-Too, gora Paspel'dyk, stepnye fitotsenozy"), date and collector as the lectotype, could not be found in FRU.

**Etymology:** The epithet honors the Russian botanist Vasilij Vasilievich Saposhnikov (1861-1924), an outstanding botanical explorer of the Altai and Tianshan mountain ranges and of the area around lake Balkhash at the begin of 20th cent.

**Biological data:** Very good germination at 5 °C, but no germination at temperatures above 10 °C (Specht & Keller 1997). The genome size was 60 pg 2C DNA (Gurushidze & al. 2012).

### 8.3 *A. sect. Acmopetala* **subsect. *Durovaginata*** R.M. Fritsch

in Linzer Biol. Beitr. 26: 973 (1994). — **Type species:** *Allium costatovaginatum* Kamelin & Levichev

**(51) *Allium costatovaginatum*** Kamelin & Levichev ex Krassovskaja & Levichev, Flora Chatk. zapov. 167 (1986) [publ. ante 23.4.1986]. — *Allium rudolfii* Turak. in Dokl. Akad. nauk Tadzh. SSR 29, 3: 180 (1986) [publ. post 29.5.1986]. Fritsch, Flora Tadzh. SSR 10: 479 (1991). Type: N Tajikistan, Kuraminskij khrebet, gory Kalkan-Ata okrestnost kishlaka Kochkarli, na shchebnistom sklone vysokikh predgorij [Kurama ridge, Kalkan-Ata Mts. in the vicinity of village Kochkarli, rubble slope of high foothills]. 24.5.1984 leg. Turakulov (holotype TAD, isotype TASH). *Allium tschimganicum* sensu Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 no. 809 (1971). *Allium "severtzovii"* sensu Vved. & auct., p. p. minore. — **Type:** Uzbekistan: Tashkentskaya obl., Chatkalskij zapovednik, Bash-Kyzyl-sai, vyshe meteostantsii [Tashkent region, Chatkal reservation, Bashkyzylsai above weather station], 30.5.1976, leg. Krassovskaja (holotype LE!, isotype TASH!).

**Distribution:** Uzbekistan, Kirgizstan?, N Tajikistan: Chatkal range and Kurama ridge, under shrubs on submontane to montane, dry stony slopes, sometimes in *Juniperus* associations.

**Description:** Bulbs ovoid, (8) 10-20 (30) mm long and in diameter; inner tunics papery, whitish, outer tunics grayish-black, ± strong, the outermost layer disintegrating. Scape straight or slightly flexuous, terete, smooth, (15?) 30-50 (80) cm long, (2) 3-5 (8) mm in diameter; green with slight glaucous bloom, basally purplish flushed. Leaves 1-3, laminae linear-lanceolate, straight to obliquely directed; thickish, canaliculate; upper side somewhat carved, lower side with dense and shallow ribs; margins whitish or reddish, basally coarsely and distally finely toothed, long tapering into the slightly hooded apex; 30-60 (70) cm long, (6) 12-30 (45) mm broad; dull green with strong glaucous bloom. Sheathy prophyll thin but strong, 2-8 (12) cm long, with 8-12 up to 1 mm high, scabrous longitudinal ribs; buff to maroon, mostly still present at anthesis. Spathe membranous, completely divided in 2-3 ovate, long acuminate valves; buff to reddish with inconspicuous veins. Inflorescence semiglobose to globose; very dense later looser, many-flowered; 3-6 finally up to 8 cm in diameter. Pedicels subequally long, thin wiry; 1-1.5 (finally up to 4) cm long; glossy greenish brown with a paler base; in the dry state very brittle. Anthesis in begin of June. Flowers cup-shaped starlike. Tepals ovate to lanceolate, concave, shortly tapering into the obtuse, claw-shaped apex, patent or obliquely directed, later variably directed and distorted or plicate or enrolled; 4-6 mm long, basally 1.5-2.5 mm broad; pinkish-carmine with initially green later violet median vein. Filaments somewhat longer than the tepals; basally for 0.5-0.8 mm connate and inner filaments 2-3 times broader and broadly-triangular widened, above subulate, outer filaments subulate throughout; pink with paler base. Anthers oblong; c. 2-2.5 mm long, 0.8-1 mm broad; violet. Pollen grayish yellow. Ovary shortly stipitate, depressed-globose triangular, c. 3 mm long and 3-3.5 mm in diam.; surface densely prickly-papillous; grayish green with darker sutures, sometimes with maroon suffused sides. Nectaries mound in small pores or slits near the base of the ovary. Style conical-thread-like, 4-6 mm long; whitish to violet. Stigma undivided; whitish. Capsule broadly ovoid-triangular, 4-5 mm long, 5-6 mm in diam., surface dull, with bumps; valves suborbicular, scarcely notched at the apex.

Seeds 1-3 per locule, flat ovoid to semi-circular with often sharp edges; surface finely tuberculate with irregularly positioned, raised wrinkles, silk-glossy black to blackish-brown; c. 2 mm long, 1.5-1.8 mm broad, 1-1.2 mm thick. The testa showed prominent (but often hidden) verrucae and Omega-like undulated anticlinal walls with short wavelength (Fritsch & al. 2006, Fig. 4).

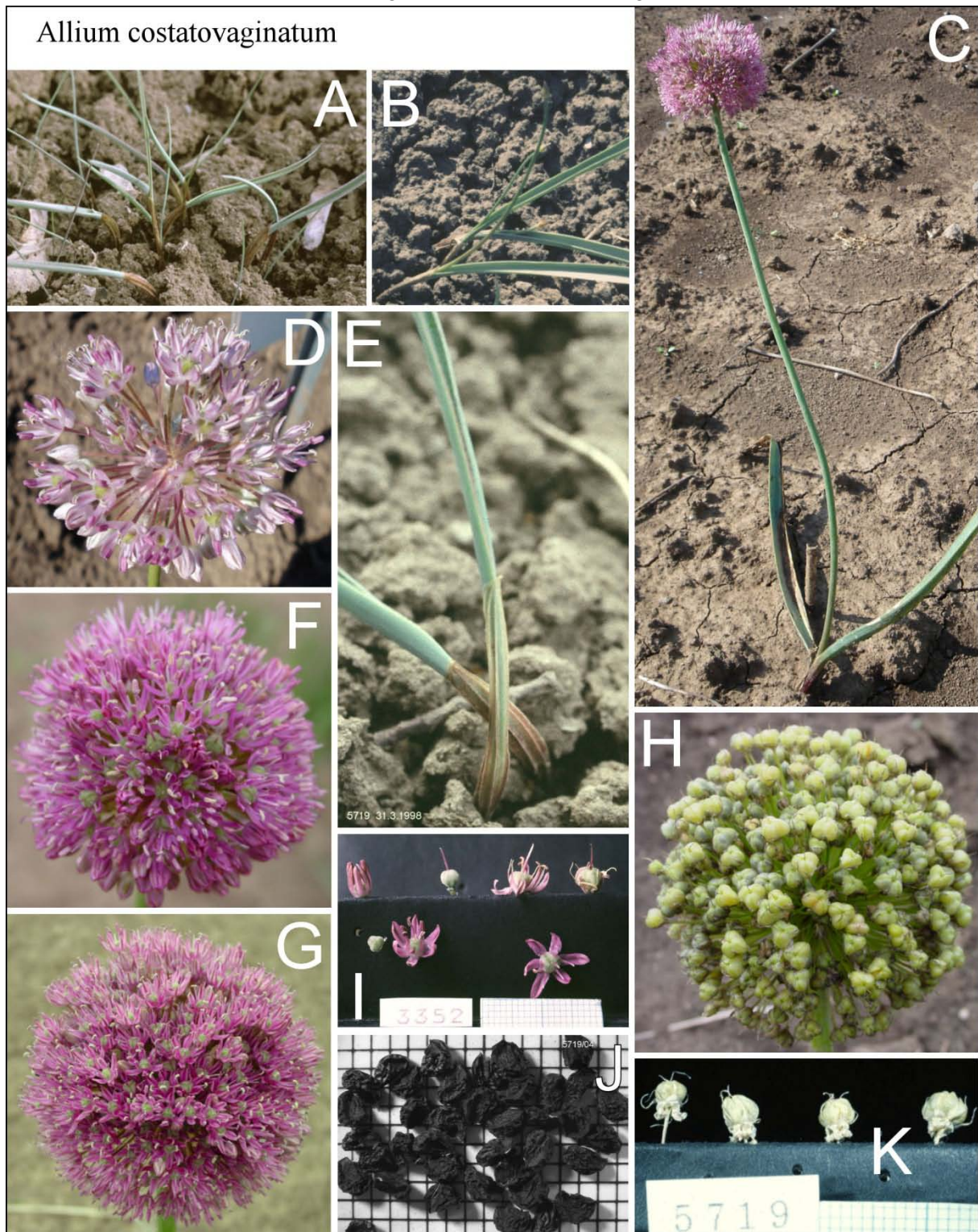


Plate (51): Cultivated plants are shown. A: Sprouting leaves; B: sprouting plants; C: flowering plant; D, F & G: inflorescences in early and full anthesis, resp.; E: ribbed outer sheath leaves; H: inflorescence with full-sized capsules; I: comparison of flowers and flower parts in different stages of anthesis; J: seeds; K: ripe open capsules (millimeter paper as background and measure scale of I, J & K).

Chromosomes:  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Uzbekistan: Chatkal range, Bashkizylsai, TAX 2790).

Living accessions studied: Uzbekistan: Kurama ridge, Angren valley 4 km below Irtashsaj (41°07'30.7" N, 70°21'35.7" E, 1200 m, 22.5.2003 Fritsch, Keusgen, Khassanov 4127; GAT TASH), stony slopes of the heights near Lashkyreksai (40°55' N, 70°12' E, 2550 m, 24.5.1992 coll. Khassanov, via Fritsch 788; GAT) TAX 3365; Chatkal range, Chilchenboa chain near Yangiabad N Angren (41°10' N, 70°08' E, 1700 m, 06.6.1990 Fritsch & Khassanov 595; GAT) TAX 2988, drainage of Dukiensai 10 km N Jangiabad, rock terraces (41°14' N, 70°09' E, 1500 m, 24. 5.1992 coll. Khassanov & Fritsch 787; GAT) TAX 3364, above vill. Sukok 50 km E Tashkent (41°14'49" N, 69°49'26.1" E, 1410 m, 09.5.2005 Fritsch & Khassanov 4213; GAT) TAX 6364, Angren valley between villages Chetsuv and Kok-Saraj (41°05' N, 70°18' E, 1200 m, 17.5.1998 Fritsch & Khassanov 1663; GAT) TAX 5780, c. 2 km above vill. Kok-Saraj, SE exposed porphyry slopes (41°07' N, 70°21' E, 1300 m, 17.5.1998 Fritsch & Khassanov 1663A; GAT) TAX 5783; Chatkal reservation, valley Bashkyzylsai (1200 m, 1992 coll. Levichev s. n.; GAT) TAX 2790, slopes in Bashkyzylsaj valley c. 7 km SE Nevich (41°14' N, 69°50' E, 1300 m, 03.6.1997 Fritsch & Khassanov 1656; GAT) TAX 5719, right slopes of Karagachli-Sai near border of reservation (41°17' N, 69°51' E, 1600 m, 19.5.1992 Fritsch 764; GAT) TAX 3352; stony SE exposed slopes in Kajnarsaj c. 18 km N Akhangaran (40°59' N, 69°40' E, 800 m, 17.5.2001 Fritsch & Hoffmann 1751; GAT) TAX 5880.

Remarks: *Allium costatovaginatatum* is the type species of subsect. *Durovaginata*. Most characteristic are the rather short tepals and the prominent longitudinal ribs on the outer sheathy prophyll that includes the leaf bases also above soil. Under cultivation, the plants did not differ from *A. rudolfii* and showed very similar tepal characters: The tepals were patent towards the end of anthesis (underlined as specific character of *A. rudolfii*) and took then an irregularly crumpled and finally reflected position (typical for *A. costatovaginatatum*). According to molecular markers (ITS sequences of nuclear rDNA), *A. costatovaginatatum* belongs to the Western Tianshan geographical clade of sect. *Acmopetala* where it constitutes an own subgroup and is less closely related to *A. tschimganicum* than to a mixed group of other species formerly affiliated in different subsections (Fritsch & al. 2010: 190 cluster 5 § 3.7.5; Fritsch 2012b: 250, 251, Fig. 3 L; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region confirmed these general relationships but three different haplotypes of *A. costatovaginatatum* were found (Gurushidze & al. 2010: 836, fig. 4 lineage III).

Etymology: The epithets refer to the characteristic ribs on the outer sheathy prophyll (from Latin "with a ribbed sheath") and honor the eminent contemporary taxonomist Rudolf Vladimirovich Kamelin, resp., who acted in Dushanbe and St. Petersburg.

Biological data: The reported genome size of 34.5 pg 2C DNA is somewhat lower than for *A. tschimganicum* (36.5 pg, as *A. motor*; Gurushidze & al. 2012).

Economic traits: In the Uzbek mountains (local name 'tosh-modor'), the leaves are sometimes collected in the spring time and used as stuffing for the national pastries somsa, sambusa, and pelmeny. They are tasty and own tonic properties giving strength and rising blood pressure (Khassanov 2008). The leaves are of lower quality compared with those of *A. tschimganicum* (Khassanov & Umarov 1989, Umarov 1992, also as *A. rudolfii*).

(52) *Allium dodecadontum* Vved., Opred. rast. Srednej Azii 2: 83, 316 (1971). — Type: Kirgizstan: [Chatkal range] Arkit, Sary-Chilek, orekhovyj les [*Juglans* forest], 1600-1700 m, 25.5.1956, leg. Galikina 236 (holotype & isotype TASH!).

Distribution: Uzbekistan?, Kirgizstan: W Tianshan mountain ranges, SE Chatkal range, montane slopes covered with shrubs and forests.

Description: Bulbs depressed-globose, 8-10 (12) mm in diam., with few smooth side bulbs; inner tunics finely membranous, longitudinally splitting, outer tunics papery, grey, later blackish disintegrating. Scape straight or slightly flexuous, terete, smooth; 40-80 (100) cm long, 2.5-5 mm in diam.; glossy dark green, basally somewhat maroon suffused. Leaves 2-3, laminae narrowly lanceolate, obliquely directed, upper part recurved later hanging down, basally narrowly canaliculate, upper part nearly flat, ± thin; upper side smooth, lower side with shallow broad ribs; margins narrowly white, basally scabrous and above glabrous, long tapering into the hooded apex; up to 25 cm long, 8-15 mm broad; dull green

with glaucous bloom, basally maroon. Sheathy prophyll long, rather pale brownish-gray, with 10-15 shallow longitudinal ribs. Spathe thin membranous, nearly completely divided into 2-3 ovate, shortly acuminate valves; buff with slightly darker veins. Inflorescence semi-globose to depressed-globose, fruiting rather irregularly ovoid; dense, many-flowered; initially c. 3 cm in diam. Pedicels equally long, thin wiry, straight; 1.5-2 cm long; green brownish flushed. Anthesis in end of May. Flowers cup-shaped starlike. Tepals narrowly linear-lanceolate, strongly canaliculate, long acuminate; patent, soon recurved later reflexed and enrolled; (6) 8-10 mm long, c. 1 mm broad; pink to pinkish-carmine, median vein greenish, fading toward the apex. Filaments  $\pm$  as long as the tepals; basally shortly connate and subquadratic widened with two long teeth, outer side ciliate, above subulate; pink with nearly white base. Anthers oblong; c. 1.8 mm long and 0.8 mm broad; pale violet. Pollen grayish yellow. Ovary shortly stipitate, club-shaped triangular, apex with 6 radial bulges; surface finely acutish papillous; dull to  $\pm$

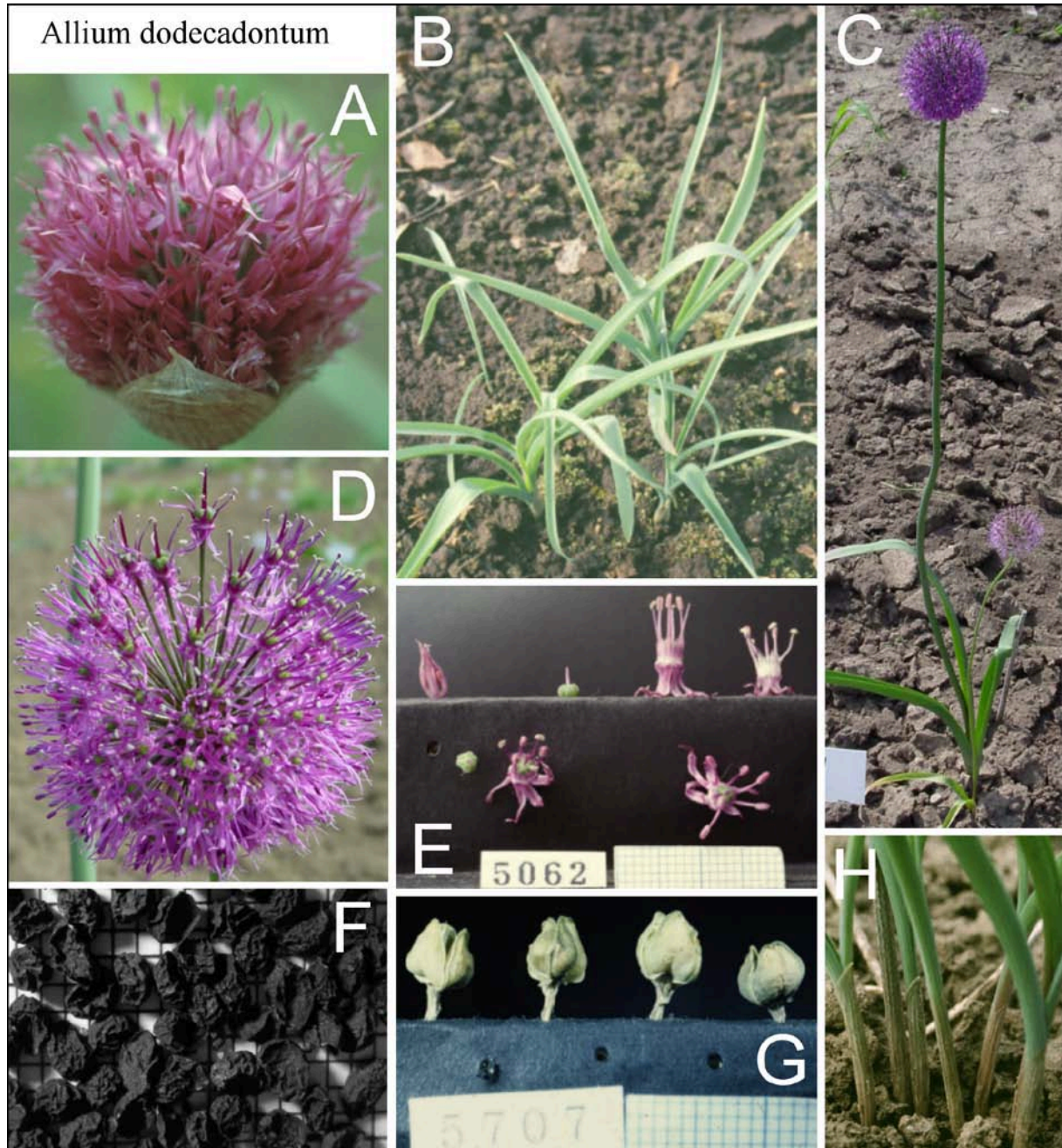


Plate 52: Cultivated plants are shown. A & D: Inflorescences in early and full anthesis, resp.; B: leaves after sprouting; C: large and very small plant, resp., in full anthesis; E: comparison of flowers and flower parts in different stages of anthesis; F: seeds; G: ripe open capsules; H: ribbed outer sheath leaves (millimeter paper as background and measure scale of E, F & G).

glossy green; 4 ovules per locule. Style conical-threadlike, c. 4 mm long; pink to carmine. Stigma undivided; whitish. Capsule obovoid triangular, 5-6 mm long and in diam.; narrowly open, valves obtusely cordate, apex slightly notched, surface dull, with some raised wrinkles; buff. Seeds 2-3 per locule, flat triangular drop-shaped with sharp edges; surface papillous, coarsely, densely, and irregularly reticulate lacunose, silk-glossy black; 2-2.5 mm long, c. 1.5 mm broad, 1-1.2 mm thick. The testa showed verrucate periclinal walls with a moderate number of verrucae, and Omega-like undulated anticlinal walls with moderate wavelengths and high amplitudes (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16+0-1B$  Pogosian & Seisums 1992 (Kirgizstan: Chatkal range, lake Sary-Chelek, Cheremnykh s. n.).  $2n = 16$  Fritsch unpublished (karyotypes see karyolog. appendix, Kirgizstan: Chatkal range, Aflatun valley TAX 5705, Sarychilek valley, Arkit TAX 5695; Kirgiz. Alatau range, Uch-Bulak TAX 5052; Chatkal range, Aflatun valley TAX 5707).

**Living accessions studied:** **Kirgizstan:** Fergan range, valley of Naryn river c. 10 km below Kara-Kul (41°37' N, 72°36' E, 1000 m, 05.7.1994 Fritsch, Khassanov, Pistrick 1222; GAT) TAX 5062; Chatkal range, valley of Aflatun river between Jangijol und Karavan (41°39' N, 72°02' E, 1000 m, 30.5.1997 Fritsch & Khassanov 1640; GAT) TAX 5707, Sarychilek valley, slopes NE vill. Arkit (41°50' N, 71°58' E, 1600 m, 29.5.1997 Fritsch & Khassanov 1628; GAT) TAX 5695.

**Remarks:** In the western Tianshan mountain range and in the Alai and Fergan mountain ranges occur several medium-sized species that share rather dense, subglobose inflorescences with pink flowers. They differ mainly by leaf widths and flower details: *A. fetisowii*, *A. dodecadontum*, *A. schachimardanicum*, and *A. pangasicum*. *Allium dodecadontum* can easily be separated from them by narrow leaves, a finely ribbed sheathy prophyll covering the leaf bases above soil, and bidentate and ciliate bases of all filaments (Fritsch 2012b: 253). They were all affiliated to sect. *Acmopetala* by Khassanov & Fritsch (1994), but molecular studies (ITS sequences of nuclear rDNA) positioned them in different, only distantly related groups: *A. fetisowii* and the newly recognized *A. chychkanense* represent an own section *Longibidentata* (Fritsch 2009: 465) positioned in the basal grade, but the other species (*A. pangasicum* was not studied) were inserted in the core clade in cluster 6 as basal subgroups of the Alai-Fergan geographical clade of sect. *Acmopetala* (Fritsch & al. 2010: 191 cluster 6 § 3.8.1; Fritsch 2012b: 252, 253 Fig. 4 Q; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). The separate basal position of *A. dodecadontum* (if confirmed by additional accessions to be studied) may question that affiliation to subsect. *Acmopetala* is a good solution (Fritsch & al. 2010: 191). Data from sequences of the plastid *trnL-trnF* region confirm the close relationship to most species of the Alai-Fergan geographical clade (Gurushidze & al. 2010: 836, fig. 4 lineage III).

**Etymology:** The epithet refers most probably to the bidentate bases of all filaments (from Greek "with 12 teeth").

**Biological data:** Reported genome size 37.4 pg 2C DNA (Gurushidze & al. 2012).

**(53) *Allium severtzovioides*** R.M. Fritsch in Linzer Biol. Beitr. 26: 974, fig. 9 (1994). — *Allium tschimganicum* p. p. sensu Vved., Flora URSS 4: 263, 266 (1935), quoad pl. Ugam.; Vved., Flora Uzbek. 1: 460 (1941); Pavlov & Polyakov, Fl. Kazakhst. 2: 190 (1958); Vved., Flora Tadzh. SSR 2: 347 (1963). *Allium "severtzovii"* sensu Vved., Flora URSS 4: 266 (1935); Lapin, Opredel. rast. Tashk. oazisa 1: 81 (1938); Vved., Flora Uzbek. 1: 460 (1941); Pavlov & Polyakov, Fl. Kazakhst. 2: 190, tab. 14/7 (1958); Vved., Flora Tadzh. SSR 2: 347 (1963), Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 (1971), omnia pro parte minore, non *A. sewerzowii* Regel (1867) s. str. *Allium collis-magni* sensu R.M. Fritsch, Flora Tadzh. SSR 10: 480 (1991). — **Type:** Uzbekistan: Westl. Ausläufer des Tian-Shan, Gebirgskette Karshantau ca. 50 km nordöstl. von Tashkent, Tal oberhalb von Aktash (Saylyk), Westhang mit [western foothills of Tian-Shan ranges, Karshantau ridge c. 50 km E Tashkent, valley above village Aktash (Saylyk), W exposed slope with] *Juglans regia*, ca. 1450 m NN, 03.6.1990 Fritsch, Pistrick 614 (holotype GAT!, isotypes TASH, GAT!, living isotypic accession TAX 2983).

**Distribution:** Uzbekistan, Kirgizstan, Kazakhstan, Tajikistan: Western Tianshan ranges in the vicinity of Tashkent, montane stony or not too dry steppe slopes, often among bushes.

**Description:** Bulbs subglobose, 1-2 (4) cm in diam.; inner tunics membranous, whitish, outer tunics buff finally blackish; strong papery, slightly longitudinally splitting and disintegrating. Scape straight or  $\pm$  flexuous, terete, smooth; 60-90 (120) cm long, 4-8 (basally up to 12) mm in diam.; green with

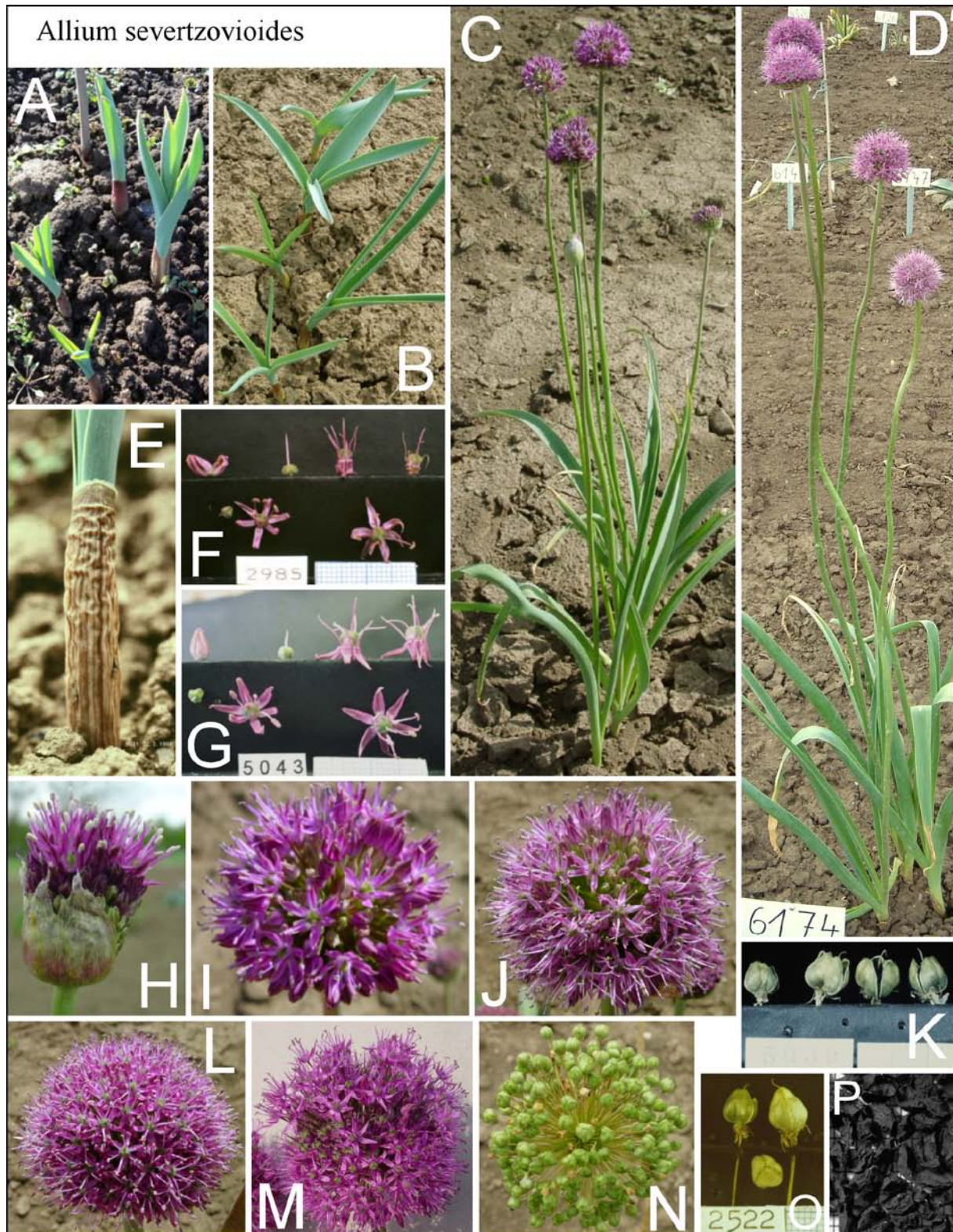


Plate (53): Cultivated plants are shown. A & B: Leaves in different stages of sprouting; C & D: plants in different stages of anthesis; E: close-up of an outer sheath leaf; F & G: comparison of flowers and flower parts in different stages of anthesis; H, I & J: inflorescences in early anthesis; K: ripe open capsules; L & M: inflorescences in full and late anthesis, resp.; N: inflorescences with developing capsules; O: full-sized capsules; P: seeds (millimeter paper as background and measure scale of F, G, K, O & P).



glaucous bloom. Leaves 2-3 (5), laminae linear-lanceolate, stiff upwards directed slightly recurved, slightly twisted, finally hanging down, basally U-like canaliculate, upper part shallower, thick, thinner towards the apex; upper side slightly grooved, lower side with some broad and shallow ribs; margins white, basally toothed, above glabrescent, shortly arcuately tapering into the hooded apex; 20-50 (70) cm long, 1-3.5 (5) cm broad; grayish green with strong glaucous bloom. Sheathy prophyll 5-8 cm long, strong, very scabrid with many narrow longitudinal ribs; buff with maroon veins, commonly still present during anthesis. Spathe membranous, completely divided in 2-3 ovate valves; initially reddish later buff with maroon veins. Inflorescence initially semi-globose later globose; dense, many-flowered; 5-7 cm in diam. Pedicels subequally long,  $\pm$  straight, thin wiry; glossy brown finally green. Anthesis in May. Flowers cup- to bowl-shaped starlike. Tepals linear-lanceolate, subobtusate with plicate apex, patent, later reflexed and subspirally enrolled; 5-7 mm long, c. 1.5 mm broad; shining pink, median vein purple greenish at the back, disappearing near the base. Filaments  $\pm$  as long as the tepals; basally shortly connate and inner filaments triangular widened (often with 2 teeth), above subulate like outer filaments; pinkish-purple. Anthers oblong; 1-2 mm long; yellowish-pink. Pollen grayish-yellow. Ovary stipitate, depressed-globose triangular (with three broad longitudinal grooves); surface finely papillous, gray-green with dark green sutures. Nectary duct mounds about 1 mm above the base of ovary in a small slit below the bottom of locules (Fritsch 1992b as *A. sewerzowii*). Style narrowly conical, 3-6 mm long, whitish finally pink flushed. Stigma undivided; whitish. Capsule broadly triangular-ovoid, surface scabrous, c. 5-7 mm long and 4-7 mm in diam.; valves rounded cordate, scarcely notched at the apex; dull buff. Seeds 2-3 per locule, triangularly oblong to crescent-shaped with sharp edges; surface papillous with an irregular pattern of raised wrinkles, silk-glossy black; 2.5-3.5(4) mm long, 1.5-2 mm broad, 1.4-1.8 mm thick. TKW 2.16 / 2.88 g (IPK, unpubl. data). The testa showed Omega-like undulated anticlinal walls with moderate wavelengths and high amplitudes. The periclinal walls were verrucate with a moderate number of verrucae (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 (Uzbekistan: Tashkent region, Karshantau ridge, Aktash s. n. "*A. severtzovii*").  $2n = 16$  IPK Allium reference collection ideogram (Uzbekistan: Tashkent region, Karshantau ridge, Sajlyk TAX 2521).

**Living accessions studied:** **Kazakhstan:** Karatau range, pass area of Kujuk Mts. right of the main road to Jambul, dry slopes (42°45' N, 70°56' E, 900 m, 30.6.1994 Fritsch, Khassanov, Pistrick 1173A; GAT) TAX 5043. **Tajikistan:** Kurama ridge, Chelata valley shortly below the pass, grazed *Juniperus* slope (40°38' N, 69°35' E, 1600 m, 29.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 558; GAT) TAX 2955, upper valley of Oshoba creek above vill. Shivar (40°45' N, 70°26' E, 1600 m, 30.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 564; GAT) TAX 2956. **Uzbekistan:** Unknown location (from Botanic Garden Tashkent 1984 no. 2578; GAT) TAX 1137; Chatkal range, Chimgan massif, side valley of Galabasaj (41°31'49.7" N, 69°54'39.6" E, 1150 m, 23.5.2003 Fritsch, Keusgen, Khassanov 4132; TASH), Aksai, N exposed slopes, in the shadows of trees and shrubs (41°30'57" N, 70°01'55" E, 1700 m, 23.5.2003 Fritsch, Keusgen, Khassanov 4137 (4078); GAT) TAX 6174, Chimgan valley, W exposed slope (1700 m, July 1995 Kapustina via Pistrick s.n.; GAT) TAX 5448, TAX 5449; Angren valley c. 2 km above Kok-Saraj, SE exposed porphyry slope (41°07' N, 70°21' E, 1300 m, 17.5.1998 Fritsch 1665; GAT) TAX 5785; Ugam range, between Charvak and Sijjak about 5 km S Sharkiramasaj (41°39'15.8" N, 70°00'14.8" E, 1200 m, 24.5.2003 Fritsch, Keusgen, Khassanov 4138; GAT), above town Charvak, E exposed shrubby slope (41°38' N, 69°57' E, 1050 m, 20.5.1998 Fritsch 1669; GAT) TAX 5789, Nauvalisaj, 5 km above the road (41°45'42.8" N, 70°05'04.6" E, 1150 m, 24.05.2003 Fritsch, Keusgen, Khassanov 4140 (4081); GAT) TAX 6176; Pskem ridge, nearby village Nanaj, valley Aksarsaj (41°42'06.4" N, 70°08'40.7" E, 1070 m, 12.5.2005 Fritsch & Khassanov 4225; GAT) TAX 6377; Karshantau ridge, near vill. Pskem (unknown collector from Bot. Institute Tashkent, 41°56'30" N, 70°22' E, 1500 m, 27.6.1994 Fritsch, Khassanov, Pistrick 1166; GAT) TAX 5039, slopes above the sanatorium of Khumsan, in the shadow of trees (41°40' N, 69°57' E, 800 m, 20.5.1998 Friesen & Fritsch 1667; GAT) TAX 5787, Aktashsai c. 55 km NE Tashkent, in the shadow under *Juniperus zeravshanica* (41°40' N, 69°46' E, 1500 m, 15.5.2001 Fritsch & Hoffmann 1734; GAT) TAX 5879, slopes near vill. Sajlyk (41°39' N, 69°47' E, 1600 m, 25.6.1988 Fritsch 250 & 256; GAT) TAX 2521, TAX 2522, valley Aktash c. 10 km N vill. Gazalkent (41°40' N, 69°47' E, 1430 m, 03.6.1990 Fritsch & Pistrick 590, 592; GAT) TAX 2983, TAX 2985; Kurama ridge, slopes N pass Kamchik, S to SW exposed porphyry slopes (41°07' N, 70°30' E, 2000 m, 18.5.1997 Fritsch & Khassanov 1606; GAT) TAX 5675.

**Remarks:** Irrespective of a superficial similarity, this taxon differs from *A. sewerzowii* s. str. by the coarse, finely and darker ribbed, and rather long-lasting sheathy prophyll, somewhat longer scapes, a denser and finally subglobose inflorescence, often brightly pink tepals with narrower median veins, and scarcely colored filaments. The erroneous affiliation of plants growing in the vicinity of Tashkent to *A. sewerzowii* traces most probably back to Regel (1887), who determined vouchers from the vicinity of Tashkent "Prope Taschkend in hortis (Krause, O. Fedtschenko)" as *A. sewerzowii*. One voucher is still present at TASH and turned out to represent *A. suworowii*. It remains unknown whether Regel simply mixed up the epitheta "*sewerzowii*" and "*suworowii*". *Allium tschimganicum* is still more similar and differs from *A. severtzovioides* mainly by short, smooth, whitish and short-living sheathy prophylls, more triangularly tapering tepals, and somewhat longer filaments always with long teeth at the base of inner filaments. Molecular markers (ITS sequences of nuclear rDNA) supported a close relationship to *A. sewerzowii*, *A. tashkenticum*, and *A. saposchnikovii* p. p. (the western Tianshan geographical clade of sect. *Acmopetala*), less close relations to *A. costatovaginatatum*, *A. tschimganicum*, *A. dasyphyllum*, and *A. vvedenskyanum*, and only moderately close relations to *A. karataviense* (Fritsch & al. 2010: 190 cluster 5 § 3.7.5; Fritsch 2012b: 250-251 Fig. 3 M; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region confirmed these relationships with a lower resolution but four haplotypes of *A. severtzovioides* were found (Gurushidze & al. 2010: 836, fig. 4 lineage III).

**Etymology:** The epithet refers to the morphological similarity to *A. sewerzowii* and was deduced from the orthographic variant *A. severtzovii* by applying the Greek suffix "-ides" indicating relationship.

**Biological data:** The genome size of 32.1 pg 2C DNA is smaller than in *A. tschimganicum* (36.5 pg as *A. motor*, Gurushidze & al. 2012). The seed storage proteins were analyzed by Maass (1992, Fig. 5 "sewe"). Fresh bulbs contain in total 0.02 / 0.1 % cysteine sulfoxides (? / 82 % methiin, ? / 0 % alliin, ? / 18 % isoalliin, ? / 0 % propiin; Keusgen & al. 2008).

**Economic traits:** Local name 'tosh-modor'. In the Uzbek mountains, the leaves are sometimes collected in the spring time and used as stuffing for the national pastries somsa, sambusa, and pelmeny; locally they are applied against stomach and duodenum diseases (Keusgen & al. 2006) but with lower activity than *A. tschimganicum* (Anonymous 1985, Khassanov & Umarov 1989, Umarov 1992; also in Tajikistan). They are tasteful and very helpful after long cold winter giving strength and rise the blood pressure (Khassanov 2008).

**(54) *Allium tokaliense*** Kamelin & Levichev in Krassovskaja & Levichev, Flora Chatk. zapov. 170 (1986) '*tokalense*'. — *Allium severtzovii* sensu Vved. & auctt., p. p. minore. — **Type:** Uzbekistan: Tashkent-kaya obl., Chatkal'skij khr., Bashkyzylsai, gora Bol'shoj Tokali [Tashkent region, Chatkal range, Bashkyzylsai, Mt. Tokali Major]; 4.7.1975, leg. Levichev & Krassovskaja (holotype LE!, isotype TASH).

**Distribution:** Uzbekistan, Kirgizstan ? : Only known from Chatkal range, grows punctually on montane steppe slopes.

**Description** (adapted from the original description): Scape and leaf shape like *A. tschimganicum*, high, with a longitudinal pattern of narrow brown stripes, sheathy prophyll thin-leathery and long-standing. Spathe membranous, divided into 2-4 broadly ovate, cuspidate valves shorter than the pedicels; buff with inconspicuous veins. Pedicels unequally long (last flowers own the longest), thin wiry, straight to slightly ascending; green with brown flush. Tepals obtuse or subobtuse, shape like *A. severtzovioides*, the color without striking nerves like *A. tschimganicum*. Filaments ± as long as the tepals; basally shortly connate and long triangular (inner filaments 2-3 times broader and with 2 small teeth), above subulate; pinkish. Anthers oblong; c. 2 mm long, 0.8 mm broad; lilac to violet. Pollen yellowish gray. Ovary sessile, depressed-globose triangular, 2-3 mm broad, 1.5-2 mm long; surface finely papillous; green with darker suturs. Style narrowly conical, 3-4 mm long; pink to lilac. Stigma undivided; whitish. Capsule broadly ovoid, surface scabrous, c. 4-5 mm long and 4-6 mm in diam.; valves rounded cordate, ± scarcely notched at the apex.

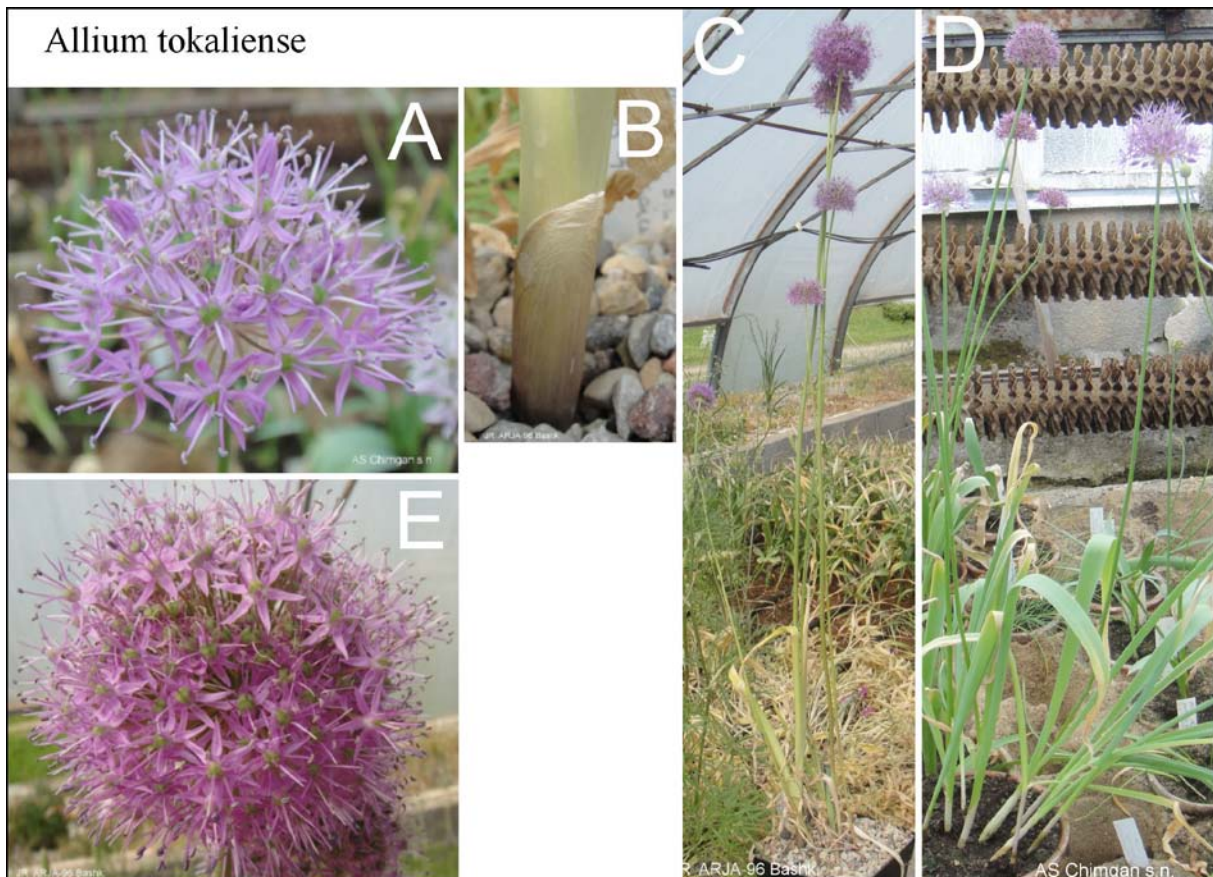


Plate 54: Plants cultivated in Latvia are shown. A: Inflorescence in early anthesis; B: outer sheath leaf; C & D: plants in late and early anthesis, resp.; E: inflorescence in late anthesis.

Living accessions studied: Uzbekistan: Kurama ridge, E part of Kamchik pass, slopes near the road c. 5 km below the pass (41°03'11.7" N, 70°34'00.6" E, 1930 m, 19.5.2003 Fritsch, Keusgen, Khassanov 4115; TASH).

Remarks: This taxon shares several characters with *A. tschimganicum* (general habit, flower color, tepals with inconspicuous median vein, and the presence of two small teeth at the basis of filaments), others with *A. severtzovioides* (subobtusate tips of tepals, and ovoid capsules), and the sheathy prophyll owns the shape but not the strength as in *A. severtzovioides*. Though described as assumed hybrid, the plants are apparently not sterile judging from the many plants present at the type location and punctual occurrence in other areas. Two samples were available for molecular studies (ITS sequences of nuclear rDNA), one of which was attached to *A. severtzovioides*, the other to *A. tschimganicum* (Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). This result is no clear evidence for the hybrid state, and also no clear proof of the contrary, investigation or more samples would be essential.

Etymology: The epithet refers to the Mt. Tokali in the Chatkal mountain range where the type specimen was collected.

8.4 *A.* sect. *Acmopetala* **subject. *Inornatae*** R.M. Fritsch  
in Linzer Biol. Beitr. 26: 970 (1994). — Type species: *Allium sewerzowii* Regel

(55) *Allium sewerzowii* Regel in Suppl. Indic. sem. a. 1866 horti Petrop.: 26 (1867), quoad typum, et in Bull. Soc. Imp. Naturalistes Moscou 41: 453 (1868), s. str.; emend. R.M. Fritsch in Linzer Biol. Beitr. 26: 972 (1994), non sensu Vved. & auct. Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 252 (1875), Regel in Izv. Imp. obshch. lyub. est., antr. etnogr. 21, 2 (1876) 103, t. XVII f. 5-7. Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887). — *Allium "severtzovii"* sensu Vved., Flora URSS 4: 266 (1935) incl. *A. tschimganicum*; Vved., Flora Uzbek. 1: 460 (1941) excl. *A. tschimganicum*; Vved., Flora Tadzh. SSR 2: 347 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 84 (1971); sensu Pav-

lov & Polyakov, Fl. Kazakhst. 2: 190 (1958); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 52 (1967), omnia p. p. minore. — Lectotype: Kazakhstan: Im Kokanischen bei [Kokand region near] Boroldaj, Mai (1866?), leg. Sewerzow ("Beschr. bei Gartenpfl. Aussaat [description at garden plants sowing] Nr. 19", LE!, design. Regel, 1868; see Fritsch 1990: 507). Another voucher labeled "Lectotype" (Seisums dated 1992, unpublished) "Ex horto bot. Petropolitano 77. 6" (LE!) cannot serve as lectotype because it cannot have been used by Regel when he described this species.

Distribution: Kazakhstan, Kirgizstan, Uzbekistan (not present in the mountains E Tashkent), Tajikistan: Western Tianshan mountain ranges, colline to submontane, open dry steppe slopes.

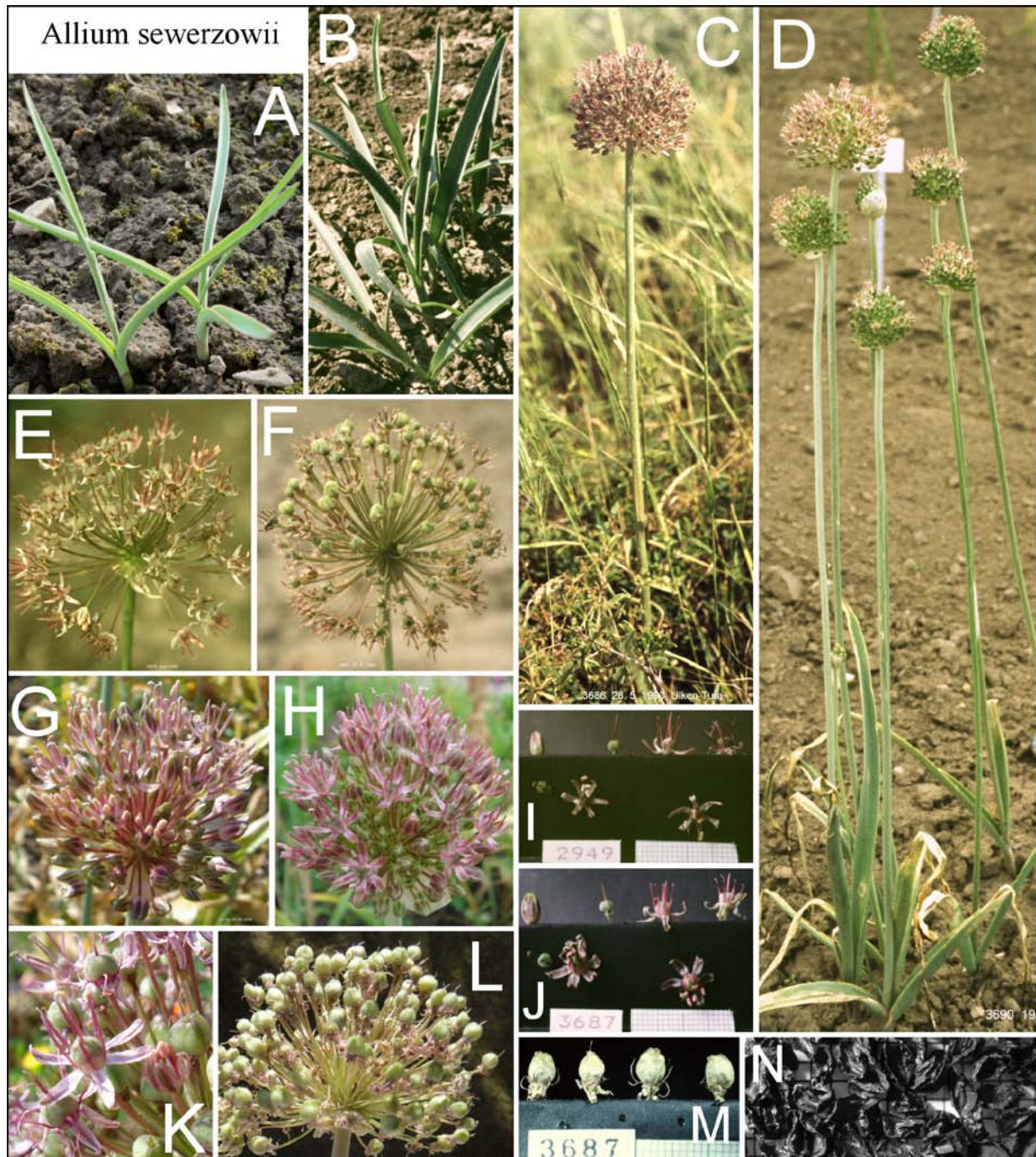


Plate (55): A & B: Sprouting leaves of cultivated plants; C: flowering plant at Ulken-Tura, Kazakhstan; D: cultivated plants in buds and early stages of anthesis, resp.; E & F: inflorescences of cultivated plants from Kochkarli, Tajikistan, in late anthesis; G & H: inflorescences of cultivated plants from Karatau range, Kzakhstan, in early anthesis; I & J: comparisons of flowers and flower parts in different stages of anthesis (I from Kochkarli, J from Ulken-Tura); K: close-up of opening buds, flowers, and developing capsules; L: inflorescence with developing capsules; M: ripe capsules; N: seeds (millimeter paper as background and measure scale of I, J, M & N).

**Description:** Bulbs  $\pm$  ovoid, rarely with small side bulbs on long stolons, 6-12 mm in diam., 8-15 mm long; inner tunics strong papery, white, outer tunics gray to blackish, slightly longitudinally splitting, finally disintegrating. Scape straight or somewhat flexuous, terete, smooth; 40-60 cm long, 4-8 mm in diam., slightly thickened below the inflorescence; dull green, basally purplish flushed. Leaves 1-3, laminae linear-lanceolate,  $\pm$  obliquely sideward directed; thickish, broadly canaliculate; upper side smooth or somewhat grooved, lower side with few flat and broad ribs; margins narrowly whitish or reddish, finely toothed,  $\pm$  long tapering into the narrow, slightly hooded apex; 20-50 cm long, 1-2.5 cm broad; dull green with glaucous bloom, basally often maroon. Sheathy prophyll up to 3 cm long,  $\pm$  smooth,  $\pm$  strong, moderately long-lasting; buff. Spathe membranous, nearly completely divided in 2-3 long cuspidate valves, mostly shorter than the pedicels; whitish with inconspicuous veins. Inflorescence semi-globose later flat conical; loose, many-flowered; 6-8 (fruiting up to 12) cm in diam., 5-6 cm long. Pedicels subequally long, thin wiry, slightly ascending; silk-glossy brown-green. Anthesis in June. Flowers cup-shaped starlike. Tepals linear to obovate, subobtusate, spoon-like concave, initially patent later reflexed and crumpled; 5.5-7 mm long, 1.5-2 mm broad; yellowish to pink, deeper speckled with narrowly lanceolate, brownish-green median vein, more conspicuous in the upper half. Filaments as long as the tepals or up to 1/3 longer; basally for c. 0.3 mm connate and inner filaments broadly triangular widened and often shortly bidentate, above like outer tepals  $\pm$  subulate; purplish speckled or violet, fading towards base and apex. Anthers oblong; 1.5-2.5 mm long, 0.7-1.2 mm broad; yellowish-pink. Pollen yellowish-gray. Ovary stipitate, depressed-globose triangular, c. 3 mm long, up to 4 mm in diam.; surface rounded or acutish papillous; gray-green with dark green sutures. Up to 5 ovules per locule, 13 ovules per ovary (Filimonova 1970). Nectaries mound in small pores near the base of the ovary. Style conical-threadlike, (2) 4-6 mm long; purplish speckled. Stigma undivided; whitish. Capsule broadly ovoid, surface coarse, 4-6 mm long and in diam.; narrowly open, valves roundish-cordate, shortly attenuate and scarcely notched at the apex; dull buff. Seeds flat triangularly oblong to semicircular with sharp edges; surface papillous with some very irregular and sharp ledges, silk-glossy black; 2-2.5 mm long, c. 1.5 mm broad, 1-1.2 mm thick. The testa showed Omega-like undulated anticlinal walls, the periclinal walls were generally verrucate with a moderate number of verrucae (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Kazakhstan: Steppe hills N Tashkent TAX 3358).

**Living accessions studied:** **Kazakhstan:** Aksu-Dzhebogly reservation (1500 m, 09.8.1997 Khassanov 4099; TASH GAT) TAX 5844; Karatau range c. 80 km SE Chajan, foothills of Mt. Ulken-Tura c. 3 km above Karatas (42°50' N, 69°52' E, 500 m, 28.5.1993 Fritsch 923 & 927; GAT) TAX 3686, TAX 3687, c. 30 km SW Jambul, pass Kujuk ca. 2 km W of the main road Chimkent - Jambul (42°45' N, 70°56' E, 1050 m, 30.5.1993 Fritsch 934; GAT) TAX 3690. **Tajikistan:** Foothills of Kurama ridge, unploughed strip S vill. Kochkarli (40°40' N, 69°25' E, 28.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 554; GAT) TAX 2951, dry hill top (40°38' N, 69°34' E, 800 m, 28.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 546; GAT) TAX 2949. **Uzbekistan:** Tashkent Chuli region, hills E of last railway post S Dzhilga c. 70 km N Tashkent (41°40' N, 69°04' E, 450 m, 08.5.1992 Fritsch 724 B, 772; GAT) TAX 3358, TAX 3370; Alymtau hill ridge c. 60 km NE Tashkent, red gypseous slopes (41°45' N, 68°39' E, 500 m, 14.5.1997 Khassanov via Fritsch 1598; GAT) TAX 5667.

**Remarks:** *Allium sewerzowii* is the type species of subsect. *Inornatae*. The plants are inconspicuous, moderately tall, and owns relatively short and flat leaf laminae with very coarse margins, rather loose inflorescences, yellowish pink speckled tepals, not pinkish-purple ones as *A. severtzovioides*, and purple to maroon, not pinkish, filaments. The southernmost population in Kurama ridge in northern Tajikistan is somewhat exceptional in having narrower leaves, and filaments and median veins of tepals are still darker. Plants occurring in the western foothills of Talas Alatau range (roughly in the middle of the area of distribution) differ by wider leaf blades and purplish-green tepals with maroon median veins and maroon filaments. The taxonomic state of these populations is not clear yet. Molecular investigations (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) confirmed the affiliation to the western Tianshan geographical clade of sect. *Acmopetala*, more in detail discussed under *A. severtzovioides* (Gurushidze & al. 2010: 836, fig. 4 lineage III; Fritsch & al. 2010: 190 cluster 5 § 3.7.5; Fritsch 2012b: 250-251 Fig. 3 M; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201).

**Etymology:** The epithet honors the outstanding Russian traveler and plant collector in Central Asia, Nikolai Alekseevich Sewerzow, who was acting in the last decades of 19th cent.

**Biological data:** Good seed germination was observed at 5 °C, but very bad at temperatures above 10 °C (Specht & Keller 1997). The genome size of 56.5 pg 2C DNA is much larger than in *A. severtzovioides* (32.1 pg, Gurushidze & al. 2012). The bulbs are located c. 6 cm deep in the soil, and the many unbranched roots penetrate the soil up to 30 cm deep (Kamenetskaya 1987).

**Economic traits:** Very rarely offered as ornamental (Fritsch 2015).

**(56) *Allium tashkenticum*** F.O. Khas. & R.M. Fritsch [in Linzer Biol. Beitr. 26: 971 (1994), nom. inval.], **spec. nova**<sup>1</sup>. — *Allium collis-magni* sensu Levichev in Krassovskaja & Levichev, Flora Chatk. Zapov.: 111 (1986), non s. str. — **Type:** Ex cultis in horto Gaterslebensis [cultivated in Gatersleben] no. TAX 2984, leg. 09.6.1992 (bulbs from Uzbekistan: Karshantau-Gebirge, Tal Aktash ca. 10 km nördl. Gazalkent, steinige Südhänge bei [Karshantau ridge, valley Aktash c. 10 km N Gazalkent, S exposed stony slopes at] 1650-1850 m NN, 03.6.1990 leg. Fritsch & Pistrick U591] (holotype GAT!).

**Distribution:** Uzbekistan, Kirgizstan?, Kazakhstan: Western Tianshan mountain ranges, Chatkal, Karshantau, and Kurama ridges; montane dry steppe and rock slopes, often among bushes and under trees, shallow-soil crest areas. The eastern limit of distribution area is unclear hitherto.

**Description:** Bulbs ovoid to depressed-globose, 15-35 mm in diam., 15-30 mm long; inner tunics papery, crème to reddish, outer tunics grey to maroon or blackish, parchment-like to leathery, extended in a short neck. Scape ± straight, terete, smooth; 30-50 (80) cm long, above (4) 5-8 mm, basally (5) 6-10 mm in diam.; silk-glossy green with slight glaucous bloom, basally sometimes reddish flushed. Leaves (1) 2-3 (5), laminae oblong to linear-lanceolate, initially subprostrate then obliquely ascending with drooping upper part, thickish, basally deep canaliculate soon becoming flat; upper side smooth or with some grooves, lower side with shallow broad ribs later smooth; margins narrowly white, basally finely toothed above glabrescent, shortly arcuately tapering into the slightly hooded apex; (10) 20-50 cm long, (0.8) 2-3.5 (4.5) cm broad; glossy yellowish green, initially basally with a purplish suffused lower side. Sheathy prophyll short, smooth, hyaline but strong, silk-glossy whitish, late decaying. Spathe ± thin papery but strong, for 3/4 divided in (1) 2-3 obtuse to shortly acuminate valves, somewhat shorter than the pedicels; pale brownish with darker veins. Inflorescence semi-globose later subglobose; dense, many-flowered; 4-6 cm long, 5-8 cm in diam., after anthesis irregularly formed. Pedicels subequally long, thickish wiry, straight or slightly ascending; 2-3.5 cm long; glossy green with brown to purplish flush. Anthesis in June. Flowers cup- to bowl-shaped starlike. Tepals oblong-lanceolate, obtuse with shortly plicate and claw-like apex, concave, obliquely sideward directed later ± reflexed and crumpled or enrolled; 4-6 mm long, 1.5-2 mm broad; ± yellowish light green-brownish, later buff, with a broad, lanceolate, pinkish-green or reddish median vein that disappears toward the base. Filaments ± as long as the tepals; basally for c. 0.5 mm connate and arcuate-triangular widened (inner filaments 2-4 times broader); above subulate; pinkish-carmine to violet, basally nearly colorless, often darker when dry. Anthers oblong; c. 2 mm long, c. 1 mm broad; yellowish to pale violet. Pollen grayish to bright yellow. Ovary ± shortly stipitate, triangular-depressed globose, 2-2.5 mm long, c. 3 mm in diam.; surface finely acutish papillous; green, often initially violet flushed; 6-8 ovules per locule. Nectary ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b as *A. collis-magni*). Style conical-thread-like, initially short later to 4 mm long; pale later deep violet. Stigma undivided; whitish. Capsule short conical-triangular, surface finely papillous with a few raised wrinkles, 5-7 mm long, 4-6 mm in diam.; whitish-green later brown; valves broadly ovate, shortly notched at the apex; buff. Seeds 2-3 per locule, triangular-oblong to semicircular with concave sides and sharp edges; surface finely papillous with sharp raised edges, silk-glossy black; 2.5-3.2 mm long, 1.5 mm broad, c. 1.2 mm thick. TKW 2.53 g

<sup>1</sup> The depository of the type specimen was missing in the description of 1994. Therefore the completed description is repeated here in order to validate this species.

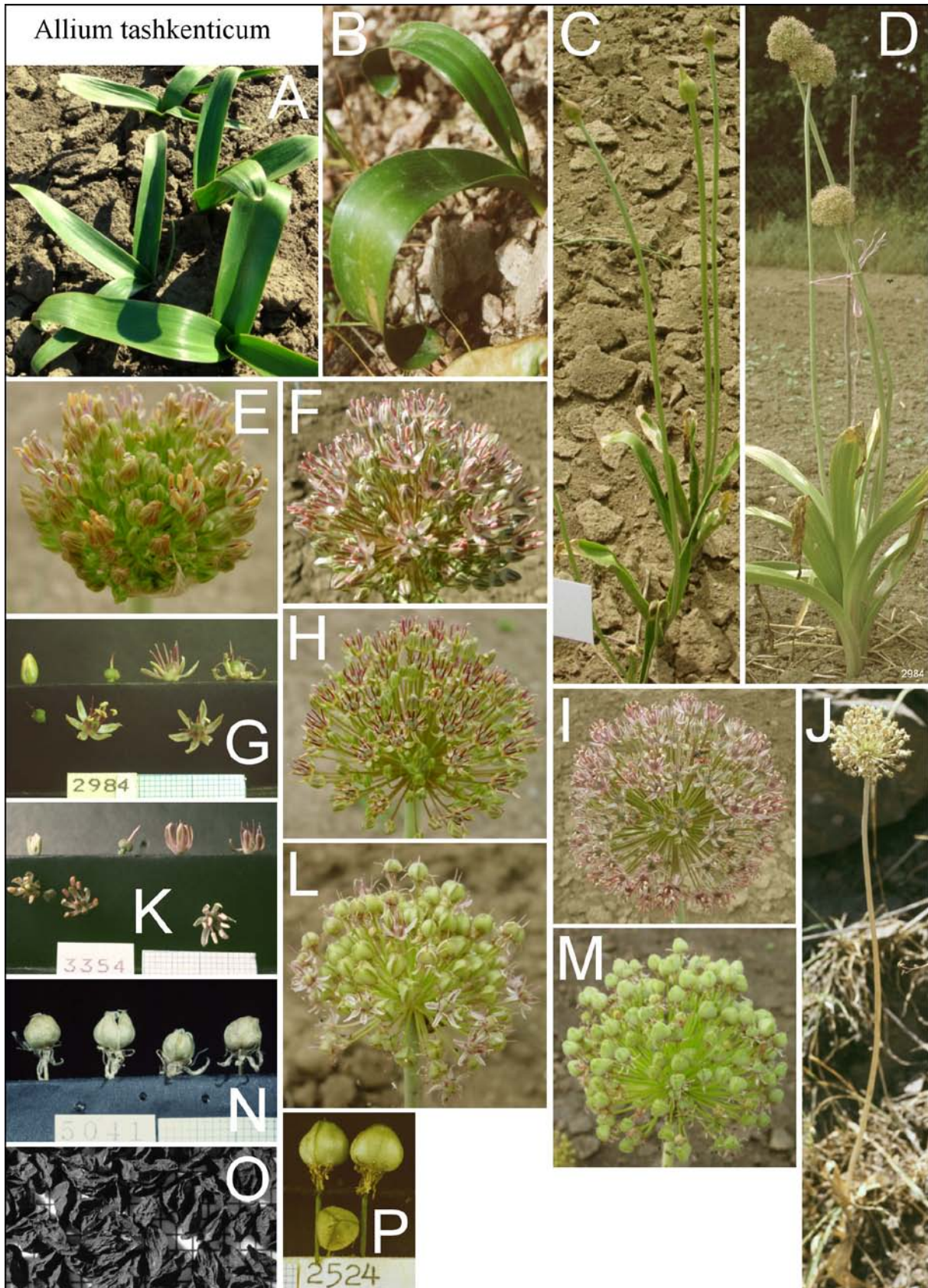


Plate (56): Cultivated plants (except B and J) are shown. A: Sprouting leaves; B: plant in early shooting stage in Chimgan Mts., Uzbekistan; C: plants in later shooting stage; D: plants in full anthesis; E & F: inflorescences in early anthesis; G & K: comparison of flowers and flower parts in different stages of anthesis; H & I: inflorescences; J: plant with infructescence in Chimgan Mts.; L & M: inflorescences in late anthesis and with developing capsules, resp.; N: ripe open capsules; O: seeds; P: full-sized capsules (millimeter paper as background and measure scale of G, K, N, O & P).

(IPK, unpubl. data). The testa showed Omega-like undulated anticlinal walls. The periclinal walls were generally verrucate with a moderate number of verrucae (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Uzbekistan: Chatkal range, Sukok TAX 3351).

Living accessions studied: Uzbekistan: Chatkal range, Chimgan massif, Galabasai valley (41°32'06.3" N, 69°53'29.5" E, 1000 m, 23.5.2003 Fritsch, Keusgen, Khassanov 4131 (4072); GAT) TAX 6171, Chimgan valley (41°24' N, 70°05' E, 2100 m, 19.6.1988 Fritsch 234; GAT) TAX 2516, Aksai valley, steep granitic slope near *Betula tianschanica* stands (41°32' N, 70°02' E, 2000 m, 18.5.2001 Fritsch & Hoffmann 1762; GAT) TAX 5885, Karazazar valley c. 2.5 km S town Charvak, porphyry slopes (41°36' N, 69°55' E, 900 m, 28.6.1994 Fritsch, Khassanov, Pistrick 1169; GAT) TAX 5041; Chatkal range above village Sukok, 50 km E Tashkent (41°14'55.5" N, 69°49'14" E, 1400 m, 09.5.2005 Fritsch & Khassanov 4211; GAT) TAX 6362, loess slopes with plantations and shrubs (41°17' N, 69°51' E, 1250 m, 19.5.1992 Fritsch 761; GAT) TAX 3351, valley Aksakata, 30 km NE town Chirchik (41°21'26.8" N, 69°55'29.4" E, 1360 m, 10.5.2005 Fritsch & Khassanov 4221; GAT) TAX 6373; Karshantau ridge, side valley above the sanatorium N Khumsan (41°42'02.3" N, 69°55'55.4" E, 1080 m, 03.6.2003 Fritsch, Keusgen, Khassanov 4189 (4130); GAT) TAX 6205, Aktash valley c. 10 km N Gazalkent, stony S exposed slopes (41°40' N, 69°47' E, 1750 m, 03.6.1990 Fritsch & Pistrick 591; GAT) TAX 2984, slopes near vill. Sajlyk, tall forbs association (41°39' N, 69°47' E, 1900 m, 25.6.1988 Fritsch 258; GAT) TAX 2524; Ugam ridge above town Charvak, rose shrubs under *Crataegus turkestanica* (69°57' N, 41°38' E, 1050 m, 20.5.1998 Fritsch 1668; GAT) TAX 5788; Pskem range, Aksarsai near village Nanay (41°42'04" N, 70°08'16.8" E, 1080 m, 06.6.2006 Fritsch & Khassanov 4250; GAT) TAX 6535; Chatkal reservation, left slope of Karagachlisai, among dense shrubs and perennials (41°17' N, 69°51' E, 1500 m, 19.5.1992 Fritsch 769; GAT) TAX 3354; Angren valley between vill. Chetsuv and Kok-Saraj, S exposed meadow slope with rock outcrops (41°05' N, 70°18' E, 1500 m, 17.5.1998 Fritsch 1661; GAT) TAX 5778.

Remarks: *Allium tashkenticum* is a very characteristic species more striking with glossy, yellowish-green leaves than with flower characters: The yellowish tepals are inconspicuous though they contrast to dark filaments. Plants from the Kurama ridge differ by slightly narrower and semi-dull leaf laminae, whitish tepals, and blackish-violet filaments. They might belong to a separate taxon but were not available yet for molecular analyses. According to molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region), *A. tashkenticum* is somewhat variable and belongs to the western Tianshan geographical clade of sect. *Acmopetala*. A close relationship exists to *A. sewerzowii*, *A. severtzovioides*, and *A. saposhnikovii*, and a less close relationship to *A. costatovaginatatum*. More distantly related are *A. tschimganicum*, *A. dasyphyllum*, and *A. vvedenskyanum*, with *A. karataviense* as most basal sister group (Gurushidze & al. 2010: 836, fig. 4 lineage III; Fritsch & al. 2010: 174 cluster 5 § 3.7.5; Fritsch 2012b: 250-251 Fig. 3 M; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201).

Etymology: The epithet refers to the Uzbek capital Tashkent. This species occurs in the mountains East and South of this town.

Biological data: The genome size is 30.4 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.16 % cysteine sulfoxides (53 % methiin, 47 % isoalliin; Keusgen & al. 2008).

Economic traits: Developing scapes are eaten (Khassanov & Umarov 1989, as *A. collis-magni*). Local name 'tosh-modor', belongs to the most important edible species in the Uzbek mountains (Khassanov 2008).

#### 8.5 *A. sect. Acmopetala* **subject. *Pharmakoprason*** R.M. Fritsch

in *Phyton* (Horn, Austria) 49: 190 (2010). — Type species: *Allium tschimganicum* O. Fedtsch.

(57) *Allium tschimganicum* [B. Fedtsch. ex] O. Fedtsch. in *Progress. Sadov. Ogorodn.* no. 36: 332 ([09. IX.]1906) (descr. ross.), sensu stricto, non sensu Vved., *Flora URSS* 4: 263 (1935); nec Vved., *Flora Uzbek.* 1: 459, 460 (1941) ambae sub *A. "fetissovii"*, p. p. — *Allium motor* Kamelin & Levichev in *Krassovskaja & Levichev, Flora Chatk. zapov.*: 168 (1986). Type: Uzbekistan: Tashkentskaya obl., Chatkal'skij zapovednik, lev. bereg Bash-Kyzyl-saya [Tashkent region, Chatkal reservation, left bank



of Bashkzyzylsai], Alchazar, 13.5.1973, leg. Krassovskaja & Levichev (holotype & isotype LE!, topotype TASH!). Non *A. tschimganicum* "B. Fedtsch." in Vved. & al., *Opred. rast. okrestn. Tashkenta* [Key Pl. Envir. Tashkent] 1: 64-65 (1923), in clavis; nec non *Allium tschimganicum* sensu Pavlov & Polyakov, *Fl. Kazakhst.* 2: 188 (1958), sub *A. "fetissoyii"*, p. p.; nec sensu Pavlov & Polyakov, l. c. 190, sub "*A. severtzovii*", p. p. — **Lectotype**: "*Allium tschimganicum* B. F. Ol'gino, cult. 1902 g. Semena iz Chimgana poseyali IX. 1897, tsvety v 1j raz v 1901 g." [cultivated in O'lgino, {leg.}1902. Seed from Chimgan was sown in September 1897, flowered for first time in 1901] with a second label "lectotype *A. Seisums* 1992" (LE!, design. Fritsch & al. 2010: 207).

**Distribution**: Uzbekistan, Kirgizstan: Western Tianshan mountain ranges, submontane to subalpine often shallow-soil slopes between perennials, shrubs and trees.

**Description**: All plant parts contain a red sap that leaks from any damaged tissue. Bulbs (depressed-) globose, often with small side-bulblets, 1-4 (6) cm in diam., up to 4 cm long; inner tunics strong papery, whitish, outer tunics dark grayish-brown, somewhat longitudinally splitting, finally disintegrating. Scape straight or subflexuous, terete, smooth; 50-100 (140) cm long, 4-5 (basally up to 12) mm in diam.; dull green with glaucous bloom, basally purplish suffused. Leaves 2-4 (6), laminae linear-lanceolate, stiff arcuately ascending rarely stronger recurved, basally thick, above thinner, basally broadly canaliculate

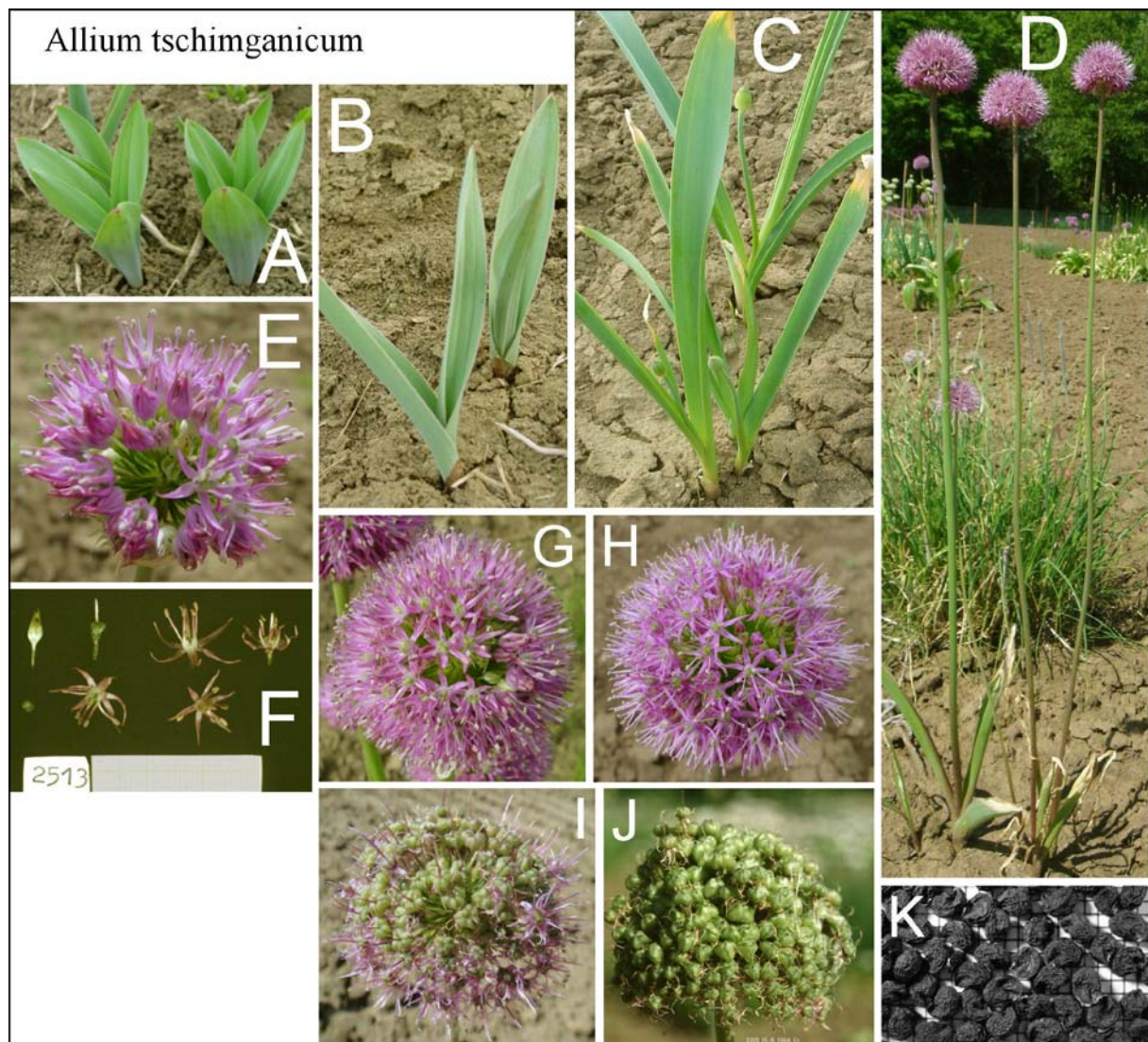


Plate (57): Cultivated plants are shown. A & B: Leaves in different stages of sprouting; C: plants in shooting stage; D: flowering plants; E, G & H: inflorescences in early to full anthesis; F: comparison of flowers and flower parts in different stages of anthesis; I & J: inflorescences in late anthesis and with developing capsules, resp.; K: seeds (millimeter paper as background and measure scale of F & K).

above nearly flat; upper side smooth or finely grooved, lower side shallowly and broadly ribbed; margins narrowly white to reddish, basally densely toothed, glabrescent towards the shortly tapering, strongly hooded apex; 20-50 cm long, 1.2-2.5 (4) cm broad; vividly to bluish green with mostly strong glaucous bloom. Sheathy prophyll short to long,  $\pm$  thin membranous, bright brownish-green with brown veins, quickly decaying. Spathe membranous,  $\pm$  completely divided into 2-4 long-ovate valves,  $\pm$  as long as the pedicels; whitish to pale brown with inconspicuous to brownish-violet veins. Inflorescence fastigiate to semi-globose finally subconical and longer as broad; dense, many-flowered; 3-7 cm in diam., 3.5-5 cm long. Pedicels subequally long, thin wiry, straight; initially 1-1.5, fruiting up to 2.5 cm long; glossy green, above reddish flushed. Anthesis in May to June. Flowers bowl-shaped starlike. Tepals long lanceolate-triangular, gradually cuspidate, patent, later reflexed and  $\pm$  tortuous; 5-7 (9) mm long, basally 1-1.8 mm broad; purplish pink with inconspicuous darker median vein fading towards the apex but outside more distinct. Filaments  $\pm$  as long as the tepals; basally for c. 0.5 mm connate and above subulate, inner filaments basally (3-4 times broader) triangularly widened and with 2 small teeth, straight, outer filaments deflexed; pinkish with paler base. Anthers oblong-ovoid; 1.5-2 mm long, c. 1 mm broad; pale grayish-violet. Pollen yellowish-gray. Ovary shortly stipitate, depressed-globose triangular, 2-3 mm broad, 1.5-2 mm long; surface papillous; grayish green with dark green sutures, basally brownish flushed. The nectary ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b as *A. motor*). Style conical-threadlike, 5-8 mm long; initially whitish finally pink. Stigma undivided; whitish. Capsule broadly ovoid-triangular, initially flat-ovoid, surface papillous, up to 8 mm long and in diam.; moderately widely open, valves broadly ovate, distinctly notched at the apex. Seeds (1) 2-4 per locule, convex, semicircular to comma-shaped, often with one concave side and sharp edges; papillous with dense and irregular, raised wrinkles, silk-glossy black; 2.5-3.2 mm long, c. 2 mm broad, 1.3-1.6 mm thick. The testa showed periclinal walls with many prominent verrucae and S- to U-like undulation of anticlinal walls (Kruse 1994; Fritsch & al. 2006, Fig. 3).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 147, Vakhtina & al. 1977 total length of chromosomes (Uzbekistan: Tashkent area, Karshantau ridge, no. 715 "*A. fetissovii*").  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Uzbekistan: Chatkal range, Karagachlisai TAX 3357 "*A. motor*", near type location of *A. motor*).

**Living accessions studied:** **Uzbekistan:** Chatkal range, N village Chetsuv (41°07'02.6" N, 70°14'18.9" E, 1700 m, 04.6.2003 Fritsch, Keusgen, Khassanov 4192 (4133); GAT) TAX 6208, (41°08'05" N, 70°13'37.8" E, 2350 m, 04.6.2003 Fritsch, Keusgen, Khassanov 4195; TASH), above village Sukok, 50 km E Tashkent (41°14'43.1" N, 69°50'16.3" E, 1510 m, 09.5.2005 Fritsch & Khassanov 4218; GAT) TAX 6369, Chilchenboa massif near Jangiabad N Angren, loose shrubs (41°10' N, 70°08' E, 1800 m, 06.6.1990 Fritsch & Khassanov 600; GAT) TAX 2990, Bashkysylsai valley (1200 m, Levichev s. n.; GAT) TAX 2792, Mt. Minora (2300 m, Levichev s. n.; GAT) TAX 2793, NE exposed left slopes of Karagachlisai, among shrubs and *Juniperus* (41°17' N, 69°51' E, 1550 - 1600 m, 19.5.1992 Fritsch 765, 771 A, B, C, 772 c; GAT) TAX 3353, TAX 3355, TAX 3356, TAX 3357, TAX 3983; Chimgan massif, Aksaj and Chimgansaj (41°31' N, 70°02' E, 1650-1980 m, 23.5.2003 Fritsch, Keusgen, Khassanov 4133; GAT), N slope of Chimgan massif, loamy terraces beside the creek in Aksai (40°59' N, 69°40' E, 1600 m, 18.5.2001 Fritsch & Hoffmann 1752; GAT) TAX 5881, Chimgan valley, W exposed slopes (collected by Kapustina, 1700 m, July 1995 via Pistrick s. n.; GAT) TAX 5446, (41°24' N, 70°05' E, 1800 m, 19.6.1988 Fritsch 230; GAT) TAX 2513; Ugam massif, near vill. Khumsan (collected by Khassanov, 41°40' N, 69°57' E, 1400 m, 04.6.1990 Fritsch 593; GAT) TAX 2986; Obgait valley between Majdantal and Pskem massif (collected by Kapustina, 2000 m, July 1995 via Pistrick s. n.; GAT) TAX 5447.

**Remarks:** *Allium tschimganicum* is the only species of subsect. *Pharmakoprason*. It is morphologically mainly characterized by short, smooth, thin and quickly decaying sheathy prophylls and two variably shaped teeth at the base of filaments, but shares the general habit, as well as soft, moderately wide leaves and dense heads of pinkish-purple flowers with *A. severtzovioides*. An original voucher determined by B. Fedtschenko is present in LE. Unfortunately, bulbs and subterranean parts are missing that would allow a doubtless identification. Violet flowers given in the original description of *A. tschimganicum* fit much better to the purplish-pink tepals of *A. motor* than to the shining pink ones of *A. severtzovioides*, side-teeth on the inner filament bases are common for *A. motor* but rare in *A. severtzovioides*, and it is especially underlined by Fritsch & al. (2010: 208) that the carefully working botanists Olga and Boris Fedtschenko would have recognized the long and strong sheathy prophylls of *A. severtzovioides*

if they were present and would not have laid the plant into the press without the prophylls. Thus several characters more favor identity with *A. motor* than with *A. severtzovioides*.

Vvedensky's (1923) point of view is not helpful in this respect. His description does not fit to the authentic material and refers probably to *A. costatovaginatatum*, but vouchers were not mentioned. In 1935, Vvedensky accepted *A. tschimganicum* as synonym of *A. fetisowii* as well as of *A. suworowii* without presenting arguments. Later, Vvedensky (1971) again accepted *A. tschimganicum* as pink flowering taxon with 4 mm long tepals, referring again most probably to *A. costatovaginatatum*. Molecular markers (ITS sequences of nuclear rDNA) included all samples in a well supported sub clade that is closely related to the western Tianshan geographical clade of sect. *Acmopetala*, to some more separate species of this section, and to *A. karataviense* as less closely related subgroup (Fritsch & al. 2010: 189 cluster 5 § 3.7.4; Fritsch 2012b: 250-251 Fig. 3 K; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage III) displayed more diversity (3 different haplotypes) but supported the identical relationships.

**Etymology:** The epithet is most probably derived from the Chimgan massif area NE Tashkent (Uzbekistan). The type was grown from seed collected there.

**Biological data:** The genome size of 36.5 pg 2C DNA is larger than in *A. severtzovioides* (32.1 pg, Gurushidze & al. 2012). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1 as *A. motor*). Bulb extract inhibited the growth of some (mainly Gram-positive) bacteria species (Jedelská & Keusgen 2008 as *A. motor*) and showed a low radical scavenger activity (Jedelska & al. 2004, Jedelská & Keusgen 2008 as *A. motor*). Fresh bulbs contain in total 0.19 % cysteine sulfoxides (only methiin), leaves contain in total 0.07 % cysteine sulfoxides (only methiin; Jedelska & al. 2004, Keusgen & al. 2008).

**Economic traits:** In some parts of the mountains South and East of Tashkent the plants are used by local healers to strengthen the blood pressure, as a tonic and for convalescence (Khassanov & Umarov 1989, Umarov 1992). Local name 'moy-modor'; in the Uzbek mountains the leaves are collected in the spring time and used for soups and as stuffing for the national pastries somsa, sambusa, and pelmeny which owns a specific activity as tonic (Keusgen & al. 2006). They can be found in May on every market in Tashkent district; they are tasteful and very helpful after long cold winter giving strength and rising blood pressure. The local name refers to its leaves that are collected in May, and "modor" means strength. The orange juice coming from the leafstalk is the main character to recognize this species (Khassanov 2008). Rarely offered as ornamental (Fritsch 2015).

#### 9. *A.* subg. *Melanocrommyum* sect. *Verticillata* Kamelin,

Florogen. Analiz Srednej Azii: 243 (1973). — *Allium* sect. *Kaloprason* subsect. *Verticillata* (Kamelin) Seisums, podrod *Melanocrommyum* (Webb & Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), comb. inval. *Allium* sect. *Molium* series *Verticillata* Tzag. in Bot. mat. gerb. inst. bot. AN Kaz. SSR vyp. 10: 13 (1977). — **Type species:** *Allium verticillatum* Regel

**(58) *Allium verticillatum*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 103 (1875), nom. altern. Regel in Trudy Imp. S.-Peterb. Bot. Sada 6: 518 (1879), Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 657 (1884), descr. ampl. Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 287, 316 (1887). Vved., Flora URSS 4: 258, tab. 15 fig. 4a, b (1935). Lapin, Opredel. rast. Tashk. oazisa 1: 79 (1938). Nikitina & Kashtsh., Flora Kirg. SSR 3: 89-90 (1951). Pavlov & Polyakov, Fl. Kazakhst. 2: 187 (1958). Vved., Flora Uzbek. 1: 458, tab. 66/2 (1941); Vved., Flora Tadzh. SSR 2: 341, tab. 60/2-3 (1963). Nikitina & al., Flora Kirg. SSR Dopoln. vyp. 1: 36 (1967); Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971); Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 127, tab. 18 fig. 3 (1988). — *Allium pallasii* Murray β *verticillatum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 102 (1875), nom. altern. — **Type:** Uzbekistan: Sarawshan-Tal, Schlucht Sangy dzhuzman [Zaravshan valley, gorge Sangy Juz-

man], 3561' - 7113', 25.5.1869, leg. O. Fedtschenko (holotype TASH-Fedt!, see Khassanov & Fritsch 1994: 983). Neotype superfl.: Kazakhstan: Karatau, VI. 1876, leg. A. Regel (LE, design. Fritsch 1990: 508; see Khassanov & Fritsch 1994: 983).

**Distribution:** Tajikistan, Uzbekistan, Turkmenistan, Kazakhstan, Kirgizstan: Western Tianshan to Pamir-Alai mountain ranges, colline to submontane dry grassy and stony slopes, rock terraces and other shallow soil places.

**Description:** Bulbs ovoid to depressed-globose, very rarely with side bulbs, 8-15 mm long, (0.6) 1-2 cm in diam.; tunics finely membranous to papery, inner tunics yellowish, undivided, outer tunics gray-brown later also maroon or blackish, longitudinally splitting and extended in a neck, finally sometimes accumulating in a leathery shell. Scape flexuous, terete, obconical (base thinner), smooth; 7-15 (20) cm long, 2-5 mm in diam.; green with glaucous bloom, sometimes basally purplish flushed. Leaves 1-2 (3), laminae completely longitudinally divided into (3) 6-9 (12) nearly threadlike, terete, smooth or finely scabrous (dry ribbed) lobes of 0.7-1.2 mm diam.; (8) 10-15 (20) cm long; glossy vividly green, basally mostly purplish flushed. Sheathy basal parts thin papery, smooth, glossy, whitish, 1-3 (5) cm long above soil, the inner sheathes consecutively up to 1 cm longer. Sheathy prophyll 0.5-1.5 cm long, scabrous, yellowish to brown, present till budding state. Spathe hyaline, mostly undivided, shorter than the pedi-

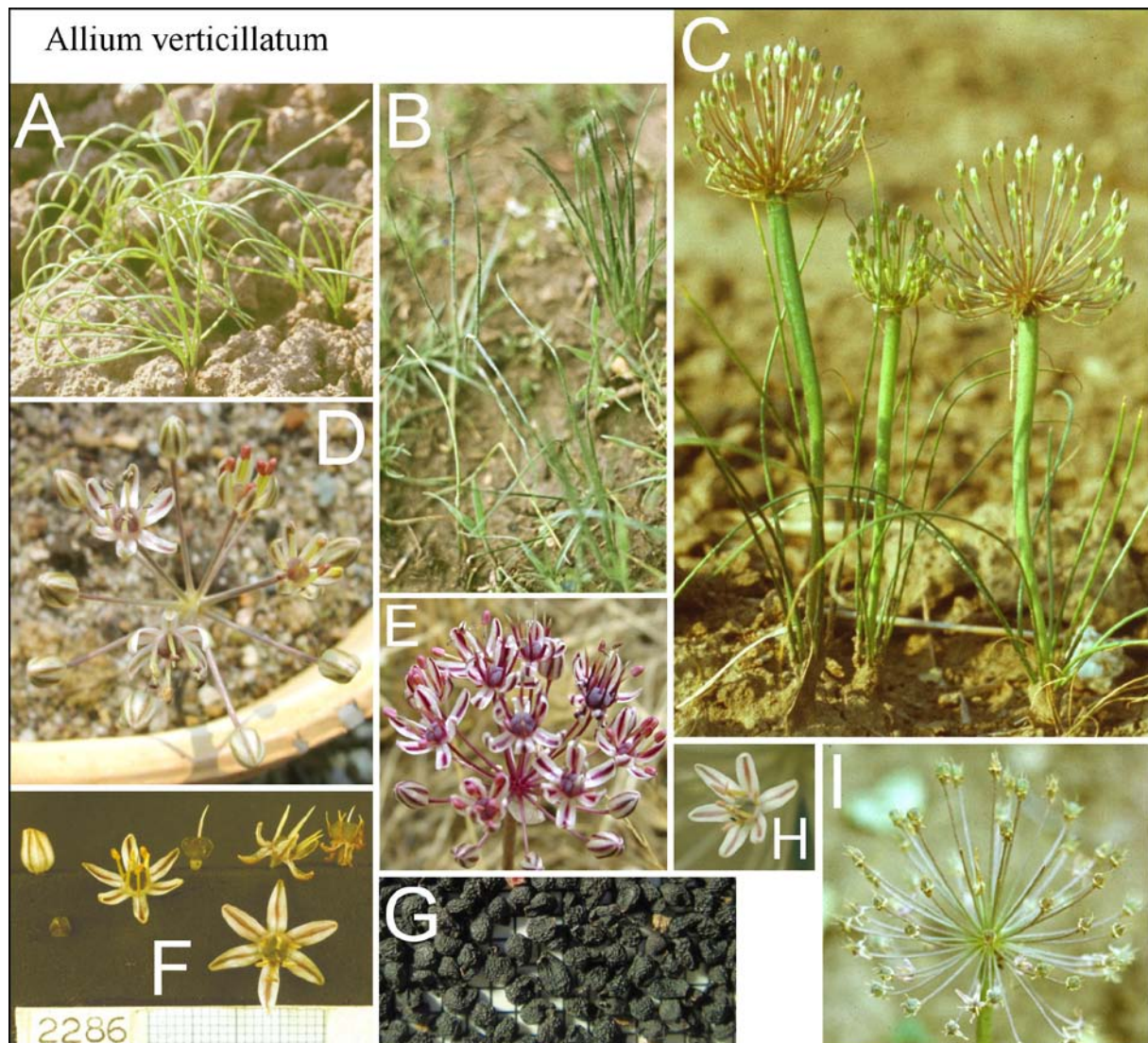


Plate (58): A & B: Sprouting leaves of cultivated plants and in Chakchar Mts., Uzbekistan, resp.; C: cultivated plants in bud stage; D: inflorescence in early anthesis; E: inflorescence of a purplish-colored plant in Sangzar valley in Uzbekistan in full anthesis; F: comparison of flowers and flower parts in different stages of anthesis; G: seeds (millimeter paper as background and measure scale of F & G); H: close-up of a flower; I: inflorescence with developing capsules.

cels, distinctly beaked; brownish with darker veins. Inflorescence flat semi-globose; loose, 15-60-flowered; 4-7 (10) cm in diam. Pedicels  $\pm$  unequally long (innermost pedicels are the longest), thickish, wiry,  $\pm$  ascending; 1-3 (5) cm long; greenish-brown to purple. Anthesis in May to June. Flowers  $\pm$  irregularly bowl-shaped starlike. Tepals oblong-lanceolate, concave, acutish with cucullate apex, patent, inner tepals more oblique, later crumpled and reflexed to enrolled; 4-6 mm long, 2-2.5 mm broad; rose-pinkish, median vein purple, narrowly lanceolate, outside narrower and more greenish. Filaments initially shorter later longer than the tepals; basally for c. 0.5 mm connate and long-triangularly widened, above subulate; yellow, basally more purplish, rarely purple. Anthers oblong; c. 1.5 mm long; yellow with violet flush. Pollen yellowish-gray. Ovary very shortly stipitate, depressed-globose triangular; surface acutish papillous; green to purplish. Up to 5 ovules per locule, 14 / 8-10 ovules per ovary were counted (Filimonova 1970 / Vvedensky 1935). The nectary ducts mound in small pores near the base of the ovary below the bottom of locules (Fritsch 1992b). Style threadlike, finally 4 mm long; whitish, finally with purplish base. Stigma undivided; whitish. Capsule subglobose, c. 4 mm in diam.; valves suborbicular, sharply notched at the apex. Seeds single or 2-3 per locule, long drop-shaped, sometimes edged; surface mostly with a dense pattern of raised wrinkles or with scabrous verrucae, silk-glossy deep brown to black; c. 1.5 mm long, c. 1.3 mm broad, c. 1 mm thick. TKW 0.81 / 0.87 / 0.90 g (IPK, unpubl. data). The testa showed periclinal walls without verrucae, and the anticlinal walls Omega-like undulation with extremely low amplitude and extremely short wavelength (Kruse 1994, Abb. 28; Fritsch & al. 2006, Fig. 23).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 147 (Uzbekistan: Zaravshan range, Amankutan, no. 766).  $2n = 16$  Vakhtina 1985 (Tajikistan: Hissar range, Kondara gorge, no. 705).  $2n = 16$  Zakirova & Nafanailova 1988 (Kazakhstan: Karatau range, Bessau gorge, Myrzakulov s. n.).  $2n = 16$  Astanova 1990 (Tajikistan: Gazimailik ridge).  $2n = 16$  Ohri & al. 1998 (Tajikistan: Gazimailik ridge, Ganjino TAX 2182).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Kondara gorge TAX 2286).  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Uzbekistan: Surkhandarya region, Akbashtau Mts. TAX 5033).

**Living accessions studied:** **Tajikistan:** Hissar range, drainage of Varzob river, Kondara canyon, 37 km N Dushanbe (1200 m, 11.5.2002 Hisoriev & Kurbonova 6024; TAD), (38°48'40.6" N, 68°48'45.3" E, 1330 m, 07.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6113; GAT) TAX 6162, beside the path from Kondara station to location Kwak (38°49' N, 68°48' E, 1600 m, 02.6.1987 Fritsch 219; GAT) TAX 2286, Jirinod valley N Dushanbe, on the crest (38°49' N, 68°50' E, 1730 m, 29.7.1988 Fritsch 288; GAT) TAX 2526; Gazimailik ridge near vill. Ganjino, flat rock slope (37°59' N, 68°34' E, 850 m, 23.5.1987 Fritsch 196; GAT) TAX 2182, top of Gazimailik ridge, around Mt. Mundytau (Munda) (38°01' N, 68°28' E, 2180 m, 13.5.1990 Fritsch, Kudratov, Pistrick 454; GAT) TAX 2876; Mogoltau ridge, Spa massif, limestone hills beside the road in "Short Sai" (40°17' N, 69°26' E, 800 m, 01.6.1997 Fritsch & Khassanov 1642; GAT) TAX 5708. **Uzbekistan:** SW Hissar range, Chakchar massif, 1 km E village Shurob (38°12'16.7" N, 66°57'28.4" E, 1130 m, 27.5.2003 Fritsch, Keusgen, Khassanov 4148; TASH), N part of Sarymask massif c. 3 km SE vill. Shurob, terrace near a gorge (38°12' N, 66°58' E, 1150 m, 11.5.2001 Fritsch & Hoffmann 1703; GAT) TAX 5870, E exposed limestone slopes W vill. Akrabad-Maidun, loamy terraces (38°14' N, 66°47' E, 1900 m, 30.4.1995 Fritsch & Khassanov 1375; GAT) TAX 5280, eroded area c. 3 km SE town Baisun S the road to Churchi, limestone hill beside the road (38°12' N, 67°15' E, 1100 m, 12.5.2001 Fritsch & Hoffmann 1710; GAT) TAX 5876; Akbashtau Mts., E and N exposed slopes of pass Tally between vill. Talla and Kurgantash (38°11' N, 66°25' E, 1350 m, 13.7.1994 Fritsch, Khassanov, Pistrick 1248; GAT) TAX 5033; Aktau ridge, slate slope near the way to Langar 5 km S Langar (40°20'00.4" N, 66° 01'13.6" E, 1100 m, 31.5.2003 Fritsch, Keusgen, Khassanov 4175 (4116); GAT) TAX 6195, S limestone chain, NW slopes of Oltynsai, rock terraces and even spots in N exposition (40°21' N, 66°01' E, 1400 m, 16.4.1995 Fritsch & Khassanov 1285; GAT) TAX 5242, N chain, granitic slope, in *Amygdalus* association (40°23' N, 66° 03' E, 1300 m, 16.4.1995 Fritsch & Khassanov 1299; GAT) TAX 5248, Ionboshsai c. 40 km NE Kattakurgan, often S exposed slate and limestone slopes (40°15' N, 66°12' E, 1300 m, 20.5.1993 Fritsch & Khassanov 872; GAT) TAX 3710; Malguzar Mts., right bank of Sangzar river, hill near village Sangzar (40°04'37.9" N, 67°43' 36.3" E, 600 m, 02.6.2003 Fritsch, Keusgen, Khassanov 4184; TASH); Kugitang ridge, W exposed slopes above vill. Panjob, plateau of a small limestone outcrop (38°02'20.4" N, 66°51'21.9" E, 1350 m, 02.6.2006 Fritsch & Khassanov 4239; GAT) TAX 6525.

**Remarks:** *Allium verticillatum* is the type species of sect. *Verticillata*. Like the second species of this section, *A. viridiflorum*, it differs strongly from all other *Allium* species by leaf laminae longitudinally

divided into several narrow, thread-like lobes appearing as single leaves. Though often handled in keys for determination jointly with truly narrow-leaved species like *A. insufficiens* and *A. vvedenskyanum*, such a similarity is purely superficial. *Allium verticillatum* is characterized by saucer-shaped flowers and rose-pinkish tepals with broad and dark median vein, and *A. viridiflorum* by flat, greenish-yellow flowers and narrower tepals that are backwards bent near the base and inwards bent toward the apex. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. verticillatum* in two well supported, basal subgroups in cluster 3 with geographic relations: Most basal are samples from west of 68° longitude, slightly more advanced those from east of this longitude (Fritsch & al. 2010: 185 cluster 3 § 3.5.1; Fritsch 2012b: 249 Fig. 2 E). The members of both subgroups do not differ morphologically. However, in the reduced dendrogram (Gurushidze & Blattner in Fritsch & Abbasi 2013: 201) the most basal subgroup was attached to former cluster 7 and split into two different positions. Surprisingly, sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage VI) resulted in two haplotypes closely related to *A. aroides*, *A. mirum*, *A. gypsaceum*, and *A. komarowii*, that is nearly the identical position as in the reduced dendrogram. This is a strong indication, that the basal position in cluster 3 was caused by long-branch attraction (as assumed by Gurushidze & al. 2008), i.e. inclusion of distantly related items at accidental positions in the dendrogram. Thus, *A. verticillatum* is most probably related to members of cluster 7.

**Etymology:** The epithet refers most probably to the seemingly whorl-like divided leaves (from Latin "whorled").

**Biological data:** The roots are short-living and possess one layer of large exodermis cells, the inner cortex has 6-8 cell layers without thickened walls, and the outer walls of endodermal cells are not thickened (Fritsch 1992c). The scape shows small and orbicular in diam. vascular bundles inside of the sclerenchyma, the outer margin of sclerenchyma is grooved, cortex cells are radially extended (Fritsch 1993 Fig. 6B). Genome sizes [2C DNA] of 38.2 pg (Ohri & al. 1998) and 33.5 pg (Gurushidze & al. 2012) were reported. Fresh bulbs contain in total 0.06 / 0.42 % cysteine sulfoxides (? / 90 % methiin, ? / 0 % alliin, ? / 10 % isoalliin, ? / 0 % propiin; Jedelska & al. 2004, Keusgen & al. 2008). Radical scavenger activity of bulb extracts was moderately low (Jedelska & al. 2004).

**(59) *Allium viridiflorum*** Pobed. in Bot. mat. gerb. bot. inst. Akad. Nauk SSSR 11: 64 (1949). Nikitina & Kashtsh., Flora Kirg. SSR 3: 90 (1951). Nikitina & al., Flora Kirg. SSR Dopoln. vyp. 1: 36 (1967). Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971). — **Neotype:** "Semennoe vosproisvedenie tipa, dostavlenno v oranzheruyu N 24, s Ferganskogo khr., ur. Arkit, Dzhalaalabadskoj obl. O. I. Neustruevoj v 1945 g., 15.8.1952 leg. Pobedimova" [Reproduction from seed of the type, delivered to the glasshouse no. 24, from Fergan range, place Arkit, district Jalalabad, leg. O.I. Neustruyeva in 1945] (LE!; design. Fritsch & al. 2010: 208).

**Distribution:** Uzbekistan, Kirgizstan: Southern slopes of Chatkal range, submontane stony slopes with shallow soil, only known from the type location and Ungortepa Mts. 1 km N vill. Paramon (Tojibaev & al. 2014); occurrence in Kugitang ridge needs verification.

**Description:** Bulbs ovoid, rarely with oblong side bulbs, 6-10 mm in diam.; tunics membranous, very brittle, extending in a short neck; inner tunics yellowish, outer tunics cinereous to blackish. Scape flexuous, terete, obconical, smooth or scabrous; 20-23 cm long, 1.5-3 mm in diam.; green to purplish with glaucous bloom. Leaf single, laminae above the sheathy part longitudinally split in 4-8 threadlike, along the margin distantly toothed lobes; much shorter than the scape. Sheathy prophyll 1-2 cm long, subsabrous, ± silky, maroon, present till budding stage. Spathe membranous, divided in 2-4 broadly ovate valves, much shorter than the pedicels. Inflorescence broadly fasciculate to ovoid; very loose, 20-50-flowered; 3-8 cm long and in diam. Pedicels unequally long, thin wiry, the central pedicels nearly straight, the others ascending; 2.5-5 cm long; green. Anthesis in June to July. Flowers bowl-shaped to flat starlike. Tepals linear-oblong, ± obtuse, outer tepals stronger concave than inner ones and with claw-like apex, only basally shortly cup-shaped connate, middle part patent and apex incurved, later

reflexed and subspirally enrolled; 4-5 mm long, 1-1.3 mm broad; yellow-green with darker, sublanceolate median vein that becomes more prominent when dry. Filaments about 3/4 as long as the tepals; basally for c. 0.3 mm connate and very shortly triangularly widened (inner filaments nearly 2 times broader), above subulate, subfleshy; yellow-green. Anthers oblong; c. 1.5 mm long, 0.7 mm broad; yellow; 3 outer anthers open earlier. Pollen sulfur-yellow. Ovary sessile, depressed-globose hexangular; surface tuberculate; yellow-green with purple flush. Style narrowly-conical, 0.5-2 mm long; yellow-green. Stigma undivided; whitish. Capsule subglobose, scarcely longer than the tepals; valves broadly obcordate. Seeds single per locule, subglobose; surface reticulate lacunose, black; 1.5 mm in diam. The testa showed periclinal walls only with finely granulate ornamentations and indication of very shallow verrucae. The undulation of anticlinal walls was S-like with low amplitude and long wavelength (Fritsch & al. 2006, Fig. 24).

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Kirgizstan: Chatkal range, lake Sary-Chelek, Cheremnykh s. n., near type location).

**Living accessions studied:** Kirgizstan: Chatkal range, Sarychilek valley, slopes NE vill. Arkit (type location, 41° 50' N, 71°59' E, 1700 m, 29.5.1997 Fritsch & Khassanov 1632; GAT) TAX 5699.

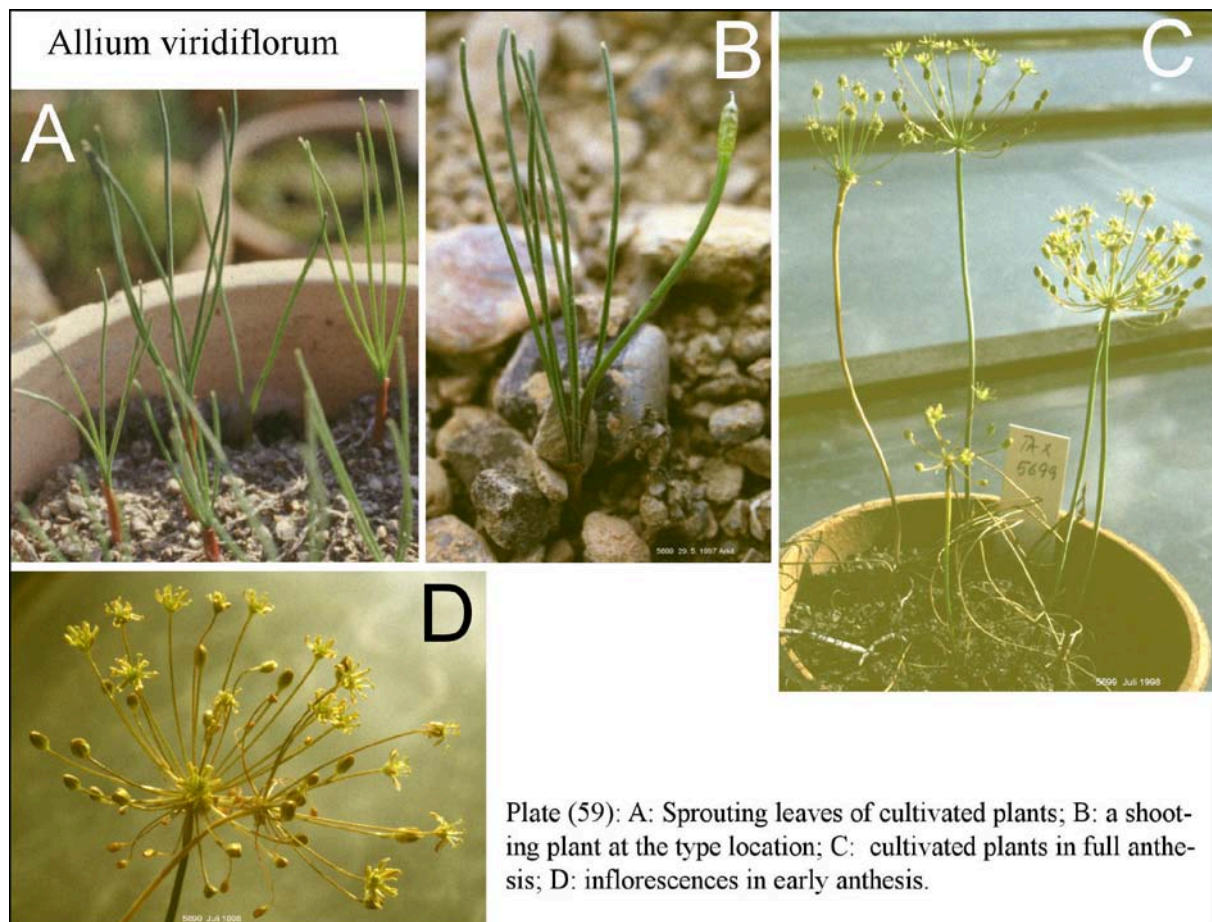


Plate (59): A: Sprouting leaves of cultivated plants; B: a shooting plant at the type location; C: cultivated plants in full anthesis; D: inflorescences in early anthesis.

**Remarks:** This species is a local endemic of the Chatkal range northeast of the Fergan depression. The differences to the related *A. verticillatum* were already discussed under that species. However, molecular markers (ITS sequences of nuclear rDNA) positioned the only investigated sample not beside *A. verticillatum*, but in the Alai-Fergan geographical clade of sect. *Acmopetala* among morphologically dissimilar species growing in the same area (Fritsch & al. 2010: 191 cluster 6 § 3.8.1; Fritsch 2012b: Fig. 4 Q; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Also sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4 lineage III) showed a similar relationship but a more derived position. This affiliation should be proved by the study of additional accessions; an ancient hybrid offspring seems possible (Fritsch & al. 2010).

This species was then validly described from living plants. Unfortunately, no herbarium voucher could be traced that could have been used when the description was established. Therefore a neotype had to be selected from later collected vouchers.

Etymology: The epithet refers rather certainly to the greenish-yellow flower color (from Latin "with green flowers").

10. *A.* subg. *Melanocrommyum* sect. *Compactoprason* R.M. Fritsch, in Hanelt & al. (eds.), genus *Allium*: 74 (1992), emend. R.M. Fritsch in Linzer Biol. Beitr. 26: 976 (1994). — Type species: *Allium giganteum* Regel

10.1 *A.* sect. *Compactoprason* **subject**. *Erectopetala* F.O. Khass. in Hanelt & al. (eds.), genus *Allium*: 158 (1992), emend. F.O. Khass. in Linzer Biol. Beitr. 26: 977 (1994). Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), p. p., sub sect. *Kaloprason*. — Type species: *Allium giganteum* Regel

(60) *Allium giganteum* Regel in Gartenflora 32: 97, t. 1113 (1883), Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 663, t. 20 f. h, t. 21 f. m (1884), Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 302, 362 (1887), cum correctionis. Baker in Curtis's Bot. Mag. 111: t. 6828 (1885). Vved., Flora Turkm. 1, 2: 294 (1932). Vved., Flora URSS 4: 274 (1935). Vved., Flora Uzbek. 1: 463 (1941). Vved., Flora Tadzh. SSR 2: 354 (1963). Vved. [ & Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971). Wendelbo, Flora Iranica 76: 88, tab. 9/127, tab. 26/4 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Fritsch in Nordic J. Bot. 16: 15 (1996). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 135, plate T53, map (2013). — *Allium procerum* Trautv. ex Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 663, t. 20 f. d-f (1884). Type: Tajikistan: Chodscha-Kadian ad orientem a [Khojakhazyan E of] Kabadian, 6000', 21.4./3.5.1883, leg. A. Regel (lectotype LE!, design. Fritsch 1990: 504), *A. procerum* Trautv. in Trudy Imp. S.-Peterb. Bot. Sada 9: 274 (1884), non Trautv. ex Regel l. c., nom. illeg., Type: Turkmenistan: Achalteke ('Karabach'), leg. Cristoph No. 4113, mis. M. N. Smirnov 1883 (LE!). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887). — Lectotype: "Ex horto bot. Petropolitano [from Bot. Garden St. Petersburg] 82.6 *Allium giganteum* Rgl." two inflorescences on the left side (LE!; design. Fritsch & al. 2010: 205). A type voucher cited by Wendelbo (1971: 88) "Planta quaedam culta, probaliter e bulbos in Persia inter Mashhad & Chacha, leg. O'Donovan" could not be traced.

Distribution: NE Iran, N & W Afghanistan, Turkmenistan, Uzbekistan, Tajikistan: colline to submontane loess slopes, stony steppe slopes, on rock outcrops, rock crevices and terraces.

Description: Bulbs ovoid to subglobose, (2.5) 5-7 (10) cm in diam., (3) 5-8 (12) cm long; inner tunics papery, whitish, outer tunics parchment-like (sometimes building a many-layered shell), longitudinally splitting; initially grayish, later blackish or blackish-carmine. Scape straight, strong, terete, smooth; (50) 80-150 cm long, near base 1-2.5 cm in diameter; green with glaucous bloom. Leaves 4-7 (10), laminae oblong to broadly lanceolate, short arcuately ascending and recurved, often with incurved apex, thick, broadly canaliculate; upper side smooth or with some coarse furrows, lower side with broad and obtuse ribs; margins smooth, initially red, later white, shortly arcuately tapering into the somewhat cucullate apex; 25-50 (60) cm long, (1.5) 3-10 (16) cm broad (the innermost leaves are the narrowest); green, mostly with strong glaucous bloom. Sheathy prophyll often very short (not visible above soil), hyaline, silk-glossy, quickly decaying. Spathe membranous, divided into 2-3 ovate to suborbicular, shortly acute, patent, later reflexed, 2-3 cm long valves; pale brown with darker veins. Inflorescence globose; very dense and pluri-flowered; initially c. 5 cm, finally c. 15 cm, in the fruiting stage up to 20 cm in diam. Pedicels unequally long, very thin, stiff, straight or slightly ascending; initially 2-3 and finally 6-8 cm long; purely green or reddish flushed; in the fruiting stage partly dropping down from the receptacle. Anthesis in April to May. Flowers bowl-shaped starlike. Tepals oblong, spoon-shaped concave and incurved, obtuse, only very basally united, patent, after anthesis irregularly crumpled; 5-6 mm long, 2.5-3 mm



broad; pinkish-lilac to deep carmine, fading during anthesis. Filaments about 1.5 times longer than the tepals, straight; basally connate for c. 0.5 mm and very short triangularly broadened (inner filaments narrowly triangular and for 1.5 times broader), above subulate, outer filaments thin subulate; color somewhat paler than the tepals and paler at the base. Anthers oblong; c. 2 mm long; pale yellow with pink flush. Pollen yellowish gray; the shape is oblate to peroblate, 29  $\mu\text{m}$  long, 13  $\mu\text{m}$  broad, P/E index

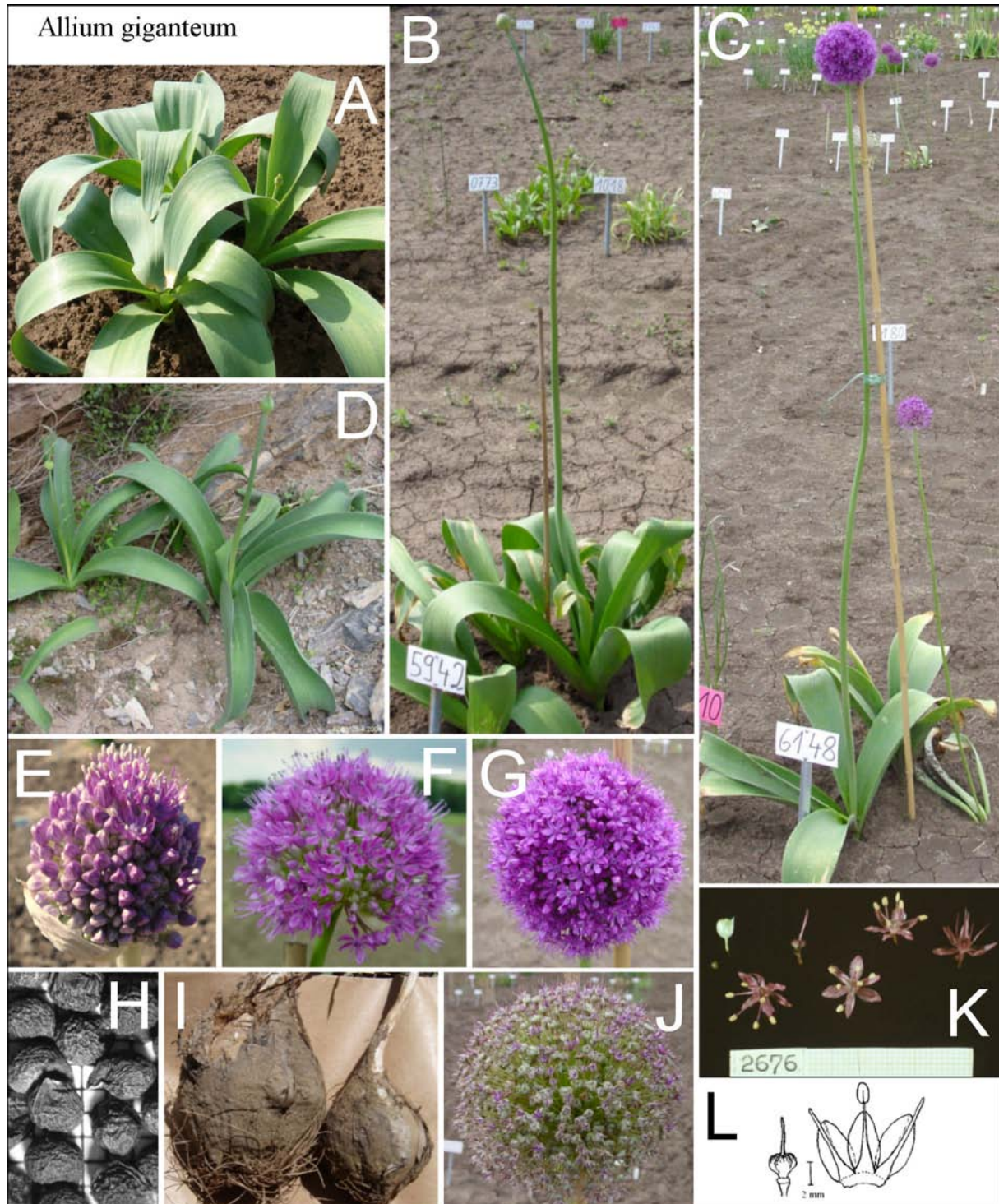


Plate (60): A: Leaves of cultivated plants after sprouting; B: cultivated plant in the late shooting stage; C: normal and small flowering plants; D: plants in the shooting stage near Kharv-e Olia (Iran); E & F: inflorescences in early anthesis; G: inflorescence in full anthesis; H: seeds; I: bulbs; J: inflorescence after anthesis; K: comparison of flowers and flower parts in different stages of anthesis; L: (millimeter paper as background and measure scale of H & K; plate copied from Fritsch & Abbasi 2013: 136 Plate T53, partly modified).

0.5, sculptures rugulate to microrugulate, wall 0.9  $\mu\text{m}$  thick (Neshati & al. 2009). Ovary shortly stipitate, depressed globose-triangular, with 3 broader pale and 3 narrow, dark violet furrows, 3-3.5 mm long and in diameter; surface finely papillous, pale greenish violet; up to 4 (Filimonova 1970) / 2 ovules per locule (Hanelt 1992). Nectaries somewhat lobed, ducts lead in dot-like holes near the base of the ovary below the bottom of the locules (Fritsch 1992b). Style narrowly conical to thread-like, 7-8 mm long; carmine. Stigma undivided dot-shaped; paler than the style. Capsule flat globose-tripartite, surface dull, finely rugose; 3-4 mm long, 6-8 mm in diam., often with unequal parts; it opens with 3 narrow slits, valves suborbicular with a deep longitudinal furrow; the ripe brown capsules drop partly from the pedicels. Seeds single per locule; subglobose with often one concave side; surface reticulate lacunose, dull black; c. 2.5 mm long, 2-2.5 mm broad and thick. TKW 4.38 / 4.64 / 4.96 / 5.11 / 5.50 g (Fritsch & Abasi 2013). The testa showed verrucose periclinal walls, the undulation of the anticlinal walls varied from U-like to Omega-like forms with low to moderate amplitude and moderate wavelengths (Kruse 1984; Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Levan 1935 (Netherlands: Bulb trader van Tubergen).  $2n = 48$  Mensinkai 1939, 1941 (Great Britain: Botanical collections).  $2n = 16$  Vakhtina 1964a, 1969 (Tajikistan: Khoja-Kazyan ridge, no. 662).  $2n = 16$  Ved Brat 1965a (source not mentioned).  $2n = 16$  Dietrich 1967 (France: Botanical collection Strasbourg).  $2n = 16$  Zakirova & Vakhtina 1974 (Turkmenistan: Botanical collection Ashkhabad, no. 43).  $2n = 16$  Vakhtina 1985 (Tajikistan: Mt. Koj-Pios-Tau, type location of *A. procerum*, no. 726).  $2n = 16$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen).  $2n = 16$ , 32 Astanova 1990 (Tajikistan: Khoja-Kazyan ridge).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Germany: Botanical collection, TAX 1702).

Living accessions studied: Tajikistan: Darai Odamkhur, western slopes of Panj Karatau ridge near the way to Akhtam Mazar (37°22'55.9" N, 69°12'41.9" E, 924 m, 20.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6036; GAT), around Mazori Khoja Mumin (37°43'58" N, 69°39'45.2" E, 1200 m, 23.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6048; GAT) TAX 6122; Khozratishoh range, Dashti Joged (38°03'20.6" N, 70°22'29.4" E, 30.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6089; GAT) TAX 6148; Karategin ridge, Vakhsh valley 10 km above Kabujara (38°49'25.2" N, 69°54'14.3" E, 1200 m, 10.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6184; GAT) TAX 6425; Darvaz range, Panj valley, along the main road from Kalaikhumb to Vanch (38°25'55.6" N, 70°55'24.2" E, 1350 m, 12.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6201; GAT) TAX 6438, Panj valley between Vanch and Khumbov valleys, Anjirag (38°29'14" N, 71°47'42.2" E, 1570 m, 21.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6212; GAT) TAX 6446. W slopes of Gazimailik ridge, place Obodkan, c. 10 km NW vill. Ganjino, sandstone terrace (38°02' N, 68°34' E, 1600 m, 12.5.1990 Fritsch, Kudratov, Pistrick 451; GAT) TAX 2933, vill. Ganjino, slopes in the river valley (37°59' N, 68°34' E, 900 m, 23.5.1987 Fritsch 183; GAT) TAX 2275, top of Gazimailik ridge, around Mt. Mundytau (Munda) (38°01' N, 68°28' E, 2000 m, 13.5.1990 Fritsch, Kudratov, Pistrick 459; GAT) TAX 2936; Rangon massif, S slopes near Khojaj-Saring (collected by unknown member of Botan. Institute Dushanbe, 38°22' N, 68°57' E, 1500 m, 25.5.1987 via Fritsch 205; GAT) TAX 2284; reservation "Tigrovaja balka" (37°15' N, 68°20' E, 400 m, coll. Kochkarev 28.4.1986 via Fritsch T151; GAT) TAX 1912; Darvaz range, unknown collection place (received 1989 from Botanic Garden Khorog; GAT) TAX 2676; Vakhsh Karatau ridge, without exact location (collected by unknown member of Botan. Institute Dushanbe, 38°20' N, 69°09' E, 01.6.1987 via Fritsch 217; GAT) TAX 2285; Khojakazyan ridge, valley Naizabulak, plateau and top of Mt. Kojpioztau (37°22' N, 68°16' E, 1550 m, 18.5.1990 Fritsch, Kudratov, Pistrick 494; GAT) TAX 2945, valley Kutorbulak, saline and gypseous limestone or sandstone slopes (37°24' N, 68°15' E, 850 m, 16.5.1990 Fritsch, Kudratov, Pistrick 480; GAT) TAX 2942. Turkmenistan: Central Kopetdag range, upper valley of Chuli above the spring area (37°57' N, 58°01' E, 920 m, 14.4.2002 Fritsch, Keusgen, Khassanov 50; GAT) TAX 5942, c. 6 km S vill. Chuli, limestone rocks and rubble slopes (37°56' N, 57°56' E, 1000 m, 25.4.1995 Fritsch & Khassanov 1368; GAT) TAX 5279; N exposed limestone rock terraces c. 3 km S vill. Gjaurs, ca. 20 km SE Ashgabad (37°42' N, 58°39' E, 500 m, 18.4.1995 Fritsch & Khassanov 1304; GAT) TAX 5252. Uzbekistan: 25 km E Baisun, side valley N of the main road (38°05'33" N, 67°26'51" E, 1000 m, 28.5.2003 Fritsch, Keusgen, Khassanov 4165 (4106); GAT) TAX 6188, low ridge c. 25 km NE Baisun (800 m, 1999 Khassanov s.n.; GAT) TAX 5835; Baisun ridge, W exposed meadow upon limestone (38°04'45.8" N, 67°25'35.5" E, 850 m, 18.5.2009 Keusgen, Khassanov 4290; GAT) TAX 6744; Babatag massif, very steep loess meadow in S exposition (38°08'28" N, 68°06'59" E, 1000 m, 16.5.2009 Keusgen & Khassanov 4283; GAT) TAX 6746, E slopes of Kafirnigan valley near vill. Jatykyr (38°20' N, 68°26' E, 1000 m, 27.5.1987 Fritsch 209; GAT) TAX 2282.

Remarks: *Allium giganteum*, the type species of sect. *Compactoprasum* and subsect. *Erectopetala*, was described from cultivated plants sent by the firms P. Miles (Bingham, England) and M. Leichtlin

(Baden-Baden, Germany) to Eduard Regel in the Imperial Bot. Garden St. Petersburg (Russia). The initial bulbs were not collected in the Himalaya (as Regel wrote) but probably at 4 August 1881 in the valley of Chahchaheh river along the northern spurs of eastern Kopetdag mountain range ('deli guzella') by O'Donovan (Dadd 1987), probably on current Turkmen territory. *Allium giganteum* reaches the SW edge and apparently also the westernmost limit of its area of distribution in Iran. This area stretches band-like roughly from 56° to 72° E and from 35° to 39° N where *A. giganteum* grows rarely in elevations above 2000 m. It is the largest species and owns the densest and largest flower heads of subsect. *Erectopetala* (Fritsch 2012b: 254). A recent report from Turkey (C9 Hakkari; Behcet & al. 2012) is an error: the plants characterized in that paper differ from *A. giganteum* in many characters of generative organs and belong very probably to a species of sect. *Procerallium*. In Central Asia and in European gardens, *A. stipitatum* is sometimes merged with *A. giganteum*. Molecular markers (ITS sequences of nuclear rDNA) verified *A. giganteum* to belong neither to sect. *Megaloprason* s. str. nor to sect. *Procerallium* but occupies the most basal position in an own section with *A. macleanii* as its closest relative (Fritsch & al. 2010: 193 cluster 7 § 3.9.3; Fritsch 2012b: 252 Fig. 4 T, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Other molecular markers (*trnL-trnF* sequences of cp DNA) did not resolve a separation from sect. *Procerallium* but confirmed the other relations (Gurushidze & al. 2010: 836, fig. 4 lineage IV). Plants of *A. procerum* as studied at the type location were morphologically inseparable from *A. giganteum*, also later under cultivation.

**Etymology:** The epithet refers certainly to the magnificent large stature of flowering plants (from Latin "gigantic").

**Biological data:** The seedlings belong to the *Allium karataviense* type (Druselmann 1992). High summer to winter dormancy, high summer flowering, complete withering of leaves before spathe opening were reported as phenological characters (Pistrick 1992). The bulbs must be stored at low temperatures for a rather long period to warrant complete development of inflorescences (Dubouzet & al. 1992; Maeda & al. 1994). Very good seed germination was reported at 5 °C, but very bad above 10 °C (Specht & Keller 1997), or partly successful germination at 5 °C but 20 °C did not break dormancy (Aoba 1967 in Ellis & al. 1985). The bulb contains steroid saponines (Kawashima & al. 1991; Mimaki & al. 1994); the structure of neoagigenin and aginosid were reported by Kel'ginbaev & al. (1973, 1976). Sokolov (1994) mentioned aginosid to occur in the whole plant, and glucose, fructose, saccharose, oligosaccharids and glucofructans as well as vitamin C (contains up to 5530 mg% ascorbic acid; Pigulevskiy 1945 cited by Shalyt 1951) in the subterranean parts. The plants contain dithiodipyrrole that causes a orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1), that was in detail investigated by Vogt & al. (2008). Fresh bulbs contain in total 0.33 / 0.02 / 0.38 % cysteine sulfoxides (100 / 52 / 89 % methiin, 0 / 48 / 11 % isoalliin; Jedelská & al. 2005; Keusgen & al. 2008, plants from Iran / Uzbekistan / Tajikistan). Bulb extract inhibited growth of some (mainly Gram-positive) bacteria species (Jedelská & Keusgen 2008) and showed a very high radical scavenger activity (Jedelska & al. 2005; Jedelská & Keusgen 2008). The genome sizes varied [2C DNA]: 28 pg (Vakhtina & al. 1977), 20.6 pg (Labani & Elkington 1987), 26.5 pg (Zakirova 1989), 42.8 pg (Gurushidze & al. 2012).

**Economic traits:** In Tajikistan, local name 'model', the fresh leaves (Saidov 1986) are collected and used (also the dried leaves, Keusgen & al. 2005) for traditional dishes. They taste not worse than common onion (Vvedensky 1963) and are eaten and used as hot spice (Sokolov 1994). The bulbs contain 60 % polysaccharids (glucofructans) in the air dry mass (Khodzhaeva & Ismailov 1979), they are used as spice, and the old bulb tunics for staining silk reddish (Larin 1950, Sokolov 1994). Fedtschenko & al. (1932) assumed that the bulbs are collected for export to India as surrogate of Salep. Local name 'evoj pijoz', it belongs to the most important edible species in the Uzbek mountains (Khassanov 2008). In the Iranian province Khorasan, the leaves are collected and used as vegetable similar to onion, local name 'kuria' (Fritsch & Abbasi 2013).

Much cultivated in European gardens (several cultivars exist) as attractive solitary plants or cut flowers with striking flower-heads on magnificent stalks, valuable for the long-lasting bloom (Kamenetsky &

Fritsch 2002, Fritsch 2015). They were also promised for Turkmenistan (Androsov 1941b). Experimental hybrids with other species and hybrids could be obtained (Dubouzet & al. 1994; Bijl 1995), some of them only after embryo rescue and in vitro cultivation (Dubouzet & al. 1998). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991) and commercially available (De Hertog & Zimmer 1993, Fritsch 2015).

**(61) *Allium isfairamicum*** [B. Fedtsch. ex] O. Fedtsch. in Progress. Sadov. Ogorodn. no. 36: 332 ([09. IX.] 1906), descr. ross., B. Fedtsch. in Bot. Zhurn. [izd. Otd. Bot. Imper. S.-Peterb. Obshch. Estestv.] (St. Peterburg) 1, 6: 194 ([02.4.]1907) "*isphairamicum*". Vved., Flora URSS 4: 274 (1935); Nikitina & Kashtsh., Flora Kirg. SSR 3: 94 (1951); Vved., Flora Tadzh. SSR 2: 354 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971), omnia sub *A. elatum*. — Type: In decliviis inter [on slopes between] Ucz-Kurgan et Karaul, VI. 1904, B. Fedtsch. (Fedtschenko 1907; voucher not traced yet, see Fritsch & al. 2010: 205). Neotype: Kirgizstan: "Alajskij khrebet [Alai range]: Langar (Ucz-Kurganskij), 28.6.1904, leg. B. A. Fedtsch.", second label "neotype A. Seisums 1992" (LE!; design. Fritsch & al. 2010: 205).

Distribution: Tajikistan?, Kirgizstan: montane or subalpine slopes of Alai mountain range.

Description: Bulbs globose. Scape glabrous; longer than the leaves; vividly green. Leaves 2-5, laminae broadly oblong, tapering towards the base; 25 cm long, 4-5 cm broad; green. Spathe divided in 2 broadly ovate, ± equal valves, shorter than the pedicels. Inflorescence globose, dense; c. 6 cm in diam. Pedicels 4-5 times longer than the tepals. Tepals lanceolate; violet. Filaments c. 1/4 longer than the tepals; inner filaments basally triangular widened, outer filaments nearly threadlike. Ovary sessile, depressed-globose. Style long threadlike. Time of anthesis, flower shape, anthers, stigma, capsule and seeds not known.

Remarks: This insufficiently known taxon was apparently not re-collected for about 100 years. Authentic vouchers could not be traced in the Fedtschenko herbarium in TASH. Kamelin (1973) regarded it a possible variant of *A. macleanii*. The description presented here was compiled from the literature. No living plants were available for study, and also no material for molecular investigations.

Etymology: The epithet refers most probably to the Isfairam river drainage (Alai mountain range, Kirgizstan) where the type specimens were collected.

**(62) *Allium macleanii*** Baker in Curtis's Bot. Mag. 109: t. 6707 (1883). Regel in Gartenflora 33: 369 Taf. 6707 (1884). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887) p. p.?. Wendelbo, Flora Iranica 76: 88, tab. 9/128 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Fritsch in Nordic J. Bot. 16: 16 (1996). — *Allium elatum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 665, t. 20 f. g-k (1884); Regel in Gartenflora 36: 369 (1887); Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887). Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 146 (1900). Vved., Flora URSS 4: 274 (1935). Nikitina & Kashtsh., Flora Kirg. SSR 3: 94-95 (1951). Vved., Flora Tadzh. SSR 2: 354, tab. 62 (1963). Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 53 (1967). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971). Lectotype: Tajikistan: "E Buchara orientali prope Koktūbe [from E Bokhara near Koktyube], 30.6.1878, leg. Mussa (LE!; design. Fritsch 1990: 503). *Allium lucens* Nikitina, Fl. Kirgiz. SSR, Dopoln. vyp. 1: 112 (1967), nom. illeg.; Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 53-54 (1967); type: Kirgizstan: Jugum alaicum, leg. R. Ajdarova & A. Ubukeyeva 1964 ... "Species e speciminibus vivis descripta est"[Alai range, leg. ... the species was described from living specimens], typus illeg. — Type: Afghanistan: "*Allium macleanii* Baker Type specimen of Bot. Mag. t. 6707! Cabul. Col. Maclean Hort. [Kew crossed out?] May 29th 1882 [dm Jas ?] Wilson, St Andrews (holotype K!, bar-coded K000802834). This text on the label of the holotype differs remarkably from the citation by Wendelbo (1971: 88).

**Distribution:** Uzbekistan?, Kirgizstan, Tajikistan, O Afghanistan, W Pakistan, India: Kashmir? : N Pamir-Alai mountain ranges, S Hindukush ranges, montane (rarely subalpine) dry stony and rubble slopes. Occurrence in Turkmenistan (Kugitang ridge, E Kopetdag range: Badkhyz) is doubtful.

**Description:** Bulbs subglobose, outer tunics papery, slightly longitudinally fibrous; whitish. Scape straight or subflexuous, terete, smooth and glossy; 50-80 (100) cm long, 7-12 (15) mm in diam.; green, basally often maroon flushed. Leaves 3-6 (8), laminae lanceolate to oblong-elliptic, basally somewhat stalk-like narrowed, obliquely arcuately ascending and flat recurved, from the narrowly canaliculate base suddenly flat and often with longitudinal wrinkles; upper side smooth or shallowly grooved, lower side shallowly and broadly ribbed; margins narrow, reddish to white, smooth or finely toothed, often short-arcuately tapering into a short,  $\pm$  hooded apex; (1) 30-50 (75) cm long, (2) 3-10 (15) cm broad (inner laminae narrower and shorter); yellow- to vividly green, glossy, not glaucous, basally often purplish suffused.

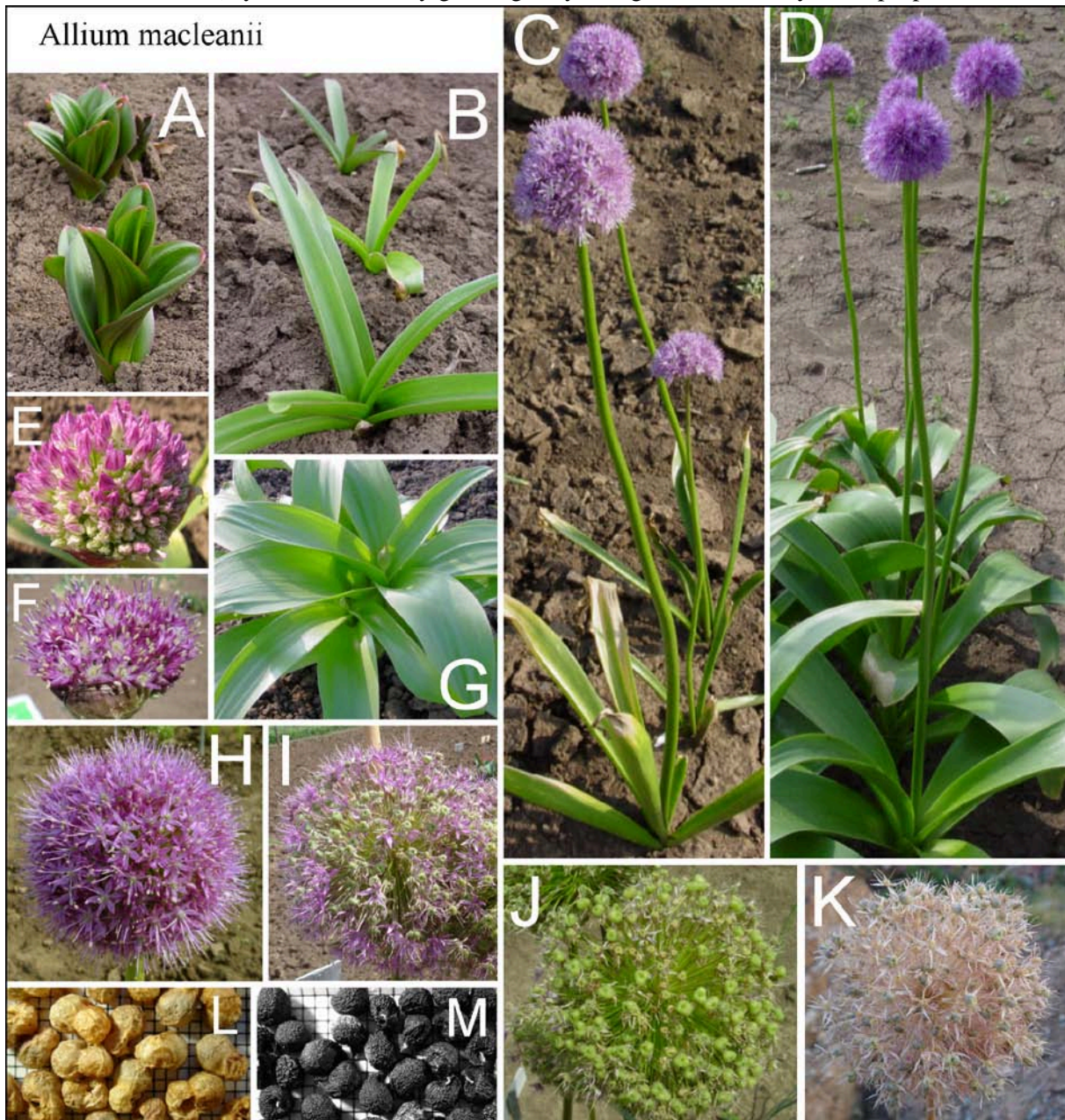


Plate (62): Cultivated plants (except K) are shown. A: Sprouting leaves of the broad-leaved form; B: sprouting leaves of the narrow-leaved form; C & D: plants in early to full anthesis; E: plants of the broad-leaved form in the early shooting stage; F, H & I: inflorescences in the bud stage and in early, full, and late anthesis, resp.; J: inflorescence with developing capsules; K: infructescence in Vanch valley, Tajikistan; L: ripe capsules; M: seeds (millimeter paper as background of L & M).

Sheathy prophyll short, greenish, later  $\pm$  colorless, tender, quickly decaying. Spathe membranous,  $\pm$  completely divided in 2-3 variably shaped valves; pale brownish to brown, veins darker. Inflorescence initially more fasciculate, later (depressed-) globose; very dense, plenty-flowered; 5-10, fruiting up to 12 cm in diam. Pedicels very unequally long (longest at the last flowers), stiff wiry, thin, straight or the last slightly descending; brownish green, basally red or green. Anthesis in end of May to June. Flowers bowl-shaped starlike. Tepals lanceolate, concave, subobtusate to acutish, basally free, apex slightly plicate, patent, later crumpled; (5) 6-7.5 mm long, (1.5) 2-2.3 mm broad; mauve to purplish-violet, median vein narrow, darker, at the outside greenish and keel-like. Filaments somewhat to 1/4 longer than the tepals; basally shortly connate and only inner filaments slightly triangular widened, above subulate; pink fading toward the base, finally colored as the tepals. Anthers subovoid; 1.5-2 mm long and 1 mm broad; bright violet-gray. Pollen yellowish-gray. Ovary initially very shortly stipitate, tri- or hexangular obconical to depressed-globose, 1.5-3 mm long, 2.5-4 mm in diam.; surface finely acutish papillous; gray-green or violet-purple. Up to 3 ovules per locule, 7 ovules per ovary (Filimonova 1970 as *A. elatum*) / 2 ovules per locule. The nectary ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b as *A. elatum*) in a triangular slit. Style conical-threadlike; (3) 5-10 mm long; whitish. Stigma undivided; white, finally purplish. Capsule sessile, flat triangular (like composed of three globose parts), 5 mm long, up to 8 mm in diam., surface finely scabrous, dull; only at the top opens a narrow cleft; gray-green, finally buff. Dry capsules drop late from the pedicels. Seeds single per locule, globose to drop-shaped, slightly edged; surface finely papillous and densely reticulate lacunose, silk-glossy black; 2.5-3.3 mm long, 2.2-2.5 mm broad and thick. TKW 8.11 / 8.13 / 6.28 g (IPK, unpubl. data). The testa showed verrucose periclinal walls, and the Omega-like undulation of the anticlinal walls displayed a moderate amplitude and short wavelengths (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 148, Vakhtina & al. 1977 total length of chromosomes (Tajikistan: Peter I. range, no. 624).  $2n = 16$  Pedersen & Wendelbo 1966 (Afghanistan: Kabul, Paghman, H&W 4404, H&W 4422).  $2n = 16$  Mehra & Pandita in Löve 1979 (= Pandita & Mehra 1981 ?) (India: Kashmir, Mahgam, Pandita 69).  $2n = 16$  Gohil & Kaul in Löve 1981 (India: Kashmir, Beramulla, RK 25).  $2n = 16$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen).  $2n = 16$  Astanova 1990 (Tajikistan: Hissar range, Sardaimiona valley, vill. Pakshir, Fritsch 299 "*A. elatum*").  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Netherlands: Botanical collection Amsterdam TAX 0465).  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Vakhsh range, Baljuan, Seisums s. n. "*A. elatum*").

Living accessions studied: Tajikistan: Darvaz range, Panj valley, garden area in vill. Shergovad 23 km below Kalai Khumb, (38°21'28.3" N, 70°39'42.5" E, 1170 m, 30.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6090; GAT) TAX 6149, Panj valley, rock slopes along the way to Khorog at km 307 (38°26'28.8" N, 70°55'55.8" E, 1340 m, 01.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6092; GAT) TAX 6150, rocks near the road to Khorog at km 415.3 km after vill. Deh (38°02'08" N, 71°17'09.9" E, 1750 m, 01.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6093; TAD); western Pamir region, Vanch valley, N slopes of Vanch range, Poi Mazor, Shavgado (38°39'37.7" N, 72°00'04.5" E, 2430 m, 18.7.2005 Fritsch, Hisoriev, Keusgen, Kudratov 6209; GAT) TAX 6445; Peter I. range, Obikhingou valley, slopes near road E village Lyangar (38°58'11.6" N, 71°05'04.7" E, 2110 m, 25.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6240; GAT) TAX 6555, slopes of Mt. Tarsher Zaga above village Arzung (38°53'28.6" N, 71°24'27.2" E, 3350 m, 28.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6250; GAT) TAX 6562, slope near the road near Alisurkhon village (38°51'28.1" N, 71°21'21" E, 2550 m, 29.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6252; GAT) TAX 6563. Darvaz range, left bank of Obichingou river above Dahani Shugarak (38°43'57.4" N, 70°35'57.2" E, 1670 m, 11.7.2005 Fritsch, Keusgen, Hisoriev, Kudratov 6187; GAT) TAX 6427, slopes above vill. Mionadu, place Zaki Khirsdara (38°48'46.7" N, 70°54'51.1" E, 2900 m, 30.6.2006 Fritsch, Hisoriev, Keusgen, Kudratov 6256; GAT) TAX 6567, Vishharvi gorge (3200 m, 1987 received from Botanic Garden Khorog s.n.; GAT) TAX 2413, pass Khobu-Rabat (3200 m, 1987 received from Botanic Garden Khorog s.n.; GAT) TAX 2415. Hissar range, slopes along the river Sardaimiona near the former vill. Pakschir (39°05' N, 69°23' E, 2000 m, 30.7.1988 Fritsch 299; GAT) TAX 2531; collection site unknown, wild plants sold in a shop in Dushanbe as vegetable (28.4.1986 Fritsch T150; GAT) TAX 1911.

Remarks: Yellowish-green and more or less shining leaves, moderately dense inflorescences, lanceolate tepals with subacute tips, and relatively darker filaments separate *A. macleanii* from small plants of *A. giganteum*. *Allium macleanii* grows in higher elevations than the other species of subsect. *Erectopetala*. The typical form with narrow (2-5 cm wide) leaves occurs only in Afghanistan. Plants with much wider leaves (*A. elatum*) are distributed in the mountains of Tajikistan, Uzbekistan, and Kirgizstan (Fritsch

2008: 64). Molecular characters (6 samples analyzed by RAPD technique, Friesen & al. 1997) confirmed the conspecificity of these leaf variants. However, the very variable flower characters are neither correlated with leaf width nor with distribution. Other molecular markers (ITS sequences of nuclear rDNA) confirmed the close relationship of *A. macleanii*, that belongs to the most advanced subgroup, with *A. giganteum* and *A. komarowii*, but also with some members of sect. *Regeloprason* (see the discussion under *A. giganteum* above; Fritsch & al. 2010: 193 cluster 7 § 3.9.3; Fritsch 2012b: 252 Fig. 4 T, 254; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Sequences of the plastid *trnL-trnF* region confirmed this relationship but with a lower resolution (Gurushidze & al. 2010: 836, fig. 4 lineage IV).

**Etymology:** The epithet honors Colonel Maclean who brought the bulbs from Cabul to England.

**Biological data:** The cultivar 'Globemaster' (a hybrid with *A. cristophii*, Friesen & al. 1997), bears up to 1.100 flowers per inflorescence (Bijl 1995). Miralibekov (1982, 1984, as *A. elatum*) counted under cultivation in the mean 409 [156-726] seeds per inflorescence, and measured the infrutescence to be 7.8 cm broad, 7 cm long, with 292 flowers (74.5 % with ovaries) that resulted in 224 seeds. The seedlings belong to the *A. karataviense* type (Druselmann 1992, also as *A. elatum*). Seeds germinate very well at 5 °C but only few percent at temperatures above 10 °C (Specht & Keller 1997). The plants need low temperatures in the winter period for flowering but sprout also without low temperatures (Dubouzet & al. 1992). The bulbs contain six different steroid saponines (Inoue & al. 1995). The underground parts contain together 41 % fructose, glucose, saccharose and oligosaccharids, 40 % glucofructans, pectin, hemi-cellulose, and glucuron acid (Sokolov 1994). Different seed storage proteins were found (Maass 1992, Fig. 5 "elat" and "mac1" differ). The reported genome sizes [2C DNA] differ: 29.3 pg (Labani & Elkington 1987) against 42.6 pg (Gurushidze & al. 2012; similar to *A. giganteum* 42.8 pg, *A. trautvetterianum* 41.3 pg, and *A. komarowii* 40.7 pg). Fresh bulbs contain in total 0.02 % cysteine sulfoxides (53 % methiin, 47 % isoalliin; Fritsch & Keusgen 2006). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1), closer investigated by Vogt & al. (2008). Bulb extracts inhibited growth of some (mainly Gram-positive) bacteria species and showed a very high radical scavenger activity (Jedelská & Keusgen 2008). Fresh bulbs contain in total 1.34 % cysteine sulfoxides (53 % methiin, 25 % alliin, 21 % isoalliin, 1 % propiin; Keusgen & al. 2008).

**Economic traits:** In Afghanistan and Pakistan (?) the bulbs are eaten and sold on markets (Uphof 1968). Plants with completely developed leaves ('model') are collected in Tajik mountains and sold at markets as vegetable (Fritsch unpubl., Keusgen & al. 2006). Also used as medical plants (Keusgen & al. 2006). Often planted in European gardens as ornamental and also crossed with other species, hybrids and cultivars exist (Fritsch 2015). The cultivars 'Lucy Ball', 'Gladiator', and 'Rien Poortvliet' arose from accidental crosses with *A. hollandicum* (as *A. aflatanense* hort.) as male parent (Bijl 1995). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991), also under the synonym *A. elatum* commercially available (De Hertog & Zimmer 1993, Fritsch 2015).

**(63) *Allium trautvetterianum*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 661, t. 21 f. a, b (1884). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 359, t. 7 f. 4. (1887). Vved., Flora URSS 4: 274-275 (1935). Vved., Flora Tadzh. SSR 2: 356 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 87 (1971). — **Lectotype:** "Ex horto bot. Petropolitano [from Bot. Garden St. Petersburg] 84. 6 A. Trautvetteri Rgl. E Baldschuan [from Baljwan] (A. Regel)" (LE, design. Fritsch 1990: 508).

**Distribution:** S Tajikistan: Vakhsh and Khozratishoh mountain ranges; montane rocky and rubble limestone slopes, rock terraces and rock clefts. Recently also found in neighboring areas of Afghanistan (Keusgen unpubl.).

**Description:** Bulbs depressed globose; tunics parchment-like, longitudinally splitting, extended in a long and fibrous neck, inner tunics white, outer tunics finally gray-brown to blackish and may accumulate to a thick shell in old plants. Scape subflexuous to straight, terete, smooth (dry with basal ribs); 50-60 (70)

cm long, basally 6-9 mm, above 4-6 mm in diam.; green with glaucous bloom, basally somewhat maroon flushed. Leaves (1) 2-4, laminae oblong-lanceolate, initially stiff later obliquely ascending and recurved to the soil, thick, basally canaliculate above nearly flat; upper and lower sides slightly grooved to ribbed; margins narrowly white or maroon, smooth or basally slightly scabrous, short-triangularly tapering into the hooded apex; 30-35 cm long, (2) 3-7 (10) cm broad; dull gray-green, basally especially along the ribs maroon flushed. Sheathy prophyll up to 2 cm long, hyaline, brownish, quickly decaying. Spathe thin membranous,  $\pm$  completely divided in 2-3 broadly ovate, acuminate, patent valves up to 15 mm long; brownish with maroon veins. Inflorescence semi-globose to subglobose; dense, many-flowered; 5-10 cm in diam. Pedicels unequally long (longest at the last flowers), thin wiry,  $\pm$  straight; c. 3.5 cm long; green in anthesis purplish flushed, paler towards the inflated receptacle. Anthesis in mid of May to June. Flowers nearly flat starlike. Tepals elliptic to broadly lanceolate, subobtuse or subacute, concave, patent, later not much changed; 5-6 mm long, 2-2.5 mm broad; glossy purple with darker, rather diffuse median vein more conspicuous outside. Filaments  $\pm$  as long as the tepals; basally for c. 0.3 mm

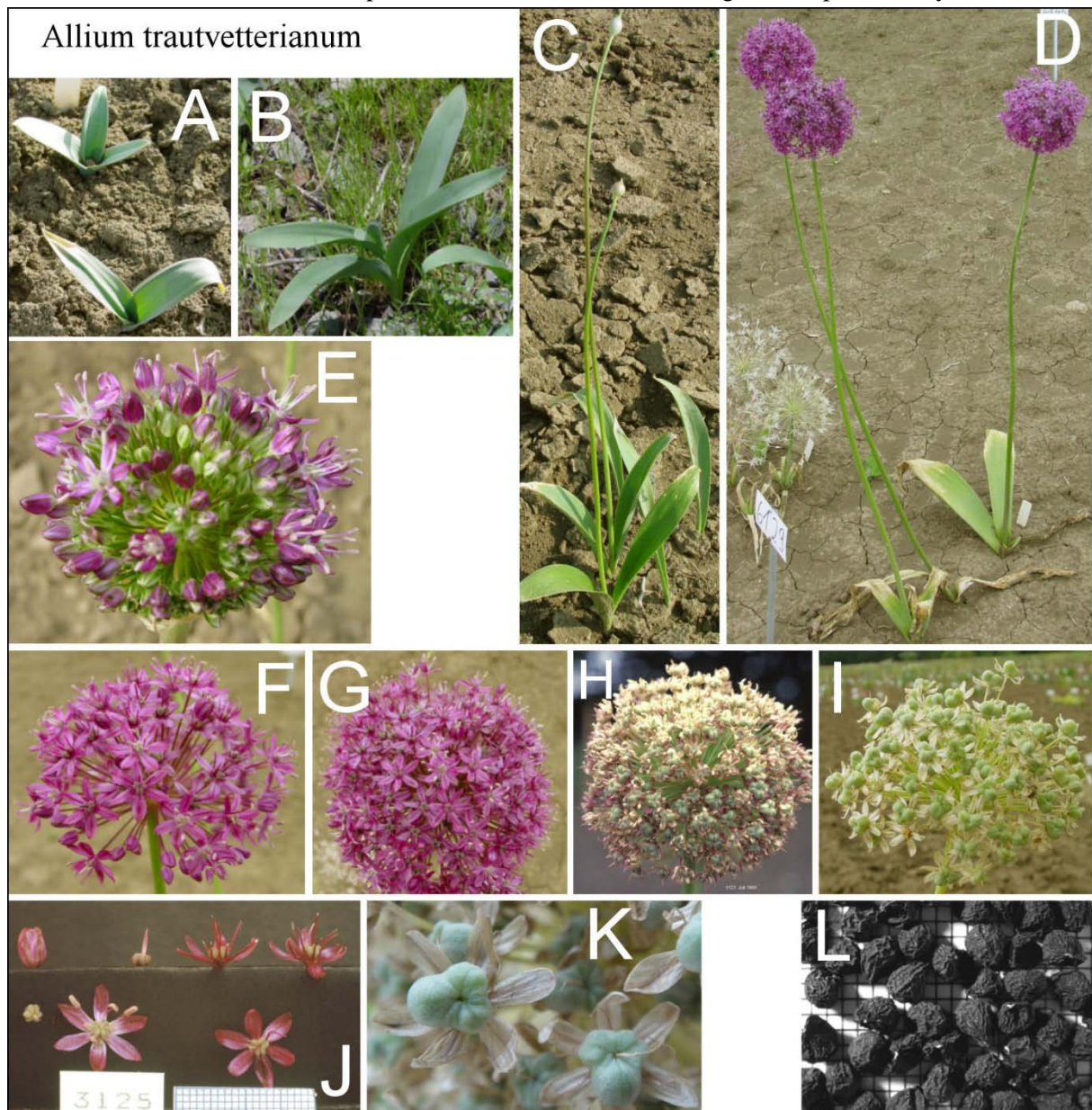


Plate (63): A: Sprouting leaves of cultivated plants; B: leaves of a sterile plant near Sarimarguzor, Tajikistan; C: shooting cultivated plants; D: cultivated plants in full anthesis; E, F & G: inflorescences in early and full anthesis, resp.; H: inflorescence after anthesis; I: inflorescence with developing capsules; J: comparison of flowers and flower parts in different stages of anthesis; K: close-up of developing capsules; L: seeds (millimeter paper as background and measure scale of J & L).



connate and shortly triangular widened (inner filaments c. 3 times broader), above subulate; basally white above ± violet. Anthers oblong; c. 2 mm long and 1 mm broad; bright pinkish violet. Pollen yellowish-gray. Ovary shortly stipitate, hexangular depressed-globose, 1.5-2 mm long, 2-3 mm in diam.; surface acutish papillous; pale grayish green with darker suturs. Style conical-threadlike, 2-4 mm long; whitish later purple. Stigma undivided; whitish. Capsule broadly and nearly tripartite depressed-globose, 3-5 mm long, c. 5 mm in diam.; it opens with three narrow clefts at the apex; buff. Seeds 1 (2) per locule, often only 1 or 2 seeds per capsule, triangularly ovoid to subglobose; surface papillous and densely reticulate-lacunose, dull black; 2.5-3 mm long, 2-2.5 mm broad and thick. The testa showed verrucose periclinal walls with high verrucae. The undulation of the anticlinal walls varied between U-like and Omega-like forms with low to moderate amplitude and moderate wavelengths (Kruse 1988, Abb. 30; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Khozratishoh range, vill. Iol, Seisums s. n.).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Vakhsh range, near Baljuan TAX 3125, near type location).

**Living accessions studied:** Tajikistan: Khozratishoh range, slopes E vill. Sarimarguzor, different exposition and altitudes at right side of Dughova river to the Sari Marguzori Bolo (37°47'48.4" N, 70°14'29" E, 1300-1600 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6062; GAT) TAX 6129, (37°47'52.8" N, 70°13'34.3" E, 1300-1400 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6063; GAT) TAX 6130; Vakhsh range, drainage of Yakhsu river, left side-valley of Heishdara valley (38°22' N, 69°42' E, 1250 m, 19.7.1991 Fritsch 674 & 676; GAT) TAX 3123, TAX 3125.

**Remarks:** *Allium trautvetterianum* is similar to *A. giganteum* with large, dull, and glaucous leaves, but differs mainly by shorter scapes with a less dense inflorescence, and seemingly larger, nearly flat and shiny tepals that do not crumple after anthesis. Surprisingly, molecular markers (ITS sequences of nuclear rDNA) inserted this species in a sister clade to sect. *Compactoprason* with *A. sarawschanicum* as closer related sister group, and less close but unresolved relationships to sect. *Kaloprason* and several smaller sections (Fritsch & al. 2010: 195 cluster7 § 3.9.6; Fritsch 2012b: 254-255 Fig. 5 U; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region confirmed these related groups but with a lower resolution (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

**Etymology:** The epithet honors the outstanding Russian (of Baltic offspring) botanist Ernst Rudolf von Trautvetter (1809-1889) who acted as director of the botanical gardens in Kiev, Mogilev, and St. Petersburg, and scientifically edited plant collections mainly from Asia.

**Biological data:** The genome size of 41.3 pg 2C DNA is similar to the other species of sect. *Compactoprason* but is larger than in *A. majus* (36.6 pg; Gurushidze & al. 2012).

**Economic traits:** In Central Tajikistan the leaves are eaten (Saidov 1986, 2001). Very rarely offered as ornamental (Fritsch 2015).

10.2 A. sect. *Compactoprason* **subsect. Komaroviana** F.O. Khass. & R.M. Fritsch in Linzer Biol. Beitr. 26: 977 (1994). — Type species: *Allium komarowii* Lipsky

**(64) *Allium komarowii*** Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 129 (1900). Vved., Flora URSS 4: 270-273 (1935); Vved., Flora Uzbek. 1: 462 (1941); Vved., Flora Tadzh. SSR 2: 352 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971), omnia "*komarovii*". — Type: Tajikistan: ad lacum [near lake] Iskander-Kul, V.1893, leg. Komarov (holotype LE!).

**Distribution:** Tajikistan, Uzbekistan: N main slopes of the Hissar mountain range, Zaravshan and Turkestan mountain ranges roughly between 68 ° and 69 ° E; steep montane rock and rubble slopes.

**Description:** Bulbs broadly ovoid to globose, 2-4 cm in diam., 2-3 cm long; inner tunics white or yellowish-gray, membranous, outer tunics blackish, papery to strong parchment-like, disintegrating. Scape subflexuous or straight, terete, smooth, rather strong; 40-65 cm long, 4-7 mm in diam.; green with glaucous bloom, basally maroon flushed. Leaves 1-2 (3), laminae oblong to obovate or broadly lanceolate,

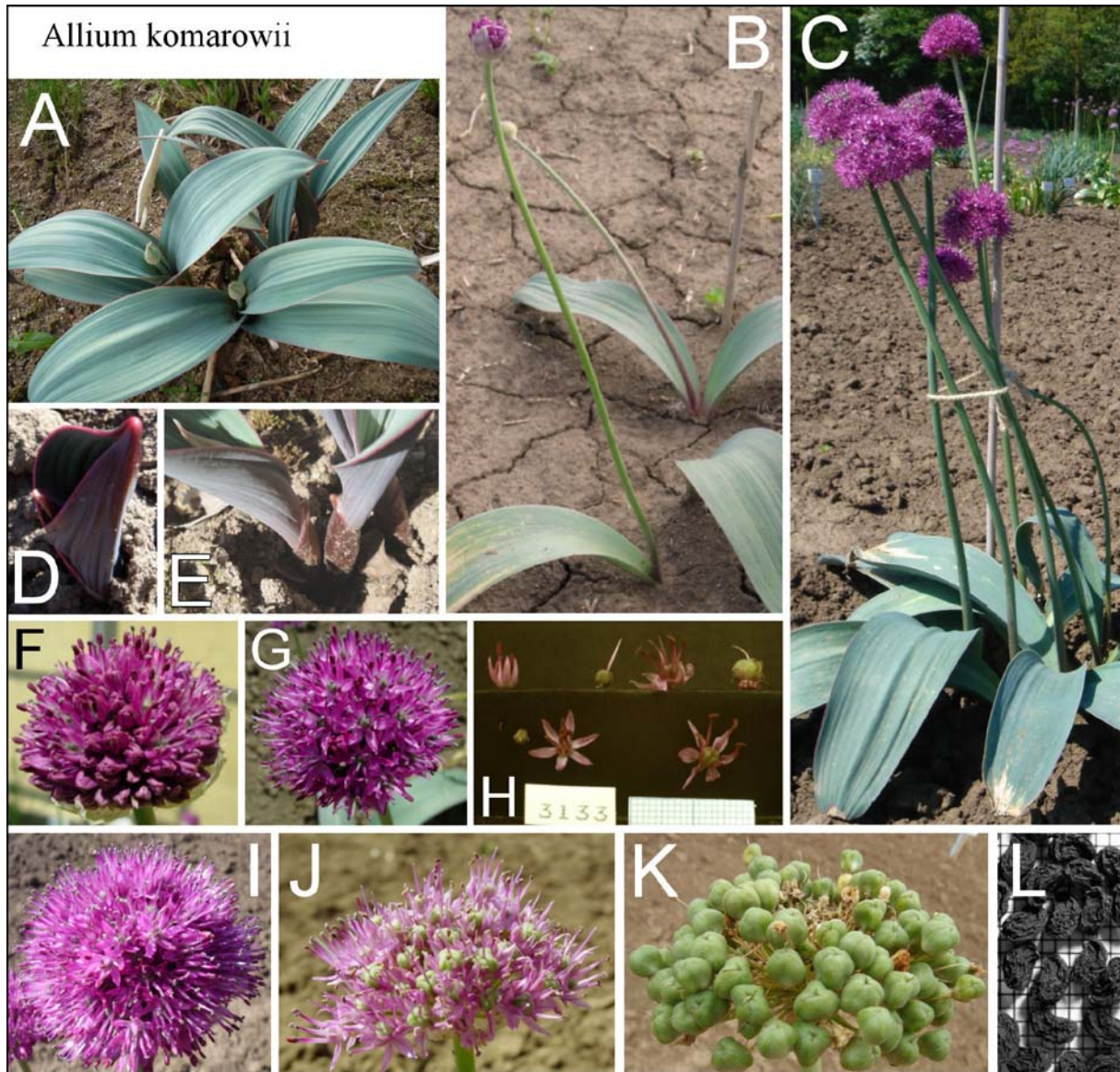


Plate (64): Cultivated plants are shown. A: plants in the shooting stage; B: plants in the budding stage; C: plants in full anthesis; D & E: leaves in the early and late phase of sprouting, resp.; F, G, I & J: inflorescences in early, full, and late anthesis, resp.; H: comparison of flowers and flower parts in different stages of anthesis; K: inflorescence with developing capsules; L: seeds (millimeter paper as background and measure scale of H & L).

flat recurved to the soil, very thick, basally U-like canaliculate and somewhat stalk-like narrowed, above  $\pm$  flat; upper side  $\pm$  grooved, lower side broadly ribbed; margins narrowly purplish, smooth, shortly arcuately tapering into the  $\pm$  hooded apex; 18-30 (40) cm long, 3-7 cm broad; bluish-green to nearly violet with strong glaucous bloom, basally  $\pm$  purple suffused. Sheathy prophyll up to 3 cm long, strong, smooth, glossy, brownish green with inconspicuous veins. Spathe  $\pm$  strong membranous, often incompletely divided into 2-5 long acuminate, nearly patent valves; buff with darker veins. Inflorescence fasciculate to semi-globose; very dense, many-flowered; 5-8 cm in diam., 3-6 cm long. Pedicels unequally long, thickish, wiry, the later flowers with longer pedicels; very glossy brownish later green. Anthesis in May to June. Flowers bowl-shaped starlike. Tepals ovate-lanceolate, spoon-like concave, subacute, patent, later reflexed and irregularly crumpled or spirally enrolled; (5) 6-7 mm long, 1.5-3 mm broad; deep pink later purplish with darker, inconspicuous median vein. Filaments as long as or slightly longer than the tepals; basally for c. 0.5 mm connate and (inner ones c. two times broader) triangular widened, above subulate; violet, fading towards the base. Anthers ovoid to arrowhead-shaped; 1.5-2 mm long, 0.7-1 mm broad; violet. Pollen yellowish gray. Ovary sessile, slightly depressed-globose triangular with 3 longitudinal furrows, 2-3 mm long and in diam.; surface acutish papillose; green, whitish-grayish

suffused. Up to 5 ovules per locule, 14 ovules per ovary (Filimonova 1970). Nectaries mound in a pore near the base of the ovary. Style conical-threadlike, 3-5 mm long;  $\pm$  white. Stigma undivided; whitish. Capsule  $\pm$  broadly triangular-conical, surface with irregular, raised wrinkles, 5-7 mm long, 6-8 mm in diam.; moderately to widely open, valves suborbicular, notched at the apex;  $\pm$  glossy buff. Seeds 1-2 per locule, flat ovoid to drop-shaped with concave sides; surface densely reticulate lacunose, silk-glossy black; 3-4 mm long, 2.5-3 mm broad, 1.5-2.5 mm thick. The testa showed verrucose periclinal walls, and transitions from U- to Omega-like undulation of the anticlinal walls with high or low amplitude and moderate or short wavelengths (Fritsch & al. 2006 Fig. 6).

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Zaravshan range, canyon Antara-Sara, Seisums s. n.).  $2n = 16$  Gurushidze & al. 2010, 2012 (Tajikistan: Hissar range, Yagnob valley, TAX 6282, Ark canyon, TAX 6296); Uzbekistan: W Hissar range, Kyzyl-darya valley, vill. Kalta-Kul TAX 3144).

**Living accessions studied:** **Uzbekistan:** Turkestan range, Zomin valley below the highest sanatorium (39°38' 27.3" N, 68°30'11.4" E, 1900 m, 04.6.2006 Fritsch & Khassanov 4245; GAT) TAX 6530; West Hissar range, 2 km above vill. Kaltakul (collected by Khassanov, 38°50' N, 67°07' E, 1600 m, 03.7.1991 Fritsch s. n.; GAT) TAX 3144, close to village Kaltakul (30°50'28.4" N, 67°07'36.4" E, 1500 m, 19.5.2009 Keusgen & Khassanov 4294; GAT) TAX 6748, S exposed granitic slope S vill. Kaltakul (38°50' N, 67°07' E, 1700 m, 20.8.2001 Fritsch & Gemeinholzer 1839\*; GAT) TAX 5908, 7 km along the road to valley Kirgalma (38°49'10.7" N, 67°07'36" E, 1800 m, 29.5.2003 Fritsch, Keusgen, Khassanov 4170; TASH). **Tajikistan:** Hissar range, Yagnob valley about 1 km E vill. Margebi Bolo, (39°10'56.5" N, 68°54'49.4" E, 2450 m, 23.6.2004 Fritsch, Hisoriev, Keusgen 6134; GAT) TAX 6282; Zaravshan range around Iskanderkul lake, S exposed steep rubble slopes of lake Iskanderkul (39°09' N, 68°20' E, 2250 m, 28.7.1991 Fritsch 691; GAT) TAX 3133, Mt. Qozkhona next valley E of mouth of Saritag river (39°04'00.6" N, 68°20'24.2" E, 2500 m, 24.6.2004 Fritsch, Hisoriev, Keusgen 6142; GAT) TAX 6289, right side of Ark canyon 3 km from mouth into Karakul river (39°08'50.7" N, 68°17'18.5" E, 2500 m, 26.6.2004 Fritsch, Hisoriev, Keusgen 6149; GAT) TAX 6296; Zaravshan range, Shing valley, W side of third Kulikalon lake from below (39°12'20.5" N, 67°48'29.5" E, 1750 m, 27.6.2004 Fritsch, Hisoriev, Keusgen 6154; GAT) TAX 6299, valley of river Obi-borik, W side of lake Khishobiston (39°11'30" N, 67°44' E, 2000 m, 29.6.2004 Fritsch, Hisoriev, Keusgen 6169; GAT) TAX 6313.

**Remarks:** *Allium komarowii* is the only species of subsection *Komaroviana*. The general habit and the dense and rather multiflorous inflorescences are more similar to moderately tall species of sect. *Acmopetala*, but the flowers resemble more sect. *Compactoprason*, and the leaf characters *A. karataviense*. Thus a taxonomic separation as subsection seems appropriate. One molecular marker studied (ITS sequences of nuclear rDNA) support a closer relationship to sect. *Compactoprason* (*A. giganteum* and *A. macleanii* belong to sister subgroups) and to some species of sect. *Regeloprason* (Fritsch & al. 2010: 193 cluster 7 § 3.9.2; Fritsch 2012b: 252 Fig. 4 S, 253; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Sequences of the plastid *trnL-trnF* region belonged to several haplotypes, closely related either to *A. giganteum*, *A. macleanii*, and several members of sect. *Procerallium* in lineage IV, or to *A. aroides*, *A. verticillatum*, *A. gypsaceum*, and *A. alexeianum* / *A. nevskianum* in lineage VI (Gurushidze & al. 2010: 836, fig. 4). Re-study of the plastid molecular markers seems necessary to clear up the disagreements.

**Etymology:** The epithet honors with certainty the outstanding Russian botanist of merit Vladimir Leontevich Komarov (1869-1945), main editor of the Opus Magnus "Flora URSS", who collected the type.

**Biological data:** Seeds germinated well at 5 °C, but no germination above 10 °C (Specht & Keller 1997). The genome size of 40.7 pg 2C DNA is similar to that of *A. trautvetterianum* (41.3 pg), but *A. giganteum* (42.8 pg) and *A. macleanii* (42.6 pg) have slightly higher, and *A. majus* (36.6 pg) a lower genome size (Gurushidze & al. 2012). Bulb extract inhibited growth of some (mainly Gram-positive) bacteria species (Jedelská & Keusgen 2008) and showed a very high radical scavenger activity (Jedelská & al. 2004, Jedelská & Keusgen 2008). The plants contain dithiodipyrrole that causes an orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1). Fresh bulbs contain in total 0.09 / 0.06 % cysteine sulfoxides (83 / 45% methiin, 10 / 55 % isoalliin, 7 / 0 % propiin), leaves contain in total 0.52 / 1.01 % cysteine sulfoxides (4 / 1.5 % methiin, 56 / 98.5 % isoalliin, 40 / 0 % propiin; Jedelská & al. 2004, Keusgen & al. 2008, from Uzbekistan / Tajikistan).

Economic traits: Local names 'gushi gurgak' and 'kujrak motor'. Fresh or dried leaves, locally also buds, are used for traditional dishes. Leaves and buds are also medically applied, e.g. as anabolic for horses (Keusgen & al. 2004, 2006). Belongs to the most important edible species in the Uzbek mountains (Khasanov 2008). Rarely offered as ornamental (Fritsch 2015).

10.3 A. sect. *Compactoprason* **subject. *Spiralopetala*** F.O. Khass. & R.M. Fritsch in Linzer Biol. Beitr. 26: 977 (1994). — Type species: *Allium majus* Vved.

(65) *Allium majus* Vved., Fl. Uzbek. 1: 462, 543 (1941). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 86 (1971). — Type: Uzbekistan, W Pamir-Alai: Verkohov'ya r. Yakkabag-Darya, okr. kish. Tash-Kurgan, melkosemnisto-shchebnistye sklony k reku Yakkabag-darya u kish. [heights of the river Yakkabagdarya in the vicinity of village Tash-Kurgan, shallow soil - rubble slopes toward river Yakkabagdarya near village] Tash-Kurgan, 2.7.1936, leg. Botschantzev & Butkov 576 (holotype TASH! one plant mounted on the sheets 161345 & 161346, isotype TASH! nos. 161347 & 161348).

Distribution: Uzbekistan: SW Hissar mountain range, montane stony-rocky and rubble slopes.

Description: Bulbs depressed-globose, 3-5 cm in diam.; inner tunics membranous, yellowish, outer tunics yellowish to grayish-black, leathery, somewhat longitudinally splitting, extended in a mostly short neck. Scape subflexuous to straight, terete, smooth; c. 1 m long, basally up to 12 mm, above up to 8 mm in diam.; green with glaucous bloom. Leaves 2-4 (6), laminae broadly oblanceolate, obliquely ascending and recurved, basally U-like, above shallowly canaliculate; upper and lower sides smooth and with very shallow grooves; margins initially purplish later white, thick cartilaginous, smooth, arcuately tapering into the slightly hooded apex; up to 40 cm long, 4-8 (12) cm broad; green with glaucous bloom. Sheathy prophyll very short, tender, whitish, soon decaying. Spathe membranous, completely divided in 2-3 shortly acuminate valves; buff with darker veins. Inflorescence initially depressed-globose later globose; very dense, many-flowered; 6-8 cm in diam. Pedicels subequally long, rather thin, straight; light green with brown flush. Anthesis in mid of June. Flowers bowl-shaped starlike. Tepals oblong to long ovate, concave, obtuse with incurved apex, patent, later reflexed and enrolled; 5.5-7 mm long, outer tepals 1.5-2 mm broad, inner ones 2-2.5 mm broad; bright violet to carmine with darker or greenish median vein fading towards the base. Filaments 1/5 to 1/3 longer than the tepals; basally scarcely 0.5 mm long connate and shortly triangular (inner filaments 2-3 times broader) widened, sometimes with 2 small side teeth, above subulate; carmine fading towards the whitish base. Anthers oblong; 2-3 mm long, 0.8-1.2 mm broad; grayish-violet. Pollen grayish yellow; 31 µm long, 19 µm broad, 90 % were fertile (Ergashev 1995). Ovary stipitate, triangular depressed-globose, 2-2.5 / 3 mm long, 2.5-3 mm in diam.; surface finely acutish papillous; grayish green, violet suffused. 6 ovules per ovary were counted by Ergashev (1995). Nectaries mound in a pore near the base of the ovary. Style conical-threadlike, 5-7 mm long; initially whitish, later carmine. Stigma undivided; whitish to violet. Capsule triangular depressed-globose, surface scabrous; the locules open only with clefts near the tip, valves ± cordate. Seeds 1-2 per locule, flat globose to ovoid, somewhat edged; surface densely reticulate lacunose, dull black; 2.5-3 mm long, 2-2.5 mm broad, c. 2 mm thick. The testa showed verrucose periclinal walls, and Omega-like to U-like undulation of the anticlinal walls with low amplitude and short wavelengths (Fritsch & al. 2006, Fig. 7).

Living accessions studied: Uzbekistan: Zaravshan range, Kitab Geological Station (39°11'56.4" N, 67°17'14.7" E, 1250 m, 20.5.2009 Keusgen & Khasanov 4295; GAT) TAX 6749; W Hissar range, Akbashtau Mts., sandstone outcrops N pass Tally S vill. Talla (38°11' N, 66°25' E, 1300 m, 14.7.1994 Fritsch, Khasanov, Pistrick 1251; GAT) TAX 5073, drainage of Kisyl-Darja river, red sandstone cliffs opposite to vill. Tash-Kurgan (type location, 38°46' N, 67°15' E, 1900 m, 24.5.1992 coll. Khasanov via Fritsch 786; GAT) TAX 3363, Kirktau Mts., rock slopes in the valley of Kashka-Darja river 15 km S vill. Wargansa (collected by Khasanov, 39°20' N, 67°10' E, 1100 m, 24.5.1992 Fritsch 785; GAT) TAX 3362.

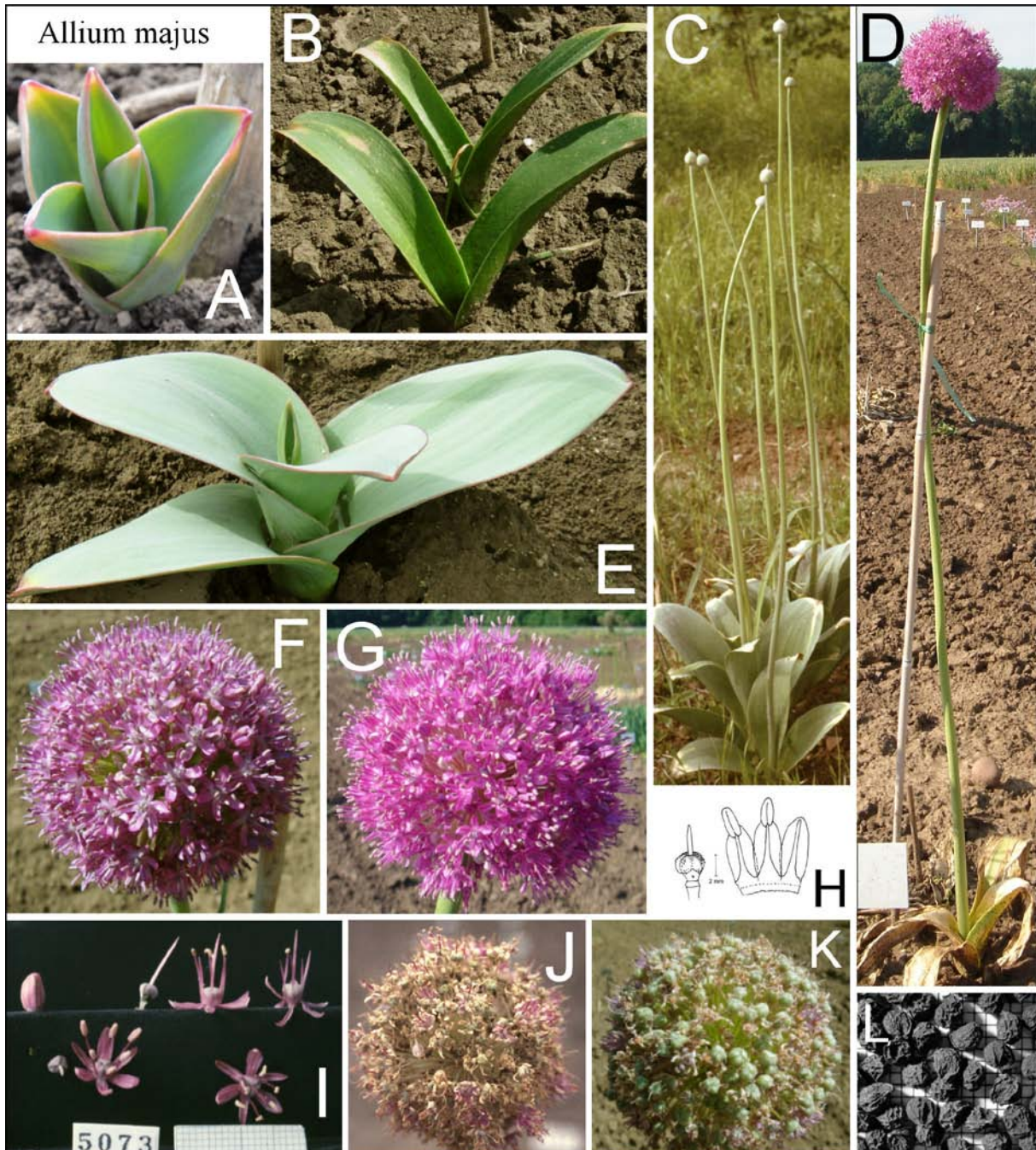


Plate (65): Cultivated plants are shown. A, B & E: Leaves in different stages of sprouting; C: plants from the type location in the shooting stage; D: flowering plant; F & G: inflorescences in full anthesis; H: shape of ovary, tepals and filaments of a flower prepared from herbarium; I: comparison of flowers and flower parts in different stages of anthesis; J & K: inflorescences after anthesis and with developing capsules, resp.; L: seeds (millimeter paper as background and measure scale of I & M).

**Remarks:** *Allium majus*, the only species of subsect. *Spiralopetala*, is morphologically more or less intermediate between *A. giganteum* and *A. komarowii*. It differs from the first species mainly by a smaller stature, shorter leaf laminae, basally relatively broader tepals  $\pm$  reflexed and spirally contorted after anthesis, and relatively broader inner filament bases. *Allium komarowii* is again smaller, and differs by bluish-green, strongly glaucous leaf laminae, a  $\pm$  semi-globose inflorescence much poorer in flowers, and less concave, more lanceolate tepals. These three species also occupy different ecological niches. Molecular markers (ITS sequences of nuclear rDNA) support a close relationship to sect. *Kaloprason* and less close but unresolved relationships to subsect. *Keratoprason* of sect. *Megaloprason* s. str. and sect. *Aroidea*, somewhat separated from the other members of sect. *Compactoprason* (Fritsch & al. 2010:

193 cluster 7 § 3.9.3; Fritsch 2012b: 254, 255 Fig. 5 Y; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). This position is concordant with its separation as monotypic subsection. Another marker (sequences of the plastid *trnL-trnF* region: Gurushidze & al. 2010: 836, fig. 4 lineage VI) confirmed this relationship in general but with much lower resolution.

**Etymology:** The epithet reflects the grand appearance of the flowering plants (from Latin comparative of "tall").

**Biological data:** The flowering period lasts 1-2 days per flower and 21 days per inflorescence (Ergashev 1995), the reported genome size was 36.6 pg 2C DNA (Gurushidze & al. 2012).

#### 11. A. subg. *Melanocrommyum* sect. *Procerallium* R.M. Fritsch

in Phytion (Horn, Austria) 49: 199 (2010). — Sect. *Megaloprason* Wendelbo in Bot. Notiser 122: 28 (1969), p. p. min., et sensu R.M. Fritsch in Candollea 48: 417-430 (1993), p. p. maj. — Sect. *Kaloprason* subsect. *Megaloprason* group of *A. rosenbachianum* relatives, Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994). — **Type species:** *Allium stipitatum* Regel

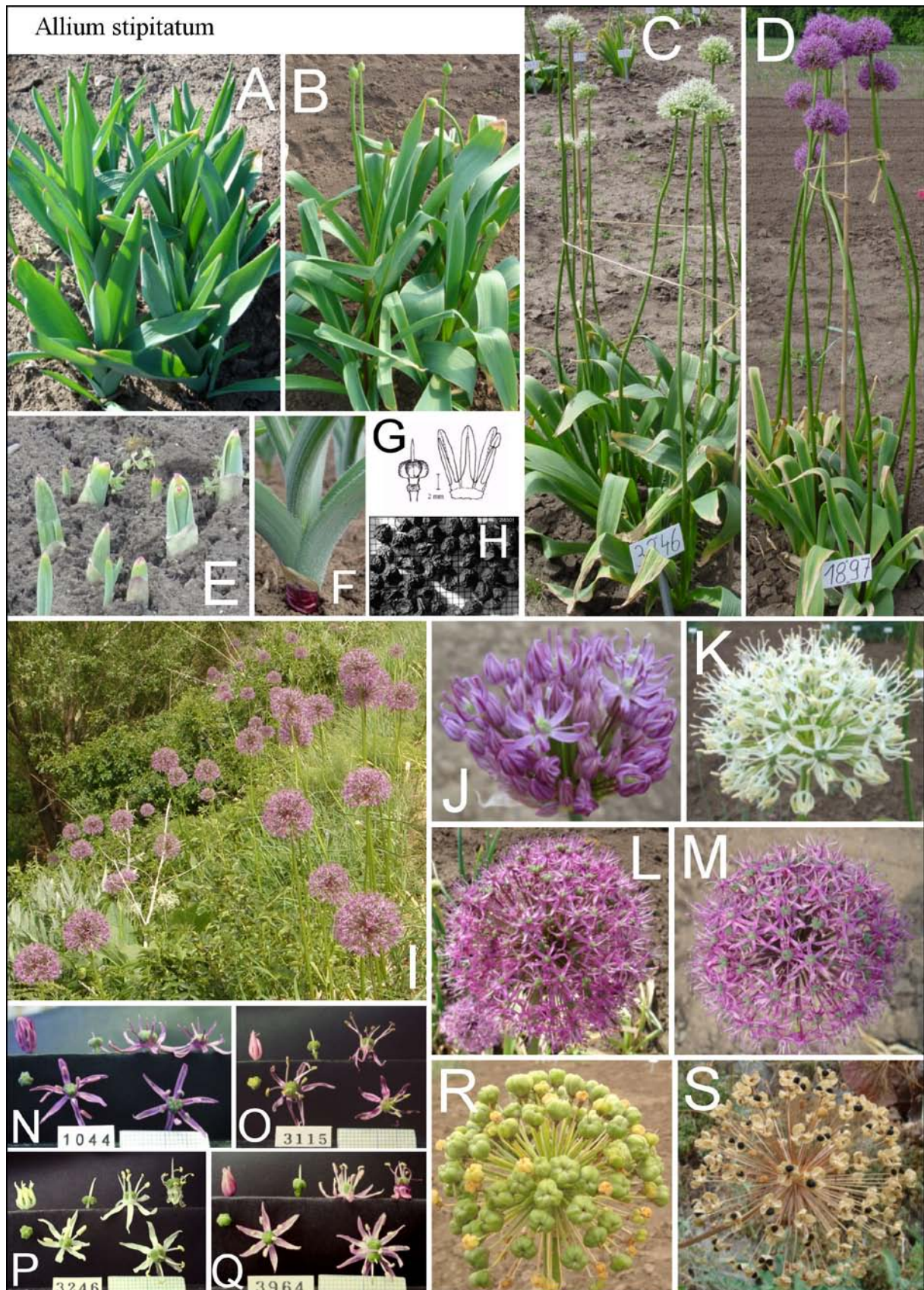
##### 11.1 A. sect. *Procerallium* subsect. *Elatae* R.M. Fritsch

in Candollea 48: 426 (1993), sub sect. *Megaloprason*. — A. sect. *Molium* series *Altissima* Tzag. in Bot. mat. gerb. inst. bot. AN Kaz. SSR vyp. 10: 14 (1977), p. p. min., type species: *A. altissimum* Regel. — **Type species:** *Allium stipitatum* Regel

**(66) *Allium stipitatum*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 7: 546 (1881), Regel in Gartenflora 30: 355, t. 1062 Fig. 1-3 "a, b, c," (1881). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 302, 360 (1887). Vved., Flora Turkm. 1, 2: 292 (1932). Vved., Flora URSS 4: 267-268 (1935). Vved., Flora Uzbek. 1: 461 (1941). Vved., Flora Tadzh. SSR 2: 349 (1963). Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 51, 54 (1967). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971). Wendelbo, Flora Iranica 76: 85, tab. 9/121 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Fritsch in Nordic J. Bot. 16: 13 (1996). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 172, plate T69, map (2013). — *Allium hirtifolium* Boiss., Fl. orient. 5: 281 (1882). Type: In Persia prope Ispahan, leg. Aucher No. 5389 (lectotype G!, isolectotype K; design. Fritsch & al. 2010: 205). Syntype: 2. Iran, in montibus Bachtiaricis [in the Bakhtiar Mts.], leg. Bode (? according to Regel (1875): 248, 1989 not traced in LE). *Allium atropurpureum* Waldst. & Kit. var. *hirtulum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 248 (1875), *A. atropurpureum* "M. Bieb." sensu Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 359 (1887), p. p. maj. *Allium botschantzevii* Kamelin in Novosti sist. vyssh. rast. 13: 42 (1976). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Type: Yushnyj Uzbekistan, Nizkogor'ya k yu. ot shosse [S Uzbekistan, low mountains south of the road] Dekhkanabad - Derbent. Gory Kuruk-dagana. Yu. sklon perv. Tally, serye solenye gliny [Kuruk-dagana Mts., southern slopes of pass Tally, gray saline clay], 19.5.1967, no. 114, leg. Botschantzev (holotype LE!). — **Type:** Zaravshanskij bassejn, pereval Anzob, vysota [Zaravshan drainage, pass Anzob, elevation] 10000', 20.6.1870, leg. O. Fedtschenko (lectotype LE!, isolectotype TASH-Fedt!, design. Fritsch 1990: 508).

**Distribution:** Iran, Afghanistan, Uzbekistan, Kirgizstan, Tajikistan, Kazakhstan, Turkmenistan, Pakistan: submontane to montane loamy to rocky steppe slopes, among trees and shrubs, in the shadow of large trees, on well manured ruderal places.

Plate (66): A & B: Cultivated plants sprouting and in early shooting stage, resp.; C & D: flowering cultivated plants; E: cultivated plants start sprouting; F: sheath leaf and bases of laminae of a moderately hairy plant; G: shape of ovary, tepals and filaments of a flower prepared from herbarium; H: seeds; I: roadside population near Sanandaj,



Iran; J & K: inflorescences at start of anthesis; L & M: inflorescences in full anthesis (L: from Kondara valley, Tajikistan, M: from Sanandaj, Iran); N - Q: comparison of flowers and flower parts in different stages of anthesis (N & P: strains from bulb trade, O: from Khilaliktai, Tajikistan, Q: from Bakhtiar Mts., Iran); R: inflorescence with full-sized capsules; S: infructescence with open capsules in Tajikistan (millimeter paper as background and measure scale of H, N, O, P & Q; plate copied from Fritsch & Abbasi 2013: 173 Plate T69, modified).

**Description:** Bulbs depressed to flat-globose, (1) 3-8 (12) cm in diameter, 2-4 cm long, with small, shield-shaped lateral bulbs that terminate 1-2 cm long, flat stolons; outer tunics yellowish to dark gray, papery, splitting into longitudinal fibers. Scape subflexuous to straight, terete, smooth and glossy like polished; 70-100 (150) cm long, 6-12 (15) mm in diam.; green with some glaucous bloom and often purple suffused in the lower part. Leaves 4-7 (10), laminae narrowly to broadly oblong to lanceolate, steep arcuately ascending and recurved to the soil or upper part hanging down, rather thick, broadly canaliculate; upper side with shallow furrows, lower side with broad ribs, densely to loosely ciliate on both sides, sometimes only with sparse cilia or tooth in the basal part on ribs and along the margins (single subglabrous plants sometimes occur); margins shortly arcuately tapering into the cucullate apex; 30-65 (90) cm long, (1.5) 3-8 (14) cm broad (the innermost leaves are the narrowest but only slightly shorter); glaucous or vividly green with glaucous bloom, often semi-glossy. Sheathy prophyll rather long, glossy, thickish, brownish green to deep purple, persisting to the budding stage. Spathe papery, completely divided in 2-3 (5) ovate, shortly acuminate, finally reflexed valves shorter than the pedicels; pale yellowish brown with inconspicuous or maroon veins. Inflorescence initially broadly fastigiate later depressed-globose; dense, many-flowered (up to 300 flowers); (3) 5-8 (12) cm in diam., in the fruiting stage also larger. Pedicels sub-equally long, rather thick, straight or slightly ascending, stiff wiry; (1) 2-5 cm long; semi-glossy to glossy brownish to purplish green. Anthesis in May to June. Flowers flat starlike. Tepals narrowly oblong to lanceolate-triangular, apex  $\pm$  cucullate, subacute, basally  $\pm$  free, patent and slightly incurved, after anthesis reflexed and crumpled or enrolled; (7) 10-12 mm long, basally 1.3-2 mm broad; pale to deep pink to purplish with a purple to greenish median vein darker on the dorsal side. Filaments  $3/4$  to as long as the tepals, subulate,  $\pm$  straight; base for 0.5-0.8 mm connate and triangular widened (inner filaments remarkably broader); color paler than the tepals and darker towards the apex. Anthers oblong; 2.3-3 mm long, c. 1 mm broad; lilac. Pollen pale yellowish gray; shape oblate to peroblate, 27.5/30/35.5-37.5  $\mu\text{m}$  long, 15 / 17.5-20  $\mu\text{m}$  broad, P/E index 0.5, sculpture rugulate to microrugulate, wall 1.1  $\mu\text{m}$  and exine 0.7  $\mu\text{m}$  thick, perfor. 0.1  $\mu\text{m}$  in diam. (Levan 1935/Neshati & al. 2009/Namin & al. 2009). Ovary stipitate, depressed globose tripartite to hexangular with 6 longitudinal furrows, 2-2.5 mm long, 3-4 mm in diam.; surface acutely papillous; dull pale green. Up to 5 ovules per locule, 14 ovules per ovary (Filimonova 1970) / 3-4 ovules per locule (Ebrahimi & al. 2014). Nectary ducts lead in pits at the base of the ovary below the bottom of the locules (Fritsch 1992b). Style narrowly conical to thread-like; whitish. Stigma undivided; white. Capsule depressed globose triangular with 3 broad and 3 narrow furrows, at the apex concave, surface papillous semi-glossy, 4-8 mm long, (5) 7-10 mm in diam.; widely open, valves suborbicular, rather shallowly notched at the apex; buff. Seeds 1-2 (3) per locule / 1-2 per locule, 3-6 per capsule (own observation / Ebrahimi & al. 2014), ovoid to flat drop-shaped; surface finely papillous with irregularly reticulate ledges, silk-glossy black; c. 3.5 mm long, 3 mm broad, 2.5 mm thick / 3.73-3.98 mm long, 2.75-3.16 mm wide, TKW 7.8-8.2 g (own observation / as *A. hirtifolium*, Ebrahimi & al. 2014). TKW 8.46 / 9.44 g (Fritsch & Abbasi 2013). The testa showed verrucose periclinal walls with a moderate or high number of verrucae and anticlinal walls with transitions from S-like to U-like and Omega-like forms with moderate to short wavelengths and low amplitudes (Kruse 1984; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Levan 1935 fig. 16h (Netherlands: Bulb trader van Tubergen).  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 148 (Uzbekistan: Zaravshan range, Amankutan, no. 176; Tajikistan: Hissar range, Anzob pass, no. 763 "*A. altissimum*").  $2n = 16$  Ved Brat 1965a fig. 7, Ved Brat 1965b (Italy: Botanical collection Villa Taranto).  $2n = 16$  Pedersen & Wendelbo 1966 (Iran: Chaham. Bakhtiari, Kuh Rang, W 928 "*A. hirtifolium*").  $2n = 16$  Dietrich 1967 (France: Botanical collection Strasbourg).  $2n = 16$  Zakirova & Vakhtina 1974 (Tajikistan: Hissar range, Anzob pass, no. 763V, Turkmenistan: Ashkhabad, "*A. altissimum*").  $n = 8$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection BIN "*A. altissimum*").  $2n = 16$  Vosa 1977 (source not mentioned).  $2n = 16$  Gohil & Kaul in Löve 1981 (India: Kashmir, Srinagar, RK 11).  $2n = 16$  Pogosian 1983 (Iran: Azerbaijan, Khoy "*A. hirtifolium*").  $2n = 16$  Astanova 1984 (Tajikistan: Vakhsh range, Obi-Mazar valley, Zaprtjagaev 865).  $2n = 16$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen).  $2n = 16$  Ohri & al. 1998 (Netherlands: Botanical collection Bergen TAX 3028).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Germany and Netherlands: Botanical collections Braunschweig TAX 0557, Amsterdam TAX 2613, TAX 2618, TAX 2619; Tajikistan: Hissar range, near type location TAX 2553).  $2n = 16$  Gurushidze & al. 2010, 2012 (Iran, Chaham. Bakhtiari: Farsan TAX 3958, Haruni TAX 3962, Chelgerd TAX 3967).  $2n = 16$  Panahandeh & Mahna 2011 Ideogram C-banding (Iran, Kurdistan: Divandare).



2n = 16 Gurushidze & al. 2012 (Netherlands: bulb trader Peter Nijssen TAX 3246, Turkmenistan: Kopetdag range, Chuli, TAX 5263). 2n = 16 IPK *Allium* reference collection ideogram (Kirgizstan: Turkestan range, Dargun, TAX 5069).

Living accessions studied: **Kazakhstan:** Kindyktas Mts., gorge Kurdai along the river (25.6.1993 Bajtulin 7; GAT) TAX 3738. **Kirgizstan:** Turkestan range, mountains c. 1 km above vill. Dargun, loamy slope base and limestone canyon (39°59' N, 69°57' E, 1650 m, 10.7.1994 Fritsch, Khassanov, Pistrick 1238; GAT) TAX 5069; foothills of Alai range, home garden in the vill. Aral, c. 6 km N town Naukat (40°20' N, 72°38' E, 1200 m, 15.5.1992 Fritsch 753; GAT) TAX 3347. **Tajikistan:** Collection site not known (from Bot. Garden Dushanbe, donated by Astanova, 16.6.1984 via Fritsch 5; GAT) TAX 1315; Central Hissar range, N slope of Hissar range, Anzob valley, NE slopes near Narzan mineral spring (lectotype location ?, 39°06'25.7" N, 68°51'12.3" E, 2800 m, 22.6.2004 Fritsch, Hisoriev, Keusgen 6130; GAT), TAX 6278, Anzob valley near main road, field margin (39°07'32.8" N, 68°51'50.4" E, 2430 m, 22.6.2004 Fritsch, Hisoriev, Keusgen 6131; GAT) TAX 6279, drainage of Varzob river, upper Varzob valley near station Kuk-Tepa E vill. Siddi (39°03' N, 68°54' E, 2600 m, 10.8.1988 Fritsch 354; GAT) TAX 2553; Maichura valley (39°03' N, 68°45' E, 2000 m, 19.5.1987 Fritsch 167; GAT) TAX 2264, mound of river Maichura (39°02' N, 68°47' E, 1900 m, 19.5.1987 Fritsch 168; GAT) TAX 2265, Kondara valley c. 50 km N Dushanbe, shady place (38°49' N, 68°48' E, 1300 m, 19.6.1984 Fritsch 25 & 34; GAT) TAX 1311, TAX 1320, (1340 m, 23.4.1986 Fritsch T121; GAT) TAX 1890, N exposed pit close to location Kwak (38°49' N, 68°46' E, 1920 m, 25.4.1986 Fritsch T133; GAT) TAX 1904, beside the path from Kondara station to location Kwak, below *Juniperus* and other trees (38°49' N, 68°46' E, 1940 m, 25.4.1986 Fritsch T129; GAT) TAX 1897, Khorongon gorge NE Dushanbe, loamy rubble slope (38°41' N, 68°52' E, 1400 m, 20.6.1984 Fritsch 47; GAT) TAX 1343; Khilaliktai massif ca. 45 km W Dushanbe, slopes above vill. Sangichob (38°44' N, 68°25' E, 1500 m, 15.7.1991 Fritsch 663; GAT) TAX 3115; Ramit reservation, left side valley of river Kholmon (38°45' N, 69°18' E, 1370 m, 14.5.1987 Fritsch 154 & 156; GAT) TAX 2255, TAX 2257, (1300 m, 17.4.1986 Fritsch T74; GAT) TAX 1872; Khozrati-shoh range, slopes E vill. Sarimarguzor, right side of Dughova river to the Sari Marguzori Bolo (37°47'17" N, 70°14'26.2" E, 1200-1600 m, 25.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6061; TAD), valley of Panj river, Margzor, along the road from Kalaikhumb to Shuroobod, 307 km to Khorog from Dushanbe (38°26'29.9" N, 70°56'10.3" E, 1800 m, 04.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6101; GAT); Zaravshan range, Panjakent region, W side of the end of 7th lake (39°06'41.1" N, 67°50'49.5" E, 2560 m, 28.6.2004 Fritsch, Hisoriev, Keusgen 6155; GAT) TAX 6300; Rangon ridge, S slopes at Khojai-Saring (38°22' N, 68°57' E, 1500 m, 23.5.1987 Fritsch 206; GAT) TAX 2281; Darvaz range, Khumbov canyon after soldier post, after second bridge (38°34'25.3" N, 70°51'02.8" E, 1900 m, 22.7.2005 Fritsch, Hisoriev, Keusgen, Kudratov 6215; GAT) TAX 6449; Obikhingou valley, N slope above vill. Khoidara (38°42'27.6" N, 70°33'03" E, 1950 m, 26.7.2005 Fritsch, Hisoriev, Keusgen, Kudratov 6232; GAT) TAX 6464; Kurama ridge, valley Chelata shortly below the pass, strongly grazed *Juniperus* slope (40°38' N, 69°35' E, 1700 m, 29.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 556; GAT) TAX 2952; Vakhsh range, mountain slopes W town Khovaling, former vill. Sebi-Sukh (38°30' N, 70°03' E, 2000 m, 06.8.1988 Fritsch 350; GAT) TAX 2549, N slopes of Kugitek Mts. along river Obi-Masar (38°27' N, 70°04' E, 2000 m, 03.8.1988 Fritsch 311; GAT) TAX 2536; Vakhsh valley 7 km NE Nurek (1550 m, 14.5.1985 Hanelt 17; GAT) TAX 1623, slopes above vill. Teguzak, Sebiston W region of Vakhsh range (38°17'26.7" N, 69°15'00.4" E, 1200 - 1700 m, 06.05.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6108; TAD); Gazimailik ridge near Ganjino, N exposed slope (37°59' N, 68°34' E, 1440 m, 23.5.1987 Fritsch 186; GAT) TAX 2277. **Turkmenistan:** Central Kopetdag range, shady valley bottom in the upper part of vill. Chuli (37°57' N, 57°59' E, 700 m, 20.4.1995 Fritsch & Khassanov 1321; GAT) TAX 5263. **Uzbekistan:** Chatkal range, above village Sukok, 50 km E Tashkent (41°14'33" N, 69°49'15.6" E, 1300 m, 09.5.2005 Fritsch, Khassanov 4219; GAT) TAX 6370, district Parkent not far from vill. Samsarak (1989 Levichev s. n; GAT) TAX 2794; Turkestan range, Zaamin valley, nearby sunstation (1700 m, 15.6.2005 Khassanov 4229; TASH); SW Hissar range, drainage of river Tupalang, right tributary of river Shargun (38°38' N, 67°57' E, 2150 m, 17.7.1994 Fritsch, Khassanov, Pistrick 1272; GAT) TAX 5080, Divlog valley E vill. Zevar, loamy slopes (38°44' N, 67°57' E, 2200 m, 16.7.1994 Fritsch, Khassanov, Pistrick 1255; GAT) TAX 5074; Zaravshan range, S slope c. 2 km S pass Takhta-Karacha, SE exposed slopes (39°17' N, 66°54' E, 1500 m, 15.5.1993 Fritsch & Khassanov 823; GAT) TAX 3659; Kugitang ridge c. 20 km W Gulistan, upper part of Baglidarasai valley (37°56' N, 66°45' E, 1500 m, 18.5.1993 Fritsch & Khassanov 859; GAT) TAX 3670.

Remarks: *Allium stipitatum*, the type species of sect. *Procerallium* and subsect. *Elatae*, is an extremely polymorphous species concerning plant height, color and indumentum of the leaves, dimensions of the inflorescences and flower organs, as well as number and color of the flowers. A reliable character is the smooth and glossy (like polished) surface of the scape that becomes ribbed only when dry. Density and dimensions of these ribs are accidental features without taxonomic value. *Allium stipitatum* differs from

*A. rosenorum*, that owns a densely ribbed scape, also by large and broad, commonly  $\pm$  hairy leaves, and by broader tepals. Although floras described the leaves of *A. stipitatum* to bear at least sparse hairs, plants with only some teeth along ribs and margins were found in most populations growing in the Hissar range. Specimens having glabrous leaves were discussed under *A. altissimum*. Because rather many *Allium* species possess more or less distinctly stipitate and tuberculate ovaries, the specific characters of leaves, scapes, inflorescences and flower parts must be jointly considered to recognize this species correctly. Morphological comparison of a large number of *A. stipitatum* accessions from Iran and different countries of Central Asia under cultivation in Germany did not result in detection of clear differences to separate species or at least infraspecific groups. Also a RAPD analysis of 10 samples from different countries did not yield clues for any geographic groups (Friesen & al. 1997). The genome size of several accession did also not point to differences (Gurushidze & al. 2012). Thus only one botanical species exist that must be named *A. stipitatum* because *A. hirtifolium* has been described some months later. However, ITS sequences of nuclear rDNA presented evidence that two molecular groups with geographical correlation exist. One group comprises *A. stipitatum* distributed from Kazakhstan to the Iranian Koppe Dagh mountain range, and plants of the other group occur in the Zagros range ("*A. hirtifolium*"; Fritsch & al. 2010: 198 cluster 7 § 3.9.11; Fritsch 2012b: 256-257 Fig. 6 Z2, Z4; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Independent evolutionary lineages seem to have converged on similar phenotypes (Gurushidze & al. 2008), but offspring by hybridizations seems not probable (Gurushidze & al. 2010). Sequences of the plastid *trnL-trnF* region confirmed the presence of one basal and several derived haplotypes (Gurushidze & al. 2010: 836, fig. 4 lineage IV). Thus we may conclude that these two groups result from long-lasting independent evolution in separate areas.

In the original description, *A. botschantzevii* was compared with *A. alaicum* and *A. hirtifolium* and characterized by up to 2 mm long connate filament bases and by more leaves than *A. alaicum*. ITS sequences of nuclear rDNA of the only studied accession do not differ from typical *A. stipitatum* (Fritsch 2012b: 257, position Z2; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202), giving evidence that it is neither closely related to *A. alaicum* nor to the NW Iranian members of *A. stipitatum*. It seems best to regard it as a smaller and subglabrous variant of *A. stipitatum* only, perhaps with a paler flower color (Kamelin in Nikitin & Gel'dikhanov 1988). Analysis of more accessions would be essential to confirm this position.

Plants of *A. stipitatum* growing in poor soil may be rather small. It was probably a merger of labels when such plants were even given out as *A. winklerianum* (HFIURSS no. 5529a, JE!).

**Etymology:** The epitheta refer to the stalked ovary and to the  $\pm$  hairy leaf laminae (from Latin, stipitatum = "provided with a little stalk", and hirtifolium = "with hairy leaves"; 'botschantzevii' honors the outstanding Russian botanist and botanical explorer in Central Asia, Viktor Petrovich Botschantzev (1910-1990), acting in the 1930ies to 1980ies in Tashkent and St. Petersburg (Leningrad).

**Biological data:** Very good germination occurred at 5 °C, but very bad above 10 °C (Specht & Keller 1997). The best germination and seedling length was noted after sandpaper scarification, GA3 application, and cold and moist stratification, caused by "mechanical dormancy" (as *A. hirtifolium*, Ebrahimi & al. 2014). Inamov (1971) reported 36-38 % germination at 0-6 °C, after stratification (January till March) in the soil 80-90 % germination; cultivation trials and morphological character as well as the stages of development were also described. The plants need low temperatures in winter, otherwise they do not flower (Dubouzet & al. 1992). The depressed-globose (with a weak tip at the apex) bulbs have  $\pm$  deep yellow storage scales, reach a weight of 100-200 g, and may divide up into 2 (or more) unequal daughter bulbs. Side-bulbs occur often, they develop on  $\pm$  long stolons and measure 8-20 mm in diameter (Yur'eva & Kokoreva 1992). Several shoots may arise in the axils of the upper leaves to build daughter bulbs (Kruse 1992). In vitro cultivation is possible (Keller 1992). Miralibekov (1982) reported in the mean 228 [56-493] seeds per inflorescence under cultivation, and supplemented that the infrutescence is 8.2 cm broad, 7.6 cm long, and 116 flowers (66,4 % with ovaries) resulted in 206 seeds (Miralibekov 1984). Radical scavenger activity of bulb extracts was low (Jedelská & al. 2005a). The bulbs

contain up to 60 % glucose, fructose, saccharose, oligosaccharids and glucofructans, the inflorescences diosgenin, juttagenin, alliogenin und anzurogenin (Vollerner & al. 1988a, b). Fresh bulbs contain in total 0.044 / 0.05 / 0.96 % cysteine sulfoxides (98 / 80 % methiin, 2 / 20 % isoalliin; Keusgen 1999; Fritsch & Keusgen 2006; Keusgen & al. 2008); they contain 0.12-0.31 % strongly antibiotic pyridyl-cysteine sulphoxide and 0.03-0.48 % methiin (Kusterer & al. 2010). Analysis of seed storage proteins showed differences to other tall species investigated (Maass 1992, Fig. 5 "stip"). Different genome sizes were reported [2C DNA]: 27.3 pg (Labani & Elkington 1987), 51.1 / 49.8 pg (Ohri & al. 1998 partly as *A. aflatunense*), 44 pg (Gurushidze & al. 2012). Khodzhaeva & Ismailov (1979) found 61 % polysaccharids (glucofructans) in the air dry mass of bulbs(?). Vollerner & al (1988a, b) reported the structure of ansurogenin A & B. The bulbs contained 3-4 times more vitamin C than common onion, carotenes, and vitamins D and E (Yur'eva & Kokoreva 1992).

**Economic traits:** Used as ornamental, medicinal, and vegetable plant (Inamov 1971, Kochkareva & Chukavina 1985), but Vvedensky (1963) explicitly expressed doubt whether the plants are edible at all. The plants are applied in the folks medicine against skin diseases (Sokolov 1994), not specified parts are baked or cooked in honey and used against several diseases (Yur'eva & Kokoreva 1992). In Central Asia (Anonymous 1985, Kochkareva & Chukavina 1985, Khassanov & Umarov 1989, Saidov 2001, Keusgen unpubl.) and Iran (Keusgen & Fritsch 2008) the incompletely developed new bulbs are pickled in aromatic vinegar (Tajik 'pijozi anzur', Uzbek 'anzur pijozi', Persian 'mu-sir', Dari 'toshi'), though medicinal use is much more in focus in Iran (Keusgen & al. 2006; Fritsch & al. 2007; Abbasi & al. 2008). In Iran, the bulbs (traditionally but wrongly named 'shallot') are very commonly chopped and mixed with yoghurt (own observations, sources in Ebrahimi & al. 2014, as *A. hirtifolium*). The bulbs have desinfectant properties and are used to treat rheumatism and high blood pressure, and as a booster in the digestive tract (sources in Ebrahimi & al. 2014). Despite this species is widely collected and sold at markets in many towns in western Iran, most natural populations are still large; locally *A. stipitatum* occurs as serious weed of ploughed fields (Abbasi & al. 2008), but Ebrahimi & al. (2014) stated to have been endangered due to over exploitation of natural populations. In the Uzbek mountains, the pickled bulbs were a favorite snack in the 20th century. For decades this species was collected in large amounts, and 'anzur' became really rare there (also in S Tajikistan, Kochkareva & Chukavina 1985). Nowadays this species is no longer endangered (Khassanov 2008). Cultivation for bulb production was recommended by Yunusov (1985), and trials have been successful (Hanelt 2001). People interviewed in all investigated areas of Central Asia and Iran confirmed that the leaves are not used (Keusgen & al. 2005). In Turkmenistan it is used as medical plant and as repellent for mice, rats, and cockroaches (Kurbanov 2005). In Iran prov. Kermanshah the raw bulbs are eaten (Maassumi & Bobrov 2004 as *A. hirtifolium*). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991) and commercially available (De Hertog & Zimmer 1993, Fritsch 2015), mentioned already by Androsov (1941) for Turkmenistan. Many named cultivars were selected out of the varying natural populations and of hybrids with other species (details given by Friesen & al. 1997, Fritsch 2015). Because of a similar general appearance, *A. stipitatum* is not rarely misnamed as *A. giganteum* in European gardens, and variants having very sparsely hairy or glabrous leaves are often misnamed as *A. altissimum* Regel or *A. aflatunense* B. Fedtsch.

(67) *Allium altissimum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 666, t. 21 f. k, l, m (1884), Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 302, 361 (1887). Vved., Flora URSS 4: 269 (1935). Nikitina & Kashtsh., Flora Kirg. SSR 3: 95 (1951); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 52, 54 (1967). ? Pavlov & Polyakov, Fl. Kazakhst. 2: 191, tabl. 14 fig. 9 (1958). Vved., Flora Tadzh. SSR 2: 350 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971). Wendelbo, Flora Iranica 76: 83, tab. 8/113, tab. 26/3 (1971), p. p. Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 125, 128 (1988). Fritsch in Nordic J. Bot. 16: 14 (1996). Seisums in Iranian J. Bot. 8: 228 (2000), ? p. p. Fritsch & al. in Stapfia 80: 392 (2002). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 170, plate T68, map (2013). — *Allium jesdianum* Boiss. & Buhse var. *latipetalum* Lipsky in Trudy Imp. S.-

Peterb. Bot. Sada 18: 145 (1900). *Allium jesdianum* sensu Vved., Flora Turkm. 1, 2: 292 (1932), p. p.  
 — Type: Ex horto bot. Petropolitano 84. 6 Turkestanica occid. semina mis. [from Bot. Garden St. Petersburg ... seed sent from western Turkestan by] Dr. A. Regel (lectotype LE!, design. Fritsch 1990: 502).

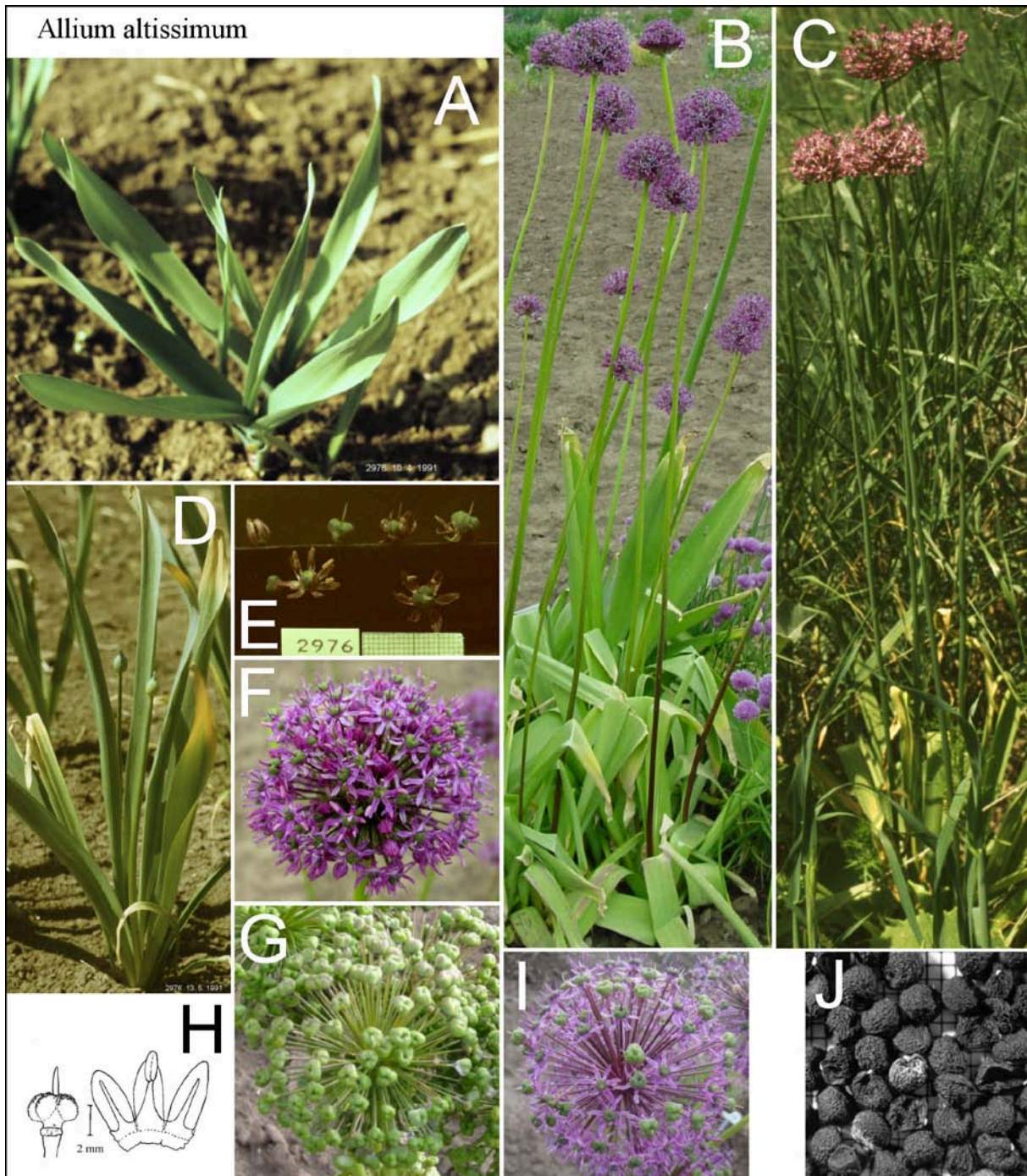


Plate (67): A: Sprouting leaves of cultivated plants; B: flowering cultivated plants; C: flowering Turkmen plants in Ashgabat; D: cultivated plants in the shooting stage; E: comparison of flowers and flower parts in different stages of anthesis; F & I: inflorescences in early and full anthesis, resp.; G: inflorescence with full-sized capsules; H: shape of ovary, tepals and filaments of a flower prepared from herbarium; J: seeds (millimeter paper as background and measure scale of E & J; plate copied from Fritsch & Abbasi 2013: 171 Plate T68).

Distribution: NE Iran, Turkmenistan, Afghanistan, Tajikistan, Uzbekistan, Kirgizstan?, Kazakhstan?; not too dry submontane to montane rocky and steppe slopes, among shrubs and under trees.

Description: Bulbs depressed-globose, 2-4 cm long, 3-6.5 cm in diam.; outer tunics papery, yellowish gray, somewhat splitting into fibers. Scape straight to subflexuous, terete, smooth; 50-80 (120) cm long,

6-10 (12) mm in diam.; ± dull green with purple flush in the lower part. Leaves 4-6 (8), laminae narrowly linear-oblong, stiff obliquely directed and somewhat longitudinally twisted, thickish, broadly canaliculate; upper side smooth, lower side with shallow broad ribs; margins smooth or somewhat toothed near the base, shortly arcuately tapering into the cucullate apex; 30-50 (80) cm long, 2-6 (9) cm broad; ± deep green with moderate glaucous bloom. Sheathy prophyll moderately long, thick to leathery, mostly maroon, later decaying. Spathe membranous, completely split into 2-3 acuminate, ± reflexed valves, 1/3-1/2 as long as the pedicels; pale brown with inconspicuous veins. Inflorescence subglobose; dense, many-flowered; 4-6 cm, in the fruiting stage up to 9 cm in diam. Pedicels subequally long, thickish, straight, stiff wiry; 15-40 mm long; glossy greenish purple. Anthesis in April to May. Flowers flat bowl-shaped starlike. Tepals linear-oblong or linear-lanceolate, ± canaliculate with a concave, acute tip, patent, later reflexed, crumpled, and spirally enrolled; 6-8 mm long, c. 2.5 mm broad; deep pink to purplish carmine with a darker, narrow median vein. Filaments 2/3-4/5 as long as the tepals; basally for c. 0.5 mm connate and triangularly broadened (inner filaments remarkably broader), above subulate, nearly straight; carmine with paler base. Anthers oblong; c. 3 mm long and 1 mm broad; pink. Pollen grayish yellow; the shape is oblate, 34 µm long, 20 µm broad, P/E ratio 0.6, sculptures rugulate to microrugulate, wall 1 µm thick (Neshati & al. 2009). Ovary stipitate, depressed-globose triangular with 3 broad and 3 narrow furrows, 2-3 mm long and 3-4 mm in diam.; surface densely acutish papillous; dull green. Up to 6 ovules per locule and 15 ovules per ovary were reported (Filimonova 1970). Nectary ducts lead in small pores near the base of the ovary. Style narrowly conical to thread-like, 2-4 mm long; pink. Stigma dot-shaped; whitish. Capsule stipitate, depressed globose triangular with a concave apex, surface finely tuberculate, semi-glossy, 4-7 mm long and 8-10 mm in diam.; widely open, valves long-elliptic, deeply notched at the apex; pale yellowish brown. Seeds 2-3 per locule, flat ovoid to drop-shaped; surface coarsely reticulate lacunose, silk-glossy black; 2.5-3 mm long, c. 2.5 mm broad, 1.5-2 mm thick; TKW 6.9 g (Fritsch & Abbasi 2013). The testa showed periclinal walls with prominent verrucae and transitions from S-like to U-like undulation of the anticlinal walls (Fritsch & al. 2006).

Chromosomes:  $2n = 16$  Ohri & al. 1998 (Kazakhstan: Botanical collection Burundai TAX 2976).

Living accessions studied: Uzbekistan: Nuratau massif, field station c. 3 km above village Uhum (40°31'19.9" N, 66°45'07.5" E, 1100 m, 06.5.2005 Fritsch & Khassanov 4206; GAT) TAX 6357. Kazakhstan: from the *Allium* collection of Dr. Kamenetskaja in Burundai near Alma-Ata, origin pass area Kurdai, near the river (43°21' N, 75°00' E, 15.6.1990 Fritsch 640; GAT) TAX 2976.

Remarks: The lectotype of this species is incomplete and shows no clear differences to glabrous plants of *A. stipitatum*. The main key character in the original description, the snail-like olive and whitish speckled apex of the scape is neither visible on the lectotype nor was it mentioned in later descriptions. Because the type location is not exactly known ( ... from the West of province Buchara “Baldschuan” in the description, but this settlement is located in the eastern part of that historical province), authentic material could not be re-collected. Also the discussion of Seisums (2000) does not deal with plants from the area of the type location and therefore cannot contribute to the knowledge of *A. altissimum* in the strict sense. Thus this species is here accepted as being more slender and somewhat smaller than typical *A. stipitatum* possessing narrower and glabrous (or at the most only sparsely toothed) leaves, a smaller umbel, and more intensely colored, sublinear, already in full anthesis recurved tepals (Fritsch 2012b: 257 Fig. 65). Such variants are known from several parts of the whole area of distribution of *A. stipitatum*. The description given above is based on living plants without documented source, but these plants correspond very well to the original description and to the lectotype. Wendelbo's photo (1971: Tab. 26/3, an inflorescence from NW Afghanistan) corresponds also well to the mentioned flower characters. Molecular analyses (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) positioned our cultivated strain of *A. altissimum* among many accessions of Central Asian *A. stipitatum* underlining a high genetic similarity (Fritsch & al. 2010: 198 cluster 7 § 3.9.11; Gurushidze & al. 2010: 836 lineage IV; Fritsch 2012b: 256-257 Fig. 6 Z2; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Also ISSR markers (Samiei & al. 2015) confirmed a close genetic relationship.

**Etymology:** The epithet reflects most probably the striking grand appearance of the flowering plants (from Latin superlative of "high").

**Biological data:** Some anatomical scape characters were shown, but not discussed at the species level (Fritsch 1993 Fig. 7A). This species is an early flowering and short-vegetating geophemeroid; the bulb scales are up to 2 cm thick, the root system belongs to the bulbous type and is frequently ephemeral, nonbranching, diffuse with up to 40 cm deep root penetration and up to 200 roots per plant; the leaf primordia of the next year's shoot develop in April to June and the inflorescences in August to October (Kamenetsky 1992). Bulbs are up to 4 cm long and 6.5 cm in diam., c. 10 cm deep buried in the soil, with up to 300 white or yellow, unbranched, up to 72 cm long roots penetrating up to 25 cm deep into the soil (Bajtulin & Kamenetskaya 1984). The storage scales are pale to dark yellow; the ability of generative multiplication is reduced, only 33 % of the flowers set seed (Yur'eva & Kokoreva 1992). Anatomical and phenological phases of the development were described by Kamenetsky & Japarova (1997). Seedlings belong to the *Allium karataviense* type (Druselmann 1992). Very good germination occurs at 5 °C, but very bad above 10 °C (Specht & Keller 1997). The plants contain steroids, also phenolcarboxylic acids, chlorogens, and flavonoids; the bulbs can be used as glue (Sokolov 1994). The bulbs contain c. 0.4 % 2-pyridyl-cysteine sulphoxide and 0.49 - 0.86 % methiin (Kusterer & al. 2010). The reported genome size [2C DNA]: 38.7 pg (Vakhtina & al. 1977), 36.5 pg (Zakirova 1989), 47.7 pg (Ohri & al. 1998), 44 pg, is partly identical with *A. stipitatum* (Gurushidze & al. 2012).

**Economic traits:** Ornamental plant listed in the "International Checklist ..." of the Royal General Bulb-growers Association (1991) and in Fritsch (2015). In Moscow cultivated as ornamental of cemeteries (Bochkin & Nasimovich 1999). All *A. altissimum* strains grown in IPK from seeds received from European botanical gardens were ± glabrous forms of *A. stipitatum* (Fritsch, unpubl. data). The true strain distributed 130 years ago from the Imperial St. Petersburg Botanical Garden seems to be extinct, but the strain collected by Wendelbo in NW Afghanistan (Wdb. 8237, discussed above) could still exist somewhere. In Kazakhstan (Pavlov & Polyakov 1958) and sometimes in Uzbekistan ('yovoy piöz', Keusgen & Fritsch 2008) the bulbs are regarded as edible and are collected; the leaves (Saidov 1986 'modari-sioalaf', 'model', report for C Tajikistan Saidov 2001) and the aerial and subterranean plant parts (Sokolov 1994) are eaten as vegetables. This species is a good honey plant for bees (Anonymus 1983b), and is used as medical plant in Turkmenistan (Kurbanov 2005).

#### 11.2 A. sect. *Procerallium* **subject. *Costatae*** R.M. Fritsch

in Candollea 48: 424 (1993), sub sect. *Megaloprason*. — **Type species:** *Allium jesdianum* Boiss. & Buhse

The typical subspecies of *Allium jesdianum* Boiss. & Buhse [in Nov. Mém. Soc. Imp. Natur. Moscou 12: 217 (1860)] occurs only in Iran (see Fritsch & Abbasi 2013: 160-163).

**(68) *Allium jesdianum* subsp. *angustitepalum*** (Wendelbo) F.O. Khass. & R.M. Fritsch in Linzer Biol. Beiträge 26: 980 (1994). *Allium angustitepalum* Wendelbo in K. Danske Vid. Selsk., Biol. Skr. 10, 3 (1959) 169. — *Allium ecornutum* F.O. Khass. & I.I. Malzev in Uzbek. Biol. Zhurn. No. 4: 43 (1988). Type: Uzbekistan: Kugitang, Bagli Dara, pod archat. sev. sklon [under *Juniperus*, northern slope], h = 1800 m, 15.5.1983, leg. Khassanov & Nenilin (holotype TASH). *Allium jesdianum* sensu Vved., Flora Turkm. 1, 2: 292 (1932). *Allium rosenbachianum* sensu Vved. in Nevski, Trudy Bot. Inst. Akad. Nauk SSSR ser. 1 vyp. 4: 331 (1937), Vved., Flora Uzbek. 1: 462 (1941), p. p., et sensu Wendelbo, Flora Iranica 76: 83, tab. 8/118, tab. 27/1-2 (1971), p. p. maj., & auctt. — **Type:** E Afghanistan: Kail, damp ground, flr. deep magenta, alt. 9000', 3.6.1937, leg. Koelz 11691 (holotype W 4213!).

**Distribution:** W and Central Afghanistan, Turkmenistan, Uzbekistan, Tajikistan?: Kugitang ridge, Panj-Karatau ridge?; northern exposed montane slopes among shrubs and in rock crevices or in [*Juniperus*] forest areas.

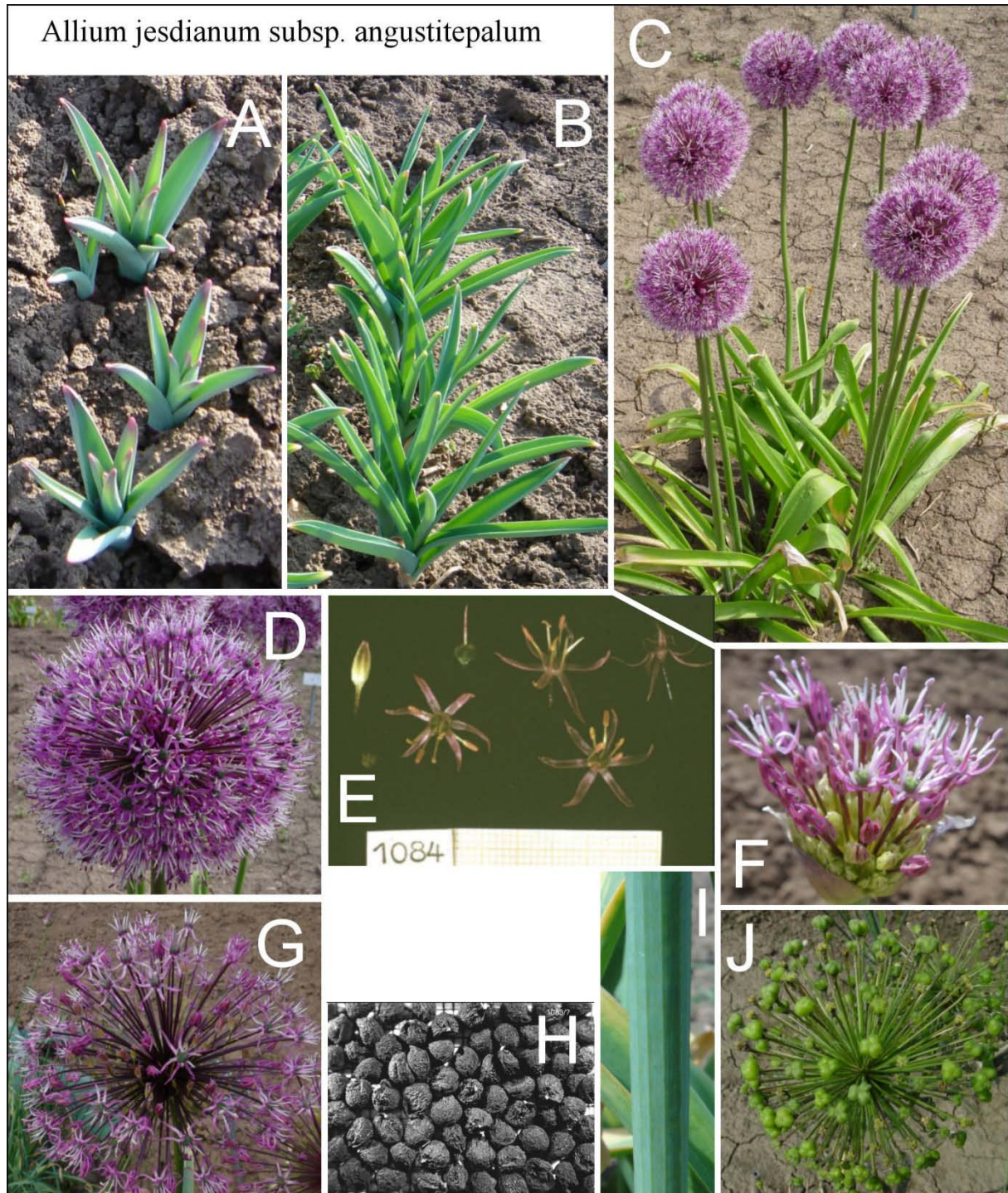


Plate (68): Cultivated plants are shown. A & B: Sprouting leaves; C: flowering plants; D, F & G: inflorescences in full, early, and late anthesis; E: comparison of flowers and flower parts in different stages of anthesis; H: seeds; I: ribbed lower part of scape; J: inflorescence with full-sized capsules (millimeter paper as background and measure scale of E & H).

**Description:** Bulbs  $\pm$  depressed-globose, 3-6 cm in diam., up to 4.5 cm long; tunics undivided, strong, parchment-like, inner tunics translucent white, outer tunics grayish-brown, finally blackish and disintegrating. Scape straight to flexuous, terete, near base with strong but shallow ribs that are gradually disappearing towards the tip, glabrous; 30-80 cm long, 4-10 mm in diam.; green with  $\pm$  glaucous bloom, near base often maroon flushed. Leaves 2-6 (10), laminae narrowly lanceolate with narrowed base, arcuately ascending and recurved to the soil,  $\pm$  moderately canaliculate, thickish; upper side smooth or slightly grooved, lower side with sharp-edged broad ribs; margins basally scabrous and above  $\pm$  smooth, or with coarse teeth up to 3/4 of length, tapering into a hooded apex; 20-40 (60) cm long, 1.2-5 cm broad;

vividly to dark green, mostly with strong glaucous bloom. Sheathy prophyll short, yellowish-green or maroon with red ribs, strong, thickish, decays prior to anthesis. Spathe membranous, completely divided into 2 broadly ovate, long acuminate valves; buff, sometimes somewhat purplish, with darker veins. Inflorescence initially fasciculate, later semi-globose finally subglobose; dense, many-flowered; 3.5-8, in the fruiting stage up to 15 cm in diam. Pedicels subequally long, thickish, wiry, slightly ascending, in the fruiting stage longer and somewhat thicker; shiny green with maroon flush. Anthesis in May to June. Flowers bowl-shaped starlike. Tepals lanceolate-triangular,  $\pm$  obtuse, concave with incurved tip, patent, after anthesis crumbled or spirally enrolled; c. 6-11 mm long, 1-2 mm broad; deep pinkish-carmine, dorsal with a darker median vein. Filaments  $\pm$  as long as the tepals; basally shoulder-like widened (inner filaments much wider) and for c. 1 mm connate, subulate above; initially upper part snow-white later pinkish, towards the very base deep pinkish-violet. Anthers oblong; 2-3 mm long, c. 1 mm broad; carmine to violet. Pollen yellowish gray. Ovary stipitate, depressed six-angled globose, with rather deep and broad furrows, 3-4 mm long and in diam.; surface acutish tuberculate; green, later maroon suffused. Nectary ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b). Style  $\pm$  thread-like, 4-8 mm long; white, later deep pinkish-violet. Stigma undivided; whitish. Capsule substipitate, depressed-globose with broad furrows, surface  $\pm$  finely rugose, up to 10 mm broad and in diam.; widely open, valves  $\pm$  broadly elliptic, shortly notched at the tip; buff. Seeds 1-2 per locule, ovoid to drop-shaped; surface densely rugose with irregular ledges, silk-glossy black; 2.5-3 mm long, 2-2.5 broad, 1.5-2 mm thick. TKW 6.73 / 7.72 g (IPK, unpubl. data). The testa showed verrucose periclinal walls, and a variable undulation of the anticlinal walls showing transitions from S-like to U-like and to Omega-like forms with low amplitudes (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Pedersen & Wendelbo 1966 (Afghanistan: Kotal-e Sabzak, Lindberg 634; Bahmian, Shahtu massif, H&W 4865 "*A. rosenbachianum*").  $2n = 16$  Gurushidze & al. 2010, 2012 (Afghanistan: Botanical collection Göteborg, PW p-69 TAX 1083; Uzbekistan: Kugitang ridge, Gulistan TAX 3671).

**Living accessions studied:** **Uzbekistan:** Surkhandarya province Baisun district, Kugitang ridge, N exposed slopes nearby vill. Upper Panjob (38°01'22.3" N, 66°50'14.5" E, 1550 m, 01.6.2006 Fritsch & Khassanov 4235; GAT) TAX 6523, (38°02'51.2" N, 66°51'45.1" E, 1820 m, 02.6.2006 Fritsch, Khassanov 4241; GAT) TAX 6527, upper Baglidarasai valley c. 20 km W Gulistan, slopes (37°56' N, 66°45' E, 1800 m, 18.5.1993 Fritsch & Khassanov 861 & 857 B; GAT) TAX 3671, TAX 3668, W exposed slopes in Baglidarasai valley (37°55' N, 66°47' E, 1350 m, 17.5.1993 Fritsch & Khassanov 849; GAT) TAX 3666.

**Remarks:** Wendelbo (1959) originally described *A. angustitepalum* to be closest related with *A. chitralicum* sensu Wendelbo, but later (Wendelbo 1971) he subsumed it as a synonym under *A. rosenbachianum*. Several collections of Afghan plants, distributed to botanicals gardens as *A. rosenbachianum*, exactly corresponded to *A. angustitepalum* when seedlings flowered for first and second time in Gatersleben. Later the plants became much stronger and differed by many leaf characters, ribbed tall scapes, and several flower characters from typical *A. rosenbachianum*. The cultivated Afghan plants, as well as cultivated specimens from the type location of *A. ecornutum* from Kugitang ridge, were much more similar to typical plants of *A. jesdianum* from Iran, and represent another subspecies (Khassanov & Fritsch 1994). Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) confirmed the very close relationship of both subspecies of *A. jesdianum*, less close relations to *A. rosenorum*, and a large distance to *A. rosenbachianum* s. str. (Fritsch & al. 2010: 175 cluster 7 § 3.9.9; Gurushidze & al. 2010: 836 lineage VI; Fritsch 2012b: 256-257 Fig. 6 Z3; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202). Plants of subsp. *angustitepalum* are well discernible from the similar *A. rosenorum* by a lower number of broader leaves, less ribs only present in the lower part of the scape, and basally rectangular widened filaments which are pure white above (Fritsch 2012b: Fig. 66).

**Etymology:** The specific epithet certainly refers to the well known and important Iranian town Yazd that also named the geographic region of the type location, the subspecific epithet to the relatively narrow tepals (from Latin "with narrow tepals").

**Biological data:** A very good seed germination occurs at 5 °C, but was bad or very low above 10 °C (Specht & Keller 1997). The reported genome size was 46 pg 2C DNA (Ohri & al. 1998) and 38.5 pg



(in *A. jesdianum* and *A. orientoiranicum* Neshati, Zarre & R.M. Fritsch 38 pg; Gurushidze & al. 2012). Fresh bulbs contain in total 0.06 / 0.062 / 0.07 % cysteine sulfoxides (97 / 97 / 98 % methiin, 3 / 3 / 2 % isoalliin) (Keusgen 1999, Krest & al. 2000, Fritsch & Keusgen 2006). The plants contain dithiodipyrrole that causes a orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1), closer investigated by Vogt & al. (2008).

Economic traits: Offered as ornamental, also mentioned as parent of registered cultivars (Fritsch 2015).

**(69) *Allium rosenorum*** R.M. Fritsch in Linzer Biol. Beitr. 26: 979, fig. 13 (1994), Fritsch in Nordic J. Bot. 16: 12 (1996). — *Allium rosenbachianum* sensu Vved., Flora URSS 4: 270 (1935); Vved., Flora Uzbek. 1: 462 (1941); Vved., Flora Tadzh. SSR 2: 351 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 85 (1971), omnia p. p. maj. *Allium rosenbachianum* hort., *Allium jesdianum* sensu R.M. Fritsch in Kulturpflanze 38: 363 ff. (1990), Fritsch, Flora Tadzh. SSR 10: 480 (1991). — Type: Tajikistan: Hissar-Gebirge, Ramit-Schutzgebiet, linkes Seitental des Kholmon-Flusses, am Bachlauf unter Gebüsch [Hissar range, reservation Ramit, left side-valley of river Kholmon, near the creek under shrubs], ca. 1370 m ü. M., 14.5.1987, leg. Fritsch 155 (holotype GAT!, isotypi: GAT!, TAD!, living isotypic strain TAX 2256).

Distribution: Uzbekistan, Tajikistan: W, SW and Central Hissar mountain range, montane steppe slopes among shrub associations, in the shadow of rocks, deciduous forests, or *Juniperus* trees.

Description: Bulbs depressed-globose, often with many side-bulbs, 2-5 cm in diam., 2-4 cm long; tunics papery with thick veins, inner tunics silky, outer tunics whitish finally blackish, slightly longitudinally splitting. Scape subflexuous to straight, terete, densely and broadly ribbed; 40-80 (120) cm long, (3) 4-10 (basally up to 15) mm in diameter; green, basally and the ribs also longer red flushed. Leaves (3) 6-12, laminae linear-lanceolate, initially steep-angled later flat-angled arcuately ascending, finally the upper part droops, basally U-like above shallower canaliculate, basally thick; upper side smooth, lower side with distantly positioned, acute ribs; margins smooth, rarely with some flat teeth, long tapering into the hooded apex; (20) 30-60 cm long, 1-3 (4) cm broad; vividly dull green mostly with ± strong glaucous bloom. Sheathy prophyll tender, ± colorless with brownish veins, quickly decaying. Spathe papery, one-valved or completely divided in 2-3 ovate, long acuminate valves; brownish or yellow-green with inconspicuous veins. Inflorescence initially broadly fastigiate later ± globose; ± dense, many-flowered (up to 300 flowers); 6-12 cm in diam. Pedicels subequally long, thin wiry, straight; glossy, basally green above more reddish to brown or nearly violet suffused. Anthesis in May to begin of June. Flowers bowl-shaped to flat starlike. Tepals narrowly lanceolate-triangular, canaliculate, long acuminate, patent, later ± reflexed and spirally enrolled; (7) 8-10 (12) mm long, the lower-third 1-1.5 mm broad; pinkish-carmine with narrow same-color or somewhat darker median vein. Filaments 2/3-4/5 as long as the tepals, basally for 0.5-0.8 mm connate and triangularly widened (inner filaments c. 1.5 times broader), above subulate; lilac to pinkish-carmine fading towards base and apex. Anthers oblong; (1.5) 2-3 mm long and c. 1 mm broad; purplish to grayish violet. Pollen yellowish gray. Ovary distinctly stipitate, depressed globose-triangular, c. 2-3 mm long and 2-4 mm in diam.; surface acutish papillous; gray-green. Up to 4 ovules per locule, 10 locules per ovary (Filimonova 1970 as *A. rosenbachianum*) / 2 ovules per locule (Hanelt 1992 as *A. jesdianum*). Nectaries somewhat lobed, ducts mound at the base of ovary below the bottom of locules (Fritsch 1992b as *A. jesdianum*). Style conical-threadlike, 4-8 mm long; initially whitish later carmine. Stigma undivided; whitish. Capsule triangular or tripartite obpyramidal-globose, surface coarsely corrugated, c. 8 mm in diam. and 5 mm long; widely open, valves broadly ovate to kidney-shaped, slightly or not notched at the apex; green finally buff. Seeds 1-2 per locule, ovoid to drop-shaped and subglobose; surface strongly reticulate-lacunose, papillous, dull black; nearly 3 mm long and 2.5 mm broad, 2 mm thick. TKW 5.03 / 5.33 / 6.30 / 6.52 / 6.66 / 7.07 / 7.55 / 7.72 / 8.85 g (IPK, unpubl. data). The testa showed verrucose periclinal walls, and the anticlinal walls transitions from S-like to U-like undulation with moderate wavelength (Kruse 1986; Fritsch & al. 2006).

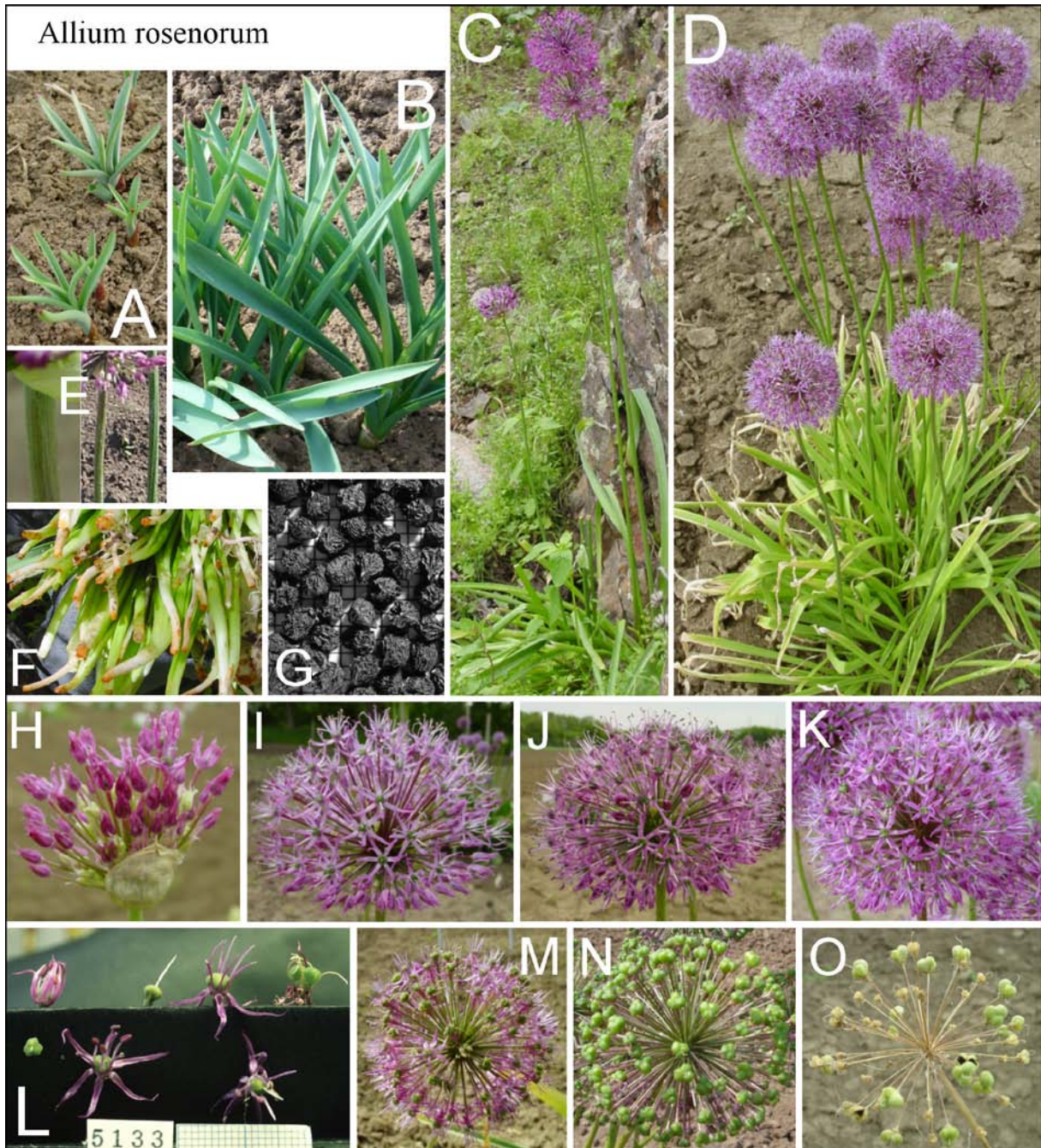


Plate (69): A & B: Sprouting leaves of cultivated plants in the early and the later phase, resp.; C: flowering plants in Kaltakul, Uzbekistan; D: flowering cultivated plants; E: close-up of the ribbed upper scape; F: orange exsudate from wounded tissues; G: seeds; H — K: inflorescences in early to full anthesis, resp.; L: comparison of flowers and flower parts in different stages of anthesis; M & N: inflorescence in late anthesis and with developing capsules, resp.; O: infructescence with partly open capsules (millimeter paper as background and measure scale of G & L).

**Chromosomes:**  $2n = 16$  Levan 1935 karyotype and meiosis (Netherlands: Bulb trader van Tubergen "*A. rosenbachianum*").  $2n = 16$  Vosa 1977 (source not mentioned "*A. rosenbachianum*").  $2n = 16$  Gohil & Kaul in Löve 1981 (India: Kashmir, Harwan, RK 24 "*A. rosenbachianum*").  $2n = 16$  Labani & Elkington 1987 (Netherlands: Bulb trader van Tubergen "*A. rosenbachianum*").  $2n = 16$  Narayan 1988 (source not mentioned "*A. jesolianum*").  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Germany: Botanical collection Gatersleben TAX 0653; Tajikistan: Hissar range, N Gusary TAX 0975, Kondara valley, type location TAX 1903).  $2n = 16$  Gurushidze & al. 2010, 2012 (Tajikistan: Vakhsh range, vill. Teguzak TAX 6158).  $2n = 16$  Gurushidze & al. 2012 (Tajikistan: Hissar range, reservation Ramit TAX 1869; Gazimailik ridge TAX 2938).  $2n = 16$  IPK *Allium* reference collection ideogram (Tajikistan: Hissar range, Kondara gorge TAX 1902).  $n = 8$  IPK *Allium* reference collection ideogram (Tajikistan: Hissar range, Siama gorge TAX 1327, TAX 1345).

**Living accessions studied:** Tajikistan: Central Hissar range, drainage of Varzob river, Varzob valley ( $38^{\circ}55' N$ ,  $68^{\circ}49' E$ , 1600 m, 19.5.1987 Fritsch 171a; GAT) TAX 2267, near vill. Varzob 20 km N Dushanbe (collector

unknown, 38°47' N, 68°49' E, 22.4.1986 via Fritsch T109; GAT) TAX 1880, N vill. Gusary (1700 m, 17.5.1983 Hanelt 9; GAT) TAX 0975, Kondara valley 37 km N Dushanbe (1500 m, 15.3.2002 Hisoriev, Kurbonova 6018; TAD), (38°49' N, 68°46' E, 1780 m, 16.5.1987 Fritsch 161; GAT) TAX 2259, (38°47' N, 68°48' E, 1390 m, 23.4.1986 Fritsch T119 a, b, c; GAT) TAX 1885, TAX 1886, TAX 1887, (38°49' N, 68°48' E, 1300 m, 19.6.1984 Fritsch T40; GAT) TAX 1328, left side-valley (38°48'56.4" N, 68°47'31.9" E, 1400 m, 07.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6110; TAD); Kondara valley, N exposed loamy slope near location Kwak (38°49' N, 68°46' E, 1900 m, 25.4.1986 Fritsch T132 a, b, c, d; GAT) TAX 1900, TAX 1901, TAX 1902, TAX 1903; left side valley of Varzob river above Kondara (38°50' N, 68°49' E, 1300 m, 24.4.1986 Fritsch T126; GAT) TAX 1894; Siama valley, steep moist slope (38°58' N, 68°44' E, 1920 m, 21.6.1984 Fritsch T51; GAT) TAX 1345, rubble slope (38°58' N, 68°44' E, 1950 m, 21.6.1984 Fritsch T53; GAT) TAX 1327; near mouth of river Maikhura (39°02' N, 68°47' E, 1900 m, 19.5.1987 Fritsch 169; GAT) TAX 2266; upper Varzob valley, slopes near station Kuk-Tepa E vill. Siddi, (39°03' N, 68°54' E, 2600 m, 10.8.1988 Fritsch 353; GAT) TAX 2552; Kharangon valley above vill. Dara (38°42' N, 68°53' E, 2400 m, 20.5.1987 Fritsch 177 & 178; GAT) TAX 2270, TAX 2271; Ramit reservation, side valley of river Kafirnigan (38°45' N, 69°19' E, 1300 m, 17.4.1986 Fritsch 70; GAT) TAX 1869; slope along Sardaimiona river near the former vill. Pakshir (39°05' N, 69°23' E, 1900 m, 30.7.1988 Fritsch 291 & 298; GAT) TAX 2529, TAX 2530; left side valley of river Kholmon (38°45' N, 69°18' E, 1370 m, 14.5.1987 Fritsch 155; GAT) TAX 2256; valley of Karatak river, (donated by Astanova, 38°45' N, 68°23' E, 16.6.1984 Chukavin s. n., via Fritsch 3; GAT) TAX 1317; Vakhsh range around Khojaigul above vill. Teguzak (38°17'30.9" N, 69°14'32.1" E, 1750 m, 06.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6109; GAT) TAX 6158; Gazimailik ridge, among stones and rocks in the shadow of *Juniperus* and *Acer* (38°04' N, 68°30' E, 2000 m, 14.5.1990 Fritsch, Kudratov, Pistrick 467; GAT) TAX 2938; Zaravshan range, Iskanderkul drainage, 2 km W Saritag, left side of Karakul river (39°03'03.3" N, 68°17'15.1" E, 2680 m, 25.6.2004 Fritsch, Hisoriev, Keusgen 6143; GAT) TAX 6290; Shing valley, west side of third Kulikalon lake from below (39°12'20.5" N, 67°48'29.5" E, 1750 m, 27.6.2004 Fritsch, Hisoriev, Keusgen 6153; GAT) TAX 6298, valley of river Obi-borik (39°12' N, 67°33' E, 1600 m, 16.8.1988 Fritsch 414; GAT) TAX 2566, place Daroshka (39°12'34.9" N, 67°43'20.8" E, 1750 m, 29.6.2004 Fritsch, Hisoriev, Keusgen 6167; GAT) TAX 6311. Uzbekistan: West Hissar range, village Kaltakul, 3 km along the road to Tashkurgan (38°49'46.4" N, 67°07'15.1" E, 1750 m, 29.5.2003 Fritsch, Keusgen, Khassanov 4167; TASH), 7.5 km along the road to the valley Kirgalma (38°49'06.1" N, 67°07'40.7" E, 1800 m, 29.5.2003 Fritsch, Keusgen, Khassanov 4171 (4112); GAT) TAX 6191, village Kaltakul (38°50'44.6" N, 67°07'05.9" E, 1377 m, 19.5.2009 Keusgen & Khassanov 4293; GAT) TAX 6747, (1650 m, 19.8.2001 Fritsch & Gemeinholzer 1838\*; GAT) TAX 5907; SW Hissar range, drainage of river Tupalang, right tributary of river Shargun (38°38' N, 67°57' E, 2050 m, 17.7.1994 Fritsch, Khassanov, Pistrick 1273; GAT) TAX 5081; Ugam range, drainage of Pskem river, between vill. Khumzan and Sijak (collected by Khassanov, 41°41' N, 70°00' E, 14.5.1993 via Fritsch 818; GAT) TAX 3658.

Remarks: This is the species mis-named *A. rosenbachianum* by the authors of Asiatic floras in the 20th century, and much traded under this name in European garden shops till today. It was newly described as *A. rosenorum* because no elder valid name was available. It differs by scapes bearing ribs over the whole length, and narrower lanceolate (nearly linear), longer, canaliculate, and thicker leaves from true *A. rosenbachianum*. The inflorescences are somewhat denser, but the flowers of both species are very similar (Fritsch 2008: 67). *Allium rosenorum* is a very variable species. Strong and tall plants grow preferably on warm places with moist soil, but plants growing in the shadow of narrow canyons or under dense *Juniperus* trees are much smaller and slender. These morphotypes retained only partly under cultivation, and all transitions also occurred. Density of inflorescences, flower color, and dimensions of the tepals vary as well. Many ornamental cultivars with promising character combinations were already selected (Fritsch 2015). As already discussed under *A. rosenbachianum*, two molecular markers (ITS sequences of nuclear rDNA as well as sequences of the plastid *trnL-trnF* region) positioned *A. rosenorum* far from *A. rosenbachianum*. However, *A. rosenorum* occupies two positions of cluster 7 (Fritsch & al. 2010: 196 ff.; Fritsch 2012b: 257 Fig. 6 Z1 and Z3; Gurushidze & Blattner in Fritsch & Abbasi 2013: 202), and in lineages IV and VI, resp. (Gurushidze & al. 2010: 836, fig. 4). The members of these subgroups are indistinguishable by morphology but own also different genome sizes of 38.7 / 40.8 pg 2C DNA (Gurushidze & al. 2012). Accessions from Central Hissar mountain range and those received from flower bulb trade are closer to Central-Asian *A. stipitatum*, *A. altissimum* and forms superficially similar to *A. aflatanense* ("af\_st"), but accessions from West and Southwest Hissar mountain range have *A. jesdianum* (incl. subsp. *angustitepalum*) as next but well separated relatives, more distantly related are

*A. stipitatum* from NW Iran, *A. remediorum* (R.M. Fritsch) R.M. Fritsch, *A. bakhtiaricum* Regel, *A. pseudohollandicum* R.M. Fritsch, and *A. hollandicum*. Approximately 68° East longitude separates the molecular variants. These relations arose perhaps after the last ice age period, when an *Allium* "*prae-rosenorum*" resettled the current Hissar mountain range from two refuge areas without undergoing visible morphological differentiation (or two evolutionary lineages seem to have converged on similar phenotypes).

**Etymology:** The epithet was created by shortening of "*rosenbachianum-aetorum*".

**Biological data:** Seed germination was very good at 5 °C but bad to very bad at temperatures above 10 °C (Specht & Keller 1997); 50 days at constant 13 °C did not break the dormancy, successful were 110 days at 5 °C (Aoba 1967 in Ellis & al. 1985, as *A. rosenbachianum*). The seedlings belong to the *Allium karaviense* type (Druselmann 1992 as *A. rosenbachianum*). The seed storage proteins were analyzed by Maass (1992, Fig. 5 "jesd"). Some anatomical scape characters were shown, but not discussed at species level (Fritsch 1993 Fig. 7E, as *A. jesdianum*). In vitro cultivation is possible (Keller 1992, Fig. 12 as *A. rosenbachianum*). The reported genome sizes [2C DNA] were 29 pg (Labani & Elington 1987, as *A. rosenbachianum*), and 38.7 / 40.8 pg (Gurushidze & al. 2012). The plants contain dithiodipyrrole that causes a orange to red color of the sap coming out of wounded tissue (Gurushidze 2008: 89 Fig. 1); it was closer investigated and the precursor substance S-(3-pyrrolyl) cysteine sulfoxide was identified by Vogt & al. (2008). Bulb extract inhibited growth of many (mainly Gram-positive) bacteria species (Jedelská & Keusgen 2008) and showed a very high radical scavenger activity (Jedelská & al. 2004, Jedelská & Keusgen 2008). Fresh bulbs contain in total 0.025 / 0.01 / 0.03 % cysteine sulfoxides (100 / ? / 97 % methiin, 0 / ? / 3 % isoalliin; Fritsch & Keusgen 2006, Jedelska & al. 2004, Keusgen & al. 2008); leaves in total 0.03 / 0.04 % (only methiin; Jedelska & al. 2004, Keusgen & al. 2008). Fresh leaves contained (per 100 g) 300.4 mg ascorbic acid, 0.27 mg carotene, 0.5 % monosaccharids, 3.1 % saccharose, 0.5 % maltose, 12.79 % cellulose, 24.86 % raw protein, 1.87 % fat, 9.49 % salts (Saidov & al. 1985 as *A. rosenbachianum*).

**Economic traits:** Local names 'siekhalf, siralaf, siohalaf, shipioz, jorji'. Young leaves are collected in the nature (Central Tajikistan: Vakhsh and Hissar mountain ranges), and are used (or the dried leaves) for the national soup dishes 'atolla' and 'oshi sioalaf' which have tonic properties (Erenberg 1971, Kochkareva & Chukavina 1985, Saidov 2001, Anonymus 1983b, Keusgen & al. 2006). About 185 t leaves were yearly sold on the markets in C Tajikistan (Saidov 1986), after 1990 the plants were strongly overcollected (own observations). Use as spice reported by Saidov (1986) is questioned because the leaves are rather tasteless (Keusgen & al. 2004). In the Uzbek mountains, it is named 'sijo alaf' and belongs to the most important edible species (Khassanov 2008) but is sometimes wrongly named 'motor', too (Keusgen & Fritsch 2008). Ornamental plant listed under the wrongly applied names *A. rosenbachianum* and *A. jesdianum* in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991) and commercially available as ornamental (De Hertog & Zimmer 1993, Fritsch 2015). The named cultivars were selected out of the varying natural populations (Fritsch 2015), also 'Michael H. Hoog' belongs to *A. rosenorum* (Friesen & al. 1997).

12. *A.* subg. *Melanocrommyum* sect. *Aroidea* F.O. Khass. & R.M. Fritsch in Linzer Biol. Beitr. 26: 966 (1994). — sect. *Aroidea* Kamelin & Seisums ex Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), nom. nud. & nom. superfl. — **Type species:** *Allium aroides* Popov & Vved.

(70) *Allium aroides* Popov & Vved. in Byull. Sredneaz. gosud. Univ. 19: 128 (1934). Vved., Flora URSS 4: 258 (1935). Vved., Flora Uzbek. 1: 458 (1941). Vved., Flora Tadzh. SSR 2: 342 (1963). Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 125, 127 (1988). — **Type:** Uzbekistan: Predgor'ya Zaravshanskogo khr. bl. k. [spurs of Zaravshan range near village] Maydan-ata, 28.5.1929, leg. Yakimova 1643 (holotype TASH!).

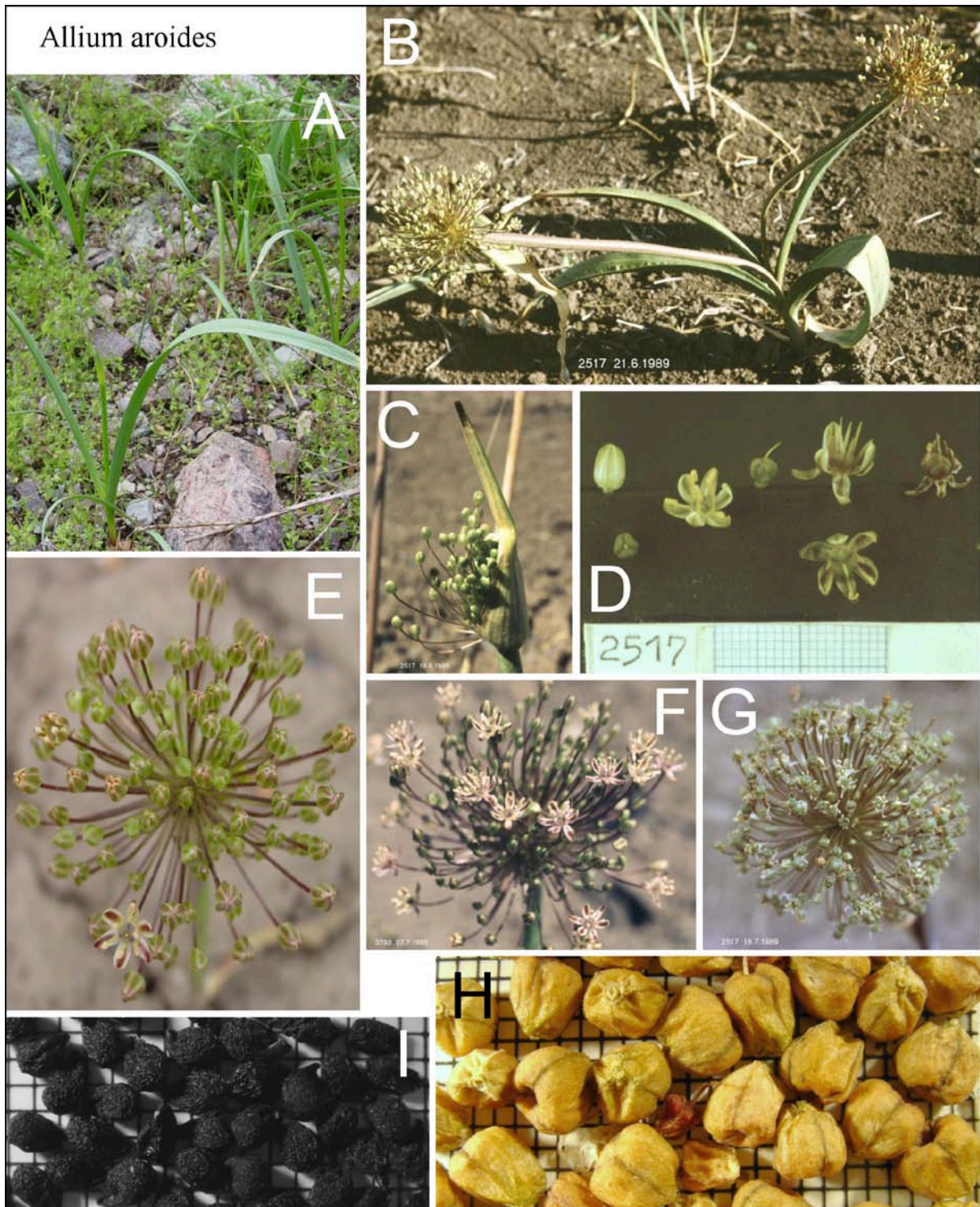


Plate (70): A: Shooting plants near pass Takhta-Karacha, Uzbekistan; B: cultivated plants in early anthesis; C: partly opened spathe prior to anthesis; D: comparison of flowers and flower parts in different stages of anthesis; E, F & G: inflorescences in buds, early anthesis, and after anthesis; H: ripe capsules, I: seeds (millimeter paper as background and measure scale of D, H & I).

**Distribution:** Uzbekistan, Turkmenistan: Zaravshan range, SW Hissar range, Kugitang ridge; submontane to montane stony and rubble slopes.

**Description:** Bulbs ovoid, 1-2 cm in diameter with  $\pm$  single, large, oblong side bulbs; inner tunics whitish, papery, outer tunics grayish brown, strongly leathery, loose-fitting, protruding in a long neck, longitudinally splitting; buff, dull up to glossy. Scape flexuous, terete, obconical (thinnest near the base), smooth (ribbed in the dry state), 20-40 cm long, 4-6 (8) mm in diameter; silk-glossy green with waxy

bloom, the side exposed to the sun is often maroon flushed. Leaves 1-2, laminae narrowly lanceolate, initially straight later flat recurved to soil, near base thick, above thin and somewhat screw-like twisted and drooping, basally  $\pm$  V-like folded, above  $\pm$  flat; upper side with a few deep grooves, lower side with flat, very scabrous ribs and keel-like median rib; margins densely and coarsely toothed, long tapering into the hooded apex; 20-35 (40) cm long, 6-25 (40) mm broad; vividly green with some waxy bloom, upper side dull, lower side  $\pm$  glossy. Sheathy prophyll rather long, thin, finely scabrous, persistent; yellowish to violet brown. Spathe thickish, mostly one-valved, 0.5-1 (2) cm long, slightly shorter than the pedicels; buff; dry very strong with a thick brown beak, nerves scarcely visible. Inflorescence semi-globose to globose; loose,  $\pm$  many-flowered; 6-10 cm in diam. Pedicels initially very short, in anthesis nearly equally long, wiry, ascending, central pedicels straight; up to 4.5 cm long; glossy brownish-green to maroon. Anthesis in May to June. Flowers bowl-shaped. Tepals ovate-oblong, strongly concave, apex spoon-like obtuse, outer tepals patent, inner tepals obliquely directed, later all reflexed and curled or somewhat enrolled; 4-6 mm long, c. 2 mm broad; pale greenish (in herbarium pinkish), median vein very broad, dirty green or dirty purplish, fading toward the base. Filaments initially slightly shorter, later somewhat longer than the tepals; basally for c. 0.5 mm connate and short-triangular (inner bases up to twice broader) widened, above subulate; yellowish, near base reddish. Anthers oblong; c. 2 mm long; yellowish. Pollen pale yellow. Ovary shortly stipitate, depressed globose to obtusely triangular, c. 3 mm in diam.; surface finely papillous; pale green with darker sutures, purplish flushed. 2(-3) ovules per locule, 6-7 / 8 ovules per ovary were counted (Vvedensky 1935, 1941 / Filimonova 1970). Nectary ducts mound above the base of ovary higher than the bottom of locules (Fritsch 1992b). Style narrowly conical, 2-3 mm long; yellowish. Stigma undivided; whitish. Capsule shortly obconical triangular, 3-5 mm long and in diameter, does not open and drops down on a whole, valves nearly papery; semi-glossy buff. Seeds one (rarely 2) per locule, comma-shaped; surface densely reticulate-lacunose corrugated, dull black (sometimes deep ochre); 2-3 mm long, 1.5-2.3 mm broad, c. 1.5 mm thick; TKW 3.53 g (IPK, unpubl. data). The testa showed flat periclinal walls with a densely granulose ornamentation but without verrucae. The anticlinal walls were straight or slightly bent without any true undulation (Kruse 1994, Abb. 27; Fritsch & al. 2006, Fig. 5).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 (Uzbekistan: Zaravshan range, Amankutan, no. 342.  $2n = 16$  Zakirova & Vakhtina 1974 (Uzbekistan: Zaravshan range, Amankutan, no. 768B).  $2n = 16$  Pogosian & Seisums 1992 (Uzbekistan: Zaravshan range, Urgurt, Seisums s. n.).  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Uzbekistan: Zaravshan range, pass Takhta-Karacha TAX 5032).

**Living accessions studied:** **Uzbekistan:** West Hissar range, vill. Kaltakul (38°50' N, 67°07' E, 1550 m, coll. Khasanov, 04.6.1990 Fritsch & Pistrick 594; TASH GAT) TAX 2987, 3 km along the road to Tashkurgan (38°49' 46.4" N, 67°07'15.1" E, 1750 m, 29.5.2003 Fritsch, Keusgen, Khassanov 4168; GAT) TAX 6189; Zaravshan range between Samarkand and Kitab, c. 2 km S Pass Takhta-Karachi (39°17' N, 66°54' E, 1500 m, 15.5.1993 Fritsch & Khassanov 822; GAT) TAX 3703, (39°17' N, 66°55' E, 1600 m, 13.7.1994 Fritsch, Khassanov, Pistrick 1242; GAT) TAX 5032.

**Remarks:** *Allium aroides*, the only species of sect. *Aroidea*, is known from a very restricted area of distribution south of Samarkand (Uzbekistan), probably with an outpost in the Kugitang ridge (northeastern corner of Turkmenistan). It is a moderately small species with flowers similar to *A. verticillatum* [Plate (58) D - F, H] but *A. aroides* owns longer pedicels and a denser inflorescence. Molecular data (ITS sequences of nuclear rDNA) showed closer relations to *A. gypsaceum* (sect. *Popovia*), *A. mirum* Wendelbo (sect. *Thaumasoprason*), *A. sarawschanicum* (subsect. *Keratoprason*), all investigated species of the sections *Kaloprason*, *Compactoprason*, and *Procerallium* as separate sister groups, and either *A. verticillatum* is also closely related (Gurushidze & Blattner in Fritsch & Abbasi 2013: 201), or not (Fritsch & al. 2010: 194 cluster 7 § 3.9.5; Fritsch 2012b: 254, Fig. 5 W). Sequences of the plastid *trnL-trnF* region supported a  $\pm$  close relationship to *A. verticillatum*, and a less close to *A. gypsaceum*, *A. komarowii*, *A. nevskianum*, and *A. alexeianum* (Gurushidze & al. 2010: 836 Fig. 4 lineage VI).

**Etymology:** The epithet reflects the similarity of the apex of the developing spathe to the apex of an *Arum* spathe (from Latin "Arum-like").

**Biological data:** Miralibekov (1982) counted 110–485 (in the mean 198) seeds per inflorescence under cultivation. The genome size was reported as 38.1 pg 2C DNA (Vakhtina & al. 1977, Gurushidze & al. 2012) or 36 pg (Zakirova 1989). Fresh bulbs contain in total 0.13 % cysteine sulfoxides (65 % methiin, 35 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008).

13. *A.* subg. *Melanocrommyum* **sect. *Acaule*** R.M. Fritsch  
in Linzer Biol. Beitr. 26: 966 (1994). — Type species: *Allium hexaceras* Vved.

(71) *Allium hexaceras* Vved., Flora Tadzh. SSR 2: 338, 424, t. 59 f. 1-3 (1963). Vvedensky [& Kovalenskaya], Opred. rast. Sredn. Azii 2: 80 (1971). — Type: Tajikistan: Declivitates meridionales jugi Hissarici. Pars borealis Chilalik-Tau. Pratulium alpinum ad marginem valli saxosi post nivem tabescen-tem [southern slopes of Hissar range, northern part of Khilaliktau Mts., alpine meadow at the margin of a rocky valley after snow melting], 3000 m s. m., 26.7.1945 Tolmachev 605 (holotype LE ?, para-type Tolmachev & Stukolkina 934, TAD; not seen).

**Distribution:** Tajikistan, Uzbekistan: Hissar mountain range: montane to subalpine grassy and stony slopes; known only from the massifs Khilaliktau, Jakhou-Kadzhou, and the heights W Tupolang drainage.

**Description:** Bulbs ovoid, 12–15 mm long, 7–12 mm in diam., without side bulblets; inner tunics hyaline-membranous, whitish, outer tunics papery, grayish-brown, finally disintegrating. Scape somewhat flexuous, terete, obconical (basally thinner), smooth; 6–9 cm long, 2–3 mm in diam.; green, the very base somewhat brownish flushed. Leaves (1) 2–3, laminae narrowly linear-lanceolate, nearly straight, upper part recurved and drooping, thickish, canaliculate; upper side smooth, lower side initially smooth, later with a few flat ribs; margins glabrous or slightly ciliate, long tapering into the hooded apex; 15–20 cm long, (3.5) 5–8 mm broad; gray-green with strong glaucous bloom. Sheathy prophyll smooth, reddish,

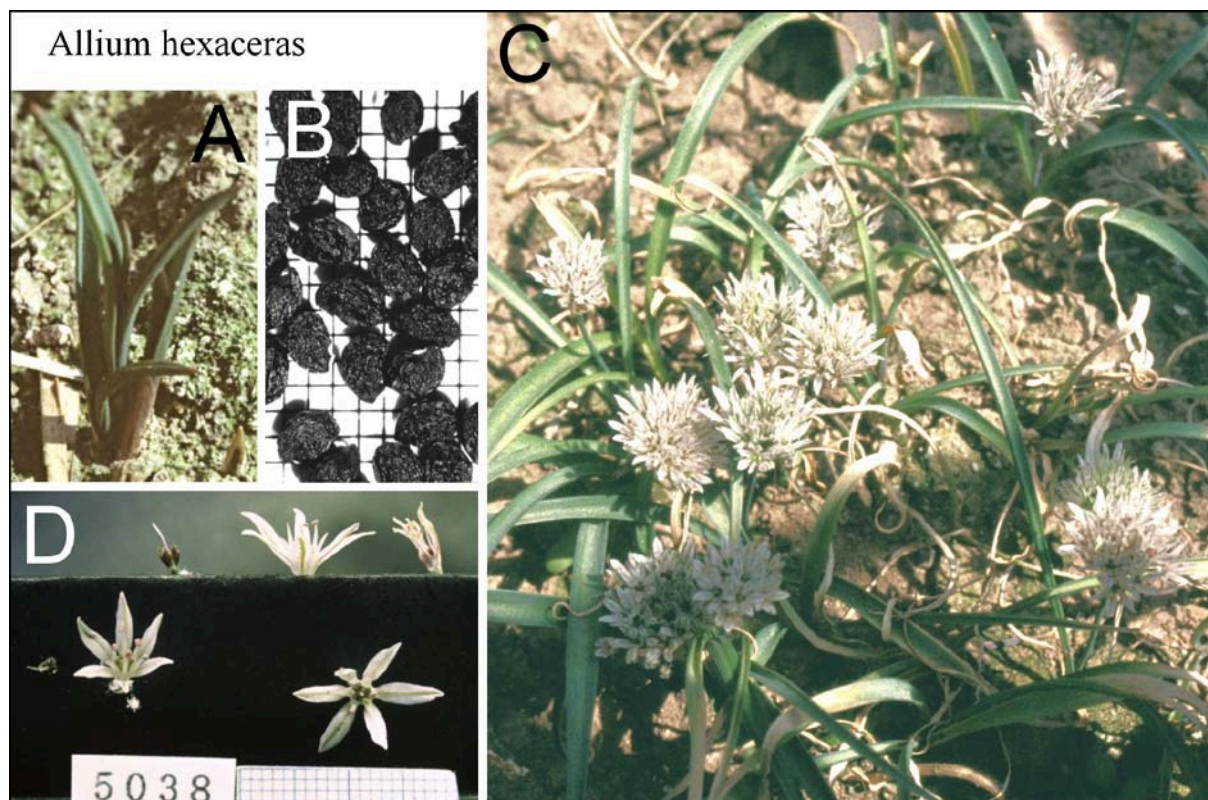


Plate (71): A: Sprouting leaves of cultivated plants; B: seeds; C: cultivated plants in full anthesis; D: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as background and measure scale of B & D).

quickly decaying. Spathe thin membranous, for 3/4 divided in 2-3 ovate-triangular, not reflexed valves; buff with very narrow, brown veins. Inflorescence fasciculate to semi-globose; dense, moderately many-flowered; 2-3 cm in diameter, c. 2 cm long. Pedicels equally long, thickish, wiry, straight; 4-10 mm long; semi-glossy green, mainly near base pale brownish. Anthesis in June to July. Flowers  $\pm$  broadly funnel-shaped. Tepals narrowly elliptic, acutish, obliquely forward directed, later connivent; (5) 8-10 mm long, 1.5-2 mm broad; pale lilac-pinkish, the conspicuous median vein is green to purple and narrowed towards the base. Filaments 1/3-1/4 shorter than the tepals; basally for c. 0.3 mm connate and short-triangular widened, above thick subulate; white with pinkish apex. Anthers ovoid; c. 1 mm long and 0.7 mm broad; grey to violet. Pollen light gray. Ovary shortly stipitate, shortly obconical triangular, apex with 6 upright, radially directed, scabrid outgrowths; surface smooth; green later brown. 3 ovules per locule were counted. Style narrowly conical, 1.5-4 mm long; white. Stigma undivided; white. Capsule depressed-globose triangular, 4-5 mm long; surface  $\pm$  papillous. Seeds ovoid to drop-shaped, slightly edged; surface papillous, densely lacunose, silk-glossy black; 2.5-3 mm long, 2-2.3 mm broad, 1.5-2 mm thick. The testa showed periclinal walls with rather shallow verrucae, and S-like with a tendency to U-like, sometimes nearly Omega-like, undulation of the anticlinal walls with very low amplitude (Fritsch & al. 2006, Fig. 2).

Chromosomes:  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Uzbekistan: Hissar range, Mt. Khoja-Kiikkolon, TAX 5038).

Living accessions studied: Uzbekistan: Hissar range, watershed between the rivers Tupalang and Obi-Sarang, Mt. Khoja-Kiikkolon, S exposed rocky area (38°45' N, 67°58' E, 3100 / 3200 m, 16.7.1994 Fritsch, Khassanov, Pistrick 1259 A, B; GAT) TAX 5038, TAX 5083.

Remarks: *Allium hexaceras* is the only species of sect. *Acaule*. It is either a very rare species, or it occurs in small populations only very few of them were hitherto detected quite by chance. This species owns flat linear leaves, and bowl-shaped star-like pinkish flowers bearing (name-giving) horn-like outgrowths on the top of the ovaries (but fig. 3 in Vvedensky [1963: pl. LIX opposite p. 338] is far from reality). Sometimes also the bulge-like outgrowths at the top of ovaries in *A. sarawschanicum* may appear horn-like on herbarium specimens, but stature of plants as well as shape of outgrowths of both species look very different. Molecular markers (ITS sequences of nuclear rDNA) could not yet elucidate the genetic relationships of *A. hexaceras*. The only studied accession was positioned most basal in the most advanced cluster 7, closely related to *A. gypsaceum* and sect. *Kaloprason* but with low bootstrap support (Fritsch & al. 2010: 196 cluster 7 § 3.9.7; Fritsch 2012b: 254, 255 Fig. 5 X; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Study of more accessions is essential, because this position of the single investigated accession does perhaps not indicate a closer relationship but was accidentally caused by long-branch attraction (putting distantly related items at accidental positions in the dendrograms, a methodical problem of computing).

Etymology: The epithet refers most probably to the horn-like outgrowths of the ovary (from Greek "with six horns").

14. *A.* subg. *Melanocrommyum* sect. *Popovia* F.O. Khass. & R.M. Fritsch  
in Linzer Biol. Beitr. 26: 967 (1994). — Type species: *Allium gypsaceum* Popov & Vved.

(72) *Allium gypsaceum* Popov & Vved. in Bot. mat. glavn. bot. sada 5, 6: 92 (1924). Vved., Flora Turkm. 1, 2: 287 (1932). Vved. in Nevski, Trudy Bot. Inst. Akad. Nauk SSSR ser. 1 vyp. 4: 330 (1937). Vved., Flora URSS 4: 256, tab. 16 fig. 1 (1935). Vved., Flora Uzbek. 1: 456 (1941). Vved., Flora Tadzh. SSR 2: 340 (1963). Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 80 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 127 (1988). — Lectotype: Uzbekistan: Bukharskoe khandstvo, Denauskoe bekstvo, Yu. zap. otr. Giss. khreb. Ushch. r. Sangardak [Bokhara khanate, Denau bek-nate, SW spurs of Hissar range, gorge of river Sangardak], Nilyu-Sangardak, 22.5.1913, leg. Michel-son 1762bis (LE!, design. Fritsch 1990: 504).



Distribution: Tajikistan, Uzbekistan, Turkmenistan: mountain ranges of the S Pamir-Alai region; colline to submontane gypseous slopes and *Pistacia* associations.

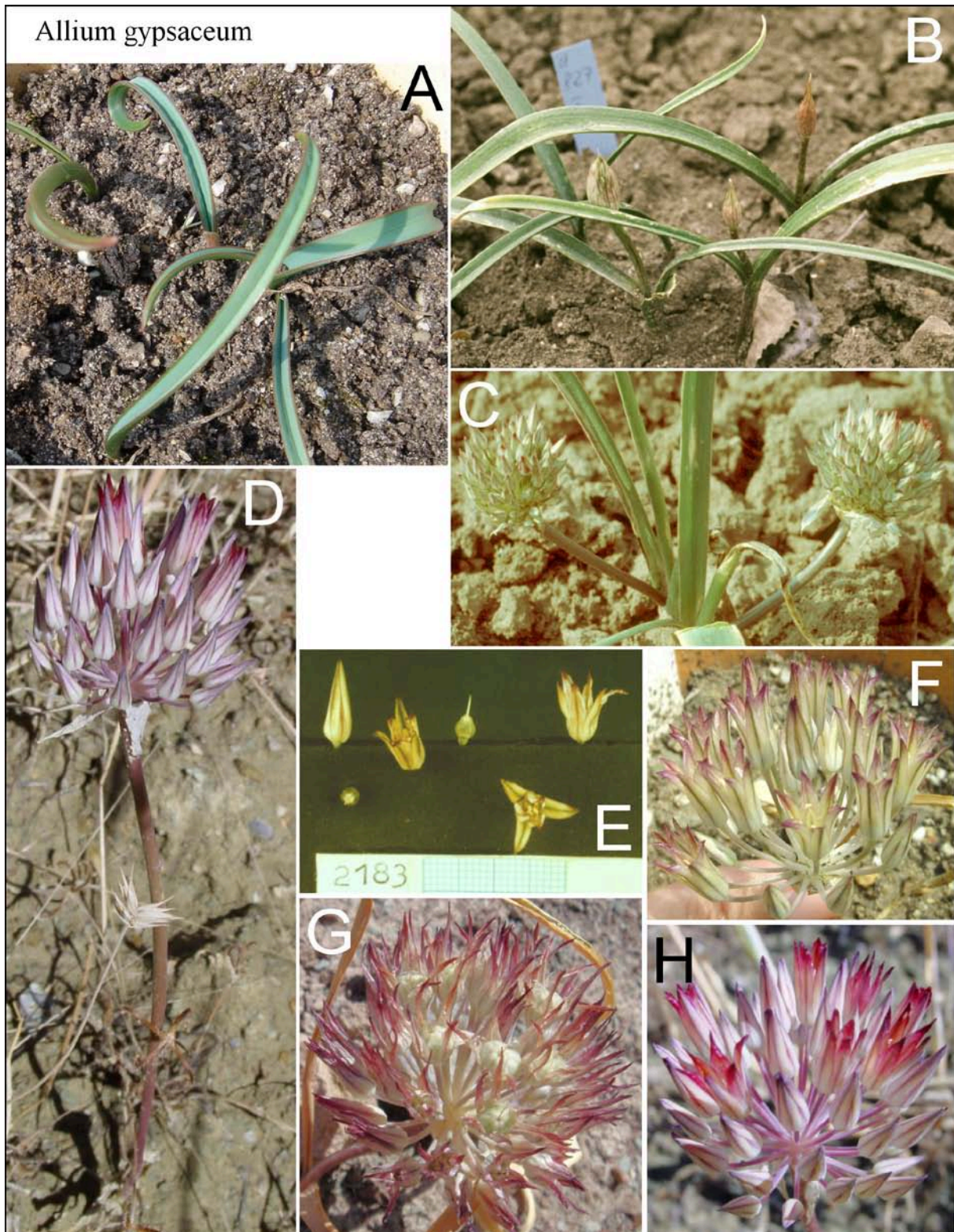


Plate (72): A: Sprouting leaves of cultivated plants; B: cultivated plant in the shooting stage; C: cultivated plants with pale flowers in early anthesis; D: plant with purplish flowers in early anthesis in Baisun ridge, Uzbekistan; E: comparison of pale flowers and flower parts in different stages of anthesis (millimeter paper as measure scale); F: inflorescence with pale flowers in full anthesis; G: inflorescence with purplish flowers after anthesis; H: inflorescence with purplish flowers in full anthesis.

**Description:** Bulbs ovoid to globose, 10-15 mm long, 10-12.5 mm in diam., without side bulbs; inner tunics brighter, outer tunics grayish, papery. Scape flexuous with curved upper part, glabrous, terete later basally slightly grooved; 7-20 cm long; maroon with glaucous bloom. Leaves 2-3, laminae long triangular to narrowly lanceolate, arcuately ascending and recurved to soil, near base narrowly canaliculate above plicate,  $\pm$  thick; upper side smooth or grooved, dull, lower side finely ribbed,  $\pm$  glossy; margins densely and finely dentate, long tapering into the hooded apex; 15-30 cm long, 5-15 (20) mm broad; vividly green with glaucous bloom, upper side grayish. Sheathy prophyll short, hyaline, finely scabrid; brownish, quickly decaying. Spathe membranous, mostly divided into 2 ovate, acute valves, half as long up to slightly shorter than the pedicels; whitish with  $\pm$  inconspicuous veins. Inflorescence broadly fasciculate to  $\pm$  globose; dense, many-flowered; 4-7 cm in diam.; decomposing when ripe. Pedicels subequally long, strong, thickish,  $\pm$  straight, basally  $\pm$  thickened; 1-2 cm long; crème with  $\pm$  purplish flush, fading towards the base. Anthesis in May to June. Flowers subtubular later narrowly campanulate. Outer tepals linear-oblong, acutish, 10-11 mm long, inner tepals oblanceolate, slightly longer and broader than the outer ones, with subobuse teeth near the apex; crème or whitish with purple flush darkest near the apex, with purple median vein. Filaments 1/2 as long as the tepals, for 1/2-2/3 connate, free parts of the inner filaments triangular, of the outer ones lanceolate-subulate but scarcely shorter and narrower than the free parts of the inner filaments; whitish. Anthers oblong; c. 1 mm long; yellow. Pollen grayish yellow. Ovary sessile, double conical-triangular, apex with 6 narrow, nose-like outgrowths, 2.5-3 mm long, c. 2 mm in diam.; green with purplish flushed sutures. Up to 4 (Vvedensky 1941) / 6 ovules per locule, 6 / 10 ovules per ovary (Vvedensky 1935 / Filimonova 1970). Nectary ducts mound above the base of ovary higher than the bottom of locules (Fritsch 1992b). Style threadlike, 2-3 mm long; whitish. Stigma undivided; whitish. Capsule irregularly oblong-ovoid, 4-5 mm long, 2.5-3 mm in diam., encased by the dry tepals and filaments, surface with raised wrinkles; only upper part open, valves suborbicular, deeply notched at the apex; pale yellowish. Seeds single per locule, often only 1 seed per capsule; ovoid to drop-shaped or semi-circular; surface finely tuberculate, with irregular, fine, raised wrinkles, dull black; 2-2.5 mm long, 1.8-2 mm broad, 1.5-1.8 mm thick. The testa showed verrucose periclinal walls with smaller verrucae. The undulation of the anticlinal walls varied from short Omega-like to U-like forms with short or moderate wavelengths (Kruse 1994; Fritsch & al. 2006, Fig. 19).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 (Uzbekistan: W Hissar range, Derbent, no. 764,  $2n = 16$  Astanova 1990 (Tajikistan: Gazimailik ridge).  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Gazimailik ridge, TAX 2874).

**Living accessions studied:** **Kirgizstan:** reservation Aksu - Dzhabagly, from *Allium* collection of Khassanov (merger of label is probable, 1998 Khassanov s. n.; GAT) TAX 5809. **Tajikistan:** W slopes of Gazimailik ridge, place Obodkan, c. 10 km NW vill. Ganjino (38°02' N, 68°34' E, 1450 m, 12.5.1990 Fritsch, Kudratov, Pistrick 447; GAT) TAX 2874. **Uzbekistan:** Babatag ridge, E slopes of Kafirnigan valley near vill. Dzhatykyr (38°20' N, 68°26' E, 1100 m, 27.5.1987 Fritsch 212; GAT) TAX 2183; SW Hissar range, Chakchar massif E Dekhkanabad E main pass, S exposed limestone slope beside the road (38°15' N, 66°51' E, 1460 m, 15.5.1993 Fritsch & Khassanov 827; GAT) TAX 3661, E slopes of a limestone outcrop W Karadagana, c. 10 km SE Dekhkanabad (38°12' N, 66°39' E, 15.5.1997 Fritsch & Khassanov 1600; GAT) TAX 5669, pass between Derbend and Sajrob (38°10'15.5" N, 66°58'44.5" E, 1270 m, 27.5.2003 Fritsch, Keusgen, Khassanov 4151; GAT), steep loamy slopes beside the road from Derbent to Sherabad (38°11' N, 66°58' E, 1250 m, 16.5.1993 Fritsch & Khassanov 843; GAT) TAX 3704; 25 km E Baisun, side valley to the north of the main road (38°05'19.1" N, 67°26'54.3" E, 800 m, 28.5.2003 Fritsch, Keusgen, Khassanov 4159; GAT), sandy slopes in an eroded area c. 3 km SE Baisun S of the road to Churchi (38°12' N, 67°15' E, 1100 m, 12.5.2001 Fritsch & Hoffmann 1708; GAT) TAX 5874; Kugitang ridge c. 20 km W Gulistan, W exposed slopes in Baglidarasai valley (37°56' N, 66°45' E, 1350 m, 17.5.1993 Fritsch & Khassanov 848; GAT) TAX 3705.

**Remarks:** *Allium gypsaceum* is the only species of sect. *Popovia*. It shows a very peculiar combination of morphological characters; especially the lanceolate, longitudinally folded leaves and narrowly campanulate, crème flowers with violet (sometimes only slightly purplish) suffused tips shall be mentioned here (Fritsch 2012b: 254). Therefore it is difficult to affiliate; the best solution is to separate it as a group of its own. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. gypsaceum* as well separated, basal subgroup beside sect. *Kaloprason*, with a closer relationship to *A. hexaceras* (sect. *Acau-*

le) and unresolved connections to *A. sarawschanicum*, *A. trautvetterianum*, *A. mirum* and *A. aroides* that belong to other sections (Fritsch & al. 2010: 175 cluster 7 § 3.9.7; Fritsch 2012b: 254, 255 Fig. 5 X; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Also sequences of the plastid *trnL-trnF* region verified the above mentioned relationships though less species were studied (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

**Etymology:** The epithet reflects certainly the preference of this species for gypseous soils (from Greek "pertaining to gypsum").

**Biological data:** Up to 7 layers of sclerenchyma cells in the scape have very different diameters, and in cross-section elliptic xylem vessels of outer vascular bundles characterize this species (Fritsch 1993 Fig. 6e). The reported genome size was 33.8 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.065 % cysteine sulfoxides (80 % methiin, 5 % alliin, 15 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008).

**Economic traits:** Very rarely offered as ornamental (Fritsch 2015).

15. *A.* subg. *Melanocrommyum* sect. *Thaumasoprason* Wendelbo

in Bot. Notiser 122: 29 (1969). — *A.* sect. *Kaloprason* subsect. *Thaumasoprason* (Wendelbo) Kamelin & Seisums ex Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 28 (1994), comb. inval. — **Type species:** *Allium mirum* Wendelbo

(73) *Allium khozratense* R.M. Fritsch in Bot. Jahrb. Syst. 127: 463, fig. 2 (2009). — ? *Allium pandzhi* Seisums in Pogosian & Seisums, Bot. Zhurn. (Moscow & Leningrad) 77 (9): 104 (1992), nom. nud., Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskiy obzor) avtoreferat: 28 (1994), nom. nud. sub sect. *Kaloprason* subsect. *Pandzhia* Kamelin & Seisums, nom. illeg. — **Type:** Tajikistan, Yugo-vostochn. chast Yuzho-tadzhikistanskoj depressii, zapadnyj sklon khrebta Khirikh, 2 km yugo-vostochni kishlaka Sarygor, na galechnikakh, [SE part of the S-Tajik depression, western slope of Khirikh massif 2 km SE of vill. Sarygor, gravel area] 1400 m, 01.6.1961, Soskov & Yunusov 283 (holotype TAD 12811!). Paratype: Tajikistan, Yugo-V. chast yuzho-tadzhikistan. depressii, 6 km S.-V. kishl. Iol, k yu.-v. ot kishl. Sary-Masgar, h= 1400-1500 m Skaly [ ... 6 km NE of vill. Iol, SE of vill. Sary-Masgar, ... rocks] 18.6.1961 Soskov, Yunusov 1440, TAD 12812!)

**Distribution:** SE Tajikistan: S part of Khozratishoh mountain range, submontane stony slopes, known only from the type area.

**Description:** Bulbs ovoid, c. 1.5 cm in diam. and 2 cm long; outer tunics membranous, grey to brown. Scape flexuous, terete, conical (narrowest near base), smooth; 15 - 25 cm long, 3-5 mm in diam.; vividly green with glaucous bloom. Leaves 2 (3), laminae narrowly lanceolate, arcuately ascending and recurved to the soil; upper and lower (?) sides smooth; margins smooth, long tapering into the apex; (4) 8-15 mm wide, 20-30 cm long; vividly green with glaucous bloom. Sheathy prophyll long, membranous, smooth (?), buff with brown veins, present until anthesis. Spathe hyaline-membranous, irregularly divided in 2-4 finally reflexed, acuminate valves as long as the pedicels; brownish with inconspicuous veins. Inflorescence semi-globose; moderately dense; c. 4 cm in diameter; after anthesis (and in the dry state) basally disintegrating. Pedicels thin wiry, nearly straight, at base long-obovate and at apex somewhat spherically inflated; c. 2 cm long; silk-glossy green, brownish flushed. Anthesis in begin of June. Flowers flat funnel-shaped starlike. Tepals lanceolate, obliquely patent; 4.5-6 mm long, 1-1.2 mm broad; pinkish-carmine with purple median vein narrower towards base and apex, after anthesis brownish. Filaments c. 2/3 as long as the tepals; basally connate and triangular widened (inner filaments slightly wider); pink, fading toward the base. Anthers oblong; c. 0.8 mm long and 0.5 mm wide; violet. Pollen grayish-yellow. Ovary strongly tapering towards the base but not stalked, depressed obovoid triangular, 1.5-2 mm long and in diameter; surface ± smooth but not glossy; green with brown sutures. Style conical-threadlike, 2-4 mm long; pinkish-white. Stigma undivided. Capsule and seeds not seen.

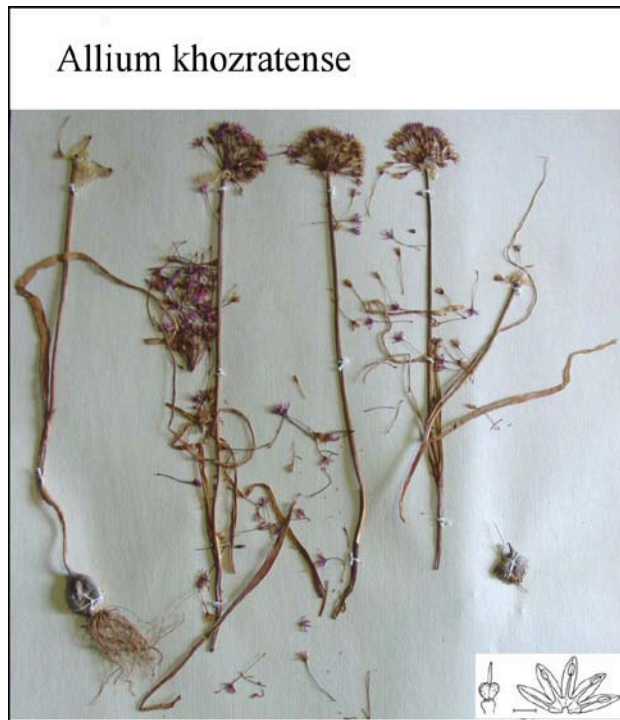


Plate (73): Plants of the type voucher, inset below right: shape of ovary, tepals and filaments of a flower prepared from herbarium, scale bar = 2mm.

**Chromosomes:**  $2n = 16$  Pogosian & Seisums 1992 (Tajikistan: Khozratishoh range, near vill. Iol, Seisums s. n. "*A. pandzhi*").

**Remarks:** On first glance, this species looks like a small member of the sects. *Megaloprason* or *Procerallium*, but the tepals are not reflexed after anthesis, the ovaries show a smooth surface and a very narrow base, and the pedicels are not only inflated near the base but also at the tip, and drop down from receptacle when the capsules are ripe. The latter character is known to occur in the sections *Thaumasioprason* and *Popovia*. Because *A. khozratense* has much less in common with *A. gypsaceum*, it was affiliated to sect. *Thaumasioprason* in the description. However, ITS sequences of nuclear rDNA positioned the only available sample close to *A. suworowii* in the more distant relationship of *A. regelii*, subsect. *Humilicognata*, and sect. *Asteroprason* (Gurushidze & Blattner in Fritsch & Abbasi 2013: 199), whereas *A. gypsaceum* and *A. mirum*, the type species of sect. *Thaumasioprason*, are related

to *A. aroides*, *A. verticillatum*, *A. sarawschanicum* and sect. *Kaloprason* (Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Addition of more samples and application of more molecular markers will be essential to verify the separate position of *A. khozratense* that could indicate to be a member of a separate taxonomic group that was proposed by Seisums (1994) but never validly described.

**Etymology:** The epithet was derived from the Khozratishoh mountain range (S Tajikistan, close to the Panj river) where the type specimen was collected.

16. *A.* subg. *Melanocrommyum* sect. *Kaloprason* K. Koch  
in Linnaea 22: 234 (1849), s. lat.; Wendelbo in Bot. Notiser 122: 29 (1969). — **Type species:** *Allium caspium* (Pall.) M. Bieb.

16.1 *A.* sect. *Kaloprason* subsect. *Kaloprason* (K. Koch) Kamelin,  
Florogen. analiz Srednej Azii: 241 (1973), s. lat. — Subg. *Melanocrommyum* subsect. *Kaloprason*  
series *Caspia* Omelczuk in Nov. sist. vyssh. rast. Kiev 3: 57 (1977). — **Type species:** *Allium caspium*  
(Pall.) M. Bieb.

*Allium caspium* (Pall.) M. Bieb., Fl. taur. cauc. 1: 265 (1808). Hook. in Curtis's Bot. Mag. 77: t. 4598 (1851). Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 251 (1875). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 301, 361 (1887). *Crinum caspium* Pall., Reise 2, Anhang: 41, Nr. 105, t. Q (1773). — **Lectotype:** Pallas, Reise 2, Anhang: 41, Nr. 105 tab. Q (design. Fritsch 1990: 503).

**(74) subsp. caspium** — *Allium caspium* sensu Vved., Flora Turkm. 1, 2: 294 (1932), p. p. maj. Vved., Flora URSS 4: 275-276 (1935), p. p. maj. Vved., Flora Uzbek. 1: 464 (1941). Vved., Flora Tadzh. SSR 2: 357 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 87 (1971). Pavlov & Polyakov, Fl. Kazakhst. 2: 192, tabl. 14 fig. 4 (1958). Wendelbo, Flora Iranica 76: 90, tab. 9/131, tab. 24 a-b (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Fritsch & Abbasi, Taxon. review *Allium* subg. *Melanocr.* Iran: 140, plate T55, map (2013). — *Allium brahuicum* Boiss., Fl. orient. 5: 278 (1882). Type: Pakistan: "Belutschia superiore", in jugo [Brahui] prope [Upper Beluchistan, Brahui massif near] Mungochar, leg. Stocks No. 936 (G-Bois!).

**Distribution:** Tajikistan, Uzbekistan, Kazakhstan, Turkmenistan, Afghanistan, Pakistan, NE and C Iran: lowland to colline sandy desert plains and depressions, dunes, rock slopes of the deserts from Caspian Sea to W Tianshan and S Pamir-Alai mountain areas.

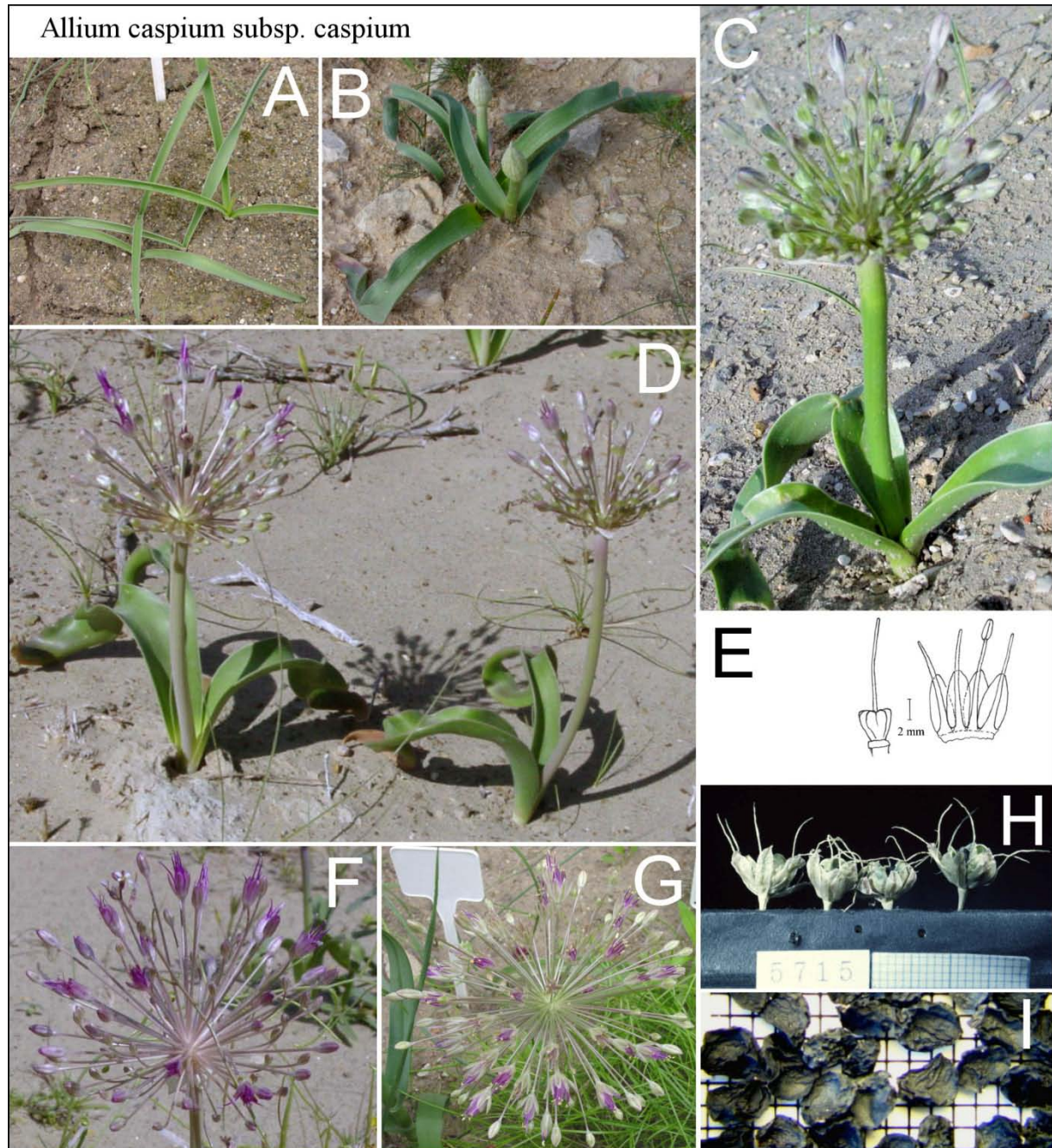


Plate (74): A & B: Cultivated plants and plants near Turkmenbashi (Turkmenistan), resp., in the early shooting stage; C: plant near Turkmenbashi in the bud stage; D: plants near Gazandzyk (Turkmenistan) in early anthesis; E: shape of ovary, tepals, and filaments of a flower prepared from herbarium; F & G: inflorescences of a plant near Gazandzyk and a cultivated plant, resp., in full anthesis; H: ripe open capsules; I: seeds (millimeter paper as background and measure scale of H & I; plate copied from Fritsch & Abbasi 2013: 141 Plate T55).

**Description:** Bulbs  $\pm$  depressed globose, (1) 1.5-3 cm in diam., (1) 1.5-2.5 cm long; inner tunics thin but strong, pale brown to white, outer tunics papery to parchment-like, longitudinally splitting; yellowish brown to grayish-black. Scape straight, strong, terete, obconical (below the inflorescence somewhat thicker than basally), smooth; (7) 10-30 (50) cm long, 4-10 (15) mm in diameter; green, upper part purplish flushed. Leaves 2-3 (4), laminae narrowly oblong to lanceolate, canaliculate, thick, obliquely or arcuately ascending and recurved to the soil, upper part often undulate and spirally enroled and lax; upper side smooth or slightly grooved, lower side ribbed; margins basally somewhat toothed or cartilaginous, above smooth, initially purplish later whitish, shortly tapering into the cucullate apex;

20-30 cm long, (5) 15-35 mm broad; green with strong glaucous bloom. Sheathy prophyll moderately long, finely membranous, pale brownish, decaying when the inflorescence expands. Spathe thin membranous, divided into 2-3 ovate, acuminate, finally reflexed, 12-25 mm long valves; brownish, veins darker. Inflorescence semi-globose to globose; very loose, many-flowered; 6-10 cm, in the fruiting stage up to 25 cm in diam., 5-7 cm long. Pedicels very unequally long, straight, thickish; 3-12 cm long; semi-glossy pale brownish-green, often purple flushed. Anthesis in April to June. Flowers narrowly campanulate (in full anthesis narrowly funnel-shaped) triangular. Tepals ovate to narrowly oblong, spoon-shaped, basally shortly connate, apex obtuse or  $\pm$  acute, straight, after anthesis stiff and strong but shape not changing; 5-8 (11) mm long, 2.5-4 mm broad, inner tepals longer and wider than outer ones; pinkish to greenish-violet with darker, after anthesis thicker and broader, outside scabrous median vein. Filaments 1.5-2 times longer than the tepals; basally shortly connate and somewhat broader, above subulate; pink to deep violet. Anthers ovoid; 1.5-2 mm long, 0.8-1 mm broad; yellow or violet. Pollen yellowish or gray; the shape is oblate to peroblate, 32  $\mu$ m long, 16  $\mu$ m broad, P/E index 0.5, sculptures rugulate to microrugulate, wall 0.9  $\mu$ m thick (Neshati & al. 2009). Ovary long stipitate, obovoid or obconical, hexangular by six longitudinal furrows (thus the flat apex nearly star-shaped), 3.5-4 mm long, c. 3 mm in diam.; surface finely scabrous, smoother towards the base; grayish-green to greenish-violet. Up to 6 / 2-3 ovules per locule (Filimonova 1970 / Vvedensky 1932). Style conical to threadlike, up to 12 mm long; whitish with violet apex. Stigma undivided; yellowish. Capsule encased by dry tepals and filaments, conical to pyramidal-triangular, apex rather flat with six flat verrucae, 6-8 mm in diam., 5-7 mm long; valves suborbicular with a longitudinal furrow only in the upper part and a short notch near the apex; buff. Seeds 1-2 per locule, drop-shaped with sharp edges; surface coarsely reticulate lacunose, silk-glossy black; 2.5-3 mm long, 2.2-2.5 mm broad, 1.8-2 mm thick. The testa showed verrucose periclinal walls with prominent (but hidden) verrucae, the anticlinal walls S-like or an intermediate type of undulation between U-like and Omega-like with varying amplitude and short wavelengths (Kruse 1994; Fritsch & al. 2006).

**Chromosomes:**  $2n = 16+0-1B$  Vakhtina 1964a, Vakhtina 1969 p. 147 (Uzbekistan: Nukus, no. 297).  $n = 8$  Vakhtina & al. 1977 total length of chromosomes (Russia: Botanical collection of BIN).  $2n = 16$  Vakhtina 1985 (Turkmenistan: Sundukli, Botschantzev 587).  $2n = 16+B$  Vakhtina 1985 (Turkmenistan: Chardzhou, Botschantzev 744 "*A. baissunense*").  $2n = 16+B$  Zakirova & Nafanailova 1990 (Kazakhstan: Ustyurt, Abenov & Kudabaeva s. n.).  $2n = 16$  Fritsch & Abbasi 2013 (Uzbekistan: Navoi, TAX 5715, Kapustina s. n.).

**Living accessions studied:** **Uzbekistan:** S Kyzylkum desert, sandy places c. 70 km NW town Navoi (02.6.1997 coll. Kapustina via Fritsch & Khassanov 1650; GAT) TAX 5715, Kyzylkum station, oversanded soil near well Ajakagytna (1993 coll. Khassanov; GAT) TAX 3786. **Tajikistan:** Fergan depression, sandy NW exposed slopes along the river Syrdarja NW Kajrakkum (40°16' N, 69°48' E, 500 m, 01.6.1990 Fritsch, Kudratov, Pistrick 588; GAT) TAX 2962. **Turkmenistan:** Sandy desert near the main road c. 18 km W Bereket = Kazanjik (39°15' N, 55°18' E, c. 50 m, 08.4.2002 Fritsch, Keusgen, Khassanov 24; GAT) TAX 5927; special place Duslychai (39°04' N, 55°01' E, 31 m, 09.4.2002 Fritsch, Keusgen, Khassanov 30; GAT) TAX 5930.

**Remarks:** *Allium caspium* is the type species of section and subsection *Kaloprason*. It is a very polymorphous species preferring locations without any precipitation during the summer. Specific characters are moderately narrow tepals, widely protruding filaments, and a turbinate ovary. The typical subspecies of *A. caspium* differs mainly by often longer tepals and more intensely colored flower parts from subsp. *baissunense*, and by the ecological preference to grow in sandy deserts of the Caspian-Balkhash region to the Iranian and Pakistani deserts (Fritsch 2012b: 255). Iranian specimens show more or less acute tepals, whereas plants from the Caspian-Aral deserts show beside acute tepals (Pavlov & Polyakov 1958: tabl. 14 fig. 4) also all kinds of transitions to obtuse or sometimes nearly spatulate tepals. Molecular markers (ITS sequences of nuclear rDNA) present strong evidence for a close relationship to *A. bucharicum*, *A. protensum*, *A. alexeianum*, and *A. nevskianum*. More distantly related are *A. gypsaceum*, *A. aroides*, and the *A. lipskyanum* alliance of sect. *Regeloprason* which form well separated, small groups (Fritsch & al. 2010: 196 cluster 7 § 3.9.8; Fritsch 2012b: 255 Fig. 5 Y; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201-202). According to sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836 Fig. 4 lineage VI), also some members of the sections *Megaloprason*, *Procerallium*, and *Stellata* are closer related.

**Etymology:** The epitheta refer certainly to the geographic areas of the type locations near the Caspian Sea and in the Brahui massif in Pakistan.

**Biological data:** Anatomical characters of the scape: outer margin of sclerenchyma is smooth (Fritsch 1993 Fig. 6C). The genome size (31.3 pg 2C-DNA) is somewhat lower than in subsp. *baissunense* (35 pg, Gurushidze & al. 2012). Fresh bulbs contain in total 0.007 % methiin (Fritsch & Keusgen 2006) or 0.15 / 0.09 % cysteine sulfoxides (51 / 62 % methiin, 49 / 38 % isoalliin; Jedelska & al. 2005; Keusgen & al. 2008, plants from Turkmenistan / Uzbekistan).

**Economic traits:** The plants ('atyshak' in Uzbek, 'it-shua, aram-zhua' in Kazakh, 'deli-chikan' in Turkmen language) are poisonous for livestock by high saponin contents (Borovskij & al. 1940 in Vvedensky 1963, Pavlov & Polyakov 1958, Kerbabaev & Meshcheryakov 1975). Androsov (1941) promised the species as ornamental for Turkmenistan, but it is not offered in recent time (Fritsch 2015). Belongs to the most important edible species in the Uzbek deserts; is used instead of garlic and onion (Khassanov 2008). Local name 'zhua', the bulbs are eaten and taste like common onion (Khassanov & Umarov 1989).

**(75) *Allium caspium*** (Pall.) M. Bieb. **subsp. *baissunense*** (Lipsky) F.O. Khass. & R.M. Fritsch in Linzer Biol. Beitr. 26: 978 (1994). *Allium baissunense* Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 140 (1900). Vved., Flora Uzbek. 1: 465 (1941); Vved., Flora Tadzh. SSR 2: 357, tab. 61/3 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 88 (1971); Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 128 (1988). *Allium caspium* var. *baissunense* (Lipsky) Vved., in [Trudy SAGU, ser. VIII-v, 3 =] Sched. HFIAM 14 no. 333: 6 (1928), Flora Turkm. 1, 2: 295 (1932). Vved., Flora URSS 4: 275 (1935), sub *A. caspium*. — *Allium rhodanthum* Vved., Fl. Uzbek. 1: 464, 543 (1941). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 124, 128 (1988). Type: Uzbekistan: Khaudak-Tau. Skreplennye peski [fastened sands] (*Carex physodes*), 13.5.1937, leg. Vvedensky 21 (isotype LE!, topotype TAD!). — **Type:** Uzbekistan: Bajsun, na peschannikakh / in arenosis ad Baissun, Buchara [sand area near Baisun], 6.6.1897, leg. Lipsky 2476 (holotype LE!).

**Distribution:** Tajikistan, Uzbekistan, Turkmenistan: W, SW and S Pamir-Alai mountain ranges, submontane saline clayey or gypseous slopes, exploration of marine sediments.

**Description:** Bulbs subglobose to ovoid, 1.5-5 cm in diam., 2-6 cm long; inner tunics papery, whitish, outer tunics sub-leathery, longitudinally splitting or fibrous, grey to blackish, protruding into a fibrous neck. Scape subflexuous, terete, smooth, 30-55 cm long, 2-6 mm in diam.; green with glaucous bloom, sometimes above purple suffused. Leaves 2-4, laminae ± broadly lanceolate, basally stiff upright directed, then arcuately descending to the soil, thick, broadly canaliculate; upper and lower sides with shallow and sometimes dense ribs; margins basally smooth and reddish, above the middle whitish and scabrous, short arcuately tapering into the hooded apex; (12) 18-35 cm long, (0.6) 1.5-5.5 (7) cm broad; green with waxy bloom. Sheathy prophyll membranous, uncolored, quickly decaying. Spathe membranous, completely divided into 2-3 valves about 1 cm long; whitish or translucent with brownish-green veins. Inflorescence irregularly subglobose to globose; loose, with 20-80 flowers; initially 5-8 cm, finally 12-15 cm in diameter. Pedicels unequally long, straight, stiff and wiry; whitish with pale purplish flush. Anthesis in May. Flowers triangularly pitcher-shaped. Tepals elliptic- to ovate-lanceolate, outer tepals spoon-like, inner tepals ± flat and slightly broader, obtuse, straight (also later); 5-8 mm long, 2-3 mm broad; whitish to pinkish with a broad, diffusely bordered, ± green or red median vein. Filaments 1.5-2 times as long as the tepals; basally for c. 0.5 mm connate and shortly triangularly widened (inner ones somewhat broader), above subulate; lilac or white. Anthers ovoid-oblong; c. 2 mm long, 1.2 mm broad; yellow to reddish. Pollen yellow. Ovary long stipitate, six-angled turbinate to pear-shaped, 3-4 mm long and in diam.; surface finely scabrous; dull bluish-green. Up to 8 ovules per locule, 23 ovules per ovary (Filimonova 1970). Nectary ducts mound near the base of ovary below the bottom of locules (Fritsch 1992b). Style conical-threadlike, 8-10 mm long, overtopping also the filaments; whitish. Stigma undivided; white. Capsule slightly triangular ± pear-shaped, 5-7 mm long, glossy; widely open, dry valves long obcordate, apex very shortly notched; dull buff. Seeds 2-4 per locule, sector-shaped ovoid, slightly

edged, sides sometimes concave; surface finely tuberculate with coarse raised wrinkles, dull black; 2.5-3 mm long, 2-2.3 mm broad, 1.5-2 thick; TKW 3.96 g (IPK, unpubl. data). The testa showed verrucose periclinal walls, and anticlinal walls with an intermediate type between U-like and Omega-like undulation with varying amplitude and short wavelengths (Fritsch & al. 2006).

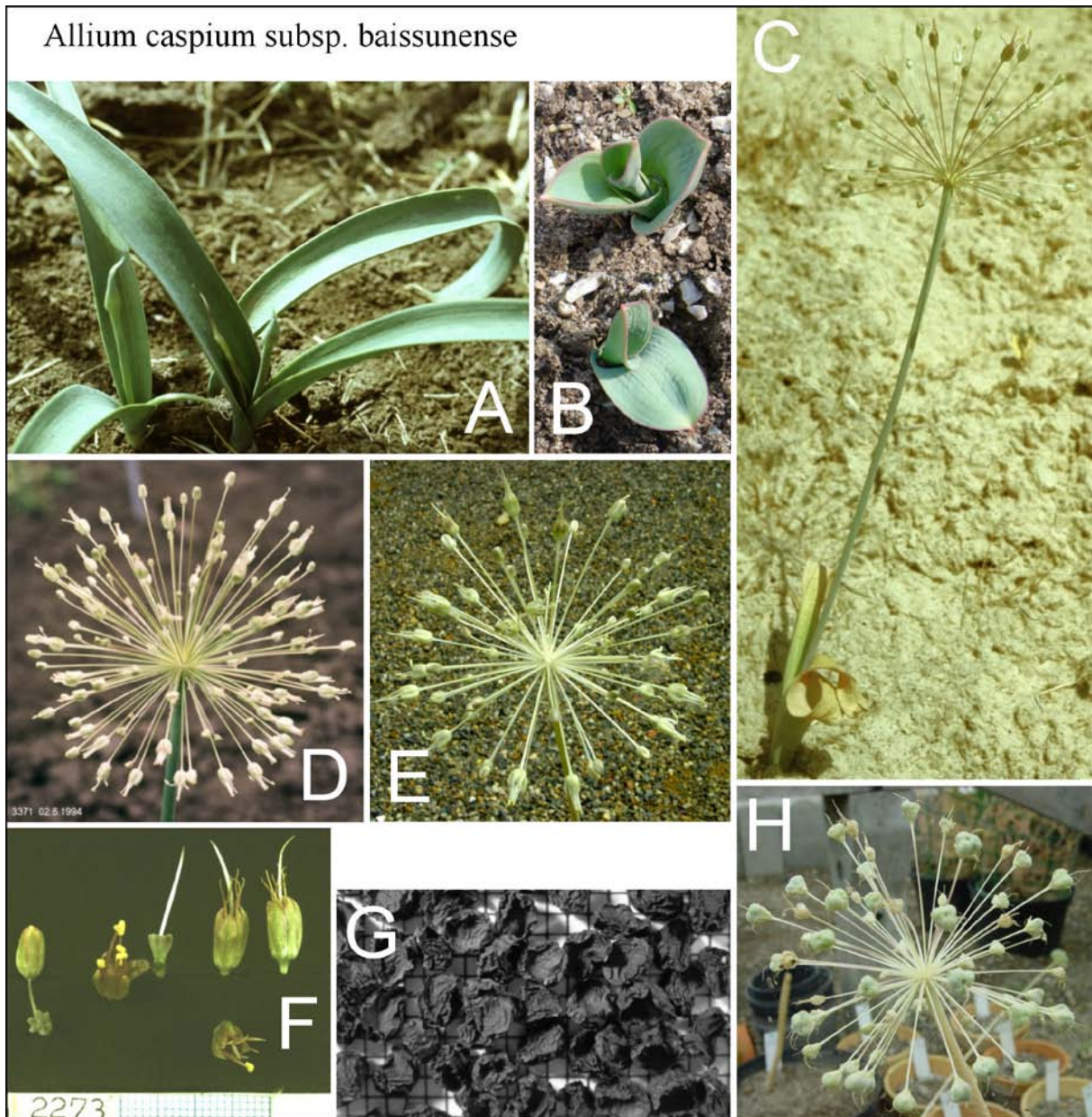


Plate (75): A: Shooting and B: sprouting cultivated plants; C: flowering plant in Gazimailik ridge, Tajikistan; D & E: inflorescences of cultivated plants in full anthesis; F: comparison of flowers and flower parts in different stages of anthesis; G: seeds; H: inflorescence with full-sized capsules (millimeter paper as background and measure scale of F & G).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a, Vakhtina 1969 p. 147, Vakhtina & al. 1977 total length of chromosomes (Uzbekistan: Baisuntau ridge, Baisun, no. 332, type location ?).  $2n = 16$  Astanova unpubl. data in litt. (Tajikistan: Aruktau massif, Kinzikaeva s. n.).

**Living accessions studied:** Tajikistan: Gazimailik massif c. 1 km W vill. Novyj Ganjino, c. 3 km SW town Ujaly, S exposed gypseous steep slopes (37°57' N, 68°35' E, 650 m, 11.5.1990 Fritsch, Kudratov, Pistrick 439; GAT) TAX 2930, steep slope near vill. Ganjino (37°59' N, 68°34' E, 930 m, 23.5.1987 Fritsch & Ivanov 181; GAT) TAX 2273; Khojakazian massif, gypseous slopes in the valley Kutorbulak (37°24' N, 68°15' E, 850 m, 16.5.1990 Fritsch, Kudratov, Pistrick 479; GAT) TAX 2941. Uzbekistan: Baisun ridge 25 km E town Baisun, side valley N of the main road (38°05'33" N, 67°26'51" E, 1000 m, 28.5.2003 Fritsch, Keusgen, Khassanov 4164; GAT) TAX 6187, sandy slopes in an eroded area c. 3 km SE town Baisun S the road to Churchi (type location?, 38°12' N, 67°15' E, 1100



m, 12.5.2001 Fritsch & Hoffmann 1707; GAT) TAX 5873; SW Hissar range, red loamy slope along the road from Akrabad to Churchi at 595 km, 5 km W vill. Churchi (37°34' N, 66°43' E, 900 m, 30.4.1995 Fritsch & Khassanov 1383; GAT) TAX 5281; spurs of Kugitang ridge, Kelif-Sherabad chain, saline slopes (37°34' N, 66°43' E, 550 m, 1992 leg. Khassanov s. n.; GAT) TAX 3371.

**Remarks:** This taxon shows a rather variable tepal and filament color from white to pinkish violet (then sometimes approximating to subsp. *caspium*) or even purplish (*A. rhodanthum*), but some of the vouchers seen of the latter seem to be stained mainly by external substances, probably red soil splashed back with rain drops. Plants found in the vicinity of the town Baisun (type location of subsp. *baissunense*) grew on saline sandy slopes, but at other places this taxon prefers gypseous steep slopes growing in *Zygophyllum* associations. Unfortunately, an own search for plants of *A. rhodanthum* at the type location in southern Uzbekistan failed in 1993, the last herbarium vouchers seen from there were collected in 1976. Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) showed much infraspecific genetic diversity not correlated with the geographic origin. The samples of subsp. *baissunense* were affiliated to three well separated subgroups of sect. *Kaloprason* (Fritsch & al. 2010: 196, cluster 7 § 3.9.8; Fritsch 2012b: 255 Fig. 5 Y; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Subsp. *baissunense* shares also the identical *trnL-trnF* haplotype with subsp. *caspium* and other species of sect. *Kaloprason* (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

**Etymology:** The epithet refers most probably to the town Baisun in southern Uzbekistan, or the administrative unit named after it, where the type was collected.

**Biological data:** The genome size was 31.9 / 35 pg 2C DNA, that is somewhat larger than in subsp. *caspium* (31 pg) and may represent the range of infraspecific variation (Ohri & al. 1998 / Gurushidze & al. 2012). Fresh bulbs contain in total 0.07 % cysteine sulfoxides (26 % methiin, 74 % alliin; Keusgen & al. 2008).

**Economic traits:** The plants are strongly poisonous (Borovskij & al. 1940) with hemolytic activity (Vvedensky 1963). Very rarely offered as ornamental (Fritsch 2015).

**(76) *Allium bucharicum*** Regel in Trudy Imp. S.-Peterb. Bot. Sada 8: 660, t. 20 f. a, b, c (1884), s. str. Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 29, 355 (1887). Vved., Flora Tadzh. SSR 2: 344, tab. 61: 1, 2 (1963). Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 82 (1971). Wendelbo, Flora Iranica 76: 90, tab. 27/4 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 128 (1988). — Non *Allium bucharicum* sensu Vved., Flora URSS 4: 275 (1935); nec sensu Pavlov & Polyakov, Fl. Kazakhst. 2: 192 (1958). — **Lectotype:** Tajikistan: Ad fluvium Pändsch Bucharae orientalis (Trudy Imp. S.-Peterb. Bot. Sada 10: 355) / In Buchara orientali ad fluvium Pändsch 4000' alt. [at river Panj in East Bokhara] (= ? 4000' alt. distr. Kurgantüpe in decliv. occid. montium Karatau pr. fontan [4000 ft. elevation, district Kurgantüpe, on western slopes of Mt. Karatau near spring] Tschiglin, 10.-22.4.1883) leg. A. Regel (LE!), design. Fritsch 1990: 503).

**Distribution:** S Tajikistan, S Uzbekistan?, Turkmenistan?: S Pamir-Alai mountain ranges, submontane to montane, dry steppe slopes, *Pistacia* associations; occurrence in N Afghanistan is extremely doubtful.

**Description:** Bulbs ovoid to globose, (8) 10-25 mm in diam., (10) 15-20 mm long; inner tunics undivided, white, outer tunics strong to leathery, splitting at base and above; brown to blackish, with an indistinct neck. Scape ± flexuous, terete, slightly obconical (somewhat thicker below the umbel), smooth; 10-20 (30) cm long, (2) 3-5 mm in diam.; green with glaucous bloom, above often maroon flushed. Leaves (2) 3-6 (7), laminae oblong- to linear-lanceolate, initially prostrate then obliquely upright directed and recurved, thick, near base U-like canaliculate, above broader canaliculate; lower side densely and shallowly ribbed or nearly smooth like the upper side; margins whitish, glabrous or finely toothed, long tapering into the short apex; 15-20 (35) cm long, (5) 10-20 (35) mm broad. Sheathy prophyll very short, ± uncolored, quickly decaying. Spathe thin membranous, divided into 2-4 ovate, ± long acuminate,

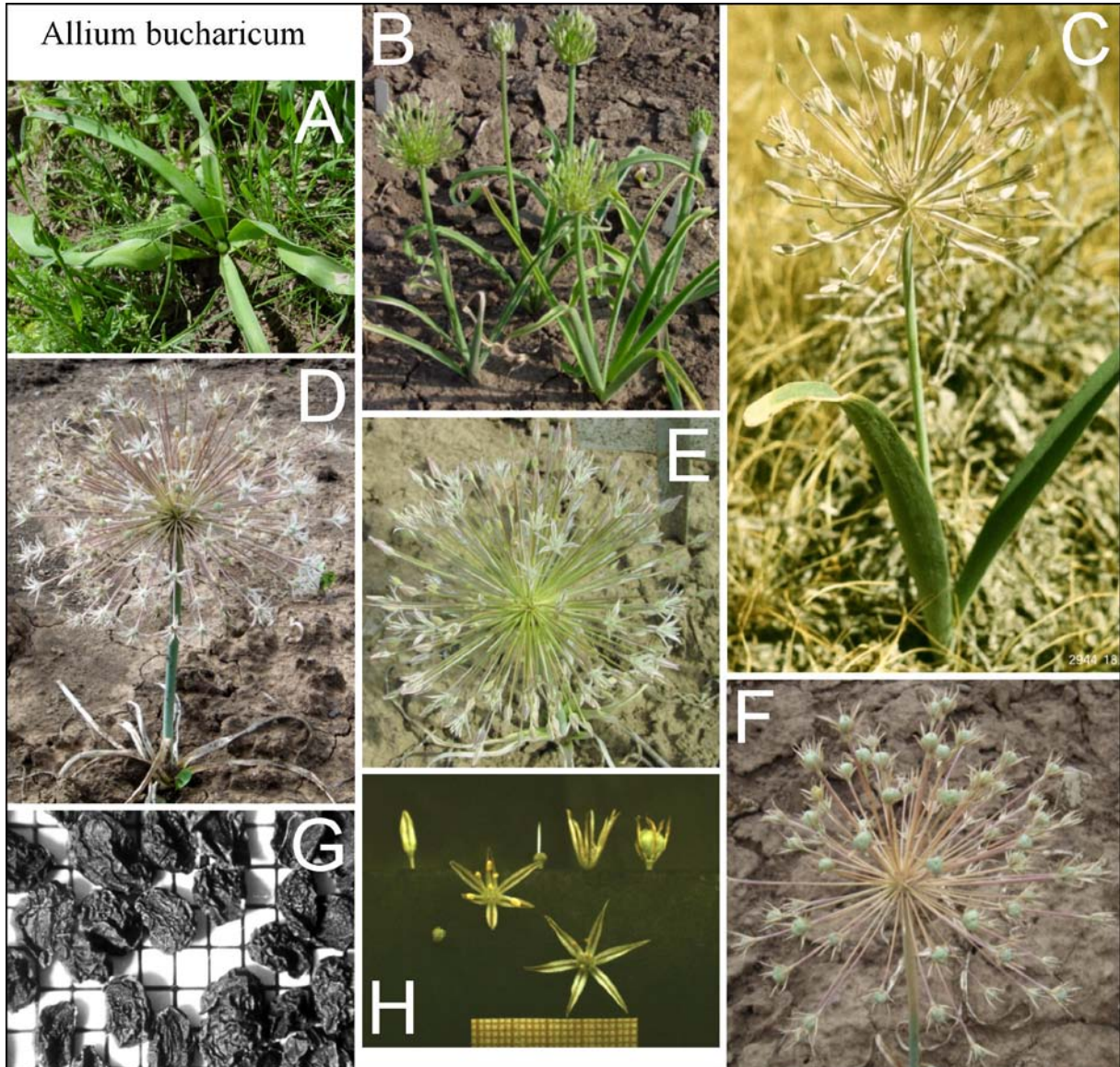


Plate (76): A: Plant in early shooting stage at the type location, Ichagli, Tajikistan; B: cultivated plants in buds; C: flowering plant at Khojakazian ridge, Tajikistan; D & E: flowering cultivated plants; F: inflorescence with developing capsules; G: seeds; H: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as background and measure scale of G & H).

finally scarcely 1 cm long valves, often disintegrating; whitish to brownish with inconspicuous veins. Inflorescence fastigiate to semiglobose, finally subglobose; very loose, many-flowered; (4) 6-10 (15) cm in diam., initially 5-7 cm long. Pedicels somewhat unequally long (shortest at the first opening flowers), thin wiry,  $\pm$  straight; dull greenish-brown to brownish-pink. Anthesis in May. Flowers widely funnel-shaped starlike. Tepals narrowly linear-lanceolate, obliquely directed,  $\pm$  acute with an incurved apex, later crumpled and stiff but not spiny; 6-8 mm long, 1.5-2 mm broad; whitish to pale rose finally buff, with a broad (especially near the base) greenish-brown median vein. Filaments  $3/4$  to as long as the tepals; basally for about 1 mm connate and inner filaments shortly widened, above subulate; whitish. Anthers oblong; nearly 2 mm long, c. 1 mm broad; grayish to yellowish pink. Pollen grayish yellow. Ovary stipitate, depressed-globose nearly hexangular, c. 3 mm long and in diam.; surface finely papillous; grayish to violet-greenish. Up to 4 ovules per locule, 12 ovules per ovary (Filimonova 1970). Nectary ducts mound near the base of ovary below the bottom of locules (Fritsch 1992b). Style conical to thread-like, 4-5 mm long; whitish. Stigma undivided; white. Capsule double obtusely triangular-pyramidal, apex with 6 obtuse bulges, 5-6 mm in diam., 4-5 mm long; valves broadly triangular with slightly notched apex. Seeds 2-4 per locule, angled flat-ovoid with sharp edges; surface densely reticulate-lacunose,

dull black; 2-2.5 mm long, 1.5-2 mm broad, 1-1.5 mm thick. The testa showed verrucose periclinal walls with few prominent verrucae, and Omega-like undulation of anticlinal walls with high amplitude and short wavelengths (Fritsch & al. 2006, Fig. 8).

Chromosomes:  $2n = 16$  Astanova 1990 (Tajikistan: Khojakazyan ridge).

Living accessions studied: Tajikistan: Vakhsh range, W-facing steep loess slope 2 km N vill. Kairagoj (37°45'31" N, 69°40' E, 700 m, 23.4.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6054; GAT) TAX 6126; Khojakazyan massif, between valley Naizabulak and the plateau below Mt. Kojpioztau (37°22' N, 68°16' E, 1200 m, 18.5.1990 Fritsch, Kudratov, Pistrick 489 A, 489 B; GAT) TAX 2943, TAX 2944.

Remarks: This species is similar to *A. protensum* but differs by more and narrower leaves, thinner scapes, smaller inflorescences with less unequal lengths of pedicels, and somewhat narrower, never yellowish or brownish colored tepals (Fritsch 2008: 65, Fig. 13 A). The occurrence in Afghanistan (Wendelbo 1971: prov. Badakhshan, and SW side of Sabzak pass) does not fit to the ecological preferences and should urgently be verified, though Wendelbo (1971) mentioned white tepals with greenish-purple median vein. Own studies of living plants from several locations in S Tajikistan confirmed this tepal color. The type specimen was probably laid into the press when in buds only, and the flowers opened in the press and does not show the correct shape of tepals. Unfortunately, plants collected at the type location in S Tajikistan died under cultivation before anthesis, and flower characters could not be verified. Molecular markers (ITS sequences of nuclear rDNA) support a closer relationship to *A. caspium* than to *A. protensum* and the other species of sect. *Kaloprason* (Fritsch & al. 2010: 196 cluster 7 § 3.9.8; Fritsch 2012b: 255 Fig. 5 Y; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region showed a low resolution, because all mentioned species shared the same haplotype (Gurushidze & al. 2010: 836, fig. 4 lineage VI).

Etymology: The epithet refers most probably to the historical administrative region of the khanate Buchara in Central Asia where the type was collected.

Biological data: Seedlings belong to the *Allium karataviense* type (Druselmann 1992). A genome size of 28.5 pg 2C DNA was reported (Ohri & al. 1998). The radical scavenger activity is moderate (Jedelska & al. 2004). Fresh bulbs contain in total 0.03 % cysteine sulfoxides (Keusgen & al. 2008).

Economic traits: The leaves are used for traditional dishes (Keusgen & al. 2004).

16.2 *A. sect. Kaloprason subsect. Ligulifolia* R.M. Fritsch  
in Linzer Biol. Beitr. 26: 978 (1994). — Type species: *Allium alexeianum* Regel

(77) *Allium alexeianum* Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 244 (1875), Regel in Izv. Imp. obshch. lyub. est. etnogr. 21, 2: t. XVI f. 4-6 (1876). Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 300, 358 (1887). Vved. (plerumque "*alexejanum*"), Flora Turkm. 1, 2: 290 (1932). Vved., Flora URSS 4: 259 (1935); Vved., Flora Uzbek. 1: 459 (1941); Vved., Flora Tadzh. SSR 2: 342 (1963), omnia p. p.; Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971). — Lectotype: Uzbekistan: Zaravshanskaya dolina, ushchel'e [Zaravshan valley, gorge] Sangy dzhizmana, 25.5. [1869? 1874?], 3561-7000', leg. O. Fedtschenko (LE!), design. Fritsch 1990: 502).

Distribution: Tajikistan, Kirgizstan, Uzbekistan, Turkmenistan?: Turkestan and Zaravshan mountain ranges, Aktau and Nuratau massifs, Kugitang ridge?, montane loamy, stony and rubble slopes.

Description: Bulbs nearly globose, 15-25 mm long, up to 3 cm in diameter; inner tunics white, membranous, outer tunics longitudinally splitting, blackish. Scape flexuous, robust, terete, obconical (thinnest near the base), smooth, in the dry state slightly ribbed and basally very brittle; 4-18 (30) cm long, (4) 5-8 mm in diam.; green with glaucous bloom, often purple flushed. Leaves 1-3, laminae ovate to oblong-elliptical, arcuately recurved, nearly leathery thick, basally shallowly canaliculate above even; upper and lower sides smooth or with some shallow grooves, glabrous; margins smooth or basally slight-

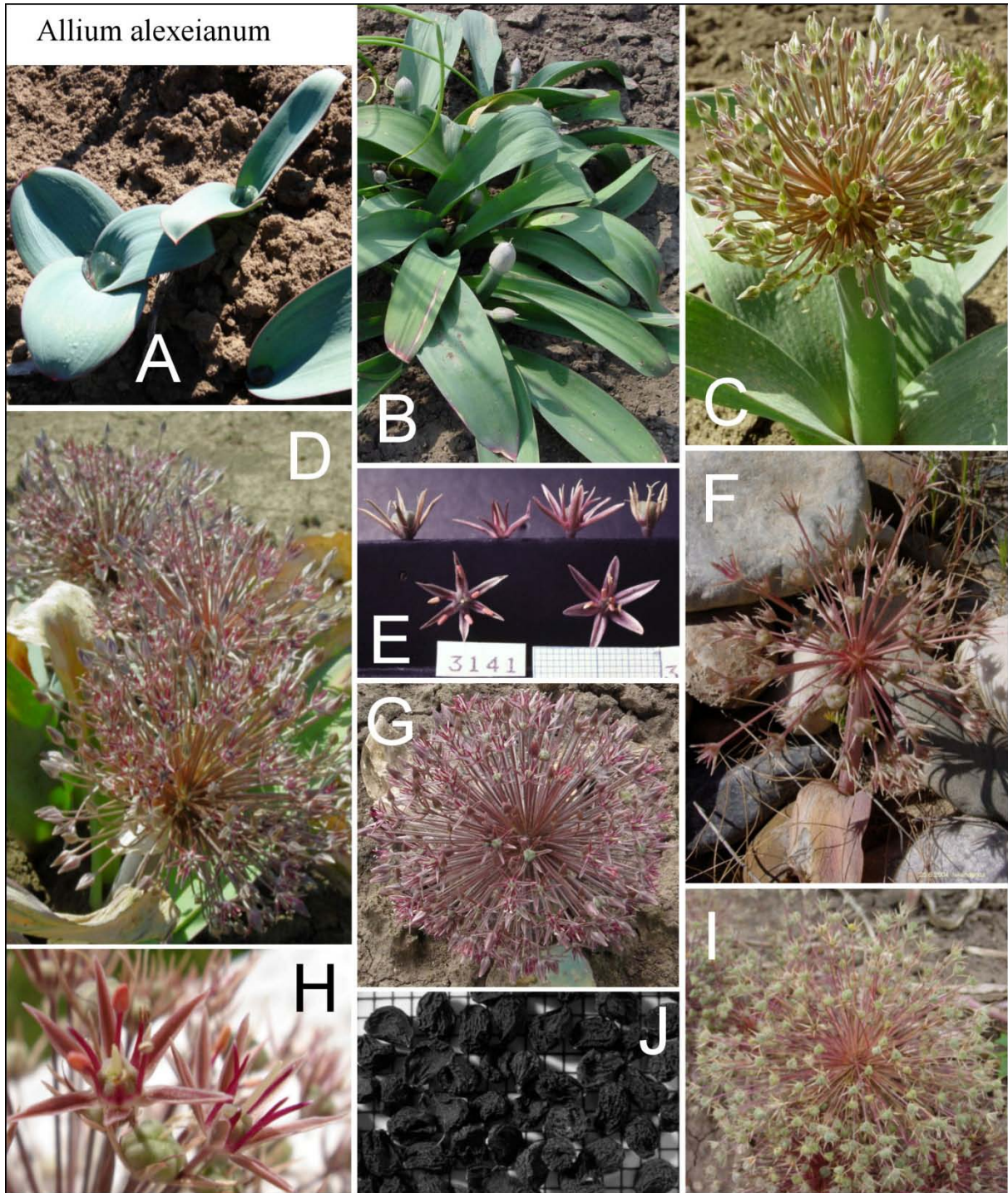


Plate (77): A & B: Sprouting leaves of cultivated plants; C, D & G: cultivated plant in early, full, and late anthesis, resp.; E: comparison of flowers and flower parts in different stages of anthesis; F: plant at end of anthesis near lake Iskanderkul, Tajikistan; H: close-up of flowers; I: inflorescence with full-sized capsules; J: seeds (millimeter paper as background and measure scale of E & J).

ly scabrous, purplish later white, shortly tapering into the  $\pm$  hooded apex; 10-20 (25) cm long, 2.5-7 (9) cm broad; greenish-violet, later grayish-green, with strong glaucous bloom. Sheathy prophyll short, thickish, purplish, moderately late decaying. Spathe membranous,  $\pm$  completely divided into 2-3 ovate, shortly acuminate, 2-2.5 cm long valves; whitish with purplish veins. Inflorescence initially broadly fasciculate to semi-globose, later irregularly subglobose; very loose,  $\pm$  many-flowered; in anthesis 7.5-10 (14) cm, in the fruiting stage up to 20 cm in diameter. Pedicels initially subequally long, straight; the later flowers on longer and ascending pedicels, wiry; semi-glossy pale brown to purple. Anthesis in May to June (July). Flowers broadly funnel-shaped starlike. Tepals lanceolate,  $\pm$  acute,  $\pm$  canaliculate,

stiff, obliquely sideways directed, after anthesis prickly with thickened median vein and convolute margins; 6-9 (10) mm long, c. 1.8-2.5 mm broad; dirty red or greenish-brown paler towards the margins; median vein narrowly lanceolate, greenish- to brownish-purple, thickened near the base. Filaments 3/4 - 4/5 as long as the tepals; basally shortly connate and the inner filaments long-triangular and 2-3 times more widened than the shortly triangular outer filaments, above subulate; pale brown to dark carmine with paler base. Anthers oblong; nearly 2 mm long and 1 mm broad; yellowish-violet to maroon. Pollen pale yellow. Ovary initially stipitate, depressed-globose to pear-shaped triangular, sides with convex base, 2-3 mm long, 3-4 mm in diameter; surface very finely tuberculate; green with violet flush. Up to 15 / 12 ovules per ovary were reported (Filimonova 1970 / Vvedensky 1932). Nectary ducts mound near the base of ovary below the bottom of locules (Fritsch 1992b). Style  $\pm$  conical-threadlike, 3-5 mm long; whitish later brownish. Stigma undivided; whitish. Capsule depressed globose triangular, surface finely coarse, sometimes with six small humps near the tip, basally sides slightly concave, 5-8 mm long and in diameter; dull grayish green, ripe greenish buff; widely open, valves nearly orbicular, shallowly notched at the tip, surface reticulate-lacunose. Seeds 1-2 (3) per locule; oblong to drop-shaped, edged; surface finely papillous and densely reticulate-lacunose, silk-glossy black; 2.5-3 mm long, 1.8-2.5 mm broad, 1.5-1.8 mm thick; TKW 4.32 g (IPK, unpubl. data).

**Chromosomes:**  $2n = 16$  Vakhtina 1969 p. 147, Vakhtina & al. 1977 total length of chromosomes (Uzbekistan?: Zaravshan range, no. 788).  $2n = 16$  Astanova 1990 (Tajikistan: Zaravshan range, lake Marguzar, Zaprjagaev no. 1168).  $2n = 16+0-4B$  Pogosian & Seisums 1992 (Tajikistan: Zaravshan range, gorge Antara-sara, Seisums s. n.).  $2n = 16$  Gurushidze & al. 2012 (Tajikistan: Zaravshan range, Karakul valley TAX 6291).

**Living accessions studied:** **Uzbekistan:** Turkestan range, Zaamin valley, above the highest sanatorium (39°38' N, 68°29' E, 2200 m, 04.6.2006 Fritsch & Khassanov 4242; GAT) TAX 6528. **Tajikistan:** Aini region, N slope of Hissar range, W steep slopes E lake Iskanderkul, left side of Saritag river Mt. Qozkhona (39°03'36.9" N, 68°20'45.4" E, 2350 m, 24.6.2004 Fritsch, Hisoriev, Keusgen 6136; GAT) TAX 6284, Mt. Qozkhona next valley E of mouth of Saritag river (39°03'52.8" N, 68°20'32" E, 2500 m, 24.6.2004 Fritsch, Hisoriev, Keusgen 6140, TAX 6288; 39°04'00.6" N, 68°20'24.2" E, TAX 6141; GAT), 2 km W Saritag, left side of Karakul river, S slope, Gorti qara, Mt. Emagan (39°03'20.3" N, 68°16'48.8" E, 2975 m, 25.6.2004 Fritsch, Hisoriev, Keusgen 6144; GAT) TAX 6291, slopes S the road above the efflux of Iskander-Darja from lake Iskanderkul (39°05' N, 68°24' E, 2300 m, 31.7.1991 Fritsch 710; GAT) TAX 3141; Zaravshan range, Panjakent region, crest of the mountain at W side of the end of 7th lake (39°06'12.3" N, 67°50'35.6" E, 3100 m, 28.6.2004 Fritsch, Hisoriev, Keusgen 6158; GAT) TAX 6303; Turkestan range, Kusavlisai valley above the station (39°32' N, 68°38' E, 3000 m, 13.8.1988 Fritsch 377; GAT) TAX 2557.

**Remarks:** *Allium alexeianum*, the type species of subsect. *Ligulifolia*, belongs to the rather large group of subg. *Melanocrommyum* species possessing long elliptic to ovate leaf laminae, that are  $\pm$  violet during unfolding, and later bluish-green. In anthesis, *A. alexeianum* (central parts of Turkestan and Zaravshan mountain ranges) is rather similar to its vicariant species *A. nevskianum* (Hissar mountain range) that has commonly paler flowers, but after anthesis the tepals of *A. alexeianum* become stiff and prickly, and those of *A. nevskianum* remain soft becoming only crumbled (Fritsch 2012b: 256, Figs. 61 and 62). Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) support affiliation of *A. alexeianum* to sect. *Kaloprason* with *A. nevskianum*, *A. caspium* s. lat., and *A. protensum* as closest relatives; *A. gypsaceum* and *A. aroides* as well as *A. sarawschanicum* are more distantly related (Fritsch & al. 2010: 196 cluster 7 § 3.9.8; Gurushidze & al. 2010: 836, lineage VI; Fritsch 2012b: 255-256 Fig. 5 Y; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). There is no closer relationship to sect./subsect. *Acanthoprason* as proposed by Kamelin (1973) and Seisums (1994). The morphological appearance of *A. alexeianum*, especially plant height and leaf number, is generally strongly influenced from growth conditions. The type specimen opened the flowers apparently only in the press and shows therefore relatively too large leaves.

Occurrence in the Kugitang ridge (Turkmenistan) remains very doubtful, no living plants could be studied. The determinations trace back to Vvedensky (in Nevski, Trudy Bot. Inst. Akad. Nauk SSSR ser. 1 vyp. 4: 330, 1937) when *A. nevskianum* was still not separated. It seems more logical to assume that *A. nevskianum* is distributed till Kugitang ridge.

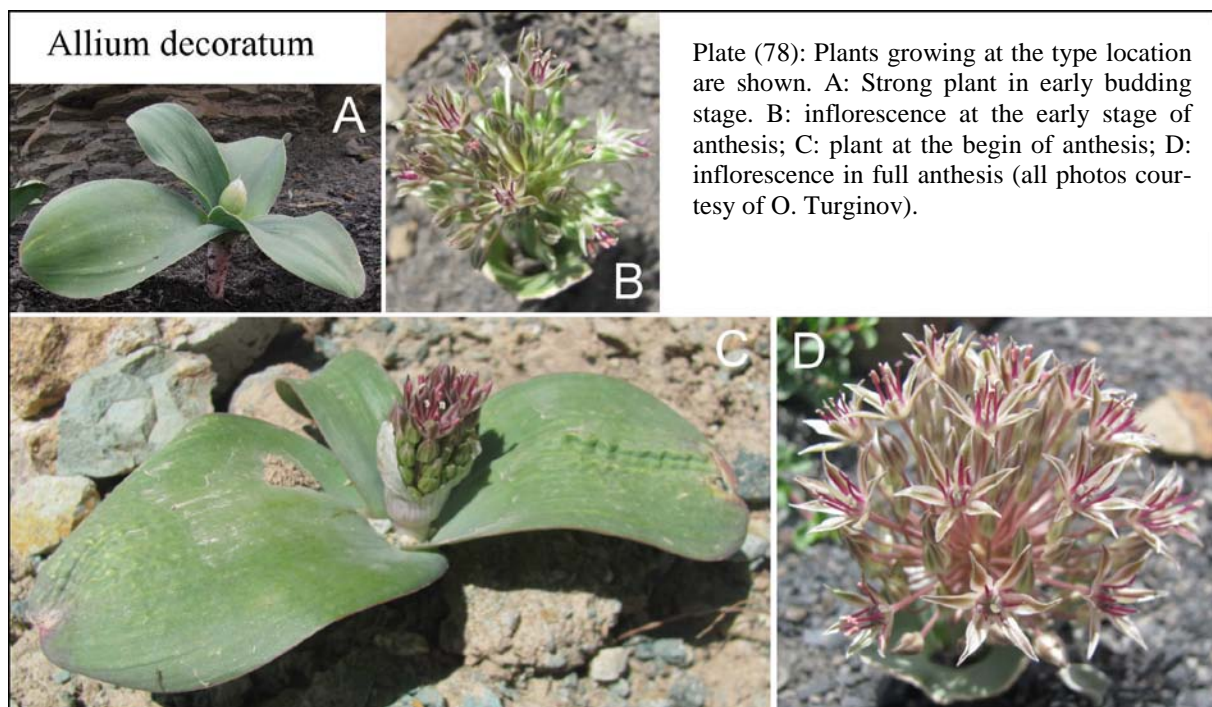
**Etymology:** The epithet honors the early deceased scientific explorer, geographer and cartographer of the western Pamir-Alai mountain region in Central Asia, Aleksey Pavlovich Fedtschenko (1844-1873).

**Biological data:** The seedlings belong to the *Allium karataviense* type (Druselmann 1992). Genome size [2C DNA] was reported as 31.5 pg (Vakhtina & al. 1977), 29.8 pg (Zakirova 1989), 31.6/34.2 pg (Gurushidze & al. 2012), that is lower than in *A. nevskianum* (36.6 pg). Bulb extract showed a low radical scavenger activity (Jedelská & Keusgen 2008). Fresh bulbs contain in total 0.09 % cysteine sulfoxides (60 % methiin, 40 % isoalliin), inflorescences contain in total 0.05 % cysteine sulfoxides (42 % methiin, 58 % isoalliin), leaves contain in total 2.48 % cysteine sulfoxides (37 % methiin, 63 % isoalliin) (Keusgen & al. 2008).

**Economic traits:** In Tajikistan leaves and bulbs are used as vegetable ('khujrog', 'kadk') for the national meal 'oshtupa', dried leaves also as spice (Keusgen & al. 2004, Keusgen & Fritsch 2008). Traded as ornamental plant and listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991), also mentioned as parent of registered cultivars (Fritsch 2015).

**(78) *Allium decoratum*** Turginov & Tojibaev in Phytotaxa 177 (5): 292, fig. 1 (2014). — **Type:** Uzbekistan, Pamir-Alai: SW Hissar Range, Baisuntau, Khojagurgurata, location Khodja Kuchkorata, subalpine stony and rocky slopes, 2650 m, N 38.31683° E 067.24160°, 12.6.2013 leg. Turginov (holotype TASH!, isotype B! bar-coded B 10 0594001).

**Distribution:** Uzbekistan: SW Hissar mountain range, subalpine and alpine stony and rocky slopes (altitudes c. 2650–3200 m), sometimes sheltered by stones. Only known from Khodja Kuchkorata and Sanjar in Khojagurgurata Mts., and Besharcha in Chulbair Mts.



**Description:** Bulbs depressed-globose, not ovoid, without bulblets, 1.5-2 (3) cm in diameter, ca. 1.2 cm long, inner tunics white, outer tunics papery, whitish. Scape ascending, terete; 10-15 cm long, up to 4-5 mm in diameter, sometimes thicker. Leaves 1, sometimes 2-3, up to 4, laminae lanceolate, oblong to elliptic; 9-10 cm long, c. 3-3.5 cm wide in the middle. Spathe membranous, up to 1 cm long, 2.5-3 times shorter than the inflorescence, shortly acuminate. Inflorescence semi-globose (globose in the fruiting stage); multiflorous. Pedicels subequally long, straight; up to 3 cm long; reddish. Anthesis in June. Tepals lanceolate, apex obtuse; 5 mm long, 1.5-2 mm wide; pale red (in the dry stage whitish), median vein red (in the dry stage vinous). Filaments slightly longer than the tepals; basally for 1.5 mm connate and adnate to the tepals; purplish. Anthers c. 1-1.2 mm long; reddish. Capsule and seeds not known.

**Remarks:** Description and taxonomic remarks were adapted from the original description. This new species differs from *A. alexeianum* by not thickened scapes 4-5 mm (not 7-14 mm) in diameter, filaments longer than the perianth (not shorter or 1.5 times shorter than the perianth), with red (not pink) tepals and vinous (not purple) median veins and  $\pm$  equal pedicels (not unequal in most plants). It differs from *A. nevskianum* by whitish tunics (not darkish), longer filaments (not shorter than the tepals) and also by pale red tepals with red median veins (not pink with purple median veins). Molecular markers (internal transcribed spacer region, ITS) positioned a specimen from Khojagurgurata among members of sect. *Kaloprason* subsect. *Ligulifolia* (Gurushidze & Blattner in Fritsch & Abbasi 2013: 201, as "specGur13"), but with a long branch. This long branch is a good indication that the specimen represents indeed a new species.

**Etymology:** The epithet refers most probably to the ornamental appearance of this taxon.

(79) *Allium nevskianum* Vved. ex Wendelbo in Bot. Notiser 122: 37 (1969), p. p. quoad typam. Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971), p. p., quoad basion.; Kamelin & Seisums in Novosti sist. vyssh. rast. 30: 32 (1996). *Allium alexeianum* Regel var. *hissaricum* Lipsky in Trudy Imp. S.-Peterb. Bot. Sada 18: 136 (1900). — *Allium alexeianum* sensu Vved., Flora USSR 4: 259 (1935); Vved., Flora Uzbek. 1: 459 (1941); Vved., Flora Tadzh. SSR 2: 342 (1963), omnia p. p. *Allium nevskianum* Vved. [& Kovalevskaya], Opred. rast. Srednej Azii 2: 316 (1971), nom. illeg. Type: Pamiro-Alaj. Ad declivia saxosa montium Tschulbair ad pedes [on rocky slopes of Mt. Chulbair near the foot of Chodsha-barku, alt. ca. 3000 m, leg. 30.6.1936 Vvedensky (TASH?; HFIURSS no. 5434 "30.6.1929" JE! LE!). — **Type:** Uzbekistan: Verkhov'ya Tupalanga, per. [height of Tupolang, pass] Sary-socho, 7780', 11.6.1897, leg. Lipsky 621 (holotype of *A. alexeianum* var. *hissaricum* Lipsky, LE!).

**Distribution:** Tajikistan, Uzbekistan, NW Afghanistan?: Central and SW Hissar range, Karategin ridge, open montane stony and rubble slopes; occurrence in E Afghanistan is extremely doubtful.

**Description:** Bulbs depressed-globose, up to 25 mm long and in diam.; inner tunics papery, whitish, outer tunics gray-brown to blackish-red, parchment-like, longitudinally splitting, finally disintegrating. Scape flexuous rarely  $\pm$  straight, terete,  $\pm$  obconical, smooth; 5-18 cm long, 4-12 mm in diam.; green with strong glaucous bloom, basally often maroon flushed. Leaves 1-2 (3), laminae long (ob-)ovate, flat arcuately prostrate, leather-like thick,  $\pm$  flat canaliculate; upper and lower sides with broad ribs; margins narrowly red to white, below finely toothed-ciliate, glabrescent above, shortly arcuately tapering into the short, hooded apex; 12-35 cm long, 2-7 (12) cm broad; initially greenish-violet later green with strong glaucous bloom. Sheathy prophyll short, thickish, brownish finally uncolored, quickly decaying. Spathe finely membranous, completely divided in 2-5 triangular to ovate valves; pale brown with darker veins. Inflorescence initially fasciculate to semi-globose, dense, later subglobose and loose, 6-12 cm in diameter; many-flowered. Pedicels  $\pm$  unequally long (the longest at last flowers), thin wiry, straight later lower pedicels ascending; glossy brown. Anthesis in May to July. Flowers broadly funnel-shaped starlike. Tepals lanceolate, obliquely directed, canaliculate, especially the subobtuse apex also plicate and subrecurved, later margin enrolled and tortuous, vein thicker but not stiff; 8-10 (12) mm long, 1.5-2 mm broad; pink or purple, fading from the narrowly lanceolate, purple-greenish median vein towards the margins. Filaments 2/3-3/4 as long as the tepals, basally for c. 1 mm connate and (outer filaments only slightly) triangular widened, above subulate; violet, fading towards the whitish base. Anthers ovoid to oblong; 1.5-2 mm long, c. 1 mm broad; pale violet to purple. Pollen yellowish-gray. Ovary stipitate, flat pear-shaped nearly hexangular, 2-3 mm long and in diam.; surface finely papillous; vividly green somewhat brownish flushed. Nectary ducts mound near the base of ovary below the bottom of locules (Fritsch 1992b). Style threadlike, 2-5 mm long; whitish finally carmine. Stigma undivided; whitish. Capsule triangular conical-depressed globose, sessile, surface very dull papillous, 4-5 mm long, 5-7 mm in diam.; valves obovate-suborbicular, slightly notched at the apex. Seeds 1-2 per locule, flat ovate to semi-circular, somewhat edged; surface finely papillous with many raised wrinkles, dull black; c. 3 mm long,

2-2.5 mm broad, c. 2 mm tick. The testa showed transitions from S-like to U-like undulated anticlinal walls and verrucate periclinal walls (Kruse 1994).

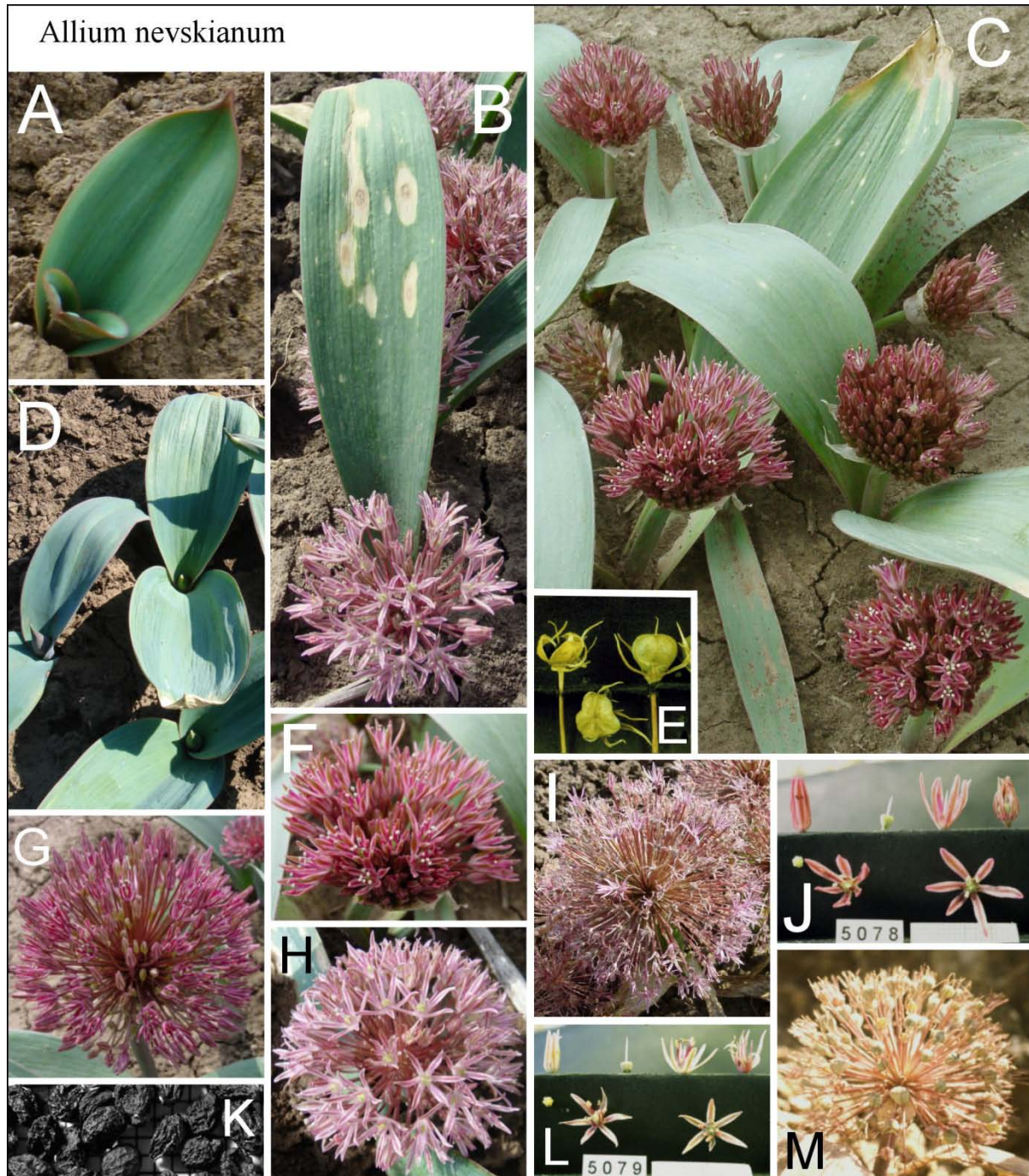


Plate (79): Cultivated plants are shown. A: Sprouting leaves; B & C: plants in early anthesis; D: plants in early shooting stage; E: ripe capsules; F — I: inflorescences in early, full, and late anthesis, resp.; J & L: comparisons of flowers and flower parts in different stages of anthesis, different color variants; K: seeds; M: inflorescence with developing capsules (millimeter paper as background and measure scale of J, K & L).

**Chromosomes:**  $2n = 16$  Vakhtina 1964a (Uzbekistan: SW Hissar range, Surchandarya province "*A. alexejanum*").  $2n = 16$  Zakirova & Vakhtina 1974 (Uzbekistan: SW Hissar range, Gul'boir Mts. no. 758V "*A. alexejanum*").  $2n = 16$  Vakhtina 1985 (Tajikistan: Varzob valley, Dushanbe, no. 728 "*A. alexejanum*").  $2n = 16$  Fritsch & Astanova 1998 Table 2 (Tajikistan: Hissar range, Varzob valley, Jirinod creek TAX 2262, Kharongon gorge TAX 2269).  $2n = 16$  Gurushidze & al. 2012 (Uzbekistan: SW Hissar range, pass Artusgar TAX 5451).  $2n = 16$  IPK *Allium* reference collection ideogram (Estonia: Botanical collection Tallin, from Tajikistan: Chinoro, TAX 2399).

**Living accessions studied:** **Uzbekistan:** West Hissar range, valley of Sangardag river (38°31'57.3" N, 67°34'44" E, 1179, 18.5.2009 Keusen, Khassanov 4288; GAT) TAX 6743, side valley of Sangardak river, loamy slope c. 1 km



SE vill. Bakhcha (38°35' N, 67°28' E, 1700 m, 12.5.2001 Fritsch & Hoffmann 1716; GAT) TAX 5878; SW Hissar range, drainage of Tupalang river, pass Artusgar c. 9 km N Chovat in direction to Khodzichisora, c. 72 km N Denau (2900 m, 24.7.1995 Pistrick 160; GAT) TAX 5451; granitic and gneiss slopes E pass Kumakhty (38°40' N, 67°57' E, 2600 m, 17.7.1994 Fritsch, Khassanov, Pistrick 1269; GAT) TAX 5079, S exposed rubble slope of Mt. Khoja-Kiikkolon (38°45' N, 67°58' E, 3200 m, 16.7.1994 Fritsch, Khassanov, Pistrick 1268; GAT) TAX 5078. Tajikistan: Central Hissar range, drainage of Varzob river, E exposed rock slope in Ojuk valley E vill. Varzob c. 22 km N Dushanbe (38°47' N, 68°50' E, 1340 m, 06.5.1990 Fritsch, Kudratov, Pistrick 437; GAT) TAX 2929, Chinoro valley (from Botanic Garden Tallin 1982, no. 472/87; GAT) TAX 2399, drainage of Jirinod creek opposite to Kondara valley (38°49' N, 68°50' E, 1800 m, 17.5.1987 Fritsch 164; GAT) TAX 2262, Kharongon valley above vill. Dara (38°42' N, 68°53' E, 2370 m, 20.5.1987 Fritsch 175; GAT) TAX 2269.

Remarks: This species has a rather complicated history. Wendelbo (1969: 39) referred to a letter from Vvedensky when he raised *A. alexeianum* var. *hissaricum* to species level as *A. nevskianum* as proposed determination for vouchers from Afghanistan. However, soon it became visible in Wendelbo (1971) that he did not mean the taxon from Hissar mountain range but another taxon later validly described as *A. hindukuschense* Kamelin & Seisums (1996). Vvedensky & Kovalevskaya (1971) newly described *A. nevskianum* with a different type voucher mentioning Lipsky's variety only indirectly. Nevertheless, according to the International Code, *A. nevskianum* [Vvedensky ex] Wendelbo remains the valid name at species level for the taxon to which var. *hissaricum* belongs (irrespective that some character states like the presence of only one leaf turned out to be accidental), and the state of *A. nevskianum* Vvedensky (1971) remained invalid irrespective that Kamelin & Seisums (1996: 32) proposed an emendated description. Molecular markers (ITS sequences of nuclear rDNA) presented evidence that *A. nevskianum* is no member of sect. *Acanthoprason* but of sect. *Kaloprason* (Fritsch & al. 2010: 196 cluster 7 § 3.9.8; Fritsch 2012b: 255 Fig. 5 Y, 256; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201), but only accessions from the type location (nevs5079 and nevs5451) formed a well supported subgroup, while accessions from other parts of the Hissar range were positioned among related taxa. Sequences of the plastid *trnL-trnF* region (Gurushidze & al. 2010: 836, fig. 4) belonged even to three haplotypes inserted at different positions in the lineages IV and VI, but confirmed the same general relationships like the ITS markers. As already discussed above, *A. alexeianum* and *A. nevskianum* are vicariant species that differ only in details of tepal color and shape when in anthesis, but later the tepals of *A. alexeianum* become stiff and prickly, those of *A. nevskianum* remain soft becoming only crumbled.

Etymology: The epithet honors the early deceased Russian taxonomic botanist Sergei Arsentsevich Nevski (1908-1938).

Biological data: The genome size of 36.6 pg 2C DNA is larger than in *A. alexeianum* (31.6 / 34.2 pg; Gurushidze & al. 2012).

Economic traits: Similar to and formerly not separated from *A. alexeianum*; still sometimes traded under that name as ornamental, also hybrids and cultivars are offered (Fritsch 2015).

**(80) *Allium protensum*** Wendelbo in Bot. Notiser 121: 276, f. 3 (1968). Wendelbo, Flora Iranica 76: 89, tab. 9/129, tab. 27/3 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 128 (1988). — *Allium schubertii* sensu Regel in Trudy Imp. S.-Peterb. Bot. Sada 3, 2: 239 (1875), p. p., Regel in Trudy Imp. S.-Peterb. Bot. Sada 10: 299, 356 (1887). *A. schubertii* sensu Vved. (incl. *A. bucharicum*), Flora Turkm. 1, 2: 288 (1932); Vved., Flora URSS 4: 275, tab. 16 fig. 2, 2a (1935); Vved., Flora Uzbek. 1: 464 (1941); Pavlov & Polyakov, Fl. Kazakhst. 2: 192 (1958); Nikitina & al., Flora Kirg. SSR, Dopoln. vyp. 1: 52 (1967); *A. schubertii* sensu Lapin, Opredel. rast. Tashk. oazisa 1: 81 (1938), sensu Vved. excl. *A. bucharicum*, Flora Tadzh. SSR 2: 357 (1963); Vved. [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 87 (1971), omnia non *A. schubertii* Zucc. s. str. (1843). ? *Allium nevskianum* sensu Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 128, quoad tab. 18 fig. 1. (1988). — Type: Afghanistan: Bamian, E of Nayek on road from Band-e Amir to Panjao, dry stony slope, 2800 m, 30. 6.1962, leg. Hedge & Wendelbo W4815 (holotype BG, isotype E, not seen).

**Distribution:** N-and NW Afghanistan, Turkmenistan, Uzbekistan, Kirgizstan, Tajikistan, Kazakhstan: lowland to montane semi-deserts and rubble slopes, on sandy to clayey and gypseous soils.

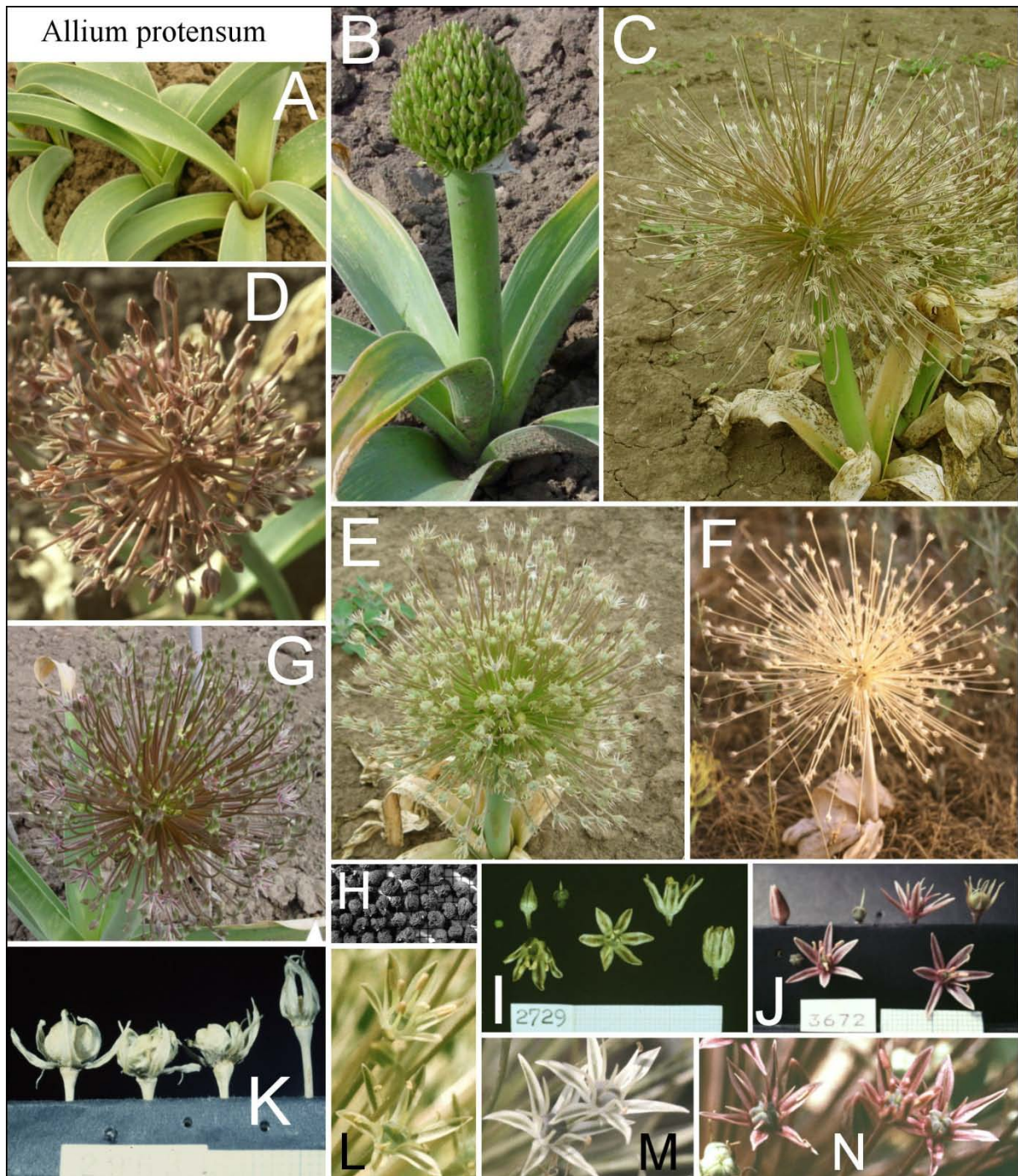


Plate (80): A & B: Cultivated plants in early and late shooting stage, resp.; C cultivated plants in full anthesis; D & G: inflorescences of cultivated plants in early anthesis; E: cultivated plant in late anthesis; F: plant with infructescence in Ulken-Burul, Kazakhstan; H: seeds; I & J: comparisons of flowers and flower parts in different stages of anthesis, crème and purplish flower variants; K: ripe capsules, right missing capsule of an outermost flower; L, M & N: close-up of flowers, L crème, M pale, N purplish flowers (millimeter paper as background and measure scale of H, I, J & K).

**Description:** Bulbs ovoid to globose, 2-3 cm in diam.; inner tunics strong membranous, whitish to red-dish, outer tunics grayish yellow, finally blackish, strong to leathery, above and below longitudinally splitting and disintegrating. Scape ± flexuous, terete, initially cylindrical later obconical (thinnest near base), solid (hollow in the dry state), smooth; 10-25 (45) cm long, 6-12 (very strong plants near the apex up to 25) mm in diam.; green with glaucous bloom, basally maroon flushed. Leaves (2) 3-6 (8), laminae

lanceolate to linear-oblong, ± flat arcuately recurved, thick, broadly canaliculate above shallower; upper side smooth or grooved, lower side shallowly and broadly ribbed; margins red later white, toothed in the lower half, above glabrescent, shortly tapering into the slightly hooded apex; 10-25 (45) cm long, 1-7 (10) cm broad; dull gray-green with strong glaucous bloom. Sheathy prophyll mostly short, tender, smooth, whitish, soon decaying. Spathe membranous, early divided in 2-many acute, 15-20 mm long valves; whitish with brownish veins. Inflorescence ± globose; many- to plenty-flowered but very loose; fruiting sometimes more than 30 cm in diam. Pedicels very unequally long, thickish wiry, straight or slightly ascending, tip thickened; pedicels of the latest (sterile) flowers 6-12 cm long, of fertile flowers about half as long; dull brownish, basally green. In the dry state very brittle. Anthesis in April to June (long continued). Flowers broadly funnel-shaped starlike. Tepals linear-lanceolate to lanceolate, ± obtuse, apex often plicate like hooded, obtusely directed and slightly twisted, canaliculate, later stiff, often contorted and margins enrolled, position unchanged or irregular, encasing the capsules; 7-8 (10) mm long, outer tepals 1.8-2.5 mm broad, inner ones up to 3 mm broad; whitish to pink and pale brown (in dry state dirty white), median vein narrowly lanceolate, greenish-brown (dry reddish), outside reaching up to 4/5 of tepal width, slightly thickened. Filaments c. 2/3 to 4/5 as long as the tepals; basally for 0.5 mm connate and triangularly widened (inner filaments twice broader), above subulate; whitish or brownish to bright violet, paler above. Anthers oblong to ovoid; 1.5-2 mm long, c. 0.8 mm broad; pinkish-brown or yellow. Pollen grayish-yellow. Ovary shortly stipitate, hexangular depressed-globose, c. 2 mm long, 3-4 mm in diam.; surface acutish papillous; initially brownish later green, often violet suffused. Up to 6 / 2-3 ovules per locule, 18 ovules per ovary (as *A. schubertii*, Vvedensky 1932 / Filimonova 1970). Nectary ducts mound near the base of the ovary below the bottom of locules (Fritsch 1992b). Style conical-threadlike, 2-4 mm long; whitish. Stigma undivided; white. Capsule nearly double pyramidal triangular, surface finely scabrous with many wrinkled bumps, 6-7 mm in diam., 4-5 (6) mm long; widely open, valves ovate to cordate clearly notched at the apex; dull greenish-white, dry buff. Seeds 2 (3) per locule, broadly ovoid to drop-shaped with sharp edges; surface papillous with longitudinal raised wrinkles; 2-2.5 mm long, 1.5-2 mm broad, (1.3)1.5-2 mm thick. TKW 3.85 g (IPK, unpubl. data). The testa showed verrucose periclinal walls and showed an intermediate type between U-like and Omega-like undulation of the anticlinal walls with varying amplitude and short wavelengths (Kruse 1988, Abb. 33; Fritsch & al. 2006).

Chromosomes: 2n = 16 Vakhtina 1964a, Vakhtina 1969 p. 147 (Uzbekistan: Hissar range, no. 9. "*A. schubertii*"). 2n = 16 Pedersen & Wendelbo 1966 (Afghanistan: Bamian, E Nayek, H&W 4815, type location of *A. protensum*, "*A. bucharicum*"). 2n = 16+0-1B Zakirova & Vakhtina 1974 karyotype (Kazakhstan: Chu-Ili-Mts., Anarkhai, no. 166; Taukum desert, Ajdarly, no. 187 "*A. schubertii*"). 2n = 16 Astanova 1990 (Tajikistan: Mogoltau massif, Turakulov 1193 "*A. schubertii*"). n = 8 Vakhtina & al. 1977 total length of chromosomes (Russia; Botanical collection BIN "*A. schubertii*"). 2n = 16 Fritsch (Kazakhstan: Karatau range, Ulken-Burul TAX 5045; see karyolog. appendix for karyotype, Kazakhstan: between Kapchagai and Karagach TAX 2963; Uzbekistan: SW Hissar range, Chakchar Mts., vill. Shurob TAX 3665). 2n = 32 IPK Allium reference collection ideogram (Germany: Botanical collection Leipzig TAX 1652).

Living accessions studied: Uzbekistan: SW Hissar range, Chakchar massif 5 km SE Dekhkanabad (38°17'38" N, 66°37'43" E, 1150 m, 26.5.2003 Fritsch, Keusgen, Khassanov 4145; TASH), Chakchar massif W Baisun, E side of main pass, canyon c. 1 km N of the road (38°15' N, 66°50' E, 1200 m, 16.5.1993 Fritsch & Khassanov 835; GAT) TAX 3663, N slope of Sarymask massif c. 3 km SE vill. Shurob (38°12' N, 66°58' E, 1150 m, 11.5.2001 Fritsch & Hoffmann 1705; GAT) TAX 5871, S slopes near vill. Shurob above the branch to Baisun (38°12' N, 66°77' E, 1250 m, 16.5.1993 Fritsch & Khassanov 842; GAT) TAX 3665; Kugitang ridge, W exposed slopes above vill. Panjob (38°02'40.1" N, 66°51'28.3" E, 1600 m, 02.6.2006 Fritsch & Khassanov 4240; TASH), W exposed slopes in the valley Baglidarasai c. 20 km W Gulistan (37°55' N, 66°47' E, 1400 m, 17.5.1993 Fritsch & Khassanov 851; GAT) TAX 3667; spurs of Kugitang ridge, Kelif-Sherabad chain, saline slopes (collected by Khassanov, 37°34' N, 66°43' E, 550 m, 20.5.1991 via Fritsch s. n.; GAT) TAX 3146; Zaravshan range S Samarkand, granitic slopes S pass Tachta-Karacha (39°17' N, 66°55' E, 1700 m, 19.5.1993 Fritsch & Khassanov 867; GAT) TAX 3672, c. 2 km S pass Takhta-Karacha (1570 m, 13.7.1994 Fritsch, Khassanov, Pistrick 1243; GAT) TAX 5071; Kashkadarya province, heights near river Ura-Darja, from *Allium* collection of Khassanov (2000, 07.5.1992 Fritsch 721; GAT) TAX 3335; relicts of the *Allium* collection in Bot. Garden Tashkent (24.6.1988 Fritsch 239; GAT) TAX 2574. Tajikistan: Valley of Syrdarya river, *Artemisia* dominated semi-desert c. 5 km E vill. Sangar (40°25' N, 70°05' E, 01.6.1990 Fritsch, Kudratov, Pistrick 585; GAT) TAX 2961. Kazakhstan: Semidesert N

Alma-Ata near Karagach (44°00' N, 77°07' E, 500 m, 08.6.1990 Fritsch 603; GAT) TAX 2963; Karatau range, SW slopes of Mt. Ulkun-Burul W Jambul (42°53' N, 71°06' E, 700 m, 13.5.1993 Fritsch 805; GAT) TAX 3728, top of Mt. Ulken-Burul (42°54' N, 71°06' E, 800 m, 30.6.1994 Fritsch, Khassanov, Pistrick 1174; GAT) TAX 5045; region of lake Aral, desert Taukum, Buratyshkan, sands (1988 from Botanic Garden Acad. Alma-Ata s. n.; GAT) TAX 2729; area of lake Balkhash, sandy to gritty dunes in the Ili river lowland c. 20 km N Bakanas (44°52' N, 76°14' E, 390 m, 03.6.1993 Fritsch 956; GAT) TAX 3727.

**Remarks:** Formerly Asiatic authors named *A. protensum* generally as *A. schubertii* because of the similar shape of the inflorescences, but the scape is shorter, the flowers are funnels-shaped (not flat star-shaped), the tepals show a dark (not inconspicuous) median vein and remain stiff (not crumpled) after anthesis, and the surface of the ovary is very coarse (not nearly smooth). The most common form of *A. protensum* has yellowish-brown tepals with a brown median vein and prefers loamy semi-desert plains. On dry rocky steppe slopes in Central Asia also plants occur with longer, whitish tepals with a green median vein, or pinkish-carmine tepals with a purple median vein; their taxonomic state is not clear yet. Molecular markers (ITS sequences of nuclear rDNA, with a lower resolution also sequences of the plastid *trnL-trnF* region) positioned *A. protensum* among the other members of sect. *Kaloprason* (Gurushidze & al. 2010: 836, fig. 4 lineage VI; Fritsch & al. 2010: 196, cluster 7 § 3.9.8; Fritsch 2012b: 255 Fig. 5 Y, 256; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). True *A. schubertii* is nested within sect. *Melanocrommyum* ("schb~" Gurushidze & al. 2010: 836, fig. 4 lineage I; Fritsch & al. 2010: 169, cluster 1 § 3.3.2; Gurushidze & Blattner in Fritsch & Abbasi 2013: 199). Thus the development of "tumble weeds" combining basally breaking scapes and large loose inflorescences with very unequally long pedicels is another case of convergent evolution in the genus *Allium*.

**Etymology:** The epithet was adopted from Latin and means "extended" which may refer to the large inflorescence or to the extended area of distribution.

**Biological data:** The plants are typical tumble-weeds: The scape base breaks when the capsules begin to open. The infructescence with the upper scape part is then blown away by the wind, and the seeds will be distributed. Nikolaeva & al. (1985) reported on seed germination: good at 5 °C, very bad at 10 °C, and bad at 20 °C. Specht & Keller (1997) confirmed very good germination at 5 °C, but found no germination at temperatures above 10 °C. Reported genome sizes [2C DNA] were 31.6 pg (Vakhtina & al. 1977), 29.8 pg (Zakirova 1989, both "*A. schubertii*"), and 32.5 / 59.8 pg (Gurushidze & al. 2012), undetected polyploidy seems possible. Fresh bulbs contain in total 0.03 % cysteine sulfoxides (Keusen & al. 2008).

**Economic traits:** Local Uzbek name 'chuchka-piyos' (Vvedensky 1971, as *A. schubertii*). The plants, local Kazakh name 'u-zhua', are extremely rich in saponines and therefore not edible (as *A. schubertii*, Pavlov & Polyakov 1958, Vvedensky 1963) and contain a glue (Vvedensky 1963). The green plant parts are eaten in Tajikistan (as *A. schubertii*, Anonymous 1985). Ornamental plant listed in the "International Checklist ..." of the Royal General Bulbgrowers Association (1991), also a hybrid cultivar is offered (Fritsch 2015).

#### 17. *A.* subg. *Melanocrommyum* sect. ***Brevicaule*** R.M. Fritsch

in Linzer Biol. Beitr. 26: 967 (1994). — *A.* sect. *Kaloprason* subsect. *Minutoprason* Kamelin & Seisums in Seisums, podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monograficheskij obzor) avtoreferat: 27 (1994), nom. nud., p. p. — **Type species:** *Allium sergii* Vved.

Regrettably, molecular data (ITS sequences of nuclear rDNA as well as sequences of the plastid *trnL-trnF* region) are currently only available for single accessions of *A. sergii* and *A. chitralicum*. These species were positioned in different clusters with different relationships. Investigation of additional accessions and of *A. eugenii* would be essential to resolve this discrepancy. It seems possible that sect. *Brevicaule* is an artificial aggregate of morphologically similar but only very distantly related species (Fritsch & al. 2010: 189).

(81) *Allium sergii* Vved. in Byull. Sredneaz. gosud. Univ. 19: 127 (1934). Vved., Flora URSS 4: 257 (1935). Pavlov & Polyakov, Fl. Kazakhst. 2: 187 (1958). Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 80 (1971). — Type: Kazakhstan: Karatau, urochishche Uch-uzen, shchebnistyj sklon [place Uch-uzen, rubble slope], 29.5.1930, leg. Lipschitz 356 (holotype MW!).

Distribution: Kazakhstan: Syrdarya-Karatau mountain range; submontane rubble slopes and rock outcrops, known from a rather restricted area.

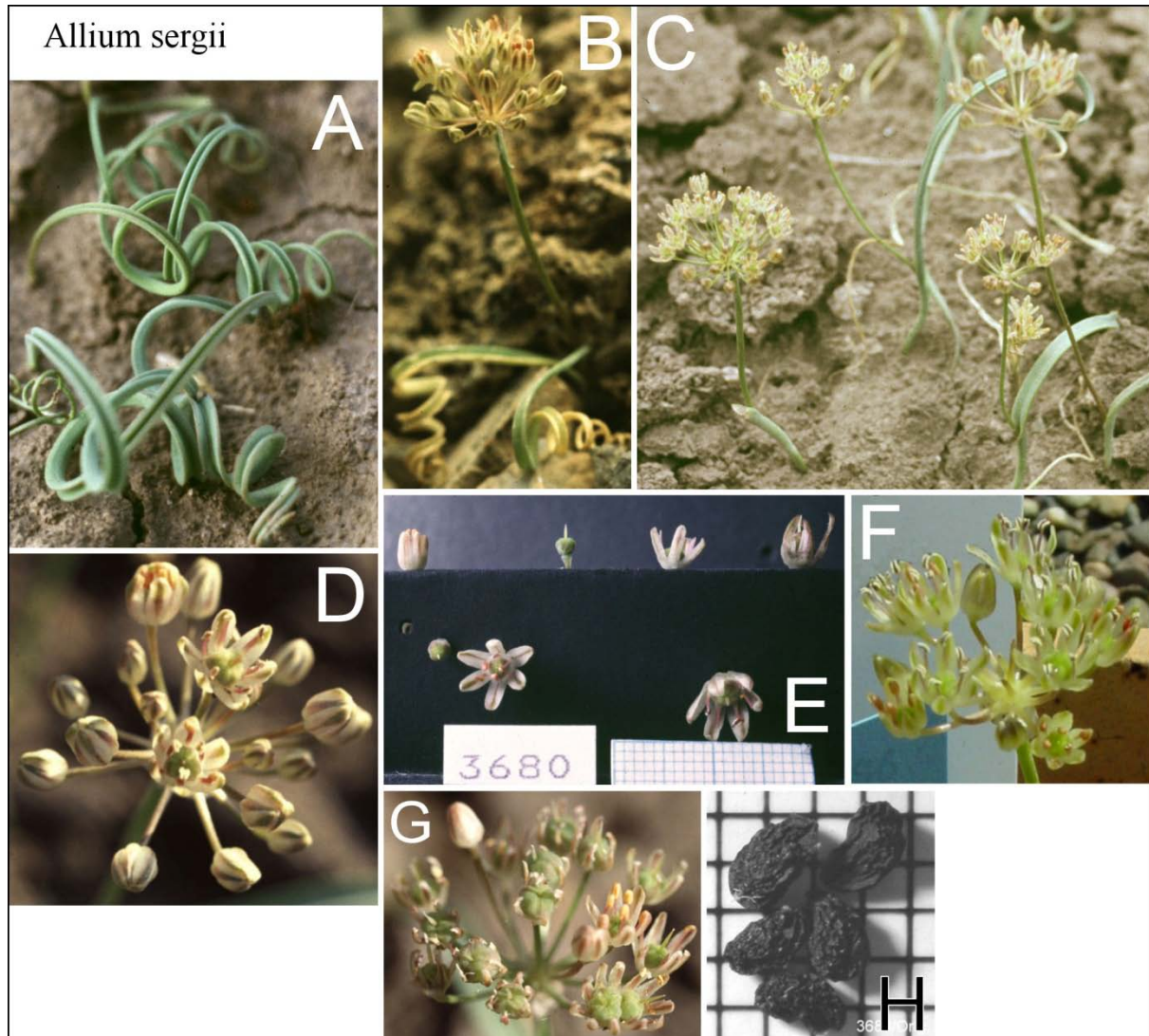


Plate (81): Cultivated plants are shown. A: Sprouting leaves; B & C: flowering plants; D & F: inflorescences in early anthesis; E: comparison of flowers and flower parts in different stages of anthesis; G: inflorescences in late anthesis; H: seeds (millimeter paper as background and measure scale of E & H).

Description: Bulbs ovoid, 7.5-10 mm in diam., with 1-2 buff, large, rather smooth side bulbs; outer tunics papery, cinereous. Scape flexuous, terete, subconical, smooth; 10-15 cm long, below 1-2, above up to 3 mm in diam.; green, basally sometimes purplish. Leaves (1) 2, laminae long linear-triangular, ± prostrate, upper part circularly to spirally enrolled; upper side basally with 2 grooves, lower side nearly smooth; margins smooth, very long tapering into the long-hooded apex; 20-25 cm long, 2-4 (6) mm broad, basally at broadest and there often 1-2 cm long sheathy above the soil; green with glaucous bloom. Sheathy prophyll short, bright, thin, quickly decaying. Spathe finely membranous, not or completely divided in 2-3 shortly acuminate valves; brownish with inconspicuous veins. Inflorescence broadly fastigiate to semi-globose; loose, rather few-flowered; 2-4 cm in diam., 1.5-3 cm long. Pedicels subequally long, thin wiry, ascending; green or brownish suffused. Anthesis in (May to) June. Flowers cup-shaped starlike. Tepals oblong to long-ovate, spoon-like concave, obtuse, obliquely patent later claw-

like incurved and margins enrolled, 4-6 mm long, 1.5-2.5 mm broad; as bud pale maroon, in anthesis pinkish yellow later brownish with brownish-purple, narrowly lanceolate median vein. Filaments nearly as long as the tepals; basally very shortly connate, inner filaments basally triangular widened above subulate, outer filaments subulate; brownish-violet fading towards the base. Anthers oblong; ca. 1.5 mm long and 0.8 mm broad; yellow with violet flush. Pollen sulfur-yellow. Ovary sessile, subglobose, 2-2.5 mm long and in diam.; surface finely papillous, green with purple flush; nectaries mound in across-ovate holes; 7-9 ovules per ovary are present (Vvedensky 1935). Style conical-threadlike, 2-3 mm long; green. Stigma undivided; greenish. Capsule subglobose triangular, surface with raised wrinkles, 3-4 mm long and in diam.; moderately widely open, valves suborbicular; dull buff. Seeds 2 per locule, flat ovoid; surface papillous with densely reticulate raised wrinkles, dull black; 2-2.5 mm long, 1.5-2 mm broad and thick. The testa showed periclinal walls with several to many large prominent verrucae, Omega-like undulation with short wavelength and low to moderate amplitude of the anticlinal walls (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Zakirova & Nafanailova 1990 (Kazakhstan: Karatau range, Uchuzen, Myrzakulov s. n., type location).  $2n = 16$  Pogosian & Seisums 1992 (Kazakhstan: Karatau range, Uchuzen, Kamelin & al. 160, type location).  $2n = 16$  Fritsch karyotype (see karyolog. appendix, Kazakhstan: Karatau range, Ikonzu gorge TAX 3680, Kantagy gorge TAX 3714).

**Living accessions studied:** Kazakhstan: Karatau range c. 25 km NE town Kentau, valley Ikonzu, loamy and limestone rubble slopes (43°35' N, 68°47' E, 900 m, 25.5.1993 Fritsch 897; GAT) TAX 3680, c. 15 km N town Kentau, valley Kantagy, loamy and limestone rubble slopes (43°39' N, 68°38' E, 900 m, 24.5.1993 Fritsch 884; GAT) TAX 3714.

**Remarks:** *Allium sergii*, the type species of sect. *Brevicaule*, is an inconspicuous tiny species characterized by narrowly linear, canaliculate, often spirally curled leaves, and lax inflorescences with rather few, small yellowish flowers, and tepals with conspicuously dark median vein. The general habit is only moderately similar to the other species of sect. *Brevicaule* and to *A. hexaceras* (sect. *Acaule*), thus all these species cannot be merged quite easily. Molecular markers (ITS sequences of nuclear rDNA, sequences of the plastid *trnL-trnF* region) univocally positioned the only available sample closely beside the morphologically dissimilar species *A. karataviense* (sect. *Miniprason*) and of the western Tianshan geographical clade of sect. *Acmopetala* (Gurushidze & al. 2010: 836, fig. 4 lineage III: Fritsch & al. 2010: 189 cluster 5 § 3.7.2; Fritsch 2012b: 250-251 Fig. 3 J; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Another member of sect. *Brevicaule*, *A. chitralicum*, was positioned closest to *A. rosenbachianum* s. str. (see below). Both positions might express geographical connections only. Molecular studies of more samples would be essential to clear up the true taxonomic affiliation.

**Etymology:** The epithet honors the eminent Russian botanist Sergei Julievich Lipschitz (1905-1983) who collected the type.

**Biological data:** Zhaparova (1987) assumed a solely vegetative multiplication. Kamenetskaya & al. (1984) reported life cycle, plant societies, and timing of the annual life cycle phases. The plants are early flowering and short-vegetating geophemmeroids; with bulb scales up to 2 cm thick, a bulbous and frequently ephemeroidal, nonbranching, diffuse root system with up to 40 cm deep root penetration and up to 200 roots per plant; the leaf primordia of the next year's shoot develop in April to June and the inflorescences in August to October (Kamenetsky 1992, Fig. 9).

**(82) *Allium chitralicum*** F.T. Wang & Tang in Bull. Fan Mem. Inst. Biol. Bot. (Peking) 7: 298 (1937), s. str. Seisums in Latv. Zinatnu Akad. Vēstis B No. 4: 76 (1992), non *Allium chitralicum* sensu Wendelbo 1971: 85, tab. 9/122. — *Allium chitralicum* var. *bifoliatum* F.T. Wang & Tang in Bull. Fan Mem. Inst. Biol. Bot. (Peking) 7: 298 (1937). Type: Pakistan: Chitral, 3.6.1895, alt. 8-11.000 ft., Surg. Lt. Harriss no. 16691a (holotype K! bar-coded K000844276, the most right plant). *Allium pauli* Vved. in Bot. mat. gerb. Bot. inst. Akad. Nauk SSSR 9: 241 (1946). Vved., Flora Tadzh. SSR 2: 342 (1963); Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 81 (1971); Fritsch in Nordic J. Bot. 16: 15 (1996), omnia sub specie. Type: Tajikistan: W Pamir, Lugovimy mezhdu pashen na pravom beregu

sklonakh r. Bishun-Dara bliz ust'ya r. [small meadows between fields at the right bank of the (slopes of) river Bishun-Dara near the mound of river] Khotsnim, h = 3080 m, 10.6.1935, leg. Ovczinnikov & Afanasiev 334 (LE!). *Allium badakhshanicum* Wendelbo in Acta Horti Gothob. 28: 39, f. 6 d-f (1966). Wendelbo, Flora Iranica 76: 86, tab. 9/124, tab. 21/2 (1971), sub specie. Fritsch in Nordic J. Bot. 16: 15 (1996), sub *A. pauli*. Type: Afghanistan: Badakhshan, Mian-Kuh (sur le lac de Chognan), 23.7. 1959, leg. Lindberg no. 709 (BG, not seen). — Type: Pakistan: Chitral, 3.6.1895, alt. 8-11.000 ft., Surg. Lt. Harriss no. 16691a (holotype K! bar-coded K000844276).

Distribution: E Afghanistan, Tajikistan, Pakistan: Pamir and Hindukush mountain ranges, montane to subalpine slopes and meadows, also among shrubs.

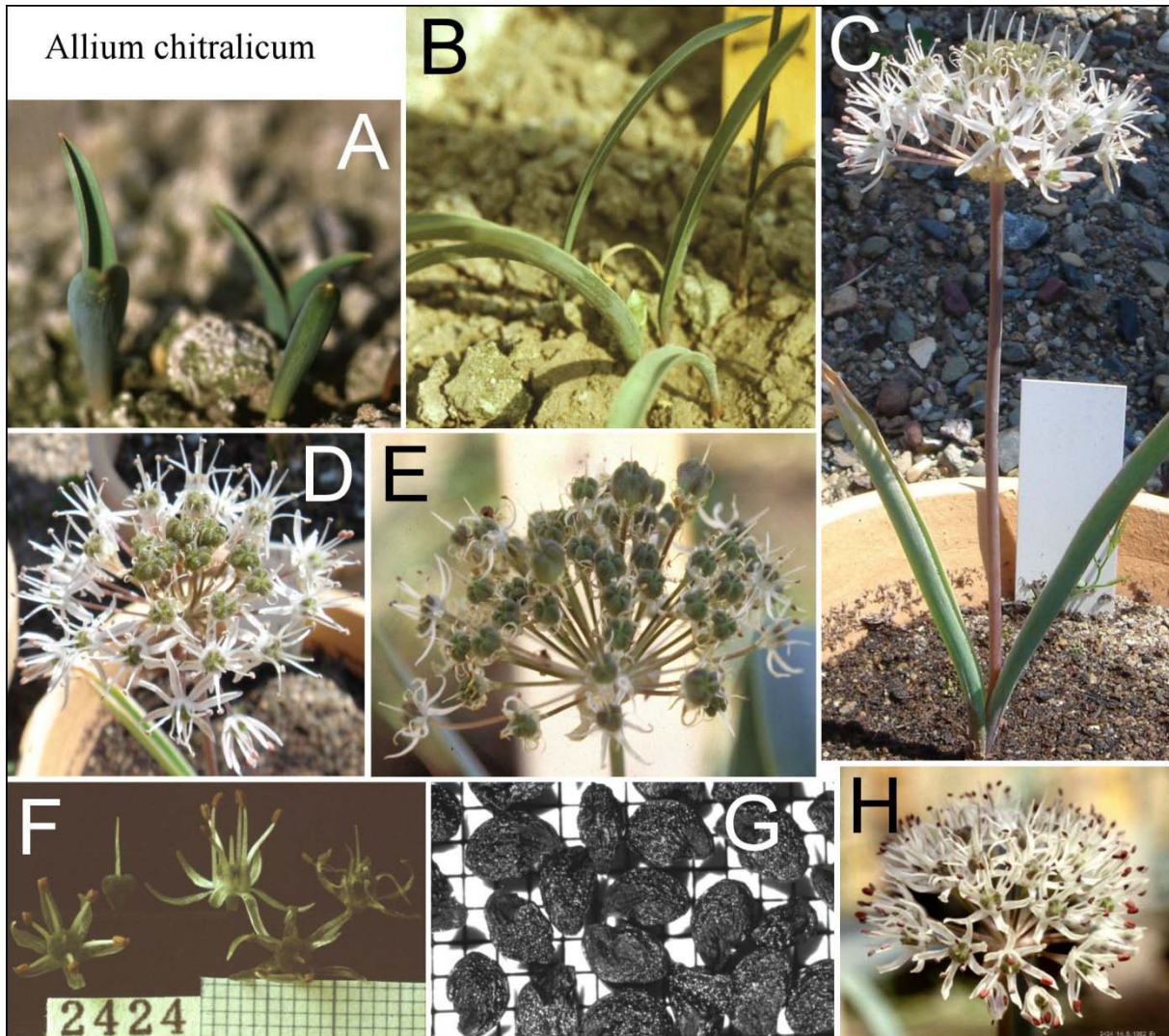


Plate (82): Cultivated plants are shown. A: Sprouting leaves; B: cultivated plants at begin of shooting stage; C: plant in full anthesis; D, E & H: inflorescences in full, late, and early anthesis; F: comparison of flowers and flower parts in different stages of anthesis; G: seeds (millimeter paper as background and measure scale of F & G).

Description: Bulbs ovoid to depressed-globose, without side bulblets, 8-15 mm long, (12) 15-20 mm in diam.; tunics finely membranous to papery, white, outer tunics cinereous to blackish, finally disintegrating. Scape ± flexuous, terete, slightly obconical, smooth, 4-10 (25 ?) cm long, up to 3 mm in diam.; green, purplish flushed. Leaves 1-2, laminae ± linear, more obliquely directed than recurved, thick, canaliculate; upper side smooth, lower side finely ribbed; margins narrowly white, densely (near base long-) toothed, tapering into the short hooded apex; 5-15 (24) cm long, 5-10 (15) mm broad; grayish green with strong glaucous bloom, basally purplish. Sheathy prophyll rather short, very thin, nearly colorless. Spathe membranous, often two-valved, ± straight, shortly acuminate, ± as long as the pedicels; whitish,

sometimes purplish flushed, veins inconspicuous. Inflorescence fasciculate to semi-globose;  $\pm$  loose, moderately many-flowered; 2-3 cm in diameter. Pedicels subequally long, after anthesis remarkably thicker and longer; 10-15 mm long; silk-glossy brownish-green later maroon. Anthesis in June to August. Flowers flat starlike. Tepals linear-lanceolate to triangular, spoon-like concave, long tapering into the obtuse, shortly incurved apex, patent, later irregularly directed or reflexed; 4-7 mm long, basally 1-1.5 mm broad; whitish with dirty-green to lilac median vein. Filaments  $\pm$  as long as the tepals; basally for c. 1 mm connate and inner filaments long-triangular widened with two triangular teeth, and above subulate like the outer filaments; whitish. Anthers  $\pm$  ovoid; up to 1.5 mm long and 1 mm broad; brownish to orange-brown. Pollen grayish. Ovary shortly stipitate, turbinate to depressed-globose, apex with 6 flat, radially directed outgrowths, 2 mm long, 2-2.5 mm in diam.; surface coarsely acutish papillous; green. (2) 3 ovules per locule are present. Style long threadlike, 3-5 mm long; whitish. Stigma dot-like; white. Capsule shortly pear-shaped to tripartite, up to 6 mm long and in diameter, surface coarsely papillous; widely open, dry valves  $\pm$  ovate, apex deeply notched; brown. Seeds 1-2 per locule, ovoid to drop-shaped, somewhat edged; surface scabrous and densely reticulate of raised wrinkles, dull to sub-glossy black; 2.5-3 mm long, 2-2.3 mm broad, 1.5-2 mm thick. The testa showed periclinal walls with several to many large prominent verrucae, and Omega-like (with transitions to S-like) undulation of the anticlinal walls with short to moderate amplitude and short wavelength (Fritsch & al. 2006).

**Chromosomes:**  $2n = 16$  Pedersen & Wendelbo 1966 (Afghanistan: Badakhshan, Mian Kuh, Lindberg 709 (type location of *A. badakhshanicum*, as *A. badakhshanicum*).  $2n = 32$  Pogosian & Seisums 1992 (Tajikistan: Gornyj Badakhshan, Garm-Chashma, Seisums s. n.).  $2n = 16$  IPK *Allium* reference collection ideogram (Tajikistan: Ishkashim ridge, TAX 2424, via Botanic garden Khorog).

**Living accessions studied:** **Tajikistan:** W Pamir area, NW exposed stony slopes above vill. Garm Chashma (37° 12'00.1" N, 71°32'08.3" E, 2700 m, 03.5.2003 Fritsch, Keusgen, Hisoriev, Kudratov, Kurbonova 6097; GAT) TAX 6153; Ishkashim range, canyon Bidzant-Dara (from Botanic Garden Khorog, 1987; GAT) TAX 2424.

**Remarks:** This species is rather small and owns  $\pm$  shallowly arched leaves and larger whitish flowers. Seisums (1992) compared the type specimens of *A. chitralicum*, *A. pauli*, and *A. badakhshanicum* and concluded that they belong to one species. Also the photo of a flowering plant of *A. badakhshanicum* in Pederson & Wendelbo (1966) supports conspecificity, but the description of *A. chitralicum* by Wendelbo (1971) differs in several details and refers probably to a member of sect. *Megaloprason* sensu Wendelbo. Molecular markers (ITS sequences of nuclear rDNA) positioned *A. chitralicum* s. str. closest to *A. rosenbachianum* s. str. widely apart from *A. sergii*, the second species of sect. *Brevicaule* investigated (Fritsch & al. 2010: 189, cluster 5 § 3.7.2; Fritsch 2012b: 251-252 Fig. 4 O; Gurushidze & Blattner in Fritsch & Abbasi 2013: 201). Sequences of the plastid *trnL-trnF* region showed an equal (but not close) relationship to members of the sections *Megaloprason* s. str., *Regeloprason*, and subsect. *Spiralitunicata* (Gurushidze & al. 2010: 836, Fig. 4 lineage V).

**Etymology:** The epitheta refer most probably to the Chitral mountain range in Pakistan and the Badakhshan province in Afghanistan, where the types were collected. The epithet of *A. pauli* honors the outstanding Russian botanist of merit Pavel Nikolaevich Ovchinnikov (1903-1979) mainly acting in Dushanbe. He rendered outstanding services to the botanical exploration of the flora of Tajikistan and acted as main editor of "Flora of Tajik SSR".

**Biological data:** The reported genome size is 68.7 pg 2C DNA (Gurushidze & al. 2012). Fresh bulbs contain in total 0.09 % cysteine sulfoxides (only methiin), leaves contain in total 0.94 % cysteine sulfoxides (37 % methiin, 63 % isoalliin; Jedelska & al. 2004, Keusgen & al. 2008). Kasach (1975, as *A. pauli*) reported the growth periods of cultivated plants in Khorog: Bud development 8.-16.05., anthesis starts at 15.05. for 15-20 days, seeds are ripe at the end of July. The plants flower not every year. This author observed 2 leaves to be narrower than 2 mm.



(83) *Allium eugenii* Vved., Flora Turkm. 1: 286 (1932), descr. ross., Vved. in Byull. sredneaz. gosud. Univ. 19: 127 (1934), descr. latin. Vved., Flora URSS 4: 257 (1935). Vvedensky [& Kovalevskaya], Opred. rast. Sredn. Azii 2: 80 (1971). Kamelin in Nikitin & Gel'dikhanov, Opredel. rast. Turkmen.: 123, 127 (1988). — Lectotype: Turkmenistan: B. Balkhany, step bliz kol. [Great Balkhan ridge, steppe near the well] Kosha-kudshuk, 1440 m, 5.6.1928, leg. Bobrov & Jarmolenko 342 (LE!), design. Vvedensky 1934, see Fritsch 1990: 504). Paratypes (design. Vvedensky 1934): 1. B. Balkhany, shchebnistyj stepnoi sklon bliz r. [rubble steppe slope near spring] Bash-mogur, 1700 m, 26.5.1928 Bobrov & Jarmolenko 198 (LE); 2. Sukhoe ruslo bliz kol. Kosh-Kudzhuk, na shchebne [dry mountain spur near the well Kosh-Kujuk, on rubble], 1450 m, 23.6.1929 Bobrov 107 (LE). 3. Archevyj sklon bliz rodn. [*Juniperus* slope near spring] Bash-mogur, 1650 m, 23.6.1929 Bobrov 104 (LE).

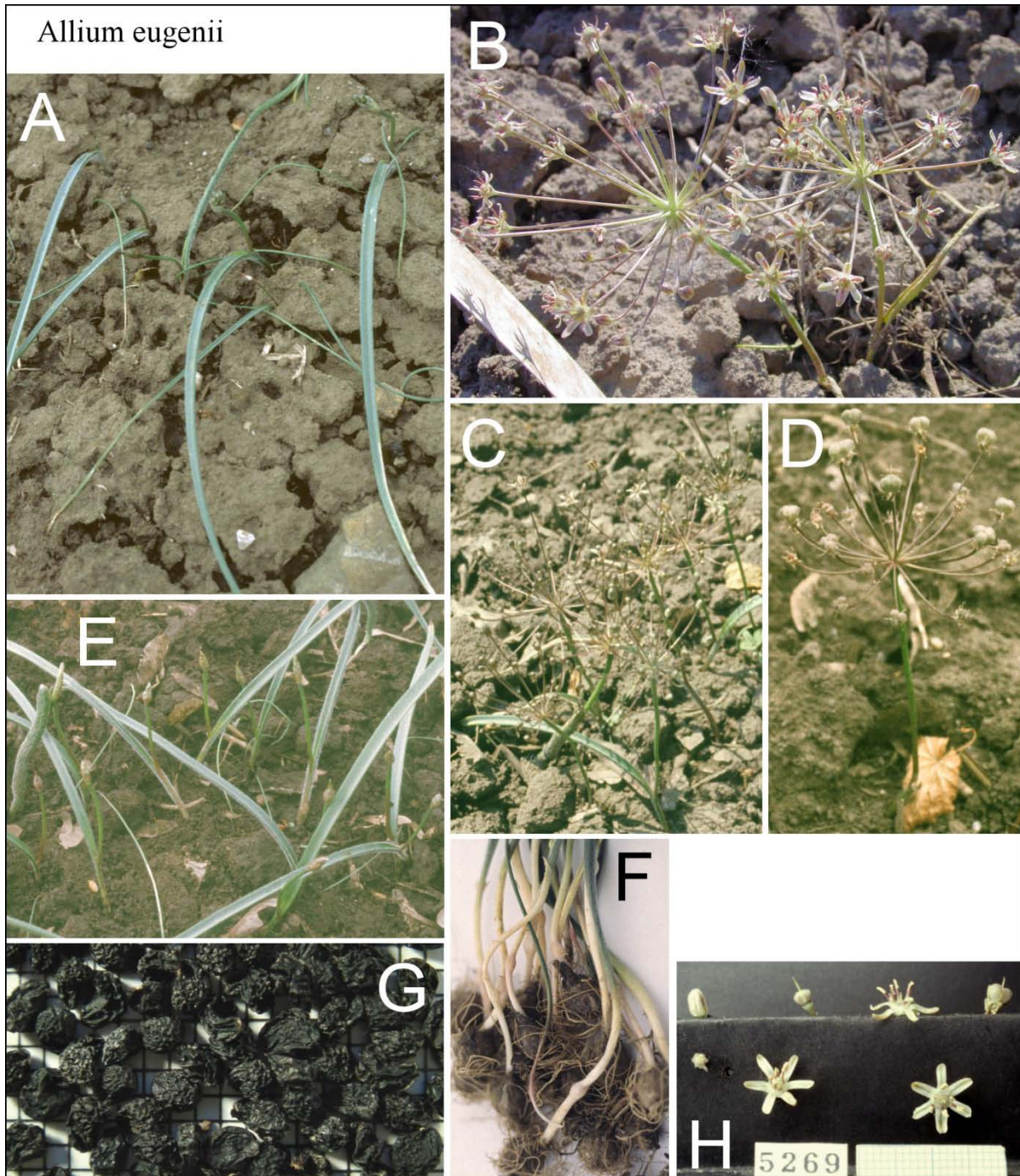


Plate (83): Cultivated plants are shown. A & E: Plants in the shooting stage; B & C: flowering plants in full and early anthesis, resp.; D: plant with full-sized capsules; F: basal plant parts with bulbs and roots showing the side bulblets on stolons inside the sheaths; G: seeds; H: comparison of flowers and flower parts in different stages of anthesis (millimeter paper as background and measure scale of G & H).

**Distribution:** Turkmenistan: Great Balkhan ridge; colline to submontane limestone rubble slopes.

**Description:** Bulbs ovoid to globose, 1-1.5 cm long and in diam., few side bulblets on long stolons positioned inside the leaf sheaths [Plate (83) F]; inner tunics yellowish, outer tunics papery, somewhat longitudinally splitting and with a short neck, grey to blackish or reddish. Scape mostly flexuous, terete,  $\pm$  obconical, smooth; 8-15 cm long, 2-3 mm in diam.; glossy green, basally brownish. Leaves 1-2, laminae linear-lanceolate, arcuately ascending and recurved to the soil, or  $\pm$  prostrate,  $\pm$  deeply canaliculate, thick; upper side smooth and glabrous, lower side with narrow and fine ribs; ribs and margins covered with fine, white, backwards directed hairs (strongest in the basal part), long tapering into the slightly hooded apex; 15-20 (25) cm long, 2-6 (8) mm broad; green with glaucous bloom. Sheathy prophyll tender, quickly decaying. Spathe thin membranous, completely divided into 2-3 very shortly ovate-triangular valves; buff, veins inconspicuous. Inflorescence fasciculate to semi-globose finally subglobose; very loose, rather few-flowered; 6-8 cm in diameter. Pedicels subequally long, thin wiry,  $\pm$  ascending; brown, basally greenish. Anthesis in June. Flowers nearly flat starlike. Tepals linear-oblong, patent with spoon-like concave, subobtuse apex, later completely reflexed and tortuous; 4-5 mm long, 1.8-2 mm broad; pinkish greenish with conspicuous green to purple median vein. Filaments  $3/4$  as long as the tepals; basally for c. 0.2 mm connate and very shortly triangular widened (inner filaments slightly wider), above subulate; basally whitish above brown-violet. Anthers oblong; c. 1.7 mm long and 0.6 mm broad; pale yellowish-violet. Pollen sulphur-yellow. Ovary sessile, flat broadly conical hexangular, 2-2.5 mm long and in diam.; surface finely acutish papillous; grayish green, violet flushed; with 6-7 ovules (Vvedensky 1932, 1935). Style conical, 1.5-2.5 mm long; yellowish. Stigma undivided; yellowish. Capsule depressed globose, c. 3 mm in diam.; valves cordate, surface scabrous. Seeds flat ovate to orbicular, somewhat edged; surface finely papillous, with densely reticulate raised wrinkles; 2-2.5 mm long, 2-2.3 mm broad, 1.5-2 mm thick. The testa showed periclinal walls with several to many large prominent verrucae, and Omega-like (with transitions to U-like) undulation with short wavelength and high amplitude of the anticlinal walls (Fritsch & al. 2006).

**Living accessions studied:** Turkmenistan: N limestone rubble or gritty slopes of Great Balkhan massif in North-, East- and West-exposition (39°42' N, 54°28' E, 850 m, 21.4.1995 Fritsch & Khassanov 1333 A, B; GAT) TAX 5269, TAX 5283.

**Remarks:** Key characters of *A. eugenii* are side-bulblets on long stolons inside the leaf sheathes, narrowly canaliculate, densely short-hairy leaves much longer than the scapes, and loose, rather few-flowered umbels. Other members of sect. *Brevicaule* own smooth leaves but all species share a small habit.

**Etymology:** The epithet honors the outstanding Russian Botanist and botanical explorer of merit of the Great Balkhan ridge, Evgeniy Grigorievich Bobrov (1902-1983).

## References

- Abbasi, M., Fritsch R. M. and Keusgen, M. (2008) Wild *Allium* species used as food and folk medicine in Iran. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, pp. 25-30.
- Agapova, N. D., Arkharova, K. B., Vakhtina, L. I., Semskova, E. A. and Tarvis, L. V. (1990) Chisla khromosom tsvetkovykh rastenij flory SSSR [Numeri chromosomatum Magnoliophytorum Florae URSS]. Aceraceae - Menyanthaceae. Nauka, Leningrad. 508 pp.
- Aitchison, J. E. T. (1888) The botany of the Afghan Delimitation Commission. Trans. Linn. Soc., Sec. Ser. 3 (1), 1-139.
- Akhavan, A., Saeidi, H., Rahiminejad, M. R., Zarre, S. and Blattner, F. R. (2015) Interspecific relationships in *Allium* subgenus *Melanocrommyum* sections *Acanthoprason* and *Asteroprason* (Amaryllidaceae) revealed using ISSR markers. Syst. Bot. 40, 706-715.
- Androso, N. V. (1941) Dikie s'edobnye rasteniya Turkmenistana. Trudy Turkm. Bot. Sada, vyp. 1.
- Androso, N. V. (1941b) Dikie dekorativnye rasteniya Turkmenii. Trudy Turkm. Gosud. Bot. Sada: 23-82.
- Anonymus (1983b) Otchet o nauchno-issledovatel'skoj rabote izuchenie pastbishchnoj rastitel'nosti APO "Khovaling" i razrabotka predlozhenij po ee ratsional'nomu ispol'sovaniyu. (Unpublished final research report) pp. 63-67, 87-88, 161-162.
- Anonymous (1985) [Oral information about use of wild *Allium* species in Tajikistan given to R.M. Fritsch during a visit in Dushanbe]
- Astanova, S. B. (1984) Chisla khromosom vidov semejstv Alliaceae, Asteraceae, Caryophyllaceae, Ebenaceae, Linaceae, Oleaceae, Lamiaceae iz Tadzhikistana. Bot. Zhurnal 69 (11), 1563-1564.
- Astanova, S. B. (1990) Chisla khromosom vidov roda *Allium* L. flory Tadzhikistana. Sb., Aktual'nye voprosy okhrany i izpol'zovaniya rastitel'nosti Tadzhikistana (Materialy dokladov Resp. nauchnoj konf. 14-16 Nojab. 1990 g.), pp. 8-10.
- Astanova, S. B. (unpubl.) Chromosome counts of 8 *Allium* species (letter in Russian to R.M. Fritsch received 05.10.1993).
- Badr, A. and Elkington, T. T. (1977) Variation of Giemsa-C-banded and fluorochrome banded karyotypes and relationships in *Allium* subgen. *Molium*. Plant Syst. Evol. 128 (1/2), 23-35.
- Bajtenov, M. S. (1995 publ. 1996) Novye taksony flory Kazakhstana. Izv. NAN Resp. Kazakhstan, ser. Biol. (6), 81-82.
- Bajtulin, I. O. and Kamenetskaya, I. I. (1983) Osobennosti kornevoj sistemy dikikh vidov luka v uslovijakh kul'tury. Vestnik A N KazSSR (8), 48-53.
- Bajtulin, I. O. and Kamenetskaya, I. I. (1984) Morphologicheskie osobennosti podzemnykh organov dikorastushchikh lukov vostochnogo Kazakhstana. Vestnik Akad. Nauk Kazakhskoj SSR (11), 41-45.
- Banfi, E., Galasso, G. and Soldano, A. (2011) Notes on systematics and taxonomy for the Italian vascular flora. 2. Atti Soc. Ital. Sci. Nat. Mus. Civico Storia Nat. Milano, 152 (2), 85-106.
- Behcet, L., Kaval, I. and Rüstemoğlu, M. (2012) Three new records from Turkey: *Allium giganteum* (Liliaceae), *Grammosciadium scabridum*, and *Ferulago angulata* subsp. *carduchorum* (Apiaceae). Turk. J. Bot. 36, 637-643.
- Bernhard R. A. (1970) Chemotaxonomy: Distribution studies of sulfur compounds in *Allium*. Phytochemistry 9, 2019-2027.
- Bieberstein, F. A. Freiherr Marschall von (1808) Flora taurico-caucasica exhibens stirpes phaenogamas, in Chersoneso taurica et regionibus caucasicis sponte crescentes ... Tomus 1. Kharkov, VI + 428 pp.
- Bijl, J. R. (1994 publ.1995) *Allium* - flowering onions. Herbertia 50, 88-94.
- Bochkin, V. D. and Nasimovich, Yu. A. (1999) Native and cultivated species of the Liliaceae Juss. s. l. family in the area of Moscow. Byull. glavnogo botan. sada 178, 69-75. [in Russian]
- Boissier, P. E. (1882) Flora orientalis sive enumeratio plantarum in Oriente a Graecia et Aegypto ad Indiae fines hucusque observatarum. Tomus 5, 1. Basel, Genève, H. Georg, 428 pp.

- Botschantzev, V. P., Kamelin, R. V. and Cherneva, O. V. (1978) Novinki Badkhyzskoj Flory, 2. Bot. Zhurn. 63 (11), 1597-1605. [In Russian]
- Brummitt, R. K. (2001) Report of the Committee for Spermatophyta. Taxon 50 (2), 559-568.
- Buhse, F. A. (1860) Aufzählung der auf einer Reise durch Transkaukasien und Persien gesammelten Pflanzen ... Nouv. Mém. Soc. Imp. Natural. Moscou 18 (12?): 1-246.
- Czerniakowska-Reinecke, E. (1930) Letzte Neuheiten über die Flora Turkmenistans und Nordpersiens. Repert. Spec. Nov. Regni Veg. 27, 262-287.
- Czernyakovskaya, E. G. (1930) Novye dannye dlya flory Turkmenistana i Severnoj Persii. Izv. glavn. bot. sada SSSR 29 (1-2), 130-162.
- Dadd, R. (1987) The discovery and introduction of *Allium giganteum*. Kew Mag. 4, 91-96.
- Dadoboeva, O. D. (1972) Slovar' nauchnykh i mestnykh nazvanij lekarstvennykh rastenij severnogo Tadzhikistana. [Dictionary of the scientific and local names of medicinal herbs of North Tajikistan. In Tajik and Russian] D-13, 20-21.
- de Hertog, A. A. and Zimmer, K. (1993) Chapter 12. *Allium* - ornamental species. In: de Hertog, A. and Le Nard, M. (eds.) The physiology of flower bulbs. Elsevier, Amsterdam, pp. 187-200.
- de Lestrieux, E. and J. de Belder-Kovačić (2000) Der Geschmack von Blumen und Blüten. Köln, DuMont Monte-Verlag, 209 pp.
- Dejneko, G. I. (1981) Zhirnikislotnyj sostav lipidov sotsvetij *Allium karataviense*. Khimiya prirodnykh soedinenij, Tashkent 6, 793.
- Dejneko, G. I. (1985) Lipids, fatty acids and carbohydrates in species of the genus *Allium* L. Rastitel'nye Resursy 2 (21), 221-229. [In Russian]
- Dietrich, J. (1967) Genre *Allium*. Caryotypes de 46 espèces en culture (Jardin botanique de Strasbourg). Inform. ann. Caryosyst. Cytogen. (1), 23-26.
- Don, G. (1832 publ. 1827) A monograph of the genus *Allium*. Memoirs of the Wernerian Natural History Society 6, 1-102.
- Druselmann, S. (1992) Vergleichende Untersuchungen an Vertretern der Alliaceae Agardh. 1. Morphologie der Keimpflanzen der Gattung *Allium* L. Flora 186 (1-2), 37-52.
- Dubouzet, J. G., Arisumi, K. I., Etoh, T., Matsuo, E. and Sakata, Y. (1992) Studies on the development of new ornamental *Allium* through interspecific hybridization. I. Evaluation of commercial ornamental *Allium* for adaptation to Kagoshima conditions. J. Jap. Soc. Hort. Sci. 61 (3), 659-664.
- Dubouzet, J. G., Arisumi, K. I., Etoh, T., Maeda, M. and Sakata, Y. (1994) Studies on the development of new ornamental *Allium* through interspecific hybridization. III. Hybridization of autumn-flowering species through pull-style pollination, cutflower culture and embryo rescue. Mem. Fac. Agr. Kagoshima Univ. 30 (1), 35-42.
- Dubouzet, J. G., Shinoda, K. and Murata, N. (1998) Interspecific hybridization of *Allium giganteum* Regel: production and early verification of putative hybrids. Theor. Appl. Genet. 96 (3/4), 385-388.
- Ebrahimi, R., Hassandokht, M., Zamani, Z., Kashi A., Roldan-Ruiz, I. and Van Bockstaele, E. (2014) Seed morphogenesis and effect of pretreatments on seed germination of Persian shallot (*Allium hirtifolium* Boiss.), an endangered medicinal plant. Hort. Environ. Biotechnol. 55, 19-26.
- Ekberg, L. (1969) Studies in the genus *Allium*. II. A new subgenus and new sections from Asia. Bot. Notiser 122 (1), 57-68.
- Elkington, T. T., Badr, A., El-Gadi, A., Hussain, L. and White, S. (1976) Giemsa C-band and quinacrine banded karyotypes and systematic relationships in *Allium*. In: Jones, K. and Brandham, P. E., (eds.) Current Chromosome Research, Amsterdam, pp. 214-215.
- Ellis, R. H., Hong, T. D. and Roberts, E. H. (1985) Handbook of seed technology for genebanks. Volume II. Compendium of specific germination information and test recommendations. Chapter 44. Liliaceae: 481-486.
- Endlicher, S. L. (1836-1840) Genera plantarum secundum ordines naturales disposita. Wien. 18 parts, 1483 pp., several supplements.
- Ergashev, E. (1995) K biologii tsveteniya *Allium majus* Vved. Botanika Fanining ustivor masalalari. Ilmij konf. ma"ruz. tez. Toshkent, 12-14 sent. 1995: 112.
- Fedtschenko, B. (1904) Novitatae floriae Turkestanicae. Bull. Herb. Boiss. sér. 2, 4, 917, cum tab. VII post p. 956.

- Fedtschenko, B. A., Berezin, L. A., Larin, I. V. and Roshevitz, R. Y. (1932) Khozyajstvennoe znachenie rastenij flory Turkmenii. In: Fedtschenko, B. A. and Popov, M. G. (eds.) Flora Turkmenii. Tom 1/2. Leningrad, 27 pp. [In Russian]
- Fedtschenko, O. (1906) Turkestanskije luki. Progressivnoe sadovodstvo ogorodnichestvo 3 no. 36, 332.
- Filimonova, Z. N. (1970) O znachenii kolichestva semjapoček v sistematike r. *Allium* L. Introduktsiya i akklimat. rast. (Tashkent) 7, 107-112.
- Friesen [Frizen], N. V. (1986) Chisla khromosom predstavitelej semejstva Alliaceae iz Sibiri. Bot. Zhurnal 71 (1), 113-115.
- Friesen [Frizen], N. V. (1988) Lukovye Sibiri: sistematika, kariologija, khorologija. Nauka, Sibirskoe Otd., Novosibirsk, 185 pp.
- Friesen, N., Fritsch, R. and Bachmann, K. (1997) Hybrid origin of some ornamentals of *Allium* subgenus *Melanocrommyum* verified with GISH and RAPD. Theor. Appl. Genet. 95 (8), 1229-1238.
- Friesen, N., Fritsch R. M. and Blattner F. R. (2006) Phylogeny and new intrageneric classification of *Allium* L. (Alliaceae) based on nuclear rDNA ITS sequences. Aliso 22, 372-395.
- Fritsch, R. (1988) Anatomische Untersuchungen an der Blattspreite bei *Allium* L. (Alliaceae) I. Arten mit einer einfachen Leitbündelreihe. Flora 181, 83-100.
- Fritsch, R. (1990) Bericht über Sammelreisen in Tadschikistan (1983-1988) zum Studium von mittelasiatischen Vertretern der Gattung *Allium* L. Kulturpflanze 38, 363-385.
- Fritsch, R. M. (1990) Lectotypification in *Allium* L. (Alliaceae) subg. *Melanocrommyum* (Webb et Berth.) Rouy. Taxon 39 (3), 501-510.
- Fritsch, R. (1991) Dopolnenie k T. II. In: Rasulova, M. R. (ed.) Flora Tadschikskoj SSR. Tom X. Nauka, Leningrad, pp. 476-480. [In Russian]
- Fritsch, R. M. (1992a) Infra-subgeneric grouping in subgenus *Melanocrommyum* (Webb et Berth.) Rouy. In: Hanelt, P., Hammer, K. and Knüpfper, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 67-75.
- Fritsch, R. M. (1992b) Septal nectaries in the genus *Allium* L. In: Hanelt, P., Hammer, K. and Knüpfper, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 77-85.
- Fritsch, R. M. (1992c) Zur Wurzelanatomie in der Gattung *Allium* L. (Alliaceae). Beitr. Biol. Pflanzen 67, 129-160.
- Fritsch, R. (1993) Anatomische Merkmale des Blütenchaftes in der Gattung *Allium* L. und ihre systematische Bedeutung. Bot. Jahrb. Syst. 115 (1), 97-131.
- Fritsch, R. (1993b) Taxonomic and nomenclatural remarks on *Allium* L. subgen. *Melanocrommyum* (Webb & Berth.) Rouy sect. *Megaloprason* Wendelbo. Candollea 48 (2), 417-430.
- Fritsch, R. M. (1996) The Iranian species of *Allium* subg. *Melanocrommyum* sect. *Megaloprason* (Alliaceae). Nord. J. Bot. 16 (1), 9-17.
- Fritsch, R. M. (1996b) Neue Ergebnisse zur Taxonomie und Evolution von *Allium* L. - In: Fritsch, R. und Hammer, K. (eds.) Evolution und Taxonomie von pflanzengenetischen Ressourcen – Festschrift für PETER HANELT (Schriften zu genetischen Ressourcen. Band 4): 19-46.
- Fritsch, R. M. (1999) (1419) Proposal to conserve the name *Allium christophii*, preferably with the spelling *A. christophii*, against *A. bodeanum* (Liliaceae). Taxon 48 (3), 577-579.
- Fritsch, R. M. (2000) Taxonomic revision of *Allium* L. sect. *Regeloprason* Wendelbo in Middle Asia. In: Ashurmetov, O., Khassanov, F. and Salieva, Y. (eds.) Plant life in South-West and Central Asia. (5th International symposium, Tashkent '98). Chinor ENK, Tashkent, pp. 62-74.
- Fritsch, R. M. (2001) Taxonomy of the genus *Allium* - contributions from IPK Gatersleben. Herbertia 56 (2), 19-50.
- Fritsch, R. M. (2008) Taxonomical remarks on *Allium* species in Iran, Tajikistan, and Uzbekistan. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, pp. 53-84.
- Fritsch, R. M. (2008b) Research missions and national living *Allium* collections. In: Keusgen M. and R. M. Fritsch (Eds.): Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytoche-

- mistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben pp. 3-11.
- Fritsch, R. M. (2009) New *Allium* L. (Alliaceae) species from Tajikistan, Kyrgyzstan, and Uzbekistan. Bot. Jahrb. Syst. 127, 459-471.
- Fritsch, R. M. (2012) Illustrated key to the sections and subsections and brief general circumscription of *Allium* subg. *Melanocrommyum*. Phytion (Horn, Austria) 52 (1), 1-37.
- Fritsch, R. M. (2012b) Geographic relations and morphological variation inside of molecular clades of Central Asian *Allium* species of subg. *Melanocrommyum* (Amaryllidaceae). Verh. Zool.-Bot. Gesell. Österreich 148/149, 245-263.
- Fritsch, R. M. (2015) Checklist of ornamental *Allium* species and cultivars currently offered in the trade. 64 pp. <http://www.ipk-gatersleben.de/gbisipk-gaterslebendegbis-i/spezialsammlungen/allium-review/>
- Fritsch, R. M. and Abbasi, M. (2013) A taxonomic review of *Allium* subg. *Melanocrommyum* in Iran. Gatersleben, 240 pp. ISBN 978-3-9813096-3-8 <http://www.ipk-gatersleben.de/fileadmin/content-ipk/content-ipk-ressourcen/Download/IrMeRevAllN.pdf>
- Fritsch, R. M., Abbasi, M. and Keusgen, M. (2006 publ. 2007) Useful wild *Allium* species in northern Iran. Rostaniha 7, Suppl 2, 189-206.
- Fritsch, R. M. and Astanova, S. B. (1998) Uniform karyotypes in different sections of *Allium* L. subgen. *Melanocrommyum* (Webb & Berth.) Rouy from Central Asia. Feddes Reper. 109 (7-8), 539-549.
- Fritsch, R. M., Blattner, F. R. and Gurushidze M. (2010) New classification of *Allium* L. subg. *Melanocrommyum* (Webb & Berthel.) Rouy (Alliaceae) based on molecular and morphological characters. Phytion (Horn, Austria) 49 (2), 145-220.
- Fritsch, R. M. and Keusgen, M. (2006) Occurrence and taxonomic significance of cysteine sulphoxides in the genus *Allium* L. (Alliaceae). Phytochemistry 67, 1127-1135.
- Fritsch, R. M., Khassanov, F. O. and Friesen, N. W. (1998) New taxa, new combinations, and taxonomic remarks on *Allium* L. from Fergan depression, Middle Asia. Linzer Biol. Beitr. 30, 281-292, 843.
- Fritsch, R. M., Khassanov, F. O. and Matin, F. (2002) New *Allium* taxa from Middle Asia and Iran. Stapfia 80, 381-393.
- Fritsch, R. M., Kruse, J., Adler, K. and Rutten T. (2006) Testa sculptures in *Allium* L. subg. *Melanocrommyum* (Webb et Berth.) Rouy (Alliaceae). Feddes Reper. 117 (3-4), 250-263.
- Gaffarov, G. and Turakulov, I. (1991) Novyj vid luka (*Allium* L.) iz Turkestanskogo khrebta. Uzb. Biol. Zhurnal 34 (2), 69.
- Gorovits, M. B., Khristulas, F. S., and Abubakirov N. K. (1973) Steroidnye saponiny i sapogeniny *Allium* IV. Karatavigenin - novyj sapogenin iz *Allium karataviense*. Khimiya prirodnykh soedinenij (Tashkent) 6, 747-749.
- Gurushidze, M. (2008) Phylogenetic analysis reveals multiple independent origins of dithiodipyrrole containing species of *Allium* subg. *Melanocrommyum*. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, pp. 85-91.
- Gurushidze, M., Fritsch, R. M. and Blattner, F. R. (2008) Phylogenetic analysis of *Allium* subg. *Melanocrommyum* infers cryptic species and demands a new sectional classification. Mol. Phylogenet. Evol. 49, 997-1007.
- Gurushidze, M., Fritsch, R. M. and Blattner, F. R. (2010) Species level phylogeny of *Allium* subgenus *Melanocrommyum*: incomplete lineage sorting, intraspecific polymorphism, hybridization and *trnF* gene duplication. Taxon 59 (3), 829-840.
- Gurushidze, M., Fuchs, J. and Blattner, F. R. (2012) The evolution of genome size variation in drumstick onions (*Allium* subgenus *Melanocrommyum*). Syst. Bot. 37 (1), 96-104.
- Hanelt, P. (1992) Ovule number and seed weight in the genus *Allium* L. In: Hanelt, P., Hammer, K. and Knüpffer, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 99-105.
- Hanelt, P. (2001) Alliaceae. In: Hanelt, P. and IPK Gatersleben (eds.) Mansfeld's encyclopedia of agricultural and horticultural crops (excepts ornamentals). Springer, Berlin, pp. 2250-2269.

- Hanelt, P., Fritsch, R., Kruse, J., Maass, H., Ohle, H. and Pistrick, K. (1989) *Allium* L. sect. *Porphyroprason* Ekberg – Merkmale und systematische Stellung. *Flora* 182 (1), 69-86.
- Hanelt, P., Hammer, K. and Knüpfner, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, 359 pp.
- Hanelt, P., Schultze-Motel, J., Fritsch, R., Kruse, J., Maaß, H. I., Ohle, H. and Pistrick, K. (1992) Infrageneric grouping of *Allium* - the Gatersleben approach. In: Hanelt, P., Hammer, K. and Knüpfner, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 107-123.
- Huang, D.-Q., Yang, J.-T., Zhou, Ch.-J., Zhou, S.-D. and He, X.-J. (2014) Phylogenetic reappraisal of *Allium* subgenus *Cyathophora* (Amaryllidaceae) and related taxa, with a proposal of two new sections. *J. Plant Res.* 127, 275-286.
- Inamov, A. I. (1971) Luk stebel'chatyj - *Allium stipitatum* Rgl. i luk zarafshanskij - *Allium saravshanicum* Rgl. ikh biologija i vozmozhnost vvedeniya v kul'turu v Samarkandskoj oblasti UzSSR. Avtoreferat dissertatsii. Samarkand, 24 pp.
- Inoue, T., Mimaki, Y., Sashida, Y., Nishino, A., Satomi, Y. and Nishino, H. (1995) Steroidal glycosides from *Allium macleanii* and *A. senescens*, and their inhibitory activity on tumour promoter-induced phospholipid metabolism of HeLa cells. *Phytochemistry* 40 (2), 521-525.
- International Checklist for Hyacinths and Miscellaneous Bulbs. (1991) Royal General Bulbgrowers Association, Hillegom, The Netherlands, p. 1-14.
- IPK Allium-Referenzkollektion [http://www.ipk-gatersleben.de/databases/genetic\\_resources/allium](http://www.ipk-gatersleben.de/databases/genetic_resources/allium)
- Jedelská, J., Fritsch, R. M. and Keusgen, M. (2005) Schwefelpyrrole – eine neue Naturstoffklasse in arzneilich genutzten, zentralasiatischen *Allium*-Arten. In: Deutscher Fachausschuss für Arznei-, Gewürz-, Aromapflanzen, Thüringer Landesanstalt für Landwirtschaft (eds.) Chancen und Herausforderungen einer zeitgemäßen Arznei- und Gewürzpflanzenproduktion: Tagungsband. Fachtagung für Arznei- und Gewürzpflanzen 2004, 07.-09.9.2004 in Jena. Dornburg, Thüringer Landesanstalt für Landwirtschaft. pp. 66-70.
- Jedelská, J. and Keusgen, M. (2008) Bioactivity of some wild *Allium* species from Central Asia. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, pp. 93-101.
- Jedelská, J., Koblihovala, H., Khassanov, F. O., Hisoriev, H., Kurbonova, P. A., Fritsch, R. M. and Keusgen, M. (2004) Aroma-Präkursoren und Scavenger-Aktivität von zentralasiatischen *Allium*-Arten. Programm Abstracts und Postertexte, Fachtagung Arznei- und Gewürzpflanzen, Jena, p. 104.
- Jedelská, J., Koblihovala, H., Khassanov, F. O., Hisoriev, H., Kurbonova, P. A., Fritsch, R. M. and Keusgen, M. (2005a) Aroma-Präkursoren und Scavenger-Aktivität von zentralasiatischen *Allium*-Arten. In: Deutscher Fachausschuss für Arznei-, Gewürz-, Aromapflanzen, Thüringer Landesanstalt für Landwirtschaft (eds.) Chancen und Herausforderungen einer zeitgemäßen Arznei- und Gewürzpflanzenproduktion: Tagungsband. Fachtagung für Arznei- und Gewürzpflanzen 2004, 07. - 09.9.2004 in Jena. Dornburg, Thüringer Landesanstalt für Landwirtschaft, pp. 219-224.
- Jones, R. N. and Rees, H. (1968) Nuclear DNA variation in *Allium*. *Heredity* 23 (4), 591-605.
- Kamelin, R. V. (1973) Florogeneticheskij analiz estestvennoj flory gornoj Srednej Azii. Nauka, Leningrad, 237 pp.
- Kamelin, R. V. (1976) A new *Allium* species from the Syrdaria Karatau Range (Kazakhstan). *Byull. Mosk. o-va Ispyt. Prir., Otd. Biol.* 81 (1), 138. [In Russian]
- Kamelin, R. V. (1976a) A new species of onion (*Allium* L.) from southern Uzbekistan. *Novosti sist. vyssh. rast.* 13, 42-44. [In Russian]
- Kamelin, R. V. (1980) New taxa of the genus *Allium* (Alliaceae). *Bot. Zhurnal* 65 (10), 1459-1565. [In Russian]
- Kamelin, R. V. and Seisums, A. G. (1996) Tres species novae generis *Allium* L. (Alliaceae) ex Asia austro-occidentalis. *Novosti sist. vyssh. rast.* 30, 29-33. [In Russian]
- Kamenetskaya, I. I., Sinitsyna, V. G. and Gusak, L. E. (1984) K biologii luka Sergeya. *Vestnik Akad. Nauk Kazakhskoj SSR* (8), 65-68. [In Russian]

- Kamenetskaya, I. I. (1987) Dikorastusshie luki juzhnogo Kazakhstana. *Izv. Akad. Nauk Kaz. SSR, Ser. Biol.* (5 (143)), 3-8. [In Russian]
- Kamenetsky, R. (1992) Morphological types and root systems as indicators of evolutionary pathways in the genus *Allium*. In: Hanelt, P., Hammer, K. and Knüpffer, H. (eds.) *The Genus Allium - Taxonomic Problems and Genetic Resources*. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 129-135.
- Kamenetsky, R. (1996) Life cycle and morphological features of *Allium* species in connection with geographical distribution. *Bocconeia* 5, 251-257.
- Kamenetsky, R. and Fritsch, R. M. (2002) 19 Ornamental Alliums. In: Rabinowitch, H. D. and Currah, L. (eds.) *Allium Crop Science: Recent Advances*, CABI Publishing, Wallingford, U. K., pp. 459-491.
- Kamenetsky, R. and Japarova, N. (1997) Relationship between annual cycle and floral development of three *Allium* species from subgenus *Melanocrommyum*. *J. Arid Envir.* 35, 473-485.
- Kamenetsky, R. and Rabinowitch, H. D. (2002) 2 Florogenesis. In: Rabinowitch, H. D. and Currah, L., (eds.) *Allium Crop Science: Recent Advances*, CABI Publishing, Wallingford, U. K., pp. 31-57.
- Karelin, G. S. and Kirilow, I. P. (1841) Enumeratio plantarum anno 1840 in regionibus Altaicis et confinibus collectarum. *Bull. Soc. Impér. Natur. Moscou* (3), 369-459, (4), 703-770 '870'.
- Karelin, G. S. and Kirilow, I. P. (1842) Enumeratio plantarum in desertis Songoriae orientalis et in jugo summarum alpium Alatau anno 1841, collectarum. *Bull. Soc. Impér. Natur. Moscou* 15, 129-180, 321-453, 503-542. (Also printed as separate publication, Moskva, 233 pp.)
- Kasach, A. E. (1975) Otchet za 1973 god. In: *Kratkie otchety Pamirskogo botanicheskogo sada im. A. V. Gurskogo za 1971-1978 gg.* (Unpublished report), 1-13.
- Kawashima, K., Mimaki, Y. and Sashida, Y. (1991) Steroidal saponins from *Allium giganteum* and *A. aflatunense*. *Phytochemistry* 30, 3063-3067.
- Kel'ginbaev, A. N., Gorovits, M. B., Khomidkhodzhaev, S. A., Abubakirov N. K. (1973) Steroidnye saponiny i sapogeniny *Allium*. V. Neogigenin iz *Allium giganteum*. *Khimiya prirodnikh soedinenij* (Tashkent) 3, 438
- Kel'ginbaev, A. N., Gorovits, M. B., Gorovits, T. T., Abubakirov N. K. (1976) Steroidnye saponiny i sapogeniny *Allium* IX. Stroenie aginozida. *Khimiya prirodnikh soedinenij* (Tashkent) 4, 480-486.
- Keller, J. (1992) *In vitro* cultivation of *Allium* species - a method for application in plant breeding and germplasm conservation. In: Hanelt, P., Hammer, K. and Knüpffer, H. (eds.) *The Genus Allium - Taxonomic Problems and Genetic Resources*. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 137-152.
- Kerbabaev, B.B. and Meshcheryakov, A.A. (1975) *Lekarstvennye rasteniya Turkmenii izpol'zuemye v nauchnoy meditsine*. Ashkhabad, Izdat. "Ylym".
- Keusgen, M. (1999) Biosensorische Methoden zur quantitativen Bestimmung von Cysteinsulfoxiden. (Berichte aus der Pharmazie). Shaker, Aachen, 152 pp.
- Keusgen, M. and Fritsch, R. M. (eds.) (2008): Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, iv+ 272 pp. ISBN 978-3-9813096-0-7
- Keusgen, M., Fritsch, R. M., Hisoriev, H., Kurbonova, P. A. und Khassanov, F. O. (2004) Wildwachsende zentralasiatische *Allium*-Arten, die als Gewürz oder Arzneimittel verwendet werden. Programm Abstracts und Postertexte, Fachtagung Arznei- und Gewürzpflanzen, Jena, p. 101.
- Keusgen, M., Fritsch, R. M., Hisoriev, H., Kurbonova, P. A. und Khassanov, F. O. (2005) Wildwachsende zentralasiatische *Allium*-Arten, die als Gewürz oder Arzneimittel verwendet werden. In: Deutscher Fachausschuss für Arznei-, Gewürz-, Aromapflanzen, Thüringer Landesanstalt für Landwirtschaft (eds.) Chancen und Herausforderungen einer zeitgemäßen Arznei- und Gewürzpflanzenproduktion: Tagungsband. Fachtagung für Arznei- und Gewürzpflanzen 2004, 07. - 09.09. 2004 in Jena. Dornburg, Thüringer Landesanstalt für Landwirtschaft, pp. 206-209.
- Keusgen, M., Fritsch, R. M., Hisoriev, H., Kurbonova, P. A. and Khassanov, F. O. (2006) Wild *Allium* species (Alliaceae) used in folk medicine of Tajikistan and Uzbekistan. *J. Ethnobiol. Ethnomed.* 2, [paper] 18. <http://www.ethnobiomed.com/content/pdf/1746-4269-2-18.pdf>
- Keusgen, M., Jedelská, J. and Fritsch, R. M. (2008) Phytochemical analysis of *Allium* species from Central Asia. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on



- „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben, pp. 103-130.
- Kew World Checklist of Selected Plant Families*. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <http://apps.kew.org/wcsp/> Retrieved 02 June 2016.
- Khalmatov, Kh. Kh. (1964) *Dikorastushchie lekarstvennye rasteniya Uzbekistana*. Tashkent, 278 pp.
- Khassanov, F. O. (1992) A revision of the genus *Allium* L. in the flora of Uzbekistan. - In: Hanelt, P., Hammer, K., & Knüpfner, H. (eds.) *The Genus Allium - Taxonomic Problems and Genetic Resources*. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 153-159.
- Khassanov, F. O. (2008) Edible Alliums of Uzbekistan. In: Keusgen, M. and Fritsch, R. M. (eds.) *Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild Allium L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben*, pp. 131-133.
- Khassanov, F. O. and Esankulov, A. S. (2015) Taxonomic revision of *Allium* L. sect. *Minuta* F.O. *Khass. Stapfia* 103, 97-102.
- Khassanov, F. O. and Fritsch, R. M. (1994) New taxa in *Allium* L. subg. *Melanocrommyum* (Webb & Berth.) Rouy from Central Asia. *Linzer biol. Beitr.* 26 (1), 965-990.
- Khassanov, F. O., Karimov, F. and Tirkasheva, B. (2013) Taxonomic revision and leptotypification of *Allium* L. sect. *Coerulea* (Omelcz.) F.O. *Khass. Stapfia* 99, 208-234.
- Khassanov, F. O. and Mal'tsev, I. I. (1988) *Allium ecornutum* Khassanov et Maltzev sp. nov. *Uzb. Biol. Zhurn.* (4), 43.
- Khassanov, F. O., Shomuradov, H. F. and Kadyrov, G. U. (2011) Taxonomic revision of *Allium* L. sect. *Allium* s.l. in Central Asia. *Stapfia* 95, 171-174.
- Khassanov, F. O. and Umarov, T. A. (1989) *Dikorastushchie pishchevye vidy roda Allium L. Zapadnogo Tyan-Shanya*. *Uzb. Biol. Zhurnal* (6), 24-25.
- Khodzhaeva M. A., Ismailov Z. F. (1979) *Uglevody Allium*. I. Vydelenie i kharakteristika polisakharidov. *Khimiya prirodnykh soedinenij* (Tashkent) 2, 137-142.
- Khristulas, F. S., Gorovits, M. B., Abubakirov N. K. (1974) Steroidnye saponiny i sapogeniny *Allium*. VI. 3-O-β-D-glyukopiranozid karatavigenina B. *Khimiya prirodnykh soedinenij* (Tashkent) 4, 530-531.
- Koch, K. (1849) *Beiträge zu einer Flora des Orientes*. - *Linnaea* [21, 289-443, 609-736;] 22, 177-336, 597-752.
- Koch, W. D. J. (1836-1837) *Synopsis florae germanicae et helvetiae, exhibens stirpes phanerogamas rite cognitae, que in Germania, Helvetia, Borussia et Istria sponte crescunt ...* Francofurti ad Moenum, sumptibus F. Wilmans, section 1 & 2, 844 pp.
- Kochkareva, T. F. and Chukavina, A. P. (1985) Wildgrowing foodstuff plants of Khovalingy region (Central Tadjikistan). *Rastitel'nye Resursy* 21 (2), 140-149. [In Russian]
- Kojima, A. and Yoshida, T. (1994) Japan-CIS joint expedition for the collection of vegetable germplasm in Central Asia. *Genetic Resources Project Newsl.* (21), 2.
- Kollmann, F. (1970) New chromosome counts in *Allium* species of Palestine and Mount Hermon. *Israel J. Bot.* 19, 245-248.
- Kollmann, F. (1984) *Allium*. In: Davis, P. H. (Ed.) *Flora of Turkey and the East Aegean Islands*. Vol. 8. Edinburgh Univ. Press, Edinburgh, pp. 98-208.
- Komissarov, V. A. and Tarasova, E. M. (1979) Morfometricheskoe izuchenie kariotipov devjati diploidnykh vidov roda *Allium* L. *Izv. Timiryasevskoj Sel'skochozyajstvennoj Akad.* (1), 188-193.
- Krassovskaya, L. S. (1982) Novyj vid roda *Allium* iz Chatkal'skogo khrebt. *Bot. mat. gerb. inst. bot. Akad. Nauk Uzb. SSR vyp.* 20, 14-17.
- Krassovskaya, L. S. and Levichev, I. G. (1986) *Flora Chatkal'skogo zapovednika*. FAN, Tashkent, 174 pp.
- Krest, I., Glodek, J. and Keusgen, M. (2000) Cysteine sulfoxides and alliinase activity of some *Allium* species. *J. Agr. Food Chem.* 48 (8), 3753-3760.
- Kruse, J. (1984) Rasterelektronenmikroskopische Untersuchungen an Samen der Gattung *Allium* L. *Kulturpflanze* 32, 89-101.
- Kruse, J. (1986) Rasterelektronenmikroskopische Untersuchungen an Samen der Gattung *Allium* L. II. *Kulturpflanze* 34, 207-228.

- Kruse, J. (1988) Rasterelektronenmikroskopische Untersuchungen an Samen der Gattung *Allium* L. III. Kulturpflanze 36, 355-368.
- Kruse, J. (1992) Growth form characters and their variation in *Allium* L. In: Hanelt, P., Hammer, K. and Knüpffer, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 173-179.
- Kruse, J. (1994) Rasterelektronenmikroskopische Untersuchungen an Samen der Gattung *Allium* L. IV. Feddes Repert. 105, 457-471.
- Kuntze, O. (1887) *Plantae orientali-rossicae*. Trudy Imp. S.-Peterb. Bot. Sada 10, 135-262.
- Kurbanov, J. (2005) Dikorastushchie luki Turkmenistana. Problemy osvoeniya pustyn (Problems of Desert Development) (3), 23-28.
- Kurita, M. (1956) Karyotypes of some species in *Allium*. Mem. Ehime Univ. sect. II 2 (3), 239-245.
- Kusterer, J., Fritsch, R. M. and Keusgen M. (2011) *Allium* species from Middle and Southwest Asia are a rich source for Marasmin. J. Agric. Food Chem. 59 (15), 8289–8297.
- Kusterer J. and Keusgen, M. (2009) A new pyridine cysteine-sulfoxide identified in *Allium stipitatum*. SL 65, Planta Medica 75 (9), 901.
- Kusterer, J., Vogt, A. and Keusgen, M. (2010 publ. 2009) Isolation and identification of a new cysteine sulfoxide and volatile sulfur compounds from *Allium* subgenus *Melanocrommyum*. J. Agric. Food Chem. 58 (1), 520–526.
- Labani, R. M. and Elkington, T. T. (1987) Nuclear DNA variation in the genus *Allium* L. (Liliaceae). Heredity 59 (1), 119-128.
- Lapin, A. M. (1938) Opredelitel rastenij Tashkentskogo oazisa. Chast 1. Tashkent.
- Larin, I. V. (ed.) (1950) Kormovye rasteniya senokosov i pastbishch SSSR. Tom 1. Moskva - Leningrad, 687 pp.
- Lazkov, G. A. (2008) A new species of the genus *Allium* (Alliaceae) from Kirghizia. Bot. Zhurnal 93 (8), 1271-1272, tabl. I - III. [In Russian]
- Lazkov, G. A. and Turdumatova, N. K. (2010) New and rare species of the genus *Allium* (Alliaceae) for flora of Kyrgyzstan. Bot. Zhurnal 95 (11): 1637-1639. [In Russian]
- Ledebour, C. F. von (1830) *Flora altaica*. Tomus 2. Berlin, G. Reimer, XVI+464 pp.
- Ledebour, C. F. von (1833) *Icones plantarum novarum vel imperfecte cognitatum florum rossicam, imprimis altaicam illustrantes*. Centuria IV. - Rigae, I. Deubner, 28 pp., tab. 301-400.
- Levan, A. (1929) Zahl und Anordnung der Chromosomen in der Meiosis von *Allium*. Hereditas 13, 80-86.
- Levan, A. (1931) Cytological studies in *Allium*. A preliminary note. Hereditas 15, 347-356.
- Levan, A. (1932) Cytological studies in *Allium* II: chromosome morphological contribution. Hereditas 16, 257-294.
- Levan, A. (1935) Cytological studies in *Allium*. VI. The chromosome morphology of some diploid species of *Allium*. Hereditas 20, 289-330.
- Li, Q.-Q., Zhou, S.-D., He, X.-J., Yu, Y., Zhang, Y.-C. and Wei, X.-Q. (2010) Phylogeny and biogeography of *Allium* (Amaryllidaceae: Allieae) based on nuclear ribosomal internal transcribed spacer and chloroplast *rps16* sequences, focusing on the inclusion of species endemic to China. Ann. Bot. 106, 709-733.
- Lipsky, V. I. (1900) Materialy dlya flory Srednej Azii. Trudy Imp. S.-Peterb. Bot. Sada 18, 1-146. [In Russian]
- Löve, A. (1977) IOPB chromosome number reports. LVI. Taxon 26 (2/3), 257-274.
- Löve, A. (1979) IOPB chromosome number reports. LXIV. Taxon 28 (4), 391-408.
- Löve, A. (1981) IOPB chromosome number reports. LXXII. Taxon 30 (3), 694-708.
- Maass, H. I. (1992) Electrophoretic study of storage proteins in the genus *Allium* L. In: Hanelt, P., Hammer, K. and Knüpffer, H. (eds.) The Genus *Allium* - Taxonomic Problems and Genetic Resources. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 183-189.
- Maassumi, S. M. and Bobrov, A. V. (2004) Wild food plants of the western Iran. Rastit. Resursy 40 (4), 86-93. [In Russian]

- Maeda, M., Dubouzet, J. G., Arisumi, K. I., Etoh, T. and Sakata, Y. (1994) Effects of cold storage and staggered planting in forcing culture of spring-flowering *Allium* species. *J. Jap. Soc. Hort. Sci.* 63 (3), 629-638.
- Mensinkai, S. W. (1939) Cytogenetic studies in the genus *Allium*. *J. Genet.* 39, 1-45.
- Mensinkai, S. W. (1941) 200. Evolution in the genus *Allium*. In: Punnett, R. C. (ed.) *Proc. Seventh Int. Genet. Congr., Edinburgh, Scotland 23-30 Aug. 1939.* Univ. Press, Cambridge, pp. 214-215.
- Meyer, C. A. von (1831) *Verzeichniss der Pflanzen, welche während der ... in den Jahren 1829 und 1830 unternommenen Reise im Caucasus und in den Provinzen am westlichen Ufer des Caspischen Meeres gefunden ...* St. Petersburg, 241 pp.
- Mimaki, Y., Kawashima, K. and Sashida, Y. (1993) Steroid glycosides from *Allium albopilosum* and *A. ostromskianum*. *Phytochemistry* 34, 799-805.
- Mimaki, Y., Nakaido, T., Matsumoto, K., Sashida, Y. and Ohmoto, T. (1994) New steroidal saponins from the bulbs of *Allium giganteum* exhibiting potent inhibition of cAMP phosphodiesterase activity. *Chem. Pharm. Bull. (Tokyo)* 42 (3), 710-714.
- Miralibekov, N. (1982) *Introduktsiya travyanistykh rastenij na Zapadnom Pamire* (Unpublished interim report of Pamir Biological Institute), 62-64.
- Miralibekov, N. (1984) *Introduktsiya drevesnykh i travyanistykh rastenij na Zapadnom Pamire* (Unpublished annual report of Pamir Biological Institute), 49-52.
- Moench, C. (1794) *Methodus plantarum horti botanici et agri marburgensis a staminum situ describendi ...* Marburgi Cattorum, 780 pp.
- Namin, H. H., Mehrvarz, S. S., Zarre, S. and Fritsch R. M. (2009) Pollen morphology of selected species of *Allium* distributed in Iran. *Nordic J. Bot.* 27 (1), 54-60.
- Namin, H. H., Mehrvarz, S. S. and Zarre, S. (2009b) Scape anatomy of *Allium* (Alliaceae) in Iran and its systematic application. *Thaiszia* 19 (1), 37-45.
- Narayan, R. K. J. (1988) Constraints upon the organization and evolution of chromosomes in *Allium*. *Theor. Appl. Genet.* 75 (2), 319-329.
- Neshati, F., Fritsch, R. M. and Zarre, S. (2009) Pollen morphology of some *Allium* L. species (Alliaceae) from Iran. *Bot. Jahrb. Syst.* 127 (4), 433-451.
- Nevski, S. A. (1937) *Materialy k flore Kugitanga i ego predgorij.* *Trudy Bot. Inst. Akad. Nauk SSSR Ser.1 vyp. 4:* 199-346.
- Nikitin, V. V. and Gel'dikhanov A. M. (1988) *Opredelitel' rastenij Turkmenistana.* Nauka, Leningrad, 679 pp. [In Russian]
- Nikitina, E. V. and Kashchenko, L. I. (1951) *Rod 7. Allium L. - Luk.* In: Vvedensky, A. I. (ed.) *Flora Kirgizskoj SSR ... Tom 3 Aroidnye - Orkhidnye.* Frunze, Izd. KirgizFAN SSSR, pp. 50-96.
- Nikitina, E. V. (1962) *Flora Kirgizskoj SSR. Opredelitel rastenij Kirgizskoi SSR.* Tom 10. Izd. Akad. Nauk Kirg. SSR, Frunze, 389 pp.
- Nikitina, E. V., Aidarova, R. S., Arbaeva, Z. S., Dzhanava, V. N., Ubukeeva, A. U. and Tkachenko, V. I. (1967) *Flora Kirgizskoj SSR. Dopolnenie, vyp. 1.* Frunze, Izd. ILIM, 149 pp.
- Nikolaeva, M. G., Rasumova, M. V. and Gladkova, V. N. (1985) *Spravochnik po prorashchivaniyu pokoyashchikhsya semyan.* Leningrad, Nauka, pp. 53-55.
- Ohri, D., Fritsch, R. M. and Hanelt, P. (1998) Evolution of genome size in *Allium* (Alliaceae). *Plant Syst. Evol.* 210 (1/2), 57-86.
- Omelczuk, T. Ya. (1962) *Sistematicheskij sklad cibul' Ukraïni (rid Allium L.).* *Ukrain. Bot. Zhurnal* 19 (3), 66-73. [in Ukrainian]
- Omel'chuk-Mjakushko, T. Ya. (1976 publ.1977) *Konspekt sem. Alliaceae J. Agardh Evropejskoj chasti SSSR.* In: Klovov, M. V., Dubovik, O. N., Makarevich, M. F., Dobrochaeva, D. N. and Dudka, I. A. (eds.) *Novosti sistematiki vysshikh i nizshikh rastenij 1976.* Kiev, pp. 51-58.
- Omel'chuk-Mjakushko, T. Ya. (1979) *Rod 1. Luk - Allium L.* In: Fedorov, An. A. (red.) *Flora Evropejskoj chasti SSSR, tom IV Pokrytosemennye Dvudol'ny Odnodol'nye.* Nauka, Leningrad, pp. 261-275.
- Pallas, P. S. (1773) *Descriptiones Plantarum.* In: *Reise durch verschiedene Provinzen des russischen Reiches ... Band 2, Anhang: 733-744.* St. Petersburg.

- Pandita, T. K. and Mehra, P. N. (1981) Cytology of *Alliums* of Kashmir Himalayas, III. Male meiosis. *Nucleus* (India) 24 (3), 147-151.
- Panahandeh, J. and Mahna, N. (2011 publ. 2012) The karyomorphology of *Allium hirtifolium* Boiss., a less known edible species from Iran. *Journal of Plant Physiology and Breeding* 1(2): 53-57.
- Pavlov, N. V. (1949) Novye rasteniya Kazakhstanskoj flory, I. *Vestnik Akad. Nauk Kaz. SSR* 1, 24-36.
- Pavlov, N. V. and Polyakov, P. P. (1958) Genus *Allium* L. In: Pavlov, N. V. (ed.) *Flora Kazakhstana* II. Alma-Ata, Izdat. Akad. Nauk Kazakhsk. SSR, pp. 134-193. [In Russian]
- Pedersen, K. and Wendelbo, P. (1966) Chromosome numbers of some SW Asian *Allium* species. *Blyttia* 24, 307-313.
- Pistrick, K. (1992) Phenological variability in the genus *Allium* L. In: Hanelt, P., Hammer, K. and Knüpfner, H. (eds.) *The Genus Allium - Taxonomic Problems and Genetic Resources*. (Proc. Int. Symp. Gatersleben, June 11-13, 1991). IPK, Gatersleben, pp. 243-249.
- Pistrick, K., Kruse, J. and Adler, K. (2001) Obdiplostemonie in der Gattung *Allium* L. *Flora* 196, 204-214.
- Pobedimova, E. G. (1949) Novyj vid luka iz Srednej Azii. *Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR* 11, 64-66.
- Pogosian, A. I. (1983) Chromosome numbers of some species of the genus *Allium* (Alliaceae) distributed in Armenia and Iran. *Bot. Zhurnal* 68 (5), 652-660. [In Russian]
- Pogosian, A. I. and Seisums, A. G. (1992) Chromosome numbers of some *Allium* species (Alliaceae) from Afghanistan, Turkey and Central Asian states. *Bot. Zhurn.* 77 (9), 103-104. [In Russian]
- Priszter, Sz. (1975) Über einige Pflanzen des westlichen Tienschan. I. *Acta Bot. Acad. Sci. Hung.* 21, 377-386.
- Rechinger fil., K. H. (1939) *Plantae novae Aegaeae*. II. *Feddes Repert.* 47, 49-51.
- Regel, E. (1868) *Liliaceae*. In: *Regel E. et von Herder, F. G. M. T., Enumeratio plantarum in regionibus cis- et transiliensibus a cl. Semenovio anno 1857 Collectarum ... Bull. Soc. Imper. Natur. Moscou* 41 (II), 437-459.
- Regel, E. (1875) *Alliorum adhuc cognitorum monographia*. *Trudy Imp. S.-Peterb. Bot. Sada* 3 (2), 1-266.
- Regel, E. (1876) *Turkestanskaya Flora. Tetrad pervaya*. In: *Fedtschenko, A. P., Puteshestvie v Turkestan. Vyp. 12, tom III. Izv. Imper. Obshch. Lyub. Estestv. Antrop. Etnogr.* 21, vyp. 2, 165 pp., 22 tab.
- Regel, E. (1878-1886) *Descriptiones plantarum novarum et minus cognitarum. Fasciculus VI, VII, VIII, VIII suppl., IX, X. Trudy Imp. S.-Peterb. Bot. Sada* 5, 575-646 (Jan-Oct 1878); 6, 287-583 (1879); 7, 541-690 (1880 publ. 1881); 8, 269-279 (1881), 641-702 (1884); 9, 575-620 (Jan-Aug 1886).
- Regel, E. (1881) A. *Allium stipitatum* Rgl. *Gartenflora* 30, 355, tab. 1062 fig. 1-3.
- Regel, E. (1881) B. *Allium suworowi* Rgl. *Gartenflora* 30, 356, tab. 1062 fig. 4, 5.
- Regel, E. (1883) A. *Allium giganteum* Rgl. *Gartenflora* 32, 97, tab. 1113.
- Regel, E. (1885) 2. *Allium backhousianum* Rgl. *Gartenflora* 34, 213-214, cum icone fig. a-e.
- Regel, E. (1887) *Allii species Asiae Centralis in Asia Media a Turcomania desertisque Araliensibus et Caspicis usque ad Mongoliam crescentes*. *Trudy Imp. S.-Peterb. Bot. Sada* 10, 278-362.
- Regel, E. (1887b): *Allium elatum* Rgl. *Gartenflora* 36, 369-370, tab. 1251.
- Rouy, G. (1910) *Flore de France ou description des plantes qui croissent spontanément en France, en Corse et en Alsace-Lorraine. Tome XII. Paris, Deyrolle, 505 pp.*
- Rukšāns, J. (2007) *Buried Treasures. Finding and growing the world's choicest bulbs*. Timber Press, Portland London, 384 pp. ISBN-13: 978-0-88192-818-1
- Sagalaev, V. A. (1997) *Luki flory nizhnego povolzh'ja*. *Byull. Glavnogo Bot. Sada* 174, 41-47.
- Saidov, M. K. (1986) *Osnovnye dikorastushchie ovoshnye rasteniya Tsentralnogo Tadzhikistana*. (The main wild vegetable plants of Central Tajikistan.) *Izv. AN Tadzh. SSR, Otdel. Biol. nauk no. 3* (104), 26-30.
- Saidov, M. K. (2001) *Izuchenie, ispol'zovanie i okhrana pishevykh rastenij s epokhi Samanidov do nashego vremeni*. [Study, utilization and protection of food plant from Samanid's epoch till now]. *Trudy Instituta Botaniki Akad. Nauk Respubliki Tadzhikistan*, 59-63.

- Saidov, M. K., Shub, S. S., Trofimova, E. P. (1985) Khimicheskaya kharakteristika osnovnikh dikorastushkikh pishchevikh rastenij Tsentral'nogo Tadzhiqistana. [Chemical characteristic of main wild food plants of Central Tajikistan] Rast. Resursy (2), 212.
- Sakhobiddinov, S. S. (1948) Dikorastushchie lekarstvennye rasteniya Sredney Azii. Tashkent.
- Samiei, L., Kiani, M., Zarghami, H., Memariani, F. and Joharchi, M. R. (2015) Genetic diversity and interspecific relationships of some *Allium* L. species using Inter Simple Sequence Repeat markers. Bangladesh J. Plant Taxon. 22 (2), 67-75.
- Schultes, J. A., Schultes, J. H. [in J. J. Roemer et J. A. Schultes] (1830) Caroli a Linné equitis Systema vegetabilium secundum classes ordines genera species ... Voluminis septimi pars secunda. Stuttgartiae, pp. 750-1815.
- Seisums, A. (1992) Interspecific differences of two *Allium* L. taxa. Latvian Zinatnu Akad. Vestis, B. (4), 79-80.
- Seisums, A. G. (1994) Podrod *Melanocrommyum* (Webb et Berth.) Rouy roda *Allium* L. (Monografičeskij obzor). Avtoreferat dissertatsii ... doktora biol. nauk. Riga, 28 pp. [In Latvian, Russian, English]
- Seisums, A. (2000) Notes on *Allium* L. subgen. *Melanocrommyum* (Webb et Berth.) Rouy in Iran. Iranian J. Bot. 8 (2), 223-232.
- Seregin, A. P. (2007) A new subspecies of *Allium decipiens* (sect. *Melanocrommyum*) (Alliaceae) from the Crimean and NW Caucasus Mts. Phytologia Balcanica 13: 193-204.
- Shalyt, M. S. (1951) Dikorastushchie poleznye rastenij Turkmenskoj SSR. Moskva.
- Sokolov, P. D. (1994) Rastitel'nye resursy Rossii i sopredel'nykh gosudarstv: Tsvetkovye rastenija, ikh khimicheskij sostav, ispol'zovanie. Semejstva Butomaceae - Typhaceae. Tom 8. Sankt Peterburg, Nauka, 271 pp.
- Specht, C. E. and Keller, E. R. J. (1997) Temperature requirements for seed germination in species of the genus *Allium* L. Genet. Resour. Crop Evol. 44 (6), 509-517.
- Sumnevich, G. P. (1942). Dikorastushchie pishchevye rastenija Uzbekistana. Tashkent.
- Thunert, K. (1967) Beiträge zur Pollenmorphologie und Taxonomie der Gattung *Allium*. Jena. (Staats-examensarbeit, nicht publiziert) 39 pp., 5 Taf.
- Tischler, G. (1931) Pflanzliche Chromosomenzahlen. (Nachtrag Nr. 1). Tabulae Biol. period. 1, 109-126.
- Tojibaev, K. Sh., Turginov, O. and Karimov, F. I. (2014) A new species and new records of *Allium* (Amaryllidaceae) for Uzbekistan (Central Asia). Phytotaxa 177 (5): 291-297.
- Trautvetter, E. R. von (1884) Incrementa florae phaenogamae rossicae. Fascic. IV. Acta Horti petrop. 9 (1), pp. 221-415 as extra publication, or pp. 735-929 of the whole opus)
- Tscholokaschvili, N. (1975) Ad cognitionem systematis generis *Allium*. Zam. sist. geogr. rast. Tbilisi 31, 36-54. [In Georgian]
- Turakulov, I. (1986) Novye vidy luka (*Allium* L.) iz Kuraminskogo khrepta. Dokl. Akad. Nauk Tadz. SSR 29 (3), 180-182.
- Tzagolova, V. G. (1977) K sistematike seksii *Molium* G. Don Kazakhstanskikh lukov. Bot. mat. gerb. inst. bot. AN Kaz. SSR, vyp. 10, 13-14. [In Russian]
- Umarov, T. A. (1992) Dikorastushchie pishchevye rastenija gornoj chasti Tashkentskoj oblasti. Avtoreferat dissertatsii. Tashkent, 19 pp.
- Uphof, J. C. Th. (1968) Dictionary of economic plants. 2. edition, revised and enlarged. Lehre, 591 pp.
- Vakhtina, L. I. (1964a) Chisla khromosom nekotorykh vidov luka rasprostranennykh na territorii SSSR. Bot. Zhurnal 49 (6), 870-875.
- Vakhtina, L. I. (1964b) Kariotipy 20-khromosomnykh vidov luka - *Allium kujukense* Vved. i *A. decipiens* Fisch. Tsitologija 6, 577-582.
- Vakhtina, L. I. (1969) Sravnitel'no-kariologicheskoe issledovanie nekotorykh vidov luka seksii *Molium* Don. Bot. Zhurnal 54 (1), 143-153.
- Vakhtina, L. I. (1974) A caryological study of *Allium grande* Lipsky (Liliaceae). Bot. Zhurnal 59 (10), 1516-1519. [In Russian]
- Vakhtina, L. I. (1985) Chromosome numbers in some species of the genus *Allium* (Alliaceae) in the flora of the USSR. Bot. Zhurnal 70 (5), 700-701. [In Russian]

- Vakhtina, L. I. and Tarvis, L. V. (1983) Mezhhvidovye razlichiya po sodержaniyu DNK v rode *Allium* L. Tez. Dokl. 7 Delegat. S'ezda Vses. Bot. o-va Donetsk 11-14 maja 1983. Leningrad, pp. 13-14.
- Vakhtina, L. I., Zakirova, R. O. and Vakhtin, Y. B. (1977) Interspecific differences in DNA content and taxonomically significant characters in the genus *Allium* L. (Liliaceae). Bot. Zhurnal 62 (5), 677-684. [In Russian]
- Ved Brat, S. (1965a) Genetic system in *Allium*. 1. Chromosome variation. Chromosoma 16 (4), 486-499.
- Ved Brat, S. (1965b) Genetic system in *Allium*. 3. Meiosis and breeding systems. Heredity 20 (3), 325-339.
- Vogt, A., Jedelská, J. and Keusgen, M. (2008) New enzymatic aspects of *Allium* subgenus *Melanocrommyum*. In: Keusgen, M. and Fritsch, R. M. (eds.) Proceedings, First Kazbegi workshop on „Botany, taxonomy and phytochemistry of wild *Allium* L. species of the Caucasus and Central Asia“, June 4 – 8, 2007, Kazbegi, Caucasus, Georgia. Marburg & Gatersleben pp. 157-166.
- Vollerner, Yu. S., Abdullaev, N. D., Gorovits, M. B. and Abubakirov, N. K. (1983) Steroidnye saponiny i sapogeniny *Allium* XVIII. Stroenie karataviozida B. Khimiya prirodnykh soedinenij, Tashkent 2, 197-201.
- Vollerner, Yu. S., Abdullaev, N. D., Gorovits, M. B. and Abubakirov, N. K. (1983b) Steroidnye saponiny i sapogeniny *Allium* XIX. Stroenie karatavigenina C. Khimiya prirodnykh soedinenij, Tashkent 6, 736-740.
- Vollerner, Yu. S., Abdullaev, N. D., Gorovits, M. B. and Abubakirov, N. K. (1984) Steroidnye saponiny i sapogeniny *Allium* XX. Stroenie karataviozidov E i F. Khimiya prirodnykh soedinenij, Tashkent 1, 69-73.
- Vollerner Yu. S., Gorovits, M. B., Gorovits, T. T., Abubakirov N. K. (1978) Steroidnye saponiny i sapogeniny *Allium* XIV. Stroenie karataviozida A. Khimiya prirodnykh soedinenij, Tashkent 6, 740-746.
- Vollerner, Yu. S., Gorovits, M. B., Gorovits, T. T. and Abubakirov, N. K. (1980) Steroidnye saponiny i sapogeniny *Allium* XVII. Stroenie karataviozida C. Khimiya prirodnykh soedinenij, Tashkent 3, 355-359.
- Vollerner, Yu. S., Kravets, S. D., Shashkov, A. S., Gorovits, M. B. and Abubakirov, N. K. (1988a) Steroidy ryada spirostana i furostana rastenij roda *Allium*. XXV. Stroenie anzurogenina B iz *Allium suvorovii* i *A. stipitatum*. Khimiya prirodnykh soedinenij, Tashkent 2, 218-221.
- Vollerner, Yu. S., Kravets, S. D., Shashkov, A. S., Gorovits, M. B. and Abubakirov N. K. (1988b) Steroidy ryada spirostana i furostana rastenij roda *Allium*. XXIV. Stroenie anzurogenina A iz *Allium suvorovii* i *A. stipitatum*. Khimiya prirodnykh soedinenij, Tashkent 1, 68-73.
- Vosa, C. G. (1977) Heterochromatin patterns and species relationships. Nucleus (India) 20 (1/2), 33-41.
- Vvedensky, A. I. (1923) Sem. XX. Liliaceae. Lilejnye. In: Popov, M. G. (red.) Opredelitel rastenij okrestnosti Tashkenta. Vyp. 1: 55-71, ris. 89-100.
- Vvedensky, A. I. (1924) Decas Alliorum novorum ex Asia Media. Bot. Mat. Gerb. Bot. Sada 5 (6), 89-96.
- Vvedensky, A. I. (1925) Schedae ad Herbarium Florae Asiae Mediae ab Universitate Asiae Medium editum. Fasc. III – V. Prilozhenie k Byull. Sredne-Aziatsk. Gosud. Univer. vyp. 9, *Allium* pp. 5-12.
- Vvedensky, A. I. (1932) XVII. Liliaceae - Lilejnye. 5. *Allium* L. - luk. In: Fedtschenko, B. A. and Popov, M. G. (eds.) Flora Turkmenii. Tom 1, vyp. 2. Izdanie Akad. Nauk SSSR i Bot. Inst. Turkmensk. SSR, Leningrad, pp. 270-296.
- Vvedensky, A. I. (1934) Descriptiones Alliorum novorum. Byull. Sredneaz. gosud. univ. 19 (18), 119-130.
- Vvedensky, A. I. (1935) Rod 267. Luk - *Allium* L. In: Komarov, V. L. (ed.) Flora SSSR; tom 4. Izd. Akad. Nauk SSSR, Leningrad, pp. 112-280.
- Vvedensky, A. I. (1941) Rod 162. (7.) *Allium* - Luk. In: Shreder, R. R. (ed.) Flora Uzbekistana. Tom 1. Izd. Akad. Nauk SSSR Uzb. Filiala, Tashkent, pp. 426-467.
- Vvedensky, A. I. (1946) Novye lilejnye Tadzhiqistana. Bot. mat. gerb. bot. inst. Akad. Nauk SSSR 9, 232-247.
- Vvedensky, A. I. (1963) Sem. Amaryllidaceae. In: Ovczinnikov, P. N. (ed.) Flora Tadzhiqskoj SSR; tom 2. Izd. Akad. Nauk SSSR, Moskva - Leningrad, pp. 290-370.

- Vvedensky, A. I.<sup>1</sup> and Kovalevskaya, S. S. (1971) Rod 151, (7) *Allium* L. - Luk zhua (kaz.) piez (tadzh.). In: Vvedensky, A. I. and Kovalevskaya, S. S. (eds.) *Opredelitel rastenij Srednej Azii. Kriticheskij konspekt flory 2*. Izd. "FAN" Uzb. SSR, Tashkent, pp. 39-89, incl. Appendix. *Descriptiones plantarum novarum in tomo II Conspectus Florae Asiae Mediae commemoratorum*: 311-328.
- Wang, F. T. and Tang, Y. C. (1937) Notes on Chinese Liliaceae IV. *Bull. Fan Memorial Inst. Biol.* 7 (6), 281-299.
- Webb, P. B. & Berthelot, S. (1846) *Histoire naturelle des Isles Canaries. Tome troisième [Botanique]* Paris, 479 pp., tab. 137-252.
- Wendelbo, P. (1958 publ. 1959) *Liliiflorae*. (In: Koie, M. and Rechinger, K. H. *Symbolae Afghanicae IV.*) *Biol. Skr. Kongel. Danske Vidensk. Selskab* 10 (3), 150-191.
- Wendelbo, P. (1966) New taxa and synonyms in *Allium* and *Nectaroscordum* of SW Asia. *Acta Horti Gothob.* 28, 15-55.
- Wendelbo, P. (1968) Some new species of *Allium* (Liliaceae) from Afghanistan. *Bot. Notiser* 121, 269-277.
- Wendelbo, P. (1969) New subgenera, sections and species of *Allium*. *Bot. Notiser* 122, 25-37.
- Wendelbo, P. (1971) *Alliaceae*. In: Rechinger, K. H. (ed.) *Flora iranica. Flora des iranischen Hochlandes und der umrahmenden Gebirge, Persien, Afghanistan, Teile von Westpakistan, Nordirak, Azerbaidjan, Turkmenistan*. no. 76. Graz, Akademische Druck- und Verlagsanstalt, 100 pp.
- Wendelbo, P. (1977) *Allium*. In: Wendelbo, P. (ed.) *Tulips and irises of Iran and their relatives*. *Bot. Inst. Iran - Ariamehr Bot. Garden, Tehran (Iran)*, pp. 18-25.
- Xu, J. M. (1980) *Monocotyledoneae - Liliaceae Allium* L. In: Wang, F. T. and Tang, T. (eds.) *Flora reip. popul. Sinicae* 14, 170-272. [In Chinese]
- Xu, J. and Kamelin, R. V. (2000) 32. *Allium* Linnaeus, Sp. Pl. 1: 294. 1753. In: Wu, Z. and Raven, P. H. (eds.) *Flora of China*, vol. 24. Science Press and Missouri Botanical Garden Press, Beijing and St. Louis, China and USA, pp. 165-202.
- Wright, C. H. (1903) *Allium albopilosum*, C. H. Wright, *sp. nov.* *Gard. Chron.* 34, Third series, II No. 864, 34, cum tab. opp. p. 40.
- Yoshida, T., Kojima, A., Gogishaishvili, N. B., Shuvalov, S. V. and Pimakhov, A. P. (1994 publ. 1995) Japan-CIS joint exploration for *Allium* germplasm in Kyrgyzstan, Kazakhstan and Uzbekistan Republics in 1993. *Allium Improvement Newsl.* 4, 117-119.
- Yunusov, S. (1985) *Okhrana redkikh i ischezayushchikh rastenij Tadzhikistana*. Dushanbe, 61 pp.
- Yur'eva, N. A. and Kokoreva, V. A. (1992) *Mnogoobrazie lukov i ikh ispol'zovanie*. Moskva, MSKhA, 159 pp.
- Zakirova, R. O. (1989) De dignitate biologica contentus diversi acidi desoxyribonucleinici. *Bot. Mat. Gerb. Inst. Bot. A. N. Kaz. SSR* 16 (1), 68-79. [In Russian]
- Zakirova, R. O. and Nafanailova, I. I. (1988) *Chisla khromosom nekotorykh vidov flora Kazakhstana*. *Bot. Zhurnal* 73, 1493-1494.
- Zakirova, R. O. and Nafanailova, I. I. (1990) Chromosome numbers in the members of some families of vascular plants in the flora of Kazakhstan. *Bot. Zhurnal* 75 (3), 438-439. [In Russian]
- Zakirova, R. O. and Vakhtina, L. I. (1974) A cytophotometric and caryological study of some *Allium* species of the subgenus *Melanocrommyum* (Webb et Berth.) Wendelbo, section *Melanocrommyum*. *Bot. Zhurnal* 59 (12), 1819-1827. [In Russian]
- Zhaparova, N. K. (1987) *Novoe mestonakhozhdienie redkogo vida Allium sergii Vved. v Karatau*. *Bot. Mat. Gerb. Inst. Bot. A. N. Kaz. SSR* 15, 34-35.
- Zimmer, K., Walingen, M. and Gebauer, B. (1985) *Untersuchungen an Allium christophii*. *Deutscher Gartenbau* 39, 2206-2209.
- Zimmer, K. and Weckeck, K. (1989) Effect of temperature on some ornamental alliums. *Acta Hort.* 246, 131-135.

<sup>1</sup> In 1988 T. A. Adylov, the "right hand" of Vvedensky in the former herbarium of Tashkent State University [TAK], told me that S. S. Kovalevskaya wrote the *Allium* treatment according to data and instructions given by Vvedensky (who was already very ill at that time).

## Appendix 1

## List of herbarium vouchers collected in Central Asia

About 2215 herbarium vouchers were compiled, plus about 125 determined accessions present in national living collections [marked (Coll)], but these determinations could not be verified during visits when no flowers were present (otherwise these accessions were included under the living accession in the main text). About 70 % of these vouchers were collected prior to 1970, and reflect thus only the historical distribution. Herbarium vouchers are presented under the alphabetically arranged species and subspecies and inside of them in the alphabetic order of country names (underlined and are separated with a full stop and a hyphen). Regions inside a country are separated by full stops, areas inside of regions by semicolons, and records from  $\pm$  identical locations by commas. As far as available, after the location more data are given between round brackets: coordinates, altitude, date, collector, number, and herbarium or herbaria where this/these vouchers are housed. If different collections were made at one place, they are separated by semicolons. The acronyms of the herbaria follows the "Index herbariorum" also available via Internet (<http://sweetgum.nybg.org/ih/>).

Labels of nearly all vouchers were hand-written in Russian. Because I am unable quickly to write Russian letters into the PC, I decided to translate the data into English for quick enlisting. Sorry for the mistakes I certainly made ...

This list is by far the weakest part of this preliminary review. The main reason is, that most herbarium vouchers were studied during visits of the herbaria ASH, TAD, TAK, TASH and LE in the 1980ies and early 1990ies, when PCs and digital cameras were still not available to me. Thus all observations had to be written by hand in notebooks of paper, and only exceptional photos could be taken. At this time, my knowledge about the borderlines between taxa was still incomplete and changing, and many determinations were only provisional. Later a PC could be used for the re-study of the collections in TASH (including the former TAK) and the study of vouchers in FRU in 1997, as well as for re-study in TAD 2003 and 2005. Study of the herbarium AA and of the very rich material in the Central Asian Sector of LE was not possible. Thus the below presented data are not only a mixture of outdated with  $\pm$  certain determinations, also the amount of data is rather incomplete. The large number of vouchers and the complicated conditions for lending vouchers did not allow to bring finally all vouchers together at one place, and carefully to re-revise them applying the contemporary taxonomic concept of accepted species and subspecies.

Another main problem is connected with the often only very short indication of the collection sites on the labels of herbarium vouchers. These data were not rarely insufficient for unambiguous geographic affiliation. Frequent problems arose by identical names of settlements and localities, and by different ways of transcriptions from local languages first into Russian and finally into English. The customary official renaming of settlements, administrative units, etc. caused additional problems. The geographic affiliation is sometimes further complicated by re-shaping of administrative borderlines still in Soviet times and especially in the independent republics, when additionally the orthographical rules changed from Cyrillic to different versions of Latin fonts. Sorry for wrong affiliation of localities to regions or even countries - I tried my best but included certainly not only single mistakes.

These geographic problems also prevented the continuous indication of the exact geographic position (in degrees latitude and longitude) of collection sites though this usage started already two decades ago. Today coordinates are quickly measured by satellite-based instruments, and their inclusion on herbarium labels became a worldwide standard despite of some personal (and seemingly also political) reservation. Because of the uncertainty of too many determinations, the geographical problems, and the predominantly historical character of most herbarium vouchers, I abstained from drawing distribution maps only based on the living accession studied whose number was much too low in very most species.

Nevertheless, this list will present an orientation for future students of subg. *Melanocrommyum* where vouchers of which taxa from which regions can be studied.



***Allium aflatunense* B. Fedtsch. s. str.**

**Kyrgyzstan:** Chatkal range, near lake Sary-chelek (41.52 N, 71.58 E, 08.5.1955 Korotkova 4656; TASH, 21.6.1966 Batalov; FRU), Tum-Anyak, forest belt (12.5.1981 Ajdarova, Kalmurzaeva; FRU), NW slopes (29.6.1962 Sudnitsyna, Gorbunova; FRU), S slope (29.6.1962 Sudnitsyna, Gorbunova; FRU), northern slope (03.6.1956 Lebedeva; FRU); Arkit forestry, open places in Juglans forest (41.50 N, 71.58 E, 10.6.1955 Belekovskaya 76; TASH); SE slopes of Chatkal range, heights above Achabukasai, side gorge Misken (09.8.1945 Popova, Tkachenko 357; FRU); drainage of river Khoja-Ata, gorge Kichkil, Arslanbob forestry (1500 m, 27.5.1957 Protopopova; FRU). Fergan range, valley of river Arslanbob (41.17 N, 72.58 E, 13.7.1926 Korovin 420; TASH); valley of river Tantak-su (?), mountains near river Arslanbob, Juglans forest (41.17 N, 72.58 E, 19.7.1927 Korovin 123, 172; TASH). Lower mountains of Fergan range, 6-7 verst from village Gava, hill slopes, NW exposition (30.7.1928 Kryl'kova 596, 597; TASH). Fergan range, heights above river Ak-Jar, N slope (21.6.1946 Popova; FRU); pass Kyzyl-Beles, bottom of gorge, damp place (21.6.1956 Ajdarova, Ubukeeva; FRU), middle part of river Manakel'da, N slope (21.6.1946 Popova FRU); way down to Ketman-Tash (05.7.1909 Yudgerev 158; LE); left side of river Kara-Kul'ja (24.5.1966 Sudnitsyna, Gorbunova; FRU); Kalkagar, N exposed meadow with tall forbs (17.7.1957 Ajdarova, Ubukeeva; FRU); valley of river Domguztau, location Akbatag (Akbashat?), NW slope (09.5.1952 Li 16; TASH); location Chaartash, subalpine meadow (18.6.1962 Pryakhin; LE); Alash-bashi Mts., subalpine meadow (08.7.1945 Fedorov, Il'ina 56; LE). S slopes of Fergan range, near Ak-Terek, on E slope (40.57 N, 73.23 E, 06.6.1955 Lebedeva, Faleeva; FRU); River Makhmal near pass Oj-Kajyn, bottom of gorge on meadow (20.6.1957 Ajdarova, Ubukeeva; FRU), bottom of gorge among shrubs (20.6.1957 Ajdarova, Ubukeeva; FRU), location Oj-Kajyn, Makmal river (20.6.1957 Ajdarova, Ubukeeva; FRU). Andizhan district, along river Urat-su near pass Kenkol (7500 ', 29.5.1899 Litwinow; LE). Mittellauf des Jassy (8-9000 ', 31.5.1880 Regel A.; LE). District Osh, between passes Neupazdyk and Chita, N slopes of high foothills (22.5.1913 Knorring 230, 320; LE). T.-Kurgan, river Kushish-Su 5 km from lake Kish-kol (20.6.1952 ??; FRU). On the way from Vasil'evskij agriculture, moist meadows (14.5.1947 Kashchenko; FRU). Way to pass Kugart, 4 verst from rise Karyak-chek to the pass (41.43 N, 69.50 E, 02.6.1911 Knorring, Minkwitz 277; LE). Atajnok district, near Air-bel', among tall forbs (???.1945 Popova, Tkachenko; FRU). Toktogul district, near vill. Toluk (24.6.1988 Klyujkov, Kashkaraeva; FRU). Jalalabad district, middle part of river Paja-Ata, left bank (24.6.1953 Ustyugova; FRU). Pass Ak-Mojnok, bottom of gorge, meadow (14.6.1957 Ajdarova, Ubukeeva; FRU). Toguztorou district, river Kabak-too, S slope, meadow (>2000 m, 28.5.1959 Gamalitskaya; FRU). Height from Ak-Tash to Kashka-Su (???.1936 ??; FRU). Union of Fergan and Susamyr ranges, gorge of Kashka-su, left tributary of Kainda river 40 km E Uch-terek (27.6.1960 Sudnitsyna; LE FRU). Jalalabad, Kugart, location Tuguz-bulak, forest meadow (1600 m, 30.5.1945 Vipper 46; TAD LE); Kugart Mts., heights near river Kara Alma, NE slopes, subalpine meadow (28.6.1936 Knorring 16; LE). Uzun-Akhmat ridge, summit of pass Mart (10.8.1930 Il'in 538; LE). - **Uzbekistan:** Tichka-sai (Nuratau), 27 km from vill. Yu-ukhun, rocky places (02.5.1958 Li, P. Zakirov; TASH).

**Determination unsure:** - **Kyrgyzstan:** Fergan range, Mittellauf der Jessy bei Usgent (5-6000 ', 30.5.1880 Regel A.; LE G); Sovkhoz Arkit, Bakhiev'sai, W slopes among trees and shrubs (41.50 N, 71.58 E, 08.9.1945 Knorring, Pyataeva 327; LE); on the Kurgan-tekil way 12 verst from Osh to gorge Ak-bur (???.1913 ? Bronevskij 1; LE). Chatkal range, Sary-Chelek reservation, near the lake (41.52 N, 71.58 E, 24.5.1979 Levichev; LE-Lev); heights near river Kurgart, alpine meadow (05.6.1913 Saposhnikov; LE), valley of E Kurgart river below pass (20.7.1915 Spiridonov 208; LE); behind pass Chakmak, location Kok-bel' (06.5.1913 Knorring 46; LE). Semirech'e, valley of Pan (Pchan?) river (09.8.1908 Roshevitz 1871; LE).

***Allium alaicum* Vved.**

**Kyrgyzstan:** Alai range?, Uzgen district, drainage of river Tar, river Terek-Su, NW exposed slopes (19.6.1974? Ajdarova, Gorbunova; FRU); valley near Aravan on the way to Osh, foot of mountain (40.32 N, 72.35 E, 06.5.1913 Dolenko 364; LE), distr. Osch, pr. Gulcza (40.19 N, 73.27 E, 03.6.1900 Tranzschel s. n.; LE), left bank of Ak-Buri river, Adyrs (27.5.1936 Bajkovskaya, Schmidt; FRU). - **Uzbekistan:** Andizhon district, 10 km S vill. Imam, steppe slopes (c. 700 m, 01.5.1997 Khassanov & al. 4001; TASH).

**Determination unsure:** - **Kyrgyzstan:** Alai range, location Nun-murchi E Mki (Made?) 10 km from Osh (21.5.1954 Aridnyuskij ? 256; TASH); adyrs nearby vill. Vuadil, on the bottom of gorge (40.10 N, 71.44 E, 11.4.1948 Shadiev; TASH).

***Allium alexeianum* Regel**

**Kyrgyzstan:** Pass over Turkestan range near vill. Tapta-Tenga (05.8.1931 Nikitin 814; LE); N slopes of Turkestan range near pass Chandaf, stony slope (3260 m, 10.7.1929 Emme 430; LE), middle part of Yaskaksai, lower third of a stony S slope (1860 m, 04.7.1934 Afanassiev 26; LE), special location Kul'-sai, mountains near Chandarsai, pass (3218 m, 16.7.1955 Demurina 31243; TASH), mountains near river Sangar, near Turalash-sai (02.8.1955 Demurina, Bulgakova 31239; TASH); drainage of Guralash river, dry slopes (26.6.1926 Zakrzhevskij 2; LE). - **Tajikistan:** Turkestan range, Shakhristan pass, meteorological station (39.33 N, 68.33 E, 3365 m ?, 24.8.1949 Ataev; TASH), near begin of serpentines (39.33 N, 68.33 E, 26.6.1958 Soskov; TAD), rubble slopes (39.33 N, 68.33 E, 13.7.1987 Palanov; TAD), (???.6.1958 Kamelin 120; LE); mouth of Kusavli-sai, in Rosa-Juniperus societies (39.35 N, 68.39 E, 2000 m, 19.6.1970 Chukavina, Kinzikaeva, Astanova 3078; TAD), Kusavlisai, NE slopes (39.35 N, 68.39 E, 2600 m, 19.6.1953 Zapryagaeva, Konnov 576; TAD), S exposed slope of a side valley (39.35 N, 68.39 E, 2450 m, 05.8.1957 Konnov 890; TAD), (2900 m, 14.6.1954 Konnov 1373; TAD); S slopes of Turkestan range, Saravshan drainage, gorge near the way from Matchta to Rars and Pakhurd (14.7.1960 Egorova 1810; LE), NW of vill. Pakhurd, on slopes near the ridge (2700 m, 14.6.1960 Yunusov 2557; TAD). N slopes of Saravshan range NW vill. Barkh, Artemisia formation (2300 m, 19.8.1948 Ovczinnikov, Zapryagajeva 396; TAD), location Igrok, rubble slope (3300 m, 06.6.1971 Sidorenko, Batashov, Safarov; TAD). Saravshan-Gebiet: See Kul-i-Kalon (1000 ', 22.6.-04.7.1882 Regel A.; LE), Kschut am Woru (4000 ', 17.-29.6.1882 Regel A.; LE); prope pagum Kschut (06.6.1892 Komarov; LE); on a slope NE

Zindeut, tributary of Magian-darya (28.7.1931 Mikhajlova 784; LE). Drainage of Fan river, slopes near ridge Ravzir (2520 m, Kozlova 198; TAD); on the way from vill. Sor to Shing (22.7.1931 Nikitin 375; LE), N slopes of Hissar range, dry rubble slope near vill. Marzich (2200 m, 04.8.1938 Grigoryev 16; TAD); right bank of Saritag river (39.03 N, 68.24 E, 2500 m, 10.7.1982 Yunusov, Sharipova, Karimova 10237; TAD); along Farab way, slopes of Farabsai valley, on sandstone outcrops (09.7.1931 Mikhajlova 107; LE). Foothills of Gazimailik ridge NNE of Chugurly-Tugai of Kafirnigan (800 m, 25.5.1939 Bodisko 520; TAD). SE end of Babatag massif, location Davlya-bulak, slope with shallow soil (08.6.1962 Soskov, Shibkova, Ismatova 721, 801; TAD); W Saravshan range, Margusar region, SW slope of summit Mukh-kua Mts. (2870 m, 21.7.1932 Ovczinnikov, Slobodov 1414a; LE). - Uzbekistan: Turkestan range, Zaamin forestry, gorge of river Kul'su (23.7. 1926 Popov, Androsov 93; TASH), Zaamin valley, nearby sunstation (1800 m, 15.6.2005 expedition 2005 4228; TASH (coll)), location Kyzyl-utek, bare red sandstones (22.6.1935 Zakrzhevskij 553, 554; TASH), on the watershed near the springs (3248 m, 10.7. 1955 Demurina 31238; TASH); Tal'cha bulak, Zaamin ... ? (26.5.1919 Kejzer; TASH), Zaamin forest residence, pass Akchekmen, stony slope (14.7.1934 Gomolitskij, Protopopov 157; TASH); Saravshan range, N slopes, Saurasai, below pass near snow patches (06.7.1929 Drobov 336; TASH); pass Kumbel' in Kenkul' (11.6.1919 Balabaev 312; TASH); Kuli Kalon (16.6. 1916 Berger; TASH); reservation Turalash, stony slopes on left side of Tyuya-tashsai (26.6.1945 Pazij 22736; TASH), height Saizara, reservation Guralashsai, SW slopes of Tyuyasai (02.8.1937 Korotkova, Vasil'kovskaya 956; TASH), height Sakzira, reservation Guralashsai, right side of Turalash river (17.6.1937 Korotkova, Vasil'kovskaya 359; TASH), gorge of Turalash river (20.7.1926 Popov, Androsov 42; TASH), drainage of Guralash river, slopes near lodge (26.6.1934 Zakrzhevskij 1, 3; TASH), steep stony slope, sunny place (2100 m, 27.6.1934 Zakrzhevskij 34; TASH), gorge of river Turalash (22.7.1926 Popov, Androsov; TASH). Turkestan range, valley of Bajkutor river, stony slopes (16.8.1957 Vvedensky 343; TASH). Saravshan range, vicinity of pass Takhta-Karacha, stony rubble slope with petrophyte - ephemeral shiblyak (39.18 N, 66.55 E, 02.6.1964 Ovczinnikov, Zapryagaeva; TAD); foothills of Saravshan range, Kir-tau Mts. SE vill. Kuzya-Dyn (?) near pass (39.20 N, 67.10 E, 02.7.1937 Granitov, Dolgikh 307; TASH); Urgut, steppe belt (3800', 21.5.1892 Komarov; LE), Urgut, on slopes (???.7.1952 Khalmatov; TASH). Drainage of river Kashka-darya, between Kurugsai and Gaukhan (08.7.1938 Kudryashev, Sumnevich 798; TASH); height ? Chesmen to the west ??? (25.6.1929 Balabaev 314; TASH); ... ? in the gorge above ? (11.6.1919 Balabaev 311; TASH); Aman-kutan to Khoja-vakhalyuk, mountains (39.19 N, 66.56 E, 30.6.1932 Massagetov, Masal'skij 14-06; LE). Malguzar ridge, way up from sai Tashkeskem to vill. Bakhmal, along summit and slopes (06.7.1972 Kamelin; LE), top of Malguzar ridge (14.7.1931 Kasimenko 373; TASH). - Uzbekistan ? : W part of N slopes of Turkestan range, near pass Talakhman, small alpine meadow (03.6.1956 Demurina 31240; TASH).

**Determination unsure:** - Turkmenistan: Kugitang ridge, way to Svin'tsovoj rudnik (37.50 N, 66.29 E, 14.5.1985 Raenko; ASH), Khoja pil' (17.5.1985 Raenko. ASH). Uzbekistan ? : Kugitang ridge, top of Mt. Ajri-baba (???.6.1973 Khidirov; ASH), opposite of Majdan (10.7.1935 Androssov 243, 244; ASH).

#### *Allium altissimum* Regel

Turkmenistan: Ashgabat town (?) (03.5.1939 Bagir, Androsov; ASH); Kopetdag range, border control station Shamgi (18.5. 1960 Ishchenko; ASH); 15 km N vill. Manysh, in dense vegetation (10.6.1972 Gudkova; ASH); Chuli, cultivated in Ashkhabad (37.57 N, 58.00 E, 25.4.1972 Sejfulin; ASH). - Uzbekistan: Malguzar massif 30 km E Jizzak, within bushes and small trees (1250 m, 27.6.2000 Khassanov 4011; TASH (coll.)); Nuratau ridge, S slope, height of sai Ustuk, stony slopes (29.5. 1964 Tsukervanik 380; TASH), near station, forests (900 m, 07.11.1999 Beshko 4060; TASH (coll.)).

**Determination unsure:** - Kazakhstan: S end of Chu-Ili Mts. near pass Kurdai, in tugaj near a spring (43.21 N, 75.00 E, 19.6. 1968 Puchkova 49a; TASH); Rami austro-occidentalis jugi Alatau Transiliensis, in fluxu medio fl. Zapadnyj Dzehenyshke (sistema fl. Czu) in pratis inter silvam (17.6.1963 Goloskokov 4452, B G). SW foothills of Zaili Alatau, middle part of Karakunuz river, in tree shadow (14.6.1963 Goloskokov; LE). - Kyrgyzstan: Alai range, near Gul'cha (40.19 N, 73.27 E, 17.5. 1927 Granitov; TASH); on the way from Aravan to Kizyl-Kurgan, moist place among red sandstones (40.32 N, 72.35 E, 06. 5.1913 Dessiatoff 494; LE). - Turkmenistan: Ashgabat town (???.4.1971 Sejfulin; ASH). Kugitang ridge, peak Hodjapil, stony Juniperus slopes (1000 m, 09.6.2003 Kurbanov & al. 131; ASH (coll.)), canyon Hodjapil, rubble slopes (650 m, 07.6. 2003 Kurbanov & al. 128; ASH (coll.)). - Uzbekistan: Drainage of Surkhandarya river, Tjube between vill. Khitoyak and Kholchiyak (?) (10.4.1928 Vvedensky 88; TASH). Nuratau ridge, Khayatsai, walnut stand (1100 m, 20.8.1977 Levichev; LE).

#### *Allium aroides* Popov & Vved.

Uzbekistan: W Hissar range, drainage of river Kashka-darya, valley of river Ayakchi, near vill. Kopkan-agach (15.6.1954 Pyataeva 459x; TASH), outskirts of Kan 32 km from Kamashi, stony rubble slopes (22.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 205; TASH), right banks of Yakkabag-darya 1.5 km SW vill. Tatar, N slope near location Ishak-Majdun (21.6.1931 Granitov 181, 182; TASH), height of Chukurlyysai, right/left banks, from vill. Lyangar along the sai to Juniperus stands (24.6. 1954 Pyataeva 590, 609, 615; TASH), 15 km S vill. Lyangar near the way to vill. Kok-bulak (25.6.1954 Pyataeva 726; TASH), the river Igrisu downwards 15 km from vill. Ak-Kishlak (05.7.1955 Pyataeva 1547, 1552; TASH), 12 km N vill. Ak-Gava, right bank of Togai-Darya river near Togaisai, stony ground (10.6.1954 Pyataeva 72; TASH), middle part of Tankhas river S Annaj, W grassy slope (14.6.1937 Kudryashev 482; TASH), Kuk Mts., N slopes between Ashgeni and Shurdney (19.6. 1937 Kudryashev 617; TASH), middle part of Tajkhan river S Kara-tepe Mts., N slope N vill. Kenkyl (21.6.1937 Kudryashev 643; TASH); Yakkabag drainage near vill. Gova Shady (?) (11.5.1916 Popov 573v; TASH), near Tova-Shady, on dry loess hills (01.6.1916 Popov 1190; TASH), mountains E Yakkabag between vill.s Tamshush and Ammagon (03.7. 1927 Kul'tiasov, Granitov 867, 871; TASH). Hissar range, Shargun mine, grassy slope (38.38 N, 67.57 E, 1600 m, 20.7.1994 Khassanov 4058; TASH (coll.)), Kitob reservation, upper Dashtibaj (?) N exposition (1600 m, 20.7.1986 Karavolaeva (?) 323; TASH), Kitob reservation ??? (near the cut) (1800 m, 15.6.1989 Soldatova 87; TASH). Baisun ridge, Khoja-gurgur ata

Mts., height near river Turgan darya, Uruglisai (16.7.1934 Peiknovich 80; TASH), vill. Mullakhona, gypsaceous slopes (1000 m, 07.8.1999 Khassanov 4059; TASH (coll.)). Saravshan range, steppe slopes near pass Takhta Karachi (39.14 N, 66.56 E, 13.6.1954 Pyataeva 131; TASH), pass Aman-kutan (39.15 N, 66.56 E, 21.7.1960 Sagatov, Abdukhamidov, Khojimatov; TASH); Kyr-tau Mts., height Kushsurkh, Chashme gorge, rocky slope (20.6.1937 Gnezdillo; TASH); Kuruksai valley (08.6.1912 Preobrashenskij; LE); foothills near vill. Majdan-ata (28.5.1929 Yakimova 1643; TASH).

**Determination unsure:** - Turkmenistan: Kugitang ridge, slopes near Maydan (10.7.1935 Androssov 247; ASH), (12.7.1935 Androssov 249, 250; ASH), (12.7.1937 Androssov 219; ASH).

***Allium bachhousianum* Regel**

Kyrgyzstan: Kirgiz Alatau (??), river Chonkurchak, N slope (23.6.1937 Nikitina; FRU). N slopes of Alai range, near pass Taldyk (1800 m, 18.6.1958 Zapryagaeva 7486, 7472; TAD); way to the pass Chigirchik at the side of Taldyk pass (40.15 N, 73.20 E, 2200, 17.6.1958 Zapryagaeva 7448, 7452; TAD); near union of Kandyra and Air-toshem, NW slopes (07.5.1913 Knorring 100; LE); from bank of Ak-bura river to pass Shlot (??5.1913 Bronevskij 17; LE); foothills opposite vill. Yatai, S slope (40.32 N, 72.35 E, 28.5.1964 Ajdarova, Gorbunova; FRU). Alai range, mountain foothills between town Osh and Gul'cha, location Kaplan-kul', S stony slopes below limestone outcrops (05.7.1929 Linczevskij; TASH); river Altyn Kyzyl (11.7.1936 Bajkovskaya, Schmidt; FRU); in valle supra frt. Gulcza (5400', 28.6.1901 Alexeenko 907, 764; LE), slopes near Gul'cha, cultivated in Bot. Garden [Tashkent] (40.19 N, 73.27 E, ???.1959 Filimonova 889 F; TASH), gorge of Chigirchik river near Gul'cha (40.19 N, 73.27 E, 11.7.1930 Juzepczuk 278; LE); upper Aksu valley c. 20 km SW Shakhimardan (39.52 N, 71.37 E, 3000 m, 26.6.1989 Günther, Zündorf, Schnittler; JE), drainage of Shakhimardan river, Mamalash gorge (40.00 N, 71.47 E, 10.6.1968 Khalkuziev; TASH), sai Jetykubak opposite vill. Karashura, stony slopes (40.00 N, 71.47 E, 09.7.1957 Soskov; TASH), near Gulcza inter Kasa-bulak et Gulcza (10.6.1900 Tranzschel; LE). E part of Alai range, near pass between Gul'cha and Karakul'cha, grassy places on loess with tall forbs (15.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 1088; TASH). Fergan range?, forest along rise from Khodjaatta river to Small Karangutung (Karakungur?) (19.7.1915 Roshkevitz 140, 140; LE TASH); gorge of river Uzun-akhmat, subalpine belt (27.8.1927 Uspenskaya 276a; TASH). Fergan range, Zergar river, stony slopes (1200 m, 25.5.1997 Khassanov 4004; TASH (coll.)); near vill. Sarybel, river Tar (22.5.1966 Sudnitsyna, Gorbunova FRU); place Omshakai (?), N slopes of mountains near river Mostu (?) (14.8.1951 Arifkhanova 146; TASH); location Zindan, E slopes (07.8.1945 Kalinin A. et al.; LE); location Irisu, on river banks of Tashbulaksai (30.6.1950 Chevrenidi 767; TASH); valley of river Yassy, on stony slope (26.6.1962 Pryakhin; TASH); Arslanbob (41.17 N, 72.58 E, 20.5.1916 Berger; TASH), (20.5.1916 Lipsky; LE); mountains near the river Tuyuk (29.-31.8.1958 Obonitskaya; TASH); valley of Kyzyl-su river, forest place Ak-ishek, forest meadow (26.6.1929 Titov, Joffe 42; TASH); Baubashata Mts., location Kyzyl Alma, red clay (Sudnitsyna, Batalov; FRU); place Kara-tyube, S mountain slopes (05.8.1950 Arifkhanova 442; TASH). Zergersai river valley 40 km N Uzgen, rocky slopes (1200 m, 03.6.2002 Khassanov 4092; TASH (coll.)); drainage of Kara-Unkur river, valley of river Kumysh-su, subalpine level (09.7.1927 Korovin 528; TASH). Chatkal range, valley of river Pasha-ata, slopes in the middle part of gorge, Juniperus woodland (12.7.1933 Kudryashev, Krasovskij 302; TASH). - Uzbekistan: Alai range, drainage of river Shakhimardan, vill. Jordan, 'red tog', stony places (39.58 N, 71.46 E, 04.6.1967 Khalkuziev TASH); gorge Dugava (39.57 N, 71.45 E, 09.6.1948 Shafeev; TASH). Karshantau ridge, valley of river Pskem, Nuvali-sai, right river bank, on sandy saline (?) soil (??7.1957 Puchkova; TASH). - Uzbekistan?: Fergan range near vill. Uzbek-gava, location Ak-terek, valley bottom near spring (40.57 N, 73.23 E, 02.8.1935 Kazachkov; TASH).

***Allium balkhanicum* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch**

Turkmenistan: Foothills of Great Balkhan massif, spring Ekerjom E Djebel' (15.5.1959 Ishchenko, Gudkova; ASH), no location (500 m, 19.5.2002 Kurbanov 61; GAT), forest road metal slopes (19.5.2002 Kurbanov 69; GAT), foothills of W rubble slopes (23.5.1928 Bobrov, Jarmolenko 41; LE), foothill near spring Nazar-e kerem (39.42 N, 54.28 E, 08.5.1966 Batyrova, Meshchanikova; ASH), hills near Nazar-Kerim (39.38 N, 54.23 E, 600 m, 19.4.1997 Khassanov 4053; TASH (coll.)); stony slopes near spring Ayak-mogur (1500 m, 28.5.1928 Bobrov, Jarmolenko 234; LE); mountains near Djebel' (18.5.1939 Androssov; ASH); rubble slopes near the gorge between the vill. Ledivi and Uzun-amar (24.5.1928 Bobrov, Jarmolenko 103; LE). Balkhan Minor massif near railway station Jebel (39.38 N, 54.16 E, 23.4.1916 Drobov 838; TASH LE).

**Determination unsure:** - Turkmenistan: Great Balkhan massif, Alekper, clayey rubble slopes (600 m, 19.5.2002 Kurbanov 63; ASH (coll.)); forest slopes (550 m, 19.5.2002 Kurbanov 62; ASH (coll.)), (520 m, 20.5.2002 Kurbanov 57; ASH (coll.)).

***Allium brachyscapum* Vved.**

Turkmenistan: W Kopetdag range, 12 km SW Nokhur, dry slopes of a gorge (38.30 N, 57.05 E, 16.5.1962 Gubanov; LE); height Taza-Taplan, mountain steppe on shallow soil (2000 m, 23.5.1954 Markova; LE); near vill. Bendesen, stony-rubble slopes (13.5.1979 Averyanov & al. 907; LE). Central Kopetdag range, watershed between Sumbar and Arvaz 15 km SW Karaul (30.5.1962 Gubanov, Vlasov; LE), 10 km S vill. Garaul, dry slopes with shallow soil (25.5.1997 Kurbanov, Ajdaev; LE); 50 km SE Bakharden, subalpine part near border station Somokli (19.5.1963 Gubanov 342; LE); Misuny summit, mountain steppe, slopes (2100 m, 19.6.1954 Markova; LE), Mergen-olsi (?), Mt. Mussunev (29.5.1961 Kurbandurdyev; ASH); between Karaul and Kanakly (27.5.1959 Meshcherjakov; ASH); height near gorge Khoz-Dere (31.5.1952 Nikitin, Meshcherjakov; ASH).

***Allium bucharicum* Regel**

Tajikistan: SE end of Babatag massif betw. tops 1625 - 1828 m of location Davlya-bulak, stony gypsaceous slopes (08.6.1962 Soskov, Shibkova, Izmatova 801; TAD); adyrs S dry Bibichek-sai (660 m, 11.5.1959 Filatov, Grebennikova 90; LE TAD). Foothills of Gardani-ushti Mts., on clayey-gypsaceous soil (950 m, 20.4.1947 Varitseva, Nepli 470; TAD). Gazimailik ridge, hills in front of the E slopes of Aruktau massif (800 m, 20.5.1959 Pogrebnova, Mechislavskij 350; TAD), E foothills of Aruk-

Tau (850 m, 18.5.1959 Chukavina, Stripsova 258; TAD), N end of Aruk-Tau massif N vill. Ganjina (37.58 N, 68.34 E, 1100 m, 21.5.1959 Strizhova, Chukavina 301; TAD), E slope of Aruktau massif, 8 km S vill. Tamgi (900 m, 20.5.1959 Golomedova 144; TAD), S end of Aktau ridge near bank of Achisu river, near vill. Berdybulak (Berdekht~?) (650-700 m, 17.5.1960 Kudryasheva, Stotskij 442; TAD). Location Garauly between Gazimailik and Khojakazyan ridges (13.4.1961 Ovczinnikov 5220; TAD). Khojakazyan ridge, E vill. Lyajlyakuya, gypseous loam (21.5.1960 Botschantzev, Egorova 234; LE), (22.5.1960 Botschantzev, Egorova 304; LE); gorge Naiza-Bulak c. 23 km NE Shaartuz (37.23 N, 68.14 E, 11.6.1986 Kinzikaeva, Lazareva 5950; TAD), saddle above the gorge NW of Mt. Kojpiostau (37.23 N, 68.14 E, 1300 m, 18.5.1990 Fritsch, Kudratov, Pistrick 361; GAT). Vaksh range, valley of Panj river, SW end of Karatau ridge (05.5.1937 Varivtseva 186; TAD), W slopes of S end of Karatau ridge (700 m, 21.4.1960 Mechislavskij, Zavedeev 241; TAD), Karatau ridge, top of slope near gorge Uchkol (16.4.1937 Varivtseva, Grigoryev 3; TAD), near spring Ich-Agly near Ich-Agly Mts. (900-920 m, 26.4.1961 Kudryasheva, Stotskij, Pavlova 563-436; TAD), S slopes of Karatau ridge 4 km S Mt. Khoja-Maston (440 m, 15.5.1960 Mechislavskij, Zavedeev 346; TAD); right banks of Vakhs river, Surkho massif 10 km ENE of Tutkaul, adyrs near vill. Dashti-Raz (1000 m, 16.5.1962 Chukavina, Bakmut, Potashev 186; LE TAD). Lowland of Vakhs river, stand of ephemers on the slopes of Kara-bura table hill (18.4.1936 Nikitin 13; TAD); upper terrace of Panj river 4 km N of town Panj (400 m, 27.4.1936 Linczevskij, Maslennikova 97; TAD); near Tabakchi massif, desert (11.5.1936 Prjachin, Slobodczikov 42/1; TAD); N loess slope of Mt. Khoja-Mumin (37.44 N, 69.39 E, 04.5.1979 Chukavina, Karimova 7757; TAD). - Uzbekistan: Babatag massif 40 km E vill. Lyalmikar, Besh-archa Mts. below spring Garma, marine sediments (18.5.1979 Li, Tsukervanik 232; TASH).

**Determination unsure:** - Tajikistan: Mt. Khojamumin 2 km N vill. Kairagoj, around Tomin's monument, grassy slope with dominant *Ferula* (680 m, 01.06.2002 Kurbonova, Hisoriev 6030; TAD (coll.)); foothills near river Vakhs (02.5.1934 Mal'kin. TASH). - Tajikistan?: Sovkhoz Vakhs (Potopol'skij; TASH).

***Allium caspium* (Pall.) M. Bieb. [subsp. *caspium*]**

Kazakhstan: Sandy area Sali, plane, saline sand steppe (19.5.1926 Spiridonov 352; TAD). Chimkent district, near Suzan way to Jugan-tyube, pass Tekej (07.6.1914 Rakhmankulov 1064; TASH). - Tajikistan: S part of Khojakazyan ridge c. 14 km E Shaartuz, around the spring Kutorbulak N Mt. Takakamar, S exposed limestone rock slope (37.24 N, 68.15 E, 800 m, 16.5.1990 Fritsch, Kudratov, Pistrick 320; GAT). Location Garauly, on a hay field 13 km NW farm No. 1 (400 m, 18.4.1954 Kudryasheva; TAD). Kafirnigan lowland, central region of sandy area Kuryala-kum (19.5.1966 Zapryagaeva, Muratova 12055; TAD), on the banks of short-term lakes between dunes (19.5.1966 Zapryagaeva, Muratova 12063; TAD). - Turkmenistan: Badkhyz region, lake Er-ojlam-duz (03.-05.5.1930 Linczevskij 364, 448; TASH), sand vegetation (28.4.1964 Botschantzev & al. 301; LE), E Nomoksar near lake Er-Ajlanduz, on rubble places (26.5.1964 Chukavina, Lazareva 861; TAD), in the Karabil plateau area (20.5.1964 Chukavina, Lazareva 776; TAD). Zaunguz Karakum, hardened sands near crossing Bala-Ischem to Charyshly (20.5.1988 Sejfulin, Ataeva, Gel'dikhanov; ASH); bank of dirt water channel near hill Konga-Kyr (13.5.1988 Sejfulin, Ataeva, Gel'dikhanov; ASH); hardened sands with stones 40 km N kolkhoz Bala-Ischem (21.5.1988 Sejfulin, Ataeva, Gel'dikhanov; ASH); between reservoir Khauz-khan and the bridge over Karakum canal N Serakhs, riffled sands (24.4.1964 Botschantzev & al. 111; LE). Regio transcaspica, Ashabad: in arenosis argillosis inter Anaju et Gjaurs (37.53 N, 58.42 E, 27.4.1900 Sintenis 301, 307, B JE), prope Ashkhabad, Keltenczinar, Kuropatkin (02.4.1898 Litwinow 2097; W); foothills along the road Geoktepe - Germab (03.7.1969 Meshcheryakov; W). Krasnowodsk, in steppis arenosis ad Ufra (21.6.1901 Sintenis 1677; B). - Uzbekistan: Kashkadarya district, 5 km NE lake Kara-bulak (28.4.1959 Li, Nyazov 119, 121; TASH). Kyzylkum desert, Kaska (22.5.1960 Djatlov; TASH); mountain remains Bel'-tau (17.5.1952 Vernik 22; TASH); 15 km W well Mulat (06.6.1967 Nabiev & al. 88; TASH). 140 km from Bukhara to Nukus, near the road, sandy dunes (01.10.1999 Khassanov 4021; TASH (coll.)); left bank of Syrdarya river, fastened sands along the way to Murun-tau (25.5.1965 Vvedensky, Puchkova 80; TASH).

**Determination unsure:** - Turkmenistan: Kugitang ridge, around vill. Gaurdak, rubble slopes (550 m, 12.4.2003 Kurbanov? 91; ASH (coll.)). - Uzbekistan: Bukhara district, Desert Research Station Kyzylkum, desert inside the area of the station (40.44.19.7 N, 63.44.54 E, 371 m, 21.03.2009 Keusgen, Khassanov 4273; TASH (coll.)); Bukantau Mts., sandy top of a hill (700 m, 16.05.2007 Khassanov? 4267; TASH (coll.)).

***Allium caspium* subsp. *baissunense* (Lipsky) F.O. Khass. & R.M. Fritsch**

Tajikistan: Vakhs range, Vakhs valley, W slopes of Kara-dum Mts (26.4.1937 Nikitin 490; TAD); right bank of Vakhs river 23 km below vill. Kizilkala, low mountains Ok-Azhar (500 m, 16.4.1965 Soskov, Odinaev ? 171; TAD); from vill. Kyzilkala 4 km to SW (07.5.1933 Zapryagaev 180; TAD); Vakhs valley, location Kashkakum, on red clay (06.5.1937 Nikitin 531; TAD); location Kashkakut, loamy terrace near Yakkadii (03.5.1937 Nikitin 527; TAD); SE of vill. Tugalan, desert of ephemers (05.5.1933 Zapryagaev 141; TAD LE). Gazimailik ridge c. 25 km NW Kurgan-Tyube, Aruk-tau massif, near height 1435.6 (1200 m, 08.5.1959 Chukavina 152; TAD), Aruk-Tau massif near vill. Ganjino (20.5.1962 Kamelin, Kamelina 148a; TAD), N end of Aruk-tau massif, E exposed rubble slope (1100 m, 21.5.1959 Strizhova, Chukavina 301; TAD), 14 km N from Chashma (11.5.1976 Kochkareva, Kinzikaeva 10890a; TAD), Esamol Mts. near vill. Ganjina, SE slope, on red sand (37.58 N, 68.34 E, 900-950 m, 29.5.1960 Kudryasheva, Stotskij 490; TAD); foothills of Gazimailik ridge, red sandstones 6 km from vill. Ganjina (37.58 N, 68.34 E, 20.5.1962 Kamelin, Kamelina 164; TAD), lower end of Ganjino gorge c. 1 km W vill. Novyj Ganjino (37.58 N, 68.34 E, 600 m, 11.5.1990 Fritsch, Kudratov, Pistrick 122; GAT). Central part of Aruk-Tau massif 15 km S vill. Sultanabad, between the rivers Vakhs and Panj (750 m, 23.4.1975 Kochkareva, Kinzikaeva 10431; TAD). Kojki-tau Mts. NW of vill. Ajvaj, slope with shallow soil and stones (17.5.1960 Botschantzev, Egorova 72; LE). Reservation "Tigrovaya Balka", Buryu-Tau Mts., on sand (37.15 N, 68.20 E, 10.4.1960 Kudryasheva, Stotskij 358; TAD), (28.5.1962 Soskov, Shibkova, Ismatova 144; TAD), (12.5.1965 Molotkovskij 242; TAD), 0.5 km from lake Darya-Kul (37.

15 N, 68.20 E, 12.5.1964 Molotkovskij, Ivanova 91; TAD). In montibus Taschbulak (5-6000', 29.4.-11.5.1883 Regel A.; LE). Jugum Aruktau ad septentrionem a trajectu Darbaza-Kum, societate e Zygophyllo gontscharovii constitutae (850 m, 12.5.1976 Kochkareva, Kinzikaeva 47; TAD TASH W B), Artemisia society (680 m, 21.4.1978 Kochkareva, Kinzikaeva, Yunusov 11557; TAD). S end of Khojakazyan ridge, sandy area Kurjala-Kumy (350 m, 15.4.1979 Kinzikaeva, Kochkareva 5220; TAD), valley S geodetic mark (430 m, 24.6.1977 Kinzikaeva, Kochkareva, Nashapova 4024; TAD), central part (700 m, 18.4.1972 Kochkareva, Kinzikaeva 12166; TAD), valley Dagana opposite of forest garden, on red clay (700 m, 18.4.1978 Kinzikaeva, Yunusov, Krapivtseva 4735; TAD), saline gypsum outcrops E town Shaartuz (15.5.1975 Botschantzev 226; LE). Jilikul, location Darya-Kul, Mentha-Carex association (20.4.1951 Kirsanova; TAD); Sovkhoz Kabidian, 2-3 km W ranch No. 1, location Garauti (?) (27.4.195? Shashkina 103; TAD); S exposed slope of Ustym-Tau Mts. (800 m, 24.4.1975 Kochkareva, Kinzikaeva 2887; TAD); in sabulosis ad orientem a monte Chodsha-Kadian pr. Kabadian (2500-3000', 24.4.-7.5.1883 Regel A.; LE), S-most mountainlet of a side ridge (26.4. 1975 Kinzikaeva 3055; TAD). Babatag massif, E slopes, location Aksai above vill. Jailma (?) (07.5.1983 Turkestan group 1788; LE); low gypseous mountains S Besharcha Mts. to Babatag massif (12.5.1975 Botschantzev 119; LE). W foothills of Garaushti ridge, gypseous sediments (950 m, 24.5.1947 Varivtseva, Nepli 937; LE). - Turkmenistan: S Kugitang ridge (09.5. 1989 Seisums, HUI); W foothills ca. 45 km from vill. Svintsovoj on the way to vill. Aktash, stony slopes of adyrs (18.5.1976 Prato, Tsukervanik, Makhmedov 538; TASH), 5 km S Karlyuk (10.5. 1985 Raenko; ASH). Badkhyz, SE part of solonchak, at mountain's rests (03.5.1956 Nechaeva, Prikhod'ko; LE). - Uzbekistan: SW Hissar range, Chulbair Mts. near vill. Sina, Kyzkurgan hill, red sandstone slopes (30.5.1973 Botschantzev 132; LE); in gypsaceis denudatis prope fontem Chojaipak, in promontoriis montium Tschulbair (19.5.1930 Botschantzev, Vvedensky, 6453; TAD JE M; 294; TASH W); drainage of Tupolang river, on SW slope of an adyr, between vill.s Sary-Jou and Kufar (29.4.1948 Chevrenidi 296; TASH), on SW slopes of adyrs near vill. Sary-Jou (28.4.1948 Bondarenko 296; TASH); marsh of Sangardak river, between stones along the bank (28.5.1948 Chevrenidi 712; TASH); left bank of river Sangardak near vill. Nelyu, NW stony rocky slope (10.6.1948 Pyataeva 354; TASH). Outcrops of marine sediments near station Kelif (?) on the way to Termez (14.5.1958 Vvedensky, Kovalevskaya, Cherneva 166; TASH). Khaudak-tau Mts., Tash-kir ridge, on red clay (37.32 N, 67.22 E, 610 m, 22.4.1976 Kinzikaeva, Kochkareva, Yunusov 10788; TAD); flat ground (37.32 N, 67.22 E, 510 m, 22.4.1976 Kinzikaeva, Kochkareva, Yunusov 10763; TAD); fastened sands 8 km SSW from Ashirkhan-kuduk (37.32 N, 67.22 E, 10.5.1940 Arkhireev 4; TASH). Baisun ridge, Byuryu Takht Mts., S dry not red slope, association with Salsola (19.4.1941 Popova 215; TASH LE); in arenosis ad Baissun, Buchara (06.6.1897 Lipsky 2476; LE); outcrops of marine sediments S vill. Kafruk (Kafrun?) (20.5.1972 Allanazarova, Butkov 123, 32; TASH); location Kara-kul, marine sediments betw. villages Kaprun and Kukurang not reaching the mountains Ak-su, outcrops of red sandstones (20.5.1972 Nabiev, Shermatov, Kazakbaev 166/2; TASH); sojchin (?) 2 km S Baisun (14.5.1964 Agilov 39; TASH). Small mountains between Baisun ridge and Churchi massif near vill. Sary-katysh, destroyed grey sandstones (20.5.1967 Botschantzev 166; LE); Mt. Aktash 7 km S vill. Aktash, along the road from Aktash to Sherabad, gypseous sediments (24.5.1972 Nabiev, Shermatov, Kazakbaev 253; TASH); outcrops of red gypseous sandstone between vill. Kaprun and Kumkurgan (20.5.1972 Nabiev, Shermatov, Kazakbaev 166; TASH); 5.5 km from kolkhoz S.S.V. from first part Sovkhoza Nur-ata, uneven fastened sands (05.5.1958 Li, P. Zakirov 378; TASH). Kugitang ridge, Aktash, marine sediments (600 m, 13.5.1984 Khassanov; TASH), mountains near vill. Aktash, grey clay (24.5.1972 Allanazarova, Butkov 221; TASH). Babatag massif, 40 km E vill. Lyal'mikar, Mt. Besh-Archa near location Kashka, gypseous slopes (19.5.1979 Li, Tsukervanik 259; TASH); way to location Chagat, Arganchisai, red clay (24.5.1977 Botschantzev 371; LE).

**Determination unsure:** - Tajikistan: In argillosis prope pagum Telekul ad fl. Wachs ripam sinistram (9-10000', 15.-27.4. 1883 Regel A.; LE). - Turkmenistan: Near town Kemer (?), outcrops of marine sediments, soft slopes (14.4.1958 Khamskov 53; TASH). - Uzbekistan: Khaudagtau Mts., outcrops of marine sediments (11.5.1975 Botschantzev 87; LE).

***Allium chitralicum* F.T. Wang & Tang s. str.**

Tajikistan: Vakhn range, SW slopes near vill. Shanbedi (3700 m, 28.6.1963 Kurbanbekov 1000; TAD); valley of Shakh-Dara river, gorge Tusion-Dara (3500 m, 09.7.1953 Razkov 586; TAD).

***Allium chychkanense* R.M. Fritsch**

**Determination unsure:** - Kyrgyzstan: Susamyr valley, W Karakol river (10.6.1951 Tkachenko ?; FRU), (30.7.1955 Korneva; FRU); location Kel'ge-tash (24.6.1951 Tkachenko; FRU).

***Allium costatovaginatatum* Kamelin & Levichev**

Tajikistan: Kurama ridge, Kalkan-ata Mts., E rubble slopes near vill. Jar-bulak (20.5.1953 Vernik, Nabiev, Tsukervanik 106; TASH), S slopes near vill. Garat, SW rubble slopes (29.5.1953 Vernik, Nabiev, Tsukervanik 181; TASH). - Uzbekistan: SW foothills of Chatkal range near vill. Zarkent (41.16 N, 69.48 E, 27.6.1949 Akhperjanyan, Takirbaev 15; TASH), S slopes opposite mazar (41.16 N, 69.48 E, 25.6.1936 Korotkova, Titov 674; TASH); Chatkal range, SW slopes near Zarkent (41.16 N, 69.48 E, 27.6.1949 Koroleva, Lavrukhina 41; TASH); Chatkal reservation, Bash-Kyzyl-sai, opposite mouth of Gaukhapa-sai (1300 m, 02.5.1977 Krasovskaya; TASH), near field camp, Amygdalus spinosissima association (04.6.1981 Shermatov, Kazakbaev, Levichev, Tagaev 417; LE-Lev), phenotic height, Arimbash ? (1300 m, 28.5.1976 Krasovskaya; TASH), phenological ridge, Atraphaxis association (1400 m, 29.5.1976 Levichev; LE), phenological ridge, lift from ? bada (1355 m, 29.5.1973 Levichev; LE-Lev), field base near meteorol. station (1100 m, 18.6.1975 Krasovskaya; TASH), (1200 m, 18.7.1976 Levichev; LE), dry terrace opposite field station (41.14 N, 69.50 E, 13.6.1981 Levichev 142; TASH); Adamtash, S exposition on rubble (1400 m, ??5.1976 Levichev; TASH), height of Adam-tash, rocks and rubble (41.16 N, 69.48 E, 23.6.1936 Korotkova, Titov 585 (58b?); TASH); Jakhtakhojasai, right slope, Amygdalus stand (1400 m, 03.6.1976 Krasovskaya; TASH). Area between the rivers Angren and Chirchik, 2 km SE vill. Parli-sai, slope of high adyr with shallow soil (07.6.1953 Butkov,

Majlun, Slovinskij 628; TASH). Kurama ridge, Kara-bel', on the top, S and W slopes (21.5.1940 Vasil'kovskij 149; TASH), S stony rubble slopes 7 km SW Almalyk (27.5.1953 Vernik, Nabiev, Tsukervanik 148; TASH). Angren valley, location Mis-koj-sai, in the gorge of Amantangan mountains (01.7.1931 Tuichiev 3, 4; TASH). Angren valley, E slopes of Kurutashsai, stony slopes (20.5.1939 Pinkhasov TASH). Near vill. Nevich (26.6.1947 Pyataeva 49; TASH); Sukok, forests (41.15 N, 69.49 E, 1300 m, 15.5.1995 Umarov 4049; TASH (coll.)). Karshantau ridge, Khumsan camp, grassy slopes (41.42 N, 69.56 E, 1100 m, 18.5.1998 Khassanov 4050; TASH (coll.)).

***Allium cristophii* Trautv. [subsp. *cristophii*]**

**Turkmenistan:** Aschabad, in montibus supra Nephton (?.5.1900 Sintenis 308; JE B G); lower foothill belt 3-4 km S Kurrugaudan (400-600 m, 14.5.1976 Nikitin, Ivanov; GAT JE), Gaudan, Mt. Naudag, N exposed ....., on stony-rubble (05.5.1961? Kurbandurdyev; ASH); summit of Mt. Chapan, steppe belt (02.-05.7.1923 Korovin 666 etc.; TASH), Chapandag, summit between gorges Zhuli and Shushanga (17.6.1961 Kurbandurdyev; ASH). W Kopetdag range, gorge Iol-dere (19.5.1933 Gnezdillo 12; TASH); near Kara-kala, steppe on the height of Khosar-dal (15.6.1931 Vvedensky; TASH); near spring Khanajlyau, steppe area (30.5.1924 Czerniakovskaya 35; TASH); Mt. Syukit, slope of waves, steppe of tall forbs (02.6.1933 Gnezdillo, Nikiforova 47; TASH); Firyuza gorge (37.55 N, 58.06 E, 10.5.1916 Androssov; TASH); area of Juniperus woods, slope of Riza summit (10.6.1924 Czerniakovskaya 197; TASH); upper valley of Chuli above the spring area, stony rubble slopes in SE to SW exposition (37.57 N, 58.01 E, 700-850 m, 14.4.2002 Fritsch, Keusgen, Khassanov 4068; TASH (coll.)), Chuli, meadow at bottom of steppe slopes (37.58 N, 58.01 E, c. 700 m, 03.4.2002 Fritsch, Keusgen, Khassanov 4; ASH (coll.)), Chuli, valley near the river (37.57 N, 58.00 E, 18.4.1912 Michelson LE GAT). Summit of Seamasur, subalpine rocky steppe (09.6.1924 Czerniakovskaya 134; TASH); Kopetdag reservation, Babazo gorge, slopes (27.4.1979 Kamakhina, Annanurov, Pashina; ASH). Wand der Karange dagh Schlucht (type of *A. walteri*, > 5000', 25.5.1887 Walter; LE). Prokhladnoe, N exposed, first belt, 1.5 - 6 km SE border control station near borderline (24.5.1961 Kurbandurdyev; ASH).

**Determination unsure:** - **Turkmenistan:** Central Kopetdag range, Germab - Syulyuklyu (14.8.1935 Gnezdillo 340; TASH). W Kopetdag range, near vill. Giumanovskoe, Mt. Kisiel (13.7.1935 Gnezdillo 108; TASH).

***Allium cristophii* subsp. *golestanicum* R.M. Fritsch**

**Turkmenistan:** Kopetdag range, Mt. Dushak (37.57.07 N, 57.54.29 E, 2200 m, Seisums, HUIJ).

**Determination unsure:** - **Turkmenistan:** Central Kopetdag range, Mt. Dushak, way to the top (37.57.07 N, 57.54.29 E, 14.6.1967 Mishchenko, Ashirov; ASH), slopes (37.57.07 N, 57.54.29 E, 16.6.1961 Kurbandurdyev; ASH); Prokhladnoe, N exposition (24.5.1961 Kurbandurdyev; ASH); border path, height of Palyzan Mts., on slopes of small four waves (03.7.1927 Bogdanovich 264, 268; TASH); near meteorol. station Kheirabad, valleys (2200 m, 30.5.1952 Nikitin, Meshcherjakov; ASH).

***Allium cupuliferum* Regel [subsp. *cupuliferum*]**

**Uzbekistan:** Mal'guzar ridge, Tamerlan gate, rubble slope (40.04 N, 67.40 E, 28.4.1947 Korotkova; TASH), (40.04 N, 67.40 E, 17.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 11; TASH), mountains near Tamerlan gate on the left side of Sanzar river (40.04 N, 67.40 E, 03.5.1921 Kul'tiasov 61-67; TASH), valley of Sanzor river below Tamerlan gate, on rubble slopes (40.04 N, 67.42 E, 23.4.1947 Korotkova 14; TASH); Kuduksai (22.5.1921 [collector ?] 1878; TASH), near Kuduk behind the mine Shorsai, on stony slopes and rubble (12.5.1954 Krasnopolin & al. (?) 936; TASH); state farm Zaamin, c. 4 km W vill. Lyajlyakuya, on steep slope of S exposition (980 m, ?.1965 Makarchuk; TASH); stony slopes on the left side of Sanzar river valley (03.5.1921 Kul'tiasov; TASH); stony slopes on the left side of Sarydi river valley (03.5.1921 Kul'tiasov; TASH); Mt. Zargar 2 km NE vill. Urta-sai on rubble slope, W exposition (1400 m, 11.5.1957 Momotov, Li 238; TASH). Nuratau rige, rayon Farish (41.23 N, 66.50 E, 20.5.1941 Momotov; TASH), (41.23 N, 66.50 E, 29.4.1941 Bukasov 9; TASH), S slopes of height near Parandassai, rubble slopes along the way to Ukhun (31.5.1964 Tsukervanik 419; TASH); on the way from Farish to Karabalan 20 km from Farish, E exposed slopes (41.23 N, 66.50 E, 17.5.1961 Vlasov 8/13-6; TASH); Tichka-sai 3-7 km S vill. Yukari-Ukhun, on stony rubble place (02.5.1958 Li, P. Zakirov 284, 285; TASH), 3 km SE vill. Yukari-ukhun on the way to pass Ukhun, on stony rubble place (29.4.1958 Li, P. Zakirov 229; TASH), Sintad, 0.5 km S vill. Yukari-kurgan, stony rubble slope in S exposition (11.5.1958 Li, P. Zakirov 486; TASH); middle part of Bolo-sai, rubble slopes in E exposition (1200 m, 26.4.1992 Beshko 92-079; TASH); watershed Khayat-Akdygen, stony slope in NW exposition (1400 m, 12.6.1992 Beshko 92-171; TASH); gorge Alichaksai, stony and rubble slopes (26.5.1969 Mambetzhumaev 43; TASH); 2 km N pass Saur-bel', stony rubble place (27.4.1958 Li, P. Zakirov 151; TASH); Nuratau reservation, in N exposition (1400 m, 15.5.1983 Fominykh (?); TASH). Aktau ridge, rocks in Tutaksai (17.6.1951 Neustrueva-Knorrning, Tsvetkova 280; LE); Ljangan, stony slopes (40.22 N, 66.01 E, 1200 m, 24.4.2001 Khassanov 4020; TASH (coll.)).

**Determination unsure:** - **Uzbekistan:** Nuratau ridge above vill. Kyzylcha, in very narrow clefts of granitic stones, in SE-exposition (40.42.53 N, 66.06.36.2 E, 22.03.2009 Keusgen, Khassanov 4275; TASH (coll.)).

***Allium darwasicum* Regel**

**Tajikistan:** Vakhsh mountain range, N slopes of Surkh massif near vill. Dashti-Mirzo, W slopes of the valley (2000 m, 21.6.1962 Popov, Stepanenko, Stotskij 967; TAD LE), NW slopes of Surkh massif 2.5 km S vill. Khamibushol (2600 m, 20.6.1962 Grebennikova, Ashirmukhamedov 147; TAD), SW slopes of Surkh massif 4 km NE vill. Ovez (2650 m, 22.6.1962 Chukavina, Bakhmut, Potashev 403; TAD), crest of Surkh massif near the Darvaz range (2800 m, 15.7.1962 Chukavina, Bakhmut, Khamidov 507; TAD), Surkho massif, near vill. Tashjon, and Galen? (1900 m, 20.6.1960 Sharipova 818, 820; TAD); 4 km SE vill. Kulyabion (2400 m, 31.5.1962 Grebennikova, Ashirmukhamedov 100; TAD); 2.5 km from vill. Khami-Bushol (2600 m, 20.6.1962 Popov, Stepanenko, Stotskij 952; TAD); S end of Zaklon Mts. (02.6.1932 Gontsharov, Grigorjev, Nikitin 482; TAD); Tiryaj massif, N slopes of Imam-Askara Mts. (2550 m, 10.6.1958 Shibkova, Lazareva 118; TAD); watershed between Shurab-Darya and Obi-Mazar, near vill. Sebi-Surkh (38.30 N, 70.03 E, 2000-2100 m, 05.6.1983 Chevtaeva 15165; TAD);

Saripul ad fl. Aksu (38.59 N, 70.20 E, ??6.1884 Regel A.; LE G), Sary-pul, on slopes (28.5.1897 Korshinsky 4984; LE), in montibus Kaschbandun pr. Mumynawad (38.12 N, 69.56 E, ??3.1884 Regel A.; LE); Vakhsh range, E slopes above Sary-Khosor (1900 m, 10.7.1957 Zapryagaeva 5001, 5002; TAD), begin of Khozretisho from Sary-Khosor, E slope (2700 m, 27.6.1957 Strizhova, Mechislavskij 193; TAD); Gulisindan massif, pass Gulisindan (16.5.1913 Michelson 1699; LE); Tal'bar, in gorges (6000-6500', 30.5.1897 Korzhinsky 4983, 1098; LE); foothills of Sipok-Tau, 2 km S vill. Kangurtut (16.5.1961 Ermolenko, Kutikova 96; LE TAD); Imam-askari Mts. W vill. Darai-imam, stony slopes (04.6.1960 Botschantzev, Egorova 908; LE); Vakhsh range near vill. Khojanor (04.6.1937 Pryakhin; TAD), Vakhsh range near pass Sulun (12.5.1913 Michelson 1575; LE), near town Shuroabad, near irrigated fields (2050 m, 29.6.1935 Linczevskij, Maslennikova 632; TAD); Gan-dara valley, right tributary of Shurak Gurzamin (12.5.1913 Michelson 3527; LE); near vill. Charsh rise to pass Arkon near snow (24.5.1910 Divnogorskaya 500; LE); Zagara Mts., in the valley (2200 m, 30.6.1987 Kochkareva 16030; TAD); height near gorge Khargush (2000 m, 14.6.1961 Yunusov, Sharipova, Stepanova 13399; TAD); Pushion plateau near vill. Dektur, Rosa kokanica and Prangos pabularia association (1350 m, 13.5.1981 Koczkareva, Czukavina HFIURSS 6656; BR B G). Central Hissar range, drainage of Varzob river, Kondara gorge, Ruidasht (2200 m, 07.6.1959 Ismailov 1106; TAD); bottom of Majchura valley c. 5 km above mouth (39.03 N, 68.47 E, 2000 m, 19.5.1987 Fritsch 165; GAT), right bank of Majkhura river, plateau Tulizor (39.03 N, 68.44 E, 09.7.1969 Kinzikaeva 2078; TAD), gorge of Majkhura river near mouth of Ziddi river (39.02 N, 68.47 E, 06.6.1959 Kudryashova, Stotskij 123(88); TAD); 1.5 km below mouth of Sioma river (38.58 N, 68.44 E, 1700 m, 21.5.1987 Chevtaeva 7; TAD); middle part of gorge Sioma, right bank (38.58 N, 68.44 E, 2500 m, 27.6.1973 Kochkareva 9187; TAD), left bank of Sioma river (38.58 N, 68.44 E, 1800 m, 27.5.1987 Chevtaeva 16; TAD), gorge Sioma, valley Malyj Ishak (38.58 N, 68.44 E, 2100-2150 m, 28.6.1973 Chevtaeva 9229; TAD); upwards from junction of Ziddy and Majkhura river (39.02 N, 68.47 E, ??7.1930 Pazij, Mironov 863; TASH); gorge Takob, right bank near vill. Rokh (13.6.1952 Konnov, Shimunova 212; TAD); Kondara valley c. 30 km N Dushanbe, W exposed slope under *Acer turkestanica* (38.49 N, 68.48 E, 1800 m, 25.5.1990 Fritsch, Pistrick 414; GAT), Kondara valley, loamy NE exposed slopes below Kwak hut (38.49 N, 68.46 E, 1700 m, 16.5.1987 Fritsch 158; GAT), Kandara [valley, location] Kwak (38.49 N, 68.46 E, 25.5.1946 Rajkova; TASH); Varzob valley, terraces of granitic rocks and on the rock waste cone of a creek (38.55 N, 68.49 E, 1600 m, 19.5.1987 Fritsch R. 172; GAT); 1.5 km S vill. Varzob-Kala (07.5.1959 Yunusov, Kochkareva 223; TAD); Kharangon valley above vill. Dara, W exposed gritty slope (38.42 N, 68.53 E, 2400 m, ??5.1987 Fritsch; GAT); Childukhtarom valley, nutrient-rich loamy slopes under *Acer turkestanica* and *Rosa* sp. (38.49 N, 68.53 E, 1880 m, 17.5.1987 Fritsch 163; GAT); Ojuk gorge, in the highest parts (38.47 N, 68.50 E, 2300 m, 20.6.1934 Koroleva, Nikitin 150; TAD); watershed between Kondara and Luchob rivers (2700 m, 16.6.1933 Zapryagaev 427; TAD); 3-4 km S of pass Anzob (2800 m, 01.7.1960 Kaletkina, Mina 1; TAD); drainage of Yagnob river, near Novobad (39.10 N, 69.18 E, 29.6.1930 Pazij, Mironov 593; TASH); on the way from vill. Ruffig via pass Khak in the Yagnob river valley to vill. Novobad (39.10 N, 69.18 E, 28.6.1930 Pazij, Mironov; TASH); glacier Mergendara (9200', 06.7.1896 Lipsky 1568; LE). Drainage of river Karatag, cultivated in Bot. Garden ANUZS No. 1408 (38.38 N, 68.20 E, 2250 m, ??7.1968 Belolipov; TASH), heights near river Karatag near customs Kosh-Assan (38.52 N, 68.26 E, 12.6.1915 Popov 991/2; TASH), in the mountains near customs Kosh-Assan (?) (38.53 N, 68.23 E, 13.6.1915 Popov 1021/5; TASH), Zarchov river, Khanaka tributary (10000', 30.6.1896 Lipsky 1567; LE), crest of Kugi-Khanaka massif (3200-3300 m, 22.7.1945 Tolmachev 513; TAD); between the massifs Khilaiktau and Khoja-Madraz (2900-3000 m, 24.7.1945 Tolmachev 581; TAD). Foothills of Karategin ridge, heights near river Ilyak near vill. Bungakion (1800 m, 12.6.1962 Popov, Stepanenko, Stotskij 862; TAD); Zarkukh Mts. (SW end of Karategin ridge) (2100 m, 27.5.1961 Strizhova 405; LE TAD); SE slopes of Karategin ridge near vill. Pionerabad close to the path to the pass (2500 m, 25.6.1962 Popov, Stepanenko, Stotskij 995; TAD); river Ob-khrez above gorge from vill. Muja-kharv (38.54 N, 69.53 E, 18.6.1911 Golbek 262; LE); heights of Fil'moni-Darya, 16 km W vill. Novobad (3300-3400 m, 27.7.1966 Strizhova 4092; TAD); 10 km SE of Ramit, height near mound of Pandema (38.45 N, 69.18 E, 2050 m, 09.6.1962 Strizhova, Sidorenko 1721; LE TAD), Ramit reservation 70 km E Dushanbe, dry slope (38.45 N, 69.18 E, 1400 m, 26.6.2002 Kurbanova 6006; TAD (coll.)); right bank of Kafir-nigan river, Jur-yaz drainage, SW slopes of Kok-tyube (23.7.1939 Afanassiev 137; LE); right banks of Surkhob river between vill. Yangakly and Jafr, slopes with shallow soil (20.6.1960 Botschantzev, Egorova 1610, 1616; LE). Peter I. range, drainage of Obi-Khingou river, Chil'dara, S slope of foothills to Surkh-su (38.48 N, 70.18 E, 2700 m, 04.7.1968 Grubov 83; LE), right bank of Surkh-su river above vill. Deli-Mullo (04.7.1968 Ryabkova, Abdusalyamova 6448; TAD); pass Kamchirak (24.6.1911 Golbek 267; LE); N slopes near lake Kara-Kul (3020 m, 04.7.1949 Zapryagaeva, Zabolotskaya, Il'inskaya 617; TAD); below vill. Khukhvak (2000 m, 29.6.1949 Zapryagaeva, Zabolotskaya, Il'inskaya 421; TAD); gorge Farkikush (1750 m, 27.6.1987 Kochkareva 16005; TAD); near vill. Shakob (1700 m, 01.7.1987 Kochkareva 16044; TAD). Hasret-sultan in decliv. occidentalibus montium Darwas (05.6.1884 Regel A. 1884; LE); foothills of Darvaz range between rivers Shurak and Khovaling (38.21 N, 70.02 E, 07.5.1913 Michelson 1346; LE); Darvaz range, W slopes, heights of river Obi-Ravnou, right bank of Kajnar-sai (2600 m, 30.6.1978 Zhogoleva (17) 11880; TAD); N slope, N exposed slope near lake Kara-kul (2740 m, 02.7.1949 Zapryagaeva, Zabolotskaya, Il'inskaya 551; TAD); above vill. Khimkak (2400 m, 02.7.1949 Zapryagaeva, Zabolotskaya, Il'inskaya 520; TAD); Kugi Frush Mts. 8 km E vill. Sharistan (Sharpetaj?) (3300 m, 30.6.1932 Zapryagaev 235; TAD), left bank of river Obi-Niou, W exposed slope of Kugi-Frush Mts. above vill. Vaglel (2800 m, 20.6.1971 Kinzikaeva 2216(34); TAD), W slopes of Kugi-Frush Mts. (2800-2900 m, 03.7.1956 Ovczinnikov, Lazareva 4051; TAD), (38.15 N, 70.15 E, 2460 m, 03.7.1956 Ovczinnikov, Lazareva 3967; TAD), Sarydasht, on slopes (38.37 N, 70.42 E, 17.6.1897 Korshinsky 4981; LE), gorge Sary-Dasht, below pass Sary-Ob (3100 m, 01.7.1967 Stepanenko, Vataga 4709; TAD), pass Zakh-bursi (10000', 09.7.1897 Lipsky 1566; LE), Sagirdasht, right bank of Sary-Ob river above vill. Kulumbai-Bolo (13.6.1966 Kochkareva, Lazareva 1813; TAD); right banks of gorge Khiryak-Dara (10.6.1966 Shibkova, Kinzikaeva 1645; TAD); left banks of river Zarakho above vill. Farkint (2200-2400 m, 08.6.1967 Shibkova, Kinzikaeva 1343; TAD). Khozra-

tishoh range, Childukhtarom massif, heights near right tributary of Obi-Surkh river (38.13 N, 70.03 E, 29.7.1969 Kamelin, Abdukhamidov LE); 10 km S town Shuroabad, N slope of gorge (2700 m, 20.6.1932 Zapryagaev 144; TAD); height of the pass over the Tirkh Mts. 2.5 km E vill. Sarygor (2100 m, 01.6.1961 Soskov, Yunusov 346; TAD), S slopes of Kafir-Kash near vill. Sary-Gor', rubble sediments (37.38 N, 70.13 E, 1500-1600 m, 31.5.1961 Stepanenko, Stotskij, Pavlov 111, 656; LE TAD); plain Dashtitiryaj between vill. Kafmar and Shuroabad (37.52 N, 70.02 E, 2000 m, 17.6.1935 Linczevskij, Maslennikova 415; LE); watershed between Kaferkash and Shpillu 6 km NW vill. Sarpon (Sarngor?) (2400 m, 06.6.1961 Soskov, Yunusov 742; LE TAD).

**Determination unsure:** - Tajikistan: Darvaz range, Obikhingou valley, N slope above village Khoidara, in the shadow of Acer trees (38.42.33,4 N, 70.33.42,6 E, 2170 m, 26.7.2005 Keusgen, Fritsch, Hisoriev 6231; TAD (coll.)).

***Allium dasyphyllum* Vved.**

Kazakhstan: Kirgiz Alatau range, opposite Uch-Bulak (07.7.1924 Popov, Mokeeva 330; TASH); Syugaty gorge, middle part of river, S stony slopes (07.6.1963 Goloskokov; LE). - Kyrgyzstan: W end of Kirgiz Alatau, Kara-Archa forestry (07.6.1967 Nikitina; FRU).

***Allium dodecadontum* Vved.**

Kyrgyzstan: Chatkal range, Arkit, Juglans forest (41.50 N, 71.58 E, 24.5.1957 Galkina 129; TASH), Sary-Chilek, Juglans forest (41.52 N, 71.58 E, 1600-1700 m, 25.5.1956 Galkina 236; TASH); Aflaton, stony slope (24.5.1957 Galkina 16; TASH); Gava valley, gorge Kupok [?Kulok] (30.6.1928 Dzents-Litovskaja 70; LE). Karavak district, Majsh-sai (19.6.19?? Galkina 348; TASH); Pajaata district, valley of river (21.5.1957 Galkina 321; TASH). - Uzbekistan: Chatkal reservation, forests (515 m, 08.6.2002 Joint expedition 4109; TASH (coll.)).

**Determination unsure:** - Kyrgyzstan: Union of Fergan and Chatkal ranges, drainage of Sumsar, location Sary-Bulak, reservation Kash-Tektyr (2040 m, 09.6.1980 Gorbunova; FRU).

***Allium eugenii* Vved.**

Turkmenistan: Great Balkhan massif, dry river bed near well Kosha-Kujuk, on rubble (1450 m, 23.6.1929 Bobrov; LE); stony steppe slope near spring Tash-Mogur (1700 m, 26.5.1928 Bobrov, Jarmolenko 198; LE), Juniperus slope near spring Tash-mogur (1650 m, 23.6.1929 Bobrov, 104; LE).

**Determination unsure:** - Turkmenistan: Top area of Great Balkhan massif near spring Nazar Ekerem, bare places at S-facing slopes with tall forbs and Juniperus turkestanica (39.37.24 N, 54.23.24 E, c. 950 m, 10.4.2002 Fritsch, Keusgen, Khassanov 35; ASH (coll.)).

***Allium fetisowii* Regel**

Kazakhstan: Zaili Alatau range, from Kastek river to location Sary-Yasyk, slopes (20.5.1912 Shishkin; LE); Syugaty Mts., gorge near kardon (11.6.1955 Goloskokov; LE); S slopes of Turajgyr, steppe slopes near bottom of gorge (1500 m, 25.5.1953 Goloskokov; LE). Chu-Ili mountains, drainage of Argaity river, vill. Gorno-Nikol'skoe, meadow steppe (17.6.1926 Abolin 119; TASH), subalpine meadow (18.6.1926 Abolin 139; TASH); Kendyk-tas massiv, N stony slopes (03.-04.6.1958 Kamelin 99-102; LE). Semirechensk, left banks of M.-Kedin river, slopes (18.5.1915 Sovetkina 336; TASH). SW foothills of Jungar Alatau, Altyn-Emel Mts., disturbed places (HFIURSS 5358, 12.6.1971 Tzagolova; W JE). Syr-darya region, Ojrandy (10.6.1903 Lipsky; LE). Talas Alatau range, Jebagly, M. Kaindy (07.6.1926 Korovin; TASH). Alatau, Jebaty, meadow Kul'-Jajlyau (22.6.1926 Korovin; TASH). Jambul area, Kirgiz Alatau range, gorge Marbal, meadow (42.49 N, 72.00 E, 1480 m, 09.6.1931 Igolkin 87; LE). - Kyrgyzstan: Chu-Ili Mts., location Kasdek ?, NW exposed slope (28.5.1953 Ajdarova; FRU); location Tejtek, rocky-stony S slope (29.5.1987 Kajdarova, Kasiev, Kashkareva; FRU); location Orto-Jon, right banks of river Bejshejs, meadow-steppe (30.5.1987 Ajdarova, Kashkareva; FRU); location Kandyk-sai, NE exposed slopes (31.5.1936 Ajdarova; FRU); Kurdai, Sovkhos Shamsi, river Kashka-Su (06.3.1934 ? Kashchenko; FRU). Kirgiz Alatau range, heights near river Tandy-su (17.6.1931 Massagetov, Massalskij 17-11; LE). Angust. Arassan. m. Alexander (7000-9000', 07.6.1880 Fetisow; LE). Karabalta area, near vill. Sosnovka, E exposed slope (42.40 N, 73.54 E, 14.-15.6.1936 Kashchenko; FRU). Kirgiz Alatau range, Ukh-Shamsi district, location Ak Jalpak, N exposed meadow (28.5.1954 Kashchenko; FRU); rocks on the left bank of river Shamsi (28.5.1926 Sovetkina, Uspenskaya 54, 1785; FRU); S slopes of height near river Nel'da (15.6.1962 Sudnitsyna, Gorbunova; LE); near gorge Taldy-bulak, E exposed slope (05.6.1936 Mikhajlova, Popova; TASH); near Alameddin river, E slopes of Mt. Shekule (17.5.1919 Sovetkina 139; TASH), Shekule massif, Ala-Medin valley, E exposed slope (15.5.1916 Kishnirenko 129; TASH), Alameddin valley, N foothills of Mt. Shekule, steppe (17.5.1919 Sovetkina 147; TASH), summit of Shekule (15.5.1916 Savenkova 129; LE). Drainage of Kainda river, location Burulyu, E exposed slope (01.6.1950 Tkachenko, Kashchenko; FRU), river Jirly-Kaindy, watershed between Dry and Damp Burulyu (14.6.1949 Tkachenko, Kashchenko; FRU). Frunze, among Rubus fruticosus shrub (02.6.1932 Nikitina; FRU), slopes below Chon-Aryk (Chap-Aryk ?) (42.45 N, 74.33 E, 18.5.1957 Nikitina, Arbaeva; FRU), Mt. Paspel'dyk (42.45 N, 74.33 E, 08.5.1959 Nikitina, Sudnitsyna; FRU), N slopes of Mt. Paspel'dyk (42.45 N, 74.33 E, 18.5.1932 Nikitina; FRU), premountain Paspel'dyk below Chon-Aryk (42.45 N, 74.33 E, 28.5.1958 Nikitina, Sultanova, Sudnitsyna; FRU); location Chongurkak (05.6.1934 Nikitina FRU), Chu valley near Pishpek, desert zone (05.5.1917 Sovetkina 66; TASH), Pishpek area, gorge of Oj-tabolq river, S stony slope (23.5.1912 Shishkin; LE). Zaili Alatau range, Chen-Kemin drainage (20.6.1955 [collector missing] 166; FRU), opposite Jamdikul (22.6.1954 Isakov; FRU), location Kapchygaj (14.5.1955 Isakov; FRU), location Kanch'tag (21.5.1954 Isakov; FRU). W foothills of Kirgiz Alatau, gorge Kara-Archa, in the forest along river (28.5.1959 Sudnitsyna; FRU), part between Atbash and Kara-archa, plain in desert zone (27.4.1917 Sovetkina 40; TASH). N slopes of Talas Alatau range, drainage of Khalda river, watershed between Ker-Bulak and Munushker (03.7.1958 Moldoyarov, Usupbaev; FRU), drainage of Khalda river, location Cholok-Bulak (06.7.1953 Moldoyarov; FRU), (10.6.1958 Moldoyarov, Usupbaev FRU); gorge of



Kolba-su, alpine meadow on NNW exposed slope (23.6.1927 Sovetkina, Uspenskaya 190; TASH); drainage of Kok-sai, shrubs (14.6.1969 Ajdarova FRU); drainage of Kashka-Suu river, location Jer-Kyen, steppe (12.6.1969 Ajdarova; FRU). Talas Alatau range, gorge of Aksai (08.7.1922 Popov 655, 795; TASH). Left bank of Kegety river, even place near the forestry (06.5.1915 Sovetkina 141; TASH LE).

**Determination unsure:** - Kazakhstan?: Talas Alatau range, pass Ulkun-Kaindy (2900 m, 06.2.1933 Linczevskij 316; LE). - Kyrgyzstan: S slopes of Susamyr ridge near vill. Toluk (24.6.1988 Klyujkov, Kashkaraeva; FRU); Susamyr valley (22.6.1973 Ajdarova, Bazhetskaya, Mursaliev; FRU). Atajnok (Uzun-Akhmat) ridge, location Kok-bel', saline-gypseous sediments (07.5.1977 Sultanova, Batalov, Ledovskaya; FRU). S slopes of Talas Alatau range, middle part of Chichka river, location Uch-Aral (13.5.1966 Sudnitsyna ?; FRU), right tributary of Dangi river (23.6.1973 Ajdarova, Bozhetskaya, Mursaliev; FRU). Clayey slopes near begin of gorge Jeboty-su (08.-11.6.1924 Mokeeva 102; TASH). Alai range, Abshir-sai, Arpa-zhaj, Juniperus forest (Ajdarova; FRU).

### *Allium giganteum* Regel

Tajikistan: Hissar range, Kirovabad, Karatag forestry (17.8.1966 Filimonova 1135; TASH); SW end of Karategin ridge, central part of Zarkukh Mts., rubble slope (1550 m, 28.5.1961 Strizhova 420; TAD). Rengentau massif, S slope S vill. Rangon, rubble slope with shallow soil in Kalta-sai (38.23 N, 38.50 E, 12.6.1959 Badritdinova, Akhmetshina, 274; TAD). Aруктау massif, in the valley above vill. Ganjino, red clay (37.58 N, 68.34 E, 23.5.1987 Kochkareva, Zhogoleva, Fritsch 16086; TAD), W slopes of Aруктау massif (1100 m, 08.5.1959 Chukavina 154; TAD). Khoja-Kazyan ridge, gorge Dagana (900 m, Kinzi-kaeva, Kochkareva 4935; TAD); Buchara orient. Sum. cacum. montis Chodscha-Kadian ad orientem a Kabadian (type of *A. procerum* Trautv. ex Regel, 6000', 21.4./03.5.1883 Regel A.; LE), summit of Mt. Kojpioztau (37.22 N, 68.16 E, 1630 m, 18.5.1990 Fritsch, Kudratov, Pistrick 347; GAT), 10 km SSE of town Kabadian, E part of Taka-Kamar (400 m, 31.5.1962 Soskov, Shibkova, Ismatova 327; TAD); Sarsaryak Mts., between vill. Jida-bulak and Naiza-bulak, marine sediments (37.23 N, 68.14 E, ???.1932 Gontsharov, Grigorjev, Nikitin 174; TAD); SW part of Khojakazyan ridge c. 14 km E Shaartuz, spring Kutorbulak N Mt. Takakamar, S exposed limestone rock slope (37.24 N, 68.15 E, 800 m, 16.5.1990 Fritsch, Kudratov, Pistrick 316; GAT), N of gorge Kutur-bulak, among rocks (800 m, 25.4.1982 Botschantzev, Yunusov, Kinzi-kaeva, Karimova 9797; TAD); E slopes of Khoja-Kazyan massif (900 m, 04.6.1975 Konnov, Kochkareva 10468; TAD); E vill. Dakka (19.5.1939 (unreadable) 72?; TAD); gorge Ispan-dara (800 m, 16.5.1979 Kinzi-kaeva, Kochkareva, Amanova 5415; TAD). Gazimailik ridge above vill. Ganjino, sandy-loamy slope (37.58 N, 68.34 E, 900 m, 23.5.1987 Fritsch 183; GAT); height near pass Khoja-Bekh-ob 1.5 km N vill. Gal'ki-bulak, W exposed stony rubble slope (1800-1850 m, 13.6.1960 Kudryasheva, Stotskij 538; TAD); E slopes 5 km NNE of vill. Kul-Bulak, top of a foothill (1880 m, 16.7.1951 Popov. 293; TAD); foothills of Gazimailik ridge, height near adyr Belenda, Pistacia association (1000 m, 25.5.1939 Podilko? 525; TAD); S end of Tereklitau Mts. (850 m, 11.5.1937 Nikitin 570; TAD). SE end of Babatag massif, top of a ridge between vill. Jilon-Bulak and Davli-Bulak, slope with shallow soil (2000 m, 10.6.1962 Soskov, Shibkova, Ismatova 897; TAD); E slopes of Babatag massif, valley Khozrat-Bobo (1400 m, 18.4.1958 Zapryagaeva 7111; TAD); Tabakchi massif, E of Kurgan-Tyube (c. 900 m, 12.5.1936 Pryachin, Slobodzchikov 149/2; TAD), Tabakchi massif, between Pistacia (09.5.1937 Pryakhin; TAD). Vakhsh mountain range, N end of Kyz-Syrgan massif, red sandstone (1200 m, 22.5.1939 Pryakhin; TAD); Vakhsh valley 5 km E Nurek, grassy gentle slope (1600 m, 15.5.1985 Hanelt; GAT); SE slopes of Surkho massif, sandy area among Amygdalus stand (05.5.1962 Chukavina, Potashev 72; TAD), right bank of Vakhsh river near Surkho massif near vill. Sangi-Juvazak (1400 m, 06.5.1962 Chukavina, Bakmut, Potashev 347; TAD); E slopes of Tujuntau massif near vill. Somgova (544 m, 08.5.1939 Nikitin 134; TAD); Kyzyl-Mazar region, S end of Koshaldy Mts. near vill. Selburg (01.6.1958 Shibkova, Lazareva 76; TAD); Panj-Karatau ridge, Mt. Chadai, along way from Kirovabad to Parkhar, E slopes (700 m, 26.5.1960 Yunusov 1315; TAD); W slopes of Karatau ridge 2-3 km SW town Khoja-Maston (29.5.1960 Mechislavskij, Zavedeev 518; TAD), Karatau ridge, lower mountains of marine sediments on right bank of Pyanj river (?.6.1930 Tyshchenko, Fel'shau 813; TASH); W slope of Karatau ridge not far from Besh-Kuduk (920 m, 07.5.1963 Filatov, Potashev, Odinaev, Ivanova 132; TAD), W slope near vill. Besh-kuduk (1200 m, 26.4.1959 Zapryagaeva 9005; TAD); Mt. Khoja-Mumin, between vill. Kara-agach und the top (37.44 N, 69.39 E, 1100 m, 08.6.1935 Linczevskij, Maslennikova 224; TAD); Chal-Tau, W exposed slope near main ridge, between Kara-sangou and Tamchi (1150 m, 14.5.1957 Zapryagaeva 3491; TAD); Tuyuntau massif, central part, 3-4 km W vill. Sangoba (450-500 m, 23.4.1960 Kudryasheva, Stotskij 372; TAD). Darvaz range, slopes of Kugi-frush 8 km E Sharistan, stony place (3500 m, 30.6.1932 Zapryagaev 255, 256; TAD LE); N slopes of Darvaz range, right banks of river Zarakho between vill. Farkint and Khavdak (08.6.1966 Kochkareva, Lazareva 1420; TAD). S slopes of Hissar range, gorge Norobod, right bank of Karatag river (30.5.1968 Rasulova, Sharipova 78; TAD). - Turkmenistan: Badkhyz, mountains near the Russian-Afghan border at Kushka (35.17 N, 62.20 E, 11.5.1914 Korovin 911; TASH), district Kushka, near village Morgunovskij, valley Shor-sefler near cemetery (15.5.1930 Linczevskij 598; TASH), near fortress Kushka, in the valley of river Shur-Sakhed (35.17 N, 62.20 E, 08.5.1930 Butkov 148; TASH); Pul'i-Khatuma, W stony slopes near spring Akarcheshme (24.4.1930 Linczevskij 176; TASH). Kugitang ridge, 2 km NE of vill. Khoja-i-fil', on marine sediments (16.5.1978 Nabiev, Li, Tsukervanik 252; TASH). Central Kopetdag range, Chuli to Chaek, slopes (37.57 N, 58.00 E, 25.5.1957 Ishchenko ASH); in fauce saxos. ad pagum Firusa (37.58 N, 58.08.02 E, 17.6.1900 Sintenis 628; B G). - Uzbekistan: Kugitang ridge, vill. Vandob, within bushes (37.43 N, 66.39 E, 1000 m, 06.8.1999 Khassanov 4052; TASH (coll.)). SW foothills of Hissar range, Baisun ridge, right banks of river Machaj near vill. Urtamachaj, marine sediments (23.5.1978 Nabiev, Li, Tsukervanik 655; TASH), lower mountains of marine sediments between Baisun and Denau, near overwintering Tash-kak, on the summit (26.5.1930 Botschantzev, Vvedensky 343; TASH), near spring Khoja-ipak, limestone rubble slope (19.5.1930 Botschantzev, Vvedensky 280; TASH); lower mountains of marine sediments SE Guzar, N slopes of Kizil-kiya gorge in height Jety-ogul (?.5.1935 Gnezdillo 77; TASH); drainage of Lyangar river, valley of Aksu river between vill.s Kyzyl Kishlak and Kyzyl Mgit, on outcrops of red marine sediments (14.5.1972 Nabiev,

Shermatov, Kazakbaev 48; TASH); drainage of Sangardak river, way downward along the river Khandiza from vill. Degi-Surkh (38.35 N, 67.36 E, 09.6.1948 Pyataeva 336; TASH); Surkhandarya region, 4 km N mark 3115 near river Obi-sarang, NE slopes (???.6.-7.1966 Kamalov; TASH). Babatag massif, location Uslov (?) (02.5.1940 Bukasov 163; TASH). - Uzbekistan?: Babatag forestry, Chigan forest, Umergen-bulak sai (26.8.1964 Filimonova 943; TASH).

**Determination unsure:** - Tajikistan: Khozratishoh range, S part of Darai Odamkhur, very steep, with stones in bottom of gorge (37.22.29,3 N, 69.12.44,3 E, 937/1081 m, 21.4.2003 Fritsch, Keusgen, Kurbonova, Hisoriev 6039; TAD (coll.)). Turkmenistan: Kopetdag range, Chuli, stony rubble slopes (1100 m, 05.8.2002 Kurbanov? 77; ASH (coll.)).

#### *Allium gypsaceum* Popov & Vved.

Tajikistan: Khojakazyan ridge, W slopes of Aruk-Tau massif, 3 km E Najza-Bulak (1230 m, 03.7.1951 Popov 165; TAD); Sarsaryak massif, between vill. Najza-Bulak and Jida-Bulak (06.6.1932 Gontscharov, Grigorjev, Nikitin 177; TAD). Babatag massif, near vill. Dukana, outcrops of red sandstones with gypsum (13.6.1936 Lepeshkin, Mukhamejanov 351; TASH); c. 5 km N Turgak, S slope of the limestone-gypsum bracing edge (750-1050 m, 27.5.1987 Fritsch 212; GAT). Vakhsh range, S slopes of Surkho massif, near vill. Darai-Os'evak, NE slope (950 m, 20.6.1969 Kochkareva, Chukavina, Sharipova 7298; TAD); E slopes of Karatau massif (700 m, 07.6.1960 Mechislavskij, Zavedeev 576; TAD). - Turkmenistan: Kugitang ridge, near kolkhoz Frunze (31.5.1973 Sejfulin; ASH), 2.5 km E vill. Khoja-Pil' (04.6.1973 Gudkova, Sukhova; ASH), 2 km E vill. Khoja-Pil' (04.6.1973 Gudkova; ASH), near vill. Khojapil' (37.56 N, 66.40 E, 05.6.1973 Chohanov; ASH), (02.6.1973 Gudkova; ASH), (10.6.1966 Meshcherjakov; ASH), above vill. Kugitang (20.7.1935 Androssov; ASH), opposite vill. Kugitang, Amygdalus spinosissima association (19.6.1931 Nevski 333; LE); near spring Myrzabedil' (23.5.1985 Raenko ASH); Airi Baba (30.5.1973 Gudkova, Sukhova; ASH). - Uzbekistan: Kugitang ridge, rocky slopes above vill. Vandob in Juniperus belt (37.43 N, 66.39 E, 12.6.1916 Fedtschenko & al. 525; LE), near vill. Vandob (37.43 N, 66.39 E, 15.6.1972 Jumaev; TASH), rocky area below height near Burulak (?) gorge (13.7.1935 Gnezdillo 117; TASH), near vill. Shalkan (04.-10.6.1973 Jumaev; TASH), Kugitang ridge (23.5.1936 Gnezdillo 896; TASH), Magently (?), among Acantholimon (2200 m, 04.5.1984 Khassanov; TASH); E slopes of Kugitang ridge, Sai Chashma-khajot (18.7.1967 Ovczinnikov 333; TAD), drainage of Shirabad river, 1.5 km SE of the top of Kugitang ridge (1800 m, 01.6.1965 Kayunov; TASH), dry valley near Zaraut-sai (28.5.1956 Mirzabaev; TASH), near vill. Kizil-alma (?), outcrops of slate (25.5.1927 ? Popov, Vvedensky 348 ?; TASH), rise to the E slopes of Kugitang ridge from Kempyr tjube, stony slope (2000 m, 01.7.1931 Vvedensky 165; LE). Baisun ridge, Khoja-gurgur ata Mts., sai Gor-bulak, near spring in Juniperus wood (01.7.1934 Butkov 18 ?; TASH), Khoja-gurgur ata mountains, sai Shar-shar, slopes with shallow soil in Juniperus forest (01.7.1934 Butkov 75; TASH). SW Hissar range, drainage of Tupolang river, right bank of Tupolang, 0.5 km below vill. Gazarak, E stony slopes (15.6.1948 Pyataeva 393; TASH), Shargun, below pass Kumakty (38.38 N, 67.57 E, 2100 m, 21.6.1987 Khassanov 33(1); TASH); drainage of Sangardak river, Nilyu-Sangardak (22.5.1913 Michelson 1762bis; LE), above Nilyu, stony slopes (16.5.1983 Turkestan group 2415; LE), in declivia saxosa gypsacea in promontoriis montium Tschulbair supra pag. Ljukka (19.6.1929 Vvedensky HFIURSS 5438; W JE TAD), foothills of Chulbair Mts., Tentyaksai, sai Garmala, spring Khojaipak, on red sandstone and clay (26.5.1977 Botschantzev 390a; LE); slopes above vill. Shiryay, in Juniperus belt (13.6.1916 Fedtschenko 557; LE); Baisun massif between Akrobat and Shurab, outcrop of red stones (38.15 N, 66.50 E, 06.6.1972 Nabiev, Shermatov, Kazakbaev 483; TASH); between Dekhkanabad and Akrobat along the main street, on rubble slopes of marine sediments (38.15 N, 66.50 E, 22.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 222; TASH); near village Derbent (28.5.1933 Butkov; TASH).

**Determination unsure:** - Uzbekistan: SW Hissar range, Sarymasg massiv, red sandstone outcrops near the road c. 15 km N Sairob; on terraces and in the clefts of rocks (38.10.25 N, 66.58.33 E, 1250 m, 31.05.2006 Fritsch, Khassanov 4232; TASH (coll.)).

#### *Allium helicophyllum* Vved.

Turkmenistan: W Kopetdag range, way Chendyr - Karakala (15.5.1967 Ashirova, Bajranova; ASH), 45 km N Karakala, rocky terraces (800 m, 20.4.1995 Khassanov 4007; TASH (coll.)); location Shikh-Bedyr, rare (31.5.1974 Popov K.; ASH); Skobelev gates, stony road metal slopes (38.53 N, 56.18 E, 700 m, 18.5.2002 Kurbanov 65; GAT). Central Kopetdag range, vicinity of Prokhladnoe (12.6.1930 Aleksandrova; ASH), Prokhladnoe, steppe along the valley (25.6.1926 Czerniakovskaya 15; LE), Tragacanthus stands on rubble places (1600 m, 02.7.1934 Borisova 357; LE), S Prokhladnoe, rubble parts between "pologikh" rubble slopes (1450 m, 20.6.1934 Borisova 254; LE). Ashabad, Suluklü (Saratowka); ad fines Persiae: in steppis montium (38.03.18 N, 57.24.45 E, ???.7.1900 Sintenis 893; LE B G), rubble slopes of Syulukli (38.03.18 N, 57.24.45 E, 23.6.1926 Cherniakovskaya 8; LE); Bami near Bakharden (24.5.1974 Meshcherjakov; ASH); near village Khoja Kala, soft and clayey slope (10.6.1973 Khamidkhoaev 20; TASH); near village Baba-durmaz (37.38 N, 59.05 E, 05.7.1988 Jabbarov (?) 24; TASH); Kopetdag (place not mentioned) (31.5.1931 Androssov; TASH).

#### *Allium hexaceras* Vved.

Uzbekistan: SW Hissar range, Mt. Khoja-kiikkalon NE vill. Zevar, S exposed slope below rocks (38.45 N, 67.58 E, 2860 m, 23.7.1987 Maltzev 25; GAT TASH).

#### *Allium hissaricum* Vved.

Tajikistan: Hissar range, Varzob drainage, gorge Guskhar, W slope (1100 m, 01.6.1964 Stepanenko, Kudryashova 2341; TAD); Kondara gorge, rubble slopes below location Kwak (38.49 N, 68.46 E, 1600 m, 04.6.1947 Pis'yaukova 56; TASH), Kondara gorge, S slope among rich vegetation (38.49 N, 68.48 E, 1100 m, Lysova 10; TASH), hill ridge S Kondara gorge, loamy-gritty slopes (38.49 N, 68.48 E, 1400-1650 m, 02.6.1987 Fritsch 127; GAT), along path between location Kwak and Kondara station, NE exposed slopes under Crataegus (38.49 N, 68.48 E, 1430 m, 22.5.1990 Fritsch, Pistrick 405; GAT); drainage of Karatag-darya, forest near vill. Saurgon (02.6.1930 Kudryashev 278; TASH); Ojuk valley E vill. Ojuk, loose stand of Zizi-

phus jujuba (38.47 N, 68.50 E, 1200 m, 05.5.1990 Fritsch, Kudratov, Pistrick 72; GAT); S foothills of Hissar range, hills 3 km above vill. Tomek, location Irgaj (29.5.1969 Rasulova, Sharipova 64; TAD). Khojaj-Zaring massif, S Tash-Mechen (1600-1700 m, 20.6.1951 Bardzhitdikova, Shashkina 115; LE); Rengen-tau massif, slopes on the crest near Tashmechet (38.23 N, 38.50 E, 25.6.1954 Badritdinova 99; TAD). Hills between the mountains Gardani-Ushti and Esal'on, N slopes (1100 m, 24.5.1960 Strizhova, Pogrebnyaya 193; TAD), E slopes of Gardaniushti Mts., S pass Khoja Bekhob on shallow rubble soil (38.04 N, 68.37 E, 2100 m, 22.6.1947 Varivtseva, Nepli 15?; LE), near pass Khoja-bekh-ob (2000-2100 m, 13.6.1960 Kudryasheva, Stotskij 530; TAD); W slopes of Gardaniushti Mts., Juniperus with Acer stands (37.53 N, 68.34 E, 2000 m, 22.7.1947 Nepli 1501; LE), N slopes (03.6.1947 Ovczinnikov, Varivtseva; TAD); Gazimailik ridge c. 35 km NW Kurgan-Tyube, location Obodkan c. 10 km NW Ganjino (38.02 N, 68.34 E, 1350 m, 12.5.1990 Fritsch, Kudratov, Pistrick 170; GAT). Vakhsh range, mountains near Bal'juan (38.18 N, 69.39 E, 02.5.1906 Morren 428; LE), near pass Okh-terak (05.7.1916 Fedtschenko & al. 829; LE); W slopes of Sanglak Mts., in tall forb association (1900 m, 12.6.1932 Gontscharov, Grigorjev, Nikitin 313; LE), Sanglak massif 5 km WSW Tutkaul, Rosa and Acer association with tall forbs (38.17 N, 69.15 E, 1600 m, 09.6.1964 Sairupova, Odipaev 192; LE); systema fl. Vakhsh, trajectory Guli-Zindan (ad austro-orientem a pag. Tutkaul) in rosario (06.7.1934 Botschantzev HFIURSS 5523; P? JE W B M), Tutkaul (38.19 N, 69.18 E, 08.5.1906 Roshevitz 443; LE); Pushon elevated area, near vill. Sal'molidasht, W slope of the valley (1350 m, 12.5.1981 Kochkareva, Chukavina, Stepanova 13166; TAD); W slopes of Karatau ridge, NW of town Khoja-Maston, in fields (13.6.1960 Mechislavskij, Zavedeev 647; TAD LE); N slope of Vakhsh range, near vill. Tagikamar near the way to Komsomolabad (2000 m, 17.6.1960 Yunusov 2154; TAD); SE slopes Surkh massif, near vill. Digisho (1850 m, 16.6.1962 Popov, Stepanenko, Stotskij 906; TAD); slope to Khozratishoh from Sary-Kosor (2400 m, 27.6.1957 Strizhova, Mechislavskij 189; TAD). Watershed between Yakhsu and Obi-Surkh rivers near mazar Tajtuto (voucher of *A. hissaricum* subsp. *cisdarvasicum*, 14.6.1981 Darvaz group 81 911; LE).

**Determination unsure:** - Tajikistan: Hissar range, drainage of Varzob river, Kondara canyon 37 km N Dushanbe; N wet scree slope (1300 m, 10.4.2002 collector not reported 6010; TAD (coll.)), on the crest of the S slope in E exposition (38.48.33,4 N, 68.49.11,7 E, 1195-1200 m, 18.5.2003 Hissoriev, Kurbonova 6115; TAD (coll.)). Right banks of Vakhsh river, SE slopes of Surkho massif 10 km NW Tutkaul among Acer (38.23 N, 69.13 E, 1400 m, 18.5.1962 Chukavina, Bakhmut, Pata-shev 253; LE TAD).

***Allium iliense* Regel s. str.**

Kazakhstan: Valley of Ili river, special location Sary-kemir (08.6.1926 Titov, Joffe 253 ?; TASH); between lake Beroldaj and mouth of river Chilik on uneven sands (Titov 502; TASH), near lake Boroldaj (29.8.1928 Titov 640; TASH), left bank of Ili valley near station Ilijskaya (43.50 N, 77.00 E, ??,5.1920 ? Titov 342; TASH), side valley of Ili river W main road Alma-Ata - Taldy-Kurgan, sandy plateau c. 2 km N Kapchagaj (43.55 N, 77.05 E, 16.6.1993 Fritsch R. 949; GAT) TAX 3724, location Syry-Kemir, near the town under construction (43.50 N, 76.07 E, 10.6.1926 Titov, Joffe 309 ?; TASH); Little Karoj, right bank of Sor-kuduk river (43.40 N, 75.10 E, 05.7.1919 Granitov 222; TASH); between well Chjakej-khaki and location Sary-Kemir, sandy place Aral-kum (43.50 N, 76.25 E, 07.6.1926 Titov, Joffe 135; TASH). Chu-Ili Mts., Kenes-Anarkhaj (27.5.1961 Ionov; FRU), Khantau, Supkar hill, circus among rocks (44.17 N, 73.48 E, 02.7.1968 Puchkova; TASH), desert (44.10 N, 74.05 E, 03.7.1926 Abolin 421a; TASH); behind village Chaganak, Kara-sai, on a stony rubble plateau on red sandstone parts (30.6.1968 Puchkova TASH); valley of Chu river, location Jarge-kul' (31.5.1926 Drobov, Gomolitskij 261; TASH), 6-7 verst from vill. Novo-Troitskoe, on a higher place, among Artemisia steppe vegetation (43.30 N, 73.50 E, 16.5.1916 Sovetkina 947; TASH.) near vill. Alekseevka, on open sand (03.5.1916 Sovetkina 452; TASH). Jambul area, sand in Talas river valley, location Uch-aral (43.59 N, 70.30 E, 06.6.1922 Drobov 378; TASH); sandy area near valley Karagudda, among shrubs (43.40 N, 71.55 E, 28.4.1916 Sovetkina 602; TASH), sandy area Muyun-Kum near the well Tyul'kubaj (44.10 N, 70.08 E, 12.6.1922 Drobov 496; TASH), near railway station Akyr-dyube (25.5.1956 Vykhodtsev, Korneva FRU), location Ak-biden (43.50 N, 71.50 E, 22.5.1926 Drobov, Gomolitskij 92; TASH), between wells Churek and Ajdarly (43.40 N, 71.50 E, 22.5.1926 Drobov, Gomolitskij 69; TASH), from well Yukalgan to river Chu, saksaul vegetation (27.5.1926 Drobov, Gomolitskij 199; TASH). Juvalij district, dry adyrs, stony grey soils Tyul'kubas - Burnoe (42.37 N, 70.46 E, 30.8.1952 Demyanenko; TASH). E Betpak-dala near Mt. Jambul, rubble plain (45°00' N, 73°10' E, 06.8.1933 Mironov 150; TASH).

**Determination unsure:** - Uzbekistan: SE margin of Kyzylkum desert, 3 km SE from spring Pashat in the mountains (04.6.1936 Kharchenko 1201, 1203; TASH).

***Allium insufficiens* Vved.**

Tajikistan: W foothills of Gardani-ushti massif, loess hills, NE slopes (06.5.1948 Varivtseva, Nepli 362; LE), between vill. Chinartut and Karabulak (1400 m, 21.5.1960 Strizhova 161; TAD), hills between massif Gardani-Ushti and Aruktau near Ganjino, W slope of a loess hill (38.00 N, 68.34 E, 22.5.1965 Nepli 139; LE); Aruktau massif near vill. Ganjino, red sandstones S of vill. (37.58 N, 68.34 E, 21.5.1967 Botschantzev 241; LE), W slope of Aruk-Tau massif (09.5.1963 Zhogoleva 91; TAD), Aruktau massif, location Tamchi (Kolontaeva TAD), hills near the E slope of Aruktau near forest station Gamcha (10.5.1959 Mechislavskij, Pogrebnova 325; TAD), Kazan-Dag Mts. near vill. Ajkashar 4 km NEN from forest house Tamchi (20.5.1959 Strizhova, Chukavina 269; TAD);, on the way between Kyzyl-Kala to Ganjino (37.58 N, 68.34 E, 23.4.1959 Chukavina, Shibkova 262; TAD), upper margin of streambeds above Ganjino, loess soil (37.59 N, 68.34 E, 900 m, 23.5.1987 Fritsch 180; GAT), height with Pistacia vera trees c. 5 km N Ganjino (38.02 N, 68.34 E, 1250 m, 11.5.1990 Fritsch, Kudratov, Pistrick 145; GAT), N foothills of Gazimailik ridge not far from vill. Esanbaj (700 m, 16.5.1983 Yunusov 10460; TAD); Kurgan-Tjube (21.4.1906 Roshevits 345; LE); Kafirnigan valley location Karagaz, on the slope to the river (05.5.1948 Varivtseva, Nepli 245; LE); low adyrs near the Kafirnigan near vill. Khoja-bul-bulak (500 m, 13.5.1939 Bodisko 428; TAD); 3 km S vill. Karabal'chik, high adyrs (950 m, 18.5.1939 Tazba 490; TAD); bank of Vakhsh river, 4 km SW of vill. Kzyl-Kala (07.5.1933 Za-

pryagaev 168; TAD); Terekli-Tau Mts., red marine sediments, N vill. Bor-Bulak (650-780 m, 08.5.1967 Popov, Krasil'nikov; TAD), S slopes of Terekli-Tau Mts., under Pistacia (1300 m, 30.5.1937 Nikitin 671; TAD LE), W slopes of Terekli-tau Mts. near spring Besh-bulak, NW exp. slope (615 m, 12.5.1936 Linczevskij, Maslennikova 206; TAD LE). Karatau risge, S end 5-6 km SW Mt. Khoja-Maston (445 m, 06.-11.5.1960 Mechislavskij, Savedeev 206, 257; TAD); near sovkhos Baumanabad (Panj), upper terrace of Panj river (37.19 N, 69.00 E, 450 m, 02.5.1936 Linczevskij, Maslennikova 143; LE TAD), between Panjskij and Karaul-Tyube (37.19 N, 68.40 E, 400 m, 27.4.1936 Linczevskij, Maslennikova 98; LE TAD), Chedaj Mts. between Kirovabad and Parkhar, red clay slopes of Ichajli sai (26.5.1960 Botschantzev, Egorova 400; LE), crest of the mountain opposite Mt. Khoja-Maston (17.5.1991 Kinzikaeva, Chevtaeva, Sharipova, Tolstaya 8115, 8153; TAD), W slopes, way to Mt. Khojamaston (600 m, 14.5.1991 Kinzikaeva, Chevtaeva, Sharipova, Tolstaya 7844; TAD), S end near vill. Rajkomabad (18.5.1991 Kinzikaeva, Chevtaeva, Sharipova 8191; TAD), not far from Besh-Kuduk (920 m, 07.5.1963 Filatov, Potashev, Odinaev, Ivanova 135; TAD); N loess slopes of Mt. Khoja-Mumin (700 m, 06.5.1979 Chukavina, Karimova 7735; TAD); location Ptashchi? (11.5.1953 Kosontaeva ? 53; TAD). Sarsaryak massif near vill. Margak 2-3 km to SE (07.6.1932 Gontsharov, Grigoryev, Nikitin 214a; LE). foothill plain near the steep slope of Karaul-Tyube (37.19 N, 68.40 E, 06.5.1937 Nikitin 547; TAD LE), adyrs 3.5 km E Karaul-Tyube shel? (37.19 N, 68.40 E, 420 m, 08.4.1963 Filatov, Ivanova, 81; TAD). Donguz-Adyrs near vill. Shurchi, N slope (16.5.1939 Pryakhin; TAD).

***Allium isakulii* R.M. Fritsch & F.O. Khass.**

Tajikistan: Mogoltau massif, vill. Katta-ajry, mountain slopes (??5.1929 Lepeshkin; TASH), Uch-bekh (04.5.1924 Popov, Vvedensky 356 (35v?); TASH), Boj-bogush-ata (40.17 N, 69.25 E, 09.5.1924 Popov, Vvedensky 565-6, 568; TASH LE), opposite pass Kashka-bel', sand and limestone remains (04.-05.5.1915 Spiridonov 183; LE), N rubble slopes along left tributary of Utkan-sai below vill. Utkan-sai (1200 m, 20.5.1948 Lysova, Sidorenko 252; LE); Khojent area, small mountains near station Jonbulak (15.6.1923 Popov, Vvedensky 32; TASH). - Uzbekistan: Malguzor massif near Timur gates, stony slope (950 m, 04. 5.1997 Khassanov 4010; TASH (coll.)). Nuratau ridge, NW part, springs of Pitau sai, E rubble slope (27.5.1964 Tsukervanik 296; TASH), 20 km S Jangikishlak, on the top (14.5.2000 Shomurodov 4036; TASH (coll.)); Nuratau valley between mountains 24 km S vill. Nurata, in Artemisietum (800 m, 08.5.1978 Botschantzev, Litvinova, Medeneva 1083; LE), 100 km S vill. Nurata (550 m, 07.5.1978 Botschantzev, Litvinova, Nikitenko 1045; LE), montes Nuratavici, jugum Bachiltau prope pagum Nurata (900 m, 8.5.1978 Botschantzev, Litvinova, Sumerin 1124; LE), Ambulatorium sai, on slope (20.5.1960 Zaprometova, Nikerov 166; LE).

**Determination unsure:** - Uzbekistan: Chatkal range, slope of foothills 2-3 km S Charkesar (41.00 N, 70.51 E, 12.5.1950 Arifkhanova 81; TASH). Alai range, forest cultures along the way from vill. Uch-Korgon to vill. Vuadil (40.10 N, 71.44 E, 03.5.1963 Ubukeeva, Gorbunova; FRU), on the margin of Vuadil way (40.10 N, 71.44 E, 10.4.1947 Shafeev; TASH); Shakhimardan valley near Fergana, stony places at Sadkak (40.24 N, 71.42 E, 31.5.1965 Khalkuziev; TASH, 10.5.1967 Khalkuziev; TASH, 30.4.1968 Khalkuziev; TASH, 07.5.1968 Khalkuziev; TASH); Fergana district, near vill. Chakalik, on conglomerats (27.4.1913 Dessiatoff 1686; LE), lowland near Akbilyal Mts., near aerodrome (25.4.1956 Golovchenko; TASH); on the old cemetery of vill. Yar mazar (11.4.1913 Dessiatoff 31; LE); Fergan breeding station "Akad. Shreder", virgin land (24.4.1961 TASH); 19 km from vill. Pap along the way to Jarpatal (??5.1950 Bondarenko, Majlun; TASH); 3 verst NE vill. Khan Kyz, near the top of conglomerats (16.4.1913 Dessiatoff 200; LE); along the way from Kokand to Margilan, less than 9-10 km from vill. Alty-Aryk, stony place with shallow soil (18.4.1959 Kovalevskaya 72; TASH); near vill. Mingbulak, sandy-clayey desert on an old terrace of Syr-darya river (11.5.1940 Lepeshkin 17929; TASH); clayey-stony plains near town Skobelev (40.28 N, 71.43 E, 27.4.1918 Arkhatel'ski, Arkhatel'ski; TASH); 2 km N Namangan, S rubble slopes of adyrs (04. 6.1928 Joffe 14; TASH LE); Fergana district, Chimion, grey soil on loess-like sandy-loam (26.4.1913 Dolenko 272; LE), vicinity of vill. Paul'gan, stony desert in location Kapchigaj (26.4.1940 Lepeshkin 17926; TASH). Nuratau ridge, N slopes, Sharaussai (04.6.1957 Zaprometova; TASH), Gacha-sai, valley bottom near spring (31.5.1957 Zaprometova 121; TASH), Ambulatar sai, slopes (20.5.1960 Zaprometova, Nikerov (?) 169; TASH); pass 2-3 km SE state farm Kizilcha, shallow soil between disturbed rocks (40.43 N, 66.08 E, 20.5.1955 Zaprometova; TASH), above the village Kyzylcha, terraces or clefts of granitic stones in N exposition (40.42.40,4 N, 66.06.48,0 E, 636 m, 22.03.2009 Keusgen, Khassanov 4274; TASH (coll.)), 1.5 km NE vill. Gillya-gan, foothills (27.5.1963 Makarchuk 49; TASH); Aktau ridge near kolkhoz Charkhana, on rubble slope (29.5.1963 Khajdarov 1660; TASH). Mirza-Rabat valley, along the way from Jantak to Ajry, in wheat fields (09.5.1938 Butkov, Majlun 316; TASH). Saravshan range, Kojtash Mts., location Arbamkul' between vill.s Sarymsakly and Tutly (40.12 N, 67.20 E, 29.5.1940 Gomolitskij, Dolgikh 82; TASH). - Uzbekistan? Fergan valley, vicinity of St. Jassy, adyrs in location Surasan, outcrops of tertiary clay (16.5.1940 Lepeshkin 17925; TASH).

***Allium isfairamicum* [B. Fedtsch. ex] O. Fedtsch.**

Kyrgyzstan: Alai mountain range, Langar (Ucz-Kurganskij) (28.6.1904 Fedtschenko, B. A. LE).

**Determination unsure:** - Kyrgyzstan: Alai valley, Mt. Daraut-tag, rocks on S slope (26.6.1936 Tyshchenko, Rozhkovskaya 65; TASH LE). Turkestan range, location Suu-Bashi, E exposed slopes, among rocks (23.5.1963 Ubukeeva, Gorbunova FRU); foothills of Turkestan range, location Korozo near vill. Ravat, N exposed stony slope (40.10 N, 70.49 E, 09.5.1962 Ajdarova, Ubukeeva FRU).

***Allium jesdianum* Boiss. & Buhse subsp. *angustitepalum* (Wendelbo) F.O. Khass. & R.M. Fritsch**

Turkmenistan: Kugitang ridge, Mamgi gorge (31.5.1935 Androssov 259; ASH), Khoja-Pil' (20.5.1985 (?) Faenko; ASH), pass above the Kizil-Alma sai, strongly rubble slopes (25.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 380; TASH), gypseous slopes near vill. Khoja-i-Fil (17.-18.5.1978 Nabiev, Li, Tsukervanik 268, 324; TASH). - Uzbekistan: Sajrob, stony slopes (01.5.1897 Korzhinsky 4971; LE); gorge Baglidara (37.58 N, 66.47 E, 13.5.1983 Turkestan group 2131, 2339; LE),

(1800 m, 15.5.1983 Khassanov[, Nenilin?]; TASH), heights of Vandobsai, juniper belt at N slope (37.43 N, 66.39 E, 19.5.1970 Nabiev, Li, Tsukervanik 366, 373; TASH), near vill. Khoja-anka, Mt. Katta-Kurchuk (09.5.1915 Popov 553/2; TASH), near vill. Kugitang (19.6.1916 Popov 202a; TASH), opposite vill. Kugitang, Juniperus stands (12.6.1931 Nevski 215; LE), along brook near vill. Kempyr-tyube (27.6.1915 Popov 274; TASH), near vill. Khoja-Karaul (17.4.1916 Popov 136; TASH), near vill. Shalkan (04.6.1973 Jumaev; TASH), N slopes of gorge Tangi-Duval (15.5.1976 Prатов, Tsukervanik, Makhmedov 282, 302; TASH).

**Determination unsure:** - Turkmenistan: Kugitang ridge, Juniperus forest of W slope near top of height Airi-Baba (12.6.1967 Choponov; ASH), above vill. Kugitang (12.6.1935 Androssov 258; ASH), above vill. Khoja-Karaul (31.5.1935 Androssov 260; ASH), E of Khoja-Pil' (02.6.1973 Gudkova; ASH), (05.6.1973 Choponov; ASH), without exact locality (25.5.1969 Ataev; ASH), near top of height Airi-Baba (30.5.1973 Gudkova; ASH), near kolkhoz Frunze (28.5.1973 Gudkova; ASH).

***Allium karataviense* Regel [subsp. *karataviense*]**

Kazakhstan: Talas Alatau range, reservation Aksu-Jabagly, summit W of gorge Taldy-Bulak (42.20 N, 70.40 E, 20.6.1952 Tsvelev; LE). S slopes of Kazy-Kurt Mts., stony-sandy slope (42.04 N, 69.44 E, 22.5.1952 Nikerov 42; LE). Karatau mountain range, stony slope below summit of Bukun-tau Mts. (1700 m, 28.6.1931 Pavlov 429; LE); Mynjilgy Mts., gorge Almaly-sai (15.5.1977 Kamelin & al. 1532; LE); Mkhijilke Mts., pass from Rajs gorge (06.7.1974 Kamelin 1593; LE); Bola-Saukandyk Mts. not far from lake Koskul' (Zhamankul') (13.5.1977 Kamelin & al. 1429; LE); rocks Jaman-taz on the way to Susak (30.4.1930 Lipschiz 200a; LE); near Aral-tyube (26.5.1963 Goloskokov; LE). Chu-Ili Mts., Khantau Jabaj massif, stony slopes of location Synkarsai (44.17 N, 73.48 E, 05.6.1949 Goloskokov; LE). Kyrgyzstan: Sandalash massif, S exposed slopes, opposite vill. Chanach, Juniperus stands, on rubble (22.7.1960 Ubukeeva FRU), location Baktai, E exposed rubble slopes (19.6.1966 Gorbunova; FRU). Chatkal range, S banks of Sary-Chelek lake (41.52 N, 71.58 E, 03.-04.6.1956 Lebedeva FRU), E banks of Sary-Chelek, Bakavy, stony rubble slope (41.52 N, 71.58 E, 15.5.1981 Ajdarova, Kalmurzaeva; FRU), E part, on rubble (41.52 N, 71.58 E, 07.6.1968 Arbaeva, Mursaliev, Ubukeeva, Sultanova; FRU), left bank of lake Sary-Chelek, W exposed stony slope (41.52 N, 71.58 E, 03.5.1962 Ajdarova, Ubukeeva; FRU); location Kongej shton berde, river Kasansai, SE stony rubble slopes (11.6.1966 Sudnitsyna, Gorbunova; FRU); S slopes of Chatkal range, location Ottun-Bulagy near vill. Sumsor, shrubs on stony soil (22.4.1962 Ajdarova, Ubukeeva; LE FRU). Chatkal valley, Akbulak drainage, way to pass of Chatkal range from Ak-takhtau location (2650 m, 29.6.1956 Majlun & al. 140; LE). SW slopes of Kirgiz Alatau, right bank of Tuyuk river (right tributary of Karaarcha river), E exposed slope, Juniperus stand (24.5.1969 no collector; FRU), left banks of Kara-Archa river, opposite of right tributary of river Tujuk, W exposed slope (23.5.1969 Musamyrova; FRU), right bank of river Tujuk, E exposed Juniperus (22.5.1969 Ajdarova; FRU LE). Kirgiz Alatau range, location Kara-Archa, N exposed slope, gorge between rocks (29.5.1959 Sudnitsyna FRU), massif Ichkeletau opposite vill. Bejsheke, S exposed rubble slopes (23.5.1990 Sheremetova, Laskov; FRU), above vill. Granitogorsk, by the river Aspara, stony W exposed slopes (19.5.1990 Sheremetova, Lazkov; FRU), Jirly Kaindy gorge, moist Burulyu, SW exposed stony slope (14.6.1949 Tkachenko, Kashchenko; FRU), gorge moist Burulyu middle part, S exposed slope, watershed between moist and dry Burulyu (05.7.1949 Tkachenko, Kashchenko; FRU), river Cholok-Kaindy, SW exposed slopes, stony rubble (02.6.1960 Isakov; FRU), location Sokuluk, E exposed slope, among shrubs (16.5.1978 Temiralieva, Atabaev FRU), near vill. Sosnovka, S exposed slope (42.40 N, 73.54 E, 04.6.1936 Gusarova; FRU); location Kara-Archa, forestry, S steppe rubble slopes (06.6.1967 Mursaliev, Sultanova; FRU); right banks of river Karabaltinka (09.6.1965 Sudnitsyna, Gorbunova; FRU). Talas Alatau, right banks of Urmalar river near right tributary Kara-koyun (01.6.1969 Ajdarova; LE); valley of Arlbik river (drainage of Kurkuru river), rubble slope (15.6.1988 Klyujkov, Vasil'eva, Kashkaraeva; FRU); Mt. Aktash, stony slope in E exposition (30.5.1990 Sheremetova, Laskov; FRU). Fergan range, drainage of Kugalt river, N part of town Mailisai, on rubble (41.19 N, 72.30 E, 27.5.1977 Sultanova, Ledovskaya, Batalov; FRU), near Mailisai, Baubashata Mts., river Kugart, left bank above town, SW exposed slope (16.4.1977 Sudnitsyna, Batalov, Ledovskaya; FRU), Mailisai (41.19 N, 72.30 E, 16.6.1976 Sudnitsyna, Ledovskaya; FRU). Atojnakk massif, S exposed slope, location Kurisai, stony rubble slope (19.4.1978 Ajdarova, Ubukeeva; FRU), valley of Karasu river, near vill. Chaldovar (Popova, Tkachenko 54; FRU). Drainage of river Urgitjuya, rubble slope (22.5.1969 no collector; FRU). Right banks of Naryn river, location Kurpsai (13.4.1980 Sudnitsyna, Mamataliev, Chypaev FRU). Manas area, vill. Pushkino, W exposed slope, rubble slope (06.5.1987 Shmakov, Usik, Kashcheev; FRU). Tajikistan: Mogoltau massif, Yanchi gorge (500 m, 20.5.1957 Plekhanov, Petsotskij 3229; TAD), NW slopes of Yanchi gorge (550 m, 20.5.1957 Zapryagaeva, Konnov 3218; TAD), near vill. Ichpak, adyrs (27.4.1948 Lysova 24; TAD), between Aktash-bulak and Mt. Spa (40.48 N, 69.27 E, 15.4.1914 Popov 858; LE); Mogoltau massif, stony outcrops (25.4.1959 Ryabkova; TAD), in detritu mobili calcareo prope sepulcrum Boj-Bogush-Ata (30.4.1924 Popov, Vvedensky 59; W B). Kansai, Okurtau Mts. 3 km from electrostation (23.4.1938 Azbukin 138; LE), Okur-tau Mts., Kap-sai mine, stony slope (??5.1943 Knorring; LE). S slopes of Kurama ridge, height near Kashkisai (1900 m, 17.5.1949 Lysova, Sidorenko 217; TAD), height near Pangazsai (1850 m, 16.5.1985 Turakulov 5849; TAD), drainage of Asht river, S slopes of Mt. Pasiasha (Pashata, Tamasha?) (2600 m, 18.6.1963 Nikitin, Soskov 498; TAD), Kurama ridge, Charvan-sai, on rocks (2000 m, 30.5.1990 Chevtaeva, Astanova, Samoshchina 1077; TAD), gorge Gervansai W vill. Sivar NE Leninabad, rock crevice (40.45 N, 70.26 E, 1800 m, 30.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 539; GAT). S slopes of Darvaz range, rubble slopes above vill. Sangsu (1230 m, 12.5.1969 Chukavina, Takhtajan, Morozova 79, 82; TAD LE). Khozratishoh range, 6 km S vill. Iol, SE vill. Sary-Mazgor, stony slope (37.46 N, 70.12 E, 1400-1500 m, 18.6.1961 Soskov, Yunusov 1447; LE). Heights of Buzdykhash river near top, 5 km SE of vill. Parvar (12.6.1961 Soskov, Yunusov 1146, 1149; TAD). Uzbekistan: Chatkal range, Chingan Mts., Aksai, stony slopes (41.31 N, 70.02 E, 1650 m, 20.4.2001 Khassanov 4026; TASH (coll.)), Chatkal reservation, rocky slopes (1200 m, 07.6.2002 Tojibaev 4106; TASH (coll.)); Angren drainage, Aktash-sai 6 km S vill. Baksuk (16.6.1954 Majlun 165; LE); Karshantau ridge, Sijak station, stony slopes (41.41 N, 70.03 E, 1400 m, 15.6.1998 Khassanov 4009; TASH (coll.)), summit of Ak-tash (41.43 N, 69.50 E, 6600', 26.5.

1925 Korovin; LE). Pskem ridge, Aksarsai near vill. Nanay, S exposed limestone rubble slope (41.42.07 N, 70.08.01 E, 1050, 06.6.2006 Fritsch, Khassanov 4248; GAT) TAX 6533. Kurama ridge, near pass Alakisrak (2300 m, 03.6.1954 Vernik, Nabiev 284; LE), pass Kamchik, stony slope (41.06 N, 70.31 E, 05.7.1959 Fedorov et al.; LE). Chatkal valley, Ak-bulak drainage, gorge opposite the mouth of Sargadon-sai (21.6.1957 Butkov 878; LE). Ugam ridge, near vill. Bakhmal-kul', alpine meadows along the crest of the ridge opposite of lake (3500 m, 22.8.1938 Lepeshkin, Bibisheva 12099; TASH).

#### ***Allium komarowii* Lipsky**

Tajikistan: Turkestan range, Bjurogansai near Kusavlisai (39.35 N, 68.39 E, 25.5.1956 Konnov 64; TAD), (2000 m, 07.7.1966 Konnov 2084; TAD), heights near Kusavlisai, slate slopes (39.35 N, 68.39 E, 3000 m, 04.6.1954 Konnov 1351; TAD), Sai Yurshi-Kanon (2500 m, 12.7.1966 Konnov 2250; TAD). Saravshan range, lake Iskanderkul, rubble slope in side valley (39.05 N, 68.22 E, 9000', 19.6.1916 Lipsky 832, 840; LE); Fan Mts., lake Kuli-Kalon, stony slopes in NW exposition (20.7.1965 Kamelin; LE). - Uzbekistan: Turkestan range, pass from Guralash to vill. Lyangar (16.7.1935 Zakrzhevskij 918; TASH); W part, upper sai Almalý near riverlet (27.5.1979 Volozheninov; TASH)

#### ***Allium kwakense* (R.M. Fritsch) R.M. Fritsch**

Tajikistan: Central Hissar mountain range, Drainage of Varzob river, Kondara valley, above hut Kvak, margin of shrubs below *Acer turkestanica* (38.49 N, 68.48 E, 1900 m, 02.6.1987 Fritsch; GAT); N slope of Takob valley opposite Takobrudstroj (20.5.1952 Konnov, Shimunova 28; LE). Saravshan range, in m. Kschut (5-7000', 29.6.-01.7.1882 Regel A.; LE).

#### ***Allium lipskyanum* Vved.**

Tajikistan: Central Hissar range, gorge of Karatag river, on meadow soil (38.45 N, 68.22 E, 15.5.1984 Khamidkhojaev; TASH); Dushanbe, Botanic Garden of Academy, cultivated (08.5.1990 Fritsch, Kudratov, Pistrick 107; GAT); Takob gorge, walnut stand near vill. Varmogliki (?) (20.5.1965 Kamelin; LE); drainage of Shurkent river, gorge Sandal (2100 m, 21.6.1955 Zapryagaeva 709; TAD). Karategin ridge, near the road from Faizabad 10 km to Ragun (27.5.1979 Sharipova, Savchenko 40, 44; TAD), 16-17 km NE vill. Faizabad near ruins Rashadion (1850 m, 21.5.1962 Strizhova 1665; TAD). - Uzbekistan: SW Hissar range, Obi-zarang river drainage, heights near the river, on a soft slope (2650 m, 19.5.1948 Bondarenko 570; TASH), Khondiza gorge between vill. Dibadom and Khondiza (17.5.1983 Turkestan group 2615, 2566; LE), Khondiza gorge near vill. Densurkh-Dibadosh (26.5.1983 Turkestan group 2618; LE); drainage of Tupolang river, ascent to pass Malyand, E slope (17.6.1948 Pyataeva 460; TASH), pass Malyand (17.6.1948 Pyataeva 474; TASH), heights of river Tamshush (1800 m, 25.5.1985 Maltzev; TASH), Juglans plantation on S slope in the valley of river Khurvantang (Khuratam?) on bank of a side river (22.5.1940 Gontscharov 337; TASH LE); 4 km N from point 3115 m near river Obi-zarat, NW slope (??6.-7.1966 O. Khassanov; TASH); gorge of Shargun river, N slopes with shallow soil (38.38 N, 67.57 E, 15.5.1963 Khamidkhojaev 13; TASH), height near river Shargun, along the way between Shargun and Zevar, on N dry stony slope in Juniperus belt (38.38 N, 67.57 E, 27.6.1957 Adylov 528; TASH); 1 km N river Jangaklik, soil with rubble and sand (2200 m, ??5.1966 Khassanov; TASH); 4-4.5 km from vill. Saksardak between Rukatsai and Kavdiyasai, sandy soil (2080 m, 19.5.1966 Khassanov; TASH). W Hissar range, watershed between Obishur and Khariushata (2830 m, 16.7.1987 Maltzev; GAT), drainage of river Kashka-darya, right bank of river Tankhaz-darya (23.7.1955 Pyataeva 2245; TASH). AK-Tau massif near village Andak (01.5.1925 Popov 28; TASH). Shakhrizabz rayon, Gissaraya, in field (1000 m, ??6.1969 Rakhimov; LE). - Uzbekistan?: Drainage of Turgandarya river, 8 verst upward of village Kimshel (?) (31.7.1931 Medkulovich; TASH). Hissar range, 3 km E of vill. Khovat, near the upper border of broad-leafed forest (2200 m, 02.7.1941 Gromakov 647; TASH).

#### ***Allium macleanii* Baker**

Kyrgyzstan: Surmetash valley 10 verst above mouth, stony slope (12.6.1913 Dolenko 726; LE). Margelan area, Surme-tash valley, on a moist stony place (12.6.1913 Dessiatoff 976; LE). Kalta-Karamuk valley, steep stony slopes between Juniperus (19.6.1913 Dessiatoff 2028; LE). Turkestan range, near Saravshan glacier, stony slope (26.7.1927 Drobov 452; TASH); drainage of Isfarinka river, left bank of side river Chimirganbobo, Guzarykhuk Mts. (1740 m, 09.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 797; TASH). N slopes of Turkestan range, drainage of Isfara river, Bashkent forestry, gorge Tuli-oftobru (27.6.1970 Chukavina, Kinzikaeva, Astanova 3501; TAD), valley of Kshemysh river above vill. Kshemysh, Juniperus and shrubs (2300 m, 04.7.1963 Abdusalyamova 107; LE TAD). Union of Turkestan and Alai ranges, drainage of Isfara river, near vill. Vorukh, Dulon Mts. (07.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 589; TASH). - Tajikistan: N slopes of Turkestan range, Isfara river drainage, S slopes above sai Puli-Aftobruj (27.6.1970 Kamelin 476; LE), main side of Vorukh river, gorge Tagoda (1950 m, 18.6.1987 Astanova 713, 719; TAD), gorge Chumurgan 10 km from Vorukh (15.6.1987 Astanova 722; TAD), 4-5 km SE Vorukh, Juniperus stands along river Kshemish (1653 m, 14.6.1962 Filatov 192; LE), Chili sai 5 km from union of Nurlou and Kshemish rivers (2500 m, 06.7.1963 Abdusalyamova 119; TAD). E slopes of Zagara Mts., valley of a river, among Betula (2200 m, 30.6.1987 Kochkareva 16035/32; TAD), (2300 m, 30.6.1987 Kochkareva 16029; TAD). Central Hissar range, drainage of Sardoj-miona river, E stony slopes opposite river Obi-pakhrut (29.7.1930 Kudryashev 1226; TASH). N slopes of Karategin ridge about 18-20 km E vill. Ramit, height of Tavishsai (38.45 N, 69.18 E, 3150 m, 17.7.1962 Strizhova, Petrov 2063; TAD), left bank of Kanyazk river, gorge Safid-ob 4 km below vill. Karnyaz-i-Poyom (29.7.1963 Popov, Stepanenko, Gorbunova 2144; TAD). E Buchara orientali prope Kok-tube (30.6.1878 Mussa; LE). Vakhsh range, foothill of Sangisabztai Mts., on red sandstone, cultivated in Bot. Garden Tashkent (1900 m, 06.9.1966 (no collector) 1136; TASH), W slope of Zaklok Mts., shrubby slope with trees, upper border of *Acer turkestanicum* (2650 m, 02.6.1932 Gontscharov, Grigorjev, Nikitin 490; TASH LE); crest of the Vakhsh range near vill. Kamoli, S slope (2750 m, 02.7.1957 Mechislavskij, Strizhova 207; TAD). Alai range, S slopes, gorge Pitautkul, above vill. Chonkirgiz (2500 m, 29.6.1967 Ryabkova, Zhogoleva, Kochkareva 4522; TAD). High Saravshan range, Sary Darvaza, middle Ajlau (3000 m, 14.9.1945 Zakirov; TASH). Darvaz range, gorge of Vanch river, gorge Tekharv (2350 m, 04.7.1958 Zapryagaeva 8040; TAD), gorge

Zygyrdarya (10.7.1899 Lipsky; LE), height of river Obi-Khumbou, right bank of river Charym-darya (38.53 N, 71.00 E, 3100 m, 28.6.1977 Strizhova 123; TAD); stony slope above vill. Sangsu (1230 m, 12.5.1969 Takhtajan, Morozova 79; LE). W end of Peter I. range, red sandstones near way Garm-Khorog, among shrubs (19.6.1960 Botschantzev, Egorova 1525; LE); S slopes of Peter I. range, near vill. Sykam (Sykat?) (3200 m, 27.7.1950 Sidorenko 243; TAD), between vill. Childora and Khashdora, stony slopes (2800 m, 16.6.1961 Shibkova 352; TAD). - Uzbekistan?: Chatkal range, Gava valley, slopes (01.7.1928 Dzents-Litovskaja 447; LE).

**Determination unsure:** - Tajikistan: Darvaz range, N slope of Vanch range, village Gujovast, Pasimanor, W and S exposed side of the rock, in trenches and on terraces (38.32.33,7 N, 71.45.38,6 E, 2300 m, 18.7.2005 Keusgen, Fritsch, Hisoriev 6210; TAD (coll.)), 1 km W village Gujovast, place Tagi ovparo, W exposed slopes, between stones (38.33.02,4 N, 71.46.04,3 E, 2340 m, 20.07.2005 Keusgen, Fritsch, Hisoriev 6211; TAD (coll.)); rock outcrop near the road from Khoburobot pass to Kalai-khumb, rock clefts and terraces (38.36.52,5 N, 70.45.17,6 E, 2900 m, 11.7.2005 Keusgen, Fritsch, Hisoriev 6198; TAD (coll.)); Khumbov canyon above third bridge, place Regi Ravon, E exposed loamy-stony slope (38.37.24,1 N, 70.51.48,7 E, 2100 m, 22.7.2005 Keusgen, Fritsch, Hisoriev 6217; TAD (coll.)); valley of Sagirdasht river, location Tagidarai melo, on rock terraces and among bushes (38.41.31,1 N, 70.40.16,5 E, 2000 m, 11.7.2005 Keusgen, Fritsch, Hisoriev 6190; TAD (coll.)).

#### *Allium majus* Vved.

Uzbekistan: W Hissar range, drainage of Kashkadarya river, Kirktau Mts., rubble slope (39.20 N, 67.10 E, 1300 m, 24.7.1991 Khassanov; TASH); drainage of Kyzylarya river, 2 km S vill. Tashkurgan (38.45 N, 67.15 E, 1900 m, 20.7.1991 Khassanov, Maltzev; TASH), mountains E Jakkabag on the side of vill. Kipchak, red slopes (38.56 N, 66.41 E, 01.7.1927 Kul'tiasov, Granitov 785; TASH). SW Hissar range, gypseous slopes 25 km E Baisun town (1100 m, 07.5.2002 Maltzev 4097; TASH (coll.)), Baisun ridge, Mullakhona vill., dry stony slopes (1200 m, 07.8.1999 Khassanov 4041; TASH (coll.)). 15 km S vill. Lyangar and 12 km from vill. Koka-bulak beside the way, in Juniperus stands (25.6.1954 Pyataeva 706a; TASH), 18 km S vill. Koka-bulak, on red marine sediments between single Juniperus trees (25.6.1954 Gringof 747; TASH).

#### *Allium monophyllum* Vved.

Turkmenistan: Central Kopetdag range, summit of Chopan-Dag (2886 m, 25.6.1958 Nikitin et al.; ASH), on stony substrate (2880 m, 25.6.1958 Nikitin; W JE), (2880 m, 28.6.1958 Nikitin; JE), steppe belt (02.7.1923 Korovin 684; TASH); in cacumis monte Bosikyamov (?) (09.7.1898 Litwinow 2120; LE).

#### *Allium nevskianum* Vved. ex Wendelbo

Tajikistan: Central Hissar range, drainage of Varzob river, Kondara gorge, near the way from Kvak to Ruidasht (38.49 N, 68.46 E, 2000 m, 18.6.1959 Chukavina, Kochkareva; TAD), plateau Ruidasht, E parts (2650 m, 22.6.1945 Pisyaukova 430; TAD); N slopes of Takob gorge 3-4 km above kolkhoz Leningrad (21.5.1989 Konnov, Shimunova 89; LE); valley of Jirinod creek, steep gritty granitic slope (38.49 N, 68.50 E, 1800-1850 m, 17.5.1987 Fritsch 164; GAT); left bank of Varzob river, between vill. Firyuzaabad and Sharshara (1600-1800 m, 23.5.1964 Stepanenko, Kudryashova 2203, 2263; TAD); gorge Khorongon, above vill. Khorongon-Bolo (1700 m, 14.6.1952 Zapryagaeva, Stepanenko, Dogonova 331; TAD), above vill. Dara, very dry and steep granitic slope W exposed (38.42 N, 68.53 E, 2370 m, 20.5.1987 Fritsch 175; GAT); watershed between Kondara and Lyuchob (2700 m, 16.6.1933 Zapryagaev 428; TAD); S slopes of valley Obi-Fanfarok (04.5.1962 Kamelin; TAD), rubble slopes near Fanfarok gorge (1300 m, 07.5.1959 Yunusov, Kochkareva 213; LE TAD); left bank of Karatag river, S slopes (2900 m, 27.4.1948 Nikitin, Borissova 305; TAD); crest in the W part Kugi-Khanaka massif (3100-3200 m, 22.7.1945 Tolmachev 504; TAD). Karategin ridge, left banks of Sardaimiona river 12 km SSE of vill. Ramit, Kokhusai (38.45 N, 69.18 E, 1400 m, 06.6.1965 Strizhova, Saprunova 3541; TAD), Javrosh, side valley of Romit gorge, S exposed rubble slope (38.41 N, 69.13 E, 16.5.1985 Hanelt; GAT); SW slopes of Karategin ridge, stony-rubble slopes (2500 m, 15.6.1962 Popov, Stepanenko, Stotskij 868; LE TAD), S slopes E pass Archaichaj 15-17 km NW Faizabad (2600 m, 20.6.1962 Strizhova 1797; TAD). - Uzbekistan: SW Hissar range, drainage of Tupolang river, along the way from Khuvratang via Sardalyu-Tas to the saddle near river Shatrut (25.6.1948 Pyataeva 710; TASH), on the saddle and way down to vill. Shatrut, middle part of Kul'tepesai (26.6.1948 Pyataeva 755; TASH), valley of Chash river above vill. Parkh, dry sai near spring Khauzy-Mordon, E slope (19.6.1948 Pyataeva 539; TASH), heights of Zevar river (38.42 N, 67.56 E, 29.6.1954 Korotkova 4524; TASH), heights near Shargun river, along the way between villages Shargun and Zevar, steep rubble slopes in Juniperus belt (38.38 N, 67.57 E, 27.6.1957 Adylov 527; TASH); Sangardak drainage above vill. Nilyu, stony slopes (16.5.1983 Turkestan group 2414, 2442; LE), valley of Sangardak river near confluence with Bakhchisai river (02.6.1948 Pyataeva 107; TASH); Chulbair Mts. near vill. Sina, granitic rubble slopes in Juniperus belt (02.6.1929 Vvedensky 244; TASH), (29.5.1973 Botschantzev 116; LE), valley of river Obi-dara above vill. Sina, rubble slope near the outlet of riverlet (26.5.1929 Vvedensky 118; TASH), on the way to the pass over Karasevar Mts., stony slopes in S part of location Duran (31.7.1934 Demurina 807; TASH), height Khoja-barku, stony slope near ...? (15.6.1929 Vvedensky 336; TASH), ad declivias saxosa montium Chulbair, ad pedes cacuminis Chodsha-barku (c. 3000 m, 30.6.1929 Vvedensky 5434; W JE); 10 km from vill. Sajrob on red sandstone (1300 m, 10.5.1956 Chukavina 82; TAD). W Hissar range, pass Khar-kush, N slopes near summit (08.7.1961 Pryakhin; LE).

**Determination unsure:** - Uzbekistan: W Hissar range, pass Khar-kush, S slope near summit (07.7.1961 Pryakhin; TASH). SW Hissar range, drainage of Sangardak river, Dikavruzai, on rubble below rocks (22.4.1982 Levichev TASH), Sangardak river near confluence with Khandiza river, rubble slopes (38.35 N, 67.36 E, 03.6.1972 Nabiev, Shermatov, Kazakbaev 395; TASH), (38.35 N, 67.36 E, 30.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 411; TASH); in a radius of 5 [km?] around vill. Kha-uz, between fields on virgin shallow soil (08.5.1941 Popova 432; TASH); Khoja-gurgur ata Mts., slope near pass Beleuta with shallow soil (24.7.1934 Butkov, Penknovich (?) 119; TASH); way up to the pass Bel'-Auty, subalpine vegetation (03.7.1941 Popova 781; TASH). - Uzbekistan?: Kugitang ridge, mountain slopes near top of Airi-baba (29.5.1973 Gudkova; ASH).

***Allium oreophilum* C. A. Mey.**

**Kazakhstan:** Jungar Alatau range, drainage of Baskan river near Amanbokter, along sai Zhavizbaj (Zhablibaj?) (46.00 N, 79.30 E, 11.7.1970 Tajzhanov 1756; TASH); Soongoria, Kuhlafu (Schrenk; W). Talas Alatau range, stony S exposed slope on heights of river Topchak-su (2000, 24.7.1931 Pavlov 730; B), N slopes, Bish-Tash, subalpine belt (28.7.1922 Korovin 1841; TASH), reservation Aksu-Jabagly, valley of Jabagly river, location Ajna-kul (42.20 N, 70.40 E, 2450 m, 04.7.1955 Tursumetova; TASH), Jebagly Mts. alpine belt, stony slope (23.7.1923 Popov; TASH). In subalpinis petrosis Alatau ad fl. Sarchan (1841 Karelin, Kiriloff 2022; W). Zaili Alatau range, heights near river Kara-archa, (27.7.1926 Titov ? 2026; TASH), location Kumbel above small and great Almaatinka (43.08 N, 77.00 E, ??8.1924 Titov; TASH), drainage of river Great Kimin, on dry ravines (14.6.1954 Isakov; FRU), river Chilik, location Aman-Jol, alpine belt (1450 sashen, 14.7.1916 Abolin 2735; TASH), river Turgen, location Kokpak-tas, alpine belt (1500 sashen, 10.7.1916 Abolin; TASH). - **Kyrgyzstan:** Kirgiz Alatau range, river Jyrlı Kaindy, gorge Cholok Ashu, S slope (2700 m, 07.8.1947 Kashchenko; FRU), drainage of river Jely Kaindy, gorge Cholok Ashu, upper part, near furcation, N exposition (2750 m, 07.8.1949 Tkachenko, Kashchenko; FRU), Jely-Kaindy, gorge Cholok, upper part, S slope, in Festuca steppe formation (18.8.1950 Tkachenko et al., B FRU), pass Tuja-Ashu, E exposed slope (10.8.1970 Arbaeva; FRU); sovkhos Shamsi, alpine belt (04.7.1930 Nikitina; FRU); drainage of river Jelaymysh, along the river Kozhbulak, NW slopes, subalpine belt, with prostrate Juniperus (30.6.1937 Kostevicz, Shimova; FRU); vill. Belogorka, location Shavaj (42.35 N, 74.08 E, 08.7.1934 Kashchenko; FRU); gorge Jalachiir (10000', 22.6.1880 Fetissow P), in montibus Alexander (10000', ???.1880 Fetissow WU), slopes of right banks of river Issykata ca. 8 worst higher than the mineral springs, among rocks in subalpine belt (30.6.1916 Sovetkina, Chausova 1988; TASH); Chonkur-Chak, location Kupak-Tjol, W slopes, rubble (23.8.1968 Moldoyarov; FRU); drainage of Talas river, river Taldy-bula, subalpine meadow (21.7.1925 Abolin 362; TASH). Talas Alatau, location Beshtash (14.7.1956 Ajdarova, Faleeva; FRU), SW slopes, on rubble (21.7.1965 Sudnitsyna, Gorbunova; FRU); drainage of river Kalba, location Munshkijor, N slope (18.7.1953 Moldoyarov; FRU), location Tabyldy, SE slopes (12.7.1958 Modayarov, Usupbaev; FRU), location Tuyuk-tol, E slope (31.7.1958 Modoyarov, Usupbaev; FRU); left bank of river Cho-Chichkam (18.6.1988 Klyujkov, Kashkaraeva; FRU); drainage of river Karakoin, Juniperus stands, N exposition (29.6.1957 Rodkin, ?; FRU), gorge of Kara-Koin river, SW exposed slope (25.6.1958 Mursaliev FRU), location Karagoin (16.6.1957? Tambovtseva 154; FRU), drainage of river Karakoin, subalpine meadow, rubble (3000 m, 07.7.1957 Saikina; FRU), forest belt, on the bottom of gorge (14.7.1957 Zaikina; FRU); gorge Bakair, atshelok Unkur, E stony slope (03.6.1947 Popova; FRU); heights near river Kara-Bura, right banks, NE slopes, near pass (14.7.1965 Sudnitsyna, Gorbunova; FRU); heights near river Chatkal, location K p r , rubble slope (16.7.1968 Gorbunova; FRU). Kungei Alatau range, gorge Senenovskoe, S exposed slope, among Juniperus (05.7.1970 Mursaliev; FRU). Central Tien Shan range, pass Kara-Gyz, alpine belt (23.7.1927 Korovin 776; TASH). Alai mountain range, location Kurundu, E slopes, alpine steppe (10.8.1948 Kashchenko; FRU); location Kyzyl-Eshme, rubble (10.7.1968 Ubukeeva, Arbaeva, Mursaliev, Sultanova; FRU); valley Ulitor c. 14 km S Shakhimardan (39.52 N, 71.47 E, 2800-3000 m, 30.6.1989 G nther, Z ndorf, Schnittler; JE), valley Shait c. 14 km SE Shakhimardan, rock and rubble slopes (39.54 N, 71.54 E, ca. 2300 m, 04.7.1989 G nther, Z ndorf, Schnittler; JE), drainage of Shakhimardan river, location Kyrgool, N exposed slope, rubble (40.00 N, 71.47 E, 10.6.1963 Ajdarova, Ubukeeva; FRU), gorge Kara-kazyk, steep limestone slopes, along the paths (40.00 N, 71.47 E, 09.8.1967 Khalkuziev; TASH); SW Alai range, in direction to river Kichik Alai (23.7.1938 Gusarova, Korzhina; FRU); above vill. Akbosop, among shrubs (16.7.1974 Jabborov 3973; TASH); N Alai range, Mt. Khurjun (2800 m, 29.7.1965 Disalanov ?; TASH), location Abshyr sai, Chuchko, stony rubble place (23.6.1974 Ajdarova, Mursaliev, Sultanova; FRU). Alai valley, valley of Kara Kabak river (24.6.1952 Al-lajarov 134; TASH). Top of Mt. Archaly (1029 s, 13.7.1917 Titov ? 751; TASH). Chon-Alai, left bank of river Daraut, middle part, steep S slopes (30.6.1954 Shmakov; FRU). S slopes of Sandalash massif, location Taldybulak, higher than prostrate Juniperus (21.8.1962 Ubukeeva; FRU), S slope, location Toozhajloo, alpine belt, SE slope, fine rubble (07.8.1961 Ubukeeva; FRU). Middle part of river Torkul (Tarkul') (24.7.1954 Faliyeva; FRU). Susamyr ridge, higher part of Kindik Mts. (19.7.1963 [collector missing] 334; FRU); in montibus Ssusamyr (9-10000', 01.6.1881 Fetissow P W), (8-1000[0]', 08.7.1881 Fetissow P W); heights of river Chichkan, pass Ala-bel, damp rubble slopes (43.03 N, 76.59 E, 03.8.1974 Nabiev & al. 836; TASH); Susamyr valley, right bank of Susamyr near the mound of Aramsa and Turkusu (7.1966 Pyataeva, Deberdeeva 3159; TASH). Fergan mountain range, N slopes of Chabak Mts. (27.7.1946 Arifkhanova 444a; TASH); Uzgen area, location Chaartash, among rocks (10.8.1957 Chevrenidi, Korotkova 10; TASH), subalpine meadow (16.6.1962 Pryakhin; TASH), location Char-tash near weather station (16.8.1960 Nabiev, Pratorov 12/1; TASH); pass Koldama, on slopes (2800 m, 01.8.1962 Pryakhin; TASH); rayon Achi, sovkhos Kirova, slopes of brown slate (08.8.1945 Kalinina; GAT); on the left banks of river Western Makmal, upper part, on different slopes (04.6.1953 Vasil'eva; FRU); near pass Kazyk Bel' on even place (13.6.1953 Porokh; FRU); gorge of Tuyuk to Yassy sais, on stony rubble slopes (15.8.1960 Nabiev, Pratorov 65; TASH); location Kyldoo, meadow with tall forbs, NE exposed rubble slope (24.7.1957 Ajdarova, Ubukeeva; FRU). Turkestan range, heights of river Keravshin along the way to pass Dusa-paya (28.7.1960 Korotkova, Khamidkhojaev 8529; TASH); heights of Andiygen Mts. near pass Ajri-Tash (17.7.1941 Pryakhin; TAD); heights of river Tamyngen (3100 m, 14.7.1937 Afanassiev 469; TAD); heights near river Kshemysh, location Shubek (4000 m, 11.7.1963 Abdusalomova 216, 251; TAD). **Kyrgyzstan?:** Ex horto bot. Petropolitano 81. 5. e Turkestanian occidentalis Fetissow misit (??5.1881 Fetissow; LE). - **Tajikistan:** Turkestan mountain range, above vill. Vorukh, gorge Sharkirama S pass Bel (2700 m, 06.8.1984 Khalkuziev 722a; TASH), 10 km from Vorukh near river Chemurgan (2000 m, 14.6.1987 Astanova 710; TAD), gorge Kuli-Abkharv-rui 12 km above vill. Vorukh (2800 m, 14.7.1986 Chevtaeva 26; TAD); heights near river Jumavlisai (2800 m, 12.7.1966 Shibkova 3437; TAD); heights near gorge Argly, side valley leading to pass Rarz (3000 m, 06.7.1954 Zapryagaeva 500, 510; TAD); Rarz valley (13.7.1959 Filatov 258; TAD); near lake Ojkul (3400 m, 02.8.1959 Yunusov 728, 730; TAD); district Aini, pylae Shakhristan (3351 m, 07.7.1985 Vasak; W); Mt.



Kurganak 60-70 m apart from top (3630 m, 21.7.1934 Afanassiev 599; TAD); heights near river Novali (3620 m, 18.8.1934 Afanassiev 518; TAD); Uch-Ochak Mts., valley S of valley Mirzoblyan (08.7.1966 Konnov 2126; TAD). Kurama ridge, drainage of Asht river (2300-2500 m, 17.6.1963 Nikitin, Soskov 450; TAD), S slope of Mt. Tamasha (2900 m, 18. 6.1963 Nikitin, Soskov 523; TAD), above vill. Asht-Bolo, Mt. Tamagio (Tamasho?) (3000 m, 22.6.1970 Chukavina, Kinzikaeva, Astanova 3231; TAD), Kattasai (21.6.1970 Chukavina, Kinzikaeva, Astanova 3207; TAD). Union of Turkestan with Alai range, drainage of Isfara river, near vill. Vorukh, Dulon Mts. (07.6.1984 Khalkuziev et 3 al. 610; TASH). E, SE Alai range, near vill. Daraut-Kurgan (39.33 N, 72.14 E, 3650 m, 20.7.1955 Sidorov 864; TAD). E Alai range (3400 m, 09.7.1955 Kri-vonogova; TAD). Saravshan range, right banks of river Tagobi-Juart (Giagobi-Juargi?) (06.7.1966 Kinzikaeva, Karimova 3329 (210); TAD); near pass Remon, stony slope (3690 m, 11.8.1948 Kozlova 655; TAD); sai opposite vill. Rart Togobi-Juft (3000 m, 11.7.1960 Chukavina 3; TAD); drainage of Kshtut river, height of stream Tandara near vill. Artuch (3350 m, 05.7. 1961 Strizhova 879; TAD); N slopes near Tege-Pastif (Tieg-Nastif?) Mts. (09.7.1966 Shibkova, Ryabkova, Kochkareva 2965; TAD); left bank of river Pastior (09.7.1966 Shibkova, Ryabkova, Kochkareva 3011; TAD), Tega-pastior Mts. (09.7. 1966 Shibkova, Ryabkova, Kochkareva 2957; TAD); drainage of Urech river, right side-river of Kshtut river (3250 m, 09.7. 1961 Strizhova 951; TAD). Central Hissar range, drainage of Varzob river, near mound of river Sioma (38.58 N, 68.44 E, 1700 m, 23.5.1987 Chevtaeva 28; TAD). Peter I. range, northern slopes, valley of Karashura river (06.8.1935 Grigoryev 69; TAD), near vill. Polima (3150 m, 26.7.1949 Zapryagaeva, Lysova, Zabolotskaya, Il'inskaya 2198; TAD), near lake Yashil-kul (N Jilikul?) (3400 m, 26.7.1976 Chevtaeva 269; TAD), near lakes Kungur and Majda-kul 12 km S vill Kal'dar (3600-3700 m, 10.8.1968 Strizhova, Koval'chuk 4823; TAD). Darvaz range, S slopes, near pass Sary-El (at map Sary-Jo) (3900 m, 06.8.1962 Chukavina 266; TAD); W slopes, heights of the river Obi-Ravnou (3500 m, 07.7.1978 Zhogoleva (173) 12035; TAD), heights of Aktashsai (3700 m, 09.7.1978 Zhogoleva (190) 12052; TAD); Kugi-Frush Mts., 8 km E vill. Sharshetam (Sharistan?) (3500 m, 29.6.1932 Zapryagaev 253; TAD). - Uzbekistan: Chatkal range, saddle Buzbash (19.7.1979 Krasovskaya; TASH), heights of Bash-kizyl-sai (41.15 N, 69.52 E, 17.7.1936 Korotkova, Titov 1364, 1443; TASH); pass Kundaban (Tashkent Alatau, near Parkent), (09/21.6.1880 Mussa; WU BR), pass Arashan, stony rubble slopes (24.7.1940 Korotkova 261; TASH), near lake Arashan, on slope (24.7.1940 Korotkova 232; TASH), S slope of Kzyl-nura gorge (11.8.1953 Tuichiev 1298; TASH), location Myn-Jilke, above river Nurek-ata, rocks (17.7.1936 Korotkova, Titov 1364; TASH), pass between valleys Bashkutan and Ak-su, slope with shallow soil (01.8.1954 Butkov, Majlun 570; TASH), NW slopes of Mt. Chimgan Major (41.30 N, 70.04 E, 12.7.1956 Granitov 909; TASH), mons Chimgan, in clivis occidentalibus (2300-3000 m, 18.7.1973 Vasák; W), in decliviis saxosis ad cacumina montis Tschimgan Majoris (22.8.1924 Baranov 62; W B). Alai range, heights of river Kok-su, drainage of glacier Abramova (3900 m, 13.7.1986 Nozdryukhin; TASH). N slopes of Turkestan range, location Kyzyl-Mazar, gorge of Kok-bulak river, on the watershed (3000 m, 09.7.1960 Korotkova, Khamidkhojaev 8241; TASH). Turkestan range, location Ak-Tash, S slopes of Mt. Dauda (40.57 N, 73.23 E, 26.6.1936 Arifkhanova 182; TASH); Zaamin forestry, gorge of Guralash river, left source of Guralash (26.7.1926 Popov, Androsov 162; TASH); pass Oburdon, NW slopes near the summit (28.7.1928 Pikok; TASH); Zaamin reservation, heights of Tuyatash(?) - sai, steep stony-rubble slope (26.6.1946 Kazarenko; TASH). Shink river, Choraga(?) - sai, stony rubble slopes (24.6.1941 Chugaeva, Sergeeva; TASH). Kurama ridge, Angren plateau, river Ikkisu, S slopes (3000 m, 02.7.1977 Kari 101; TASH).

**Determination unsure:** - Tajikistan: West Pamir area, along Gunt river 63 km E Khorog, just E vill. Ver, N exposed dry scree slope (2650 m, 02.8.2002 Kurbonova, Hisoriev 6012; TAD (coll.)).

***Allium pangasicum* Turak.**

Tajikistan: Kurama ridge, S slopes above vill. Asht-Bolo, right banks of Katta-sai (1950 m, 21.6.1970 Chukavina, Kinzikaeva, Astanova 3189; TAD); heights near Pangazsai (2000 m, 16.5.1985 Zhogoleva 5823; TAD).

**Determination unsure:** - Tajikistan: Kurama ridge, Obi-Asht valley, sai Kzyl-Tosh, rocks (21.6.1970 Kamelin 263; LE).

***Allium protensum* Wendelbo**

Kazakhstan: Sands between location Bil'-Kora and the old bed of Chu river (30.4.1916 Sovetkina 626; TASH); Kurmanyn-kum, Chu river - town (mount?) Gagyrlı (31.5.1926 Drobov, Gomolitzkij 265; TASH), Chu river - town (mount?) Khantau (44.17 N, 73.48 E, 10.6.1926 Drobov, Gomolitzkij 549; TASH); Muyun-Kum, well Yukalgan - Chu river, Saksaul stand (27. 5.1926 Drobov, Gomolitzkij 200; TASH), location Ak-biden (43.50 N, 71.50 E, 22.5.1926 Drobov, Gomolitzkij 92a; TASH); S margin of Muyun-kum between Lugovoj and Jambul, hardened sands (16.5.1963 Goloskokov LE). 'Pritashkent Chuli', 40 km W railway station Jilga, Alymtau height (??5.1980 Melibaev 1853; TASH), (??5.1980 Rakhmankulov 1553; TASH), (14.5.1975 Li, Pakhomova, Pratov, Shermatov, Tsukervanik 21; TASH), (03.6.1960 Pryakhin & al. LE), 10-12 km N railway station Jilga, dry hills (13.5.1975 Li, Pakhomova, Pratov, Shermatov, Tsukervanik 14; TASH); Keles Mts., NW Ishak-Bazar (?), 5 km W vill. Sausabaj (16.4.1946 Vernik TASH), Kaplanbek near Tashkent, hills (41.30 N, 69.15 E, 29.5.1920 Popov 354; TASH), location Kuzzi-Tugaj (?), 2 km from river Syr-Darya, on sands (26.4.1962 Tajzhanov TASH), 1 km W location Kara-Mirza, on the top of the hill (27.3.1947 Vernik 26; TASH), middle part of river Keles, location Kaplanbek, red sandstone area (41.30 N, 69.15 E, 1500', 04.5.1921 Abolin; TASH). In ripam sinistram fl. Ili in sabuletis Taukum, in arenis collicosis (12.6.1968 Tzagolova HFURSS 5359; JE W). Near the banks of lake Sassy-kul (03.5.1904 Abramov & al. 11; LE). Auli-eata, sands near valley Karagunda, among shrubs (28.4.1916 Sovetkina 597; TASH). Low sand hills in the valley of Kargala lake (43.15 N, 72.05 E, 10.6.1930 Zapryagaev? 166; LE). Between station Darbaza and the road Chimkent - Tashkent (41.34 N, 69.05 E, 11.5.1958 Soskov; LE). S Karatau range, drainage of Asy river, lake Bujli-Kul' (25.5.1925 Sovetkina 147, 148; TASH). Alma-Ata area, location Karoj, 6 verst N well Bes-kora, Artemisia steppe (43.40 N, 75.10 E, 06.6.1926 Titov, Joffe 53, 56; TASH). Aral lake, steppe near N bank of bay Sary-Cheganak near landing place Aralska (30.5.1921 Rajkova 57; TASH), island Barsa-kel'mis (45.40 N, 59.55 E, 02.8.1921 Rajkova; TASH). Between Emba and Ust-Urt rivers, sandy steppe

(47.22 N, 56.20 E, 11.5.1926 Rusanov 67/4; LE). Between wells Tyuba-kuduk and Maman-kuduk, on a sandy plain (19.5.1914 Dessiatoff 556; LE). Dalversin steppe, sand hills (18.4.1911 Dimo, Sprygin, Shul'ga; TASH). - Kyrgyzstan: Talas Alatau range, near kolhoz "Victory", Artemisia dominated semi-desert (11.6.1969 Ajdarova FRU). Ichkele-tau (W town Talas), stony ground (16.6.1958 [no collector] FRU). N foothills of Turkestan range, N slope E Uzungyr (14.5.1941 Pryakhin; TAD). - Tajikistan: Kurama ridge, Mogoltau massif, E slopes of gorge Biva (900 m, 15.5.1956 Zapryagaeva, Chukavina, Plekhanov 1264; TAD), adyrs S vill. Uyas (03.5.1948 Sidorenko; TAD), sai Schaftola-Bulak (800 m, 14.5.1978 Zapryagaeva, Nazarov, Kuz'mina 111, 151; TAD); Kul'-Keryz, Khojent area (13.5.1924 Popov, Vvedensky 624, 628; TASH). Upper Saravshan range (Kuhistan), drainage of river Fon, Gushty, S rubble slopes (2800 m, 22.6.1940 Zakirov, Popov, Sergeeva; TASH). N foothills of Turkestan range, NE vill. Kostakhoz, near an adyr (29.5.1941 Pryakhin; TAD). Right bank of Vakhsh river, between height Saraj-Khamor and the river gorge (03.6.1929 Granitov 163; TASH). - Turkmenistan: Kugitang ridge, stony slopes E kolkhoz Frunze in a gorge with shrub and tree vegetation, shallow soil (28.5.1973 Gudkova; ASH), Khoja-Pil, stony slopes behind plateau of dinosaurs (17.5.1985 Yachenko?; ASH), Juniperus forest opposite vill. Khoja-Fil-Ata (14.5.1915 Popov 703; TASH), near vill. Khoja-i-Fil (16.5.1978 Nabiev, Li, Tsukervanik; TASH), near vill. Kugitang (19.6.1916 Popov 214; TASH). - Uzbekistan: Kugitang ridge, Katta-kurchuk Mts. (09.5.1915 Popov 553; TASH), gorge Tangi-Duval, left bank 10 km above vill. Khatak, stony SE/N slopes (15.5.1978 Nabiev, Li, Tsukervanik 159, 178; TASH), summit of Kugitang ridge, base of N slopes near vill. Khoja-Ankhor (15.6.1916 Fedtschenko & al. 642; LE). W Hissar range, drainage of river Kashkadarya, left bank of river Kichik-uru near village Dekkhanabad, marine sediments (29.6.1954 Pyataeva, Gringof, Sevindikov 8; TASH), N slopes of Kojpantau near vill. Dekkhanabad (10.5.1959 Korotkova 6728; TASH), right bank of river Guzar-darya, 3 km below Ak-Kishlak, rocky outcrops of limestone (02.7.1955 Pyataeva 1226; TASH), near village Akrobat on the way to the pass Akrobat (38.15 N, 66.50 E, 26.6.1954 Pyataeva 819; TASH), near vill. Khtaj, on rocks and slopes of marine sediments (12.7.1955 Pyataeva 1771, 1795; TASH), right banks of river Tankhaz-darya (29.7.1955 Pyataeva 2232; TASH), valley of river Tangaz-darya, left bank of river Kajnar-sai, village Shurasan, stony slopes (15.7.1955 Pyataeva 1974, 17.7.1955 Pyataeva 2116; TASH), height of river Jakkabag-darya near vill. Tash-kurgan, location Kan'er-sai (Kapyr- ?), red sandstone slopes with gypsum (38.46 N, 67.15 E, 04.7.1936 Botschantzev, Butkov 605; TASH), drainage of Ak-darya river, 5-6 km NE of village Tash-Kurgan, location Kentura, NW slope, steppe with *Inula grandis* (38.49 N, 67.19 E, 29.5.1971 Koshurnikova 71; TASH), height of Besh-tau Mts., N slopes (24.7.1937 Kudryashev 1123; TASH LE); Baisun ridge, foot of Mt. Ketmen-chapty, on rocks (24.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 306; TASH); Baisun ridge between Dekkhanabad and Sajrob (27.4.1972 Kinzikaeva, Badritdinova 239; TAD), from waterfall Gobjibota 3-4 km downwards on right bank of Sangardak river, side gorge, soft slope (31.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 525; TASH), drainage of Machaj-Darya, Uryukisai (1800 m, 14.8.1958 Vasilevskij 168; LE); Chul'bair Mts., between vill.s Mokhka and Vakhshuor, stony slopes (01.6.1929 Vvedensky 200; TASH). Hissar range, Kitab reservation near vill. Kholi-Sufi, NE exposition (1900 m, 09.6.1988 Soldatova, Pulatov 55; TASH). W foothills of Hissar range, near Kan 32 km from Kamashi, stony-rocky slopes (22.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 198; TASH). Babatag massif, valley of Kafirnigan river 3 km SW village Mamyk (660 m, 01.5.1940 Bukasov 14; TASH). Saravshan range, near pass Takhta-karacha (39.18 N, 66.55 E, 1650 m, 11.5.1956 Zapryagaeva, Chukavina 1181, 1186; TAD), (18.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 54; TASH), old pass Takhta-karacha, S stony rubble slope on sandstone (39.15 N, 66.56 E, 19.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 87; TASH), pass Aman-kutan (39.15 N, 66.56 E, 1800 m, 02.6.1986 Kazakbaev, Levichev 28; TASH); village Urgut, gorge Gul'bokh-sai, cultivated in Bot. garden Tashkent (?) (13.4.1965 [collector missing] 989; TASH). W Saravshan range, Karatepa Mts., near settlement Agalyk, in a narrow gorge (31.5.1986 Kazakbaev, Levichev 16; TASH). Samarkand region, Mt. Kara-Kemer near vill. Kyzlyly (07.4.1914 Popov 440-2; TASH). Shakhriyabs - Shtut (6700', 06.6.1896 Lipsky 620; LE). Shakhriyabs - Chopukh (6000', 12.6.1896 Lipsky; LE). SE Kyzylkum desert, near mountain remains Murun-Karak (18.5.1975 Bulgakova; TASH); Kenyamekh chul', sif, Ayak-Agitmis lowland (11.5.1936 Islamov; TASH). Kyzylkum desert station, sandy slopes (400 m, 05.6.1998 Shomurodov 4003; TASH (coll.)). Kungur tau (04.4.1914 Kul'tiasov 122; TASH). N foothills of Nuratau ridge near Kozy-baj (05.5.1939 Mikhajlova, Popova; TASH). Pistali tau (40.30 N, 67.30 E, 07.4.1911 Dimo, Sprygin, Shul'ga; TASH), (07.4.1915 Kul'tiasov 38; TASH). Turkestan range, Jizak forestry, near village Kzil-mozar (20.-23.7.1958 Gordova; TASH), drainage of river Zaamin-su, Uryukly-sai, dry terraces (16.7.1934 Zakrzhevskij 120; TASH). Urgandpsi to Ak Tash, Iris formation (01.5.1913 Korovin 1500; TASH). Mountains SE of Tashkent (1800 m, 26.6.1942 Arnoldi; TASH). Tashkent (no details) (17.4.1914 Minkwitz, W B). N kolkhoz Kyzylga on the pass It-bakh-mast-beli, places with shallow soil between gypsum rocks (03.5.1935 Gnezdillo 1714; TASH). - Uzbekistan ?: Hissar range, valley of river Khanaka-su in the gorge near vill. Khanaka, slopes and rocks of grey slate (02.7.1936 Lepeshkin, Mukhamejanov 816; TASH). Drainage of river Kyzyl-darya, special location Taipok, SW slope (05.9.1941 Koshurnikova 696; TASH). Foothills near vill. Bish-Timur (25.4.1914 Kul'tiasov 450, 451; TASH).

**Determination unsure:** - Uzbekistan: West slope of Kugitang ridge, border to Turkmenistan; limestone rubble slope in E exposition (37.35.17,3 N, 66.32.58,2 E, 950 m, 15.05.2009 Keusgen, Khassanov 4282; TASH (coll.)).

***Allium pseudowinklerianum* R.M. Fritsch & F.O. Khass.**

Kyrgyzstan: W Fergan range, forestry Gava, near vill. Ak-terek, slope in S exposition (40.57 N, 73.23 E, 12.5.1947 Zarubina 510; TASH); near Arslanbob (41.17 N, 72.58 E, 27.5.1899 Litwinow; TAD), location Dongur-Atma, on a moist place near water (41.17 N, 72.58 E, 08.5.1929 Kostina, Linczevskij; TASH), valley of Arslanbob river, subalpine belt (13.-16.7.1926 Korovin 415, 532; TASH), height of river Arslanbob, Juglans forest (41.17 N, 72.58 E, 19.6.1927 Korovin 118, 119; TASH), Dsharador valley, Juglans forest near vill. Arslanbob (41.17 N, 72.58 E, 08.5.1929 Kostina, Linczevskij HFIURSS 5529; JE W B G). Between vill. Gava and Arslanbob, Sharopsai, Juglans forest (41.17 N, 72.58 E, 03.5.1929 Kostina, Linczevskij; TASH); location Ak-terek near vill. Uzbek-Gava, S slope (40.57 N, 73.23 E, 14.5.1935 Kazachkov; TASH), (10.6.1935 Kaz-

achkov; TASH), 6-7 verst from vill. Gava, SW slope among stones (30.6.1928 Kryltsova 435; TASH); river Tar near vill. Sarybe (21.5.1966 Sudnitsyna, Gorbunova; FRU); location Chaartash (2600 m, 15.6.1962 [Tujchiev,] Pryakhin; TASH); Yassu river drainage, middle part, among shrubs (11.5.1965 [Tujchiev,] Pryakhin; TASH); Irisu river drainage, in natural "taran" vegetation (21.6.1950 Chevrenidi 248; TASH). Bazar-Kurgan rayon, river Karaungur, forestry Achinsk, S exposed slope behind the village (41.20 N, 73.05 E, 06.5.1966 Subarev; FRU); location Kurmajdan (16.-20.5.1956 Lebedeva; FRU); terraces of river Kugart (04.6.1956 Ajdarova, Ubukeeva; FRU); pr. Usgent (5-6000', ???.1880? Regel A.; LE). Alai range, drainage of river Kirgiz-Ata, location Karagaj (25.7.1957 Janaeva; FRU); N slope of location Aj-Topan (31.5.1966 Nikolaev; TASH); Gul'cha river drainage, valley of river Khoshola (?), subalpine meadow (19.6.1975 Aleksandrova (?); TASH); near the way from pass Kok-bel to Osh (22.5.1954 Arifkhanova 274; TASH); location Ish (40.16 N, 72.37 E, 04.7.1934 Vykhotsev; FRU); Ak-bura river drainage, gorge of river Berek-su above Grigor'ev "paseka" (13.5.1927 Granitov 526-528; TASH), gorge of river Ak-bura between mouth and Grigor'ev "paseka" (12.5.1927 Granitov 393-394; TASH).

***Allium regeli* Trautv.**

**Turkmenistan:** Badkhyz region, near fort Kushka, hills near station Sary-Yazy, sandy soil (35.17 N, 62.20 E, 23.4.1930 Butkov 87; TASH), vicinity of settlement Mogunovskij, left river banks of Kushka, N slope (19.4.1985 Friesen; GAT), between Kepelya and Akaf-cheshme, shallow soil slopes of hills (04.5.1976 Botschantzev 437; LE); between spring Kakar-cheshme and well Kopala, outcrops of red sandstone (29.4.1930 Linczevskij 302; TASH). Badkhyz region, Gyazgadyk Mts., pass Rakhmatur, E stony slopes with shallow soil (07.5.1977 Botschantzev 185; LE), slopes (30.5.1949 Nikitin; ASH), (23.5.1971 Sejfulin, Pimiryazov; ASH), (16.6.1972, 15.5.1973 Gudkova; ASH); area of lake Er-ojlan-duz, near the lake near Mt. Bovachimgiz, sandy slopes (02.5.1930 Linczevskij 340, 358; TASH); Pynkhan cheshme (27.4.1978 Gorelova; ASH), 5-6 km S well Pynkhan-Cheshme, clayey soil (15.5.1967 Chopanov, Ataev; ASH), well Kogazly-Sujji (17.5.1957 Chopanov; ASH), between well Juma-jik and Shirdepe (17.6.1972 Puchkova, Chopanov; ASH), near well Chajnura (20.4.1941 Adylov 83; TASH). Badkhyz reservation, Krasnogor cleft, sandstone slopes (800 m, 20.4.1979 Rodin 742; LE). Drainage of Amu-Darya, mountain near the Afghan border near post Islim-cheshme (17.4.1916 Korovin 419, 432; TASH); Mary region, left bank of Karakum canal above ferry, crest of sand ridges (19.4.1971 Kostjukovskij; TASH); lowland of Tejen river, 1.5 km N of well Kara-Syrt (26.4.1957 Orazmykhomedov; ASH); compressed sands between wells? Tscharychly and Eki-sezen (21.4.1925 Korovin 179, 179; TASH B G). Karabil', Ata-Muran, somewhat fastened sand (09.5.1964 Berdyev, Ataeva; ASH), Zastava Karvaza - Kem (06.6.1964 Berdyev; ASH), 1 km SE kurgan Er-gobek, flat sands (04.5.1964 Berdyev; ASH). Foothills of Kopetdag range, sands near station Sary-Yazy (08.4.1916 Androssov; TASH ASH). Flat hilly region near Shejkh Mansur (control station?) (30.3.1914 Korovin E83; TASH). Central Kopetdag range, 7 km S settlement Beresengi, lower foothills (20.5.1978 Kamakhina; ASH); in arenosis argillosis inter Annaju et Gjajurs (4./5.1900 Sintenis 309, 309; JE B G), (02.5.1896 Brotherus 1023, G); near Ashgabat, Aryk NE aul Bagir (30.5.1943 Petrov; ASH), vicinity of Ashgabat (15.5.1897 Litwinow 35; TAD W), (24.6.1921 Popov 798; TASH); Gaurdan field (20.6.1972 Gudkova, Sukhova; ASH), Kurru-Gaudan, clayey slopes (30.5.1972 Chopanov et al.; ASH), Chuli - Chaek (37.57 N, 58.00 E, ???.1921 Michelson; ASH); S Zastava Chaek, slopes near gorge (19.6.1961 Kurbandurdyev; ASH); Mt. Kharnasan, slopes from direction Chuli (37.57 N, 58.00 E, 25.5.1958 Chopanov; ASH); in montibus supra pagum Nephton (04.5.1900 Sintenis 311; JE B G), Firyuza, Artemisia steppe (37.55 N, 58.06 E, 14.6.1924 Czerniakowskaja; ASH), rubble slope of a hill in Vannoskij garden area (37.55 N, 58.06 E, 06.6.1937 Koroleva 25; TASH); border control station Shangi, saline clayey soils (18.5.1960 Ishchenko; ASH), stony N slopes 10 km SE vill. Shamli (29.5.1964 Agjankova, Arupdyunov; ASH), Shamli, saline clayey slopes (12.6.1972 Gudkova; ASH); Kulecha II, W slopes (28.5.1991 Ataeva; ASH); Manysh, 0.5 km along the way to Shamli, clayey slopes (10.6.1972 Gudkova; ASH); slope 10 km from Uch-Aju to Repetek (01.7.1976 [no collector]; ASH); Bami, stony slopes (15.5.1974 Meshcherjakov; ASH). W Kopetdag range, Kizilarvat, in steppis et montosis arenosis argillosis (30.4.1901 Sintenis 1678, 1678; JE B G), (???.1883 Becker, G JE), (400 m, 19.5.2002 Kurbanov 54; ASH), (800 m, 20.5.2002 Kurbanov 74; GAT), loess hills nearby the main road from Kizylarvat to Khojakala, grassy slopes (14.5.1976 Ashirova 10; TASH), fastened hills near Khojakala (20.5.1974 Ashivova, Orazov; ASH); small and shallow valley ca. 5 km E Parnawbibibi, loamy-loess slopes (38.57.42 N, 56.05.48 E, 200 m, 08.4.2002 Fritsch, Keusgen, Khassanov 4065; TASH (coll.)), Kazanjik, 22 km SW station Iskander, saline slopes (39.15 N, 55.32 E, 03.5.1952 Nikitin, Mez. ...?; ASH), foothills of Trgoi Mts. (11.5.1981 Proskuryakova, Sergejkova; TASH), in montibus Trgoi in pratis subsalsuginosis (04.5.1981 Proskuriakova, Sofeikova, Kostyleva 11872; BR B G). SE Karakum desert, sandy adyrs near well Osman-ayuk (30.6.1926 Korovin; TASH).

**Determination unsure:** - **Turkmenistan:** Badghys region, to canyon Eroylanuz, sandy slopes (230 m, 26.4.2003 Kurbanov? 112; ASH (coll.)), canyon Akrobat, sandy slopes (650 m, 29.4.2003 Kurbanov? 115; ASH (coll.)). Kizilarvat, saline forest slopes (350 m, 18.5.2002 Kurbanov? 52; ASH (coll.)). Karakum desert, S border of sandy area, N Kizyl-Arbaza (13.4.1952 Rodin, Raczkovskaya, et 4 al. 1376; GAT).

***Allium robustum* Kar. & Kir.**

**Kazakhstan:** On the way from Semipalatinsk to Ajagut (17.-21.5.18?? Lehmann; P).

**Determination unsure:** - **Kazakhstan?:** In rupestribus prope Usunbulak deserti soongoro-kirghisici (1840 Karelin, Kiriloff 469; W G).

***Allium rosenbachianum* Regel s. str.**

**Tajikistan:** Vaksh mountain range, pass between Dangara Mts. and Vakhsh river on the way from Dangara to Dushanbe, stony slope (27.5.1967 Botschantzev 364; LE); NW slopes of Surkh massif, 0.5 km E vill. Khami-Bushol (2150 m, 20.6.1962 Popov & al. 943; LE), SE slopes between vill. Muminabad and Tashjon (2450 m, 26.6.1990 Sharipova 829; TAD); in decliv. septentrion. montis Choja-Mumyn ad meridiem versus a Kulab (4-5000', 29.3.-10.4.1883 Regel A.; LE), Mt. Khoja Mumin

near rayon centre Moskovskij (37.44 N, 69.39 E, 30.5.1960 Botschantzev, Egorova 650; LE), S slopes of Mt. Khoja-Mumin (37.44 N, 69.39 E, 1000-1300 m, 30.5.1960 Yunusov 1457; TAD), (37.44 N, 69.39 E, 1200 m, 18.5.1974 Chukavina, Karimova 5363; TAD), N slopes of Mt. Khoja-Mumin (37.44 N, 69.39 E, 24.5.1976 Chukavina, Chevtaeva, Amanova 6952; TAD), Vasmikuh Mts., NW slopes, left bank of Obi-Pitau river (38.27 N, 70.11 E, 1700-1800 m, 16.6.1963 Chevtaeva, Atashova 15343; TAD); foothills of Sangisabz-tau, S slopes near vill. Mumla kani (grown in Tashkent Bot. Garden) (08.9.1966 [no collector]; TASH). Darvaz range, N slopes, Saiki-Pu, near vill. Zivai (Zakhar?) (2820 m, 03.7.1950 Agakhanyants 37; TAD), N slope Mukadusai, NW exposition (38.42 N, 70.50 E, 2745 m, 02.7.1950 Agakhanyants 15; LE); W slopes of Darvaz range to the Obi-niou river, rise to Kugi-frush near vill. Valgil (2150 m, 02.7.1956 Ovczinnikov, Lazareva 3930; LE TAD); SE foothills of Darvaz range, 8 km NW vill. Iol (37.46 N, 70.12 E, 2000 m, 19.6.1961 Soskov, Yunusov 1540; TAD); SW foothills of Darvaz range, Muminabad forestry, gorge Jausy-Dara (1790 m, 14.7.1951 Zapryagaeva, Stepanenko, Dodonova 208; TAD). Tirkh Mts., W slopes 2 km SE vill. Sarygor (1700 m, 01.6.1961 Soskov, Yunusov 270; TAD).

**Determination unsure:** - Tajikistan: Top area of Mt. Khoja Mumin, Archazor, under Juniperus seravshanica (37.43.31 N, 69.38.43.8 E, 1300 m, 23.4.2003 Fritsch, Keusgen, Kurbonova, Hisoriev 6051; TAD (coll.)).

#### *Allium rosenorum* R.M. Fritsch

Tajikistan: C Hissar range, Varzob drainage, near the mouth of river Majchura, fan delta of a side creek (39.02 N, 68.47 E, 1900 m, 19.5.1987 Fritsch 169; GAT), Varzob valley, damp cleft near base of an overhanging granitic rocks (38.55 N, 68.49 E, 1600 m, 19.5.1987 Fritsch 171a; GAT), under shrubs near the Varzob bank in vill. Pugus (20.4.1931 Androssov; TASH); right bank of Takob river, behind vill. Rokh (13.6.1952 Konnov, Shimunova 221; TAD); Kondara valley, warm shay S slope (38.49 N, 68.48 E, 1780 m, 16.5.1987 Fritsch 161; GAT), SW exposed slope, Acer turkestanica stand (38.49 N, 68.48 E, 1540 m, 22.5.1990 Fritsch, Pistrick 425; GAT), below station Kvak (38.49 N, 68.48 E, 1800 m, 02.6.1987 Fritsch; GAT), Ojuk valley ca. 22 km N Dushanbe c. 2.5 km E vill., NE slopes below Juglans regia (38.47 N, 68.50 E, 1150 m, 06.5.1990 Fritsch, Kudratov, Pistrick 75; GAT), height near Kharongon river (22.6.1962 Kamelin, Ashurov 832; TAD), Zamchurud gorge, among alfalfa (2000 m, 10.6.1964 Kudryashova, Stepanenko 2439; LE TAD); plateau Ruidasht, near E border (2600 m, 26.5.1946 (unreadable) 233; TAD). NW part of Karatag drainage, plateau Kajou (2800 m, 15.7.1946 Tolmachev 998; TAD). Dushanbe, cultivated in Botan. Garden of Academy (08.5.1990 Fritsch, Kudratov, Pistrick 108; GAT). S slopes of Hissar range, gorge Sorbo near union with Kanyaz (1700 m, 02.7.1952 Zapryagaeva, Stepanenko, Dodonova 467; TAD), upper part of Semiganch creek (N side valley of Sorbo) c. 23 km N Dushanbe, side valley SE vill. Dara, NW exposed (38.39 N, 69.00 E, 1600 m, 24.5.1990 Fritsch, Pistrick 447; GAT). Heights near the river Dukan-Khan (27.5.1911 Golbek 263; LE). Iskanderkul (39.05 N, 68.22 E, 18.5.1892 Komarov; LE). Shink and dero (??) (28.-31.5.1914 Dubyanskij; LE). Peter I. range, S slope, gorge Farkikush (2100 m, 27.6.1987 Kochkareva 16013; TAD). Right banks of Panj river, sai Varzy-Su, 0,5 km SW vill. Sebanda, E exposition (1000 m, 03.4.1964 Potashev, Koval'chuk 39; LE). - Uzbekistan: SW Hissar range, drainage of Tupalang river, valley of Chash above vill. Parkh, dry gorge of spring Khauzi-Mordon (19.6.1948 Pyataeva 541; TASH), heights near river Ak-su (05.6.1948 Pyataeva 214; TASH), gorge of Sina river near vill. Sina (25.5.1960 Korotkova 8124; TASH), inter frutices ad declivia abrupta argilloso-saxosa humida montium Tschulbair secus fl. Obidara supra pag. Sina (25.5.1929 Vvedensky HFIURSS 5443; JE M), from vill. Mut to Khurvagan (?) (1500 m, 22.5.1940 Gontscharov 296; LE). W Hissar range, vill. Kaktaluk, within bushes (1450 m, 24.8.2001 Khassanov 4019; TASH (coll.)).

**Determination unsure:** - Uzbekistan: SW Hissar range, union of Sus'utau and Sarytas Mts., near vill. Derbent, gorge Buzgolakhon (11.5.1983 Turkestan group 2057; LE).

#### *Allium saposhnikovii* Nikitina

Kyrgyzstan: Foothills of Kirgiz Alatau, Chon-Aryk, near forest cultures (type location, 42.45 N, 74.33 E, 04.6.1956 Nikitina; FRU), (18.5.1957 Nikitina, Arbaeva; FRU), (24.5.1961 Nikitina, Sudnitsyna FRU), (13.5.1956 Nikitina; FRU LE), Mt. Paspel'dyk (42.45 N, 74.33 E, 15.6.1959 Nikitina, Sudnitsyna; FRU), (08.6.1963 Nikitina, Gorbunova; FRU), forest cultures (42.45 N, 74.33 E, 06.6.1962 Nikitina, Sudnitsyna; FRU), E stony slopes of Paspel'dyk (42.45 N, 74.33 E, 31.5.1948 Popova, Kashchenko; FRU), E slope of the third ridge (42.45 N, 74.33 E, 15.5.1939 Movrim (?); LE); W foothills of Kirgiz Alatau near Kara-Archa (09.6.1988 Klyujkov, Vasil'eva, Kashkaraeva; FRU); Karabal'ta, location Tandy-bulak (1000-1200 m, 05.6.1936 Gusarova, Mikhajlova, Popova; FRU); Besh kungej (30.5.1950 Nikitina; FRU).

**Determination unsure:** - Kazakhstan: Karatau range, location Tersakkan 10 km N mine Achisai, NW slope among shrubs (29.6.1976 Kamelin & al. 6733; LE).

#### *Allium sarawshanicum* Regel

Tajikistan: Saravshan range, heights near river Kashka-Darya, near vill. Farob, gorge of Tash-Farob river, among rocks on rubble slope (18.5.1936 Gnezdillo 100; TASH). N slopes of Saravshan range above vill. Revad, gorge Tangi-dara (2000 - 2300 m, 27.7.1989 Kinzikaeva, Lazareva 7184; TAD). Kshtut, slope to SW station (5000', 06.5.1893 Komarov; LE); near Kshtut, heights of river Artuch, slope with shallow soil (08.6.1973 Khamidov; TASH). Hissar range, N slopes near vill. Mogian (03.7.1929 Drobov 246; TASH). Central Hissar range, drainage of Varzob river, Sardai-miona valley near vill. Guskef (27.6.1930 Pazij, Mironov 364; TASH); left bank of Takob river (1550 m, 12.6.2002 Astanova, Chevtaeva; TAD); valley of Jirinod creek, humous soil under Acer regelii (38.49 N, 68.50 E, 1500 m, 17.5.1987 Fritsch 162; GAT); crest S Kondara valley, margin of a small Acer stand (38.49 N, 68.48 E, 1780 m, 02.6.1987 Fritsch; GAT), left bank of Kondara river, Amygdalus stands (38.49 N, 68.48 E, 1100, 11.5.2002 Chevtaeva, Astanova; TAD), shady bottom of valley under Juglans regia and Acer turk. (38.49 N, 68.48 E, 1200 m, 22.5.1990 Fritsch, Pistrick 399; GAT), near Kondara river in the tree-shrub belt (38.49 N, 68.49 E, 02.6.1960 Korotkova 8160; TASH); Varzob valley between vill. Firysabad and Sharshara, below rocks (1800 m, 23.5.1964 Stepanenko, Kudrjasheva 2278; TAD); valley Fanfarok (04.5.1962 Kamelin 408; TAD), near vill. Bushara, N

exposed (19.6.1944 Tujchiev 60; TASH), Ojuk valley c. 1 km of vill., NW exposed rock slope (38.47 N, 68.50 E, 1100 m, 06.5.1990 Fritsch, Kudratov, Pistrick 91; GAT). Upper part of Semiganch valley c. 23 km NE Dushanbe, side valley SE vill. Dara (38.39 N, 69.00 E, 1600 m, 24.5.1990 Fritsch, Pistrick 446; GAT); drainage of Karatag-darya, middle part between Khakimi and Lyabija (08.6.1930 Kudryashev 452; TASH). Karategin ridge, S slopes, 800 m N vill. Loiob (2100 m, 27.6.1966 Chukavina, Ashirmukhamedov 11213; TAD). N slopes of Karategin ridge, valley Khirskhor, vegetation of tall forbs (2200 m, 27.7.2002 Boborajabov, Chevtaeva, Astanova 1405; TAD). Summit of Gardaniushti massif, location Mundy, Juniperus belt (38.01 N, 68.28 E, 2200 m, 29.5.1947 Nepli 971; LE). Gazimailik ridge c. 35 km NW Kurgan-Tyube, location Obodkan c. 10 km NW Ganjino, terraces of sandstone (38.02 N, 68.34 E, 1600 m, 12.5.1990 Fritsch, Kudratov, Pistrick 186; GAT). Vicinity of water source Khoja-Bekbob c. 2 km NW Mt. Mundytau (Munda) (38.04 N, 68.30 E, 1900 m, 14.5.1990 Fritsch, Kudratov, Pistrick 226; GAT), E part between Mt. Mundytau and vill. Ganjino, W exposed limestone rock slope (38.01 N, 68.28 E, 1300 m, 15.5.1990 Fritsch, Kudratov, Pistrick 260; GAT), N slopes above vill. Ganjino, N slope under Pistacia (37.58 N, 68.34 E, 1380 m, 23.5.1987 Fritsch 185; GAT), location Obodkan, c. 10 km NW Ganjino (38.02 N, 68.34 E, c. 1600 m, 12.5.1990 Pistrick, Fritsch 452; TAD). Vakhsh range, Vakhsh valley, Rosa shrubs near vill. Garmak near top of ridge (13.6.1933 Botschantzev 37; TASH LE), systema fl. Vachsch, trajectus Guli-Zindan (ad austro-orientem pag. Tutkaul) in rosario (29.5.1934 Botschantzev HFIURSS 5522; W B), gorge Shurab-dara above vill. Teit (1450 m, 05.7.1957 Zapryagaeva 3976; TAD), above Sarykhosor 3-4 km above vill. Bulgory (1900 m, 07.7.1957 Zapryagaeva 4042, 4073; TAD); SW slopes of Surkh massif, 0.5 km E vill. Khamgebushol (2200 m, 20.6.1962 Grebennikova, Ashirmukhamedov 126; LE). E slopes of Zagara Mts., valley of the river (2200 m, 30.6.1987 Kochkareva 16033; TAD). S slope of Peter I. range between vill. Chil-dara and Tavil-dara, gorge Chil-dara above vill. Shanob (15.6.1966 Shibkova 1932; TAD), valley of Obi-Khingou, gorge Lyuli-Kharvi near vill. Lyuli Kharvi (1750 m, 26.6.1987 Kochkareva 16001; TAD). SW end of Darvaz range, drainage of Murabadara above vill. Khausoni (1550 m, 03.7.1957 Zapryagaeva 3921; TAD). Khozratishoh range, mazar near vill. Childokhturon (06.7.1956 Ovczinikov, Lazareva 4125; TAD), near village Lyangar (1800, 26.7.2002 Boboev; TAD) mountain, just N Ljangan village, small grained and dry scree slope (1800 m, 22.7.2002 Kurbonova, Hisoriev 6019; TAD (coll.)); Nikolaev descent, in the S end of Khozratishoh (01.6.1961 Kinzikaeva 2055; TAD). - Turkmenistan: Central Kopetdag range, Missuny (27.-28.4.1949, 20.6.1953 Nikitin; ASH), (19.6.1953 Egorova; LE), (29.5.1961 Kurbandurdyev; ASH), 50 km S Geok-Tepe, alpine meadow of Mesinev summit (21.5.1963 Gubanov 362; LE), Masinev, on the summit of ridge (08.6.1889 Antonow; LE); 30 km S Geok-Tepe, meadow along valley near Germab (23.5.1963 Gubanov 339a; LE), rayon Geok-Tepe, Mt. Dushak, in gorges, at shady places (2200 m, 02.6.1975 Nikitin, Ivanov GAT JE), Mt. Dushak, bottom of the gorge near meteorol. station (13.5.1985 Sejfulin ASH), Geoktepe, slopes near vill. Prokhladnoe (10.6.1934 Borisova 165; LE), (10.6.1934 Borisova ASH), (04.4.1958 Kasova; ASH), (24.5.1961 Kurbandurdyev; ASH), Kurru Gaurdan (30.5.1972 Chopanov et al.; ASH), Gaurdan, bottom of gorge (02.6.1972 Sejfulin et al.; ASH LE), W slopes near border control station Arvaz (23.6.1971 Sejfulin, Pirmijazov; ASH), Arvaz 5 km W border control station (30.6.1962 Berdiev; ASH), Mt. Dushak, gorge S Dushak (09.6.1961 Kurbandurdyev; ASH), (13.6.1985 Sejfulin ASH), Mt. Seamasur, in the gorge (08.6.1924 Czerniakovska 108; TASH LE), top of Mt. Semansur (26.6.1958 Nikitin et al.; ASH), Kheirabad (12.6.1961 Kurbandurdyev; ASH), (09.7.1955 Ishchenko; ASH), near spring (11.5.1942 Blinovskij; ASH), gorge near Mt. Dalancha, NW slopes (13.6.1954 Medvedova, Markova; LE); between Kheirabad and post Chaek (27.4.1912 Lipsky 2298, 2306; LE), (30.6.1972 Gudkova, Sukhova ASH), between Germab and Kheirabad (01.6.1969 Berdiev; ASH); upper part of gorge Annagelon (?) W Karaul, mountain steppe, in gorge (16.5.1954 Markova; LE); Burnoe, Msinen cheshme gorge, in the shadow of shrubs on the slopes (38.43.48 N, 56.48.87 E, 17.5.1972 Peshcheryakov; LE), upper part of gorge Dabary Dere (03.6.1947 Nikitin; ASH); In angustiis Karanki (07.6.1898 Litwinow 2093; LE TAD W), great Karanki gorge, under Acer tree (23.6.1972 Gudkova; LE TASH ASH); gorge Khurs-dere (16.5.1985 KamaKhina, Strizhak; ASH), gorge Sandakhin (?) (29.5.1940 Androssov, Blinovskij; ASH); Kopetdag range, border path from Saram-sakli to the Almanjikh Mts. (19.6.1927 Bogdanovich 71; TASH); Mt. Chapandag, along the way to the spring (18.6.1985 Raenko; ASH), on stony rubble soil (18.-22.7.1961 Kurbandurdyev; ASH), Sarymsakly (19.5.1961 Kurbandurdyev; ASH); Central Kopetdag range [G from Aktag near Samarkand] (5525; JE B G); 10 km W Nokhur, slopes of Dej Dere gorge (38.30 N, 57.05 E, 14.5.1962 Gubanov 907; LE), grown in Turkmen Bot. garden (14.5.1931 Androssov; TASH); Nukhur, Karasu-dere (1100 m, 29.6.1925 Fedtschenko & al. 843; LE); Gendivar, Mt. Amarat (10.5.1962 Kurbandurdyev; ASH); upper part of Mt. Sumbar (1957 m, 31.5.1977 Nikitin & al. ASH). Chodscha Kala - Bami (11.5.1886 Radde; LE). W Kopetdag, near vill. Bensedin, N slopes, among shrubs (13.5.1979 Averyanov & al. 921, 784; LE). Kugitang ridge, SE Khoja-Pil' (25.6.1964 Bilagov, Berdyev; ASH), 2 km E Khoja-Pil' (05.6.1973 Choponov; ASH), opposite vill. Kugitang, Juniperus stands (12.6.1931 Nevski 215; LE). - Uzbekistan: SW Hissar range, Tupalang river drainage, heights of Shargun sai, N slopes, among Juniperus (38.38 N, 67.57 E, 31.5.1972 Nabiev, Shermatov, Kazakbaev 366; TASH); height of river Ak-su, soft slopes in direction to location Surpatash (04.6.1948 Bondarenko 886; TASH). W Hissar range, Ak-Darya river drainage, location Dashti Chingurak, river bank (31.5.1941 Koshurnikova 110; TASH). near Kan 32 km from Kamashi, stony rubble slopes (22.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 208; TASH). Kitab geol. reservation, N slopes of Karatag (2500 m, 28.6.1989 Soldatova 51; TASH), Khojakurgan sai (04.6.1983 Karabamaeva, Sharipov 45; TASH). Kurdara sai, Shink river, rocks (2800-3000 m, 22.6.1941 Chugaeva, Sergeeva; TASH). Babatag massif, height of Khoja-Kul'sun sai, SW slope (18.5.1941 Lopott, Pinkhasov 232; TASH), NW exposed slopes (16.5.1941 Lopott, Pinkhasov 237; TASH); vill. Aspi-Duktar W of Tajik border E of pass Sangitar (2500 m, 25.5.1958 Lobyzova; TASH); N Onar(?)-bulak-sai, NW exposed slope (17.5.1941 Lopott, Pinkhasov 470; TASH); top of central part (2200 m, 13.7.1936 Lepeshkin, Mukhamejanov 529; TASH). Saravshan range, near vill. Sary-Kul, limestone (02.5.1925 Popov 192; TASH); Aktag Mts. S vill. Kara-batpak, in Juniperus belt (02.5.1935 Kudryashov 426; TASH); Mogian-Darya (04.6.1979 Li, Tsukervanik TASH); Urgut, slopes (???.7.1952 Khalmatov 56, 61; TASH), Mt. Alla-yaran (25.6.1929 Drobov 23; TASH), location Tashissyk near Urgut (13.5.1979 Li, Tsukervanik, Kam-

elin, Makhmedov 44; TASH), heights of gorge Sajlyk, rubble slopes near pass Sary-Tash (06.6.1936 Gnezdillo 174; TASH LE), S exposed slope (02.5.1936 Gnezdillo 28; TASH), 200 m down from pass Takhta-Karacha, right of the main way, SE stony-rubble slopes (39.18 N, 66.55 E, 18.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 24; TASH), above pass Takhta-Karacha, Juglans plantation on N exposed slope (39.18 N, 66.55 E, 03.6.1986 Kazakbaev, Levichev 51; TASH); above pass old Takhta-Karacha, terraces in shadow N exposed (39.18 N, 66.57 E, 03.6.1986 Kazakbaev, Levichev 51; TASH); slopes near vill. Ak-sai (07.5.1931 Butkov 154; TASH), (15.-20.5.1931 Butkov 190; TASH), Aman-Kutan (39.19 N, 66.56 E, 1730 m, 17.5.1936 Nikanorova TASH). Near vill. Alla-Irishak(?) (10.5.1925 Popov 116; TASH); mountains below pass Urta-Bel (14.5.1925 Popov 223; TASH). W Saravshan range, Karatepa Mts., near vill. Agalyk, in shadow of Lonicera (31.5.1986 Kazakbaev, Levichev 22; TASH); E slopes W of vill. Palna (?) (2000 m, 20.6.1932 Ovczinnikov, Slobodov 746; LE). N slopes of Turkestan range, Sangsar heights, reservation Guralash-sai, middle part on S slopes (20.7.1938 Korotkova 84; TASH), SE exposed fine rubble slopes (2300-2450 m, 06.6.1937 Korotkova, Vasil'kova 217; TASH), meadow in Gurulash (23.6.1920 Balabaev 315; TASH).

**Determination unsure:** - Tajikistan: Hissar range, drainage of Varzob river, Kondara canyon 37 km N Dushanbe; wet scree slope (38.49 N, 68.48 E, 1200 m, 10.4.2002 Kurbonova, Hisoriev 6023; TAD (coll.)). - Turkmenistan: Kugitang ridge, Hod-japil (650 m, 07.6.2003 Kurbanov? 132; ASH (coll.)), peak Airibaba, loess slopes (800 m, 05.6.2003 Kurbanov? 129; ASH (coll.)). - Uzbekistan: Hissar range, Kitab geol. reservation near vill. Khojakurgan above Gushlik, stony bottom of sai (1600 m, 20.6.1987 Soldatova, Pulatov 74; TASH).

#### *Allium schachimardanicum* Vved.

Kyrgyzstan: N slopes of Alai range, Shakhimardan drainage, above Jordan in shadow of rocks (39.58 N, 71.46 E, 09.5.1979 Kamelin, Makhmedov 21; LE); near pass Shivali, stony slopes mostly with grass meadows (11.6.1967 Khalkuziev TASH), Mt. Katran, N slopes (40.00 N, 71.47 E, 25.5.1964 Ajdarova, Gorbunova; LE FRU), Arpa place 32 verst S Skobelev, stony slope in Juniperus stand (40.17 N, 71.43 E, 22.5.1916 Drobov 1041; LE TASH), N slope of Tangi-Sek, rocks (40.00 N, 71.47 E, 09.6.1963 Ajdarova, Ubukeeva; LE); Alai range, river Sokh, slope with shallow soil (24.5.1966 Khalkuziev; TASH); Jajlyau Mashelan (06.6.1948 Shafeev; TASH), Dugava gorge (39.57 N, 71.45 E, 09.6.1948 Shafeev; TASH). - Uzbekistan: SE slope of Alai range near Khamza-Abad, stony slope (1900-2000 m, 04.6.1959 Ismailova, Karimov 111; TAD). Near Shakhimardan (40.00 N, 71.40 E, 19.6.1963 Shonazarov 2399; TASH). Alpine meadows near the heights of Shakhimardan sai (40.00 N, 71.47 E, 3000-4000 m, 12.6.1934 Abdukhakimov 98; TASH).

**Determination unsure:** - Kazakhstan: Semirech'e, Dshol(?)-Bulak pass, NW slopes (19.5.1915 Sovetkina 360; TASH). - Kyrgyzstan: Susamyр valley, right bank of Turkusu river (???.7.1966 Pyataeva, Tuzhilkina 2395, 2401; TASH), near mound of rivers Aramsa and Turkusu, meadow (13.6.-21.7.1966 Pyataeva, Deberdeeva 3030; TASH), Hordeum field (18.6.1966 Pyataeva, Puzhelkina(?) 2662; TASH).

#### *Allium schugnanicum* Vved.

**Determination unsure:** - Tajikistan: Plants from collection of Khorog Botanical Garden (2200 m, 01.6.2002 [collector not reported] 6020; TAD (coll.)).

#### *Allium severtzovioides* R.M. Fritsch

Kazakhstan: Talas Alatau range, reservation Aksu-Jabagly, subalpine meadow above gorge Taldy-bulak (42.20 N, 70.40 E, 20.6.1952 Tsvelev; LE), Novo-Nikolaevka on the way to Jaty-sai (42.26 N, 70.29 E, 1700 m, 03.6.1976 Levichev; LE), stony slope and subalpine meadow at heights between Aksu and Irisu rivers (42.20 N, 70.40 E, 11.7.1952 Tsvelev; LE); gorge of Kshi-koyandy river, left side, Juniper stands on a rubble slope (20.7.1928 Granitov 8; TASH). Karatau mountain range, location Ush-uzen, clayey slope (29.5.1930 Lipschitz 357; TASH). - Kyrgyzstan: middle part of Kirgiz Alatau range, river Aksu (24.6.1936 [no collector]; FRU). Ugam ridge?, valley of Ugam river, vill. Khumeni (25.7.1932 Lepeshkin; TASH). Pskem ridge, drainage of Chatkal river, Kara-Korum (16.6.1966 Sudnitsyna, Gorbunova; FRU); Kuruk-tugarak-sai (2150 m, 04.10.1966 Adylov, Tuleganova; TASH). - Tajikistan: N, Kurama ridge, Charvan-sai, Apricot orchard (1500 m, 30.5.1990 Chevtaeva, Astanova, Samoshina 1084; TAD), gorge of the river Souk-sai near vill. Yangavat (15.5.1928 Gomolitskij, Granitov 318/9 ?; LE). - Uzbekistan: Tashkent, near kolkhoz Suksuk-kuduk, slope (09.5.1926 Jarmolenko; LE), Tashkent, ??? (24.6.1921 Bulgakov; TASH), near Tashkent, Sharnakhaj (?) (11.5.1926 Jarmolenko; LE). Chatkal range, reservation Bashkyzyl-sai, Serkeli-sai, meadow between shrubs (07.5.1974 Levichev; LE-Lev), Great Tokali, W slope (2600 m, 02.7.1975 Levichev; LE), Minuro summit (31.7.1973 Levichev, Kamelin 31; LE), Chatkal reservation (1200 m, 07.6.2002 Tojibaev 4104; TASH (coll.)). Chatkal range, sai Itel'ge, S slope, often present (13.6.1931 Matskevich 79; TASH). Chimgan Mts., vicinity of Chimgan (41.33 N, 70.01 E, 19.6.1921 Bulgakov; TASH), top of Mt. Chimgan Minor (41.24 N, 70.05 E, 28.6.1923 Baranov 117; TASH), stony slopes of Mt. Chimgan Minor (41.24 N, 70.05 E, 30.6.1926 Popov, Vvedensky HFIAsMed 342; LE), near Chimgan Bot. station, crest of Kizyl-Jar, W exposed slope with shrubs (41.33 N, 70.01 E, 1600 m, 24.7.1925 Gomolitskij 8; TASH), heights of Sandalash river, NE slopes of pass Ming-bulak (2930 m, 17.8.1938 Pyataeva, Momotov 1073; TASH). Ugam ridge, height of sai Alikhoja, stony slope (20.6.1962 Adylov 1834; TASH), watershed between saıs Keragil, Kajnar, Almame, and Alikhoja (40.59 N, 69.40 E, 27.6.1962 Adylov 1870; TASH), valley Kajnar-Sai (40.59 N, 69.40 E, 1200 m, 06.8.1961 Zapryagaeva, Abdushakudova, Ashurov, Kamelin, etc. 10273; TAD), location Kajnar-sai near Sijak (41.41 N, 70.03 E, 24.6.1960 Pyataeva, Tulaganova 18; LE), left banks of Ugam river, mountains between Khumsan and Irgailyk (41.42 N, 69.58 E, ???.6.1921 Baranov 141; TASH), valley of Ugam river near Khumsan (41.42 N, 69.56 E, 17.6.1921 Toshchevskij ???; TASH), left bank of Ugam river ... (???.6.1921 Baranov 113; TASH), gorge Makhbal'kul between that lake and the Ugam river (???.4.1921 Baranov 316; TASH), vill. Khumsan, outcrops of conglomerates (41.40 N, 69.58 E, 15.7.1932 Lepeshkin; TASH). Basmandy ?, near Charvak Kajnsur sai (Kajchar?) below Juglans (41.38 N, 69.56 E, 26.5.1959 Makhamajanov 10;

TASH). Karshantau ridge, Aktash forest place, Alchaban-sai, walnut plantation (41.39 N, 69.47 E, 05.8.1933 Drobov, Sakhabutdinov 423; TASH); near vill. Khaidajlyk, stony slopes and foothills (41.43 N, 69.50 E, 5.-6.5.1939 Achilov (?) 13687; TASH), in declivibus ad ripam dextram rivi Ak-tash (900-1400 m, 09.7.1973 Vasák; W), in valle rivi Ak-tash (1100-1500 m, 14.7.1973 Vasák, M), Ak-Tash, slopes of right side of Ak-bulak-sai (41.38 N, 69.47 E, 30.6.1956 Granitov 570; TASH), valley above Aktash (Sajlyk), W slope, Juglans regia orchard (41.38 N, 69.47 E, 1450 m, 03.6.1990 Fritsch, Pistrick 614; GAT). Valley of Pskem river, right banks, location Kunch, NW slopes (09.6.1956 Tsukervanik 113; TASH). Koksuy valley, source of Gentash sai, SE slopes (2450 m, 11.7.1957 Butkov, Nabiev 150; LE). Valley of Chotkal river, near vill. Brich-mulla, mountains above walnut plantations (04.7.1928 Batolkina 566; TASH). Kurama ridge, pass Kamchik, S grassy slopes (41.06 N, 70.31 E, 2280 m, 29.5.1981 Shermatov, Kazakbaev, Levichev, Tagaev 369; LE-Lev), stony slopes (1600 m, 14.5.2000 Khasanov 4031; TASH (coll.)), 10-15 km W pass Kamchik (41.06 N, 70.31 E, 28.7.1972 Kamelin 396; LE). Fergan depression, Chadak low mountains (05.05.2002 Tojibaev 4091; TASH (coll.)). Nuratau ridge, heights of Sintad-sai, in the valley (10.5.1958 Li, P. Zakirov 476, 477; TASH).

**Determination unsure:** - Kazakhstan: Talas Alatau range, near Mashat Mts. (42.30 N, 70.00 E, 08.5.1955 Oraleeva, Lebedev; FRU). Foothills near railway station Chimkent (41.24 N, 70.05 E, 02.6.1951 Vykhodtseva, Popova, Ajdarova; FRU). Aksu-Jabagly reservation, near gorge B. Kaindy (42.20 N, 70.40 E, 17.7.1958 Soskov 58; LE). - Kyrgyzstan: Talas Alatau range, valley Kish-Kaindy, S stony slopes (1700 m, 25.6.1933 Linczevskij 89; LE), location Uzun Tashty, E slope (20.6.1971 Sudnitsyna; FRU). Sandalash massif, NW slope (1700 m, 06.6.1977 Popova, Gorbunova; FRU). Syugaty, S slopes of vill. Jangi-Jol (22.5.1977 Batalov, Ledovskaya, Sultanova; FRU). - Tajikistan: Kurama ridge, Urtasai (15.5.1985 Zhogoleva 5808; TAD), S slope, upper part of river Asht (1700-1900 m, 17.6.1963 Nikitin, Soskov 383; TAD), heights of Kyzyl-almaly-sai (1700 m, 17.5.1948 Sidorenko 201; TAD), Shivar NE Leninabad, Oshoba valley above the village, W exposed granitic rock (40.45 N, 70.26 E, 1700 m, 30.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 528; GAT), Kapsai, Taboshar pass over Okur-tau (12.5.1939 Azbukin 224; TASH).

***Allium sewerzowii* Regel s. str.**

Kazakhstan: "Tashkent chuli" area, between railway stations Stepnoe and Darbaza (41.34 N, 69.05 E, 28.5.1987 Levichev; TASH), way from station Jilga to post station Ak-Dzar, low foothills (12.5.1914 Minkwitz 429; LE); state farm Darbaza, 0.5 km NW from topogr. point Kuruk-sai, large-rocky plain (41.34 N, 69.05 E, 19.5.1940 Kazarenko; TASH), 4 km to the west from Kuruk-sai, large-stony area (41.34 N, 69.05 E, 19.5.1940 Kazarenko; TASH); adyrs of Keles near station Darbaza (41.34 N, 69.05 E, 22.5.1987 Bulgakova; TASH), Kaplanbek hills (41.30 N, 69.15 E, 27.5.1920 Popov 287; TASH); Alymtau, plain (600 m, 09.5.1997 Khassanov 4014; TASH (coll.)). 10 verst SW from Chan-Kurgan, steppe of high foothills (12.6.1909 Minkwitz 674; LE). Kara-bas-tau Mts., in grassy steppe and wheat fields (22.6.1908 Minkwitz 1398; TASH). E Karatau range, Aksakal-sai (19.5.1977 Kamelin & al. 1883; LE); ascent from Baijansai mine to the plateau, stony margin of plateau (17.6.1959 Pyataeva 46; LE); Vannovskoe to Vysokoe (18.5.1909 Michelson 336; LE), gorge Berk-kara (23.5.1909 Knorring 272; LE), (23.5.1909 Minkwitz 267, 279; LE), (30.5.1922 Drobov 174; TASH), stony slope near river Saya-su (23.6.1931 Pavlov 318; LE B). S Karatau range, drainage of river Asy, ??? of lake Ak-kul', S slopes of Ulken-burul (42.54 N, 71.06 E, 27.5.1925 Sovetkina 507 (567?); TASH), drainage of river Arys, station Sae-tyube, ??? (01.6.1925 Abolin 1; TASH). Chimkent area, Kazy-Kurt Mts., on the ascent to pass Kazak-bek (42.04 N, 69.44 E, 19.7.1928 Baranov 411; TASH). Aksu-Jabagly reservation, way down to gorge Ak-su, stony-rocky slope, Juniperus belt (42.20 N, 70.40 E, 21.6.1959 Pyataeva 186; LE), Novo-Kikaevka (?) on the way to Jetisai (42.26 N, 70.29 E, 03.6.1976 Levichev; LE). - Kazakhstan ?: Slopes to river Mashat near vill. Antonovka (20.5.1927 Mokeeva, Linczevskij 29; TASH). - Kyrgyzstan: Talas Alatau range, N slope of Kokje-biltau near the tunnel (23.5.1927 Mokeeva, Linczevsky 77; TASH), hills between spring Kel'te-mashat and vill. Antonovka (19.5.1927 Mokeeva, Linczevsky 26; TASH). - Tajikistan: Foothills of Kurama ridge c. 45 km NE Leninabad, meadow steppe c. 5 km N vill. Cholata (40.38 N, 69.34 E, 800 m, 28.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 463; GAT). Kalkan Ata Mts. ... (10.7.1953? Vernik, Nabiev, Tsukervanik 28; TASH), pass Ak-bel, slopes (28.5.1953 Vernik, Nabiev, Tsukervanik 153; TASH). - Uzbekistan: Drainage of Angren river, in a gorge of Altyn-topkan Mts. near Shakar-bulak (40.39 N, 69.35 E, 10.7.1953 Vernik, Nabiev, Tsukervanik 28; TASH).

**Determination unsure:** - Kazakhstan: Foothills of Karatau range near settl. Vannovskij, shrubs (21.6.1931 Pavlov N.V. 260; B), (17.5.1931 Pavlov 234, B LE); Karatau range, location Kara-bas-tau, among tall forbs on shallow soil (30.5.1956 Vvedensky, Kovalevskaya 37; TASH), N exposed slopes near vill. Kitaevka (30.5.1956 Bulgakova 25323; TASH). - Uzbekistan: Tashkent, valley of Angren river, near vill. Oktyabrskoe, high mountain spurs NE of the way Uralevka to Khanabad (40.56 N, 69.31 E, 01.6.1928 Gomolitskij 110; TASH), in gorge of Aman-topkan Mts. near Shakar iryuk (14.7.1953 Tuichiev (?) 15; TASH), foothill loess plateau and hills S vill. Telyau (27.5.1931 Butkov 52; TASH), between vill. Telyau and Kambyraul (29.5.1931 Butkov 73; TASH). Kurama ridge, valley of Angren river, gorge Souk sai near Yangiabat (15.5.1928 Gomolitskij, Granitov 393(2); TASH), pass from Almalyksai to Karakelsai, on shallow soil of grassy slope (19.5.1981 Shermatov, Kazakbaev, Levichev, Tagaev 10; LE-Lev). Niaz-Bek near Tashkent (30.5.1903 Lipsky 2484; LE). Parkent district, near lake Khoja-kul' (???.5.1954 Pyataeva; TASH).

***Allium stipitatum* Regel**

Kazakhstan: Rrami austro-occidentalis jugi Alatau transiliensis, in fluxu medio fl. Zapadnyj Jenyshke ... (17.6.1963 Goloskokov HFIURSS 4452; TAD). - Kyrgyzstan: Turkestan range, drainage of Khoja-Bakirgan river, Burgekurmas Mts. (05.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 301; TASH), location Chat, W exposed slopes (1530 m, 04.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 230; TASH), near vill. Churbak (19.4.1960? Adylov 1338; TASH), location Tyuya-Jajlyau (20.5.1954 Aleksandrova; TASH); location Shandarak, NW slope (06.5.1964 Ajdarova, Gorbunova; FRU);

river Isfana, location Tegirmensai (19.6.1968 Arbaeva, Ubukeeva, Mursaliev, Sultanova; FRU). N foothills of Alai range between rivers Sokh and Shakhimardan, taken into garden ... (40.00 N, 71.47 E, 13.5.1938 Glybin; TASH), ... ? in a garden of vill. Jorai (?) (13.5.1938 Glybin; TASH). - Tajikistan: Kurama ridge, near Altyn-Topkan (40.39 N, 69.35 E, 1600 m, 16.5.1948 Lysova 189; TAD), Chelata gorge c. 38 km N Leninabad N pass, grazed granitic slope (40.38 N, 69.34 E, 1700 m, 29.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 508; GAT); heights of Ajassai, Juniperus forest (1500-1700 m, 20.5.1981 Shermatov, Kazakbaev & al. 71; TASH). Upper Saravshan range (Kukhistan), drainage of Fan river, right bank of Pasrud in Tursulsai (2300 m, 09.6.1940 Zakirov, Popov, Sergeeva; TASH); drainage of Kshtut river, rivulet Negnot (2700 m, 20.6.1961 Strizhova 606; TAD), drainage of Yagnob river, near the way from vill. Rufigar via pass Khak in the Yagnob valley (28.6.1930 Pazij, Mironov; TASH), heights near river Aksu near village Suvtushar (14.6.1957 Adylov T. 489; TASH). N slopes of Hissar range, 15 km N of pass Anzob, N slopes facing to river Gush-dara (29.6.1956 Shibkova, Chukavina 58; TAD). Central Hissar range, drainage of Varzob river, along the river Ziddy from union of rivers Ziddy and Maj-kura (02.7.1930 Pazij, Mironov 860, 861; TASH), Varzob valley near the mouth of Majchura, gently slopes foot of a slope (39.02 N, 68.47 E, 1900 m, 19.5.1987 Fritsch 168; GAT); way from pass Mura (05.8.1932 Ovczinnikov, Slobodov; LE); ascent to Anzob pass 96 km from Dushanbe, cultivated in Bot. garden Tashkent no. 1072 (39.00 N, 68.51 E, 25.4.1966 Koshelev; TASH); Kondara valley, saddle of a W side valley, granitic grit (38.49 N, 68.48 E, 1660 m, 22.5.1990 Fritsch, Pistrick 424; GAT); drainage of Karatag river, middle part, tree and shrub belt between Khakimi and Lyabijoi (08.6.1930 Kudryashev 478; TASH). Ramit reservation, left side valley of river Kholmon, loamy soil under shrubs near the creek (38.45 N, 69.18 E, 1370 m, 14.5.1987 Fritsch 156; GAT). S slopes of Karategin ridge, 1.5 km W vill. Buni-Safion (1600 m, 17.6.1966 Chukavina, Ashirmukhamedov 11054; TAD). Gazimailik ridge above vill. Ganjino, SE exposed slope (37.58 N, 68.34 E, 24.5.1987 Fritsch; GAT), location Obodkan c. 10 km NW Ganjino, sandstone terraces (38.02 N, 68.34 E, 1600 m, 12.5.1990 Fritsch, Kudratov, Pistrick 189; GAT), from Gazimailik ridge, cultivated in Botan. Garden Tashkent (07.8.2000 Filimonova, 4043; TASH (coll.)). SE slopes of Vakhsh range, watershed between Shurob Dara and Obi Mazar, gorge Safedsangob (1700 m, 08.5.1983 Gul'zorkhanova, Abdullova 14977; TAD); W slope of Sanglok Mts., in a gorge (2000 m, 12.6.1932 Gontscharov, Grigorjev, Nikitin 303; LE), near weather station (23.5.1979 Li, Tsukervanik 299; TASH); pass Shar-shor, NW exposed slopes (20.5.1984 Khamidkhojaev; TASH); W slopes of Imom-maskarid Mts., E vill. Darai-imom (2800 m, 05.6.1960 Yunusov 1785; TAD); SW slopes of Surkho massif (05.5.1962 Chukavina, Filimonova, GOTH); Sebestash Mts., S very gypseous slopes (08.6.1933 Botschantzev 31; LE); pass Guli-Sindan (HFIURSS 5592a; JE); slopes above Teguzak village, Sebeston W region of Vakhsh range, NE exposition (38.17.26.7 N, 69.15.00.4 E, 1200 - 170, 06.5.2003 Fritsch, Keusgen, Kurbonova, Hisoriev 6108; TAD (coll.)). E slopes of Khozratishoh range, heights of river Novo (2320 m, 27.6.1956 Ovczinnikov, Lazareva 3759; TAD), Nikolaev descent in the S foothills of Khozratishoh range (01.6.1961 Kinzikaeva 2054; LE), Tiryaj (Teryay) ridge, Nikolaev way down (2000 m, 01.6.1961 Stepanenko 120; TAD), SW part of Tirkh Mts., 3 km E vill. Sarygor (1900 m, 01.6.1961 Soskov, Yunusov 372; TAD). N slopes of Darvaz range, left banks of river Zarako facing vill. Khavdak (09.6.1966 Shibkova, Kinzikaeva 1569; TAD), sai to vill. Zivai (2820 m, 03.7.1950 Agakhanyants 37; TAD). SW foothills of Darvaz range, drainage of Shurab river, above vill. Khauson (1500 m, 03.7.1957 Zapryagaeva 3799; TAD); left bank of river Obi-Niou, W slopes of Kugi-frush Mts., ascent to vill. Vaglel (2600 m, 21.6.1971 Kinzikaeva 2251(69); TAD), gorge Farkikush (2100 m, 27.6.1987 Kochkareva 16014; TAD). N slopes of Peter I. range, gorge Kharkikush 1.5 km NE of union of rivers Safed-ob and Kharki-Kush (2400 m, 15.6.1967 Potashev 10; TAD). - Turkmenistan: Central Kopetdag, cultivated in the Turkmen Bot. Garden in Ashkhabad (10.6.1972 Durdjev, G), Chuli gorge, mostly in Ulmus wood, cultivated in Turkm. Botan. garden (37.57 N, 58.00 E, 20.4.1931 Androssov 2; TASH), gorge Chuli, valley of the river (37.57 N, 58.00 E, 18.4.1912 Michelson; TASH). Kugitang ridge, Khoja-Pil' (24.5.1959 Ashirova & al. ASH), (13.8.1932 Gnezdillo, Butkov; TASH); without exact location (25.5.1969 Ataev; ASH), (12.6.1961 Kazanov et al.; ASH); above vill. Kugitang (12.6.1935 Androssov 262; ASH); near height Airi-Baba (30.5.1973 Gudkova; ASH), N exposed slopes above vill. Kugitang, bottom of a deep gorge (1300 m, 01.7.1928 Lepeshkin; TASH), Svinsovoj rudnik (37.50 N, 66.29 E, 15.5.1985 Raenko ASH). - Uzbekistan: W Hissar range, heights of Yakkabag-darya near vill. Tash-kurgan (38.46 N, 67.15 E, 24.6.1936 Botschantzev, Butkov 389; TASH), sai opposite of the bridge on the way to vill. Zarmas (38.46 N, 67.15 E, 16.7.1936 Botschantzev, Butkov 971; TASH), way down from pass Chakman-kujdy to vill. Tash-kurgan (38.46 N, 67.15 E, 18.6.1936 Botschantzev, Butkov 16; TASH); drainage of Kashkadarya river, stony pass Yarra-tash, vill. Eanykh (09.7.1959 Li, P. Zakirov 1364; TASH); heights of river Kashka-Darya, walnut stands in location Yangaklyk (22.6.1970 Allanazarova 53; TASH); vill. Kizil Imchak. Medium mountain belt near the top of mountains with glaciers (2200 m, 10.6.1969 Nikitin, Zhilenko; GAT); near the top of mountains near pass Chekmen-kujki(?) (11.5.1961 Abdukhaliev; TASH); heights of Khazalyak near pass (12.7.1938 Kudryashev, Sumnevich 877; TASH); valley of Kyzyl-darya near vill. Kelty-Darya (26.5.1959 Li, Niyazov 661, 662; TASH); valley of Guzar river, 12 km higher of vill. Igri-su along the river (06.7.1955 Pyataeva 1605; TASH); Yakkabag rayon, along river Kzyl-Tash, in Teng'i (06.8.1942 Korotkova 129; TASH). SW Hissar range, 3-5 km above vill. Guli-ob, on rocks (14.5.1948 Chevrenidi 533; TASH); middle part of river Ak-su, stony places along right banks (03.6.1948 Pyataeva 151; TASH); Chulbair Mts. above vill. Sina, loamy slopes in Rosa association (03.6.1929 Vvedensky HFIURSS 5444; JE G GOTH); gorge of Shargun river, NW slopes with shallow soil (38.38 N, 67.57 E, 15.5.1963 Khamidkhojaev 13; TASH); valley of Sangardak river, heights of river Ka-su (2400-2800 m, 04.6.1948 Pyataeva 189; TASH), near vill. Takhcha, E exposed slope (29.5.1948 Bondarenko 750; TASH); drainage of Tupolang river near vill. Khurvatang, NE slopes on right banks of Khurvatang river (10.8.1947 Pyataeva 82; TASH), heights above the Chilik-su to the glaciers (28.6.1948 Pyataeva 784; TASH), right banks of Malyand river, vill. Malyand (17.6.1948 Pyataeva 446; TASH). Baisun ridge, N exposed slope (03.6.1928 Yakimova, Moskvina 671; TASH), at begin of Ketmen-chaply Mts., Juniperus forest (24.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 332; TASH), Aulat, slopes of Ketmen-Chaply Mts., Juniperus forest (22.5.1930 Lepeshkin; TASH). Kugitang ridge, village Upper Panjob, in a garden under fruit trees (38.01 N,



66.50 E, 1150 m, 10.6.2006 Fritsch, Khassanov 4238; TASH (coll.); location Tangi-Duval 10 km above vill. Khamak (14.5.1978 Nabiev, Li, Tsukervanik 115; TASH); W exposed slopes, gorge of Gurum-sai, in the shadow of Juniperus (15.7.1935 Gnezdillo 127, 35; TASH), in Juniperus forest apposite vill. Khoja-fil'-Ata (07.5.1915 Popov 516, 737z; TASH). Kurama ridge, Altyn-Topkan Mts. 3.5 km E of the ores, W exposed rubble slope (40.39 N, 69.35 E, 17.6.1953 Vernik, Nabiev, Tsukervanik 329; TASH), above town Altyn-Topkan left of way to Taboshar (40.39 N, 69.35 E, 29.4.1962 Adylov, Tsukervanik 29; TASH); valley of Abzhaz (Abiyaz) river, konzavod 68, right bank of Abiyaz river (19.6.1936 Fedorova 78; TASH), Abjazzsai, Juniperus associations (1800 m, 07.9.1956 Li, Kamanov 23; TASH); left part of Angren river, near vill. Bash-kutan, hilly slope of the mountain top (24.5.1926 Berezin 1521, 1522; TASH), valley of Angren river, near vill. Telyau (31.5.1931 Butkov 176; TASH). Chatkal range, in gardens near vill. Samsarak (41.15 N, 69.49 E, 05.5.1974 Levichev, LE-Lev); Chatkal reservation (1200 m, 07.6.2002 Tojibaev 4103; TASH (coll.)). Saravshan range, Aman-Kutan forest dacha, near the spring in the Karagach-sai (39.19 N, 66.56 E, 25.5.1933 Drovov, Sakhabutdinov 46; TASH), Yul sai near Amankutan, W exposed slopes (39.19 N, 66.56 E, 17.5.1936 Nikanorov; TASH), near vill. Ak-sai, heights near river Ak-sai (10.-15.5.1931 Butkov A. 173; TASH), near vill. Urgut, heights near gorge Sajlyk, stony slope near pass Sarni-tal (06.6.1936 Gnezdillo 169; TASH), gorge Taglyk, on the bottom (09.6.1936 Gnezdillo 203; TASH). W foothills of Saravshan range, way from pass into the valley of Kuznchi river (29.6.1937 Granitov, Dolgikh 273; TASH). Malguzar massif 30 km E Jizzak, rocks (1250 m, 27.6.2001 Khassanov 4046; TASH (coll.)); Archali Mts., location Astash (01.6.1984 Khalkuziev, Shermatov, Makhmedov, Gaffarov 17; TASH), location Baras, stony slope of gorge (07.9.1937 Demurina 1633, 1634; TASH); heights near river Sanzar, valley Tugan-bulak (02.5.1938 Demurina; TASH), drainage of Sansar river, valley of Kzyl Kuruk river, Juniperus forest (28.7.1934 Gomolitskij 308; TASH), Kurche-tau Mts., gorge Andaraksai near gorge Rusalaksai (30.4.1927 Granitov 233; TASH). Turkestan range, drainage of Saamin-su, foothills near vill. Bish-Kubu, Ak-Tash-sai (21.5.1935 Zakrzhevskij 100; TASH); drainage of Guralash river, Khayr-chink-katy (01.7.1934 Zakrzhevskij 189; TASH), location Gurolash 7 km from meteorol. station (28.6.1955 Demurina, Bulgakova TASH), reservation Turalash, left side of Tyua-Tash-sai (26.6.1945 Pazij; TASH). Kitab State geol. reservation N vill. Kurgan above Tumlaki (?) (1600 m, 30.6.1987 Soldatova 75 ?; TASH), Khojakurgansai, Sangi-likov (20.5.1981 Karabalaeva, Khalimov 5; TASH). Tashkent town, garden Makhram str. 8 (41.20 N, 69.18 E, ??5.1921 Vvedensky; TASH). West Tien Shan, drainage of Nurak-ata river, in a gorge near vill. Nurakata (13.7.1953 Tujchiev 643; TASH). Nuratau ridge, N slopes of Kichik-sai (15.6.1956 Saprometova 221; TASH). - Uzbekistan ?; Babatag massif, NW exposed slopes N Onarbulak-sai (18.5.1941 Lopott, Pinkhasov 451, 469; TASH).

**Determination unsure:** - Kazakhstan: Chu-Ili Mts., Anarkhaj Mts. between vill.s Rajsai and Kopaly-slem (?), stony rubble slopes with rocky outcrops (23.6.1968 Puchkova 207; TASH). - Kyrgyzstan ?; S slope of Alai range, E part of vill. Majda-Teryak, in and nearby gardens (2300 m, 08.-13.7.1963 Chukavina, Bakhmut, Mansurov 374; LE TAD). - Tajikistan: Central Hissar range, drainage of Varzob river, Kharangon valley above vill. Dara, loamy place under shrubs below the crest (38.42 N, 68.53 E, 2400 m, 20.5.1987 Fritsch 178; GAT), Kondara canyon 37 km N Dushanbe, wet scree slope (38.49 N, 68.48 E, 1250 m, 18.2.2002 Kurbonova, Hisoriev 6022; TAD (coll.)), Majchura valley c. 5 km above the mouth, lower part of a loamy gneiss slope (39.02 N, 68.47 E, 2000 m, 19.5.1987 Fritsch 167; GAT). Crest of Gazimailik ridge near Mt. Mundytau (38.01 N, 68.28 E, c. 2180 m, 13.5.1990 Pistrick, Fritsch 458; TAD). Khozratishoh range, pass Shar-shar along the road to Kulyab, open place on SW exposed slope (1250 m, 07.5.2005 collectors unknown 6174; TAD (coll.)). Vaksh range, N slopes of Kugitek Mts. along river Obi-Masar c. 20 km NE Khovaling (38.27 N, 70.04 E, 1900-2200 m, 03.8.1988 Fritsch 312; GAT). Peter I. range, Obikhingou valley, slope near the road below vill. Lyangar, among shrubs and tall forbs (38.54.18,7 N, 71.01.03,0 E, 2080 m, 29.6.2006 Keusgen, Fritsch, Hisoriev 6253; TAD (coll.)), terraces along Obikhingou river near vill. Layroni Pojon, among tall forbs (38.53.25,7 N, 70.55.42,5 E, 2000 m, 25.6.2006 Keusgen, Fritsch, Hisoriev 6237; TAD (coll.)). Khozratishoh range, Childukhtaron near height of upper tributary of Obi-Surkh (29.7.1969 Kamelin, Abdukhamidov; LE). Turkmenistan: Kugitang ridge, Khoja-Pil' (06.6.1966 Kazanov; ASH), without location (12.6.1939 (?) Androssov 261; ASH). - Uzbekistan: Nuratau ridge, stony slopes of gorge Mazhrumsai (19.6.1969 Mambetzhumaev 216; TASH), on the bottom of gorge Alichaksai (26.5.1969 Mambetzhumaev 42; TASH).

***Allium subkopetdagense* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch**

Turkmenistan: Central Kopetdag range, Chuli, 1 km S spring Chulinki, rubble slopes (37.57 N, 58.00 E, 14.5.1963 Arutjunov, 24.5.1963 Jakovleva, Arutjunov; ASH); Germab (31.5.1889 Antonow; LE); SE foothills of Kelyat Mts., rubble slopes (800 m, 21.5.1954 Markova, Medvedev; LE). Kopetdag reservation, near way from Mergen-Omy to Kurkulab (03.6.1981 Kamakhina, Smirnova; ASH). W Kopetdag range, environs of Charlauk (19.5.1972 Ashirova, Orasev; ASH); Khoja-Kala to Bami (11.5.1886 Radde ? 292; LE).

**Determination unsure:** - Turkmenistan: Central Kopetdag range, between Chuli and Cheekol (37.57 N, 58.00 E, 03.6.1963 Nikitin; ASH). Geoktepe district, S street Kurkulab - Mergen (25.5.1949 Nikitin; ASH), (03.6.1981 Smirnova; ASH), Kara-Agach (18.6.1969 Meshcherjakov; ASH), Karagachi, near river Sekis-yab, dry slopes (16.5.1986 Sejfulin; ASH). W Kopetdag range, Nokhur (38.30 N, 57.05 E, 23.5.1959 Meshcherjakov; ASH). Kazanjik district, Mt. Kushlyuk (21.4.1959 Ishchenko; ASH).

***Allium suworowii* Regel**

Kazakhstan: Kirgiz Alatau range, mountain along river Choldavar (28.7.1924 Popov, Mokeeva 1130; TASH); Chu-Ili Mts., Kurdai pass area (43.21 N, 75.00 E, [no collector]; FRU). - Kyrgyzstan: Turkestan range, location Uzgorush, W slopes (26.5.1963 Gorbunova; FRU), location Beles Mazar, near river (25.5.1963 Gorbunova; FRU). Fergana range, drainage of Zarger-sai, river banks near the last bus stop of vill. Zarger (40.55 N, 73.30 E, 17.5.1990 Gazybaev, 249; TASH). Alai range, vicini-

ty of Osh, Kolundy, gorge Tagi-Tagob (16.5.1978 Sharipova, Savchenko; TAD). Kirgiz Alatau range, river Tujuk (22.5.1969 Ajdarova; FRU), location Kichik-Kaindy (10.6.1988 Kashkaraeva FRU). Talas Alatau range, location Kara-Archa, meadow near river (30.5.1959 Sudnitsyna; FRU). - **Tajikistan:** S slopes of Kurama ridge, heights near sai Ishum (2200 m, 07.6.1948 Sidorenko 384; TAD). Foothills of Turkestan range near town Ura-tyube (22.5.1958 Soskov; TAD). Central Hissar range, drainage of Varzob river, left bank of Takob river (1550 m, 12.5.2002 Chevtaeva, Astanova; TAD). ridge S Kondara valley, loamy slope (38.49 N, 68.48 E, 1300 m, 16.5.1987 Fritsch 141; GAT); foothills between the rivers Dyushambinka and Khanaka near the union of both (25.5.1930 Kurdryashev 58; TASH). S slopes of Karategin ridge, reservation Ramit (38.45 N, 69.18 E, 13.5.1987 Kochkareva, Zhogoleva 16102; TAD), left side valley of Kholmon river, grassy gritty creek terrace (38.45 N, 69.18 E, 1120 m, 14.5.1987 Fritsch 157; GAT). Gazimailik ridge c. 35 km NW Kurgan -Tyube, location Obodkan ca. 10 km NW vill. Ganjino, sandstone (38.02 N, 68.34 E, 1600 m, 12.5.1990 Fritsch, Kudratov, Pistrick 187; GAT), near vill. Zarangbulak (1900 m, 30.5.1939 Tazba 605; TAD), In montis prope Choshbulak ad orientem versus a montibus Gasi-Majlik inter fluvios Wachs & Kafirnigan (4-5000', 07.-19.5.1883 Regel A. LE). Vakhsh mountain range, E slopes of Terekli-tau Mts., near vill. Khoja-Kurelay (10.5.1967 Popov, Krasil'nikov 475; TAD); S slopes of Mt. Khoja-mumin (750 m, 19.5.1977 Chukavina, Chevtaeva 7223; TAD), N slopes of Khoja-Mumin, among Pistacia (37.44 N, 69.39 E, 950 m, 24.5.1976 Chukavina, Chevtaeva, Amanova 6925; TAD); right bank of Vakhsh river, SE slopes of Surkho massif 10 km NE Tutkaul (1400 m, 18.5.1962 Chukavina, Bakmut, Patashev 223; TAD); Chal-tau Mts. near vill. Kara-sangou (1200 m, 14.5.1957 Zapryagaeva 3514; TAD). - **Turkmenistan:** Kugitang ridge, 2 km N vill. Khoja-Pil', wheat field (18.6.1967 Chopanov, Ataev; ASH), 2 km E Khoja-Pil', margin of wheat field (04.6.1973 Gudkova, Sukhova; ASH); plateau (24.5.1969 Ataev; ASH). Badkhyz region, Kushka, wheat field (35.17 N, 62.20 E, 06.4.1916 Androssov; ASH); Gaz-Gjadyk (15.5.1973 Chopanov et al.; ASH), Gaz-Gjadyk Mts., slopes near pass Pakhtatur (23.5.1971 Sejfulin, Pirmijazov; ASH). - **Uzbekistan:** In valle fl. Syr-Darja prope st. Tschinaz (12.5.1923 Kaschkarov, G); Uralsk (no date, Burmester; WU). Tashkent, Chilanar, abandoned pioneer's camp near hospital Zhukovsky (30.4.1986 Levichev; LE-Lev). Ad declivia argillosa secus canalem Salar prope urbem Taschkent (08.5.1925 Vvedensky 181; B). W Hissar range, drainage of river Kashka-darya, river Igrisu downwards, 15 km from vill. Ak-kishlak (05.7.1955 Pyataeva 1592; TASH), in the Uradarya valley 10 km from Igrisu (22.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 190; TASH). SW Hissar range, Sangardak drainage, gorge Khondiza near vill. Densurkh-Dibadon (16.5.1983 Turkestan group 2517; LE).

**Determination unsure:** - **Tajikistan:** Central Hissar range, drainage of Varzob river, Varzob canyon near vill. Navobad, on red sandstone (1350 m, 06.5.2005 collector unknown 6175; TAD (coll.)); Kondara valley, on the crest of S slope in E exposition, in the shadow of planted Rhus trees (38.48.27,6 N, 68.48.13,5 E, 1300 m, 18.5.2003 Kurbonova, Hisoriev 6116; TAD (coll.)); Vakhsh mountain range, pass Shar-shar near the road to Kulyab (1600 m, 14.5.2005 collector unknown 6176; TAD (coll.)); right bank of Vakhsh river, SE slopes of Surkho massif 12 km E Tutkaul (1300 m, 16.5.1962 Chukavina & al. 202, 203; LE). - **Uzbekistan:** Turkestan range, Zomin valley, meadow at the ground of valley in a cemetery (39.37.53.0 N, 68.29.28.4 E, 2036 m, 21.5.2009 Keusgen, Khassanov 4296; TASH (coll.)). Inside the town Jizzak; very common in the whole area at ruderal places (23.03.2009 Keusgen, Khassanov 4276; TASH (coll.)). 4-5 km W Shakhriyabz, higher place between swamp (16.6.1927 Kul'tiasov, Granitov 627; TASH).

***Allium taeniopetalum* subsp. *mogoltavicum* (Vved.) R.M. Fritsch & F.O. Khass.**

**Tajikistan:** Mogol-Tau massif, Mt. Spa (11.5.1985 Zhogoleva 5744; TAD), S side summit of Mt. Spa, rock slope, Amygdalus spinosissima association (40.18 N, 69.27 E, 1260 m, 31.5.1990 Fritsch, Kudratov, Pistrick, Turakulov 574; GAT); gorge E of Mamransai gorge (40.47 N, 69.30 E, 04.5.1927 Granitov 349; TASH). - **Uzbekistan:** Chatkal range, Bashkzyyl-sai, left bank, location Alkazar, N exposition (1200 m, 09.5.1981 Levichev, Krasovskaya; TASH), foothill of Alchazar (1300 m Krasovskaya 26; LE TASH), steep slope facing field base, xeromesophytic shrub (41.14 N, 69.50 E, 13.6.1986 Levichev 140; TASH), Chatkal reservation, nearby the river (900 m., 07.6.2002 Tojibaev 4102; TASH (coll.)), valley of Angren river, sai Kichking-Yangoklik (16.6.1952 Rodina 33; TASH); area between rivers Angren and Chirchik 3 km SW vill. Tash-sai, soft N slope of high adyr (30.5.1953 Majlun, Slovinskij 607; TASH).

**Determination unsure:** - **Kyrgyzstan:** N foothills of Turkestan range, N slope of Mt. Uzungyr (08.5.1941 Pryakhin; TAD), near pass Tagop (27.4.1941 Pryakhin; TAD). - **Tajikistan:** N slopes of Turkestan range, location Kyzyl-Shangi (2000 m, 21.7.1967 Konnov 2455; TAD). - **Uzbekistan:** Chatkal range, Bash-kyzyl-sai, stony slope (41.14 N, 69.50 E, 28.6.1974 Levichev; TASH); Angren area, Yangaklyk sai, tall forbs and rocks (06.7.1954 Neustrueva-Knorrng 93; LE).

***Allium taeniopetalum* Popov & Vved. [subsp. *taeniopetalum*]**

**Tajikistan:** Turkestan range, N slopes, drainage of Shakhristanriver, mound of Kusavli-sai (39.35 N, 68.39 E, 18.6.1970 Kamelin 190; LE). N premountains of Turkestan range, near vill. Tagop (02.5.1941 Pryakhin; TAD). - **Uzbekistan:** Turkestan range, Jizak area, gorge Archa-Majdan-sai (19.7.1914 Michelson; LE); foothills near the way from Zaamin to vill. Besh-Kudu (21.5.1937 Korotkova, Vasil'kovskaya 66; TASH); lower part of Kul'-sai, Chertanga (14.6.1938 Korotkova 125/a; TASH), 2 km S from the base of reservation in Kul'-sai, gorge Chortang (10.7.1945 Pazij; TASH); Timur gates, rocks (600 m, 25.6.1999 Khassanov 4048; TASH (coll.)); Malguzar ridge, way down from pass Chal on the N slope (1900 m, 04.6.1929 Emme 204; LE). Nuratau ridge, N slopes, gorge Gurdara near vill. Sarymsak (23.6.1971 Botschantzev, Kamelin 344; LE), slopes of Kojtash Mts. (28.5.1941 Lepeshkin TASH), S slopes near vill. Kojtash, near summit (40.12 N, 67.20 E, 28.6.1971 Botschantzev, Kamelin 598; LE); Nuratau reservation, Khayatsai, above end of nut stands (1400 m, 16.8.1978 Korshupov LE), Khayat-sai (?) (???.1976 Abrasimov LE); Ambulatorium sai, 2 km W Kyzylcha (700 m, 20.5.1960 Zaprometova, Nikerov 202; LE), state farm Kzyl Cha, bottom of gorge (01.5.1957 Novikova TASH), NE slope of Mt. Karandas (1500 m, 09.6.1982 [collector missing] LE-Lev). Ak-tau ridge near kolkhoz Chay, near water spring (01.6.1951 Gorokhova; TASH), from Utaksai to vill.

Lyangar (40.22 N, 66.01 E, 02.6.1951 Neustrueva-Knorring, Tsvetkova 60a; LE), near vill. Ljangar, under the trees (40.22 N, 66.01 E, 1200 m, 24.4.2001 Khassanov 4047; TASH (coll.)), Bakhiltau Mts. Kurtkasai (29.4.1977 Kamelin et al.1977; LE).

***Allium taeniopetalum* subsp. *turakulovii* R.M. Fritsch & F.O. Khass.**

Tajikistan: N slopes of Turkestan range, valley of Byurogan-sai, location Er-Tegermel (2100 m, 17.6.1958 Konnov 1046; TAD). **Determination unsure**: - Kyrgyzstan: N foothills of Turkestan range, S slope of Mt. Uzungyr (04.5.1941 Pryakhin; TAD). - Uzbekistan: Turkestan range, Zaamin valley nearby sunstation; SW slope, within bushes (1700 m, 14.6.2005 Khassanov, Tojibaev ? 4226; TASH (coll.)).

***Allium tashkenticum* F.O. Khass. & R.M. Fritsch**

Kazakhstan: Aksu Jabagly reservation, Novo-Nikolaevka near the way to Jestysai (42.26 N, 70.29 E, 1300 m, 03.6.1976 Levichev; TASH). Tashkent area, Kaplanbek hills (41.30 N, 69.15 E, 27.5.1920 Popov 300; TASH). - Uzbekistan: Town Tashkent, garden at street Boz-su (?) (41.20 N, 69.18 E, 07.5.1920 Drobov; TASH). Chatkal range, Aksakata river, near the road (41.22 N, 69.54 E, 1450 m., 24.8.2001 Khassanov 4035; TASH (coll.)), Ad declivia saxosa montis Tschimgan minoris (41.24 N, 70.05 E, ? 24.6.1923 Baranov 74; TASH, 25.7.1926 Baranov, Rajkova; TASH, 30.6.1926 Popov, Vvedensky 342; TASH LE G, 15.7.1920 Vasil'ev; TASH); Aksai, shiny places (41.31 N, 70.02 E, 1650 m, 20.4.2001 Khassanov 4015; TASH (coll.)), chalky pass (08.7.1956 Tsukervanik 745; TASH). Chatkal reservation, Bashkyzylsai part, near the third pheno-place (1700 m, 17.6.1976 Levichev; LE), above the field base (1250 m, 15.7.1975 Krasovskaya; LE), middle part of Shavazi-Kalon sai, damp defile (10.6.1953 Nazarenko; TASH), Shavazi-Kurt sai (1200 m, 10.6.1966 Lopot; TASH), place not mentioned (1400 m, 05.6.2002 Tojibaev 4100; TASH (Coll)). Chatkal range, Akcha-sai, N slope of a hill, Amygdalus shrub (05.7.1939 Kudryashev 449; LE); right banks of Akbulak river, right side of Sargardon sai (03.7.1963 Puchkova 35; TASH). Left bank of Angren river between locations Shaugaz and Kara-mazar, zone of *Inula grandis* (40.50 N, 69.51 E, 25.6.1924 Korovin 2474; TASH). **Determination unsure**: - Uzbekistan: 3.5 km WSW from vill. Tash-tepe, E slopes with shallow soil (21.5.1953 Butkov & al. 473; LE).

***Allium tokaliense* Kamelin & Levichev**

**Determination unsure**: - Kazakhstan: Karatau range, gorge Berkara (drainage of Bijlikul lake), stony slope (23.5.1963 Goloskokov, LE).

***Allium trautvetterianum* Regel**

Tajikistan: Vaksh mountain range, Bulon Mts. between Kurban-Shang and Dangara, 3 km from vill. Bulion, stony slopes (09.6.1960 Botschantzev, Egorova 1091; LE), right bank of Vakhsh river, Surkho massif 2 km E Tutkaul (800-900 m, 08.5.1962 Shibkova 728; TAD), Tutkaul (09.5.1906 Roshevitz 458; TAD LE), Sar-Saryak near Tutkaul (700 m, 18.5.1957 Zaprugaeva 3682; TAD), S slope of Surkho massif 2 km N Tutkaul (800 m, 07.5.1962 Chukavina, Potashev 89; TAD), Surkho massif, N slopes near vill. Khonoko (?) (1400 m, 04.6.1962 Chukavina & al. 326; LE TAD); right bank of Vakhsh river, Sipok-Tau Mts., E vill. Dagana (16.5.1967 Lazareva, Ryabkova 4114; TAD), Yakh-su drainage, right banks near vill. Khojai-Sharif, stony outcrops (1300 m, 28.6.1961 Stepanenko 248, 778; LE TAD); N end of Tabashi massif, Kaz-Syrgyzai Mts. 7 km S vill. Sangudy (960 m, 18.5.1955 Pryakhin 464; TAD); right banks of Panj river, mountains E vill. Bag, S stony slopes (31.5.1960 Botschantzev, Egorova 713; LE), 1 km S vill. Sebanda, rocks (1100-1200 m, 09.5.1964 Koval'chuk 179; LE). Khoz-ratishoh range, 3-4 km S vill. Sarygor, near river Kaferkash (1350 m, 02.6.1961 Soskov, Yunusov 462; TAD LE); 6 km NE of vill. Iol, middle part of river Avtov-zamin (37.46 N, 70.12 E, 1500 m, 17.6.1961 Soskov, Yunusov 1421; TAD).

***Allium tschimganicum* [B. Fedtsch. ex] O. Fedtsch.**

Kyrgyzstan: Talas valley, summit of Ichkeletau Mts., on limestone (12.6.1974 Kamelin 1287; LE). - Uzbekistan: Ugam ridge, location Kyzyl-Tal, left banks of Ugam river, subalpine meadow (09.6.1977 Bulgakova 53; TASH); Nauvalisai, forests (41.44 N, 70.04 E, 950 m, 13.8.1999 Khassanov 4044; TASH (coll.)). Pskem ridge, Aksar-sai 3 km ? from vill. Sanaj (22.6.1966 Vybornov 76; TASH). Chatkal range, Mt. Great Chimgan, near melting snow patches (41.30 N, 70.04 E, 25.6.1959 Botschantzev 526; LE), gorge of Mt. Great Chimgan (22.6.1923 Baranov 52; TASH), mountains below pass Adjas (?) (23.6.1924 Korovin; TASH), in a dry sai on the way to an old mine (10.6.1956 Tsukervanik 269; TASH), slopes of Chimgan Mts. near chalky pass (09.6.1966 Filimonova; TASH); Sukok, forests (41.15 N, 69.49 E, 1300 m, 15.5.1994 Umarov 4029; TASH (coll.)). Chatkal reservation, forests (1200 m, 07.6.2002 Tojibaev 4107; TASH (coll.)), Mt. Minora, near salt place (1900 m, 20.5.1977 Levichev; TASH), above the spring (2290 m, 16.6.1973 Levichev; LE-Lev), Mt. Minora (01.8.1973 Levichev; LE-Lev), (2270 m, 15.7.1973 Levichev LE-Lev), Mt. Tokali major (2600 m, 02.6.1975 Levichev; TASH), crest of W descend (17.6.1974 Levichev LE-Lev); phenological ridge, 2. phenoplace, among apple trees (1400 m, 14.5.1976 Levichev; TASH); Bash-kyzyl-sai (41.14 N, 69.50 E, 10.5.1987 Levichev; LE-Lev), left bank of Bashkyzylsai opposite the field base, among shrubs (41.14 N, 69.50 E, 1200 m, 08.5.1973 Krasovskaya; TASH), Shabashi-Kurt sai, dry bottom of gorge (41.14 N, 69.50 E, 1200 m, 10.6.1966 Lopot; TASH); Chatkal range, near vill. Kumyshkan E Parkent (05.6.1966 Filimonova; TASH). Kurama ridge, fork of Katta sai, among *Juniperus* (29.5.1954 Vernik, Nabiev 183; TASH), Abuzhajasai, among *Juniperus* at right banks (26.5.1954 Vernik, Nabiev 143; TASH). Right banks of Angren river, heights of river Shavas, shrub belt (19.6.1924 Korovin 281; TASH).

***Allium tulipifolium* Ledeb.**

Kazakhstan: Kazakh Altai range, Azutau Mts. (S foothills), Sargalim section, crushed stone sections, S slope (11.5.1984 Kotukhov; B). Steppe W Zelinograd (06.6.1984 Gutte; GAT). Termenbes Mts. near right bank of lake Aral, at saline gypsum (31.5.1965 Soskov, Duskabilov 652-26; TAD). Ili lowland 20 km S Kapchagaj (N Alma-Ata), *Eremurus* semidesert, gentle slopes of a hill ridge (43.44 N, 77.05 E, 12.5.1985 Hanelt; GAT). Temirtau NNW Karaganda, hill slopes N water reservoir, rubble slope (750 m, 09.5.1980 Hanelt; GAT). Ilijsk (17.4.1877 Regel A. 222, G). Aktyubinsk, Bolshie Barsuki, prope station-

nem viae ferreae Czelkar, in arenis (14.5.1908 Androssov 4256; TAD W). Near lower Lepsa river and lake Baskan-kul', hardened sands 1 km NW vill. Baskan (46.00 N, 79.30 E, 21.6.1934 Linczevskij 30; LE). Kurty sands (23.-24.5.1930 Nikitin; LE). **Determination unsure:** Kazakhstan: Soongoria, between Semipalatinsk and Ajagus (16.-20.5.18?? Schrenk; W). Area between the rivers Uil and Emba, S Temir (47.22 N, 56.20 E, 24.5.1926 Knorring 2; TAD).

#### *Allium verticillatum* Regel

Kazakhstan: "Pritashkentskie Chuli" between Stepnoe and Darbaza (41.34 N, 69.05 E, 26.5.1987 Levichev; TASH), Kaplanbek, hills (41.30 N, 69.15 E, 29.5.1920 Popov; TASH), (41.30 N, 69.15 E, 1500', 05.6.1921 Abolin 7575; TASH), (41.30 N, 69.15 E, [no collector] TASH). Chimkent region, Ak-tash (24.5.1908 Minkwitz 172; LE TASH), between station Chapak and well Uzun-kuduk (17.5.1926 Jarmolenko 200; LE). Syrdarya lowland, hills near railway station Arys, among Artemisia (25.5.1923 Mokeeva TASH). - Kyrgyzstan: Turkestan range, valley of Khoja-Bakirgan river, on stony hills (??6.1949 Obidov; TASH). - Tajikistan: Kurama ridge, Mogol-Tau massif, gorge Kiz-Bibi (900 m, 15.5.1956 Zapryagaeva, Chukavina, Plekhanov 1316, 1337; TAD), heights of Karangul sai, NW slopes (17.5.1964 Tsukervanik 98; TASH), mountains near Mt. Barsa? (18.6.1918 Popov, Vvedensky 100, 100a; TASH), on the bottom from Uch-bag site (07.5.1924 Popov, Vvedensky 438; TASH). N slopes of Turkestan range, lower part of Byurogan-sai (1800 m, 16.6.1956 Konnov 361; TAD). Hissar range, drainage of Varzob river, crest of a ridge S Kondara valley (38.49 N, 68.48 E, 1580-1650 m, 02.6.1987 Fritsch 219; GAT). Kurama ridge, S slopes near station Ramit (38.45 N, 69.18 E, 1250 m, 26.6.1962 Kirillova, Karimova 11; LE). N slopes of Saravshan range, right banks of river Kshtut N vill. Shishkat (1650 m, 14.6.1961 Strizhova 466; TAD). SE foothill of Baba-Tag massif, between heights 1685 & 1828 m, location Davlya-Bulak (08.6.1962 Soskov, Shibkova, Ismatova 743, 805; TAD). E end of Gazimailik ridge, pass-like area (20.6.1951 Ovczinnikov 289; TAD); W slope of Gazimailik ridge W Ganjino (37.58 N, 68.34 E, 1200 m, 06.6.1976 Karimova, Kashanova 666; TAD). Vakhsh mountain range, S end of Darvaz range, 2 km E vill. Kodara (1700 m, 18.5.1932 Zapryagaev, ? 140; TAD), 3 km W bridge over Kysyl-su, on slopes (27.5.1960 Botschantzev, Egorova 579; LE), E slopes of Karatau ridge opposite mouth of Kyzyl-su between Kirovabad and Parkhar (1100 m, 28.5.1960 Yunusov 1442; TAD), valley Sardai-bulak, on the top of crest (19.5.1967 Popov, Krassilnikov 309; TAD), Mt. Khoja-Maston (20.6.1986 Botschantzev, Kinzikaeva 6228; TAD). Karshi-tau Mts. 5-7 km NE vill. Marpaya (c. 1000 m, 10.6.1960 Kudryasheva, Stotskij 508; TAD). W slope of Jetysh-Tau Mts. 5 km NE vill. Kurdai-Shaid (1800 m, 09.6.1960 Yunusov 1882; TAD). - Turkmenistan: Kugitang ridge, Khojapil' (37.56 N, 66.40 E, 23.5.1985 Raenko; ASH), 2 km E Khoja-Pil, slopes (04.6.1973 Sejfulin; ASH), vill. Khoja-filata (2100 m, 21.6.1967 Kinzikaeva, Yunusov 662; TAD), near spring Myrzavedil (23.5.1985 Raenko; ASH), near kolkhoz Frunze (31.5.1973 Sejfulin; ASH). Uzbekistan: Tashkent area, slopes to the Chatkal river near vill. Brichmulla (18.7.1921 Drobov 146; TASH), near Yusun-kan. (18.6.1921 Bulgakov 82; TASH). Foothills of (Ka=Nu)ratau, NW slopes (20.7.1931 Kasimenko 725; TASH). Nuratau ridge, Karachka-tau Mts., N slopes 2.5-3 km NE vill. Yukary-Kariya (06.7.1937 Demurina 539; TASH), foothill plain 2 km NE vill. Kauncha (07.7.1937 Demurina 442, 450e; TASH), S slopes of Koj-Tash Mts., stony S slopes 5-6 km W vill. Gujum (23.7.1937 Demurina 719!; TASH), 1.5 km N vill. Gujum, S slope (04.7.1937 Kakarchuk 514; TASH), 2-3 km SE vill. Jangak (30.6.1937 Demurina 345a; TASH), 2-3 km from vill. Kok-bulak, N slopes with some large slate outcrops (18.7.1937 Demurina 599; TASH), location Beretek (40.12 N, 67.20 E, 28.5.1940 Gomolitskij, Dolgikh 46; TASH), heights near Ostan-sai (40.12 N, 67.20 E, 07.8.1932 Botschantzev; TASH); Urganji (01.5.1913 Korovin 10; TASH); rayon Farish (41.23 N, 66.50 E, 19.-21.5.1941 Momotov; TASH). Aktau ridge, pass Tikalik (1600 m, 14.6.1951 Gorokhova; TASH); Kuratash Mts. near Lyangar, Yangogly (=Juglans regia) (40.22 N, 66.01 E, 19.-21.5.1941 Zakirov, Niyazov; TASH), sai Ingichke 22 km E Nurata town (26.6.1971 Botschantzev, Kamelin 486; LE), 7-9 km S vill. Chiya (?) (41.27 N, 69.35 E, 01.7.1937 Demurina 405; TASH), Aktau ridge (29.5.1983 Khajdarov 1621; TASH). Turkestan range, Malguzar ridge, Tamerlan Gate, slopes with shallow soil (40.04 N, 67.40 E, 17.5.1980 Nabiev et 3 al. 5; TASH), NE slopes of Turkestan range, near Jizak (26.5.1931 Ksimenko, 734; TASH); N foothills of Malguzar ridge 4 km SW vill. Kulyan-Kaly, near the way to vill. Zagara (06.6.1940 Gomolitskij, Dolgikh 126; TASH). N slopes of Saravshan range near vill. Urgut, stony slopes (23.6.1929 Drobov 2; TASH), Urgut (3800', Komarov; LE), Mt. Alla-yaran (25.6.1929 Drobov 45; TASH), near vill. Char-chik, on top of Mt. Allya-Ajran (06.6.1936 Gnezdillo 150; TASH), middle part of Amankutan, on S rubble slopes (39.19 N, 66.56 E, 26.5.1933 Drobov, Sakhabudtdinov 63; TASH); W foothills of Saravshan range, mountains E vill. Mironkol, watershed between rivers Agomi and Mironkol (?) (24.6.1937 Granitov, Dolgikh 208; TASH); NW Saravshan range, near vill. Chashtepa, Kushbut (Kumtut?) sai (09.6.1973 Nabiev, Pratov, Shermatov 176; TASH); pass Takhta-Karacha, stony rubble slope (39.18 N, 66.55 E, 18.5.1980 Nabiev, Shermatov, Kazakbaev, Levichev 79; TASH), Kyr-tau W pass Takhta-Karacha, pass Kajra-Gusar, S & E rubble slopes (1450 m, 19.6.1937 Granitov? 143; TASH). Shakhriyabs, Gilyan (39.04 N, 67.27 E, 6700', 07.6.1896 Lipsky 625; LE). Foothills of Hissar range, Kshtut rayon, row of hills right of blue gorge (03.6.1939 Smirnova, Juraev; TASH). Hissar range, Chakki Mts., Mt. Sutan-Khazrat, rocky outcrops (20.5.1980 Nabiev et 3 al. 150; TASH); Kitab reservation, right banks of Dzh-darya (1400 m, 04.6.1987 Soldatova 12; TASH). W Saravshan range, S slopes, heights of Kuruk-sai (08.7.1938 Kudryashev, Sumnevich 788; TASH); valley of Aksu river, 8-10 km NNE vill. Merake, W slope (26.5.1941 Koshurnikova 19; TASH), valley of Ayakchi river near vill. Kopkan-agach (15.6.1954 Pyataeva 435a?; TASH), right bank of Guzar-darya river below vill. Ak-Kishlak, rocky limestone outcrops (02.7.1955 Pyataeva 1182, 1228; TASH), left bank of Guzar-darya river near vill. Ak-Kishlak (03.7.1955 Pyataeva 1297, 1305; TASH); valley of Guzar river near vill. Igru-Su, on stony shallow soil (28.6.1955 Pyataeva 1012; TASH). W Hissar range, mountains E Yakkabag, height of mountains SW vill. Uordan (Ufdan?) (05.7.1927 Kul'tiasov, Granitov 1013; TASH); heights of Yakkabag river near vill. Tash-kurgan, top of small plateau near the village (38.46 N, 67.15 E, 27.6.1936 Botschantzev, Butkov 449; TASH), saline sediment layers near location Kzyl-gaz ?? (38.46 N, 67.15 E, 21.7.1936 Botschantzev, Butkov 202; TASH), valley of Aksu river near vill. Gissarak (14.6.1954 Pyataeva 252; TASH); mountains S town Guzar, near Kzylchi (20.4.1935 Slovinskij? 252; TASH), 1 km N of vill. Khazara, on a steep slope (12.6.1937 Kudryashev 428; TASH), area N vill. Guli-Od 6-8 km

from vill. Gazarak, on the watershed (06.6.1958 Gringof 84; TASH); on the way from Derbent to Shurob (38.12 N, 66.57 E, 26.5.1941 Popova 519; TASH). SW Hissar range, pass Derbent between Derbent and Shurab, slopes with shallow soil (38.10 N, 66.59 E, 5.6.1980 Nabiev & 3 al. 639; TASH), near vill. Shurob, gypseous slopes (900 m, 29.4.1995 Khassanov 4008; TASH (coll.)), marine sediment hills near Baisun, location Guada-Dasht (13. 5.1930 Lepeshkin; TASH), 1 km E Baisun, loess slope among fields (07.6.1986 Kazakbaev, Levichev 117; TASH). Syrdarya, location Burduk, 3 verst W vill. Bajshi-kuduk (23.5. 1926 Kul'tiasov 408; TASH). N slopes of Ilikbash mountains ...? (29.5.1935 Kudryashev 309; TASH). Way from Dekhanabad to vill. Sajrob, foothills of Kugitang ridge (03.6.1964 Ovczinnikov, Zapryagaeva 6254; TAD); E foothills of Kugitang ridge, drainage of Shirabad river, 1.5 km SE vill. Lajlik (620 m, 15.4. 1965 Kayumov; TASH). W slopes of Kugitang ridge, lower frontier of Juniperus zone, near Burulak gorge (13.7.1935 Gnezdillo 118; TASH). Kugitang ridge, Pyanjob, on the way to Susyz-tau (27.5.1930 Lepeshkin; TASH). Baisun bekstvo, above vill. Shirzhan, grassy slopes (13.6.1916 Fedtschenko & al. 581, 581; LE). In collibus argilloso-arenosis prope stationem viae ferrae Kabul-sai (21.5.1926 Botschantzeva, Mokeeva HFIAsMed 244; TASH). Karacha-tau Mts. near vill. Sary-Bulak, hilly area (08.6.1929 Kudryashov; TASH). - Uzbekistan?: Turkestan range, Jalair gorge, stony slopes (1200 m, 26.5.1924 Emme 14; LE). Mountains between Jar and Zom-Taryl (?) (01.6.1919 Balabaev 310; TASH). Tashkent, Sakharyk, rubble-stony slopes near recreation house of Troitzky [part] (07.6.1951 Ziyatdikova; TASH).

**Determination unsure:** - Turkmenistan: Kugitang, canyon Hodjapil; rubble slopes (800 m, 08.6.2003 Kurbanov? 130; ASH (coll.)). - Uzbekistan: W Hissar range, Sarymasg Mts., slopes near the road on a small pass N Sairob, NW-exposed slopes, among rocks and in rock clefts (38.10.15,1 N, 66.58.47,8 E, 1300 m, 31.05.2006 Fritsch, Khassanov 4231; TASH (coll.)).

***Allium victoris* Vved.**

Kazakhstan: Boquet sold on the railway station Jilga (23.5.1936 Vvedensky; TASH). Chimkent region, on a red sandstone outcrop ca. 7 km E railway station Chanak (42.00 N, 69.00 E, 07.5.1941 Butkov; TASH). Kaplanbek, hills (41.30 N, 69.15 E, 17.5.1925 Ishimov; TASH). 10 km S Alymtau Mts., brown clay on small mountains of marine sediments (21.6.1947 Botschantzev; TASH).

**Determination unsure:** - Kazakhstan: Aulie-Ata, S Karatau range, drainage of Assa river (22.5.1925 Sovetkina 127; TASH).

***Allium viridiflorum* Pobed.**

Kyrgyzstan: Fergan range, Arkit sovkhov, sai at right banks of Arkitun river (41.50 N, 71.58 E, 08.9.1945 Knorring 321; LE). - Turkmenistan: Foothills of Kugitang ridge opposite vill. Kugitang (02.6.1931 Nevski 13; LE).

***Allium viridulum* Ledeb.**

**Determination unsure:** - Kazakhstan: Narym Mts., between springs of rivers Dsaksykel'dy and Konajkt, subalpine meadows (12.6.1931 Shishkin, Chilikina; GAT).

***Allium vvedenskyanum* Pavlov**

Kazakhstan: Chu-Ili Mts., Komuta river drainage, steppe (24.6.1926 Abolin 230; TASH), Ak-tas Mts., foothill plain of Konsai valley (06.6.1942 Goloskokov; LE), 15 km from crossing 83, clayey small mountains, grown in Bot. Garden Tashkent (11.5.1961 Filimonova 580; TASH), Korsuk, Argaita river drainage, steppe (12.6.1926 Abolin 20; TASH), pass Kur dai, grown in the Bot. Garden Tashkent (43.21 N, 75.00 E, 19.5.1965 [no collector] 1017; TASH).

**Determination unsure:** - Kazakhstan: SW foothills of Jungar Alatau range, Altyn-Emel Mts., on weedy places (12.6.1971 Tzagolova HFIURSS 5358 p.p.; JE).

***Allium winklerianum* Regel**

Kyrgyzstan: Alai mountain range, rayon Kizyl-kiya, Isfairam river drainage, Austan river valley, location Kamyrsa (17.5. 1930 Titov 25; TASH). - Kyrgyzstan?: Left bank of river Kursandarya, S slope (2200 m, 08.6.1984 collector unknown? 16; TASH). - Tajikistan: S slope of Alai range, sai Daraj-Khauz near vill. Khait (2700 m, 06.6.1963 Chukavina, Bakhamut, Mansurov 9; TAD), crest near sai Pizan (3800 m, 15.-20.7.1969 Chukavina, Bakhamut, Mansurov 401; TAD). Saravshan range, N slope to Saravshan glacier (39.27 N, 70.30 E, 22.7.1927 Drobov 348; TASH). Rushan ridge, Bartang, Rid-Dara (3700 m, 03. 7.1961 Agakhanyants 425; TAD). N slope of Peter I. range, sai Kharki-Kush 1.5 km NE of its union with Safed-Ob (2400 m, 15.6.1967 Potashev 12; TAD), 2.5 km NW vill. Lyuli-Kharvi (3200 m, 22.6.1967 Potashev 44; TAD), sai Nushor facing vill. Khait (2500 m, 08.6.1963 Strizhova 2462; TAD), sai Shurik (2800 m, 11.6.1963 Strizhova 2497; TAD), near vill. Khukhvak, upper part of watershed (2080 m, 29.4.1949 Zapryagaeva & al. 425; TASH), near vill. Ushturgel, upper terrace of Surkhob river (39.02 N, 70.35 E, 1400 m, 25.6.1949 Zapryagaeva & al. 283; TASH); N slopes near lake Kara-Kul (3100 m, 03.7.1949 Zapryagaeva, Zabolotskaya, Il'inskaya 604; TAD); S slopes of Peter I. range, between vill. Lengar and pass Gardani-Kaftar (2500 m, 21.6.1979 Kochkareva, Silap...? 12331; TAD), Mt. Gapsol (2980 m, 25.7.1949 Zapryagaeva & al. 1240; TAD); Obikhingou river valley, S slope near pass Gardani-Kaftar (3400 m, 13.7.1979 Krizberg, Filimonova; TASH). N slope of Darvaz range, below vill. Mijonadu (c. 3400 m, 18.7.1969 Strizhova 5025; TAD); W slopes of Darvaz range, heights of Obi-Ravnou river, location Gryt (2600 m, 01.7.1978 Zhogoleva (27)11890; TAD). Foothills of Karategin ridge, heights of river Ilyak near vill. Butgakion (1800 m, 12.6.1962 Popov, Stepanenko, Stotskij 861; TAD). S slopes of Karategin ridge 1 km E vill. Sangi-Manik (2500 m, 18.6.1966 Chukavina, Ashirmukhamedov 11126; TAD), 3 km N vill. Loyak (3000 m, 09.7.1966 Chukavina, Ashirmukhamedov 11388; TAD). S slopes of Hissar range, Kafirnigan valley, gorge Kanyaz, location Zor-Kamar (2300 m, 05.6.1952 Zapryagaeva, Stepanenko, Dodonova 557; TAD). N slopes of Hissar range, left banks of Anzob river 2 km above its mouth (2500 m, 11.7.1960 Strizhova, Grebennikova 54; TAD). Top of Hissar range 5 km SE pass Anzob (3100 m, 24.6.1958 Kaletkina, Filatova 9; TAD), c. 2-3 km SE pass Anzob (3200 m, ???.1978 Kaletkina; TAD). Central Hissar range, drainage of Varzob river, location Kok-kul in the height near river Lyuchob (3200 m, 10.7.1947 Pis'yaukova 187; TAD). Ku-

khistan, drainage of Fan river, height of Pas Rud, slope (39.08 N, 68.20 E, 13.6.1940 Zakirov, Popov, Sergeeva; TASH). Watershed between Vakhsh and Ilyak rivers, crest of Khojou-Dolon Mts. between vill. Yalanginor and Kahfnady (1400 m, 17.5.1961 Strizhova 263; TAD). Systema fl. Vakhsh, trajectus Guli-Zindan (ad austro-orientem a pag. Tutkaul), in rosario (29.5.1934 Botschantzev HFIURSS 5529a; W). Right bank of Vakhsh river, Surkho massiv near vill. Safedsyash (1800 m, 7.-9.6.1962 Chukavina, Bakhmut, Potaliev 359; TAD), crest of Surkho massiv near Darvaz range (2800 m, 15.7.1962 Chukavina, Bakhmut, Khamidov 474; TAD). N loess slopes of Mt. Khoja-Mumin (37.44 N, 69.39 E, 1200 m, 28.5.1978 Chukavina, Chevtaeva 7564; TAD); S loess slopes of Mt. Khoja-Mumin (37.44 N, 69.39 E, 1200 m, 09.5.1979 Chukavina, Karimova, 7801; TAD). Vakhsh mountain range, vicinity of vill. Khojanor (05.6.1937 Pryakhin TAD); W slopes of Sufai-mir-tau Mts. (2600 m, 01.7.1932 Gontscharov, Grigorjev, Nikitin 468; TAD); base of E slopes of Sanglok Mts. (17.5.1966 Kochkareva, Lazareva, Chukavina 904; TAD). - Uzbekistan: Shakhimardan river drainage, Bukan Mts., dry stony gorge near sanatorium (40.00 N, 71.47 E, 10.4.1966 Khalkuziev; TASH). - Uzbekistan ?: Hissar range, rayon Kshtut, pass Dukdon, sai Obi-darya, N slopes (39.05 N, 68.10 E, 3200 m, 21.6.1920 Smirnova, Ishmatov; TASH).

**Determination unsure:** - Tajikistan: S slopes of Peter I. range near vill. Katta-Guzor in direction to Khingou river (07.6.1966 Kochkareva, Kinzikaeva 1213; TAD). Rushan ridge, Baju valley, among grasses (2800 m, 08.6.2003 Hisoriev, Kurbonova 6128; TAD (coll.)). Darvaz range, Khobu-Rabat pass, E slope along the path near the soldier's post, SE exposition (38.37.31.7 N, 70.43.04.1 E, 3273 m, 08.8.2003 Hisoriev, Kurbonova 6119; TAD (coll.)). Saravshan range, heights of Saravshan river, Sary-Darbaza, in Crambe formation (41.52 N, 71.58 E, 14.9.1945 K. Zakirov; TASH).

***Allium zergericum* F.O. Khass. & R.M. Fritsch**

Kyrgyzstan: Fergan range, Baubashata Mts. near vill. Aktash, on red clay (19.4.1977 Batalov; FRU); sovkhos Kugart, river Kara-alma, right bank between mound of river Besh-yaitak, *Hordeum bulbosum* association (1500 m, 29.5.1945 Vipper; LE). Uzgen, Zerger river, within bushes (900 m, 25.5.1997 Khassanov 4016; TASH (coll.)).

**Determination unsure:** Kyrgyzstan: Sovkhos Kugart, location Besh-Ajgak, steppe (1500 m, 29.5.1945 Vipper 41; LE).

No additional herbarium vouchers (beside type vouchers in many cases) were seen of these taxa:

*Allium arkitense* R.M. Fritsch

*Allium bekeczalicum* Lazkov

*Allium chodsha-bakirganicum* Gaffarov & Turak.

*Allium cupuliferum* subsp. *nuratavicum* R.M. Fritsch & Beshko

*Allium decoratum* Turginov & Tojibaev

*Allium intradarvazicum* R.M. Fritsch

*Allium karataviense* subsp. *henrikii* Rukšāns

*Allium khozratense* R.M. Fritsch

*Allium kurdaicum* Bajtenov

*Allium sergii* Vved.

*Allium sochense* R.M. Fritsch & U. Turakulov

## Karyological Appendix

Additional chromosome data of some species of *Allium* subg. *Melanocrommyum* and *Allium oreophilum* from the Gatersleben collection

Chromosome numbers of 4 species and karyotypes of 15 more species are presented (based on altogether 27 accessions).

After having completed the manuscript of Fritsch & Astanova (1997), some karyological data not suitable for this publication remained, and some additional analyses were conducted in later time. These data may own some value to supplement hitherto known karyological data and were therefore arranged here in a very short form. The methods applied were already described in Fritsch & Astanova (1997). Vouchers for the accessions investigated are housed in herbarium Gatersleben (GAT). The classification of the chromosome morphology follows Agapova & Grif (1982): Short arm length in percent of the whole length m (metacentric): 50-37.5 %, sm (submetacentric) 37.49-25 %, and sa (subacrocentric) 24.99-12.5 %; true acrocentric (< 12.5 %) chromosomes were not found.

The author thanks Mrs. I. Faustmann and Mrs. B. Sperling for careful technical assistance.

***Allium alaicum* Vved.**

**2n = 16 = 12m+4sm**, Table A, total chromosome length:  $175.81 \pm 29.56 \mu\text{m}$

TAX 5676 Kirgizstan/Uzbekistan: Aravan (details see p. 133), 13 plates evaluated, SAT-chromosomes were not detected. It is the first count for this species.

***Allium aroides* Popov & Vved**

**2n = 16 = 15m+1sm**

TAX 5032 Uzbekistan: pass Takhta-Karachi (details see p. 198), 2 plates evaluated, SAT-chromosomes were not seen, 5 metacentric chromosomes were nearly sub-metacentric. Earlier counts of Vakhtina (1964a, 1969), Zakirova & Vakhtina (1974), Pogosian & Seisums (1992) are confirmed.

***Allium bakhtiaricum* Regel**

**2n = 16 = 14m+2sm(sat)**, Table A, total chromosome length:  $126.37 \pm 20.13 \mu\text{m}$

TAX 3924 Iran: Deh Cheshmeh, c. 5 km S Farsan, Bakhtiar Mts., 2000 m, (32°13' N, 050°32'37" E), 5 plates evaluated. It is the first count for this species.

***Allium caspium* (Pall.) M. Bieb. subsp. *caspium***

**2n = 16 = 13m+2sm+1sm(sat)**, Table A, total chromosome length:  $176.11 \pm 24.72 \mu\text{m}$

TAX 5715 Uzbekistan: Kyzylkum desert (details see p. 206), 6 plates evaluated. Earlier counts of Vakhtina (1964a, 1969, 1985), Vakhtina & al. (1977), Zakirova & Nafanailova (1990) are confirmed. The ideogram of Vakhtina (1969) shows another SAT-chromosome.

***Allium chychkanense* R.M. Fritsch**

**2n = 16 = 13m+3sm**, Table A, total chromosome length:  $171.848 \pm 6.80 \mu\text{m}$

TAX 5060 Kirgizstan: (details see p. 49), 5 plates evaluated, SAT-chromosomes were not detected. It is the first count for this species.

***Allium costatovaginatatum* Kamelin & Levichev**

**2n = 16 = 12m+2sm+2sm(sat)**, Table A, total chromosome length:  $123.778 \pm 20.78 \mu\text{m}$

TAX 2790 Uzbekistan: Bashkizylsai valley (details see p. 149), 10 plates evaluated, also the chromosomes 1, 4, 5, 8, 9, 10, and 15 may bear satellites. It is the first count for this species.

***Allium dodecadontum* Vved.**

**2n= 16 = 12m+4sm+1sm(B)**, Table A, total chromosome length:  $158.99 \pm 15.50 \mu\text{m}$

TAX 5695 Kirgizstan: Arkit (details see p. 151), 8 plates evaluated, SAT-chromosomes were sometimes found on chromosomes 13, 14, 16.

**2n= 16+0-1B = 13m+1sm+2sm(sat)**; Table A, total chromosome length:  $154.47 \pm 21.08 \mu\text{m}$

TAX 5707 Kirgizstan: Aflatun valley (details see p. 151), 10 plates evaluated.

An earlier count of Pogosian & Seisums (1992) is confirmed.

***Allium fetisowii* Regel**

**2n= 16+2-3B = 14m+1m(sat)+1sm(sat)+2-3sm(B)**, Table A, total chromosome length:  $188.08 \pm 32.95 \mu\text{m}$

TAX 5052 Kirgizstan: (details see p. 46), 6 plates evaluated. Earlier counts of Zakirova & Vakhtina (1974), Vakhtina & al. (1977), Zakirova & Nafanailova (1990), Pogosian & Seisums (1992) are confirmed. These authors did not report B-chromosomes.

***Allium helicophyllum* Vved.**

**2n= 16 = 13m+1sm+2sm(sat)**, Table A, total chromosome length:  $291.51 \pm 45.36 \mu\text{m}$

TAX 5272 Turkmenistan: W Kopetdag range (details see p. 89), 7 plates evaluated. An earlier count of Pogosian (1983) is confirmed.

***Allium hexaceras* Vved.**

**2n= 16 = 14m+2m(sat)+2sm**

TAX 5038 Uzbekistan: Mt. Khoja-Kiikkolon (details see p. 200) 3 plates evaluated, the SAT-chromosomes were nearly sub-metacentric. It is the first count for this species.

***Allium karataviense* Regel subsp. *karataviense***

**2n= 18+0-1B = 12m+1sm+1sm(sat)+1sa+1sa(sat)**

TAX 2323 Germany: Home garden Gatersleben, 3 plates evaluated, 3 chromosomes with unclear shape.

**2n= 18 = 12m+2sm+1sm(sat)+1sa+2sa(sat)**

TAX 2989 Uzbekistan: Jangiabad (details see p. 124), 2 plates evaluated.

**2n= 17 = 11m+4sm+2sm(sat)**

TAX 4141 Germany: Botanic Garden Halle, 2 plates evaluated.

**2n= 18+0-1B = 14m+1m(sat)+4sm(sat)**

TAX 5040 Uzbekistan: Charvak (details see p. 124), 4 plates evaluated.

**2n= 18 = 12m+6sm,**

TAX 5690 Kirgizstan: Kirgiz Alatau (details see p. 124), 3 plates evaluated, satellites were not seen. Many earlier counts with  $2n= 18$  are confirmed, but B-chromosomes were earlier not reported.

***Allium oreophilum* C.A. Mey.**

**2n= 16 = 14m+2sm(sat)**, Table A, total chromosome length:  $166.15 \pm 11.20 \mu\text{m}$

TAX 2559 Tajikistan: Kusavlisai valley (details see p. 43), 7 plates evaluated. Many earlier counts with  $2n= 16$  are confirmed.

***Allium protensum* Wendelbo**

**2n= 16 = 14m+2sm(sat),**

TAX 2963 Kazakhstan: Karagach (details see p. 220), 2 plates evaluated, 2 metacentric chromosomes were nearly submetacentric.



**2n= 16 = 15m+1sm(sat)**, Table A, total chromosome length:  $191.078 \pm 27.50 \mu\text{m}$

TAX 5045 Kazakhstan: Mt. Ulken-Burul (details see p. 220), 9 plates evaluated, also chromosome 11 may bear satellites.

Many earlier counts with  $2n= 16$ , mostly published as *A. schubertii* auct., are confirmed.

***Allium rothii* Zucc.**

**2n= 16 = 12m+4sm**

TAX 3235 Israel: Negev, near sede Boker hills, 3 plates evaluated, SAT-chromosomes were not found, 3 metacentric chromosomes were nearly submetacentric. An earlier count of Kollmann (1970) is confirmed.

***Allium saposchnikovii* Nikitina**

**2n= 16 = 10m+4sm+2sm(sat)**, Table A, total chromosome length:  $177.50 \pm 50.97 \mu\text{m}$

TAX 5687 Kirgizstan: Paspel'dyk hills (details see p. 146) 12 plates evaluated.

**2n= 32 = 23m+5sm+4sm(sat)**, Table A, total chromosome length:  $438,27 \pm 43,64 \mu\text{m}$

TAX 5047 Kazakhstan: Mt. Ulken-Burul (details see p. 146), 11 plates evaluated, 3 metacentric chromosomes were nearly submetacentric, 5 submetacentric chromosomes were nearly metacentric. An earlier count of  $2n= 16$  of Pogosian & Seisums (1992) is confirmed.

***Allium schachimardanicum* Vved.**

**2n= 16 = 12m+2sm+2sm(sat)**, Table A, total chromosome length:  $196.802 \pm 33.86 \mu\text{m}$

TAX 5066 Uzbekistan: Jordan (details see p. 141), 15 plates evaluated, also the chromosomes 5, 6, and 10 may bear satellites. It is the first count for this species.

***Allium sergii* Vved.**

**2n= 16 = 13m+1m(sat)+2sm**

TAX 3714 Kazakhstan: Kantagy valley (details see p. 222), 3 plates evaluated, the SAT-chromosome and 3 more metacentric chromosomes were nearly sub-metacentric.

**2n= 16 = 13m+3sm(sat)**, Table A, total chromosome length:  $204.634 \pm 20.32 \mu\text{m}$

TAX 3680 Kazakhstan: Ikonzu valley (details see p. 222), 14 plates evaluated, either chromosome 8 or 12 & 15 bear satellites. Earlier counts of Zakirova & Nafanailova (1990), Pogosian & Seisums (1992) are confirmed.

***Allium taeniopetalum* Popov & Vved. subsp. *turakulovii* R.M. Fritsch & F.O. Khass.**

**2n= 16 = 10m+4sm+2sm(sat)**, Table A, total chromosome length:  $191.38 \pm 63.09 \mu\text{m}$

TAX 5068 tura Kirgizstan: Dargun (details see p. 102), 8 plates evaluated, also chromosome 3 may bear satellites. It is the first count for this subspecies.

***Allium verticillatum* Regel**

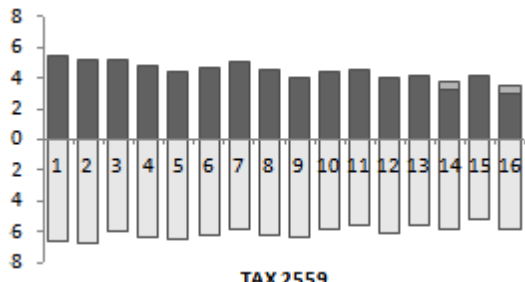
**2n= 16 = 12m+2sm+2sm(sat)**, Table A, total chromosome length:  $203.31 \pm 15.77 \mu\text{m}$

TAX 5033 Uzbekistan: Akbashtau Mts. (details see p. 165), 8 plates evaluated. Many earlier counts with  $2n= 16$  are confirmed, the ideogram of Fritsch & Astanova (1998) differs in some details.

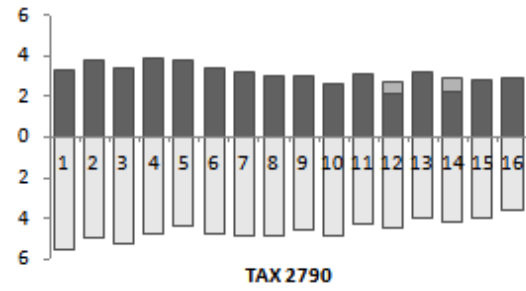
Table A. Dimensions of chromosome arms (mean with standard deviation, μm; in the sequence satellite – short arm – long arm); left column: accession number, the other columns: numbering of chromosomes

acc.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.58	0	0
2559	5.46 ± 0.34	5.17 ± 0.42	5.24 ± 0.29	4.86 ± 0.33	4.47 ± 0.33	4.74 ± 0.60	5.04 ± 0.49	4.61 ± 0.44	4.08 ± 0.55	4.44 ± 0.61	4.61 ± 0.53	4.06 ± 0.40	4.13 ± 0.32	3.23 ± 0.31	4.19 ± 0.48	3.03 ± 0.38
	6.56 ± 0.45	6.63 ± 0.47	5.89 ± 0.67	6.24 ± 0.67	6.45 ± 0.71	6.18 ± 0.61	5.73 ± 0.49	6.12 ± 0.55	6.29 ± 0.84	5.77 ± 0.48	5.54 ± 0.46	6.00 ± 0.54	5.52 ± 0.53	5.80 ± 0.43	5.13 ± 0.40	5.75 ± 0.51
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0.61	0	0.62	0	0
2790	3.29 ± 0.62	3.85 ± 0.77	3.47 ± 0.77	3.96 ± 0.75	3.79 ± 0.94	3.43 ± 0.71	3.25 ± 0.81	3.02 ± 0.73	3.02 ± 0.76	2.66 ± 0.50	3.15 ± 0.56	2.15 ± 0.47	3.20 ± 0.48	2.28 ± 0.57	2.83 ± 0.51	2.90 ± 0.48
	5.52 ± 0.98	4.89 ± 0.94	5.24 ± 1.00	4.67 ± 1.16	4.37 ± 0.76	4.71 ± 0.91	4.82 ± 0.86	4.85 ± 0.85	4.52 ± 0.84	4.84 ± 0.97	4.19 ± 0.77	4.41 ± 0.75	3.96 ± 0.65	4.14 ± 0.74	3.83 ± 0.65	3.58 ± 0.39
TAX 0	0	0	0	0	0	0	0	1.16	0	0	0	0.96	0	0	0.81	0
3680	5.73 ± 0.77	6.80 ± 0.90	6.00 ± 0.89	5.33 ± 0.60	6.57 ± 0.87	6.36 ± 0.89	5.87 ± 0.67	4.36 ± 0.46	5.03 ± 0.62	5.38 ± 0.58	4.70 ± 0.55	3.66 ± 0.68	5.01 ± 0.90	4.78 ± 0.70	3.57 ± 0.72	4.57 ± 0.57
	8.60 ± 1.14	8.28 ± 1.50	8.92 ± 0.87	8.33 ± 0.93	7.76 ± 0.90	7.43 ± 0.64	7.48 ± 0.60	7.46 ± 0.88	7.92 ± 0.94	7.11 ± 0.74	7.74 ± 0.81	7.04 ± 0.87	6.59 ± 0.82	6.42 ± 0.66	6.51 ± 0.92	5.77 ± 0.63
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0.97	0	0.85	0	0
3924	4.36 ± 0.74	3.56 ± 0.61	3.88 ± 0.71	3.80 ± 0.66	3.88 ± 0.75	3.55 ± 0.37	3.16 ± 0.58	3.15 ± 0.43	3.21 ± 0.41	2.95 ± 0.54	3.40 ± 0.45	1.89 ± 0.39	2.92 ± 0.82	1.99 ± 0.17	3.32 ± 0.59	3.10 ± 0.51
	4.76 ± 0.87	5.46 ± 1.07	5.18 ± 0.91	5.03 ± 0.94	4.33 ± 0.75	4.65 ± 0.84	5.00 ± 0.98	4.74 ± 0.77	4.38 ± 0.90	4.63 ± 0.78	4.09 ± 0.83	4.60 ± 0.63	4.31 ± 0.48	4.34 ± 0.41	3.57 ± 0.45	3.73 ± 0.57
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.23	0	0.27
5033	5.79 ± 0.60	5.40 ± 0.45	6.26 ± 0.44	5.60 ± 0.61	4.88 ± 0.95	5.49 ± 0.75	6.22 ± 0.38	5.71 ± 0.76	5.03 ± 0.24	5.67 ± 0.39	5.52 ± 0.43	5.18 ± 0.63	5.36 ± 0.51	3.84 ± 0.31	4.80 ± 0.76	3.11 ± 1.43
	9.07 ± 0.82	9.15 ± 0.90	8.03 ± 0.88	8.40 ± 1.06	8.44 ± 0.90	7.82 ± 0.55	6.83 ± 0.86	7.18 ± 0.82	7.54 ± 0.83	6.79 ± 0.79	6.69 ± 0.82	6.80 ± 0.87	6.24 ± 0.52	7.19 ± 0.79	6.37 ± 0.65	6.37 ± 2.89
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.55	0
5045	6.43 ± 1.14	5.8 ± 1.18	5.07 ± 1.31	5.96 ± 0.99	5.41 ± 0.64	5.39 ± 1.02	5.44 ± 0.92	4.62 ± 1.04	5.54 ± 1.12	5.04 ± 1.20	4.78 ± 1.20	4.75 ± 0.82	4.48 ± 1.06	4.62 ± 0.79	2.72 ± 0.69	3.89 ± 0.67
	7.53 ± 1.18	8.07 ± 1.22	8.37 ± 1.30	7.45 ± 1.50	7.56 ± 1.79	7.24 ± 1.09	6.82 ± 1.20	7.51 ± 1.00	6.38 ± 0.81	6.81 ± 0.96	7.69 ± 1.24	6.83 ± 1.10	6.59 ± 0.71	6.36 ± 1.07	6.83 ± 0.90	6.08 ± 0.88
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0
5047	6.49 ± 1.32	7.85 ± 1.22	6.69 ± 0.80	6.24 ± 1.23	7.08 ± 0.57	5.47 ± 0.78	6.69 ± 0.95	6.11 ± 0.92	6.89 ± 0.98	5.51 ± 0.70	5.95 ± 0.93	6.50 ± 1.01	6.32 ± 0.72	5.90 ± 0.70	5.26 ± 0.74	6.11 ± 0.85
	10.80 ± 1.11	8.94 ± 1.10	9.70 ± 1.29	10.12 ± 0.95	8.69 ± 1.20	10.02 ± 1.29	8.79 ± 0.83	9.33 ± 0.94	8.07 ± 0.88	9.36 ± 0.92	8.87 ± 0.61	8.21 ± 0.67	7.98 ± 0.82	8.40 ± 1.05	8.88 ± 0.95	8.05 ± 0.82
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0.94	0.90	0	0
5052	5.02 ± 0.92	5.27 ± 1.20	5.76 ± 1.30	4.89 ± 1.00	5.52 ± 1.13	4.87 ± 0.94	5.09 ± 1.11	4.56 ± 0.94	4.61 ± 0.95	4.87 ± 0.94	4.47 ± 0.77	4.20 ± 0.74	3.56 ± 0.79	3.15 ± 0.40	4.34 ± 0.82	4.05 ± 0.76
	7.76 ± 1.51	7.43 ± 1.54	6.71 ± 1.22	7.11 ± 1.43	6.37 ± 1.40	6.73 ± 1.51	6.09 ± 1.13	6.63 ± 1.13	6.34 ± 1.19	5.81 ± 1.20	6.13 ± 1.32	6.39 ± 1.36	5.87 ± 1.04	5.68 ± 1.42	5.00 ± 1.14	5.20 ± 1.00
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5060	5.88 ± 0.21	5.35 ± 0.39	4.93 ± 0.18	4.88 ± 0.53	5.40 ± 0.46	4.45 ± 0.23	4.53 ± 0.43	4.16 ± 0.27	4.67 ± 0.25	4.47 ± 0.33	4.08 ± 0.42	3.76 ± 0.27	4.38 ± 0.25	3.62 ± 0.71	2.85 ± 0.17	2.51 ± 0.30
	6.86 ± 0.36	7.22 ± 0.45	7.44 ± 0.46	6.81 ± 0.26	6.28 ± 0.30	6.96 ± 0.50	6.48 ± 0.38	6.57 ± 0.36	6.04 ± 0.25	5.88 ± 0.32	6.17 ± 0.22	6.30 ± 0.29	5.26 ± 0.27	5.78 ± 0.38	6.21 ± 0.28	5.85 ± 0.34
TAX 0	0	0	0	0	(1.7)	(0.53)	0	0	0	(0.98)	0	0	0	0.35	0	0.46
5066	5.59 ± 1.13	5.85 ± 0.98	6.38 ± 1.10	5.95 ± 1.02	5.17 ± 0.96	6.04 ± 1.25	5.74 ± 1.07	4.87 ± 0.90	5.31 ± 1.25	4.91 ± 1.19	5.36 ± 1.06	4.56 ± 0.67	4.77 ± 1.01	2.89 ± 0.72	4.31 ± 0.86	2.84 ± 0.63
	9.50 ± 2.13	9.05 ± 1.91	8.40 ± 1.44	8.12 ± 1.40	6.89 ± 1.34	6.98 ± 1.36	7.81 ± 1.53	8.20 ± 1.74	7.55 ± 1.41	6.42 ± 1.05	6.46 ± 1.32	7.08 ± 1.50	6.08 ± 0.88	6.73 ± 1.20	5.61 ± 1.00	5.99 ± 1.20
TAX 0	0	0	0	0	(0.84)	0	0	0	0	0	0	0.99	0	0	0	0.96
5068	5.45 ± 1.69	6.30 ± 1.39	5.18 ± 1.67	5.98 ± 2.18	5.75 ± 2.16	4.51 ± 1.14	5.07 ± 1.80	4.72 ± 1.34	4.24 ± 1.49	4.86 ± 1.69	4.49 ± 1.34	2.97 ± 0.55	3.75 ± 1.54	4.33 ± 1.66	3.93 ± 1.76	2.77 ± 0.64
	9.20 ± 3.01	8.32 ± 3.10	8.44 ± 3.02	7.40 ± 2.28	7.16 ± 2.55	8.07 ± 2.82	7.44 ± 2.90	7.14 ± 2.72	7.42 ± 2.62	6.40 ± 2.16	6.76 ± 2.52	6.71 ± 2.06	6.64 ± 2.35	6.02 ± 2.27	5.97 ± 1.99	6.08 ± 2.20
TAX 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.94	0.8
5272	9.17 ± 1.92	9.64 ± 1.38	8.91 ± 1.33	7.80 ± 1.15	7.77 ± 0.84	8.56 ± 1.20	7.64 ± 1.10	8.69 ± 1.08	6.90 ± 1.32	8.03 ± 1.14	7.74 ± 1.44	8.19 ± 1.15	8.08 ± 0.40	6.72 ± 1.35	4.74 ± 1.04	4.62 ± 1.36
	13.21 ± 3.61	12.10 ± 2.09	11.22 ± 2.04	12.20 ± 1.94	11.79 ± 2.02	10.75 ± 1.64	11.26 ± 1.57	10.17 ± 1.53	11.55 ± 1.67	10.07 ± 1.49	10.08 ± 1.25	9.52 ± 1.36	9.58 ± 2.18	10.01 ± 1.94	10.63 ± 1.99	10.12 ± 1.75

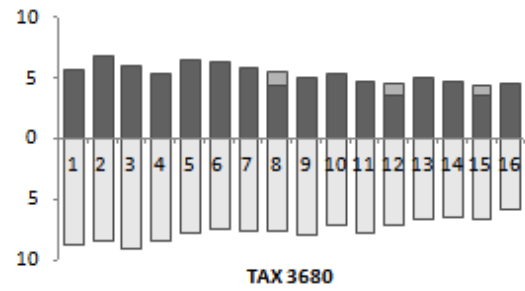




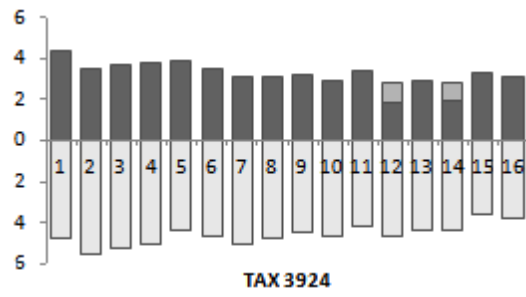
TAX 2559



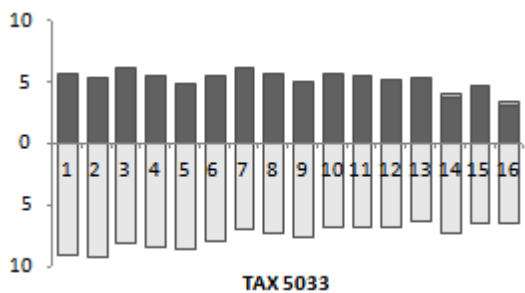
TAX 2790



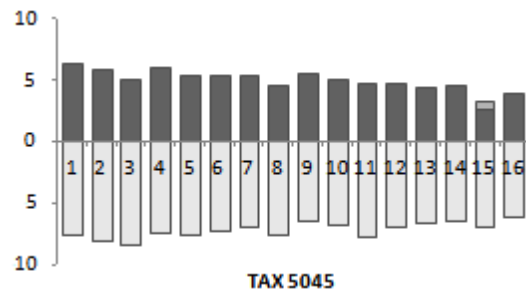
TAX 3680



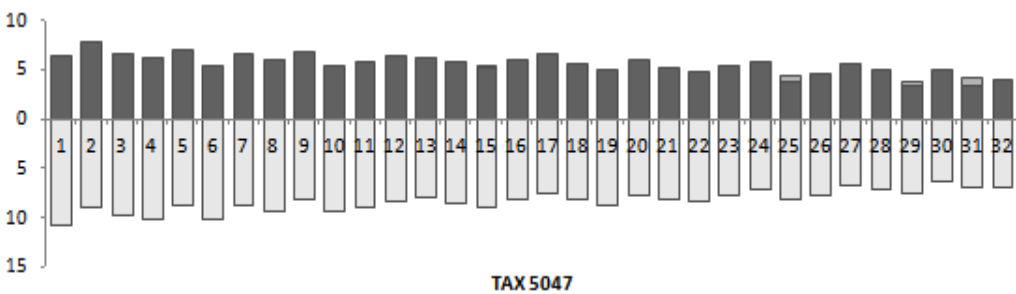
TAX 3924



TAX 5033



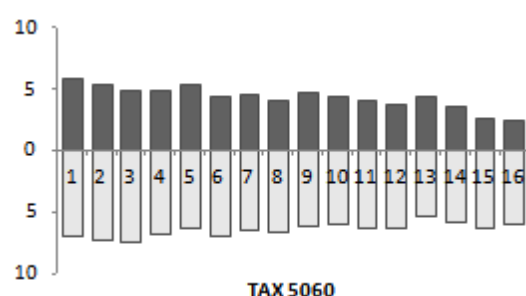
TAX 5045



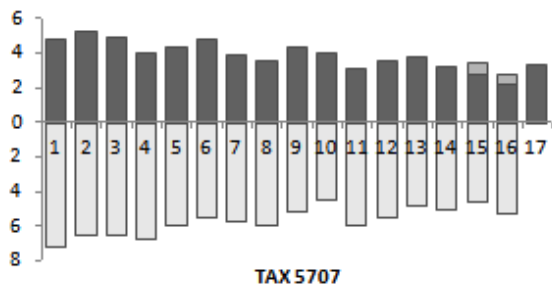
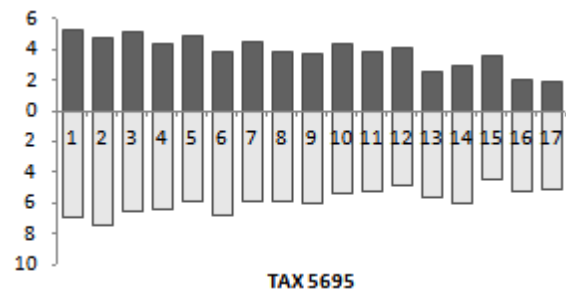
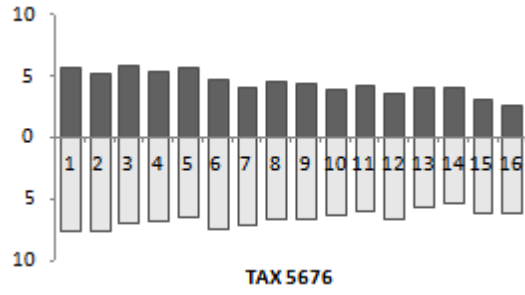
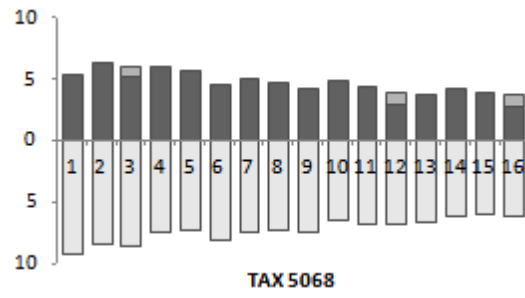
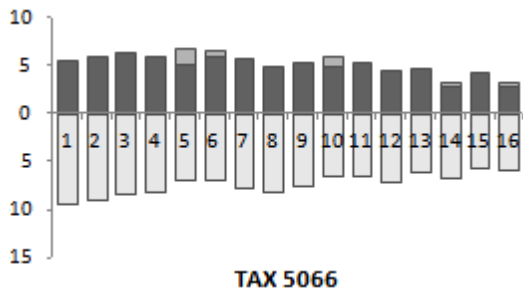
TAX 5047



TAX 5052



TAX 5060



Karyograms of the investigated accessions. The chromosomes are arranged according to their total lengths. Measures of the arm lengths [μm] are given on the left side; satellites are lighter grey colored.

## General Index

(accepted scientific names and important page numbers in **bold** type; keywords may occur repeatedly on identical pages)

- A. sect. Acanthoprason* Wendelbo - 68, 91, 94, 124, 213, 217
- A. sect. Acaule** R.M. Fritsch - 16, 24, 25, **199**, 200, 202, 222
- A. sect. Acropetala** R.M. Fritsch - 15, 30, 31, 36, 37, 46, 73, 84, 97, 108, 118, 120, 124, **126**, 128, 129, 131, 133, 135, 137, 141, 142, 144, 146, 149, 151, 154, 157, 160, 163, 167, 179, 222
- A. sect. Aroidea** F.O. Khass. & R.M. Fritsch - 16, 26, 27, 181, **196**, 198
- A. sect. Aroidea* Kamelin & Seisums - 196
- A. sect. Asteroprason** R.M. Fritsch - 15, 26, 27, **87**, 89, 91, 94, 114, 204
- A. sect. Breviceale** R.M. Fritsch - 16, 24, 25, 91, **220**, 222, 224, 226
- A. sect. Compactoprason** R.M. Fritsch - 15, 16, 30, 31, 32, 33, 62, 73, 75, 77, 82, 87, 124, **168**, 170, 177, 179, 180, 181, 198
- A. sect. Decipientia** (Omelczuk) R.M. Fritsch - 14, 28, 29, 34, 35, 46, **49**, 51, 53
- A. sect. Kaloprason** K. Koch - 16, 26, 27, 65, 68, 70, 94, 104, 121, 124, 163, 168, 177, 181, 182, 198, 200, 202, 203, **204**, 206, 209, 211, 213, 215, 217, 220
- A. sect. Longibidentata** (R.M. Fritsch) R.M. Fritsch - 14, 38, 39, **44**, 46, 51, 53, 135, 141, 151
- A. sect. Megaloprason s. strictiss.* - 73, 79
- A. sect. Megaloprason sensu* Wendelbo - 182, 190, 224
- A. sect. Megaloprason** Wendelbo s. str. - 15, 22, 23, 58, 65, 70, 79, 87, 89, **104**, 106, 108, 110, 112, 114, 117, 118, 120, 124, 171, 181, 190, 204, 206, 224
- A. sect. Melanocrommyum* Webb & Berthel. - 49, 50, 51, 55, 84, 104, 118, 126, 220
- A. sect. Melanocrommyum s. lat.* - 49
- A. sect. Melanocrommyum s. str.* - 85, 141
- A. sect. Miniprason** R.M. Fritsch - 15, 22, 23, **121**, 124, 222
- A. sect. Molium* G. Don ex Koch - 41, 44, 163, 182
- A. sect. Molium sensu* Regel - 44
- A. sect. Popovia** F.O. Khass. & R.M. Fritsch - 16, 18, 19, 91, 198, **200**, 202, 204
- A. sect. Porphyroprason** Ekberg - 22, **23, 41**
- A. sect. Procerallium** R.M. Fritsch - 16, 30, 31, 38, 39, 50, 82, 106, 110, 131, 133, 171, 179, **182**, 185, 190, 198, 204, 206
- A. sect. Regeloprason p. p.* - 124
- A. sect. Regeloprason** Wendelbo - 14, 15, 18, 19, **55**, 57, 58, 60, 62, 65, 66, 70, 77, 82, 84, 85, 89, 101, 106, 114, 175, 179, 206, 224
- A. sect. Schoenoprasum* Dumort. - 55
- A. sect. Stellata** (F.O. Khass. & R.M. Fritsch) R.M. Fritsch - 15, 34, 35, 62, 65, 68, 70, 73, **97**, 99, 124, 206
- A. sect. Thaumasioprason** Wendelbo - 16, 24, 25, 198, **203**, 204
- A. sect. Verticillata** Kamelin - 16, 24, 25, 124, **163**, 165
- A. sect.(?) Moly* (Moench) Endl. - 44
- A. series Altissima* Tzag. - 182
- A. series Caspia* Omelczuk - 204
- A. series Decipientia* Omelczuk - 49
- A. series Oreophila* Tzag. - 41
- A. series Verticillata* Tzag. - 163
- A. subg. Allium* - 7, 137
- A. subg. Melanocrommyum** (Webb & Berthel.) Rouy - 7, 9, 13, 14, 43, **44**, 46, 49, 55, 117, 126, 128, 144, 163, 168, 182, 196, 199, 200, 203, 204, 213, 220
- A. subg. Porphyroprason** (Ekberg) R.M. Fritsch - 13, 22, 23, **41**
- A. subg. Vvedenskya* (Kamelin) R.M. Fritsch - 13
- A. subsect. Acanthoprason* (Wendelbo) Kamelin - 91, 213

- A. subsect. *Acmopetala* R.M. Fritsch - 15, 30, 31, 36, 37, 38, 39, **126**, 128, 151
- A. subsect. *Albidiflora* R.M. Fritsch - 15, 36, 37, **144**, 146
- A. subsect. *Asteroprason* R.M. Fritsch - 15, 26, 27, **87**
- A. subsect. *Costatae* R.M. Fritsch - 16, 30, 31, 117, **190**
- A. subsect. *Cristophiana* Tscholok. - 15, 26, 27, **91**, 94
- A. subsect. *Diffusoumbellata* R.M. Fritsch - 14, 20, 21, **60**, 62
- A. subsect. *Durovaginata* R.M. Fritsch - 9, 15, 36, 37, **147**, 149
- A. subsect. *Elatae* R.M. Fritsch - 16, 30, 31, **182**, 185
- A. subsect. *Erectopetala* F.O. Khass. - 15, 30, 31, 32, 33, **168**, 170, 171, 174
- A. subsect. *Humilicognata* R.M. Fritsch - 15, 22, 23, 58, **112**, 114, 204
- A. subsect. *Iliensia* Kamelin & Seisums - 68
- A. subsect. *Inornatae* R.M. Fritsch - 15, 36, 37, **155**, 157
- A. subsect. *Jaxartoprason* Seisums - 126
- A. subsect. *Kaloprason* (K. Koch) Kamelin - 16, 26, 27, 28, 29, **204**, 206
- A. subsect. *Keratoprason* R.M. Fritsch - 15, 34, 35, **114**, 117, 181, 198
- A. subsect. *Komaroviana* F.O. Khass. & R.M. Fritsch - 16, 32, 33, **177**, 179
- A. subsect. *Ligulifolia* R.M. Fritsch - 16, 26, 27, 28, 29, **211**, 213, 215
- A. subsect. *Longibidentata* R.M. Fritsch - 44
- A. subsect. *Megaloprason* (Wendelbo) Kamelin & Seisums - 104, 121, 182
- A. subsect. *Megaloprason* R.M. Fritsch - 15, 32, 33, 34, 35, **104**, 106
- A. subsect. *Megaloprason* s. str. - 114
- A. subsect. *Melanocrommyum* - 49, 118
- A. subsect. *Melanocrommyum* sensu Kamelin - 104, 126
- A. subsect. *Minutoprason* Kamelin & Seisums - 220
- A. subsect. *Odoratae* R.M. Fritsch - 15, 18, 19, **70**, 73
- A. subsect. *Pandzhia* Kamelin & Seisums - 203
- A. subsect. *Pharmakoprason* R.M. Fritsch - 15, 38, 39, 142, **160**, 161, 162
- A. subsect. *Regeloprason* (Wendelbo) Kamelin - 14, 18, 19, 20, 21, **55**, 57
- A. subsect. *Spiralitunicata* R.M. Fritsch - 15, 32, 33, 114, **118**, 120, 224
- A. subsect. *Spiralopetala* F.O. Khass. & R.M. Fritsch - 16, 30, 31, **180**, 181
- A. subsect. *Stellata* F.O. Khass. & R.M. Fritsch - 97
- A. subsect. *Thaumasioprason* (Wendelbo) Kamelin & Seisums - 203
- A. subsect. *Verticillata* (Kamelin) Seisums - 163
- acronyms - 8, 14
- Akhalteke - 94, 97
- Alai - 13
- alkaloids - 12
- alliin - 12
- allium [Latin] - 13
- Allium "prae-rosenorum"* - 196
- Allium aflatunense* B. Fedtsch. - 15, 38, 39, **129**, **130**, 131, 187, 195, 241
- Allium aflatunense* hortulanorum - 129, 175
- Allium aflatunense* s. str. - 129, 133, 135
- Allium alaicum* sensu Pavlov & Polyakov - 132, 135
- Allium alaicum* Vved. - 15, 38, 39, 129, **132**, 134, 135, 137, 144, 186, 241, 271
- Allium albopilosum* C.H. Wright - 15, 92, 93, 94, 95
- Allium alexeianum* Regel - 16, 28, 29, 124, 179, 198, 206, **211**, **212**, 213, 215, 217, 241
- Allium alexeianum* Regel var. *hissaricum* - 215, 217
- Allium alexeianum* sensu Vved. - 215
- Allium alexejanum* - 211, 216
- Allium altissimum* Regel - 16, 30, 31, 128, 182, 184, 186, **187**, **188**, 189, 190, 195, 242
- Allium angustitepalum* Wendelbo - 106, 190, 192
- Allium arkitense* R.M. Fritsch - 15, 40, 129, **133**, **134**, 135, 144, 270

- Allium aroides* Popov & Vved. - 16, 26, 27, 166, 179, **196, 197**, 198, 203, 204, 206, 213, 242, 271  
*Allium assadii* Seisums - 114  
*Allium atropurpureum* Waldst. & Kit. - 49  
*Allium atropurpureum* "M. Bieb." sensu Regel - 182  
*Allium atropurpureum* Waldst. & Kit. var. *hirtulum* Regel - 182  
*Allium backhousianum* Regel - 15, 30, 31, 38, 39, **126, 127**, 128, 129, 133, 135, 243  
*Allium badakhshanicum* Wendelbo - 16, 223, 224  
*Allium baissunense* Lipsky - 206, 207  
*Allium bakhtiaricum* Regel - 196, 271  
*Allium balkhanicum* (R.M. Fritsch & F.O. Khass.) R.M. Fritsch - 14, 20, 21, 62, **63, 64**, 65, 66, 68, 70, 73, 243  
*Allium balkhanicum* alliance - 101  
*Allium baschkyzylsaicum* Krassovsk. - 15, 99, 101  
*Allium bekeczalicum* Lazkov - 15, 40, 46, **135**, 270  
*Allium bodeanum* Regel - 15, 92, 94, 95, 96  
*Allium botschantzevii* Kamelin - 59, 182, 186  
*Allium brachyscapum* Vved. - 15, 22, 23, **112, 113**, 114, 243  
*Allium brahuicum* Boiss. - 16, 204  
*Allium bucharicum* Regel - 16, 26, 27, 206, **209, 210**, 217, 219, 243  
*Allium bucharicum* sensu Vved. - 209  
*Allium bucharicum* sensu Wendelbo - 217  
*Allium cabulicum* Baker - 121, 124, 125  
*Allium caspium* (Pall.) M. Bieb. **subsp. baissunense** (Lipsky) F.O. Khass. & R.M. Fritsch - 16, 28, 29, 206, **207, 208**, 209, 244  
*Allium caspium* (Pall.) M. Bieb. **subsp. caspium** - 16, 28, 29, **204, 205**, 206, 207, 209, 211, 244, 271  
*Allium caspium* s. lat. - 213  
*Allium caspium* sensu Vved. - 204  
*Allium caspium* var. *baissunense* (Lipsky) Vved. - 207  
*Allium cathodicarpum* Wendelbo - 66, 68, 70  
*Allium chelotum* Wendelbo - 51, 53  
*Allium chitralicum* F.T. Wang & Tang - 16, 24, 25, 91, 220, **222, 223**, 224, 245  
*Allium chitralicum* sensu Wendelbo - 192, 222  
*Allium chitralicum* var. *bifoliatum* F.T. Wang & Tang - 222  
*Allium chodsha-bakirganicum* Gaffarov & Turak. - 15, 18, 19, **74, 75**, 82, 84  
*Allium christophii* - 92, 95  
*Allium chychkanense* R.M. Fritsch - 14, 38, 39, 46, **47, 48**, 49, 141, 151, 245, 271  
*Allium collis-magni* Kamelin - 15, 144, 146, 160  
*Allium collis-magni* sensu Levichev - 158  
*Allium collis-magni* sensu R.M. Fritsch - 151  
*Allium costatovaginatatum* Kamelin & Levichev - 16, 36, 37, **147, 148**, 149, 154, 160, 163, 245, 271  
*Allium cristophii* - 91, 97, 175  
*Allium cristophii* Trautv. sensu Wendelbo - 95  
*Allium cristophii* Trautv. **subsp. cristophii** - 15, 26, 27, **92, 93**, 94, 97, 246  
*Allium cristophii* Trautv. **subsp. golestanicum** R.M. Fritsch - 15, 26, 27, 94, **95, 96**, 97, 246  
*Allium cupuliferum* alliance - 101  
*Allium cupuliferum* Regel **subsp. cupuliferum** - 14, 20, 21, 59, **60, 61**, 62, 63, 65, 68, 70, 73, 80, 81, 85, 246  
*Allium cupuliferum* s. str. - 68  
*Allium cupuliferum* sensu Kamelin - 55, 69  
*Allium cupuliferum* sensu Vved. - 58, 80  
*Allium cupuliferum* **subsp. nuratavicum** R.M. Fritsch & Beshko - 14, 20, 21, **62, 63**  
*Allium cupuliferum* var. *regelii* (Trautv.) O. Kuntze - 55  
*Allium darvasicum* - 70



- Allium darwasicum* alliance - 106  
*Allium darwasicum* p. p. - 77, 82, 87, 111  
***Allium darwasicum*** Regel - 15, 18, 19, **70, 71**, 73, 75, 79, 87, 246  
*Allium darwasicum* s. str. - 79, 108  
***Allium dasyphyllum*** Vved. - 15, 36, 37, **135, 136**, 137, 142, 154, 160, 248  
*Allium decipiens* Fisch. ex Schult. & Schult. f. - 49, 53, 55  
*Allium decipiens* s.lat. - 53, 55  
*Allium decipiens* sensu Regel & auctt. - 51  
*Allium decipiens* subsp. *decipiens* - 53  
*Allium decipiens* subsp. *quercetorum* Seregin - 53  
***Allium decoratum*** Turginov & Tojibaev - 16, 28, 29, **214**  
*Allium dodecadontum* sensu R.M. Fritsch - 138  
***Allium dodecadontum*** Vved. - 15, 36, 37, 129, 135, 139, **149, 150**, 151, 248, 271  
*Allium ecornutum* F.O. Khass. & I.I. Malzev - 16, 190, 192  
*Allium elatum* Regel - 172, 174, 175  
*Allium elburzense* Wendelbo - 87, 94  
*Allium esfahanicum* R.M. Fritsch - 114  
***Allium eugenii*** Vved. - 16, 24, 25, 220, **225**, 226, 248  
***Allium fetisowii*** Regel - 14, 38, 39, **44, 45**, 46, 47, 49, 135, 137, 141, 151, 163, 248, 272  
*Allium fetissovii* - 44, 139, 162  
*Allium fetissovii* p. p. - 160, 161  
*Allium fetissovii* sensu Vved. - 139  
***Allium giganteum*** Regel - 15, 30, 31, 32, 33, 128, **168, 169**, 170, 171, 174, 175, 177, 179, 181, 187, 249  
*Allium grande* Lipsky - 51, 53, 55  
*Allium gulczense* [B. Fedtsch. ex] O. Fedtsch. - 15, 126, 128, 129  
*Allium gultschense* Vved. - 126, 128  
***Allium gypsaceum*** Popov & Vved. - 16, 18, 19, 166, 179, 198, **200, 201**, 202, 204, 206, 213, 250  
***Allium helicophyllum*** Vved. - 15, 26, 27, **87, 88**, 250, 272  
***Allium hexaceras*** Vved. - 16, 24, 25, 91, 117, **199**, 200, 202, 222, 250, 272  
*Allium hindukuschense* Kamelin & Seisums - 217  
*Allium hirtifolium* Boiss. - 16, 182, 184, 186, 187  
*Allium hissaricum* p. p. - 75, 84, 87  
*Allium hissaricum* subsp. *cisdarvasicum* Kamelin & Seisums - 75, 77  
*Allium hissaricum* var. *albinoticum* auct. - 74  
***Allium hissaricum*** Vved. - 15, 18, 19, 58, 59, **75, 76**, 77, 82, 84, 87, 250  
*Allium hollandicum* R.M. Fritsch - 131, 175, 196  
***Allium iliense*** Regel s. str. - 14, 22, 23, 59, **65**, 66, 68, 70, 73, 251  
*Allium iliense* s. lat. - 68  
*Allium iliense* s. latiss. - 66  
*Allium iliense* sensu Vved. & auctt. - 64, 65, 66, 69  
*Allium iliense* subsp. *nuratense* Kamelin - 14, 66, 68  
***Allium insufficiens*** Vved. - 15, 32, 33, **106, 107**, 108, 142, 166, 251  
***Allium intradarvazicum*** R.M. Fritsch - 15, 20, 21, 73, **78**, 79, 108, 111  
***Allium isakulii*** R.M. Fritsch & F.O. Khass. - 14, 22, 23, 62, 65, **66, 67**, 68, 70, 73, 252  
*Allium isakulii* subsp. *balkhanicum* R.M. Fritsch & F.O. Khass. - 63  
*Allium isakulii* subsp. *nuratense* (Kamelin) R.M. Fritsch & F.O. Khass. - 66  
*Allium isakulii* subsp. *subkopetdagense* R.M. Fritsch & F.O. Khass. - 69  
***Allium isfairamicum*** [B. Fedtsch. ex] O. Fedtsch. - 15, 32, 33, **172**, 252  
*Allium isphairamicum* - 172  
***Allium jesdianum*** Boiss. & Buhse - 104, 133, 190, 192, 193, 195, 196  
*Allium jesdianum* Boiss. & Buhse var. *latipetalum* Lipsky - 187  
*Allium jesdianum* incl. subsp. *angustitepalum* - 117, 195

- Allium jesdianum* sensu R.M. Fritsch - 193  
*Allium jesdianum* sensu Vved. - 188, 190  
*Allium jesdianum* subsp. *angustitepalum* (Wendelbo) F.O. Khass. & R.M. Fritsch - 16, 30, 31, 133, **190, 191**, 192, 195, 252  
*Allium jesolianum* - 194  
*Allium karataviense* Regel - 73, **121**, 124, 126, 135, 137, 154, 160, 163, 179, 222  
*Allium karataviense* Regel subsp. *karataviense* - 15, 22, 23, **122**, 126, 253, 272  
*Allium karataviense* subsp. *henrikii* Rukšāns - 15, 22, 23, **125**, 126  
*Allium karataviense* var. *granitovii* Priszter - 121, 124  
*Allium khozratense* R.M. Fritsch - 16, 24, 25, **203, 204**  
*Allium komarovii* - 177  
*Allium komarowii* Lipsky - 16, 32, 33, 110, 166, 175, **177, 178**, 179, 181, 198, 254  
*Allium kopsedorum* R.M. Fritsch - 114  
*Allium kuhstorkhense* R.M. Fritsch & Joharchi - 89  
*Allium kurdaicum* Bajtenov - 15, 40, **137**  
*Allium kwakense* (R.M. Fritsch) R.M. Fritsch - 15, 34, 35, 73, 106, 108, **109**, 110, 111, 254  
*Allium lallemantii* Regel & Rach - 51, 53  
*Allium lipskyanum* Vved. - 15, 20, 21, 62, 75, **80, 81**, 82, 87, 206, 254  
*Allium lucens* Nikitina - 172  
*Allium macleanii* Baker - 15, 32, 33, 77, 87, 171, **172, 173**, 174, 175, 179, 254  
*Allium magicum* L. - 44  
*Allium majus* Vved. - 16, 30, 31, 177, 179, **180, 181**, 255  
*Allium masjidense* - 94  
*Allium mirum* Wendelbo - 124, 166, 198, 203, 204  
*Allium mogoltavicum* Vved. - 99, 101  
*Allium monanthum* Maxim. - 44  
*Allium monophyllum* Vved. ex Czerniak. - 15, 26, 27, **89, 90**, 91, 255  
*Allium motor* Kamelin & Levichev - 15, 124, 149, 154, 160, 162, 163  
*Allium nevskianum* sensu Kamelin - 217  
*Allium nevskianum* Vved. - 215, 217  
*Allium nevskianum* Vved. ex Wendelbo - 16, 28, 29, 179, 198, 206, 213, 214, **215, 216**, 217, 255  
*Allium nigrum* group - 50  
*Allium nigrum* L. - 44  
*Allium nobile* Regel - 118  
*Allium nuratense* - 68  
*Allium oreophilum* C.A. Mey. - 22, 23, **41, 42**, 43, 256, 272  
*Allium oreophilum* var. *ostrowskianum* (Regel) Regel - 41  
*Allium oreophilum* var. *typicum* Regel - 41  
*Allium orientoiranicum* Neshati, Zarre & R.M. Fritsch - 193  
*Allium ostrowskianum* - 41  
*Allium ostrowskianum* Regel - 41, 43  
*Allium pallasii* Murray - 55  
*Allium pallasii* Murray  $\beta$  *verticillatum* Regel - 163  
*Allium pandzhi* Seisums - 203, 204  
*Allium pangasicum* Turak. - 15, 40, 46, **138**, 151, 257  
*Allium pauli* Vved. - 16, 222, 223, 224  
*Allium platystemon* Kar. & Kir. - 41  
*Allium procerum* Trautv. - 168  
*Allium procerum* Trautv. ex Regel - 15, 168, 170, 171  
*Allium protensum* Wendelbo - 16, 26, 27, 206, 211, 213, **217, 218**, 219, 220, 257, 272  
*Allium pseudohollandicum* R.M. Fritsch - 196  
*Allium pseudoseravschanicum* - 114  
*Allium pseudowinklerianum* R.M. Fritsch & F.O. Khass. - 15, 20, 21, 79, **82, 83**, 84, 258

- Allium pseudozeravschanicum* Popov & Vved. - 15, 114, 117  
*Allium regelii* subsp. *salangense* Kamelin & Seisums - 55  
*Allium regelii* subsp. *yatei* (Aitch. & Baker) Kamelin & Seisums - 55  
***Allium regelii*** Trautv. - 14, 20, 21, **55, 56, 57, 58, 62, 87, 204, 259**  
*Allium remedium* (R.M. Fritsch) R.M. Fritsch - 196  
*Allium rhodanthum* Vved. - 16, 207, 209  
***Allium robustum*** Kar. & Kir. - 14, 28, 29, **49, 50, 51, 259**  
*Allium robustum* var. *alpestre* Kar. & Kir. - 49  
*Allium rosenbachianum* hort. - 104, 193  
***Allium rosenbachianum*** Regel s. str. - 15, 34, 35, **104, 105, 106, 110, 111, 112, 117, 192, 193, 194, 195, 196, 222, 224, 259**  
*Allium rosenbachianum* Regel subsp. *kwakense* R.M. Fritsch - 109  
*Allium rosenbachianum* sensu Vved. & auctt. - 16, 104, 190, 193, 195  
***Allium rosenorum*** R.M. Fritsch - 16, 30, 31, 73, 110, 186, 192, **193, 194, 195, 196, 260**  
*Allium rothii* Zucc. - 272  
*Allium rudolfii* Turak. - 15, 147, 149  
***Allium saposhnikovii*** Nikitina - 15, 36, 37, **144, 145, 146, 160, 260, 272**  
*Allium saposhnikovii* p. p. - 154  
***Allium sarawschanicum*** Regel - 15, 34, 35, 73, 106, **114, 116, 117, 177, 198, 200, 203, 204, 213, 260**  
***Allium schachimardanicum*** Vved. - 15, 40, 49, 135, **139, 140, 141, 151, 262, 272**  
*Allium schubertii* - 219, 220  
*Allium schubertii* sensu Regel & auctt. - 16, 217  
*Allium schubertii* Zucc. - 217, 220  
***Allium schugnanicum*** Vved. - 15, 34, 35, 104, **111, 112, 262**  
*Allium scotostemon* Wendelbo - 114  
*Allium seravschanicum* - 114  
***Allium sergii*** Vved. - 16, 24, 25, 89, 220, **221, 222, 224, 273**  
*Allium severtzovii* - 153, 154  
*Allium severtzovii* p. p. - 161  
*Allium severtzovii* sensu Vved. & auctt. - 147, 151, 154, 155  
***Allium severtzovioides*** R.M. Fritsch - 15, 36, 37, 46, **151, 152, 154, 155, 157, 158, 160, 162, 163, 262**  
***Allium sewerzowii*** Regel s. str. - 15, 36, 37, 118, 137, 147, 151, 153, 154, **155, 156, 157, 160, 263**  
*Allium simile* Regel - 14, 44, 46  
*Allium simile* sensu horti Gaterslebenensis - 44, 47  
*Allium singulifolium* Rech.f. - 121  
***Allium sochense*** R.M. Fritsch & U. Turakulov - 15, 18, 19, 59, **84**  
*Allium stellerianum* Willd. - 55  
***Allium stipitatum*** Regel - 16, 30, 31, 50, 110, 121, 124, 128, 129, 131, 133, 171, **182, 183, 185, 186, 187, 189, 190, 195, 196, 263**  
***Allium subkopetdagense*** (R.M. Fritsch & F.O. Khass.) R.M. Fritsch - 15, 22, 23, 62, 65, 66, 68, **69, 70, 73, 265**  
*Allium suvorovii* - 118  
***Allium suworowii*** Regel - 15, 32, 33, **118, 119, 120, 121, 154, 163, 204, 265**  
***Allium taeniopetalum*** Popov & Vved. subsp. *taeniopetalum* - 15, 34, 35, **97, 98, 99, 101, 266**  
***Allium taeniopetalum*** subsp. *mogoltavicum* (Vved.) R.M. Fritsch & F.O. Khass. - 15, 36, 37, **99, 100, 101, 103, 266**  
***Allium taeniopetalum*** subsp. *turakulovii* R.M. Fritsch & F.O. Khass. - 15, 34, 35, 101, **102, 103, 267, 273**  
***Allium tashkenticum*** F.O. Khass. & R.M. Fritsch - 15, 38, 39, 154, **158, 159, 160, 267**  
*Allium thunbergii* Regel - 44  
*Allium tokalense* - 154

- Allium tokaliense* Kamelin & Levichev - 15, 36, 37, **154**, **155**, 267  
*Allium trautvetterianum* Regel - 15, 32, 33, **175**, **176**, 177, 179, 203, 267  
*Allium tschimganicum* "B. Fedtsch." - 161  
*Allium tschimganicum* [B. Fedtsch. ex] O. Fedtsch. - 15, 38, 39, 44, 46, 137, 139, 149, 154, 155, **160**, **161**, 162, 163, 267  
*Allium tschimganicum* sensu Pavlov & Polyakov - 161  
*Allium tschimganicum* sensu Vved. - 147, 151  
*Allium tulipifolium* auct. - 50, 51, 267  
*Allium tulipifolium* Ledeb. var. *subscabrum* Regel - 14, 34, 35, **51**, **52**, 53, 55  
*Allium tulipifolium* s. str. - 53  
*Allium ursinum* L. - 44  
*Allium vakhtinae* Seisums - 53  
*Allium verticillatum* Regel - 15, 24, 25, 73, 101, 108, 142, **163**, **164**, 165, 166, 167, 179, 198, 204, 268, 273  
*Allium victoris* Vved. - 14, 18, 19, **58**, **59**, 108, 142, 269  
*Allium viridiflorum* Pobed. - 16, 24, 25, 165, **166**, **167**, 269  
*Allium viridulum* Ledeb. - 14, 28, 29, 51, **53**, **54**, 55, 269  
*Allium vvedenskyanum* Pavlov - 15, 40, 108, 137, **141**, **142**, 154, 160, 166, 269  
*Allium walteri* Regel - 15, 92, 94  
*Allium winklerianum* auct., p. p. - 78  
*Allium winklerianum* Regel - 15, 20, 21, 58, 77, 79, 80, 81, 82, 83, 84, **85**, **86**, 87, 186, 269  
*Allium winklerianum* s. lat. - 79  
*Allium winklerianum* s. str. - 75, 77, 84  
*Allium winklerianum* sensu Nikitina & Kashtsh. & auctt. - 85  
*Allium winklerianum* sensu Vved. - 75, 80, 82  
*Allium yatei* Aitch. & Baker - 14, 55, 58  
*Allium zeravschanicum* - 114  
*Allium zergericum* F.O. Khass. & R.M. Fritsch - 15, 30, 31, 38, 39, 51, 134, **143**, 144, 270  
ancestral genome sizes - 12  
annual cycle - 11  
anthers - 10  
anthesis - 9, 10, 11  
antibiotic activity - 12  
anzur - 187  
anzur pijož - 121, 131, 187  
apical meristem - 11  
aram-zhua - 207  
Armenia - 7  
artificial characters - 7  
Asia Minor - 8  
atolla - 106, 121, 196  
atyshak - 207  
band-e-jamia - 73  
base number of chromosomes - 11  
bobuna - 121  
botanical phrases - 14  
botanical terminology - 14  
bulbs, bulb tunics - 8  
bulbs among pedicels - 9  
*Caloscordum cristophii* (Trautv.) Banfi & Galasso - 92  
*Caloscordum* Herb. subg. *Melanocrommyon* (Rouy) Banfi & Galasso - 44  
*Caloscordum oreophilum* (C.A. Meyer) Banfi & Galasso - 41  
*Canidia* Salisb. - 44

- Canidia magica* (L.) Salisb. - 44
- capsule - 11
- carbohydrates - 12
- carpels - 10
- cataphylls - 8, 9
- Central Asia - 13
- centre of diversity - 8
- cepa [Latin] - 13
- chemical characters - 12
- chemotaxonomic importance - 12
- chromosomes - 11
- chuchka piyoz - 125
- chuchka-piyos - 220
- chychla-kulak - 125
- classification - 5, 7, 12, 14
- common onion - 13
- conservation of flowers - 9
- contractile roots - 8, 11
- cotyledon - 12
- crommyum [Latinized] - 13
- cultivation of excessively collected taxa - 13
- cysteine sulfoxides - 12
- deli-chikan - 207
- differentiation of organs - 11
- distribution - 8
- dithiodipyrrole cysteine sulfoxide - 12
- DNA content - 12, 13
- dormanyc - 11
- eastern Asia - 13
- ebracteolate - 9
- ecology - 8
- economical importance - 13
- ephemeroidal growth rhythm - 11
- etymology of scientific names - 13, 14
- evoj pijoz - 117, 171
- excretory tubes - 10
- filament appendages - 10
- filaments - 10
- filamentum, filum [Latin] - 14
- flavonoids - 12
- flowers - 9, 10
- foliage leaves - 9
- garlic - 12, 13
- genomic in situ hybridization (GISH) - 12
- geographic names - 7
- geography and ecology - 8
- geophytes - 11
- Georgia - 7
- germination - 12
- 'Gladiator' - 175
- 'Globemaster' - 95, 175
- 'Globus' - 95
- gluco-fructanes - 12

- group "sphere of *A. gultschense* relatives" - 126
- group of *A. aschersonianum* relatives - 118
- group of *A. cristophii* relatives - 91
- group of *A. decipiens* relatives - 49
- group of *A. karataviense* relatives - 121
- group of *A. rosenbachianum* relatives - 182
- gushi buzak - 106
- gushi gurgak - 180
- gynobasic style - 10
- habitats - 8
- herbarium specimens - 8, 9, 10
- herbarium storage - 7
- hexamerous flowers - 9
- historical names - 7
- Index Herbariorum - 8
- inflorescence - 9
- Iran - 7
- isoalliin - 12
- it-shua - 207
- jordji - 196
- juvenile stage - 12
- kadk - 214
- karyological data - 7, 11, 271
- Kazakhstan - 7
- khujrog - 214
- Kirgizstan - 7
- krom[m]yon [Greek] - 13
- kujrak motor - 180
- kuria - 171
- Late Tertiary - 13
- Latin terms - 16
- leaf lamina - 9
- leaf sequence - 8
- leek - 13
- life form - 11
- loculicidal dry capsule - 11
- long-branch attraction - 82, 166, 200
- 'Lucy Ball' - 175
- luk karatavskij - 125
- marasmin - 12
- massif - 7
- matalluk - 125
- medical plants - 13
- Mediterranean region - 13
- methiin - 12
- 'Michael H. Hoog' - 196
- modari-sioalaf - 190
- model - 99, 117, 171, 175, 190
- modor, motor - 163, 196
- molecular marker applications - 12
- Moly* Moench - 44
- Moly speciosum* Moench - 44
- morphological characters - 8

- mountain range - 7
- mountain ridge - 7
- mountains "Mts." - 7
- moy-modor - 163
- mu-sir - 187
- natural habitat - 7
- nectaries - 10
- nomenclature - 7
- nomenclatorial terms - 16
- noncoding regions of chloroplast DNA - 12
- number of ovules per locule - 11
- ornamental habit - 13
- orthographically different names - 7
- oshi sioalaf - 196
- oshtupa - 214
- outgrowths of ovaries - 10
- ovary, ovaries - 10
- pedicels - 9
- petalum [Latin], petalon [Greek] - 14
- phenolic compounds - 12
- phylogenesis - 13
- phylogenetic relationship - 12, 14
- phylogenetically basal and advanced groups - 13
- pijozi anzur - 187
- pioseke harz - 91
- piozi anzur - 121
- plant-geographic elements - 8
- ploidy levels - 11
- pollen - 10
- polymerase chain reaction amplified restriction fragments (PCR-RFLP) - 12
- polysaccharides - 12
- prason [Greek] - 13
- propiin - 12
- pyridine cysteine sulfoxide - 12
- radical scavenger activity - 12
- rakkyo - 13
- random amplified polymorphic DNA (RAPD) markers - 12
- range - 7
- receptacle - 9
- 'Red Globe' - 126
- ridge - 7
- 'Rien Poortvliet' - 175
- root growth - 11
- roots - 8
- saponins - 12
- scape - 8, 9
- scapus [Latin] - 14
- scent of flowers - 10
- seed surface sculptures - 11
- seeds - 9, 11
- sequence analysis of the nuclear ITS (Internal Transcribed Spacer) region - 12
- sequences of the *trnL-trnF* region of chloroplast DNA - 12
- shallot - 187

sheath leaves - 9  
sheathy prophyll - 9  
shipioz - 196  
shriveling process of vascular bundles - 10  
siekhalaf - 196  
sijo alaf - 196  
siohalaf - 196  
sir - 77  
siralaf - 196  
slash / - 8  
Southwest Asia - 8  
spathe - 9  
spices - 13  
starch - 12  
stemon [Greek], stemum [Latin] - 14  
stigma - 11  
style - 11  
subterranean sheath part - 9  
summer dormancy - 11  
superposed inflorescence parts - 9  
Tajikistan - 7  
tepals - 10  
tepalum [Latin] - 14  
testa cells - 11  
thousand-kernel-weight TKW - 8, 11  
Tianshan - 13  
titbit - 121  
toshi - 187  
tosh-modor - 149, 154, 160  
tumble-weeds - 9, 66, 89, 97, 220  
Turkey - 7  
Turkmenistan - 7  
type locations - 7  
type vouchers - 7  
Uzbekistan - 7  
u-zhua - 220  
valves - 9  
vegetables - 13  
vitamins - 12  
western Asia - 13  
yovoy pioz - 190  
zhua - 207